



Douglas Shire Council
Warners and Anichs Bridge Upgrades
Detailed Design Report

April 2021

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1. Introduction

GHD has been commissioned by Douglas Shire Council (DSC) to undertake the Concept and Detailed design for the upgrade of the existing Warners and Anichs Bridge Crossings.

This report focuses on the detailed design phase of the consultation and is a continuation on the Concept Design Report which was issued to DSC on the 23rd March 2021. This Concept Design Report created preliminary design for both crossing. The concepts for each crossing were the preferred designs selected by DSC from a variety of different design options presented during the Options Assessment Phase (refer GHD Options Assessment Report issued 8th February 2021). After the submission of the Concept Design Report and Preliminary Design Drawings, a workshop was then held with DSC on the 23rd March 2021 to discuss the designs for each crossing. This provided DSC with the opportunity to provide comments on each crossing, which are summarised below:

- Approach road for Warners Bridge was designed to be a 2-coat bitumen seal. DSC advised that their preference is for the approach roads to be asphalt, similar to the deck wearing surface.
- Other minor drafting changes were discussed.

These comments have been addressed and the Drawings have been updated to be Issue For Construction (IFC). This report outlines the final design criteria, design loads, as well as details the outcomes from hydraulic and geotechnical investigations which have been undertaken during the design process. This additional information is accompanied by IFC Drawings for both Warners and Anichs Bridge which are attached in Appendix A.

1.1 Warners Bridge

1.1.1 Bridge History

The existing Warners Bridge is a timber dual purpose bridge with a single trafficable lane and a rail line running longitudinally through the centre of the bridge deck. The bridge is located along Warner Rd approximately 4.5 km south-east of Mossman and passes over Cassowary Creek. Council advised that the load capacity for the bridge was assessed in 2020 to be maximum 10 tonnes.

The bridge is currently used by both by the public as a roadway and by the Mossman Sugar Mill during the sugar cane crush season.



Figure 1 Existing Warners Bridge

1.1.2 Bridge Site Assessment

1.1.2.1 Bridge Configuration, Level and Alignment

The existing Warners Bridge is a three-span timber bridge consisting of a timber deck supported by timber girders that span on 2 No. concrete abutments, 1 No. concrete blade wall pier, and 1 No. steel pile and timber headstock pier. The overall length of the bridge is 24 m comprising of 3 No. 8 m spans. The bridge deck contains timber kerbs and with no bridge railing.

The approaching road has a bend in the road on the western side of the bridge and a slight bend immediately to the eastern side of the bridge. The approaching roads are sealed pavements.

There is no alternative access across the crossing so either the existing bridge or a side access track would be required to maintain passage to vehicles during construction.

1.1.2.2 Existing Drainage and Site Conditions

Warners Bridge is over Cassowary Creek, a non-tidal waterway, which flows at a skew of 22.5° to the road alignment. Dense tree and vegetation is present along the waterway that runs up to the bridge crossing.

1.1.2.3 Existing Services

Power lines are situated on the northern side of the crossing that runs parallel to the bridge and passes over the western approaching road. Proposed construction methodologies will need to consider the proximity of overhead powerlines when using cranes, plant, and machinery.

Attached to the existing bridge deck is a small diameter water main and Telstra line.

1.1.2.4 Rail Line

A rail line is present at the crossing that runs parallel to the southern side of the approaching roads up to the bridge crossing where the road deviates towards the rail line with the tramrail running longitudinally through the centre of the bridge, then returning back to its normal alignment. It is understood that the tramline is used by the Mossman Sugar Mill during the sugar cane crush season.

If a new bridge is constructed, then the bridge could be positioned north (upstream) of the existing crossing to more align the bridge crossing with the approaching roads and separate the proposed road bridge from the existing bridge.

1.1.2.5 Environmental Approval Requirements

The following were noted in relation to potential environmental constraints for Warners Bridge and should be read alongside the 'Approvals Management Plan Report' attached in Appendix B:

- Mapped as part of Queensland waterways for waterway barrier works – High risk of impact (red)
- The section of Cassowary Creek associated with the bridge works is mapped as Regulated Vegetation Management (RVM) Category B (remnant vegetation) and with Category R (reef-regrowth vegetation) within close proximity to the works.
- The bridge works is mapped in the Regional Ecosystem (RE) Mapping as Category B containing Of Concern vegetation (RE 7.3.10a)
- The area of the bridge works is identified as an essential habitat area. Essential Habitat for conservation significant species of wildlife is listed under the provisions of the *Nature Conservation Act 1993*.
- Parts of the project is within Protected Plants Trigger Map, which would require a Flora Survey as per the *Flora Survey Guidelines – Protected Plants* by the Department of Environment and Science.

1.2 Anichs Bridge

1.2.1 Bridge History

The existing Anichs Bridge is a timber dual purpose bridge with a single trafficable lane and a rail line running longitudinally through the centre of the bridge deck. The bridge is located on Finlayvale Road 1.3 km from Syndicate Road and crosses over a collector creek next and is near the Mossman River that runs parallel to the bridge and approaching roads.

The bridge is also frequently used by cyclists and adventure tourists from the near by Silky Oats resort. There is also a popular local swimming spot directly adjacent to the bridge.

The bridge is currently used by both by the public as a roadway and by the Mossman Sugar Mill during the sugar cane crush season. Council advised that the load capacity for the bridge was assessed in 2020 to be maximum 13 tonnes.



Figure 2 Existing Anichs Bridge

1.2.2 Bridge Site Assessment

1.2.2.1 Bridge Configuration, Level and Alignment

Anichs Bridge is a single span bridge with a timber decking supported by 3 No. steel girders spanning on concrete abutments. The overall length of the bridge is 16 m long with a train line running longitudinally through the centre of the bridge deck. The bridge deck contains timber kerbs with no bridge railing, however, there is approach railing present at both ends of the bridge.

Both of the approaching roads have slight bends in the road just before and after the bridge. The approaching roads are sealed pavements.

There is no alternative access across the crossing either the existing bridge or a side access track would be required to maintain passage to vehicles during construction.

1.2.2.2 Existing Drainage and Site Conditions

Anichs Bridge passes over a small creek that continues upstream of the current bridge crossing and connects immediately downstream into the Mossman River that runs parallel with the road either side of the crossing. There is insufficient space available between the current bridge and the Mossman River for a new bridge to be constructed.

1.2.2.3 Existing Services

There are powerlines that run diagonally above the current Anichs Bridge. This will need to be considered in the bridge design as both construction and demolition plant and equipment will need to work around this service.

Attached to the existing bridge deck is a Telstra line on the northern side of the bridge.

1.2.2.4 Rail Line

A rail line is present at the crossing that runs parallel to the northern side of the approaching roads up to the bridge crossing where the road deviates towards the rail line with the train rail running longitudinally through the centre of the bridge, then deviating away from the rail line.

It is understood that the train line is used by the Mossman Sugar Mill during the sugar cane crush season.

1.2.2.5 Environmental Approval Requirements

The following were noted in relation to potential environmental constraints for Anichs Bridge and should be read alongside the 'Approvals Management Plan' report attached in Appendix B:

- The watercourse that Anichs Bridge crosses is a non-perennial (stream order 3) unnamed watercourse that flows through to Mossman River. It is mapped as part of Queensland waterways for waterway barrier works – Major risk of impact (purple).
- The area of the bridge works is mapped as Regulated Vegetation Management (RVM) Category R, with Category B within close proximity to the works.
- The bridge works is mapped in the RE Mapping as Category R containing endangered vegetation (RE 7.3.23).
- An initial desktop survey has identified essential habitat within 10 metres of proposed area associated with the bridge reconfiguration and construction.
- The project area is within Protected Plants Trigger Map, which would require a Flora Survey as per the *Flora Survey Guidelines – Protected Plants* by the Department of Environment and Science.

1.3 Purpose of Report

This report outlines the structural design criteria, design process and the adopted outcomes developed during the detailed design of Warners and Anichs Bridge. It also summarises the associated investigative reports, construction methodologies, durability issues and the inspection and maintenance requirements. This will serve to assist DSC in the determination of the appropriate way forward for the tendering and construction of the bridge.

This report should be read in conjunction with the concept design drawings attached in Appendix A.

2. Geotechnical Investigation and Site Condition

2.1 Bridge Foundation Assessment – Warners Bridge

This bridge foundation assessment should be read in conjunction with Douglas Partners Report: 104527.00.R.002.Rev0 attached in Appendix C.

2.1.1 Geotechnical Investigation and Site Conditions

The geotechnical investigation that was undertaken at Warners Bridge consisted of one (1) borehole undertaken on the eastern side of the crossing. This bore hole was discontinued at 22 m with no rock encountered. Additionally, no ground water was observed to a depth of 2.5 m, at which point drilling fluid prevented any further observations.

The general subsurface profile encountered in the borehole carried out at BH1:

- Medium to coarse Sand and Silty Clay to a depth of 1.0 m, underlain by
- Very loose Clayey Sand and Silty Clayey Sand to 5.5 m, overlaying
- Loose Gravelly Sand to 7.0 m, overlaying
- Loose Silty Clayey Sand and Sand to 8.0 m, overlaying
- Very stiff Silty Clay to 11.0 m, overlaying
- Loose to medium Clayey Sand to 13.0 m, overlaying
- Firm to stiff Sandy Silty Clay to 14.5 m, overlaying
- Medium dense Clayey Sand to 15.5 m, overlaying
- Very stiff Gravelly Sandy Clay to 22.0 m, bore hole discontinued.

2.1.2 Foundation Type

Based on the outcomes from the geotechnical investigation carried out at Warners Bridge, driven steel piles are considered to be the most cost-effective option. Due to the relatively low loads, steel driven piles are the most effective foundation type for this crossing. The final outcomes from this investigation are consistent with the preliminary advice provide by Douglas Partners during the Options Assessment phase.

2.2 Bridge Foundation Assessment – Anichs Bridge

This bridge foundation assessment should be read in conjunction with Douglas Partners Report: 104527.00.R.001.Rev0 attached in Appendix C.

2.2.1 Geotechnical Investigation and Site Conditions

The geotechnical investigation that was undertaken at Anichs Bridge consisted of one (1) borehole undertaken on the southern side of the crossing. This bore hole was discontinued at 18 m with no rock layer encountered. Additionally, no ground water was observed to a depth of 1.8 m, at which point drilling fluid prevented any further observations.

The general subsurface profile encountered in the borehole carried out at BH1 was:

- Clayey Sand to Silty Clay to a depth of 2.5 m, underlain by
- Very loose to loose Sand to 6.5 m, overlaying

- Stiff Sandy Silty Clay to 8.0 m, overlaying
- Medium dense Clayey Sand to 13.0 m, overlaying
- Hard Silty Clay to 18.0 m, bore hole discontinued.

2.2.2 Foundation Type

Based on the outcomes from the geotechnical investigation carried out at Anichs Bridge, driven steel piles are considered to be the most cost-effective option. Taking into account the design loads and the site specific constraints (low overhead powerlines), steel driven piles are the most effective foundation type for this crossing. The final outcomes from this investigation are consistent with the preliminary advice provide by Douglas Partners during the Options Assessment phase.

2.2.3 Acid Sulfate Soil

Four (4) samples were taken from the bore hole (BH1) and submitted for additional laboratory testing to comment on the presence or otherwise of Acid Sulfate Soil (ASS). The laboratory tests found that 'Existing Plus Potential Acidity' of the samples were all less than the appropriate action criteria, and therefore no acid sulfate management plan would be required at this site.

3. Hydrologic and Hydraulic Assessment

3.1 Introduction

A hydrological and hydraulic assessment was done in order to determine velocities for the purposes of conceptual design of Warners and Anichs Bridge. This section contains the input data, assumptions, limitations, methodology and results for the assessment.

3.1.1 Modelled design option

The following design arrangement was modelled for Warners and Anichs Bridge.

Warners Bridge

- Downstream Offline Replacement (PSC Concrete Deck units)
 - A 21 m single span bridge constructed downstream of the current bridge alignment with the existing bridge intact

Anichs Bridge

- Inline Bridge Replacement (PSC Concrete Deck units)
 - A new 16 m single span bridge with the same alignment as the current bridge, demolishing the existing bridge

3.1.2 Data used

The following data were used for the hydrologic and hydraulic assessment:

- Shuttle Radar Topography Mission (SRTM) 1 second (30 m) resolution Digital Elevation Model (DEM) data with a vertical accuracy of $\pm 9\text{--}10\text{ m}^1$
- A Digital Elevation Model (DEM) of the area using 1 metre LiDAR data with a vertical accuracy of $\pm 0.15\text{ m}^2$
- Design rainfall depths from Bureau of Meteorology website
- freely available aerial imagery

3.1.3 Hydrology model approach

Two methodologies were adopted for the hydrological analysis as follows

- TMR based Rational Method
- Regional Flood Frequency Estimation (RFFE)

3.1.4 Limitations

- The Rational Method is recommended for catchment areas within 1 km^2 . As such, a second approach using the RFFE method was undertaken. However, the catchment areas for the Warners and Anichs Bridge locations are considerably smaller than the gauged catchment areas used in the development of RFFE (see graphs in Appendix D and Appendix E). As a result, the RFFE procedure results in significantly higher flows than the Rational Method.

¹ Geoscience Australia. (2010). ELVIS – Elevation and Depth – Foundation Spatial Data. Retrieved from <https://elevation.fsdf.org.au/>

² Geoscience Australia. (2010). ELVIS – Elevation and Depth – Foundation Spatial Data. Retrieved from <https://elevation.fsdf.org.au/>

- Hydraulic modelling has been done using 1-D approach steady state approach. However, due to the nature of the terrain, flooding through the overbank of the creek was noticed (for both Warners and Anichs Bridge), even in the 2% AEP event. 1-D modelling is not well suited to model flows through floodplains, especially if the floodplain adjacent to the channel has significantly large areas as in the case of Warners and Anichs Bridge catchment. As such, should more certainty be required, a 2-D unsteady hydraulic model is recommended for a better representation of flows and velocity results.
- For Warners Bridge, the 0.05% AEP RFFE flows breached the extents of the 1-D cross section in the hydraulic model, resulting in water glass walling at the edge of the model. The cross section couldn't be extended further as the terrain consisted of more floodplains and other creeks. The hydraulic results for the 0.05% AEP RFFE flows are impacted due to this and do not provide a realistic representation.

3.2 Warners Bridge

3.2.1 Hydrology

Catchment characteristics

The catchment was delineated using best available elevation data. For majority of the catchment, 1 m DEM was available, however, for areas near south-west region, only 30 m SRTM DEM was available. Impervious fractions were based on an examination of the aerial imagery while the catchment slope was calculated by identifying each catchment's longest flow path and calculating the equal area slope for each of these flow paths using GIS software. The C_{50} factor was used as the runoff coefficient determined based on rainfall intensity, topography, storage and ground cover. The catchment area is shown in Figure 3, while the catchment characteristics are represented in Table 1.

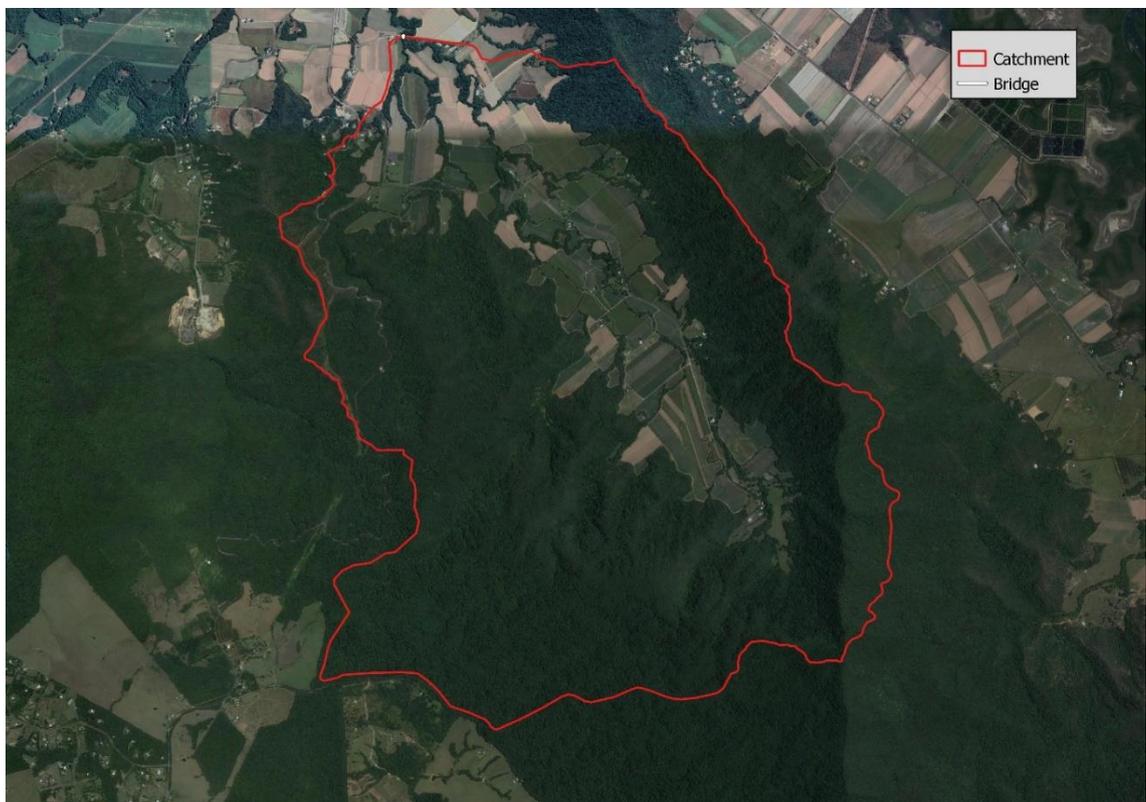


Figure 3 Warners Bridge catchment area

Table 1 Warners Bridge catchment characteristic

Catchment	Area (km ²)	Slope (%)	Longest flow path (km)	Impervious fraction	C ₅₀ value
Warners Bridge	20.5	1.90	10.28	0	0.71

Design rainfall

The design events for this study were set out as the 2%, 1% and 0.05% AEP. Design rainfall intensities were estimated using the procedure described in ARR (2019) and used the 2019 Intensity: Frequency: Duration (IFD) data from the Bureau of Meteorology (BoM). The location of this grid cell was 16.4875 (S), 145.3875 (E) and the data was accessed on 14 January 2021.

Rainfall Interpolation

Both Rational method and RFFE cannot directly calculate flows for less than 1% AEP event. As such, 2% and 1 % AEP flows were used alongside with the Probable Maximum Precipitation-Design Flood (PMP-DF) to interpolate the 0.05% AEP flow by adopting a methodology from ARR (1987). The PMP-DF flow was calculated via a simplified empirical formula based on analysis of catchment in the similar region³. The interpolation calculation for Warners Bridge using Rational Method flows have are presented in Appendix F.

Results

The peak flows for the design rainfall events are presented in Table 2.

Table 2 Warners Bridge peak flowrates

Flows	2% AEP	1% AEP	0.05% AEP
Rational Method (m ³ /s)	217	250	467
RFFE (m ³ /s)	638	771	1199

3.2.2 Hydraulics

Hydraulic model approach

A 1-D steady state HEC-RAS model was used for the hydraulic analysis. Flows from both Rational and RFFE methods were introduced into separate models. These results are meant to be a high-level indicative value and should more accurate results be required, 2D hydraulic modelling needs to be done.

³ Watt, S., Sciacca D., Hughes, M., & Pedruco, P. (2018). A quick method for estimating the Probable Maximum Flood in the Coastal GTSMR Zone. Melbourne: Hydrology and Water Resources Symposium 2018

Model extent

The model extent for Warners Bridge is presented in Figure 4.

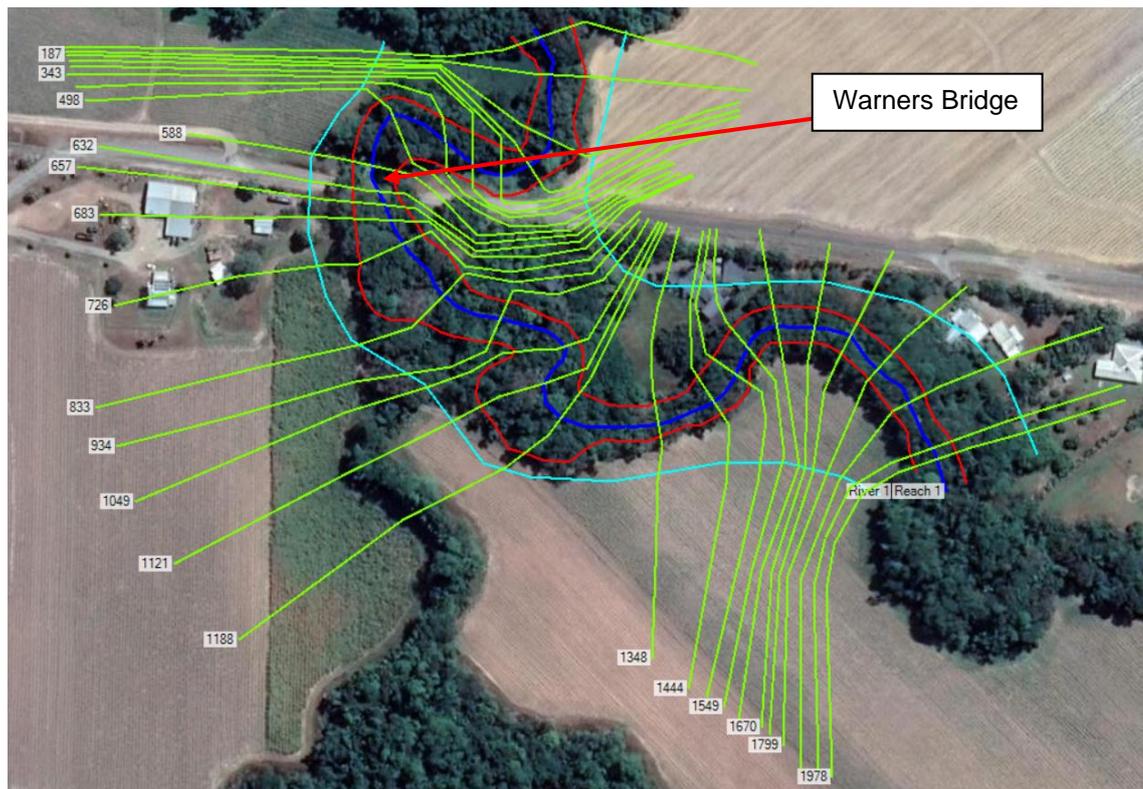


Figure 4 Warners Bridge hydraulic model extent

Boundary conditions

For both upstream and downstream boundary conditions, a normal depth condition was assumed considering a general slope of 0.2% of the creek.

Hydraulic roughness

Hydraulic roughness was represented by Manning's n with the aid of site photos, aerial imagery, and Ven Te Chow (1959) table as shown in Table 3. The overbanks Manning's n value was adopted considering the dense vegetation and presence of trees around the banks, while the channel's Manning's n value was selected based on winding nature of the incoming creek, as well as the presence of weeds and stones in the channel.

Table 3 Manning's n for Warners Bridge model

	Channel	Overbanks
Manning's n	0.04	0.08

Results

The resulting velocities are tabulated in Table 4.

Table 4 Peak velocity upstream of the Warners Bridge

Velocities	2% AEP	1% AEP	0.05% AEP
Rational Method (m/s)	2.5	2.9	3.4
RFFE (m/s)	3.6	3.9	4.4

3.3 Anichs Bridge

3.3.1 Hydrology

Catchment characteristics

The catchment was delineated using best available elevation data. For majority of the catchment, 1 m DEM was available, however, for areas near the south-west region, only 30 m SRTM DEM was available. Impervious fractions were based on an examination of the aerial imagery while the catchment slope was calculated by identifying each catchment's longest flow path and calculating the equal area slope for each of these flow paths using GIS software. The catchment characteristics are represented in

Table 5 while the catchment area is shown in Figure 5.



Figure 5 Anichs Bridge catchment area

Table 5 Anichs Bridge catchment characteristics

Catchment	Area (km ²)	Slope (%)	Longest flow path (km)	Impervious fraction	C ₅₀ value
Anichs Bridge	6.0	6.0	4.22	0	0.71

Design rainfall

The design events for this study were set out as 2%, 1% and 0.05% AEP. Design rainfall intensities were estimated using the procedure described in ARR (2019) and used the 2019 IFD data from the BoM. The location of this grid cell was 16.4625 (S), 145.3625 (E) and the data was accessed on 13 January 2021.

Rainfall Interpolation

Both Rational method and RFFE cannot directly calculate flows for less than 1% AEP event. As such, 2% and 1 % AEP flows were used alongside with the PMP-DF to interpolate the 0.05% AEP event flow by adopting a methodology from ARR (1987). The PMP-DF flow was calculated via a simplified empirical formula based on analysis of catchment in the similar region⁴. The interpolation calculation for Anichs Bridge using Rational Method flows have are presented in Appendix G.

Results

The peak flows for the design rainfall events are presented in Table 6.

Table 6 Anichs Bridge peak flowrates

Flows	2% AEP	1% AEP	0.05% AEP
Rational Method (m ³ /s)	101	115	214
RFFE (m ³ /s)	265	320	536

3.3.2 Hydraulics

Hydraulic model approach

A 1-D steady state HEC-RAS model was used for the hydraulic analysis. Flows from both Rational and RFFE methods were introduced in separate models. These results are meant to be a high-level indicative assessment and should more accurate results be required, a 2-D hydraulic modelling needs to be done.

⁴ Watt, S., Sciacca D., Hughes, M., & Pedruco, P. (2018). A quick method for estimating the Probable Maximum Flood in the Coastal GTSMR Zone. Melbourne: Hydrology and Water Resources Symposium 2018

Model extent

The model extent for Anichs Bridge is presented in Figure 6.

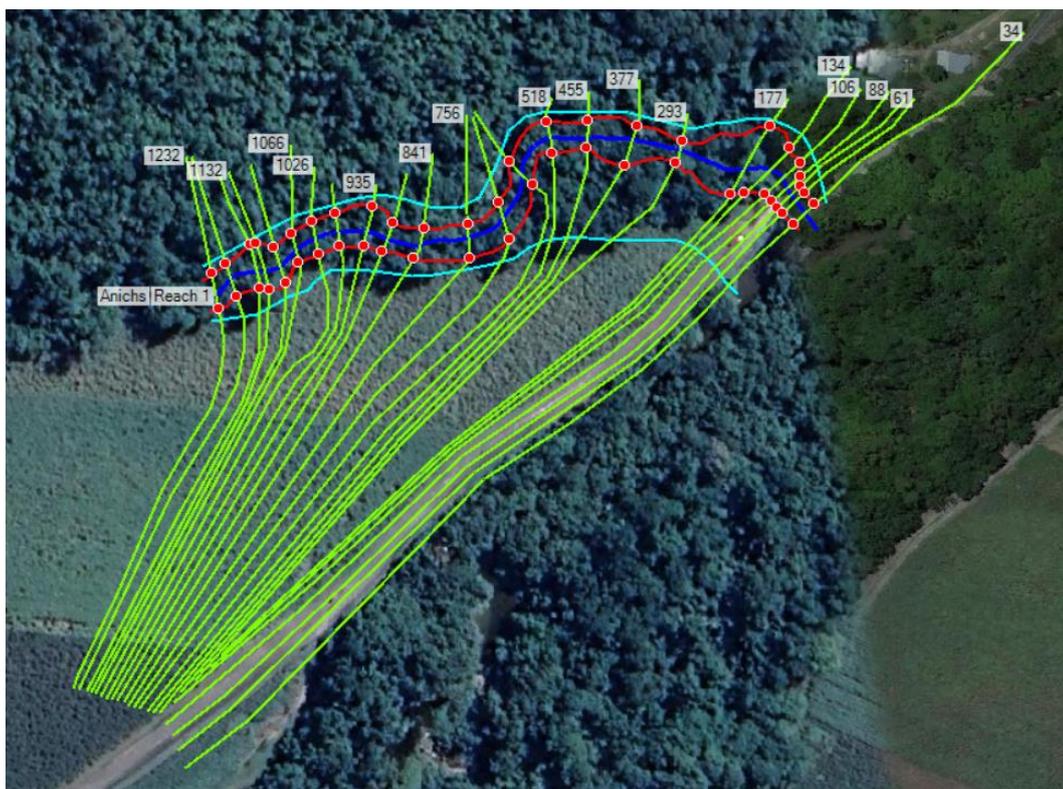


Figure 6 Anichs Bridge hydraulic model extent

Boundary conditions

For the upstream boundary, normal depth condition was assumed considering a general slope of 0.2% of the creek. Downstream of the bridge, a normal depth boundary condition with similar slope as upstream was applied considering the low water level scenario.

A sensitivity test was done considering the high tail water level in the Mossman River considering bank full water level.

The low water level scenario was adopted as it resulted in more critical velocities.

Hydraulic roughness

Hydraulic roughness was represented by Manning's n with the aid of site photos, aerial imagery, and Ven Te Chow (1959) table, as presented in Table 7.

Table 7 Manning's n for Anichs Bridge model

	Channel	Overbanks
Manning's n	0.04	0.08

Results

The resulting velocities are tabulated in Table 8.

Table 8 Peak velocity upstream of the Anichs Bridge

Velocities	2% AEP	1% AEP	0.05% AEP
Rational Method (m/s)	2.3	2.5	2.4
RFFE (m/s)	2.6	2.7	4.0

4. Design Options

This section of the report provides the concept design option for each crossing and should be read in conjunction with the concept design drawings attached in Appendix A of this report.

4.1 Warners Bridge

4.1.1 Concept Design

As discussed in Section 1, multiple conceptual design options were prepared during the Options Assessment phase. These designs were presented to DSC within the Options Assessment Report issued on the 8th February 2021. DSC have since advised that the preferred option for Warners Bridge is a downstream replacement with PSC deck units and an AC wearing surface.

4.1.2 Span Arrangement

This concept consists of a 21 m single span bridge to be positioned downstream of the current bridge. The approaches are to be realigned to marry with the new abutment positions which includes clearing of adjacent vegetation. The approaches are to be asphalt to match the surfacing along the bridge deck.

4.1.3 Superstructure

The bridge is comprised of 7 PSC deck units and 2 PSC kerb units with an AC wearing surface. The PSC deck units are to be 900 mm deep and are to be transversely stressed and located on mortar pads at each abutment. The superstructure is to be installed on a 22.5° skew to match the profile of the creek. The clear distance between the two kerbs is to be 4.8 m with a single trafficable lane located centrally. Traffic data provided by DSC that was utilised for the design of Warners Bridge is in Appendix H.

4.1.4 Substructure

The bridge substructure consists of two concrete abutments founding on steel WC piles. Each abutment is to be comprised of 6 No. 350WC197 piles to be cast into the concrete headstock. Piles are to be 16.5 m long with the top 6 m of pile to be coated with Interzone 954 applied at 500 µm thick. All abutment headstocks are proposed to be cast in-situ reinforced concrete.

As outlined in Section 2.1.2 driven steel WC piles are considered to be the most suitable foundation option for this crossing.

4.1.5 Service Provisions

The existing water main is proposed to be relocated to the upstream side of the new bridge. The main is to be installed on a steel frame comprised of 100 PFC's and 2 x M16 S.S. bolts. The nominated coating for the steel frame is a hot dipped galvanised coating.

4.1.6 Guardrails

A Barrier Assessment was previously conducted as part of the Options Assessment Report delivered to DSC and is located in Appendix I. This assessment found that Warners Bridge complied with 6 of the 8 triggers for 'No Barrier Installed onto Bridge'. The crossing was deemed to have all of the triggers for a 'Low Load' barrier requirement and none of the triggers for a 'Medium Load' barrier. An internal review was conducted by DSC and it was advised that no barriers were required along the bridge.

4.1.7 Bridge Fixing Criteria

Table 9 below provides an overview of the geometric parameters that have been adopted for Warners Bridge.

Table 9 Warners Bridge Fixing Criteria

General summary of bridge geometry			
Span:	1 Span, 21 m (Abutment A to Abutment B)		
Deck arrangement:	Single trafficable lane		
Width between barriers:	4.8 m		
Skew Angle:	22.5°		
Vertical alignment:	There is no vertical grade on the bridge		
Deck cross fall:	Deck has 2.5% cross fall from the centre of the bridge.		
Abutment A:	CH 0.000	E 328834.896	N 8175560.543
Abutment B:	CH 20.517	E 328855.232	N 8175557.830

4.2 Anichs Bridge

4.2.1 Concept Design

As discussed in Section 1, multiple conceptual design options were prepared during the Options Assessment Phase. DSC have since advised that the preferred option for Anichs Bridge is an inline replacement with PSC deck units and a concrete topping slab. The train rail is to be incorporated into the concrete topping slab to provide access for the sugar cane trains during crushing season. Additionally, a temporary side track is to be installed to allow local traffic to pass over the crossing during the construction phase.

4.2.2 Span Arrangement

This concept includes demolition of the existing bridge and construction of a 16 m single span bridge. The new bridge deck level is to match the existing levels meaning the approaches are to remain unchanged.

4.2.3 Superstructure

The bridge superstructure is to be comprised of 7 PSC deck units with 2 PSC kerb units that will span 16 m between Abutments A and B. The deck units are to have a concrete topping slab approx. 350 mm thick with train rails recessed into the deck. The train rail is to run centrally. The clear distance between the two kerbs is to be 4.8 m with a single trafficable lane located centrally. Traffic data provided by DSC that was utilised for the design of Anichs Bridge is located in Appendix H.

A pedestrian/cyclist walkway is to be constructed on the new bridge to allow safe passage for locals and tourists. This walkway is to cantilever off the downstream side of the of the bridge providing a 2 m clear width. The walkway is to consist of precast concrete panels attached to a stainless steel supporting frame. The concrete panels with stainless steel members were selected to provide a durable long-term solution.

4.2.4 Substructure

The bridge substructure consists of two concrete abutments founding on steel WC piles. Each abutment is to be comprised of 5 No. 350WC197 piles to be cast into the concrete headstock. Piles are to be 16.5 m long with the top 9.5 m to be coated in Interzone 954 applied at 500 µm thick. WC piles have been designed to allow for splicing which is required due to the low overhead power lines. All abutment headstocks are proposed to be cast in-situ reinforced concrete.

As outlined in Section 2.2.2 driven steel WC piles are considered to be the most suitable foundation option for this crossing.

4.2.5 Service Provisions

The existing Telstra line is proposed to be relocated to the upstream side of the new bridge. The line is to be installed on a steel frame comprised of 100 PFC's and 2 x M16 S.S. bolts. The nominated coating for the steel frame is a hot dipped galvanised coating.

4.2.6 Temporary Gravel Side Track

The inline replacement requires the existing crossing to be demolished and as such a temporary crossing will be required to provide access for local traffic. The Side Track Performance Specifications are as follows:

- The gravel side track would need to be designed by an Geotechnical RPEQ to withstand loading from local traffic and construction vehicles, flood loading, and to last the duration of construction.
- Public access is to be maintained both during and outside working hours. All road safety signage and barriers will need to be in accordance with relevant Main Roads regulations.
- As a minimum, pipe culverts are to be used to allow water flow through the gravel side track and would need to:
 - be 1200 mm internal diameter
 - have minimum 900 mm cover
 - be a strength class to suit construction plant loads
- The side track is to be built upon a geo-fabric membrane to minimise scour.
- The material used for the side track needs to be protected from erosion and scour.
- Material used for the side track needs to be removed as soon as possible at completion of the bridge works and stored on councils facilities as agreed upon with Council.
- Imported fill is to be free from organic material and shall only be used if approved by the Superintendent.
- The contractor shall program the works to limit works in the waterway during high river flow months.
- The maintenance and protection the side track shall be the responsibility of the contractor and shall comply with the requirements of the environmental approvals. Where water is diverted from the site it shall be confined to existing drainage paths and away from adjacent private property.
- Avoid the concentration of water runoff through the side track. Where concentrate runoff is unavoidable, protect outfall of channels with crushed rock to minimise scouring.
- The riverbed is to be returned to its original conformation after construction.

- No stockpiles or materials to be left where they can contaminate waterways. minimum distance between stockpile and watercourse of 50 m.

4.2.7 Guardrails

A Barrier Assessment was previously conducted as part of the Options Assessment Report delivered to DSC and is located in Appendix I. This assessment found that Anichs Bridge complied with 5 of the 8 triggers for 'No Barrier Installation onto Bridge'. The crossing was deemed to meet all of the triggers for a 'Low Load' barrier requirement and none of the triggers for a 'Medium Load' barrier. An internal review was conducted by DSC and it was advised that 'Low' performance barriers are to be installed along the bridge. Balustrading is also to be installed along the pedestrian walkway.

4.2.8 Bridge Fixing Criteria

Table 10 below provides an overview of the geometric parameters that have been adopted for Anichs Bridge.

Table 10 Anichs Bridge Fixing Criteria

General summary of bridge geometry			
Span:	1 Span, 16 m (Abutment A to Abutment B)		
Deck arrangement:	Single trafficable lane with a train rail through the centre of the bridge. Pedestrian/cyclist walkway attached to the downstream side.		
Width between barriers:	4.8 m		
Skew Angle:	No skew		
Vertical alignment:	There is no vertical grade on the bridge		
Deck cross fall:	Deck has 1.5% cross fall from the centre of the bridge.		
Abutment A:	CH 0.000	E 324903.350	N 8180528.297
Abutment B:	CH 15.550	E 324914.236	N 8180539.401

4.3 General

4.3.1 Lighting

Lighting is not proposed for either crossing as this has not been requested by Council and thus outside the design scope.

4.3.2 Abutment Protection

The abutments at each crossing are detailed to have slope protection provided. It was determined that placed rock protection shall be provided in accordance with Main Roads Specification 'MRTS 03 Section 41'.

4.3.3 Materials and Durability – Both Bridges

Table 11 below summarises the materials and protective measures proposed for both bridges.

Table 11 Materials

Materials				
Concrete	To MRTS70			
	Element	Class	Exposure*	Cover (mm)
	Blinding Concrete	N15/20	-	-
	Abutments	S40/20	B2	65
	PSC Deck Unit	S50/20	B2	35
	Concrete Topping Deck (Anichs)	S40/20	B2	50 (Bottom) 60 (Top)
	Kerbs (Warners)	S40/20	B2	50
	Relieving Slab	S40/20	B2	50
	Precast Deck	S40/20	B2	50
	Footpath	S40/20	B2	50
Reinforcement	Grade D500N deformed bars or Grade R250N plain round bars, both to AS/NZS 4671 and MRTS71			
Prestressing Strand	7-wire ordinary – 15.2-1750-Relax 2 to MRTS73 and AN/NZS 4672.1			
Steelwork	All steelwork is to be fabricated to MRTS78 or MRTS78A and the following:			
	Element	Nom. Grade	Standard	Galvanising Standard
	WC Piles	300	AS3679.2	Interzone 954
	100 PFC	300	AS3679.2	AS4680
	150 PFC (Anichs Bridge)	316 S.S.	ASTM A276	-
	Plates	316 S.S.	ASTM A240	-
	Bolt Assembly for 4.6 Grade	400	AS1111	AS1214
	Bolt Assembly for 8.8 Grade	830	AS1252	AS1214
	Bolt Assembly for Grade 316 S.S.	50	ISO 3506-1	-

*Exposure here relates to exposure classification for determining concrete cover for durability requirements only, and is not used for the crack control criteria.

5. Constructability Review

The constructability of Warners and Anichs Bridge replacements were previously reviewed as part of the Options Assessment Report presented to DSC. This review was undertaken with the assistance of a bridge Contractor Civform, who attended a site meeting with DSC to provide constructability considerations for each crossing. Below is a summary of the constructability review from each site and design option:

5.1 Warners Bridge

- An issue for the Warners Bridge Crossing is whether construction equipment can cross over the existing road bridge. This has been previously discussed with DSC, with DSC advising that a permit may be provided for construction plant to cross the bridge if needed, as long as it is confirmed that structurally the bridge can accommodate these loadings. If the bridge cannot accommodate the loadings a short term construction access will be required.
- It should be noted that there would need to be access to the eastern side of the crossing to undertake piling. However, other major lifts could be done from the western side of the bridge without crossing the existing road bridge.
- Based on the site conditions with no direct overhead obstructions and large laydown areas, it is possible for all the deck units to be lifted into position.
- A single clear span makes for easier construction as high flows within the waterway can stop work. There would be less risk of delays with all works being situated outside the waterway.
- Construction can be undertaken with limited disruption to traffic flow if constructed offset to the current alignment.
- Site has sufficient room to allow for a large crane set up to land concrete deck units.
- Because of the road re-alignment, the finished alignment will be far more suitable than the current deviation and will separate road and rail bridges.

5.2 Anichs Bridge

- As stated in Section 2.2.2 steel WC drive piles are the most likely option, meaning that multiple splices may be required for piling to be undertaken. A pre-bore may be required to get the first length of pile in deep enough to mount the hammer whilst maintaining minimum clearances to the powerlines.
- Craning of concrete deck units is feasible but will need additional care. Two smaller slew cranes either side of bridge with a very low boom configuration would be needed to lift the deck units off trucks parked on the side-track. Other control measures will also be required including a certified electrical line spotter and possible tiger tails attached to the powerlines.
- The rail line would need to be integrated into the wearing surface of the bridge as this cannot be accommodated into the PSC deck units.
- If constructed on the existing alignment then the timing of works would need to be considered, with risk of losing the side-track due to a rain event and possibility of works conflicting with the cane crushing season. This is understood to be manageable.
- Extra tree clearing would be required to install the side-track.

- If the existing road alignment is maintained, then there would be no changes required to the car park.

Refer to the Options Assessment Report dated 8th February 2021 for exhaustive list of constructability issues.

6. Structural Design

6.1 Design standards

The design is in accordance with AS5100 – *Bridge Design*, in particular:

- Scope and general principles – to AS5100.1: *Scope & General Principles*
- Balustrade loads – to AS5100.2: *Design Loads*
- Design loads – to AS5100.2: *Design Loads*
- Foundations and retaining walls – to AS5100.3: *Foundations and Soil Supporting Structures*, and AS2159: *Piling Code*
- Bearings and joints – to AS5100.4: *Bearings and Deck Joints*
- Concrete elements and reinforcing – to AS5100.5: *Concrete*
- Steel and composite elements – to AS5100.6: *Steel and Composite Construction*
- Other Standards and Guidelines used for the design include:
 - AS3600-2018 for strut and tie analysis only
 - AS4100-1998 for structural steel design

6.2 Design loads

The design loadings considered for the two bridges are summarised below:

6.2.1 Dead loads

- Self-weight of PSC Deck Units girders
- Self-weight of concrete kerbs and decking
- Self-weight of steel post and balustrading
- Self-weight of steel frames

For the calculation of dead loads, the following was used:

- Density of reinforced concrete = 25.0 kN/m³
- Density of prestressed concrete = 26.0 kN/m³
- Density of structural steel = 79.0 kN/m³
- Load factors to AS5100.2 Clause 5.2

6.2.2 Superimposed dead loads

The following superimposed dead loads were considered:

- Self-weight of the deck wearing surface

For the calculation of superimposed dead loads, the following was used:

- Density of the deck wearing surface = 21.0 kN/m³
- Load factors to AS5100.2 Clause 5.3

6.2.3 Road traffic loads

The following road traffic loads were considered for both bridges:

- T44 moving vehicle loading in accordance with AS5100.2 Section 6.
- Design lanes, accompanying lane factors, dynamic load allowance, horizontal (braking and centrifugal) forces, load factors, deflection, and distribution through fill – all to AS5100.2 Section 6.

6.2.4 Collision loading

Council have chosen to have No Bridge Barrier for Warners Bridge and a Low Performance barrier for Anichs Bridge in accordance with AS 5100.2 Section 11.

6.2.5 Minimum lateral restraint

The superstructure and substructures, including the restraint system, are designed to withstand the minimum lateral restraint force in accordance with AS 5100.2 Section 9.

6.2.6 Earthquake loads

In line with the 'Additional Requirements to AS 5100 Bridge Code' on page 74 of the *TMR Design Criteria for Bridges and Other Structures (August 2014)*, the earthquake loading was determined in accordance with AS/NZS1170.4 – 2007 version, and applied in accordance with AS5100.2.

Both bridges were found to be BEDC-1 Category Bridges, meaning that the applicable loading was Minimum Lateral Restraint as outlined in Section 9 of AS5100.2.

6.2.7 Wind Loads

Wind loads applied to the bridges were determined in accordance with AS 5100.2 Section 16.

6.2.8 Water Loads

The design steam velocities and submerged debris mats outlined in Table 12 were adopted for the hydraulic assessment and design of Warners and Anichs Bridge in accordance with AS 5100.2 Section 15.

Table 12 Water Loads

	Stream Velocity (m/s)	Submerged Debris Mat (m)
Anichs Bridge	4.0	2.0
Warners Bridge	4.4	1.2

6.2.9 Thermal Effects

The variation in average bridge temperature was calculated in accordance with AS 5100.2 Section 17.

The abovementioned thermal effects were considered for the design of each of the bridge elements and as such, the bridge girders are required to be locked off at 25 degrees Celsius.

6.2.10 Shrinkage, Creep and Prestress Effects

Prestress effects, in accordance AS5100.2 Clause 18.2, were considered in the bridge designs.

The shrinkage and creep calculations were determined in accordance with AS 3600-2018 Section 3, which provides a more up to date calculation than AS 5100.5 Section 6.

The design for shrinkage and creep to the substructure is based on girder erection no earlier than 100 days after manufacture.

6.2.11 Rail Loading (Anichs Bridge only)

The rail loadings used for the design of Anichs Bridge, as provided by Council, were taken in accordance with "Bridge Design Criteria Mackay February 2013". The following loads were considered:

- 2/18t Double Headers directly linked to 28t Loco
- Nosing loads, braking forces, design wind load on train and ultimate design factors in accordance with "Bridge Design Criteria Mackay February 2013".

7. Safety in Design Risk Assessment

The safety in design risk assessment is displayed in this section of the report. These elements were identified both during the design as potential safety issues throughout the life cycle of the bridge. It is important for DSC and the Contractor to understand these issues and ensure mitigation methods are in place prior to the construction of the project. It would be responsible of the Construction Contractor and DSC to update the risk assessment to include hazards that arise during construction or not foreseen in the design phase.

8. Construction Cost Estimates

Construction cost estimates from each crossing were determined based on the design drawings attached in Appendix A. These cost estimates were provided by a quantity surveyor Donald Cant Watts Corke (DCWC) and were prepared in accordance with TMR OnQ Cost Estimating Manual. Total cost estimates from each crossing are provided in Table 13 below with detailed breakdowns provided in Appendix J of this report.

Table 13 Construction Cost Estimates

Crossing	Total cost (excl. GST)
Warners Bridge	\$1,611,000
Anich Bridge	\$1,619,000

Appendices

Appendix A – Detailed Design Drawings

GENERAL

- G1. READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES, THEN SPECIFICATION.
- G2. CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE LEGISLATION, STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONNEL AND GENERAL PUBLIC IN ACCORDANCE WITH ALL CURRENT WORK HEALTH AND SAFETY ACTS, LEGISLATIVE REQUIREMENTS, ASSOCIATED REGULATIONS AND CODES OF PRACTICE, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE.
- G3. REFER DISCREPANCIES TO SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
- G4. SUBMIT DETAILS OF PROPOSED CHANGES TO SCOPE, WORK METHODS OR MATERIALS etc FOR APPROVAL BEFORE PROCEEDING. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT.
- G5. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE, BUT INDICATES REQUIRED PROPERTIES OF ITEM. SIMILAR ALTERNATIVES HAVING REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.
- G6. OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. NOTIFY RELEVANT SERVICE AUTHORITIES BEFORE COMMENCING WORK ON SITE.
- G7. GIVE TWO WORKING DAYS' (48 HOURS) NOTICE SO THAT INSPECTION MAY BE MADE OF CRITICAL STAGES OF WORK.
- G8. INSPECTIONS AND REVIEWS UNDERTAKEN BY SUPERINTENDENT OR OTHERS DO NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.
- G9. DO NOT OBTAIN DIMENSIONS BY SCALING FROM DRAWINGS.
- G10. DIMENSIONS ARE IN MILLIMETRES, LEVELS ARE IN METRES UNO, CHAINAGES ARE IN METRES UNO.
- G11. DATUM FOR LEVELS IS AH (AUSTRALIAN HEIGHT DATUM), CO-ORDINATES ARE TO MGA ZONE 55.
- G12. HAVE SURVEY AND SETTING OUT UNDERTAKEN BY A REGISTERED SURVEYOR.
- G13. VERIFY ON SITE SETTING OUT DIMENSIONS AND EXISTING MEMBER SIZES SHOWN ON DRAWINGS BEFORE SHOP DRAWINGS, CONSTRUCTION AND FABRICATION IS COMMENCED. EXISTING STRUCTURES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY.
- G14. USE STANDARD BOLT PATTERNS etc THROUGHOUT THE WORKS TO AVOID CONFUSION OR AMBIGUITY.
- G15. TAKE CARE OF HAZARDS ASSOCIATED WITH BURIED, CONCEALED OR OVERHEAD SERVICES. TAKE PRECAUTIONS AND UNDERTAKE EXPLORATION TO ESTABLISH LOCATION OF AND PROTECT EXISTING SERVICES AT SITE. SERVICES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY. SERVICES OTHER THAN THOSE SHOWN MAY EXIST ON SITE. MARK LOCATIONS OF SERVICES CLEARLY ON SITE, AND ON AS-BUILT DRAWINGS. HAND EXCAVATE WITHIN ONE METRE OF IN-GROUND SERVICES.
- G16. DISPOSE OF SURPLUS MATERIAL OFF SITE IN ACCORDANCE WITH LOCAL AUTHORITY WASTE REGULATIONS.
- G17. IMPLEMENT SOIL AND WATER MANAGEMENT PROCEDURES TO AVOID EROSION, CONTAMINATION AND SEDIMENTATION OF SITE, SURROUNDING AREAS AND DRAINAGE SYSTEMS.
- G18. WORKMANSHIP AND MATERIALS TO COMPLY WITH REQUIREMENTS OF AUSTRALIAN STANDARDS, NATIONAL CONSTRUCTION CODE (NCC) AND BY-LAWS AND ORDINANCES OF RELEVANT BUILDING AUTHORITIES. ALL STANDARDS REFERRED TO ARE THOSE CURRENT (AS AMENDED) AT COMMENCEMENT OF CONTRACT.
- G19. OBTAIN REQUIREMENTS FOR SERVICES, ADJOINING ELEMENTS etc TO BE EMBEDDED IN, FIXED TO OR SUPPORTED ON WORK AND PROVIDE FOR REQUIRED FIXINGS. PROVIDE FOR TEMPORARY SUPPORT OF ADJOINING ELEMENTS DURING CONSTRUCTION. DRAWINGS DO NOT SHOW DETAILS OF ALL REQUIRED FIXTURES, INSERTS, SLEEVES, RECESSES OR OPENINGS etc.
- G20. PROTECT EXISTING STRUCTURES FROM DAMAGE OR CRACKING. MAKE GOOD ANY DAMAGE TO EXISTING ELEMENTS AT COMPLETION OF WORKS OR AS DIRECTED BY SUPERINTENDENT.
- G21. WHERE NEW WORK ABUTS EXISTING, PROVIDE SMOOTH TRANSITION FREE OF ABRUPT CHANGES.
- G22. HAVE TESTING PERFORMED BY AN INDEPENDENT NATA (NATIONAL ASSOCIATION OF TESTING AUTHORITIES) ACCREDITED AUTHORITY, AND PROVIDE TEST REPORTS TO SUPERINTENDENT.
- G23. SEPARATE METALS FROM INCOMPATIBLE MATERIALS (eg STAINLESS STEEL, GALVANIZED STEEL, UNGALVANIZED STEEL AND TREATED TIMBER etc) BY CONCEALED LAYERS OF SUITABLE INERT MATERIALS OF SUITABLE THICKNESSES. USE PLASTIC SLEEVES AND WASHERS FOR BOLTS, etc.
- G24. EXTERNAL ELEMENTS ARE THOSE EXPOSED TO WEATHER, RAIN AND WATER PENETRATION IN FINAL WORKS.
- G25. FOR EXTERNAL HORIZONTAL SURFACES, PROVIDE ADEQUATE GRADIENT TO DRAIN WATER.
- G26. UNO=UNLESS NOTED OTHERWISE, SLS=SERVICEABILITY LIMIT STATE, ULS=ULTIMATE LIMIT STATE, NSL=NATURAL SURFACE LEVEL, FSL=FINISHED SURFACE LEVEL.
- G27. SUPERINTENDENT=SUPERINTENDENT NOMINATED IN CONTRACT.
- G28. BUILD, FABRICATE AND PROCURE ONLY FROM DRAWINGS 'ISSUED FOR CONSTRUCTION'.
- G29. KEEP ON SITE A COMPLETE SET OF CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS) AND SITE INSTRUCTIONS.

TEMPORARY WORKS

- G30. THESE DRAWINGS DO NOT DETAIL TEMPORARY WORKS. CONSTRUCTION METHODS AND TEMPORARY WORKS ARE RESPONSIBILITY OF THE CONTRACTOR.
- G31. PROVIDE SCAFFOLDING, BARRIERS, FALL RESTRAINT, HAND-MID RAILS AND TOE BOARDS FOR WORK AT HEIGHT. ERECT ACCESS STAIRS AT EARLIEST OPPORTUNITY TO REDUCE OPEN SHAFT HAZARDS AND FACILITATE ACCESS. MAINTAIN SAFETY MESH AND BARRIERS TO ALL OPENINGS AND ELEVATED EDGES.
- G32. MAINTAIN STRUCTURE IN A STABLE CONDITION DURING CONSTRUCTION AND PROVIDE TEMPORARY BRACING AND / OR SUPPORT AS REQUIRED. SHOW TEMPORARY MEMBERS ON SHOP DRAWINGS. PROVIDE SPREADERS AT LOADS AND / OR LIFTING POINTS WHERE REQUIRED. ENSURE NO PART IS OVERSTRESSED. DO NOT PLACE OR STORE BUILDING MATERIALS ON, SUPPORT FORMWORK OR PROP FROM STRUCTURAL MEMBERS WITHOUT SUPERINTENDENT'S APPROVAL. PROVIDE CALCULATIONS BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO PROVE ADEQUACY OF STRUCTURE FOR PROPOSED CONSTRUCTION SEQUENCE, METHODS AND LOADS INCLUDING PROPPING, CRANE LIFTS etc.
- G33. PROVIDE TEMPORARY BRACING WHERE REQUIRED FOR STRUCTURAL ELEMENTS OR FRAMES STABILIZED BY MASONRY, PRECAST CONCRETE OR OTHER ELEMENTS CONSTRUCTED AFTER ERECTION OF THE STRUCTURAL ELEMENT OR FRAME, AND SHOW ON SHOP DRAWINGS.

DESIGN ASSUMPTIONS

- G34. STRUCTURAL WORK HAS BEEN DESIGNED FOR FOLLOWING LOADS:
 - PERMANENT DEAD LOAD OF STRUCTURE AS SHOWN ON DRAWINGS
 - LIVE LOADS:
 - T44 TRUCK LOADING & L44 LANE LOADING
 - 5 kPa ON WALKWAYS
 - HYDRAULIC LOADS:
 - WARNERS BRIDGE: 4.4 m/s (1.2 m DEBRIS MAT)
 - ANICHS BRIDGE: 4.0 m/s (2.0 m DEBRIS MAT)
 - BRIDGE EARTHQUAKE CLASSIFICATION:
 - BEDC-1 (BOTH)
 - PILE LOADING:
 WARNERS BRIDGE:
 - 500 kN COMPRESSION 250 kN TENSION (1000 kN COMPRESSION 500 kN TENSION GEOTECHNICAL LOAD).
 ANICHS BRIDGE:
 - 640 kN COMPRESSION 200 kN TENSION (1280 kN COMPRESSION 400 kN TENSION GEOTECHNICAL LOAD).

DELIVERABLES

- G35. RECORD ADOPTED CHANGES TO WORKING DRAWINGS AND SHOP DRAWINGS. ON COMPLETION OF WORKS SUBMIT A FULL SET OF 'AS CONSTRUCTED' DRAWINGS.

- G36. PREPARE WORKSHOP DRAWINGS, CALCULATIONS etc FOR PREFABRICATED COMPONENTS, INCLUDING STRUCTURAL STEELWORK, LIGHTWEIGHT STEELWORK, PRECAST CONCRETE, PRESTRESSING, FABRICATED TIMBER FRAMES etc AND SUBMIT ELECTRONIC PDF'S OR THREE PAPER COPIES OF EACH FOR SUPERINTENDENT'S REVIEW OF GENERAL COMPLIANCE WITH DESIGN CONCEPT. DO NOT COMMENCE FABRICATION UNTIL SHOP DRAWINGS AND CALCULATIONS HAVE BEEN REVIEWED. ALLOW 14 DAYS FOR SUPERINTENDENT'S REVIEW.
- G37. SUPERINTENDENT'S REVIEW OF SHOP DRAWINGS AND CALCULATIONS IS OF GENERAL CONFORMANCE WITH DESIGN CONCEPT AND GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS ONLY, AND DOES NOT INCLUDE CHECKING OF DIMENSIONS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING QUANTITIES AND DIMENSIONS, SELECTING FABRICATION PROCEDURES AND CONSTRUCTION TECHNIQUES, AND PERFORMING WORK IN A SAFE MANNER. CORRECTIONS OR COMMENTS MADE ON SHOP DRAWINGS AND CALCULATIONS DO NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR COMPLIANCE WITH REQUIREMENTS OF CONTRACT DRAWINGS AND SPECIFICATION.

SAFETY IN DESIGN

- SID1. THE SAFETY RISK MITIGATION ITEMS BELOW ARE BASED ON GHD'S DESIGN OFFICE EXPERIENCE AND DO NOT NECESSARILY ACCOUNT FOR ALL CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION SAFETY RISKS. BASED ON INFORMATION AVAILABLE WHEN THIS DRAWING WAS MADE, IN ITS CAPACITY AS DESIGNER ONLY, GHD HAS TRIED TO IDENTIFY SAFETY RISKS PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION PHASES OF THE ASSET. INCLUSION (OR NOT) OF ANY ITEM DOES NOT REDUCE OR LIMIT OBLIGATIONS OF CONSTRUCTOR, USER, MAINTAINER AND DEMOLISHER TO UNDERTAKE APPROPRIATE RISK MANAGEMENT ACTIVITIES TO REDUCE RISK AND IS NOT AN ADMISSION BY GHD THAT INCLUSION OF ANY ITEM IS DESIGNER'S RESPONSIBILITY.
- SID2. CONSTRUCT BUILDING ELEMENTS THAT CONTRIBUTE TO SAFETY, SUCH AS HANDRAILS AND TOE BOARDS, FALL ARREST SYSTEMS, ACCESS STAIRS, etc AS EARLY AS POSSIBLE.
- SID3. PROVIDE SAFETY BARRIERS AT EDGES OF OPENINGS AND ELEVATED AREAS.
- SID4. REVIEW ADEQUACY OF WORKING SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES. ENSURE SEPARATION OF PLANT AND PERSONNEL ON SITE, INCLUDING MOVEMENTS OF BOTH.
- SID5. LOCATE LIFTING SLEW AND LAY DOWN AREAS AWAY FROM REGULAR CONSTRUCTION TRAFFIC.
- SID6. PROVIDE PROTECTION TO PERSONNEL FROM PLANT AND EQUIPMENT, INCLUDING POST-TENSIONED GROUND ANCHOR INSTALLATION WORKS.
- SID7. ENSURE ISOLATION SAFE SYSTEMS OF WORK OR PROTECTIVE MEASURES ARE INSTALLED BEFORE WORKING NEAR LIVE ELECTRICAL INFRASTRUCTURE. PROVIDE PROTECTION OF ELECTRICAL OVERHEAD WIRING SYSTEMS DURING CONSTRUCTION.
- SID8. WRITTEN RISK ASSESSMENTS ARE ADVISED FOR ACCESS TO OPEN EXCAVATIONS.
- SID9. PROVIDE ACCESS AND EGRESS TO EXCAVATIONS APPROPRIATE IN CASE OF INUNDATION, COLLAPSE OR ENGULFMENT.
- SID10. LOCATE STOCKPILES AND HEAVY EQUIPMENT INCLUDING CRANES AWAY FROM BURIED SERVICES AND BUILDING BOUNDARIES WHERE ADJACENT BASEMENTS ARE PRESENT.
- SID11. SEEK ADVICE FROM SUITABLY QUALIFIED GEOTECHNICAL OR STRUCTURAL ENGINEER PRIOR TO OPERATION OF HEAVY SURFACE PLANT AND EQUIPMENT OR STOCKPILING MATERIAL NEAR OPEN EXCAVATIONS OR EXISTING RETAINING STRUCTURES.
- SID12. DO NOT STOCKPILE MATERIALS BEHIND OR EXCAVATE IN FRONT OF EXISTING RETAINING WALLS UNTIL WALL STABILITY HAS BEEN REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SID13. HAVE LOAD CAPACITY OF STRUCTURES VERIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE LOADING OR STORING MATERIALS ON EXISTING OR PARTIALLY COMPLETED STRUCTURAL ELEMENTS.
- SID14. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER IF PLANNING CRANE LIFTS OR HOIST INSTALLATION ON PARTIALLY ERECTED OR SUSPENDED STRUCTURES.
- SID15. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE CORING, CHASING, CUTTING OR REMOVAL OF EXISTING CONCRETE AND REINFORCEMENT.
- SID16. DEVELOP STEELWORK / PRECAST / TILT UP INSTALLATION SAFE WORK METHOD STATEMENT TO ELIMINATE AND MINIMISE INSTALLATION RISKS, AND HAVE REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER PRIOR TO ERECTION.
- SID17. DO NOT CUT OR UNBOLT ANY STRUCTURAL MEMBERS WITHOUT SEEKING REVIEW BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SID18. MINIMIZE SITE BASED TREATMENTS (eg WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING, etc) PROVIDE ADEQUATE PROTECTION, SCREENING AND VENTILATION TO MINIMIZE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.
- SID19. AVOID HOT WORKS ON SITE. HOT WORKS TO COMPLY WITH CLIENT PROCEDURES FOR APPLICABLE 'HOT WORKS PERMITS'.
- SID20. DETERMINE APPROPRIATE METHOD OF PAINT REMOVAL AND DISPOSAL BEFORE STRIPPING PAINT, PARTICULARLY ON HISTORIC STRUCTURES. COATINGS CONTAINING COAL TAR EPOXIES, BITUMENS AND ASPHALTS, ZINC CHROMATE AND LEAD PRESENT A HEALTH RISK. PROVIDE SCREENING TO PUBLIC AND ENVIRONMENT FOR PAINT REMOVAL AND CLEANING OPERATIONS. USE ENVIRONMENTALLY APPROPRIATE RESTORATION METHODS DURING MAINTENANCE AND REPAIR WORK.
- SID21. MAKE WORK AREAS SAFE WHERE STRUCTURAL ELEMENTS ARE DAMAGED, CRACKED OR HAVE SUFFERED SIGNIFICANT SECTION LOSS BEFORE ALLOWING GENERAL CONSTRUCTION OR REPAIR ACCESS.
- SID22. REPORT SIGNIFICANT SECTION LOSS OR CORROSION FLAKING BEFORE STARTING PAINTING OR REPAIRS. CONSULT SUITABLY QUALIFIED STRUCTURAL ENGINEER IF SECTION LOSS OR EXTENSIVE CORROSION FLAKING PRESENT BEFORE PROCEEDING WITH WORK.
- SID23. REPORT LOOSE OR MISSING BOLTS etc IN CONNECTIONS ENCOUNTERED DURING DAY TO DAY OPERATIONS.

DEMOLITION

- D1. DEMOLITION WORK TO BE TO AS2601. TAKE PRECAUTIONS NECESSARY FOR PROTECTION OF PERSONS AND PROPERTY. PREVENT DAMAGE TO CONCRETE OR REINFORCEMENT TO REMAIN WHEN CUTTING AND REMOVING OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. DO NOT COMMENCE DEMOLITION WORK BEFORE DEMOLITION PERMIT / SCAFFOLD PERMIT OBTAINED.
- D2. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ESTABLISH CRITICAL STABILITY ELEMENTS AND ASSIST DEVELOPMENT OF DEMOLITION METHOD STATEMENT.
- D3. MAKE ALLOWANCE FOR CONDITION OF STRUCTURAL AND OTHER ELEMENTS (eg WALL TIES), INCLUDING LOSS OF CAPACITY DUE TO DETERIORATION OR AGE.
- D4. CONSIDER PROVIDING LOCAL EMERGENCY SERVICES WITH COPY OF DEMOLITION METHOD STATEMENT BEFORE COMMENCING WORK.
- D5. HAVE ADJACENT STRUCTURES REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ASSESS IMPACT OF PROPOSED DEMOLITION WORK.
- D6. PROVIDE TEMPORARY SUPPORT TO ADJOINING STRUCTURES BY SHORING, UNDERPINNING, PROPPING OR AS REQUIRED DESIGNED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ).
- D7. NOTIFY OWNERS AND OCCUPANTS OF ADJOINING PROPERTIES OF PROPOSED DEMOLITION WORKS, INCLUDING DETAILS AND TIMING OF WORKS.
- D8. DO NOT USE EXPLOSIVES.
- D9. USE DEMOLITION METHODS TO MINIMISE INTERFERENCE WITH AND PROTECT OCCUPANTS AND THEIR ACTIVITIES, INCLUDING FROM NOISE, NOXIOUS EFFECTS OF DUST, FUMES, LIQUIDS, GASES, INFECTION, FIRE, EXPLOSION, RADIATION OR OTHER HAZARDS, ETC.
- D10. CAPTURE AND DISPOSE OF SAFELY ANY DUST, DEBRIS OR SPILLAGES.
- D11. ADVISE SUPERINTENDENT IMMEDIATELY IF HAZARDOUS MATERIALS ARE FOUND ON SITE, INCLUDING ASBESTOS, FLAMMABLE OR EXPLOSIVE LIQUIDS OR GASES, TOXIC, INFECTED OR CONTAMINATED MATERIALS, RADIATION OR RADIOACTIVE MATERIALS, NOXIOUS OR EXPLOSIVE CHEMICALS, TANKS OR OTHER CONTAINERS THAT HAVE BEEN USED FOR STORAGE OF ABOVE.

- D13. GIVE NOTICE FOR INSPECTION AT THE FOLLOWING STAGES:
 -ADJOINING STRUCTURES BEFORE COMMENCEMENT OF DEMOLITION.
 -BEFORE DISCONNECTION OR DIVERSION OF SERVICES.
 -TREES SPECIFIED TO BE RETAINED BEFORE COMMENCEMENT OF DEMOLITION.
 -MEASURES TO PROTECT ADJOINING STRUCTURES IN PLACE.
 -UNDERGROUND STRUCTURES AFTER DEMOLITION OF WORK ABOVE SUCH STRUCTURE.
 -EXCAVATION REMAINING AFTER REMOVAL OF UNDERGROUND WORK.
 -SITE AFTER REMOVAL OF DEMOLISHED MATERIALS.
 -SERVICES AFTER RECONNECTION OR DIVERSION.
 ON COMPLETION OF DEMOLITION GIVE NOT LESS THAN SEVEN WORKING DAYS NOTICE SO ADJOINING STRUCTURES CAN BE INSPECTED.
- D14. REMOVE FROM SITE ALL DEMOLISHED MATERIALS NOT REQUIRED IN FINAL WORKS.
- DELIVERABLES**
- D15. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED DEMOLITION SUBCONTRACTORS.
- D16. SUBMIT ELECTRONIC PDF'S OR THREE PAPER COPIES OF PROPOSED DEMOLITION METHOD STATEMENT AT LEAST 14 DAYS PRIOR TO DEMOLITION WORK. DO NOT PROCEED WITH DEMOLITION UNTIL WRITTEN APPROVAL ISSUED. METHOD STATEMENT TO INCLUDE METHODOLOGY, PERSONNEL, EQUIPMENT, PROPOSED SEQUENCE OF WORKS, TIMES FOR DISCONNECTION AND RECONNECTION OF SERVICES, SITE SECURITY, HOT WORKS, SPLINTERS AND EXPOSED ELEMENTS, DEBRIS, TRANSPORT AND DISPOSAL, ACCESS EQUIPMENT, TEMPORARY BATTERS, AIR QUALITY AND POLLUTION CONTROL MEASURES.
- D17. HAVE CHARTERED STRUCTURAL ENGINEER REVIEW PROPOSED DEMOLITION LOADS THAT MAY AFFECT STRUCTURES AND SUBMIT REPORT TO SUPERINTENDENT PRIOR TO COMMENCEMENT OF DEMOLITION.

EARTHWORKS, FOUNDATIONS AND FOOTINGS

EARTHWORKS

- F1. EARTHWORKS TO BE TO AS3798 AND AS2870.
- F2. REMOVE TOPSOIL, MATERIAL CONTAINING GRASS ROOTS OR OTHER ORGANIC MATTER, RUBBLE AND / OR DEBRIS AND ALL UNSUITABLE MATERIAL BELOW FOUNDATIONS AND WHERE SHOWN ON DRAWINGS.
- F3. DO NOT STOCKPILE MATERIAL AGAINST RETAINING WALLS, BUILDINGS, FENCES OR TREES etc. DO NOT OBSTRUCT THE FREE FLOW OF WATER.
- F4. REFER TO GEOTECHNICAL INVESTIGATION REPORTS No. 104527.00.R.001 & 10452700.R.002 PREPARED BY DOUGLAS PARTNERS DATED FEBRUARY 2021. NOTIFY SUPERINTENDENT IF CONDITIONS ENCOUNTERED DIFFER FROM THOSE DESCRIBED IN THE REPORT AND SEEK DIRECTIONS.
- F5. NOTIFY SUPERINTENDENT IF GROUND WATER ENCOUNTERED.
- F6. DESIGN IS BASED ON DATA FROM DISCRETE LOCATIONS AS RECORDED IN GEOTECHNICAL INVESTIGATION REPORT. SUBSURFACE CONDITIONS SHOWN ON DRAWINGS IS INFERRED FROM DATA IN GEOTECHNICAL INVESTIGATION REPORT AND IS GIVEN AS A GUIDE ONLY. ACTUAL GROUND CONDITIONS MAY VARY FROM THOSE SHOWN.
- F7. PROVIDE TEMPORARY SUPPORT TO FACES OF EXCAVATIONS AS REQUIRED.
- F8. HAVE SAFETY OF PROPOSED EXCAVATIONS INCLUDING ANY TEMPORARY WORKS ASSESSED BY SUITABLY QUALIFIED GEOTECHNICAL / STRUCTURAL ENGINEER.
- F9. GENERAL FILL TO BE WELL GRADED MATERIAL, INORGANIC, LESS THAN 0.5% SULPHUR, MAXIMUM PARTICLE SIZE 75 mm, PLASTICITY INDEX < 55%.
- F10. SELECTED FILL MATERIAL SHALL COMPLY WITH THE FOLLOWING:
 -INORGANIC, LESS THAN 0.5% SULPHUR
 -MAXIMUM PARTICLE SIZE 75 mm
 -PROPORTION PASSING 0.075 mm SIEVE: 25% MAXIMUM
 -PLASTICITY INDEX: >2%, <15%
 -PROPORTION EXCEEDING PARTICLE SIZE OF 50 mm: 75% MINIMUM
- F11. PLACE FILL MATERIAL UNDER SLABS AND OTHER FOOTINGS IN LAYERS NOT EXCEEDING 150 mm THICK AND COMPACT TO AT LEAST 95% MAXIMUM DRY DENSITY (STANDARD COMPACTION) TO AS1289.
- F12. ADJUST MOISTURE CONTENT OF FILL AT TIME OF COMPACTION WITHIN THE RANGE OF 85-115% OF OPTIMUM MOISTURE CONTENT DETERMINED BY AS1289 TO ACHIEVE REQUIRED DENSITY.
- F13. SAMPLE AND TEST COMPACTION AS PER SPECIFICATION.

FOUNDATIONS

- F14. FOUNDATION LEVELS SHOWN ARE CONTRACT LEVELS. FINAL LEVELS TO BE AS DIRECTED BY SUPERINTENDENT.
- F15. AVOID OVER EXCAVATION. BACKFILL OVER EXCAVATION WITH GRADE N7 BLINDING CONCRETE.
- F16. KEEP EXCAVATIONS FREE OF WATER. PROVIDE ADEQUATE DRAINAGE TO ENSURE FORMATION IS NOT AFFECTED BY MOISTURE. PREVENT FOUNDATION DRYING OUT DUE TO EXPOSURE. PLACE BLINDING, FOOTINGS, PILES AND BACKFILL AS SOON AS PRACTICABLE AFTER EXCAVATION.
- F17. ENSURE EXCAVATIONS ARE STABLE AND PROTECT SURROUNDING PROPERTY AND SERVICES FROM ADVERSE EFFECTS OF GROUND WORKS. PROVIDE TEMPORARY WORKS AS REQUIRED. PROVIDE SHORING CERTIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ALL DEEP EXCAVATIONS.
- F18. DO NOT UNDERMINE EXISTING FOOTINGS.
- F19. PROVIDE SAFETY MESH AND OTHER PROTECTION TO PREVENT EXPOSURE OF PERSONNEL TO EXCAVATIONS DURING FOUNDATION CONSTRUCTION.
- F20. USE SUITABLE CONSTRUCTION TECHNIQUES AND EQUIPMENT FOR BACKFILLING ADJACENT TO STRUCTURES TO PREVENT OVERSTRESS AND DAMAGE. PROVIDE SUPPORT TO RETAINING WALLS IF CONSTRUCTION METHODS IMPOSE COMPACTION LOADS GREATER THAN ALLOWED (SEE DESIGN LOADS IN GENERAL NOTES). BACKFILL EVENLY TO AVOID DIFFERENTIAL SOIL PRESSURES ON STRUCTURES. BACKFILL AGAINST RETAINING WALLS ONLY AFTER SPECIFIED CONCRETE STRENGTH IS ACHIEVED, AND PERMANENT SUPPORTS INSTALLED.

SLABS AND FOOTINGS

- F21. PROOF ROLL FORMATION WITH HEAVY DUTY ROLLER.
- F22. OBTAIN APPROVAL OF FOUNDATION MATERIAL FOR THE DESIGN PRESSURES FROM SUITABLY QUALIFIED GEOTECHNICAL ENGINEER BEFORE FIXING REINFORCEMENT OR PLACING CONCRETE.
- F23. SLAB PANELS TO BE FOUNDED ON UNDISTURBED NATURAL SOIL WITH ALLOWABLE BEARING CAPACITY OF NOT LESS THAN 100 kPa. REMOVE SOFT SPOTS AND REPLACE WITH COMPACTED CRUSHED ROCK.
- F24. PROVIDE 0.2 mm HIGH IMPACT-RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 ON 50 mm SAND BLINDING WHERE SHOWN ON DRAWINGS. LAP 200 mm AND SEAL DAMP PROOF MEMBRANES, TAPE AT PENETRATIONS, etc TO ENSURE A COMPLETE VAPOUR BARRIER IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS2870. PREVENT PUNCTURING OR DAMAGE BY PLACING A PLASTIC PLATE UNDER REINFORCEMENT SUPPORTS.
- F25. SLOPE GROUND SURROUNDING APPROACHES SO WATER WILL DRAIN AWAY FROM APPROACHES TO SUITABLE DISCHARGE POINTS WITHOUT PONDING. WHERE ACHIEVED BY FILLING, FILL TO BE LESS PERMEABLE THAN UNDERLYING MATERIAL.

PILES

- F26. PILES TO BE INSTALLED BY AN APPROVED SPECIALIST SUB-CONTRACTOR IN ACCORDANCE WITH DRAWINGS, SPECIFICATION AND AS2159 OR AS5100. SUBMIT NAME AND CONTACT DETAILS OF PROPOSED SUBCONTRACTOR.
- F27. PILING CONTRACTOR TO ALLOW FOR INFORMATION IN GEOTECHNICAL INVESTIGATION REPORT AND FOR SITE CONDITIONS.
- F28. PILE CAPACITY MUST EXCEED SPECIFIED DESIGN LOAD.
- F29. PILES MUST BE CAPABLE OF RESISTING ADDITIONAL RELEVANT TEMPORARY, CONSTRUCTION AND PERMANENT LOADS, INCLUDING FORCES DUE TO ECCENTRICITY OF PILE, LATERAL SOIL LOADS AND DRAG FORCES.

- F30. INSPECTION MAY BE MADE OF THE FOLLOWING: SETTING OUT, PILES AND PILING MATERIAL AFTER DELIVERY TO THE SITE AND BEFORE INSTALLATION, INSTALLATION OF PILING, PILE HEADS AFTER PREPARATION, PILE LOAD TESTS, REINFORCEMENT CAGES AFTER ASSEMBLY AND BEFORE INSTALLATION, EXCAVATED SHAFTS, INCLUDING CASINGS AND SOCKETS BEFORE PLACING REINFORCEMENT, REINFORCEMENT IN EXCAVATED SHAFTS BEFORE CONCRETING AND CONCRETING OF PILES.
- F31. PRE-DRILLING OF DRIVEN PILES TO BE APPROVED BY SUPERINTENDENT. MAXIMUM DIAMETER OF PRE-DRILLED HOLES: 50 mm LESS THAN DIAGONAL / LARGEST DIMENSION OF PILE.
- F32. WHERE PILE CUT-OFF LEVEL IS ABOVE ADJACENT GROUND, FORM PILE ABOVE GROUND LEVEL.
- F33. MAKE ALLOWANCE FOR TRIMMING DRIVEN ENDS OF PILES AND EXTENSION OF PILE REINFORCEMENT INTO ABUTMENT AS REQUIRED. LENGTH OF REINFORCEMENT EXTENSION TO BE AS SHOWN ON DRAWINGS, 1000 mm UNO.
- F34. PILES TO PROJECT INTO 50 mm INTO ABUTMENTS UNO.
- F35. DRIVE PILES TO PROVIDE ULTIMATE RESISTANCE AS NOMINATED ON DRAWINGS. DETERMINE PILE LENGTH TO ACHIEVE THIS CAPACITY. PROVE THIS CAPACITY BY TESTING AT LEAST ONE PILE PER ABUTMENT USING P.D.A. TESTING WITH CAPWAP ANALYSIS TO CONFIRM LOAD CAPACITY AND MONITOR INTEGRITY DURING INSTALLATION. USE RESULTS OF TESTING TO ESTABLISH PILE DRIVING CRITERIA FOR REMAINING PILES.
- F36. ADVISE SUPERINTENDENT IF PILE IS DAMAGED BY DRIVING (OR IS OTHERWISE UNSOUND) AT OR BELOW CUT-OFF LEVEL.
- F37. PEG POSITION OF EACH PILE AND ESTABLISH GRID OF RECOVERY PEGS TO ENABLE SETTING OUT TO BE CHECKED.
- F38. PILE LEVELS SHOWN ARE CONTRACT LEVELS. FINAL LEVELS TO BE AS REQUIRED TO ACHIEVE SPECIFIED PILE CAPACITY. DO NOT FOUND PILES HIGHER THAN LEVELS SHOWN.
- F39. NOTE POSSIBILITY OF ENCOUNTERING BASALT COBBLES AND / OR BOULDERS IN CLAY. PRE-BORING WILL BE NOTED ON DRAWINGS IF REQUIRED.
- F40. IF DAMAGE IS CAUSED TO ADJOINING PROPERTY, STOP PILING OPERATIONS AND ADVISE SUPERINTENDENT.
- F41. PILE DRIVING HEAD TO BE DESIGNED BY PILE SUB-CONTRACTOR.
- F42. PILE SETTING OUT DIMENSIONS ARE TO CENTRELINE OF PILE AT UNDERSIDE OF PILECAP. TOLERANCE ON POSITION OF PILES ± 75 mm. MAXIMUM DEVIATION OF PILE FROM SPECIFIED INCLINATION 1 in 50.

PILING DELIVERABLES

- F43. SUBMIT CALCULATIONS AND DRAWINGS TO DEMONSTRATE THE PILE DESIGN SATISFIES THE SPECIFIED DESIGN REQUIREMENTS BEFORE COMMENCING WORK ON SITE.
- F44. SUBMIT REPORT INCLUDING PILE DRIVING RECORDS AND LOAD TEST RESULTS TO SUPERINTENDENT BEFORE BREAKING BACK PILES.
- F45. SURVEY AS CONSTRUCTED PILE POSITIONS, GROUND LEVEL AT TIME OF INSTALLATION AND CUT-OFF LEVELS, AND SUBMIT RECORDS TO SUPERINTENDENT WITHIN ONE WEEK OF COMPLETION OF PILING.

STEEL

- S1. WORKMANSHIP, FABRICATION AND MATERIALS TO COMPLY WITH AS4100, AS/NZS4600, AS/NZS1554, AS/NZS5131 AND AS4673 FOR STAINLESS STEEL.
- S2. PROVIDE STEEL IN ACCORDANCE WITH:
 - AS1163 GRADE C350 OR C450 FOR RECTANGULAR AND SQUARE HOLLOW SECTIONS,
 - AS1163 GRADE C250 OR C350 FOR CIRCULAR HOLLOW SECTIONS, AS NOTED ON DRAWINGS
 - AS1443 COLD-FINISHED BARS,
 - AS/NZS1594 GRADE 250 HOT-ROLLED STEEL FLAT PRODUCTS,
 - AS/NZS3678 FOR PLATES AND FLOOR PLATE,
 - AS/NZS3679 PART 2, GRADE 300 FOR WELDED BEAMS AND WELDED COLUMNS,
 - AS/NZS3679 PART 1 GRADE 300 OR BHP GRADE 300 PLUS FOR UNIVERSAL BEAMS, UNIVERSAL COLUMNS, PARALLEL FLANGE CHANNELS, ANGLES, FLATS, BARS AND RODS,
 - OTHERWISE TO COMPLY WITH AS/NZS3678 OR AS/NZS3679 GRADE 250 UNO.
- S3. MANUFACTURERS AND PROCESSORS OF STRUCTURAL STEEL MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH RELEVANT STANDARDS, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL STRUCTURAL STEELWORK.
- S4. MARK STEEL GRADES ON STRUCTURAL MEMBERS IN NON-CRITICAL AREAS. USE IDENTIFICATION MARKS COMPATIBLE WITH AND VISIBLE THROUGH PAINT SYSTEM.
- S5. PROVIDE 3 mm CAP PLATES SEAL WELDED TO HOLLOW SECTIONS UNO.
- S6. CARRY OUT ERECTION OF STEELWORK IN ACCORDANCE WITH AS/NZS5131 GUIDELINES FOR THE ERECTION OF BUILDING STEELWORK.
- S7. PROTECT STEELWORK FROM DAMAGE DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. SUBMIT PROPOSED METHOD TO REPAIR DAMAGE FOR APPROVAL. PROTECT STEELWORK STORED ON SITE FROM CORROSION OR DETERIORATION OF COATINGS.
- S8. SEQUENCE ERECTION WORKS TO AVOID PINCH POINTS AND SITE CONGESTION.
- S9. INSTALL BEAMS WITH NATURAL CAMBER UPWARD.
- S10. PROVIDE STEEL MEMBERS MADE FROM WHOLE LENGTHS WHEREVER POSSIBLE. SEEK APPROVAL TO MAKE LENGTHS UP OF SECTIONS JOINED BY COMPLETE PENETRATION FULL STRENGTH BUTT WELDS GROUND FLUSH WHERE REQUIRED. WHERE PROPOSED, SHOW JOINTS ON SHOP DRAWINGS. ENSURE MEMBERS ARE CONCENTRIC AT CONNECTIONS (GRAVITY- OR GAUGE-LINES TO INTERSECT) UNO. ACCURATELY PRE-FORM PARTS TO AVOID FORCE AND / OR RESTRAINT DURING JOINING.
 DRILL HOLES FULL SIZE OR REAM TO FULL SIZE AFTER SUB-DRILLING OR SUB-PUNCHING. SUB-DRILLED OR SUB-PUNCHED HOLES TO BE AT LEAST 3 mm UNDERSIZE. 'OXY' OR FLAME CUTTING OF HOLES IS NOT PERMITTED. BOLT HOLE SIZE TO BE:
 - BOLT DIAMETER PLUS 2 mm FOR STEEL TO STEEL CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR STEEL TO CONCRETE CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR HOLDING DOWN BOLTS UP TO M20.
 - BOLT DIAMETER PLUS 6 mm FOR HOLDING DOWN BOLTS M24 OR LARGER.

WELDING

- S12. DEVELOP WELD PROCEDURES TO SUIT JOINT DETAILS AND SHOW ON SHOP DRAWINGS. USE PREQUALIFIED WELD PROCEDURES AND CONSUMABLES TO AS/NZS1554.1 CLAUSE 4.3 OR DEVELOP QUALIFICATION OF WELD PROCEDURE AND CONSUMABLES BY TESTING TO AS/NZS1554.1 CLAUSE 4.2. LIST APPLICABLE PARAMETERS ON WELDING PROCEDURE QUALIFICATION RECORD AND MAKE RECORD AVAILABLE FOR INSPECTION.
- S13. WELDING TO BE UNDERTAKEN BY SUITABLY QUALIFIED EXPERIENCED WELDER UNDER SUPERVISION OF QUALIFIED WELDING SUPERVISOR.
- S14. CARRY OUT WELDING TO AS/NZS1554. ALL INTERFACES BETWEEN STEEL SECTIONS TO BE CONNECTED WITH 6 mm CONTINUOUS FILLET WELDS ALL ROUND, BOTH SIDES UNO.
 - WELDS TO BE SHOP WELDED UNO.
 - WELDS TO BE CATEGORY SP.
 - BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO.
 - ELECTRODES TO BE LOW CARBON WITH TENSILE STRENGTH OF $f_{tw}=490$ MPa, PRE-APPROVED TO AS/NZS1554. eg CLASSIFICATION E 490XX.
 EXTENT OF WELD INSPECTION / TESTING TO BE:
 - VISUAL SCANNING: 100% OF WELDS
 - VISUAL EXAMINATION: 100% OF BUTT WELDS IN TENSION MEMBERS AND 50% OF OTHER WELDS
 - RADIOGRAPHIC OR ULTRASONIC: 10% OF BUTT WELDS IN TENSION MEMBERS AND 5% OF OTHER WELDS
- S16. GRIND WELDS SMOOTH AND FLUSH WITH PARENT METAL WHERE NOMINATED ON DRAWINGS. GRIND ONLY IN LONGITUDINAL DIRECTION OF MEMBER.
- S17. REPAIR FAULTY WELDS AND DEFECTS REVEALED BY WELD INSPECTION / TESTING AND REPEAT THE EXAMINATION.
- S18. WELDS TO BE INSPECTED BY INDEPENDENT NATA ACCREDITED QUALIFIED WELDING INSPECTOR TO AS2214. PROVIDE WELDING INSPECTOR'S REPORT TO SUPERINTENDENT.
- S19. WELDING SYMBOLS ARE TO AS1101.3. 'CFW' INDICATES CONTINUOUS FILLET WELD. 'FPBW' INDICATES FULL PENETRATION BUTT WELD WHICH IS EQUIVALENT TO CPBW. 'CPBW' INDICATES COMPLETE PENETRATION BUTT WELD.

BOLTS

0	APPROVED ISSUE		WRC	*MI	*AA	12.04.21
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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DO NOT SCALE		Drawn W.CLARKE	Designer A.AHILADELLIS	Client	DOUGLAS SHIRE COUNCIL WARNERS AND ANICHS BRIDGE UPGRADES WARNERS AND ANICHS BRIDGE STRUCTURAL NOTES - SHEET 1		
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- S20. M16 AND LARGER BOLTS TO BE HIGH STRENGTH STRUCTURAL BOLTS, 8.8/8 PROCEDURE AND M12 SIZE BOLTS SHALL BE COMMERCIAL BOLTS, 4.6/5 PROCEDURE UNO.
- S21. FOR BOLTS MANUFACTURED OUTSIDE AUSTRALIA, PROVIDE LOCAL INDEPENDENT NATA-ACCREDITED LABORATORY COMPLIANCE CERTIFICATE BASED ON APPROPRIATE TESTING AND VERIFICATION.
- S22. USE BOLTS WITH THREADS IN COMPLIANCE WITH AS1275. BOLTS OF STRENGTH GRADE 4.6 TO BE COMMERCIAL GRADE BOLTS TO AS1111 AND 1112. BOLTS OF STRENGTH GRADE 8.8 TO BE HIGH STRENGTH STRUCTURAL BOLTS, NUTS AND WASHERS TO AS/NZS1252. MECHANICAL PROPERTIES OF BOLTS, NUTS, SCREWS AND STUDS TO COMPLY WITH AS/NZS4291. WASHERS TO COMPLY WITH AS1237. TIGHTENING PROCEDURES TO COMPLY WITH AS4100.
- S SNUG TIGHT.
 - TB BEARING MODE JOINT, BOLTS FULLY TENSIONED.
 - TF FRICTION MODE JOINT, BOLTS FULLY TENSIONED. (CONTACT SURFACES OF FRICTION CONNECTIONS TO BE UNCOATED AND FREE OF MILL SCALE.)
- S23. BOLT TYPE AND TIGHTENING PROCEDURE ARE DESIGNATED: NUMBER, SIZE STRENGTH GRADE / TIGHTENING PROCEDURES
- eg 4-M24 8.8/TB = 4 OFF 24 DIAMETER METRIC HIGH STRENGTH STRUCTURAL BOLTS FULLY TENSIONED IN BEARING MODE.
- S24. USE BOLT LENGTHS SO THAT PROJECTION BEYOND NUT IS AT LEAST TWO THREADS, AND NOT MORE THAN 10 mm.
- S25. USE BOLTS, SCREWS, NUTS AND WASHERS HOT DIP GALVANIZED BY MANUFACTURER TO AS1214. TAP GALVANIZED NUTS 0.4 mm OVERSIZE TO SUIT GALVANIZED THREADS TO AS1214 AND OIL FOR PROTECTION. INSTALL WASHERS UNDER BOLT HEAD OR NUT, WHICHEVER PART IS ROTATED. USE HARDENED OR PLATE WASHERS UNDER BOTH HEAD AND NUT FOR OVERSIZED AND SLOTTED HOLES TO AS4100. USE TAPERED WASHERS AS REQUIRED UNDER NON-ROTATING PART.
- S26. SLOTTED HOLES TO BE 2.5 x BOLT DIAMETER LONG UNO. BOLTS TO BE SET CENTRAL IN SLOT UNO. USE 8 mm PLATE WASHERS UNDER BOLT HEAD AND NUT TO COMPLETELY COVER HOLE.

CONNECTIONS

- S27. STEEL CONNECTION DETAILS TO BE IN ACCORDANCE WITH AS4100 AND AUSTRALIAN STEEL INSTITUTE (ASI) STRUCTURAL STEEL CONNECTION SERIES OF MANUALS AND GUIDES UNO.
- S28. PROVIDE CLEATS AND DRILL HOLES NECESSARY FOR FIXING OTHER ELEMENTS TO STEELWORK. SHOW ON SHOP DRAWINGS.
- S29. PROVIDE RADIUSED CORNERS ON EXPOSED CLEATS TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.
- S30. PROVIDE BOLTED CLEAT CONNECTIONS TO SITE WELDED CONNECTIONS CAPABLE OF BEING LOADED BEFORE OR WHILE CONNECTIONS ARE WELDED TOGETHER.
- S31. CROP INTERNAL CORNERS OF CLEATS AND STIFFENERS, etc TO FACILITATE DRAINAGE. PROVIDE DRAINAGE HOLES TO PREVENT WATER PONDING ON STRUCTURAL ELEMENTS DURING CONSTRUCTION. SHOW PROPOSED HOLES ON SHOP DRAWINGS.

STAINLESS STEEL

- S32. PROVIDE STAINLESS STEEL GRADE 316L UNO.
- S33. BOLTS AND NUTS TO BE STAINLESS STEEL GRADE A4 CLASS 50 TO ISO 3506. WASHERS TO BE STAINLESS STEEL TO ISO 7089 OR ISO 7090. AVOID GALLING BY USING METAL-FREE LUBRICATING PASTE OR OTHER METHOD APPROVED BY SUPERINTENDENT.
- S34. STAINLESS STEEL SURFACE FINISH TO BE < 12 µm AS DETERMINED ACCORDING TO AS2382. WELDS TO BE POLISHED TO MATCH ADJACENT STAINLESS STEEL ROUGHNESS AND APPEARANCE. APPLY PASSIVATION TREATMENT USING NITRIC ACID (HNO₃) SOLUTION TO ALL STAINLESS STEEL SURFACES IN ACCORDANCE WITH ASTM A380. WASH THOROUGHLY AFTER PASSIVATION. SUBMIT SAMPLES (0.1 m² MINIMUM SIZE) OF SURFACE FINISH FOR APPROVAL.
- S35. STAINLESS STEEL TO BE WELDED TO AS/NZS 1554.6. WELDS TO BE CLASS 1A FOR STAINLESS STEEL. WELD SURFACE FINISH GRADE II TO AS/NZS1554.6 CLAUSE 6.2. SURFACE ROUGHNESS (R_a) TO BE 12.5 TO AS2382. ELECTRODES TO BE E316LX UNO, PRE-QUALIFIED TO AS/NZS1554.6.
- S36. DO NOT FLAME CUT STAINLESS STEEL. KEEP STAINLESS STEEL SURFACES CLEAN AND FREE OF BLEMISHES THROUGHOUT FABRICATION.
- S37. FABRICATE STAINLESS STEEL IN WORKSHOP AREAS SEGREGATED FROM CARBON STEEL FABRICATION AREAS. USE TOOLS DEDICATED TO STAINLESS STEEL FABRICATION. WIRE BRUSHES AND WIRE WOOL USED IN FABRICATION OF STAINLESS STEEL TO BE STAINLESS STEEL OR CLEAN INERT MATERIALS.
- S38. PREVENT CONTACT BETWEEN STAINLESS STEEL AND CARBON STEEL, IRON, CHEMICALS, OILS AND / OR GREASE. REMOVE SURFACE CONTAMINANTS INCLUDING STICKERS AND MARKINGS PRIOR TO WELDING OR FABRICATION.

BASEPLATES AND HOLDING DOWN BOLTS

- S39. HOLDING DOWN BOLTS TO BE GRADE 4.6 UNO. SUPPLY HOLDING DOWN BOLTS WITH TWO CLASS 5 HEXAGONAL HEAD NUTS AND EXTRA LARGE HARDENED OR 4 mm PLATE WASHER. HOT DIP GALVANIZE HOLDING DOWN BOLTS, NUTS AND WASHERS TO AS1214. TIE HOLDING DOWN BOLT GROUPS RIGIDLY TOGETHER PRIOR TO INSTALLATION (eg. TACK WELD WITH 10 mm DIAMETER REINFORCING BAR TO FORM A RIGID CAGE) TO ENSURE CORRECT BOLT LOCATIONS, AND SET OUT USING A 3 mm MILD STEEL TEMPLATE SUPPLIED BY STEELWORK FABRICATOR. PROVIDE 4 N12 LIGATURES TO FIX HOLDING DOWN BOLT CAGE SECURELY TO SLAB / FOOTING REINFORCEMENT.
- S40. GROUT BASE PLATES, HOLDING-DOWN BOLTS, REBATES etc BEFORE LOADING COLUMNS OR ERECTING WALLS. USE APPROVED HIGH-STRENGTH (40 MPa AT 7 DAYS) NON-SHRINK PRE-MIXED RANMED GROUT. GROUT THICKNESS 15 mm MINIMUM, 40 mm MAXIMUM UNO. CHAMFER GROUT EDGES AT 45 DEGREES UNO. DO NOT LOAD GROUT UNTIL FULL STRENGTH ACHIEVED.

DURABILITY & PROTECTIVE COATINGS

- S41. HOT DIP GALVANIZE GRATING, HANDRAILS, LADDERS AND STEP IRONS etc TO AS/NZS4680. PROVIDE STAIRS, LADDERS, PLATFORMS, WALKWAYS AND HANDRAILS, etc TO AS1657.
- S42. AFTER COMPLETION OF FABRICATION, PREPARATION FOR SURFACE TREATMENT TO BE: ROUND OFF ROUGH WELDS, SHARP EDGES (ROUND TO 2 mm RADIUS) etc. SURFACE TO BE FREE OF WELDING SPATTER, SLAG, UNDERCUTS, VISIBLE PORES PITS AND CRATERS, VISIBLE SLIVERS, ROLL-OVERS, LAMINATIONS, ROLLED-IN EXTRANEUS MATTER, GROOVES (RADIUS OF GOUGES TO BE LESS THAN 4 mm), INDENTATIONS, ROLL MARKS, BURRS, ARISES, CRACKS, etc. PREPARE WELDS, EDGES AND OTHER AREAS WITH SURFACE IMPERFECTIONS TO ISO 8501-3 PREPARATION GRADE P3.
- S43. SURFACE PREPARATION: REMOVE OIL, GREASE AND OTHER CONTAMINANTS TO AS1627.1. ABRASIVE BLAST CLEAN TO AS1627.4 CLASS SA 2½ WITH SURFACE PROFILE 40 TO 70 MICRONS OR AS SPECIFIED BY COATINGS MANUFACTURER FOR THE SERVICE CONDITIONS. ASSESS ABRASIVE BLAST CLEANED SURFACE TO AS1627.9 AND SURFACE PROFILE TO AS3894.5. FOR SMALL AREAS WHERE ABRASIVE BLAST CLEANING IS NOT POSSIBLE OBTAIN APPROVAL FROM SUPERVISOR TO USE POWER TOOL CLEANING TO AS1627.2 CLASS ST 3 / PST 3 AS DEFINED IN ISO 8501.1 FOR STEEL CLEANED TO A METALLIC FINISH WITH MINIMUM 25 MICRON SURFACE PROFILE. REMOVE DUST BY BRUSHING OR VACUUM CLEANING.
- S44. COATING REPAIRS: REINSTATE COATING TO DAMAGED AREAS TO PROTECTIVE COATINGS SPECIFICATION. FIELD WELD REPAIRS: DO NOT WELD THROUGH EXISTING GALVANIZING OR COATINGS. REMOVE WELD SPATTER, RESIDUAL FLUX etc BY CHIPPING, GRINDING OR ABRASIVE BLAST CLEANING. GRIND FLUSH ROUGH WELD BEADS. PREPARE SURFACE FOR PAINTING AS PER COATING SPECIFICATION. REMOVE RUST, LOOSE AND BURNT PAINT AND SUFFICIENT SOUND COATING SO PAINT EDGE IS FEATHERED AND SMOOTH. STRIPE COAT ALL WELDS, EDGES AND ROUGH SURFACES USING A BRUSH. REINSTATE COATING AS PER PROTECTIVE COATINGS SPECIFICATION.
- S45. WHERE NOMINATED AS GALVANIZED ON DRAWINGS, STEELWORK IS TO BE HOT DIPPED GALVANIZED TO AS/NZS4680 AND AS 1214 FOR FASTENERS. THICKNESS OF GALVANIZED COATINGS TO AS/NZS4680. ZINC IN GALVANIZING BATH TO BE NOT LESS THAN 98% PURE. BATH TEMPERATURE, TIME OF IMMERSION AND WITHDRAWAL SPEED TO BE AS REQUIRED TO ACHIEVE SPECIFIED COATING THICKNESS AND FINISH. ZINC COATING TO BE CONTINUOUS, ADHERENT, FREE FROM LUMPS, SPIKES, DAGS, RUNS, BUSTERS, ROUGHNESS, GRITTY AREAS, UNCOATED SPOTS, ACID AND BLACK SPOTS, DROSS, FLUX AND OTHER IMPERFECTIONS.
- S46. DO NOT USE HIGH STRENGTH LOW ALLOY STEELS CONTAINING HIGH SILICONE (>0.04% Si) THAT CAN PRODUCE THICKER AND / OR BRITTLE GALVANIZED COATINGS. REFER TO GALVANIZER FOR ACCEPTABLE STEEL COMPOSITIONS.
- S47. BUTT WELD END PLATES ON HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED IN LIEU OF FILLET WELD TO AVOID RISK OF CREVICE CORROSION. DO NOT USE A BACKING PLATE.

- S48. PASSIVATE GALVANIZED STEEL TO BE IN CONTACT WITH CONCRETE BY DIPPING IN 0.2% SODIUM DICHROMATE SOLUTION.
- S49. STRAIGHTEN MEMBERS DISTORTED DURING FABRICATION AND/OR GALVANIZING PROCESS USING AN APPROVED METHOD.
- S50. ANNUAL COLD WORKED ITEMS TO 650°C PRIOR TO GALVANIZING.
- S51. REPAIR DAMAGE TO GALVANIZED COATING TO AS/NZS 4680 SECTION 8 –REPAIR AFTER GALVANIZING. USE ORGANIC TWO-PACK ZINC RICH EPOXY COATING COMPLYING WITH AS/NZS 3750.9 APPLIED IN TWO COATS EACH 50 MICRON, MINIMUM TOTAL DRY FILM THICKNESS 100 MICRONS. DO NOT USE SPRAY CANS OF ‘COLD GALV’ OR ZINC ALLOY ‘SOLDER STICKS’. SURFACE PREPARATION OF EXPOSED BARE STEEL TO BE ABRASIVE BLAST CLEANED TO AS 1627.4, CLASS 2½ (PREFERRED) OR POWER TOOL CLEANED TO AS 1627.2 CLASS ST 3. LIGHTLY SWEEP BLAST GALVANIZED SURFACES.
- S52. PROVIDE DRILLED VENT / DRAIN HOLES AT TOP AND BOTTOM EXTREMITIES FOR HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED. PROVIDE RUBBER SEALS OR PLUG WELD VENT / DRAIN HOLES THAT REMAIN EXPOSED. REPAIR DAMAGE TO GALVANIZING.
- S53. PROVIDE DRILLED SUSPENSION HOLES IN END PLATES, ETC FOR ITEMS TO BE HOT DIPPED GALVANIZED.
- S54. PRIOR TO DIPPING ADVISE SUPERINTENDENT OF ANY DESIGN FEATURES THAT MAY LEAD TO DIFFICULTIES DURING GALVANIZING AND SUBMIT DETAILS FOR IMPROVEMENT.
- S55. DO NOT PAINT GALVANIZED STEELWORK UNLESS SPECIFIED ON THE ENGINEERING DRAWINGS. ADVISE GALVANIZER OF ITEMS TO BE PAINTED AFTER GALVANIZING AND FINAL ZINC PASSIVATION IS TO BE OMITTED. PREPARE GALVANIZED SURFACES TO BE PAINTED AS PER AS/NZS4680 APPENDIX I AND APPLY PAINT IN THE WORKSHOP. COATING MANUFACTURER TO PROVIDE A 10 YEAR WARRANTY OF COATING SYSTEM.
- S56. PROTECTIVE COATINGS ARE TO BE SHOP APPLIED AND CURED IN WORKSHOP IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS UNLESS APPROVED OTHERWISE IN WRITING BY SUPERINTENDENT. PROTECTIVE COATINGS ARE TO BE SMOOTH, UNIFORM AND WITHOUT RUNS, BEADS, PINHOLES, SURFACE CRACKING OR OTHER IMPERFECTIONS.
- S57. PROTECT COATINGS FROM DAMAGE AND DETERIORATION DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. REPAIR DAMAGE TO PROTECTIVE COATINGS TO REINSTATE INTEGRITY OF NOMINATED COATING IN ACCORDANCE WITH MANUFACTURERS’ RECOMMENDATIONS AND SPECIFICATION. EDGES OF PATCH REPAIRS TO BE FEATHERED.

DELIVERABLES

- S58. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED FABRICATION AND INSTALLATION SUBCONTRACTORS.
- S59. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS. REFER GENERAL-DELIVERABLES NOTES. SHOP DRAWINGS AND DESIGN CALCULATIONS TO SHOW ARRANGEMENT OF MEMBERS, MARKING PLAN, MEMBER SCHEDULE, LOCATION AND ORIENTATION OF MEMBERS IN BUILDING, REQUIRED CAMBER (WHERE APPLICABLE), RELEVANT DETAILS OF EACH ASSEMBLY, COMPONENT AND CONNECTION, DIMENSIONS OF ITEMS, LOADING PARAMETERS AND BRACING LENGTHS ASSUMED IN DESIGN, DESIGN STRESSES, STRENGTH OF MATERIALS, SIZE OF EACH MEMBER, TOLERANCES ON MEMBER SIZES, JOINT DETAILS, TRIMMERS, NOGGINGS etc, LIFTING POINTS, METHOD OF FIXING AND BRACING, DESIGN DEFLECTION, METHOD OF FABRICATION, SIZE AND SPECIFICATION OF CLEATS, BOLTS, SCREWS, WELDS, WELD CATEGORIES AND BOLTING CATEGORIES, WELD PROCEDURES (INCLUDING POST WELD HEAT TREATMENT), SURFACE PREPARATION METHODS AND PROTECTIVE COATING SYSTEM, VENT / DRAIN HOLES FOR HOT DIP GALVANIZING, PROPOSED JOINTS IN MEMBERS, TEMPORARY MEMBERS, BRACES AND FIXINGS, LOCATION OF FALL ARREST CONNECTIONS, FIXINGS FOR ADJOINING BUILDING ELEMENTS, BASE PLATE DETAILS, FIXINGS FOR PURLINS, GIRTS, LOCATION OF AND PREPARATION FOR SITE WELDS AND BRACING, METHOD OF HANDLING TEMPORARY WORKS, ASSEMBLY, TRANSPORT AND ERECTION (INCLUDING TEMPORARY BRACING IF REQUIRED), PRECAMBER, etc.
- S60. PROVIDE DOCUMENTARY EVIDENCE (INCLUDING TEST RESULTS) OF COMPLIANCE WITH RELEVANT AUSTRALIAN STANDARDS ISSUED BY MANUFACTURER FOR ALL STEELWORK AND EACH BATCH OF FASTENERS USED. EVIDENCE MUST PROVIDE CLEAR VERIFICATION THAT PRODUCT MEETS RELEVANT AUSTRALIAN STANDARDS AND BE WRITTEN IN ENGLISH ALPHANUMERIC CHARACTERS. EVIDENCE TO INCLUDE: NAMES AND ADDRESSES OF MANUFACTURER, SUPPLIER AND TESTING AUTHORITY; TEST CERTIFICATE NUMBER AND DATE WITH PAGE NUMBER ON EACH PAGE; PRODUCT TESTING SPECIFICATION AND GRADE OF STEEL; PRODUCT DESIGNATION AND RELEVANT DIMENSIONS; PRODUCT STEEL MAKING PROCESS; LENGTH, BUNDLE, PACK OR UNIQUE IDENTIFIER TO WHICH CERTIFICATE APPLIES; HEAT NUMBER (FROM CASTING); MECHANICAL PROPERTIES FROM TENSILE TEST (ALL VALUES CITED IN AS/NZ STANDARD), WHETHER EACH MEASURED MECHANICAL PROPERTY COMPLIES WITH AS/NZS STANDARD, CHEMICAL ANALYSIS RESULTS AND TYPE OF ANALYSIS UNDERTAKEN; CUSTOMER PURCHASE ORDER TO MATCH BATCH NUMBER; ANY OTHER SYSTEM REFERENCE NUMBERS AND SIGNATURE OF AUTHENTICITY.

CONCRETE

CONCRETE MIX

- C1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS3600, AS3610, AS1379, AS1478, AS3682, AS3799, AS2758.1, AS5100.5 AND AS3972.
- C2. WET CONCRETE TO BE UNIFORM, DENSE, HOMOGENEOUS, COHESIVE AND ABLE TO WORK READILY INTO CORNERS AND AROUND REINFORCEMENT COMPLETELY FILLING FORMWORK WITHOUT SEGREGATION OF AGGREGATES AND / OR FIBRES, EXCESS FREE WATER ON SURFACE, LOSS OF MATERIAL, CONTAMINATION OR OTHER VISIBLE DEFECTS.
- C3. FINISHED CONCRETE TO BE A DURABLE, DENSE, HOMOGENEOUS MASS COMPLETELY FILLING FORMWORK, EMBEDDING FIBRES, REINFORCEMENT AND TENDONS, AND FREE OF STONE POCKETS OR HONEYCOMBS, OF UNIFORM COLOUR AND TEXTURE, WITH LOW PERMEABILITY AND ADEQUATE BUT NOT EXCESSIVE STRENGTH FOR GRADE.
- C4. AIR ENTRAINMENT IS NOT PERMITTED UNLESS APPROVED IN WRITING BY SUPERINTENDENT.
- C5. QUALITY OF CONCRETE ELEMENTS TO BE AS FOLLOWS:

STRUCTURAL ELEMENT	BLINDING	PRECAST DECK UNITS	CAST INSITU CONCRETE
EXPOSURE CLASSIFICATION	B1	B2	B2
STRENGTH GRADE (MPa)	N7	S50	S40
MINIMUM DENSITY (kg/m ³)	-	2350	2350
MAX AGGREGATE SIZE (mm)	-	20	20

- C6. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY. PROVIDE CONCRETE WITH:
- AN AVERAGE COMPRESSIVE STRENGTH AT COMPLETION OF CURING NOT LESS THAN 75% OF SPECIFIED f_c.
 - A TOTAL REACTIVE ALKALI CONTENT NOT GREATER THAN 3.0 kg/m³ Na₂O (EQUIVALENT).
- C7. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY.
- DO NOT USE METAL INSERTS WITHIN COVER CONCRETE INCLUDING METAL BAR CHAIRS.
 - DO NOT ALLOW CONCRETE TO FALL VERTICALLY WHEN PLACING, OR TO ENTRAP AIR IN ANY OTHER WAY.
 - PREVENT EVAPORATION OF WATER FROM CONCRETE SURFACES IMMEDIATELY AFTER LAYING.
 - MOIST CURE CONCRETE FOR A MINIMUM OF SEVEN DAYS.
- C8. SUPPLEMENTARY CEMENTITIOUS MATERIALS INCLUDE AMORPHOUS SILICA FUME, FLY ASH, AND GROUND GRANULATED BLAST FURNACE SLAG (GGFBS OR SLAG) COMPLYING WITH AS3682.
- C9. RHEOLOGY, WORKABILITY AND SLUMP TO BE AS REQUIRED FOR PLACEMENT (eg PUMPING, CHUTE, SPRAYING etc), COMPACTION AND FINISHING. USE SUPERPLASTICISERS AND HIGH RANGE WATER REDUCERS TO AS1478 TO ACHIEVE ADEQUATE WORKABILITY.
- C10. MAXIMUM SULPHATE CONTENT OF CONCRETE TO BE LESS THAN 5% BY MASS OF ACID SOLUBLE SO₃ AS A PERCENTAGE OF CEMENTITIOUS MATERIAL.

- C11. FOR GENERAL BLENDED CEMENT (GB) CONTAINING ORDINARY PORTLAND CEMENT PLUS AT LEAST 5% SUPPLEMENTARY CEMENTITIOUS MATERIALS:
- SILICA FUME TO BE LESS THAN 10%, OR
 - FLYASH TO BE LESS THAN 25%, OR
 - GROUND GRANULATED BLAST FURNACE SLAG TO BE LESS THAN 40%.
- FOR DOUBLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN SMALLER OF PERCENTAGES GIVEN ABOVE FOR CONSTITUENTS INCLUDED.
- FOR TRIPLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN 40%.
- C12. SUPPLEMENTARY CEMENTITIOUS MATERIALS SPECIFIED IN TABLE ABOVE ARE IN ADDITION TO MATERIALS INCORPORATED IN GB CEMENT.
- C13. ADMIXTURES TO COMPLY WITH AS1478. ADMIXTURES MUST NOT REDUCE STRENGTH OF CONCRETE BELOW SPECIFIED VALUE IN SHORT OR LONG TERM. ADMIXTURES MUST NOT CONTAIN CALCIUM CHLORIDE. USE ADMIXTURES IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS. CONCRETE ADMIXTURES SHALL NOT CAUSE OR ACCELERATE CORROSION OF REINFORCEMENT, NOR BE DETRIMENTAL TO CONCRETE OR STEEL DURING EXPECTED LIFE OF STRUCTURE. DO NOT USE CHEMICAL ADMIXTURES OR OTHER MATERIALS WITHOUT SUPERINTENDENT’S WRITTEN APPROVAL.
- C14. DO NOT ADD WATER TO CONCRETE AFTER TRUCK HAS LEFT BATCHING PLANT.
- C15. MIX CONCRETE TO ENSURE UNIFORM DISTRIBUTION OF CONSTITUENTS.

CONCRETE TESTING

- C16. TEST SLUMP OF EACH BATCH OF CONCRETE DELIVERED BEFORE PLACING CONCRETE FROM THAT DELIVERY. SLUMP MEASURED TO BE NO GREATER THAN TARGET SLUMP WITHIN TOLERANCES GIVEN IN AS1379 CLAUSE 5.2.3. CONCRETE OUTSIDE SLUMP TOLERANCE LIMITS IS LIABLE TO REJECTION.
- C17. CARRY OUT PROJECT ASSESSMENT OF CONCRETE TO AS1379 CLAUSE 6.4 AND 6.5. TAKE SAMPLES AT PROJECT SITE AT POINT OF DISCHARGE FROM AGITATOR. SPREAD SAMPLING EVENLY THROUGH FOUR SAMPLE CONCRETE FOR PROJECT ASSESSMENT CONCURRENTLY WITH EACH SAMPLE TAKEN FOR PRODUCTION ASSESSMENT AT PROJECT SITE. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE FROM EACH 25 m³ OF CONCRETE DELIVERED PER DAY. NOT LESS THAN FIVE SAMPLES TOTAL FOR EACH MIX DESIGN. EACH SAMPLE TO COMPRISE FOUR CYLINDERS. TEST TWO AT 7 DAYS AND TWO AT 28 DAYS. NOTIFY SUPERINTENDENT WITHIN 2 WORKING DAYS IF 7-DAY CONCRETE TEST RESULTS INDICATE 28 DAY STRENGTHS ARE LIKELY TO BE BELOW SPECIFIED STRENGTH.
- C18. CARRY OUT DRYING SHRINKAGE TESTING TO AS1012.13. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE EVERY THREE MONTHS, OR FOR EVERY 1000 m³ OF CONCRETE PLACED, MINIMUM OF ONE SAMPLE. EACH SAMPLE TO COMPRISE THREE SPECIMENS. SAMPLE CONCRETE AT PROJECT SITE, DIRECTLY FROM DELIVERY VEHICLE. BASE ASSESSMENT ON AVERAGE OF THREE TEST RESULTS.
- C19. CONCRETE SAMPLING AND TESTING TO BE BY AN APPROVED INDEPENDENT NATA REGISTERED LABORATORY.

FORMWORK

- C20. RESPONSIBILITY FOR DESIGN, CERTIFICATION, CONSTRUCTION AND PERFORMANCE OF FORMWORK AND FALSEWORK LIES WITH CONTRACTOR.
- C21. FORMWORK TO BE DESIGNED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ) TO AS3610, AND INDEPENDENTLY CERTIFIED BY A CHARTERED ENGINEER EXPERIENCED IN FORMWORK DESIGN AND REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ). PROVIDE COPY OF DESIGN CALCULATIONS AND CERTIFICATION TO SUPERINTENDENT. DESIGN FORMWORK TO ACCOMMODATE DIMENSIONAL CHANGES AND MOVEMENTS RESULTING FROM IMPOSED ACTIONS, CONCRETE SHRINKAGE AND CREEP, TEMPERATURE CHANGES, PRESTRESSING FORCES, etc.
- C22. DO NOT SUPPORT OR RESTRAIN FORMWORK ON PERMANENT WORKS WITHOUT SUPERINTENDENT’S WRITTEN APPROVAL.
- C23. CONSTRUCT FORMWORK TO COMPLY WITH AS3610 AND CLAUSE 17.6 OF AS3600 WHERE THIS IS MORE STRINGENT SO CONCRETE WILL HAVE DIMENSIONS, SHAPE, LOCATION AND FINISH SPECIFIED.
- C24. PROVIDE OPENINGS OR REMOVABLE PANELS IN FORMWORK FOR INSPECTION AND CLEANING.
- C25. APPLY RELEASE AGENT COMPATIBLE WITH CONTACT SURFACES TO INTERIOR OF FORMWORK (EXCEPT WHERE CONCRETE IS TO RECEIVE AN APPLIED FINISH OR COATING FOR WHICH THERE IS NO COMPATIBLE RELEASE AGENT). WHERE NECESSARY CLEAN REINFORCEMENT TO REMOVE TRACES OF RELEASE AGENT.
- C26. SEAL JOINTS BETWEEN FORMWORK PANELS, AND TO HARDENED CONCRETE WITH A FLEXIBLE RUBBER STRIP. SET OUT FORMWORK TO GIVE A REGULAR ARRANGEMENT OF PANELS, JOINTS, BOLT HOLES AND SIMILAR VISIBLE ELEMENTS IN FORMED SURFACE.
- C27. DO NOT USE FORMWORK HARDWARE THAT FORMS A COMPLETE HOLE THROUGH CONCRETE ELEMENTS. DO NOT USE REINFORCEMENT TO SUPPORT FORMWORK.
- C28. PROVIDE HOLES IN REBATE FORMERS, etc. AS REQUIRED TO PREVENT AIR ENTRAPMENT.
- C29. DO NOT STRIP FORMWORK PRIOR TO 72 HOURS AFTER PLACEMENT.
- C30. DO NOT STRIP FORMWORK UNTIL CONCRETE IS HARDENED SUFFICIENTLY TO WITHSTAND MOVEMENT AND FORM REMOVE WITHOUT DAMAGE. MINIMUM STRIPPING TIMES TO BE AS PER AS3610 TABLE 5.4.1.
- C31. STRIP FORMWORK TO AS3600 CLAUSE 17.6. REMOVE FORM THE BOLTS WITHOUT DAMAGING CONCRETE. PARTS OF BOLTS LEFT IN CONCRETE MUST NOT INTRUDE INTO COVER CONCRETE. FLUSH HILIT HOLES USING PREMIXED NON-SHRINK CEMENTITIOUS APPROVED REPAIR MORTAR MATCHING CONCRETE SURFACE COLOUR, STRENGTH AND DURABILITY AND ADEQUATE BOND. SUBMIT DETAILS OF PROPOSED REPAIR METHODS TO SUPERINTENDENT FOR APPROVAL.

PLACING CONCRETE

- C32. CONSTRUCTION TOLERANCES TO BE TO AS3610.
- C33. FORMWORK, REINFORCEMENT AND COVER, DOWELS, WATERSTOPS, CAST-IN ITEMS etc TO BE INSPECTED AND APPROVED BY SUITABLY QUALIFIED GEOTECHNICAL ENGINEER / SUPERINTENDENT / BUILDING SURVEYOR BEFORE CONCRETE IS PLACED.
- C34. REMOVE FREE WATER, DUST AND DEBRIS, STAINS etc FROM FORMS, EXCAVATIONS etc BEFORE PLACING CONCRETE. IN HOT CONDITIONS DAMPEN FORMWORK AND / OR SUB-GRADE BEFORE PLACING CONCRETE.
- C35. INSTALL 0.2 mm HIGH IMPACT RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 TO BASE TO RETAIN WATER IN FRESH CONCRETE.
- C36. PLACE CONCRETE IN LAYERS LESS THAN 300 mm THICK FOR FIRST LAYER AND 75% OF IMMERSION VIBRATOR LENGTH FOR SUBSEQUENT LAYERS, AND VIBRATE EACH LAYER BEFORE PLACING NEXT.
- C37. ELAPSED TIME BETWEEN WETTING OF MIX AND DISCHARGE OF CONCRETE AT SITE MUST BE AS SHORT AS POSSIBLE, AND MUST NOT EXCEED LIMITS GIVEN WITHOUT SUPERINTENDENT’S PRIOR WRITTEN CONSENT.

CONCRETE TEMPERATURE AT TIME OF DISCHARGE (°C)	MAXIMUM ELAPSED TIME (HOURS)
10 – 24	2.00
24 – 27	1.50
27 – 30	1.00
30 – 32	0.75

- C38. ELAPSED TIME LIMITS MAY BE VARIED IF TRIALS DEMONSTRATE USE OF SET RETARDERS (TYPE R_o OR WR_R TO AS1478) PROVIDE ADEQUATE RETENTION OF WORKABILITY FOR LONGER PERIODS AT REQUIRED TEMPERATURE. SLUMP LIMITS STILL APPLY. RE-TEMPERING BEYOND MAXIMUM ALLOWED DISCHARGE TIME USING WATER OR ADMIXTURES IS NOT ALLOWED.
- C39. USE PLACEMENT METHODS THAT WILL MINIMISE PLASTIC SETTLEMENT AND SHRINKAGE CRACKING. LIMIT VERTICAL FREE FALL BY USE OF CHUTES, etc. KEEP CHUTES VERTICAL, FULL AND IMMERSED IN CONCRETE. PLACE CONCRETE IN LAYERS AND BLEND SUCCEEDING LAYERS BY COMPACTION. MAINTAIN CONCRETE EDGE IN A PLASTIC STATE. PROPERLY COMPACT CONCRETE USING MECHANICAL VIBRATORS (AND HAND METHODS IF REQUIRED AND APPROVED BY SUPERINTENDENT) TO REMOVE AIR BUBBLES AND GIVE MAXIMUM COMPACTION WITHOUT SEGREGATION OF CONCRETE. TAKE CARE TO AVOID CONTACT BETWEEN VIBRATORS AND PARTIALLY HARDENED CONCRETE, FORMWORK OR REINFORCEMENT. DO NOT USE VIBRATORS TO MOVE CONCRETE ALONG FORMS.
- C40. DO NOT DISTURB CONCRETE ONCE INITIAL SET HAS OCCURRED.
- C41. OBTAIN SUPERINTENDENT’S WRITTEN APPROVAL OF PLACEMENT METHODS FOR CONCRETE ELEMENTS GREATER THAN 1500 mm HEIGHT.

- C42. KEEP ON SITE A LOG BOOK RECORDING EACH PLACEMENT OF CONCRETE INCLUDING DATE, CLIMATIC CONDITIONS, PORTION OF WORK, SPECIFIED GRADE AND SOURCE OF CONCRETE, DELIVERY DOCKET DATA, METHODS OF PLACEMENT AND COMPACTION, PROJECT ASSESSMENT CARRIED OUT, SLUMP MEASUREMENTS, VOLUME AND OTHER NOTABLE MATTERS THAT MAY AFFECT PERFORMANCE OF CONCRETE.
- C43. IN HOT WEATHER PREVENT PREMATURE STIFFENING OF FRESH CONCRETE, REDUCE WATER ABSORPTION AND EVAPORATION LOSSES. MIX, TRANSPORT, PLACE AND COMPACT CONCRETE AS QUICKLY AS POSSIBLE. DURING PLACEMENT TEMPERATURE OF CONCRETE MUST NOT EXCEED TEMPERATURES BELOW:

CONCRETE ELEMENT	TEMPERATURE LIMIT
UNREINFORCED CONCRETE IN SECTIONS ≥ 1 METRE EACH DIMENSION.	27°C
CONCRETE f _c ≥ 40 MPa IN SECTIONS ≥ 500 mm THICKNESS	27°C
CONCRETE IN FOOTINGS, BEAMS, COLUMNS, WALLS AND SLABS f _c ≤ 32 MPa	32°C
ELSEWHERE	32°C

- DO NOT MIX CONCRETE WHEN SURROUNDING OUTDOOR SHADE TEMPERATURE ≥ 38°C. MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT ≤ 32°C BEFORE AND DURING PLACING. COOL REINFORCEMENT AND FORMWORK AS REQUIRED. MAINTAIN SPECIFIED TEMPERATURE OF PLACED CONCRETE BY:
- PLACING CONCRETE WHEN AMBIENT TEMPERATURE IS LOW (AT NIGHT)
 - COOL CONCRETE USING LIQUID NITROGEN INJECTION BEFORE PLACING, OR
 - COVER CONTAINER IN WHICH CONCRETE IS TRANSPORTED TO FORMS, OR
 - SHADING AND SPRAYING COARSE AGGREGATE USING COLD WATER, OR
 - USE CHILLED MIXING WATER.
- C44. PROTECT FRESH CONCRETE FROM PREMATURE DRYING - PARTICULARLY IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS, EXCESSIVELY HOT OR COLD TEMPERATURES, RAIN, etc. PROVIDE WIND BREAKS, MAINTAIN CONCRETE AT A REASONABLY CONSTANT TEMPERATURE WITH MINIMUM MOISTURE LOSS FOR CURING PERIOD.
- C45. FOR CONCRETE WITH WATER-CEMENT RATIO LESS THAN 0.5, IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS SPRAY EXPOSED SURFACES OF FRESH CONCRETE WITH FOG SPRAY APPLICATION OF ALIPHATIC ALCOHOL RETARDANT IMMEDIATELY AFTER PLACEMENT TO REDUCE RISK OF PLASTIC SHRINKAGE CRACKING. IN SEVERE CLIMATIC CONDITIONS CONSIDER RE-VIBRATING CONCRETE BEFORE IT REACHES INITIAL SET. COMMENCE CURING OF CONCRETE TO AS3600 AS SOON AS POSSIBLE AFTER PLACING AND FINISHING OR STRIPPING, AND WITHIN ONE HOUR. ENSURE EXPOSED SURFACES ARE NOT STAINED. ACCEPTABLE METHODS OF CURING INCLUDE:
- RETENTION OF FORMWORK
 - PONDING OR CONTINUOUS SPRINKLING WITH WATER (MOIST CURING)
 - AN IMPERMEABLE MEMBRANE (USE CLEAR, WHITE OR LIGHT COLOURED PLASTIC IN HOT CONDITIONS) SEALED AROUND EDGES
 - AN ABSORPTIVE COVER KEPT CONTINUOUSLY WET AND COVERED BY IMPERMEABLE MEMBRANE
 - STEAM CURING
 - AN APPROVED CURING COMPOUND. PROVIDE:
 - EFFICIENCY INDEX
 - CERTIFIED TEST RESULTS FOR WATER RETENTION TO AS3799 APPENDIX B
 - EVIDENCE THAT AN ACCEPTABLE FINAL SURFACE COLOUR WILL BE OBTAINED
 - EVIDENCE OF COMPATIBILITY WITH CONCRETE AND APPLIED FINISHES (IF ANY)
 - METHODS OF OBTAINING REQUIRED ADHESION FOR TOPFINISH, RENDER etc.
 - UNIFORM CONTINUOUS FLEXIBLE COATING WITHOUT VISIBLE BREAKS OR PINHOLES, WHICH REMAINS UNBROKEN FOR AT LEAST THE CURING PERIOD AFTER APPLICATION.

- C47. DO NOT USE WAX-BASED OR CHLORINATED RUBBER-BASED CURING COMPOUNDS ON SURFACES FORMING SUBSTRATES TO APPLIED FINISHES, CONCRETE TOPFINISHES AND CEMENT BASED RENDER.
- C48. CURE CONTINUOUSLY UNTIL NUMBER OF DAYS DURING WHICH AIR TEMPERATURE IS ABOVE 10°C TOTALS:
- 3 DAYS FOR EXPOSURE CLASSIFICATION A1 AND A2
 - 7 DAYS FOR EXPOSURE CLASSIFICATION B1, B2 AND C
 - 14 DAYS FOR MIXES CONTAINING GB CEMENT AND SUPPLEMENTARY CEMENTITIOUS MATERIALS.
- C49. PREVENT RAPID DRYING OUT AT END OF CURING PERIOD.
- C50. FINISH CONCRETE SURFACES TO AS3610 AND AS SHOWN BELOW:
- FORMED SURFACES:
 - EXPOSED SURFACES 2C
 - HIDDEN SURFACES 5
 - FINISHES AS LAID:
 - EXPOSED SURFACES STEEL TROWEL UNO
 - HIDDEN SURFACES WOOD FLOAT
- C51. PROVIDE EXPOSED EDGES AND RE-ENTRANT CORNERS WITH 45 DEGREES x 25 mm CHAMFERS OR FILLETS UNO.
- C52. DO NOT MAKE HOLES, PENETRATIONS, RECESSES, CHASES, NOR EMBED PIPES (OTHER THAN THOSE SHOWN ON STRUCTURAL DRAWINGS) WITHOUT APPROVAL OF SUPERINTENDENT. DO NOT PLACE CONDUITS, PIPES etc WITHIN COVER CONCRETE. LOCATE CONDUITS, PIPES etc ONLY IN MIDDLE THIRD OF SLAB OR BEAM DEPTH AND BETWEEN REINFORCEMENT LAYERS, SPACED AT 3 x PIPE / CONDUIT DIAMETER CENTRES MINIMUM. DO NOT CUT REINFORCEMENT AT PENETRATIONS WITHOUT APPROVAL.
- C53. PROVIDE DRIP GROOVES IN SOFFIT OF BEAMS AND SLABS AT EXTERNAL PERIMETER OF STRUCTURES. ENSURE COVER TO REINFORCEMENT IS ACHIEVED.

JOINTS

- C54. FORM CONSTRUCTION JOINTS AND USE ONLY WHERE SHOWN OR WHERE APPROVED BY SUPERINTENDENT. CONSTRUCTION JOINTS IN SLABS TO BE VERTICAL, STRAIGHT AND TRUE. TO ACHIEVE ADEQUATE BOND ENSURE ENTIRE SURFACE IS CLEAN, FREE OF LAITANCE AND BLEMISHES, AND INTENTIONALLY ROUGHENED TO A FULL AMPLITUDE OF NOT LESS THAN 5 mm WITH COARSE AGGREGATE EXPOSED.
- C55. IF CONSTRUCTION JOINTS PROPOSED OTHER THAN WHERE SHOWN, PROVIDE PROPOSED LOCATIONS FOR SUPERINTENDENT’S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- C56. PROVIDE JOINTING MATERIALS COMPATIBLE WHEN USED TOGETHER, AND NON-STAINING TO CONCRETE IN VISIBLE LOCATIONS.
- C57. PROVIDE DETAILS OF CONSTRUCTION JOINTS FOR SUPERINTENDENT’S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- C58. SUBMIT PROPOSALS FOR CUTTING OR CORING HARDENED CONCRETE OR SAW CUT JOINTS, INCLUDING METHODS, TIMING AND SEQUENCE AT LEAST 7 DAYS BEFORE UNDERTAKING WORKS.
- C59. SAW CUT CRACK CONTROL JOINTS AS SOON AFTER CASTING AS PRACTICABLE TO AVOID SPALLING OR RAVELLING OF JOINT EDGES, AND WITHIN 16 HOURS OF CASTING TO PREVENT THERMAL AND / OR SHRINKAGE CRACKING OF SLAB. IMMEDIATELY AFTER SAW CUTTING FLUSH OUT JOINTS TO REMOVE SAWING RESIDUE AND INSERT A TEMPORARY FOAMED PLASTIC BEAD TO KEEP JOINT CLEAN PRIOR TO FILLING OR SEALING. PROTECT SAW CUTS FROM WHEEL LOADS FOR AT LEAST ONE WEEK AFTER CUTTING.
- C60. DO NOT INSTALL SEALANTS IF EXPECTED MAXIMUM DAILY TEMPERATURE EXCEEDS 30 DEGREES C. ENSURE RECESSES ARE CLEAN AND DRY PRIOR TO INSTALLING FILLERS OR SEALANTS, AND PREPARE IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS. TOLERANCE ON SEALANT WIDTHS +5, -0 mm.

REINFORCEMENT COVER

- C61. COVER IS CLEAR DISTANCE BETWEEN ANY REINFORCEMENT (INCLUDING LIGATURES, TIE WIRE etc) AND OUTSIDE SURFACE OF STRUCTURAL CONCRETE.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	*MI	*AA	Date
0	APPROVED ISSUE		WRC				12.04.21

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DOUGLAS SHIRE COUNCIL
WARNERS AND ANICHS BRIDGE UPGRADES
WARNERS AND ANICHS BRIDGE
STRUCTURAL NOTES - SHEET 2

Drawing No: **12540427-S002** Rev: **0**

C62. COVER MUST NOT BE LESS THAN SPECIFIED. PROVIDE MINIMUM CLEAR COVER TO REINFORCEMENT AS SHOWN BELOW, EXCEPT WHERE SPECIFIED OTHERWISE:

LOCATION	COVER (mm)
DECK UNITS	35
ABUTMENTS	65
TOPPING SLAB	50
ELSEWHERE	50

COVER GIVEN IS ONLY FOR CONCRETE CAST AGAINST FORMWORK OR CONCRETE BLINDING UNO. REQUEST REQUIRED COVER DIMENSION FROM SUPERINTENDENT WHERE CONCRETE IS CAST AGAINST GROUND OR A FLEXIBLE MEMBRANE ON GROUND. CONCRETE THICKNESSES MAY BE INCREASED.

C63. TOLERANCE ON COVER TO BE TO AS5100.5 CLAUSE 4.10.3.1

C64. PROVIDE 50 mm BLINDING CONCRETE UNDER STRUCTURAL REINFORCED CONCRETE CAST ON GROUND UNO.

DELIVERABLES

C65. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED CONCRETE SUBCONTRACTORS, INCLUDING SPRAYED CONCRETE SUB-CONTRACTORS.

C66. AT LEAST ONE WEEK PRIOR TO CONCRETE PLACEMENT SUBMIT DETAILS OF PROPOSED READY MIXED CONCRETE SUPPLIER, NAME OF CONCRETE DELIVERY SUPERVISOR, LOCATION OF BATCHING PLANT, CONCRETE MIX DESIGNS, METHOD OF CONCRETE TEMPERATURE CONTROL, MIXING, HANDLING, TRANSPORT, PUMPING, PLACEMENT / SPRAYING, COMPACTION, FINISHING, PROTECTION AND CURING, SEQUENCE AND TIMES FOR CONCRETE POURS, CONSTRUCTION JOINT LOCATIONS AT LEAST ONE WEEK PRIOR TO DELIVERY OF CONCRETE FOR SUPERINTENDENT'S APPROVAL. NOMINATE FOR EACH MIX DESIGN THE SOURCE, TYPE AND PROPORTIONS OF CONSTITUENTS, AGGREGATE GRADINGS AND SATURATED SURFACE-DRY DENSITIES, ADDITIVES AND ADMIXTURES, MAXIMUM WATER CONTENT AND MAXIMUM WATER-CEMENT RATIO, TARGET SLUMP, TARGET CHARACTERISTIC STRENGTH (f_c) AND TARGET DRYING SHRINKAGE.

C67. PROVIDE DOCUMENTARY EVIDENCE OF PREVIOUS PERFORMANCE AND RELEVANT TEST RESULTS OF MIX DESIGN TARGETS, INCLUDING 3, 7 AND 28 DAY COMPRESSIVE STRENGTHS FOR CONCRETE MIXES, CHARACTERISTIC STRENGTH, TEMPERATURE RISE, DRYING SHRINKAGE, LIMITS OF SOLUBLE SALTS AND ALKALI AGGREGATE REACTIVITY etc. BEING CERTIFIED TEST RESULTS MADE ON AT LEAST TWO SEPARATE SAMPLES FROM A NATA REGISTERED LABORATORY EITHER:

- ON CONCRETE OF SAME MIX DESIGN (IN RESPECT OF ALL DETAILS TO BE NOMINATED ABOVE) OF SAME GRADE MADE UNDER PRODUCTION CONDITIONS IN SAME PLANT WITHIN LAST SIX MONTHS, OR
- ON PRELIMINARY TESTS FROM LABORATORY OR PLANT TRIALS OF PROPOSED MIX

C68. USE READY MIXED CONCRETE MIXED BY BATCH PRODUCTION PROCESS DELIVERED IN AGITATING TRUCKS FOR EACH BATCH SUPPLY A DOCKET LISTING INFORMATION REQUIRED BY AS1379 CLAUSE 1.7.3 AND FOLLOWING:

- SERIAL NUMBER OF IDENTIFICATION CERTIFICATES OF EACH BATCH
- TIME OF BATCHING
- NAME OF CONCRETE DELIVERY SUPERVISOR
- ELEMENT FOR WHICH CONCRETE WAS ORDERED AND WHERE IT WAS PLACED
- METHOD OF PLACEMENT AND CLIMATIC CONDITIONS DURING POUR
- PROJECT ASSESSMENT CARRIED OUT
- TOTAL AMOUNT OF WATER REQUIRED BY MIX DESIGN
- ADMIXTURES TYPE AND QUANTITY
- ADDITIVES TYPE AND QUANTITY
- TOTAL AMOUNT OF WATER ADDED AT PLANT
- TOTAL FREE WATER IN CONCRETE

SUPERINTENDENT MAY NOT REQUIRE CONCRETE TRIAL MIX TESTS SUBJECT TO REVIEW OF PRODUCTION TEST RESULTS.

C69. SUBMIT DETAILS OF ALL PROPOSED CONCRETE COATINGS TO SUPERINTENDENT FOR REVIEW.

C70. PROVIDE RECORD OF SLUMP TESTING TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.

C71. FORWARD CONCRETE PROJECT ASSESSMENT INFORMATION TO SUPERINTENDENT AS PER AS1379 CLAUSE 6.3 WHEN PROJECT ASSESSMENT IS UNDERTAKEN. REFER CONCRETE TESTING NOTES.

C72. REPORT DRYING SHRINKAGE TESTING RESULTS TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.

C73. PROVIDE CONCRETE TEST RESULTS TO SUPERINTENDENT PROMPTLY, WITHIN SEVEN DAYS OF TESTING.

REINFORCEMENT

R1. SYMBOLS ON DRAWINGS FOR GRADE AND TYPE OF REINFORCEMENT ARE AS FOLLOWS:

- R: STRUCTURAL GRADE 250 PLAIN ROUND BAR TO AS/NZS4671
- N: HOT ROLLED GRADE 500 DEFORMED (RIBBED) BAR DUCTILITY CLASS N TO AS/NZS4671
- L: HOT ROLLED GRADE 500 DEFORMED BAR DUCTILITY CLASS L TO AS/NZS4671
- SL: HARD DRAWN WIRE GRADE 500 SQUARE MESH DUCTILITY CLASS L TO AS/NZS4671
- RL: HARD DRAWN WIRE GRADE 500 RECTANGULAR MESH DUCTILITY CLASS L TO AS/NZS4671
- TM: HARD DRAWN STEEL GRADE 500 TRENCH MESH DUCTILITY CLASS L TO AS/NZS4671
- W: GRADE 500 STEEL REINFORCING WIRE TO AS/NZS4671

R2. MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRE-STRESSING MATERIALS MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH AS/NZS4671, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL REINFORCEMENT. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.

R3. PROVIDE DOCUMENTATION TO SHOW THAT REINFORCEMENT SUPPLIER AND MILL COMPLY WITH AS/NZS4671.

R4. REINFORCEMENT MUST HAVE UNIQUE MARKS TO IDENTIFY SUPPLIER.

R5. DO NOT USE LOW DUCTILITY REINFORCEMENT (GRADE L) UNO.

R6. USE MESH SUPPLIED IN FLAT SHEETS UNLESS APPROVED OTHERWISE.

R7. REINFORCEMENT TO BE CLEAN, FREE OF LOOSE MILL SCALE, RUST, OIL, GREASE, MUD OR OTHER MATERIAL THAT MIGHT REDUCE BOND BETWEEN REINFORCEMENT AND CONCRETE.

R8. SUBMIT PROPOSAL FOR CUTTING OR DISPLACING REINFORCEMENT. CLEAN AND PROTECT EXPOSED CUT ENDS OF REINFORCEMENT USING 6 mm APPROVED EPOXY. REFER TO CONCRETE REPAIR NOTES FOR TREATMENT OF NEWLY EXPOSED CONCRETE AND REINFORCEMENT SURFACES AT NEW PENETRATIONS OR AREAS OF DEMOLITION.

R9. DESIGNATION OF REINFORCEMENT BARS IS AS SHOWN:

- eg 17 N20 - 350 EF
- 17: DENOTES No OF BARS AND TYPE IN GROUP
- N: DENOTES BAR GRADE AND DUCTILITY CLASS
- 20: DENOTES NOMINAL BAR DIAMETER IN mm
- 350: DENOTES SPACING IN mm
- EF: DENOTES LOCATION

R10. TO MINIMIZE TRIP HAZARDS CONSIDER MAXIMUM REINFORCEMENT BAR SPACING FOR TRAFFICABLE AREAS PRIOR TO CASTING CONCRETE OF 200 mm. ALTERNATIVELY PROVIDE SL82 ADDITIONAL IF MAIN REINFORCEMENT SPACING IS GREATER THAN 200 mm.

R11. FOLLOWING ABBREVIATIONS APPLY TO LOCATION OF REINFORCEMENT:

- EW: EACH WAY FF: FAR FACE BB: BOTTOM BOTTOM (LAID FIRST)
- EF: EACH FACE B: BOTTOM TT: TOP TOP (LAID LAST)
- NF: NEAR FACE T: TOP C OR CP: CENTRALLY PLACED

R12. PROVIDE STANDARD COGS AND HOOKS TO AS3600. TERMINATE ENDS OF COLUMN AND BEAM LIGATURES IN A HOOK OF AT LEAST 135 DEGREES. PROVIDE FIRST LIGATURE WITHIN 50 mm OF FACE OF SUPPORT.

R13. PROVIDE ONE CONTINUOUS BAR PARALLEL TO (WITHIN 75 mm OF) CONCRETE EDGES, INCLUDING CONSTRUCTION JOINTS UNO.

R14. PROVIDE N12 DIAGONAL TRIMMER BARS BY 1000 mm LONG AT EACH LAYER OF REINFORCEMENT AT RE-ENTRANT CORNERS, OPENINGS, SERVICE PENETRATIONS etc UNO.

R15. REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY IN TRUE PROJECTION. SET REINFORCEMENT OUT AT EQUAL CENTRES IF SPACING IS NOT NOMINATED.

R16. CAP STARTER BARS AND OTHER REINFORCEMENT TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.

R17. ENSURE ALL LAID REINFORCING BARS ARE RESTRAINED BEFORE STOPPING WORK TO PREVENT BARS ROLLING UNDERFOOT.

R18. SECURE REINFORCEMENT IN POSITION AGAINST DISPLACEMENT AND MAINTAIN SPECIFIED CLEAR CONCRETE COVER TO REINFORCEMENT (INCLUDING FITMENTS) BY APPROVED CHAIRS, SPACERS, LIGATURES OR TIES AT 800 mm MAXIMUM CENTRES EACH WAY UNO. PROVIDE ADEQUATE SUPPORT TO PREVENT DISPLACEMENT OF REINFORCEMENT BY WORKMEN OR EQUIPMENT DURING CONCRETE PLACEMENT.

R19. SECURELY TIE REINFORCEMENT WITH WIRE TIES. TURN ENDS OF TIE WIRES INTO CONCRETE, CLEAR OF COVER ZONE.

R20. SUPPORT REINFORCEMENT ON PROPRIETARY CONCRETE, METAL OR PLASTIC SUPPORTS ADEQUATE TO WITHSTAND CONSTRUCTION AND TRAFFIC LOADS AND MAINTAIN DURABILITY OF FINISHED CONCRETE STRUCTURE. FOR CONCRETE SURFACES WITH B2 EXPOSURE CLASSIFICATION OR GREATER, ONLY USE PROPRIETARY HIGH STRENGTH FIBRE REINFORCED CEMENT SPACER BLOCKS OR SUPPORTS.

R21. DO NOT PLACE OR MOVE REINFORCEMENT DURING OR AFTER CONCRETE PLACEMENT.

R22. ENSURE EMBEDDED ITEMS (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, DISSIMILAR METAL ITEMS, etc) IN COVER CONCRETE OR EXPOSED TO AIR ARE NOT IN CONTACT WITH REINFORCEMENT. PROVIDE ISOLATION BETWEEN DISSIMILAR METALS, AND BETWEEN REINFORCEMENT AND EXPOSED ITEMS.

R23. OBTAIN SUPERINTENDENT'S APPROVAL OF INSERTS, FIXINGS AND OTHER ITEMS EMBEDDED IN COVER CONCRETE.

R24. SPLICE REINFORCEMENT ONLY AT LOCATIONS SHOWN ON DRAWINGS OR AS APPROVED BY SUPERINTENDENT. STAGGER LAPS WHERE POSSIBLE. LAPPED SPLICE LENGTHS TO COMPLY WITH AS3600. CLEAR SPACING BETWEEN LAPPED BARS TO BE LESS THAN THREE TIMES BAR DIAMETER. WHERE BAR SIZES VARY USE LAPPED SPLICE LENGTH FOR SMALLER BAR DIAMETER.

R25. LAPPED SPLICE LENGTHS FOR HORIZONTAL BARS WITH MORE THAN 300 mm CONCRETE CAST BELOW THE BAR AND SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f _c	N12	N16	N20	N24	N28	N32
≥ 25	≥ 20	770	1150	1570	-	-	-
≥ 30	≥ 25	630	980	1350	1740	-	-
≥ 40	≥ 32	510	770	1100	1440	1810	2220
≥ 50	≥ 40	460	630	890	1200	1530	1890

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.

LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.

R26. LAPPED SPLICE LENGTHS FOR VERTICAL BARS (AND HORIZONTAL BARS WITH LESS THAN 300 mm CONCRETE CAST BELOW THE BAR) SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f _c	N12	N16	N20	N24	N28	N32
≥ 25	≥ 20	590	890	1210	-	-	-
≥ 30	≥ 25	490	750	1040	1340	-	-
≥ 40	≥ 32	390	600	840	1110	1400	1710
≥ 50	≥ 40	350	480	690	920	1180	1450

NOT APPLICABLE FOR BARS IN COLUMNS

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.

LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.

R27. LAY MESH REINFORCEMENT SO THAT MINIMUM COVER IS TO MAIN WIRES UNO.

R28. PROVIDE MINIMUM MESH LAPS TO CROSS WIRES OF REINFORCING MESH, SO TWO OUTERMOST WIRES OF ONE SHEET OVERLAP TWO OUTERMOST WIRES OF ADJACENT SHEET BY AT LEAST 25 mm. THUS:

MESH TYPE	END LAP	SIDE LAP
RECTANGULAR MESHES	225	125
SQUARE MESHES SL102 TO SL42	225	225
SL81	125	125
TRENCH MESH	500	N/A

USE LAP LENGTHS BASED ON LARGEST WIRE SPACING. DO NOT LAP MORE THAN THREE SHEETS AT ANY ONE POINT.

R29. ALTERNATIVELY USE N12 SPLICE BARS TO LAP ADJACENT SHEETS OF MESH, SPACING OF SPLICE BARS TO MATCH SPACING OF BARS IN MESH, SPLICE BARS TO OVERLAP MESH BY 750 mm MINIMUM UNO.

R30. DO NOT WELD REINFORCEMENT, CAST-IN ITEMS etc UNLESS SHOWN ON DRAWINGS OR OTHERWISE APPROVED BY SUPERINTENDENT. WHERE ALLOWED, WELDING OF REINFORCEMENT (INCLUDING TACK-WELDING FOR FIXING PURPOSES) TO COMPLY WITH AS3600 AND AS/NZS1554.3. DO NOT WELD REINFORCEMENT WITHIN 75 mm OF A SECTION THAT HAS BEEN BENT (100 mm FOR N28 AND N32 BARS, 125 mm FOR N36 BARS). EXTENT OF WELD INSPECTION / TESTING TO BE:

- VISUAL SCANNING 100% OF WELDS
- VISUAL EXAMINATION 50% OF WELDS
- RADIOGRAPHIC OR ULTRASONIC 5% OF FILLET WELDS AND 100% OF BUTT WELDS

R31. DO NOT BEND OR STRAIN REINFORCEMENT IN A WAY THAT MAY CAUSE DAMAGE. BEND DIAMETERS TO BE TO AS3600. BARS TO BE BENT COLD UNO. GRADE 250 BARS MAY BE BENT AT TEMPERATURES UP TO 850°C. DO NOT COOL HEATED BARS BY QUENCHING.

R32. ENSURE HOT BENDING OF REINFORCEMENT COMPLIES WITH AS3600 CLAUSE 17.2.3.1. DO NOT HEAT D500N REINFORCEMENT. USE TEMPERATURE INDICATOR PAINTS AND / OR CRAYONS TO ENSURE REINFORCEMENT TEMPERATURE DOES NOT EXCEED MANUFACTURERS' RECOMMENDED LIMITS, 450 DEGREES MAXIMUM. REINFORCEMENT THAT CHANGED COLOUR DURING HEATING MUST BE DISCARDED.

R33. DO NOT BEND REINFORCEMENT AFTER GALVANIZING OR APPLICATION OF OTHER COATINGS.

R34. PERCUSSION ROTARY DRILL HOLES FOR GROUTED BARS AND THREADED RODS (NOTE: CORED HOLES MUST BE ROUGHENED). HOLE DIAMETER AND INSTALLATION TO BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. EMBEDMENT LENGTHS AS PER DRAWINGS.

R35. ENSURE HOLES FOR GROUTED BARS AND THREADED RODS ARE DRY AND CLEANED THOROUGHLY BEFORE INSTALLING ANCHORS. WIRE BRUSH HOLES AND BLOW OUT WITH COMPRESSED AIR TO REMOVE DUST. FILL HOLE WITH ADHESIVE USING A CAULKING GUN FROM BOTTOM OF HOLE OUTWARDS. DISCARD ADHESIVE FROM FIRST TRIGGER PULL. PROVIDE BARS / THREADED RODS WITH CHAMFERED (CHISELLED) ENDS. BARS TO BE DEGREASED, AND FLAKY RUST REMOVED. ROTATE WHILE INSERTING TO ENSURE FULLY COATED AND PUSH FULLY INTO HOLE. PROTECT FROM DISTURBANCE DURING CURING. FOLLOW MANUFACTURER'S RECOMMENDATIONS.

PRESTRESSING

P1. PRESTRESSING WORKMANSHIP, MATERIALS, PROCEDURES AND EQUIPMENT TO COMPLY WITH AS3600.

P2. PRESTRESSING REINFORCEMENT RATIOS SHOWN FOR INFORMATION ONLY. CONTRACTOR IS RESPONSIBLE FOR DETERMINING PRESTRESSING REINFORCEMENT REQUIRED. CONTRACTOR TO EMPLOY SPECIALIST SUB-CONTRACTOR FOR THIS WORK.

P3. TENDONS TO BE 15.2 mm DIAMETER RELAX 2 STRAND TO AS/NZS4672.1 WITH MINIMUM BREAKING LOAD OF 250 kN, MODULUS OF ELASTICITY (E) OF 195,000 MPa.

P4. SUPPLY STRAND IN COILS SUFFICIENTLY LARGE SO STRAND RETAINS ITS PHYSICAL PROPERTIES AND IS STRAIGHT WHEN UNWOUND. PROVIDE MANUFACTURER'S TEST CERTIFICATES FOR EACH COIL. MARK STRANDS TO IDENTIFY COIL NUMBER.

P5. STRAND LENGTHS TO INCLUDE STRESSING ALLOWANCE AT EACH END.

P6. DO NOT USE GREASE TO DEBOND TENDONS.

P7. PROTECT TENDONS AND PREVENT DAMAGE.

P8. STRESS TO 100% JACKING FORCE AT f_c = 40 MPa.

P9. CONFIRM CONCRETE TRANSFER STRENGTH BY TESTING SITE-CURED CYLINDERS PRIOR TO EACH STRESSING STAGE.

P10. MINIMISE ECCENTRICITIES AND LATERAL EFFECTS WHEN TRANSFERRING PRESTRESS FORCES FROM TENDONS TO CONCRETE.

P11. MAXIMUM JACKING FORCE TO BE 85% OF MINIMUM BREAKING LOAD.

P12. TOTAL INITIAL FORCE IN TENDONS TO BE 188 kN PER STRAND AFTER ALLOWANCE FOR LOSSES IN GRIPS, JACKETS etc.

P13. CUT ENDS OF PRESTRESSING STRAND FLUSH WITH CONCRETE. CLEAN AND PROTECT EXPOSED STRAND WITH 6 mm APPROVED EPOXY.

P14. EMBEDDED FIXTURES (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, STAINLESS REINFORCING etc) WITHIN COVER CONCRETE OR EXPOSED TO AIR MUST NOT BE IN CONTACT WITH REINFORCING STEEL. PROVIDE ISOLATING STRIPS BETWEEN DISSIMILAR STEELS AND TO SEPARATE EXPOSED FIXTURES.

DELIVERABLES

P15. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS, REFER GENERAL-DELIVERABLES NOTES. DESIGN CALCULATIONS / SHOP DRAWINGS TO SHOW: MARKING PLAN, ARRANGEMENT OF MEMBERS, LOCATION OF MEMBERS IN BUILDING, LOADING PARAMETERS ASSUMED, MATERIAL PROPERTIES AND DESIGN STRESSES, SIZE OF EACH MEMBER, PRESTRESSING STRAND NUMBERS AND DRAPE DIMENSIONS, TOLERANCES, STRESSING FORCES, STAGES AND PROCEDURES, ASSUMED LOSSES FOR SHRINKAGE, CREEP, RELAXATION AND DRAW-IN, EXPECTED DEFORMATIONS, ANCHORAGE DETAILS etc.

P16. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.

P17. PROVIDE RESULTS OF STRESSING EXTENSIONS TO SUPERINTENDENT FOR APPROVAL IMMEDIATELY AFTER STRESSING.

PRECAST CONCRETE

W1. COMPLY WITH REQUIREMENTS OF AS3850 PREFABRICATED CONCRETE ELEMENTS CODE, NATIONAL CONSTRUCTION CODE (NCC), CONCRETE NOTES AND SPECIFICATION.

W2. PRECAST CONCRETE UNITS HAVE BEEN DESIGNED FOR INSTALLED CONDITIONS ONLY.

W3. PRECAST UNITS TO BE SUPPLIED BY A SPECIALIST SUB-CONTRACTOR.

W4. SUPPLIER TO DESIGN PROPS, CONNECTIONS, FIXING DETAILS AND JOINTS etc TO PROVIDE SATISFACTORY PERFORMANCE FOR STABILITY, SERVICEABILITY AND STRENGTH REQUIREMENTS DURING MANUFACTURE, STRIPPING, HANDLING, LIFTING, STACKING, TRANSPORT, ERECTION AND INSTALLATION OPERATIONS. PROVIDE TEMPORARY PROPPING AND ADDITIONAL REINFORCEMENT AS REQUIRED.

W5. USE FORMWORK BOND BREAKERS AND STRONG BACKS AS REQUIRED.

W6. DO NOT APPLY ACID TREATMENTS TO PRECAST CONCRETE SURFACES UNO.

W7. LOCATE CONNECTIONS TO FACILITATE CONCRETE PLACEMENT, EASE OF ACCESS DURING INSTALLATION AND FINAL AESTHETICS.

W8. USE CAST IN FERRULES FOR STRUCTURAL FIXINGS, NOT MECHANICAL OR CHEMICAL ANCHORS.

W9. DO NOT USE REBARS OR STRESSING TENDONS AS LIFTING LOOPS. DO NOT USE FIXINGS FOR LIFTING. USE PROPRIETARY LIFTING INSERTS WITH PUBLISHED LOAD RATINGS. LIFT OR SUPPORT PRECAST UNITS ONLY AT SPECIFIED POINTS. LOCATE LIFTING POINTS TO SUIT CENTRE OF GRAVITY OF UNIT.

W10. SUBMIT NAME, CONTACT DETAILS AND CREDENTIALS OF PROPOSED MANUFACTURER OF PRECAST UNITS.

W11. PROVIDE TEMPORARY BRACING TO AS3850 AND AS/NZS1170.2 AS REQUIRED TO ENSURE STABILITY DURING CONSTRUCTION.

W12. DO NOT PLACE LIFTING ATTACHMENTS, HOLES OR OTHER TEMPORARY FIXINGS etc ON VISIBLE FACES OF UNITS.

W13. ENSURE THAT PRECAST UNITS REMAIN UNCRACKED AND UNDAMAGED DURING MANUFACTURE, HANDLING, ERECTION AND INSTALLATION OPERATIONS. PROVIDE PROTECTION TO AVOID CRUSHING AND / OR CHAFING. PROTECT UNITS FROM STAINING, DISCOLOURATION AND OTHER DAMAGE.

W14. HOT DIP GALVANIZE CAST IN STEELWORK INCLUDING LIFTING INSERTS, FERRULES, DOWEL BARS, ANGLE CLEATS, BOLTS, NUTS WASHERS AND PACKERS etc. MINIMUM GALVANIZED COATING THICKNESS 600 gm².

W15. USE RIGID FORMWORK AND INTENSE COMPACTION, SUCH AS VIBRATING TABLES OR FORM VIBRATORS, TO AS3600.

W16. PRECAST UNIT TOLERANCES TO BE TO AS3600 EXCEPT WHERE VARIED BY SPECIFICATION.

W17. FINISH SURFACE OF PRECAST UNITS IN ACCORDANCE WITH SPECIFICATION.

W18. EACH UNIT TO HAVE LEGIBLE MARKING (HIDDEN IN COMPLETED STRUCTURE) INCLUDING UNIT THICKNESS, REINFORCING SIZES AND SPACING, NUMBER OF STRANDS AND STRAND DIAMETER, CONCRETE COVER, DATE OF CASTING, CORRECT ORIENTATION OF UNIT AND WEIGHT, POSITION FOR TEMPORARY BEARING DURING STORAGE etc.

W19. SET ASIDE DAMAGED UNITS (CRACKED, SPALLED, INADEQUATE COVER) FOR INSPECTION BY SUPERINTENDENT. REPAIR OR RE-CAST AS INSTRUCTED.

W20. ALLOW FOR DEPARTMENT OF LABOUR OR OTHER REQUIREMENTS GOVERNING HANDLING, LIFTING, ROTATION OR TRANSPORT OF PRECAST UNITS.

W21. WHERE PRECAST UNITS ARE TO BE SUPPORTED BY CONCRETE MEMBERS, DO NOT ERECT UNITS UNTIL 28 DAY STRENGTH HAS BEEN ACHIEVED.

W22. SEAL GAPS BEFORE GROUTING. USE NON-SHRINK NON-STAINING GROUT WITH 28 DAY CHARACTERISTIC STRENGTH OF 40 MPa. SUBMIT DETAILS FOR APPROVAL.

W23. JOINTS BETWEEN UNITS TO BE AS SPECIFIED ON DRAWINGS. TOLERANCE ON WIDTH +5, -0 mm. PROVIDE JOINTS IN WALL FINISHES AT JOINTS BETWEEN UNITS UNO. PLACE POLYSTYRENE IN JOINTS DURING CONSTRUCTION TO ENSURE HARD MATERIALS AND OTHER DEBRIS DOES NOT FALL INTO OR REMAIN IN JOINTS. REMOVE POLYSTYRENE PRIOR TO FILLING JOINTS, OR AT COMPLETION. MAINTAIN JOINTS FOR UNIFORM PLACEMENT OF SEALANTS.

W24. PROTECT, CLEAN AND MAINTAIN PERMANENT BEARINGS DURING CONSTRUCTION.

DELIVERABLES

W25. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS (PREPARED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ), REFER GENERAL-DELIVERABLES NOTES. DRAWINGS TO SHOW PROPOSED DETAILS FOR DESIGN, MANUFACTURE, ASSEMBLY, TRANSPORT AND INSTALLATION OF PRECAST CONCRETE ELEMENTS, INCLUDING FOLLOWING INFORMATION SPECIFIED IN AS3850.2 CLAUSE 2.10 AND APPENDIX A, PROJECT TITLE AND MANUFACTURER'S NAME, SHAPE AND PROFILE DRAWINGS INCLUDING WEIGHT OF UNITS, REINFORCEMENT AND TENDON DETAILS INCLUDING LOCATIONS, SIZES, MATERIALS, DUCTILITY AND STRESS GRADES, CAST IN ITEMS INCLUDING LOCATIONS, SIZES, DETAILS, MATERIALS, CORROSION PROTECTION AND GRADE OF FERRULES, PLATES, CUT-OUTS AND OPENINGS, ANCHORS, LIFTING DEVICES, PLUGS FOR SEALING RECESSES etc. CAST IN SERVICES, EQUIPMENT AND METHODS OF HANDLING, LIFTING, TRANSPORT INCLUDING LOCATION OF LIFTING POINTS, MAXIMUM LOADS ON LIFTING AND BRACING POINTS, EVIDENCE OF LOAD CAPACITY OF LIFTING AND BRACING INSERTS AND ATTACHMENTS IN FORM OF TEST REPORTS OR CALCULATIONS, CONCRETE MIX DESIGN, FORMWORK TYPE, SURFACE FINISH CLASS AND SURFACE TREATMENT, CURING AND PROTECTION METHODS, IDENTIFICATION MARKS, EQUIPMENT AND METHODS FOR HANDLING, TRANSPORT AND INSTALLATION, ERECTION AND INSTALLATION CONDITIONS.

W26. SUBMIT SAFE WORK METHOD STATEMENT SPECIFIC TO PROJECT FOR MANUFACTURE AND INSTALLATION OF UNITS. CARRY OUT WORK ONLY UNDER WIND AND TEMPERATURE CONDITIONS CONSISTENT WITH SAFE WORK METHOD STATEMENT AND STRUCTURAL CAPABILITY OF UNIT.

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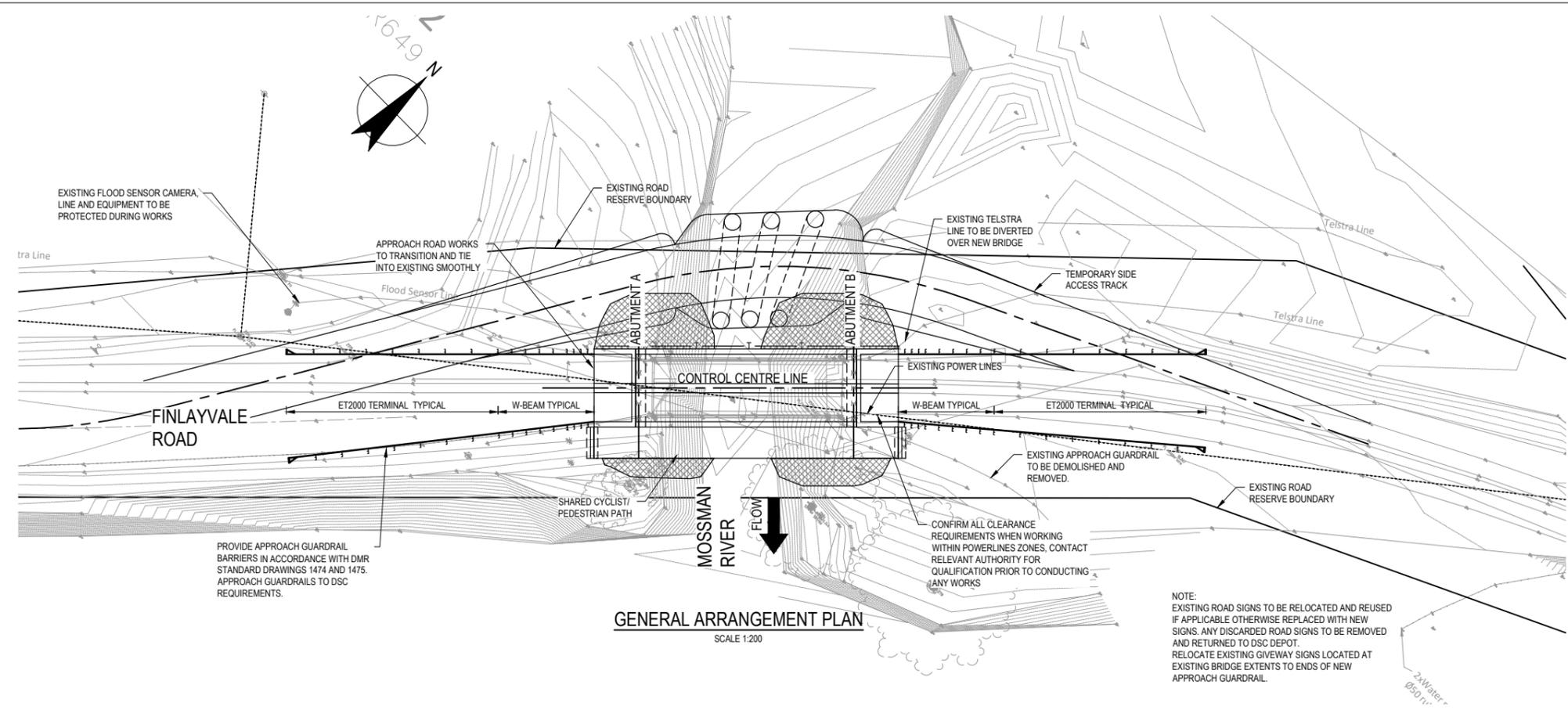
Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
Scale	NOT TO SCALE		

Client **DOUGLAS SHIRE COUNCIL**
 Project **WARNERS AND ANICHS BRIDGE UPGRADES**
 Title **WARNERS AND ANICHS BRIDGE STRUCTURAL NOTES - SHEET 3**

Original Size **A1** Drawing No: **12540427-S003**

Rev: **0**

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GENERAL NOTES

- LEVELS DATUM - AHD
ORIGIN OF LEVELS: STN Z (E:325055.106 N:8180675.827) (RL 10.574)
MERIDIAN: MGA ZONE 55
- ALL EXISTING SERVICES AND UTILITIES SHALL BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
- CONTRACTOR SHALL VERIFY ALL SETOUT DETAILS AND DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF SITE WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE SUPERINTENDENT IMMEDIATELY.
- SPOIL MATERIAL TO BE DETERMINED IF SUITABLE AND TO BE USED AS DIRECTED BY SUPERINTENDENT. IF NOT SUITABLE CONTRACTOR TO REMOVE AND DISPOSE OFF SITE AS DIRECTED BY SUPERINTENDENT.
- GRADE EVENLY BETWEEN LEVELS SHOWN.
- ALL NEW SIGNS AND PAVEMENT MARKING TO BE CONSTRUCTED IN ACCORDANCE WITH MUTCD PART 2.
- ALL SIGNS TO BE INSTALLED AS PER FNQROC STANDARD DRAWING S1041.
- ALL EXISTING SIGNS TO BE RETAINED UNLESS NOTED OTHERWISE.
- ALL RRPMS TO BE INSTALLED AS PER THE MUTCD PART 2.
- FOR ET-2000 PLUS. REFER TO INGA CIVIL PRODUCTS, GUARDRAIL EXTRUDER TERMINAL SITE PLAN DWG CAB STD-61.

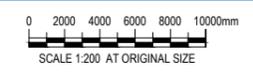
EARTHWORKS

- EARTHWORKS SHALL BE IN ACCORDANCE WITH A.S. 3798 INCLUDING THE FOLLOWING:
- THE SITE SHALL BE STRIPPED OF ALL DEBRIS AND ALL VEGETATIVE MATTER AND THE ASSOCIATED LAYER OF TOPSOIL TO A DEPTH OF 150mm MIN. FILL HOLES LEFT FROM TREES, ETC. REMOVED DURING CLEARING TO BE BACKFILLED. FILL MATERIAL TO BE COMPACTED IN ACCORDANCE WITH NOTE 3 BELOW.
 - THE TOP 150mm OF SUBGRADE SHALL BE COMPACTED TO A DENSITY OF NOT LESS THAN 98% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH METHOD 5.1. OF A.S. 1289 (STANDARD COMPACTION). ANY LOOSE OR UNSUITABLE MATERIAL ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH AN APPROVED FILL MATERIAL AS PER NOTE 3.
 - FILL MATERIAL SHALL BE AN APPROVED GRANULAR MATERIAL (CBR 15) AND SHALL BE PLACED IN LAYERS NOT EXCEEDING 300mm IN THICKNESS. FILL SHALL BE COMPACTED TO 98% OF THE MAXIMUM DRY DENSITY AS PER NOTE 2 ABOVE.
 - SELECTED FILL MATERIAL SHALL COMPLY WITH THE FOLLOWING:
 - INORGANIC, LESS THAN 0.5% SULPHUR
 - MAXIMUM PARTICLE SIZE 75mm
 - PROPORTION PASSING 0.075mm SIEVE: 25% MAXIMUM.
 - PLASTICITY INDEX: 2%, 15%
 - PROPORTION EXCEEDING PARTICLE SIZE OF 50mm: 75% MINIMUM.
 - CONFIRM THE SPECIFIED DEGREE OF COMPACTION HAS BEEN ACHIEVED BY TESTING. TESTS TO BE CARRIED OUT BY A NATA REGISTERED FIRM. CARRY OUT ONE TEST PER LAYER FOR EVERY 500 SQUARE METRES OF FILL AND FOR FILL IN EACH LOCATION.
 - ALL EARTHWORKS PERFORMED BOTH PRIOR TO CONSTRUCTION AND SUBSEQUENTLY SHOULD BE CARRIED OUT IN A RESPONSIBLE MANNER IN ACCORDANCE WITH ACCEPTED BUILDING PRACTICES AND AUSTRALIAN STANDARD AS 3798-1990 "GUIDELINES ON EARTHWORKS FOR COMMERCIAL AND RESIDENTIAL DEVELOPMENTS". UNLESS NOTED OTHERWISE, ALL LANDSCAPED AREAS ARE TO BE GRASS SEEDING IN ACCORDANCE WITH FNQROC SPECIFICATION S8 - LANDSCAPING.

NOTE:
EXISTING ROAD SIGNS TO BE RELOCATED AND REUSED IF APPLICABLE OTHERWISE REPLACED WITH NEW SIGNS. ANY DISCARDED ROAD SIGNS TO BE REMOVED AND RETURNED TO DSC DEPOT.
RELOCATE EXISTING GIVEWAY SIGNS LOCATED AT EXISTING BRIDGE EXTENTS TO ENDS OF NEW APPROACH GUARDRAIL.

GENERAL ARRANGEMENT PLAN
SCALE 1:200

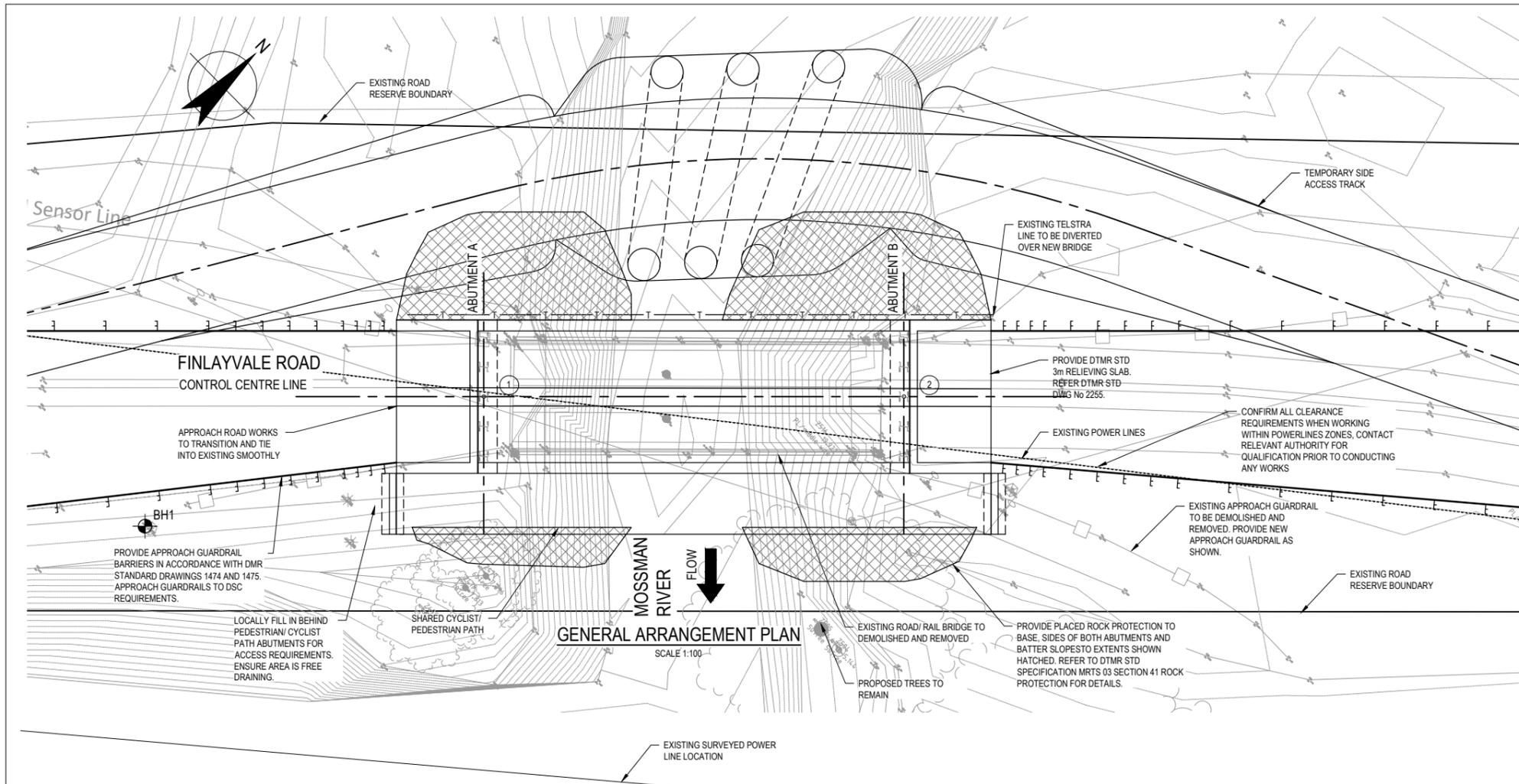
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	Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
	Approved (Project Director)	*A.AHILADELLIS		
	Date	12.04.21		
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Client	DOUGLAS SHIRE COUNCIL		
Project	WARNERS AND ANICHS BRIDGE UPGRADES		
Title	ANICHS BRIDGE		
	GENERAL ARRANGEMENT		
Original Size	A1	Drawing No:	12540427-C010
			Rev: 0



GENERAL NOTES

1. READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES THEN SPECIFICATION.
2. CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONAL AND GENERAL PUBLIC IN ACCORDANCE WITH LEGISLATIVE REQUIREMENTS, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE.
3. REFER TO GEOTECHNICAL INVESTIGATION REPORT No104527.00 PREPARED BY DOUGLAS PARTNERS DATED FEBRUARY 2021. NOTIFY SUPERINTENDENT IF CONDITIONS ENCOUNTERED DIFFER FROM THOSE DESCRIBED IN THE REPORT AND SEEK DIRECTIONS.
4. LEVELS DATUM - AHD
ORIGIN OF LEVELS: STN Z (E:325055.106 N:8180675.827) (RL 10.574)
MERIDIAN: MGA ZONE 55
5. NO FILLING TO BE PLACED ABOVE SOFFIT OF ABUTMENT HEADSTOCKS UNTIL AT LEAST TWO (2) DAYS AFTER ERECTION OF ALL SPANS AND GROUTING OF DOWEL BAR HOLES.
6. LEVELS ARE CALCULATED ALLOWING FOR REINFORCED CONCRETE DECK SURFACE ON ROADWAY AT ABUTMENTS TO BE 376mm THICK AT CENTERLINE OF ROAD AND 340mm THICK AT KERBS. THE THICKNESS OF DWS AT ANY POINT MUST NOT BE LESS THAN 50mm THICK. AN ALLOWANCE OF 27mm (30 DAYS AFTER TRANSFER, 37mm AT 100 DAYS) HAS BEEN ASSUMED FOR THE UPWARD DEFLECTION (HOG) OF THE PSC UNITS IN CALCULATING LEVELS.
7. REINFORCING STEEL TO BE AUSTRALIAN MADE GRADE 500N TO AS 1302.
8. ALL BOLTS AND NUTS TO BE HOT DIP GALVANISED TO AS 1214 UNO. ALL WASHERS TO BE HOT DIP GALVANISED TO AS1650 UNO. ANY GALVANISED ELEMENT IN CONTACT WITH CEMENTITIOUS MATERIAL TO BE PASSIVATED IN 0.2% SODIUM DICHROMATE SOLUTION.
9. SPACING OF REINFORCEMENT IN HEADSTOCKS MAYBE ALTERED SLIGHTLY IF NECESSARY TO CLEAR CORED HOLES.
10. ALL EXPOSED EDGES TO HAVE 25x25 CHAMFERS UNLESS SHOWN OTHERWISE.
11. A DATE PLATE IS TO BE CAST INTO THE TOP OF THE LEFT HAND SIDE WALL AT ABUTMENT A SIMILAR TO DTMR STANDARD DATE PLATE DRAWING 2005. CONFIRM DATE PLATE WITH CLIENT.
12. A BRASS BENCHMARK IS TO BE CAST INTO THE TOP OF THE LEFT HAND WINGWALL AT ABUTMENT A.
13. LOADINGS IN ACCORDANCE WITH:
 - (a) ROAD DESIGN LIVE LOAD IS AUSTRROADS T44 TRUCK LOADING AND L44 LANE LOADING.
 - (b) RAIL DESIGN LIVE LOAD IS 218 TONNE DOUBLE HEADER LOCO AND 28 TONNE LOCO DIRECT LINKED WITH 10 TONNE BINS. LOCO DIMENSIONS AS PER "ROLLING STOCK DIMENSIONS" SUPPLIED BY FAR NORTHERN MILLING Pty Ltd.
 - (c) RAIL LOAD CRITERIA IN ACCORDANCE WITH "BRIDGE DESIGN CRITERIA MACKAY FEB 2013"
 - (d) ULTIMATE RAIL BRAKING FORCE = 300 kN
 - (e) DLA = 1.7
 - (f) ULTIMATE LIMIT STATE FACTOR = 1.5
 - (g) ULTIMATE NOSING LOAD = 22 kN
 - (h) DESIGN WING LOAD ON TRAIN = 28 m/sec
 - (i) PILE TIP LEVELS SHOWN ARE CONTRACT LEVELS AND ARE SUBJECT TO VARIANCE AS DIRECTED BY THE SUPERINTENDENT.
 - (j) BRIDGE DESIGN IS DESIGNED AS SINGLE LANE IN ACCORDANCE WITH LOW TRAFFIC VOLUME AND AUSTRROADS REQUIREMENTS.
 - (k) DESIGN MAXIMUM STREAM VELOCITY - 4.0m/s - 1 IN 2000 YEAR EVENT
 - (l) BRIDGE IS DESIGNED AS SUBMERGED WITH 2.0m DEBRIS MAT
 - (m) BRIDGE EARTHQUAKE CLASSIFICATION - BEDC-1
 - (n) BRIDGE PEDESTRIAN PATH LOCATED ON DOWNSTREAM SIDE OF BRIDGE AND IS NOT DESIGNED TO ACCOMMODATE FLOOD/ DEBRIS LOADING ONLY
 - (o) ULTIMATE ROAD BRAKING FORCE = 600 kN
14. PILE ULTIMATE LOAD:
350WC197 PILE - 640 kN COMPRESSION 200 kN TENSION (1280 kN COMPRESSION 400 kN TENSION GEOTECHNICAL LOAD)
15. ALL EXISTING SERVICES AND UTILITIES SHALL BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
16. CONTRACTOR SHALL VERIFY ALL SETOUT DETAILS AND DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF SITE WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE SUPERINTENDENT IMMEDIATELY.
17. SPOIL MATERIAL TO BE USED ON SITE AS DIRECTED BY SUPERINTENDENT.
18. GRADE EVENLY BETWEEN LEVELS SHOWN.
19. CANE RAIL OPERATIONS TO BE SHUT TO ALLOW CONSTRUCTION WORKS. CONTRACTOR TO LIAISE WITH FAR NORTHERN MILLING TIMING OF WORKS.

TEMPORARY SIDE TRACK PERFORMANCE SPECIFICATION:

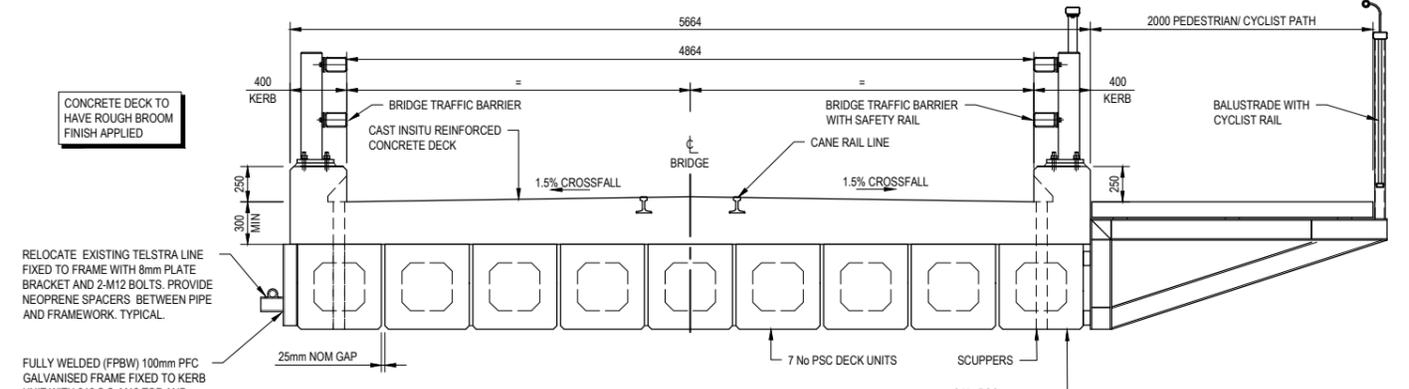
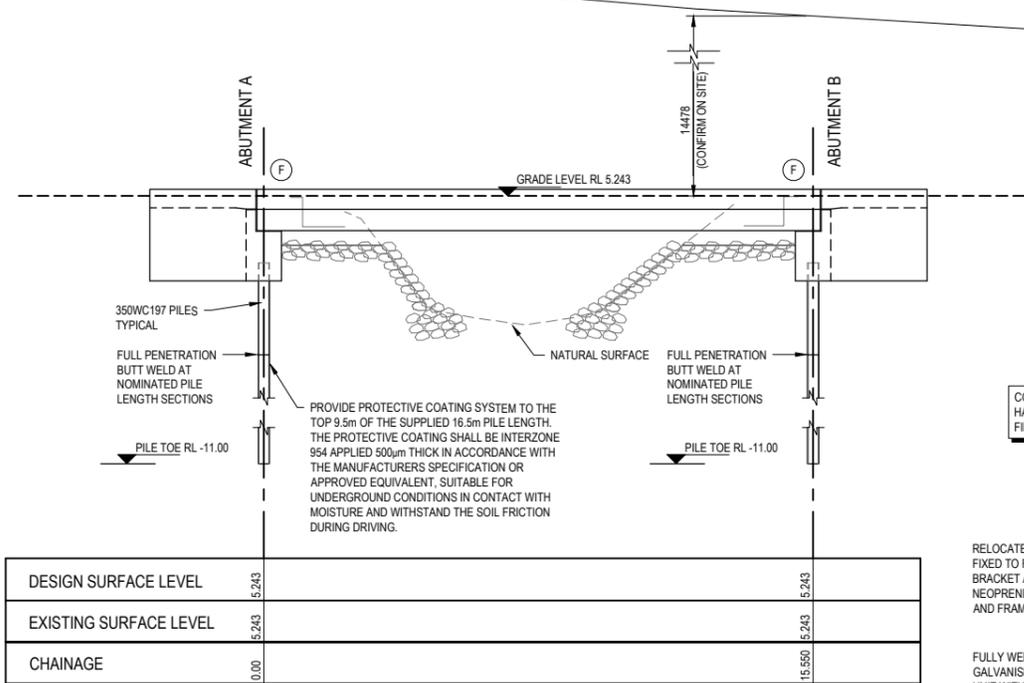
- THE GRAVEL SIDE TRACK WOULD NEED TO BE DESIGNED BY AN GEOTECHNICAL RPEQ TO WITHSTAND LOADING FROM LOCAL TRAFFIC AND CONSTRUCTION VEHICLES, FLOOD LOADING, AND TO LAST THE DURATION OF CONSTRUCTION.
- PUBLIC ACCESS IS TO BE MAINTAINED BOTH DURING AND OUTSIDE WORKING HOURS. ALL ROAD SAFETY SIGNAGE AND BARRIERS WILL NEED TO BE IN ACCORDANCE WITH RELEVANT MAIN ROADS REGULATIONS.
- AS A MINIMUM, PIPE CULVERTS ARE TO BE USED TO ALLOW WATER FLOW THROUGH THE GRAVEL SIDE TRACK AND WOULD NEED TO:
 - BE 1200mm INTERNAL DIAMETER
 - HAVE MINIMUM 900mm COVER
 - BE A STRENGTH CLASS TO SUIT CONSTRUCTION PLANT LOADS
- THE SIDE TRACK IS TO BE BUILT UPON A GEO-FABRIC MEMBRANE TO MINIMISE SCOUR.
- THE MATERIAL USED FOR THE SIDE TRACK NEEDS TO BE PROTECTED FROM EROSION AND SCOUR.
- MATERIAL USED FOR THE SIDE TRACK NEEDS TO BE REMOVED AS SOON AS POSSIBLE AT COMPLETION OF THE BRIDGE WORKS AND STORED ON COUNCILS FACILITIES AS AGREED UPON WITH COUNCIL.
- IMPORTED FILL IS TO BE FREE FROM ORGANIC MATERIAL AND SHALL ONLY BE USED IF APPROVED BY THE SUPERINTENDENT.
- THE CONTRACTOR SHALL PROGRAM THE WORKS TO LIMIT WORKS IN THE WATERWAY DURING HIGH RIVER FLOW MONTHS.
- THE MAINTENANCE AND PROTECTION THE SIDE TRACK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL COMPLY WITH THE REQUIREMENTS OF THE ENVIRONMENTAL APPROVALS. WHERE WATER IS DIVERTED FROM THE SITE IT SHALL BE CONFINED TO EXISTING DRAINAGE PATHS AND AWAY FROM ADJACENT PRIVATE PROPERTY.
- AVOID THE CONCENTRATION OF WATER RUNOFF THROUGH THE SIDE TRACK. WHERE CONCENTRATE RUNOFF IS UNAVOIDABLE, PROTECT OUTFALL OF CHANNELS WITH CRUSHED ROCK TO MINIMISE SCOURING.
- THE RIVERBED IS TO BE RETURNED TO ITS ORIGINAL CONFORMATION AFTER CONSTRUCTION.
- NO STOCKPILES OR MATERIALS TO BE LEFT WHERE THEY CAN CONTAMINATE WATERWAYS. MINIMUM DISTANCE BETWEEN STOCKPILE AND WATERCOURSE OF 50m.

LEGEND:

- ⊙ DENOTES FIXED BEARING
- ⊙ DENOTES SETOUT POINT
- x RL 14.42 DENOTES DESIGN LEVELS
- BH1 DENOTES BORE HOLE LOCATION

SETOUT POINTS		
POINT	EASTING	NORTHING
1	324903.350	8180528.297
2	324914.236	8180539.401

- NOTE:
1. PROVIDE PILE LENGTHS AS FOLLOWS TO ALLOW PILE DRIVING (UNLESS OTHERWISE APPROVED BY THE SUPERINTENDENT):
 - OVERALL PILE LENGTH 16.5m
 - TOP SECTION 4.75m - (COATED)
 - MIDDLE SECTION 4.75m - (COATED)
 - BOTTOM SECTION 7m - (UNCOATED)
 2. ENSURE COATING SYSTEM IS REAPPLIED AND REPAIRED AFTER WELDING.



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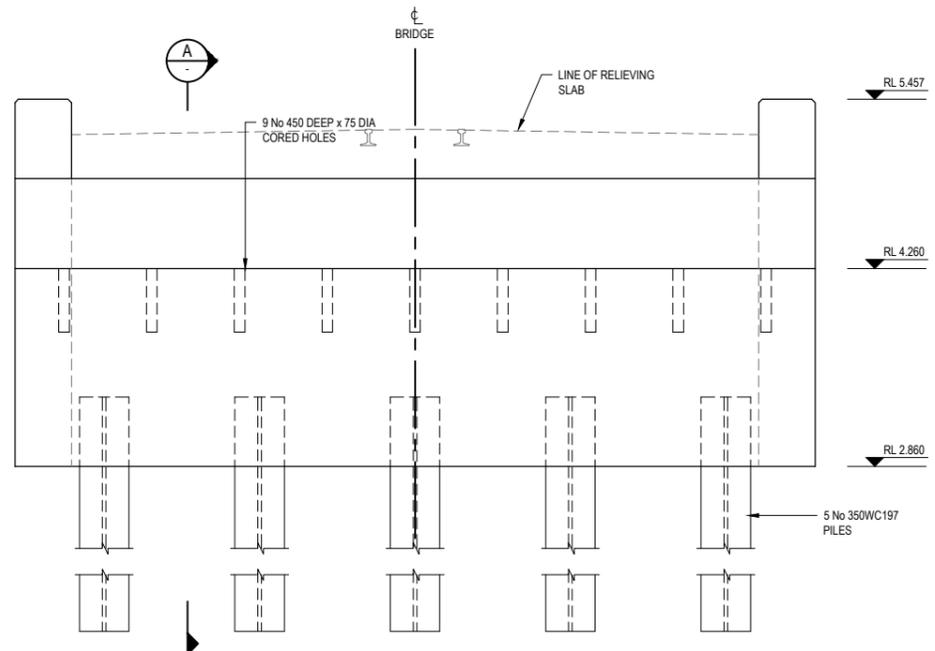
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	Approved (Project Director) *A.AHILADELLIS	Date 12.04.21
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Client **DOUGLAS SHIRE COUNCIL**

Project **WARNERS AND ANICHS BRIDGE UPGRADES**

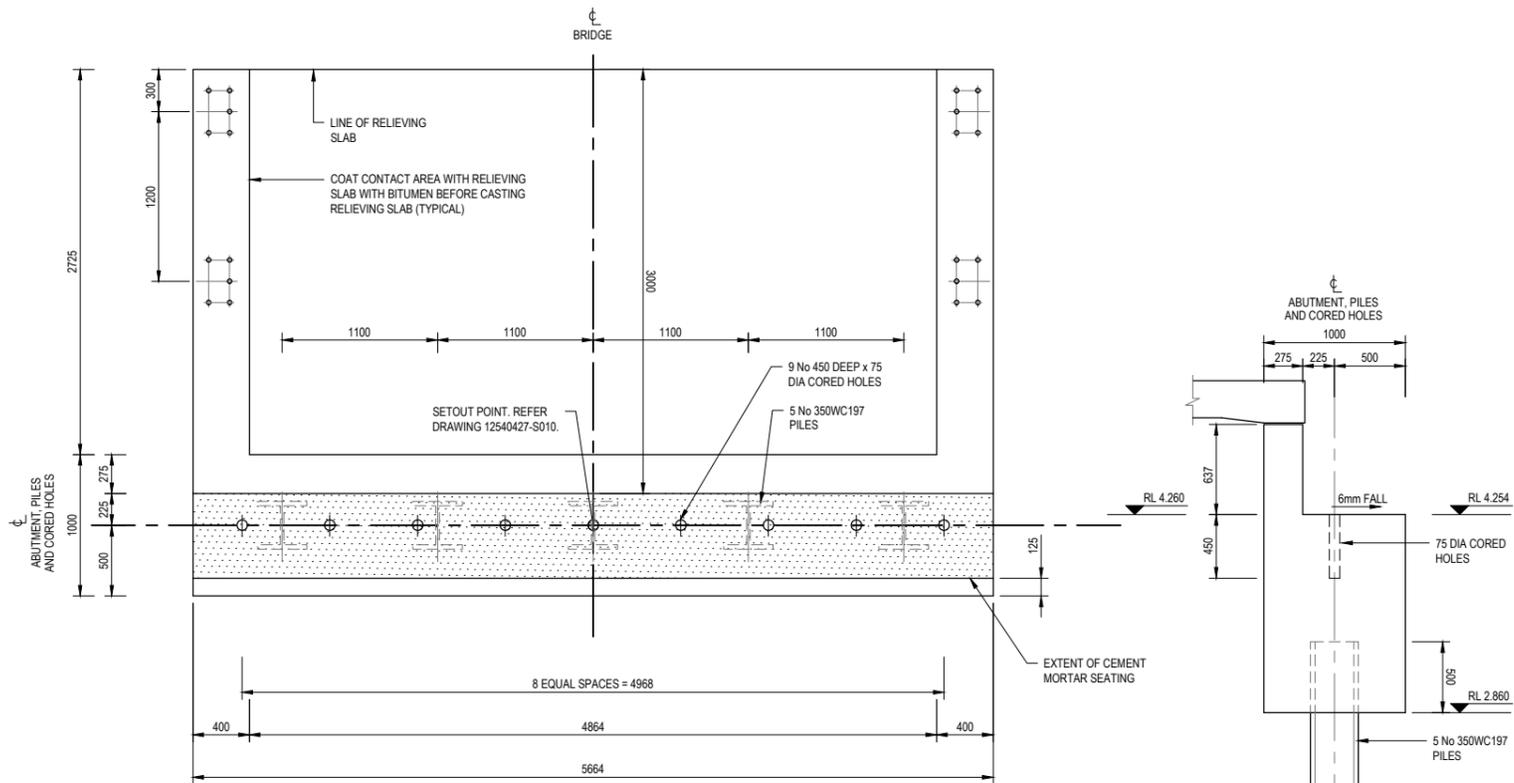
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Original Size **A1** Drawing No: **12540427-S010** Rev: **0**



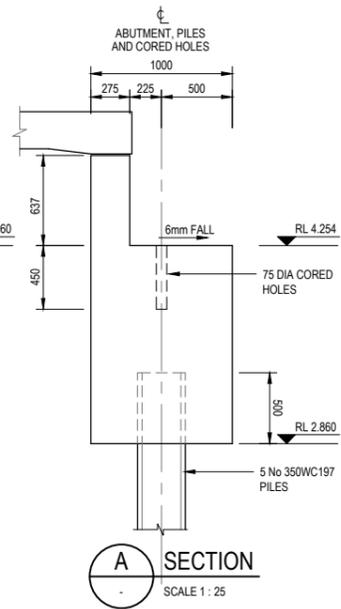
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(ABUTMENT A SIMILAR)

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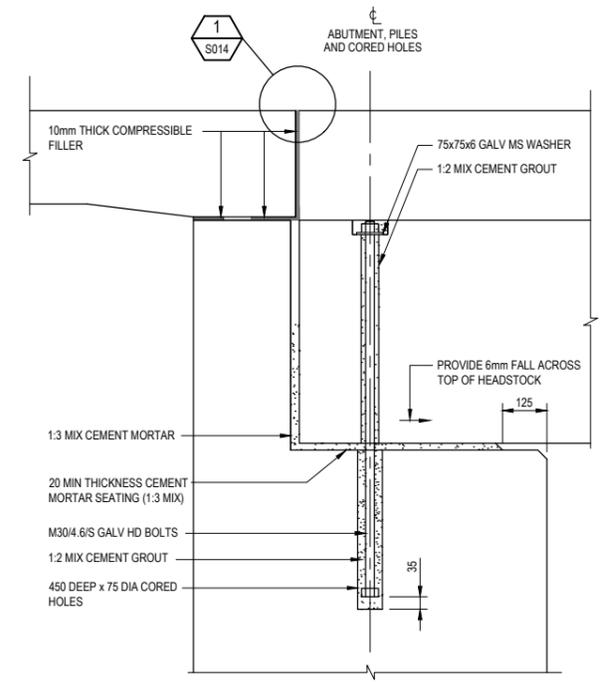
PLAN ON HEADSTOCK

SCALE 1:25



SECTION A-A

SCALE 1:25

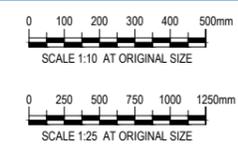


TYPICAL ABUTMENT ANCHOR DETAILS

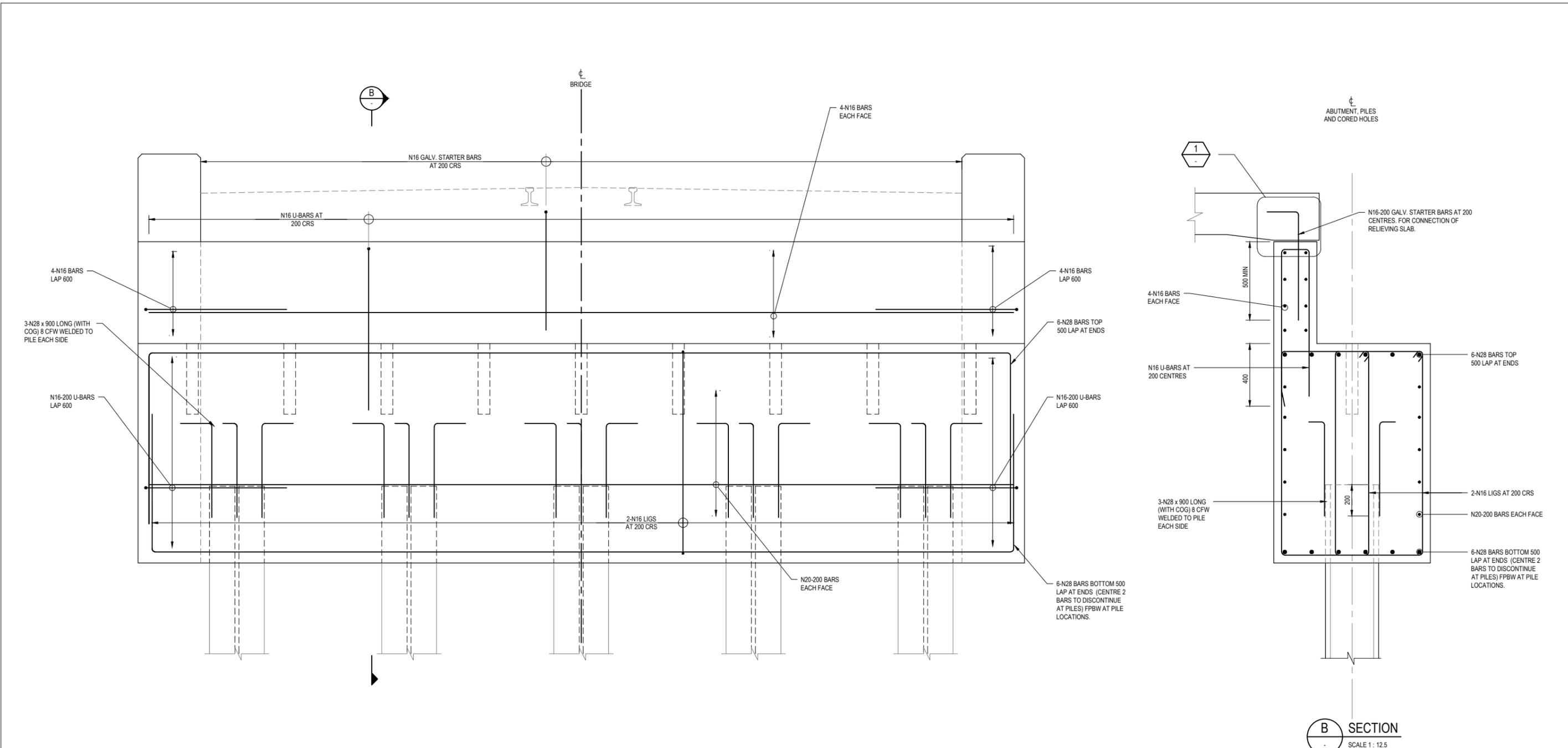
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DECK UNIT
LOCK OFF 25°C

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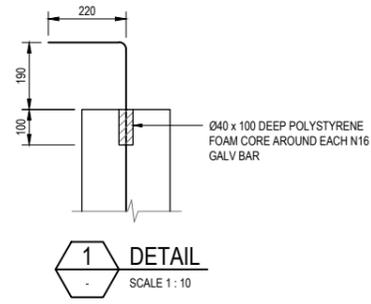


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	Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT	Project	WARNERS AND ANICHS BRIDGE UPGRADES
	Approved (Project Director)	*A.AHILADELLIS		Title	ANICHS BRIDGE	
	Date	12.04.21		Title	ABUTMENT DETAILS	
Scale	AS SHOWN		Original Size	A1	Drawing No:	12540427-S011
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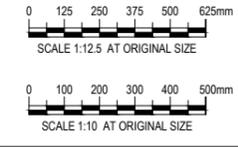
ELEVATION - ABUTMENT B REINFORCEMENT
(ABUTMENT A SIMILAR)
 SCALE 1:12.5

B SECTION
 SCALE 1: 12.5



1 DETAIL
 SCALE 1: 10

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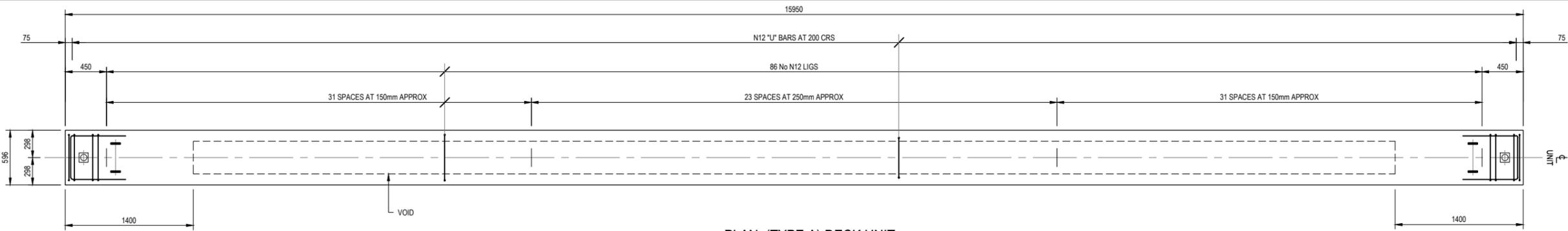


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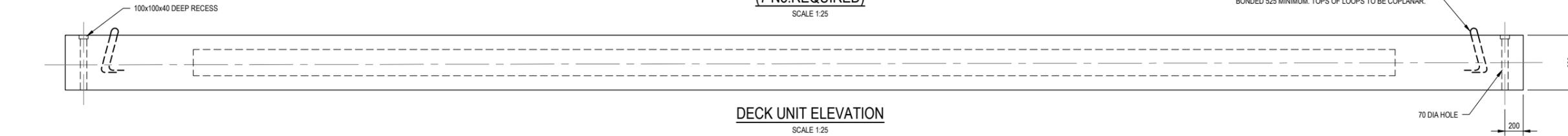
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 Approved (Project Director) *A.AHILADELLIS
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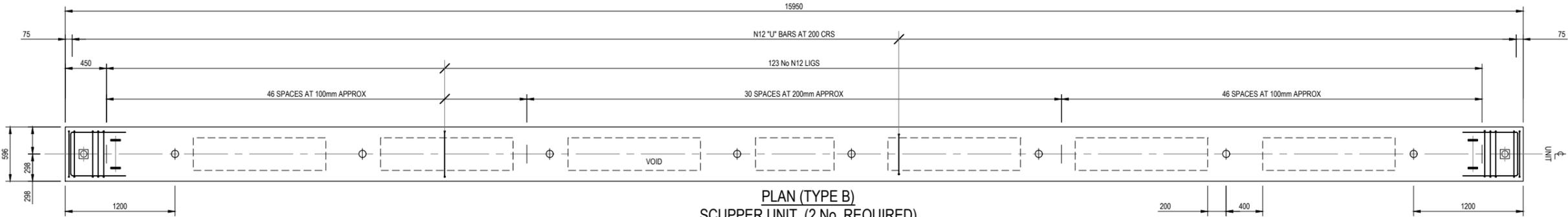
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 Project **WARNERS AND ANICHS BRIDGE UPGRADES**
 Title **ANICHS BRIDGE ABUTMENT DETAILS**
 Original Size **A1** Drawing No: **12540427-G011** Rev: **0**



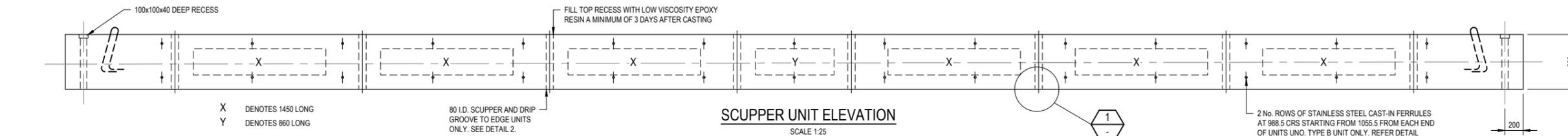
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(7 No. REQUIRED)
SCALE 1:25



DECK UNIT ELEVATION
SCALE 1:25



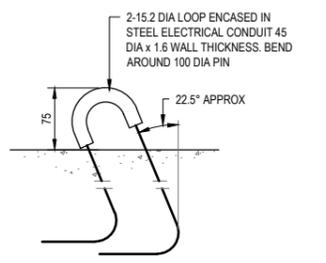
PLAN (TYPE B) SCUPPER UNIT
(2 No. REQUIRED)
SCALE 1:25



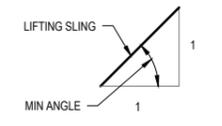
SCUPPER UNIT ELEVATION
SCALE 1:25

X DENOTES 1450 LONG
Y DENOTES 860 LONG

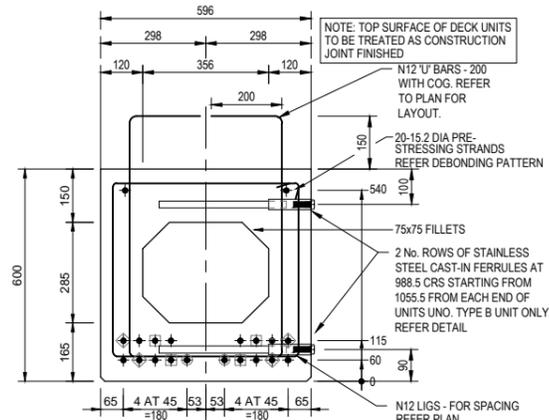
80 I.D. SCUPPER AND DRIP GROOVE TO EDGE UNITS ONLY. SEE DETAIL 2.



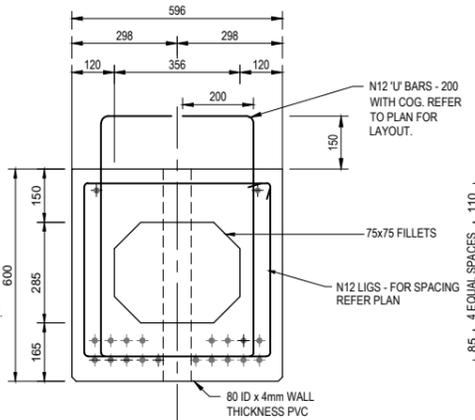
LIFTING LOOP
SCALE 1:5



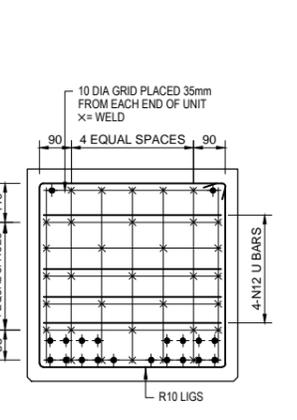
LIFTING ANGLE
SCALE 1:5



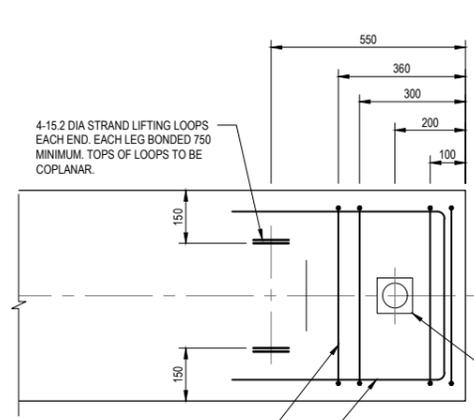
TYPICAL SECTION DECK UNIT
SCALE 1:10



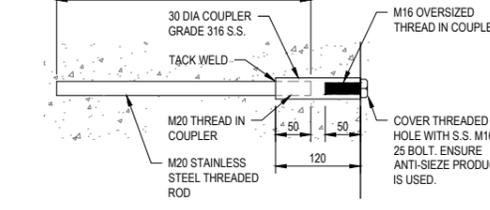
TYPICAL SECTION SCUPPER UNIT
SCALE 1:10



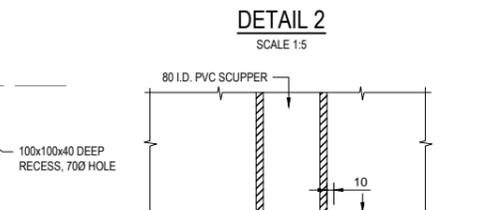
TYPICAL SECTION END GRID
SCALE 1:10



DECK UNIT END DETAIL
SCALE 1:10



DETAIL 2
SCALE 1:5



DETAIL 1
SCALE 1:5

NOTES:

1. CONCRETE CLASS TO BE 50 MPa/20. STRENGTH AT TRANSFER TO BE 40 MPa MINIMUM. EXPOSURE CLASSIFICATION B2. CONCRETE SHALL BE CAST IN RIGID FORMS AND SUBJECTED TO INTENSE VIBRATION.
2. COVER TO REINFORCING STEEL TO BE 35mm UNO.
3. STRANDS TO AS 4672.1 & 4672.2 - 7 WIRE ORDINARY - 15.2 - 1750 - RELAX 2. PRETENSIONING FORCE AT STRESSING = 188 kN PER STRAND.
4. ALL CHAMFERS WHERE SHOWN TO BE 25mm x 25mm MAXIMUM U.N.O.
5. ENDS OF STRANDS TO BE COATED WITH 0.3mm MINIMUM OF TAR EPOXY AFTER GRINDING FLUSH WITH ENDS OF UNITS (3 COATS MINIMUM).
6. SPACING OF LIGATURES IN UNITS MAY BE ALTERED SLIGHTLY TO CLEAR CORED HOLES.
7. ALL REINFORCEMENT TO CONFORM TO AS 4671. DEFORMED BARS GRADE D500N. ROUND BARS GRADE R250N.
8. COUPLERS FOR ANCHORS TO AS 1444 OR APPROVED EQUIVALENT. THREADS FOR COUPLERS TO AS 1275. TACK WELDING OF COUPLERS TO CONFIRM TO AS 1554.6
9. TACK WELDING FOR LOCATION PURPOSES TO CONFORM TO AS 1554.3 CLAUSES 3.3.1 AND 3.3.2. WELDING CONSUMABLES TO BE E4916, E4918 OR W50X.
10. VOIDS SHALL BE CELLULAR POLYSTYRENE GRADE SL TO AS 1366.3.
11. WHEN CASTING UNITS, THE MANUFACTURER SHALL MAKE ALLOWANCE FOR AXIAL SHORTENING (EQUAL AMOUNTS EACH END).
12. LOADING: DESIGN LIVE LOAD IS T44/ L44.

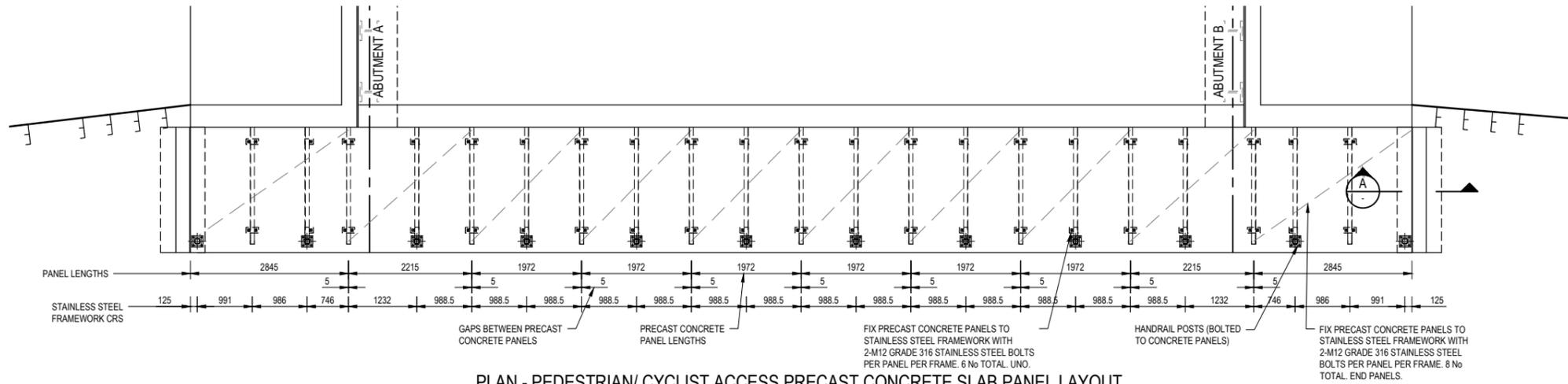
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No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



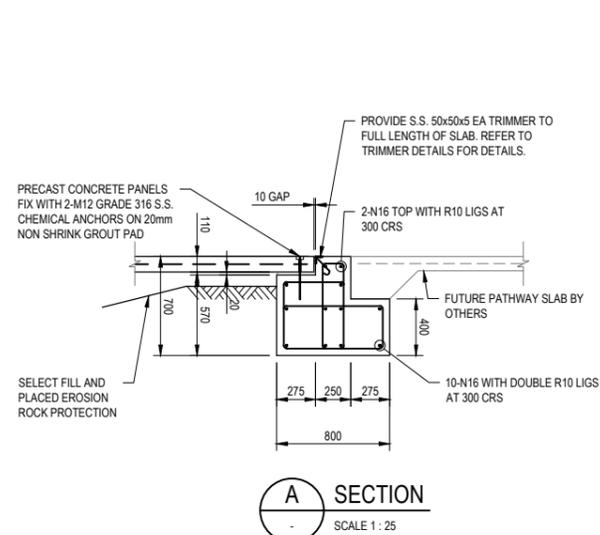
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Date	11.03.21		
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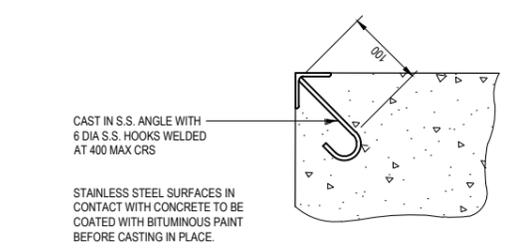
Client **DOUGLAS SHIRE COUNCIL**
Project **WARNERS AND ANICHS BRIDGE UPGRADES**
Title **ANICHS BRIDGE**
PSC DECK UNITS
Original Size **A1** Drawing No: **12540427-S012** Rev: **0**



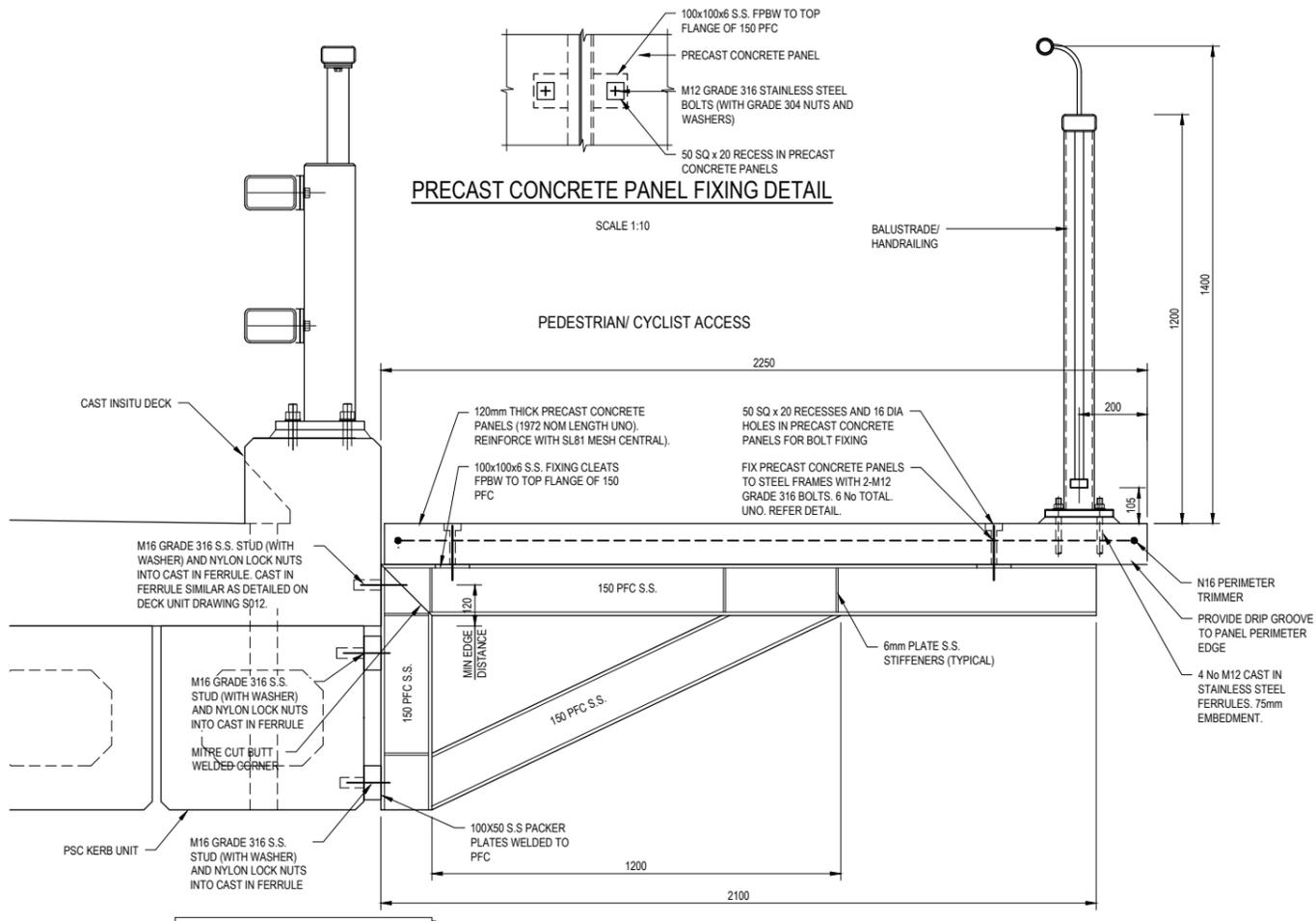
PLAN - PEDESTRIAN/ CYCLIST ACCESS PRECAST CONCRETE SLAB PANEL LAYOUT
SCALE 1:50



A SECTION
SCALE 1:25



TYPICAL TRIMMER DETAIL
SCALE 1:5



PRECAST CONCRETE PANEL FIXING DETAIL
SCALE 1:10

TYPICAL PEDESTRIAN/ CYCLIST ACCESS DETAIL
SCALE 1:10

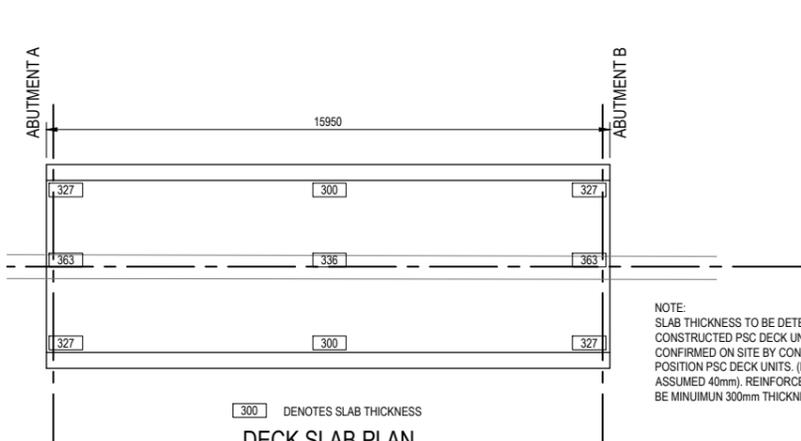
NOTES:
FRAMES ARE REQUIRED AT 988.5 CRS TO MATCH CAST-IN FERRULES IN PSC KERB UNITS.
FRAMES TO BE STAINLESS STEEL.
ALL WELDS TO BE 6mm CONTINUOUS FILLET WELDS UNLESS NOTED OTHERWISE.



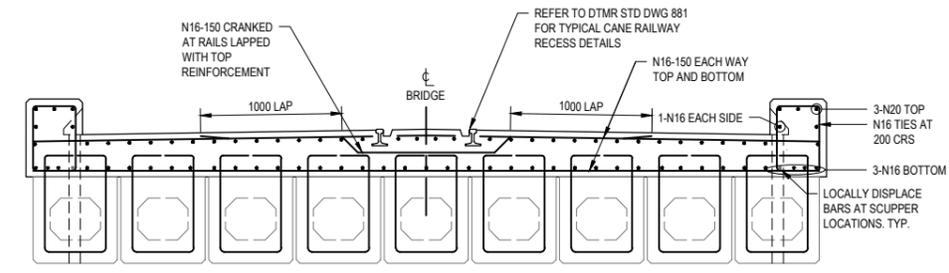
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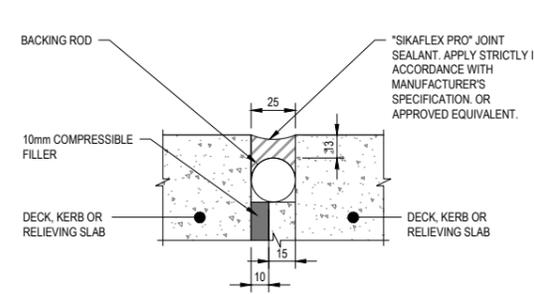
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	Approved (Project Director) *A.AHILADELLIS	Date 12.04.21	Title ANICHS BRIDGE PEDESTRIAN/ CYCLIST ACCESS DETAILS
	Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	Original Size A1 Drawing No: 12540427-S013 Rev: 0



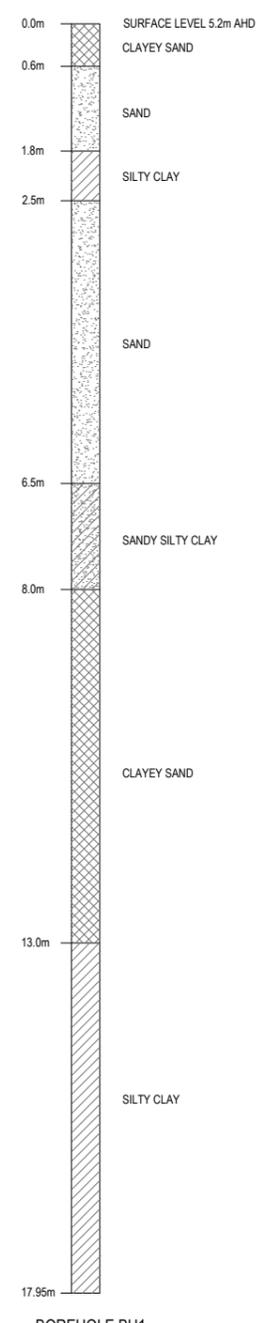
DECK SLAB PLAN
SCALE 1:100



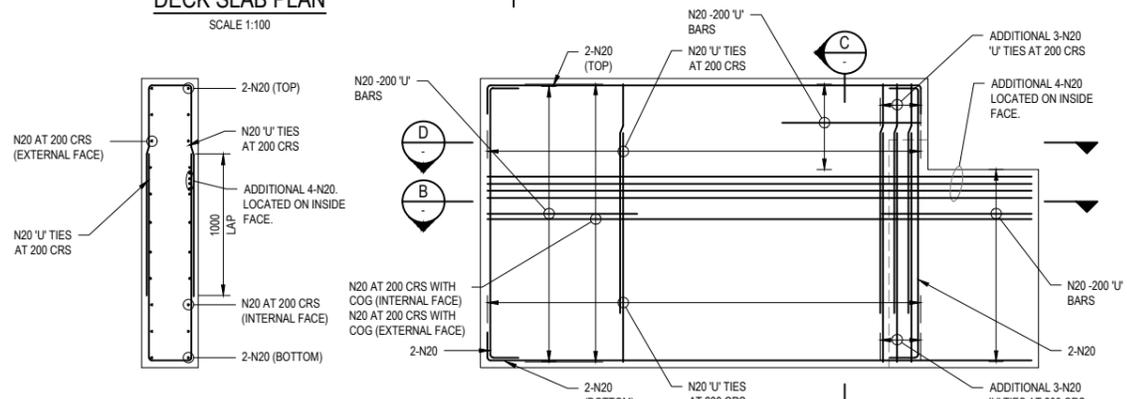
TYPICAL DECK REINFORCEMENT CROSS SECTION
SCALE 1:25



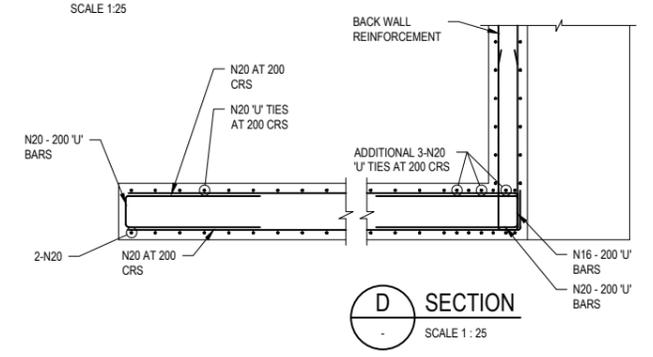
1 DETAIL
SCALE 1:2



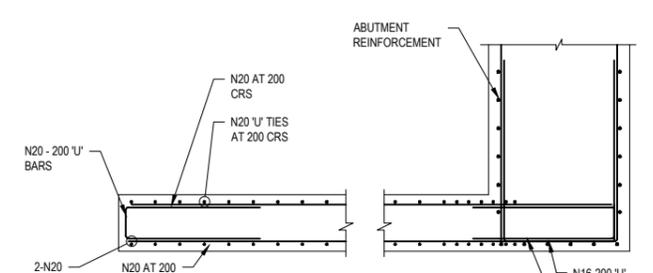
BOREHOLE INFORMATION
(EXTRACTED FROM DOUGLAS PARTNERS REPORT)
REFER TO DOUGLAS PARTNERS REPORT No. 104527.00
FEBRUARY 2021 FOR GROUND CONDITIONS.



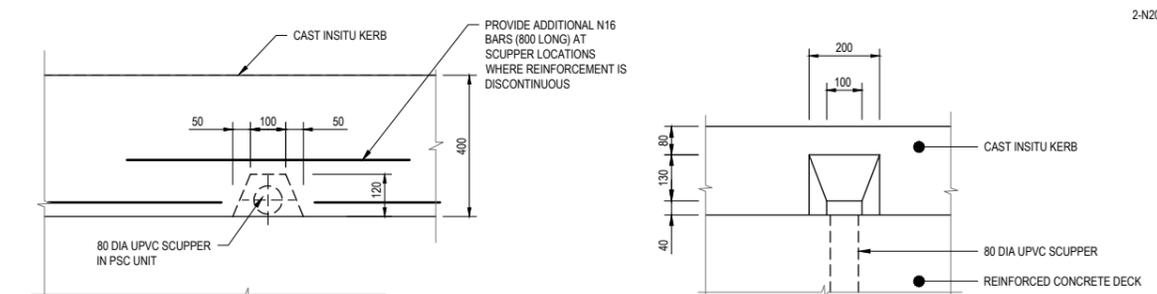
TYPICAL WINGWALL DETAILS
SCALE 1:25



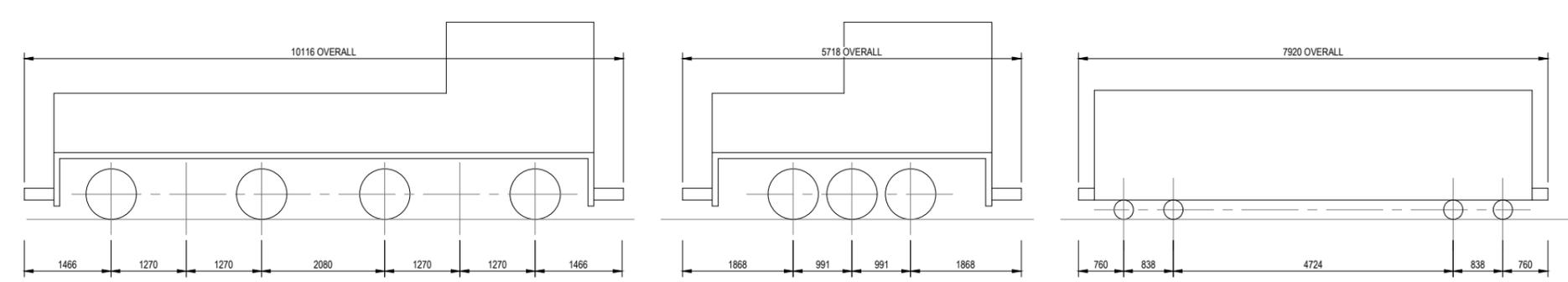
D SECTION
SCALE 1:25



B SECTION
SCALE 1:25

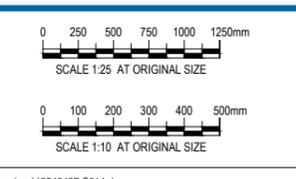


SCUPPER RECESS DETAILS
SCALE 1:10



28 TONNE LOCO NOT TO SCALE
18 TONNE LOCO NOT TO SCALE
10 TONNE CANE BINS NOT TO SCALE

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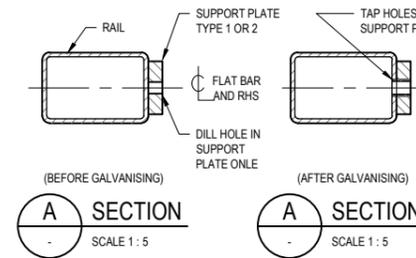
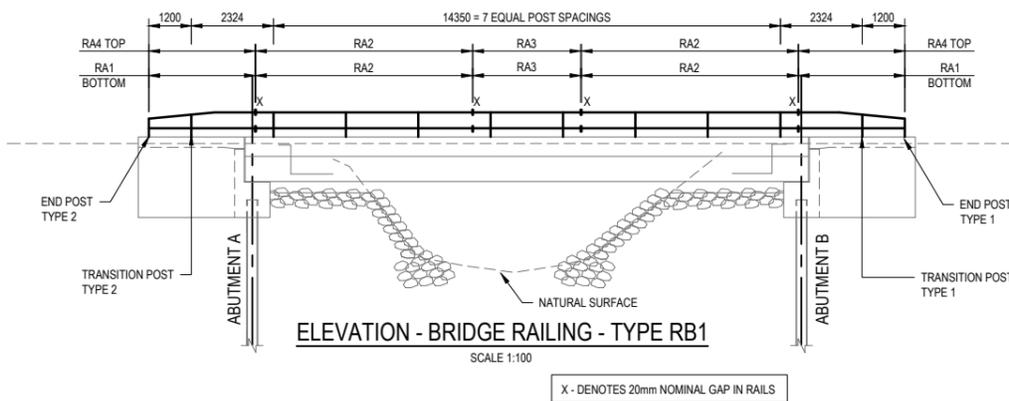
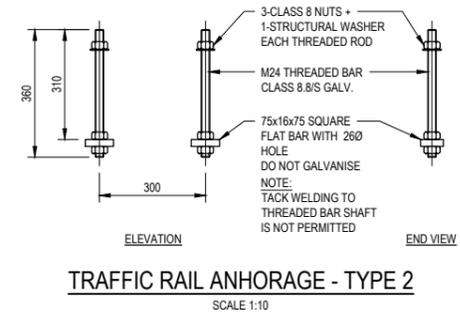
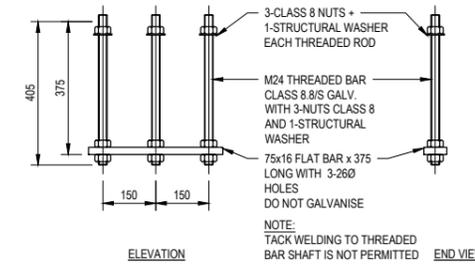
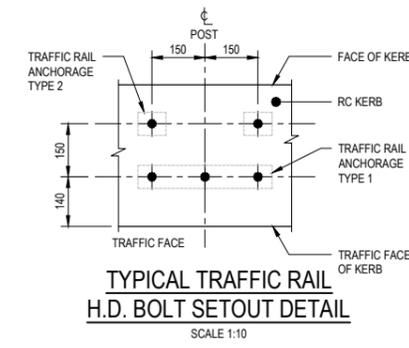
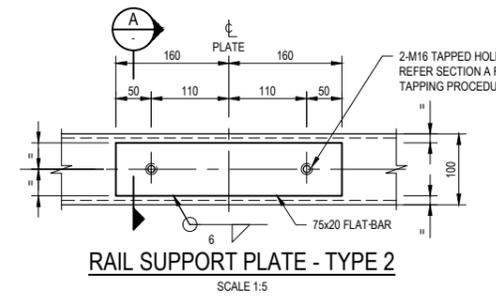
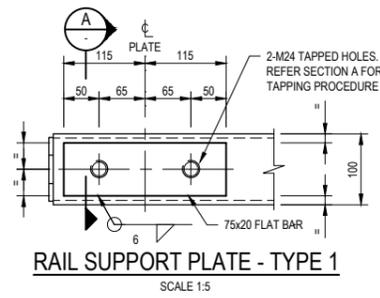
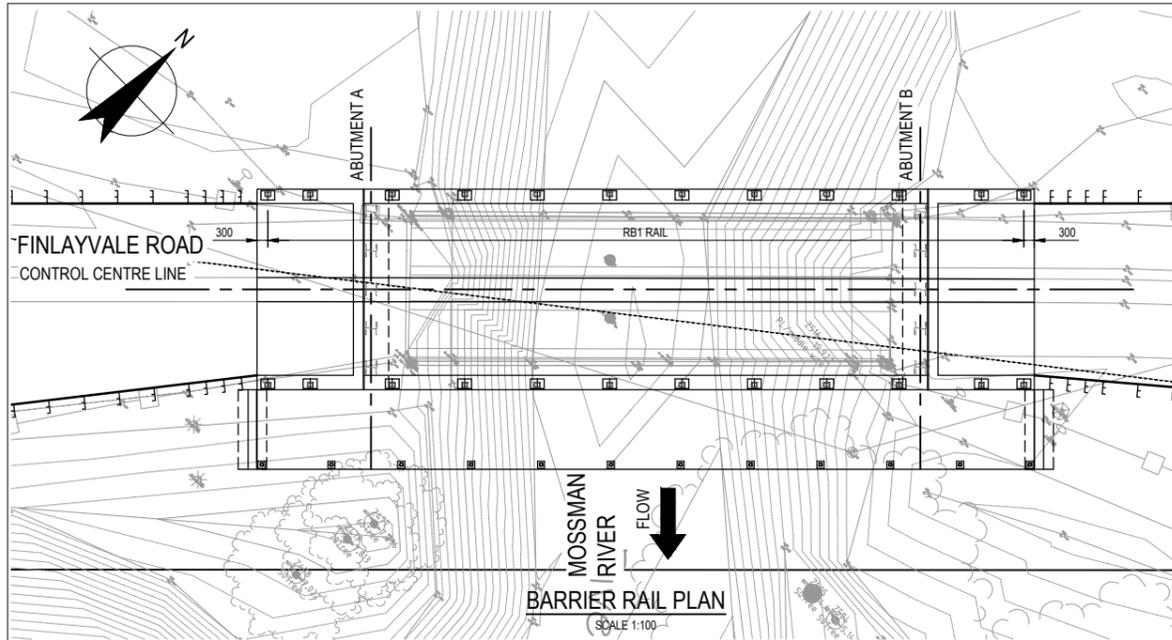
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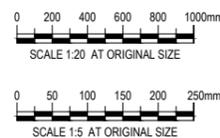
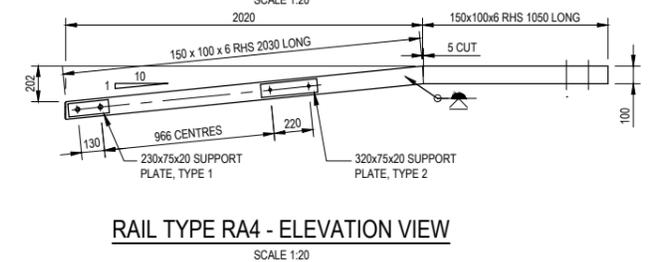
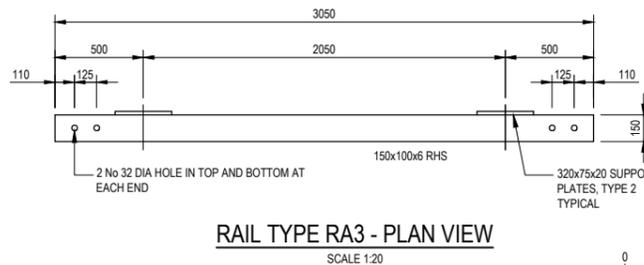
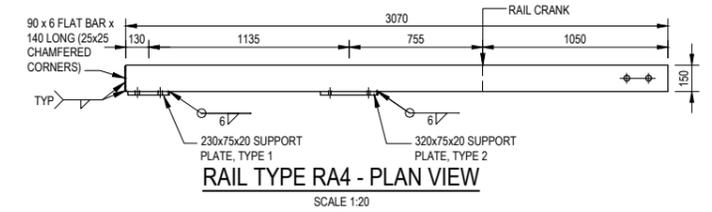
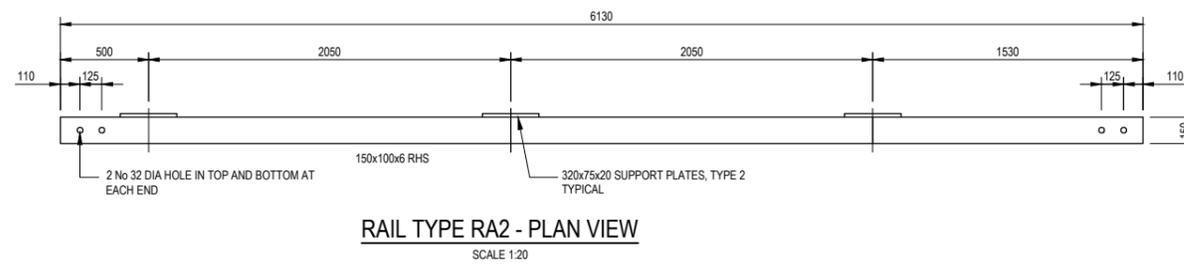
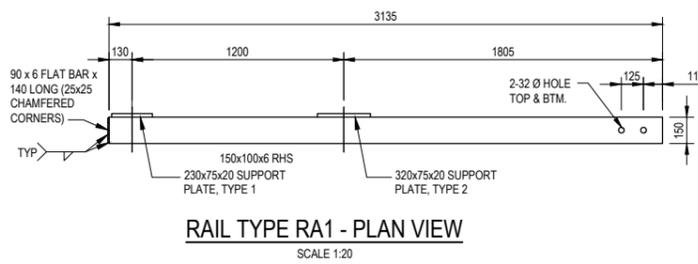
Project WARNERS AND ANICHS BRIDGE UPGRADES

Title ANICHS BRIDGE MISCELLANEOUS DETAILS

Original Size **A1** Drawing No: **12540427-S014** Rev: **0**



- TAPPING PROCEDURE:**
1. DRILL HOLES (USING CORRECT TAPPING DRILL OR SMALLER SIZE) THROUGH THE SUPPORT PLATE ONLY.
 2. POSITION AND WELD THE SUPPORT PLATE TO RAIL.
 3. FILL THE HOLES IN SUPPORT PLATE WITH NATURAL SILICONE.
 4. GALVANISE THE RAIL.
 5. DRILL AND TAP REQUIRED SIZE HOLES THROUGH SUPPORT PLATES AND RAIL.

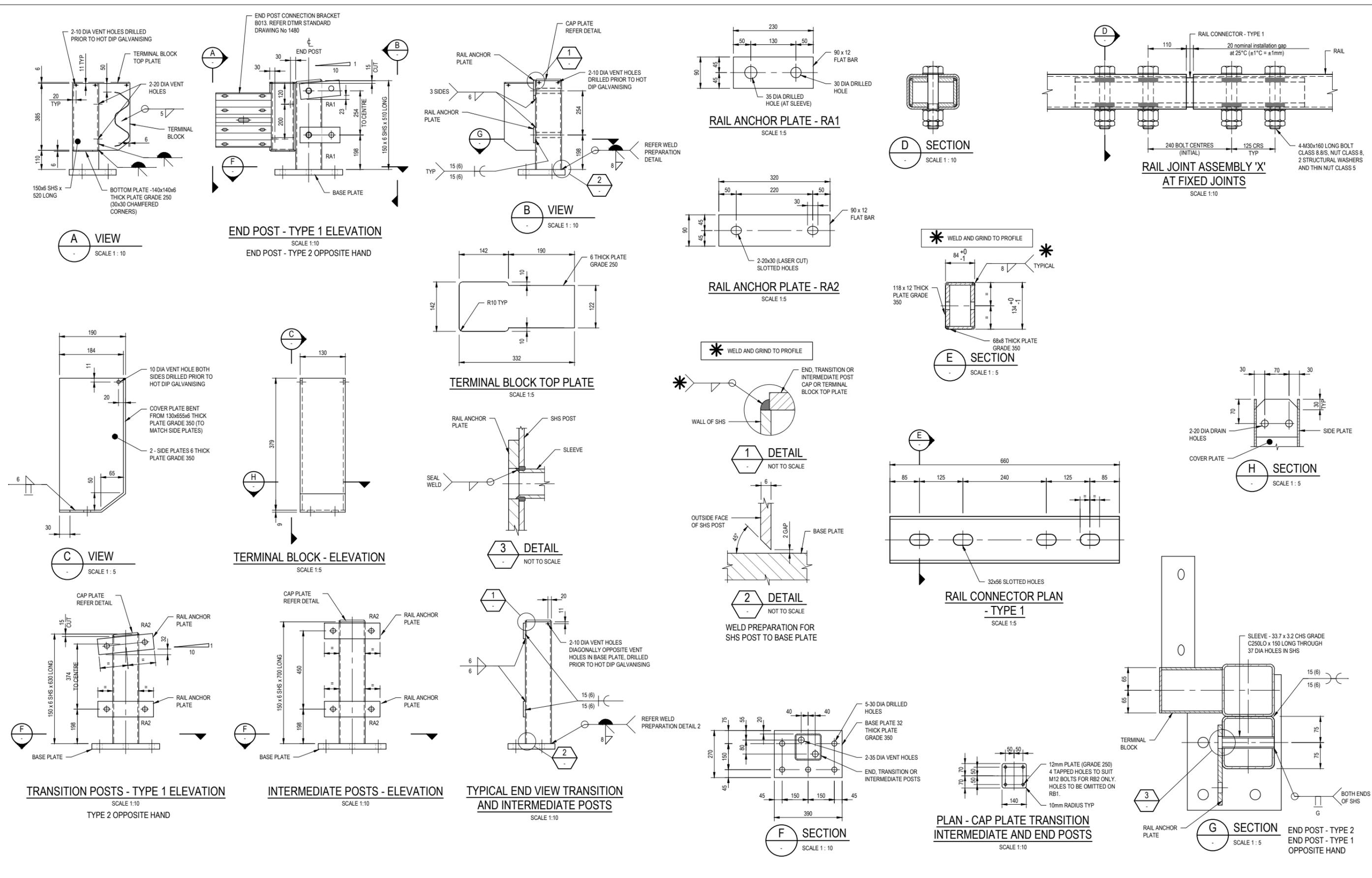


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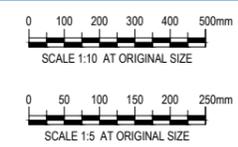
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Scale	AS SHOWN		

Client	DOUGLAS SHIRE COUNCIL
Project	WARNERS AND ANICHS BRIDGE UPGRADES
Title	BRIDGES BRIDGE ANICHS TRAFFIC BARRIER
Original Size	A1
Drawing No:	12540427-S015
Rev:	0



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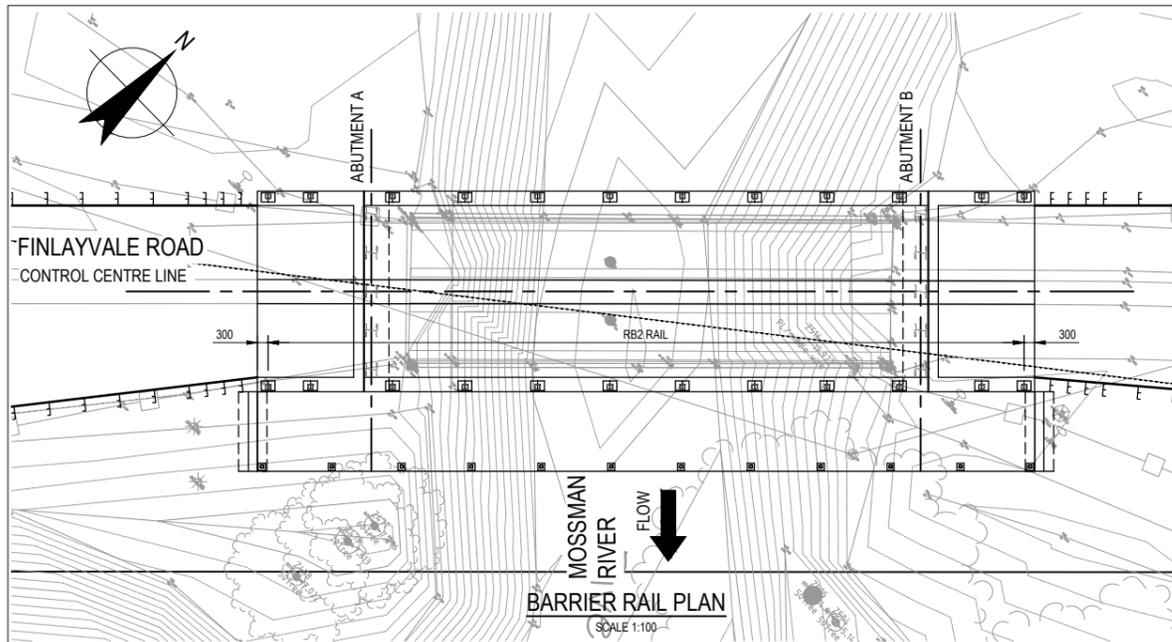
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Date	12.04.21		
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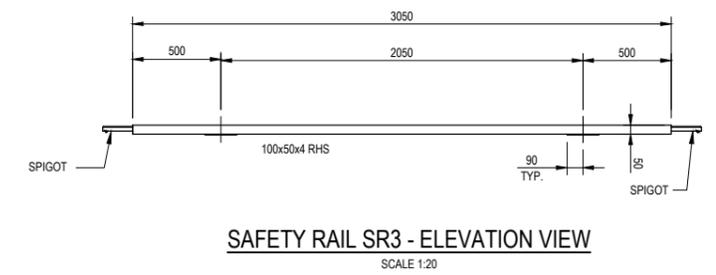
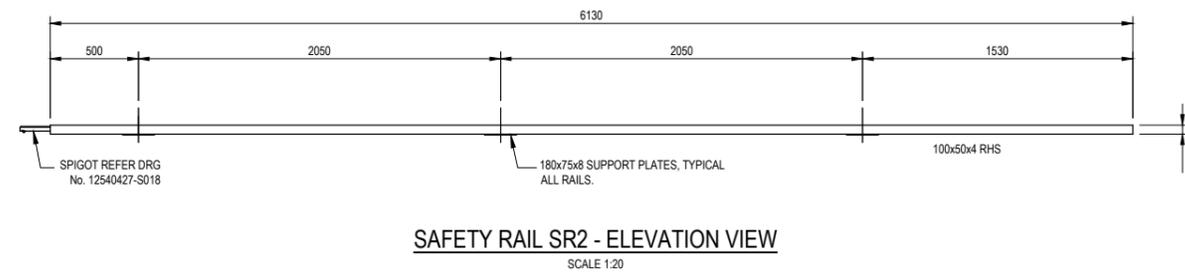
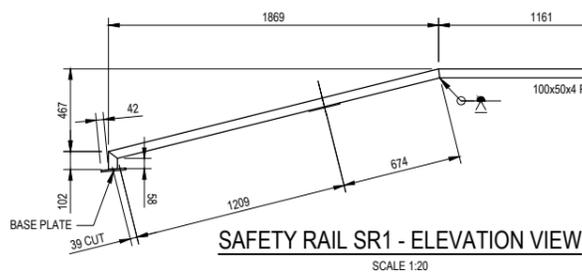
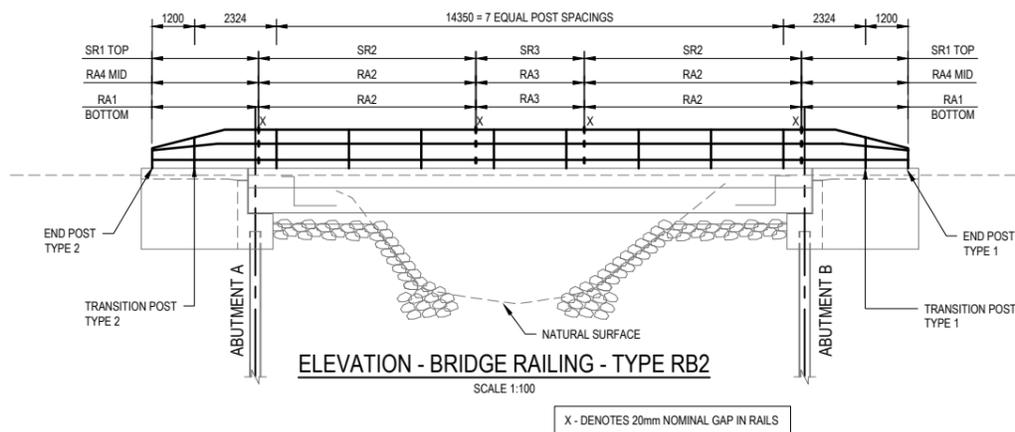
Client **DOUGLAS SHIRE COUNCIL**
Project **WARNERS AND ANICHS BRIDGE UPGRADES**
Title **BRICHS BRIDGE ANICHS TRAFFIC BARRIER DETAILS**

Original Size **A1**
Drawing No: **12540427-S016**
Rev: **0**

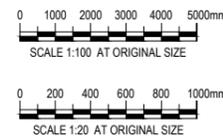


NOTES

1. DELINEATION ON THE BRIDGE TRAFFIC BARRIER SYSTEM SHALL BE INSTALLED IN THE LOCATION AND TO THE SPACING SHOWN ON THE DRAWING. DELINEATORS SHALL BE CONSISTENT WITH THE REQUIREMENTS SPECIFIED IN MRTS14.
2. RHS AND SHS TUBE TO BE GRADE C450L0 TO AS/NZS 1163.
3. ALL HOLLOW SECTION MATERIAL MANUFACTURED TO AS/NZS 1163 WILL REQUIRE ABRASIVE BLASTING TO DEVELOP A SURFACE PROFILE OF 50 µm PRIOR TO HOT DIP GALVANIZING. STEEL PLATE TO AS/NZS 3678. FLAT BAR TO BE GRADE 300 TO AS/NZS 3679.1.
4. BOLTS CLASS 8.8, NUTS CLASS 8 AND WASHERS FOR CLASS 8.8 BOLTS TO AS/NZS 1252, THIN NUTS CLASS 5 TO AS 1112 AND ELS WASHERS TO AS 1237.
5. ALL BOLTS AND NUTS TO BE HOT DIP GALVANISED TO AS 1214. WASHERS TO BE HOT DIP GALVANISED TO AS/NZS 4680.
6. STEELWORK TO BE FABRICATED TO THE REQUIREMENTS OF MRTS 78 FABRICATION OF STRUCTURAL STEELWORK.
7. WELDING SYMBOLS CONFORM TO AS 1101.3. ALL WELDING TO CONFORM TO MRTS 78 AND AS/NZS 1554.1. ALL WELDS TO BE SP CATEGORY. WELDING CONSUMABLES FOR GRADE C450L0 RHS/SHS TO BE CONTROLLED HYDROGEN TYPE: W503. WELDING CONSUMABLES FOR ALL OTHER STRUCTURAL STEEL SHALL BE CONTROLLED HYDROGEN TYPE: W50X UNLESS SHOWN OTHERWISE.
8. MEMBERS TO BE BRANDED WITH APPROPRIATE TYPE NUMBER AFTER FABRICATION.
9. RAIL POSTS AND CONNECTORS TO HAVE WELD SPLATTER AND WELDING SLAG REMOVED PRIOR TO HOT DIP GALVANISING TO AS/NZS 4680.
10. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.



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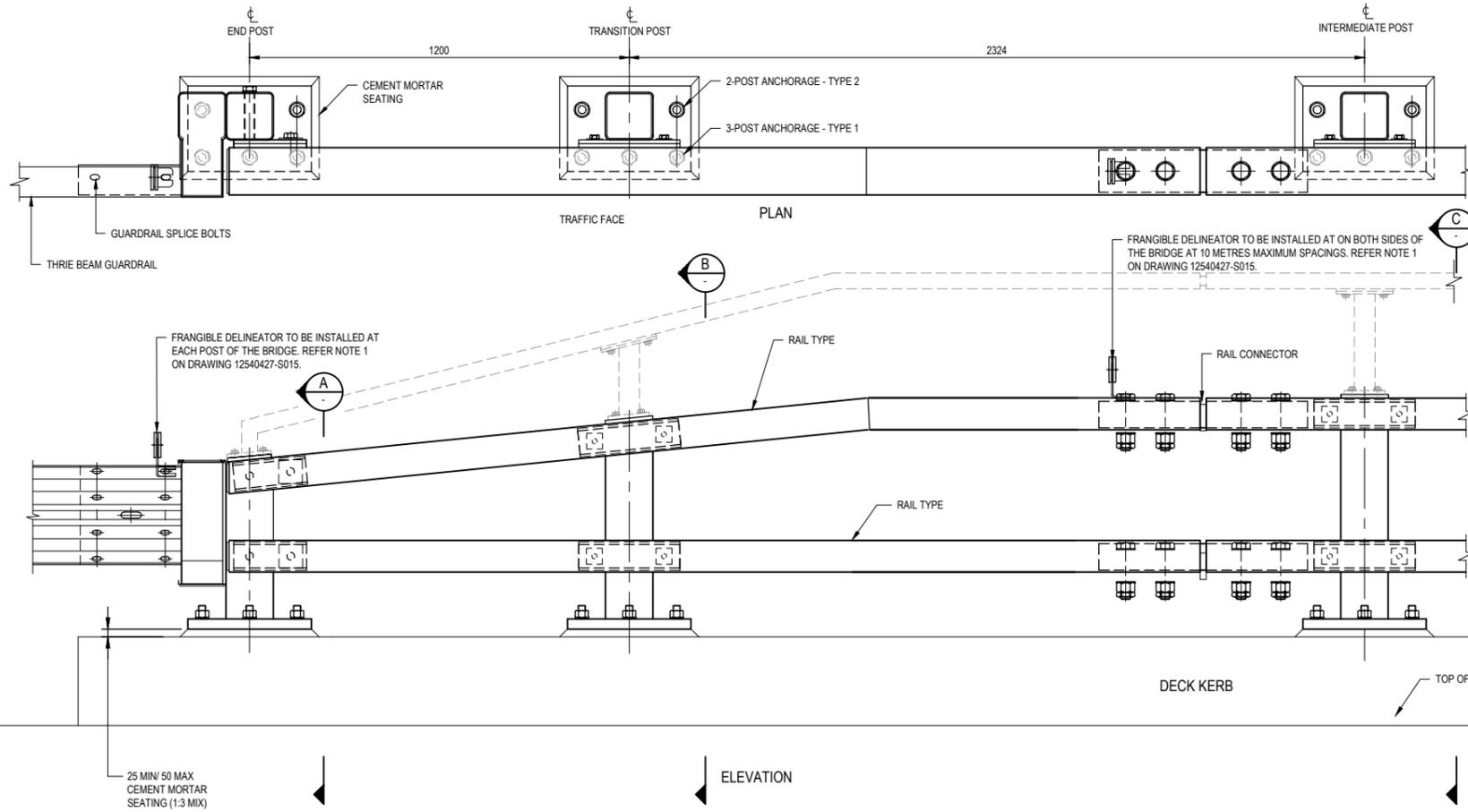
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Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
Scale	AS SHOWN		

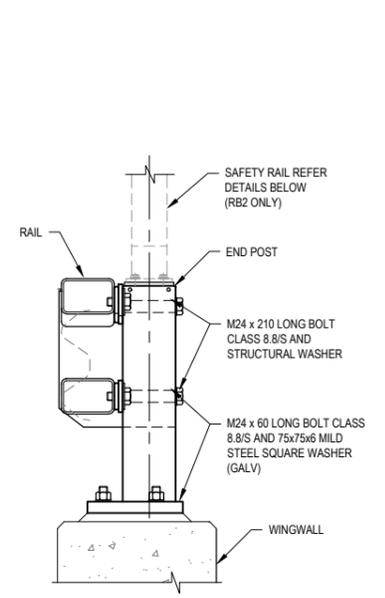
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Client	DOUGLAS SHIRE COUNCIL
Project	WARNERS AND ANICHS BRIDGE UPGRADES
Title	SAFETY RAILS ARRANGEMENT
Original Size	A1
Drawing No:	12540427-S017
Rev:	0

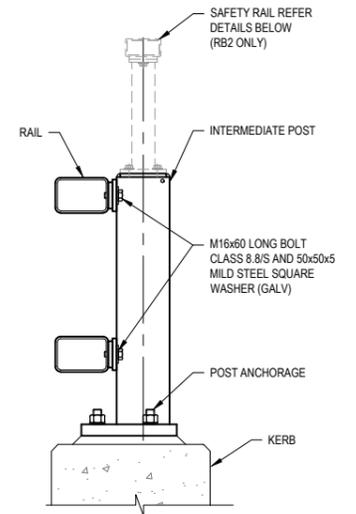


TYPICAL ASSEMBLY - END, TRANSITION AND INTERMEDIATE POST

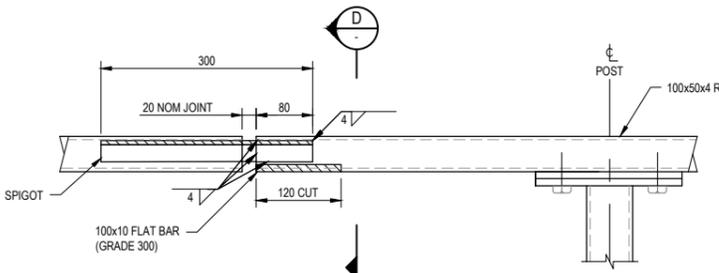
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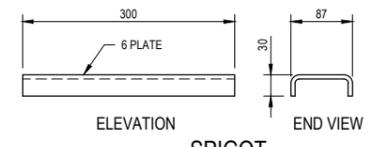
A SECTION
SCALE 1:10



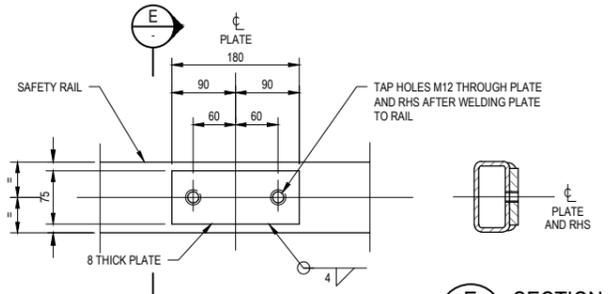
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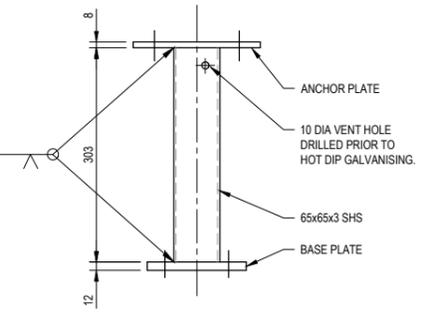
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ELEVATION
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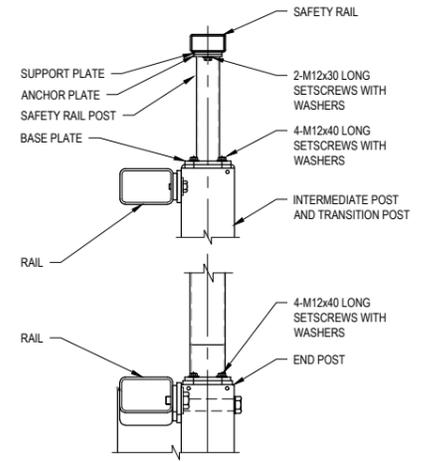
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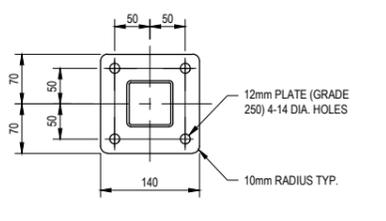
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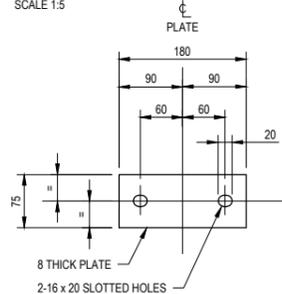
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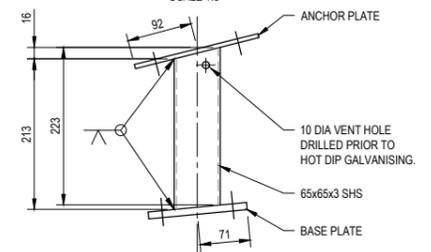
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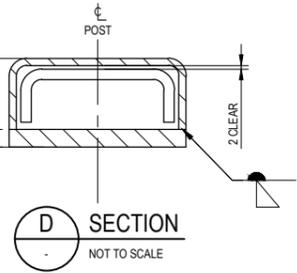
PLAN - BASE PLATE
INTERMEDIATE, TRANSITION AND END POSTS
SCALE 1:5



ANCHOR PLATE
SCALE 1:5

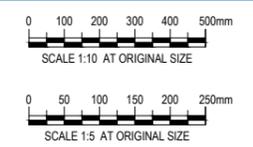


TRANSITION SAFETY RAIL POST
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D SECTION
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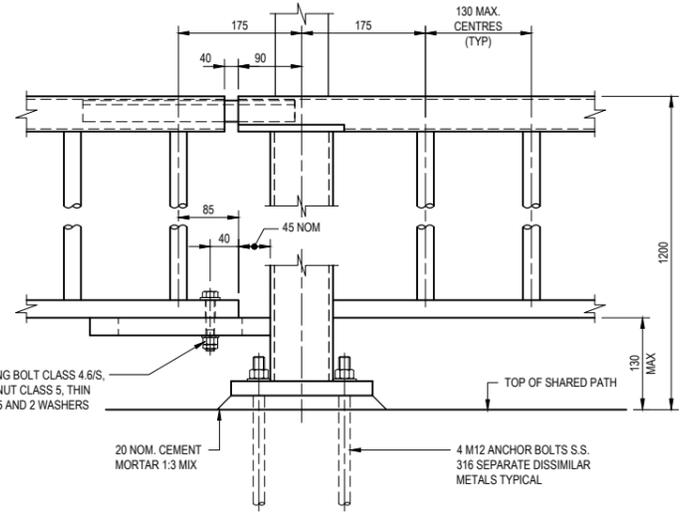
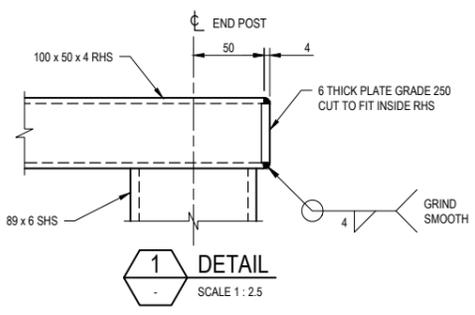
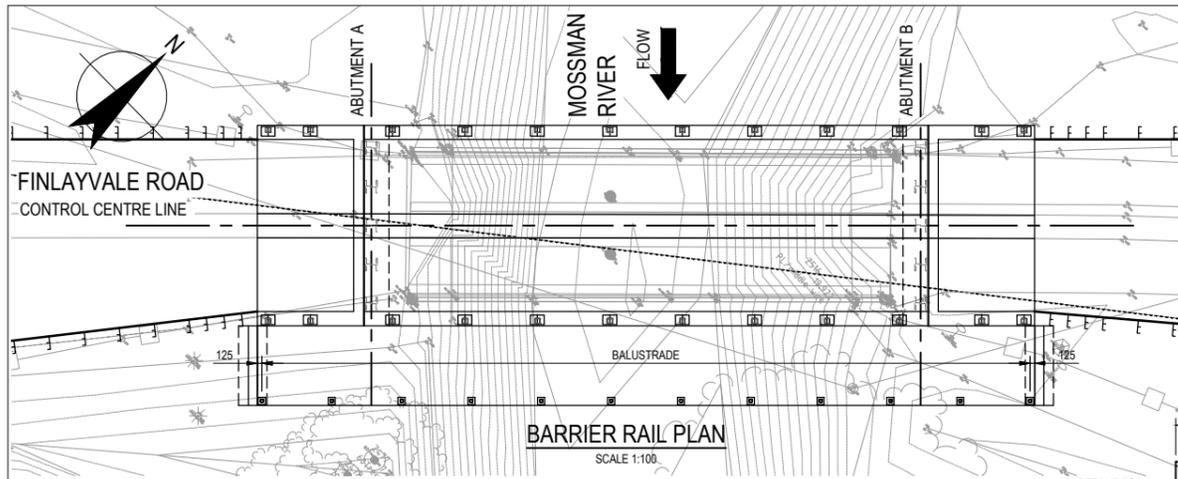
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0	APPROVED ISSUE		WRC	*MI	*AA	12.04.21



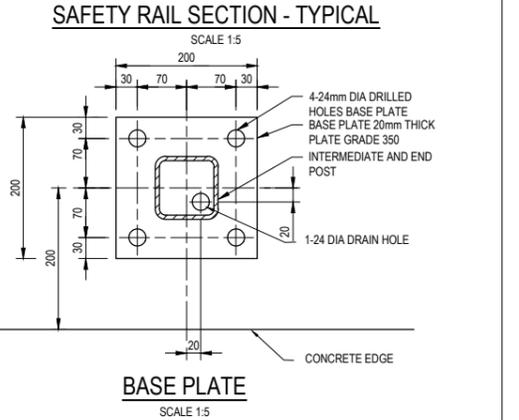
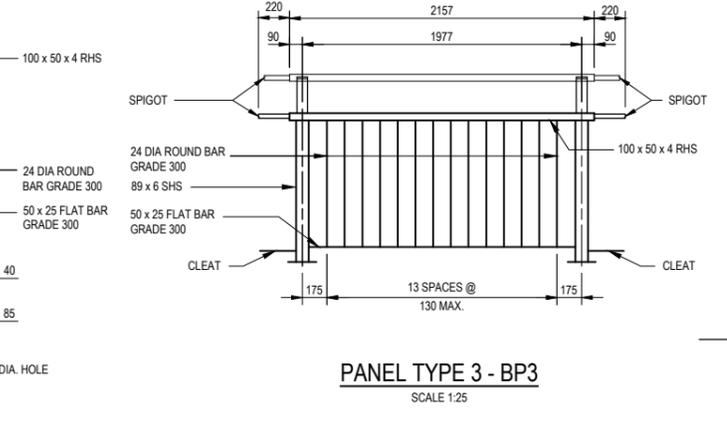
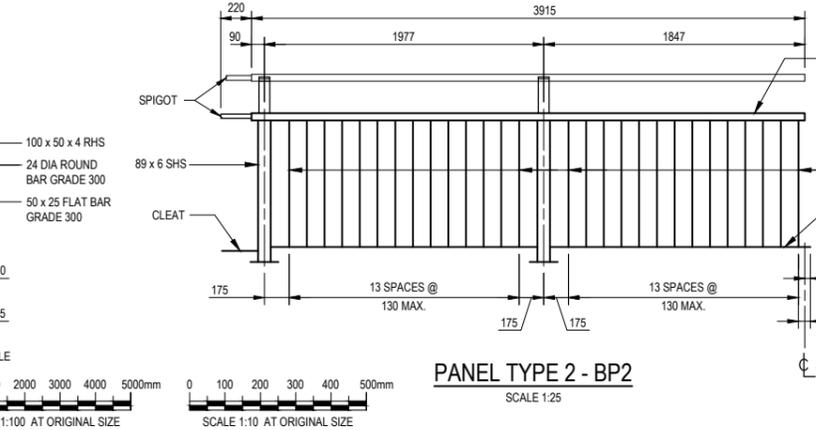
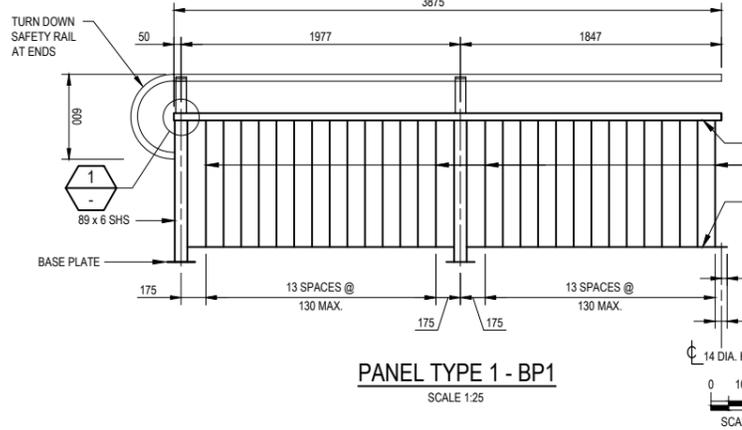
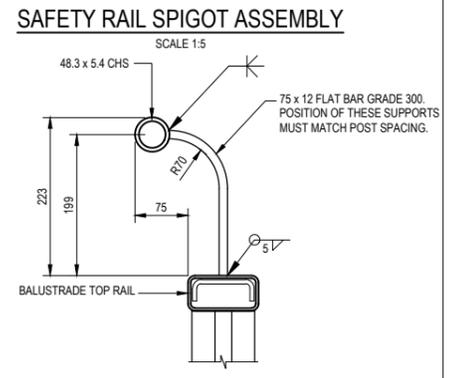
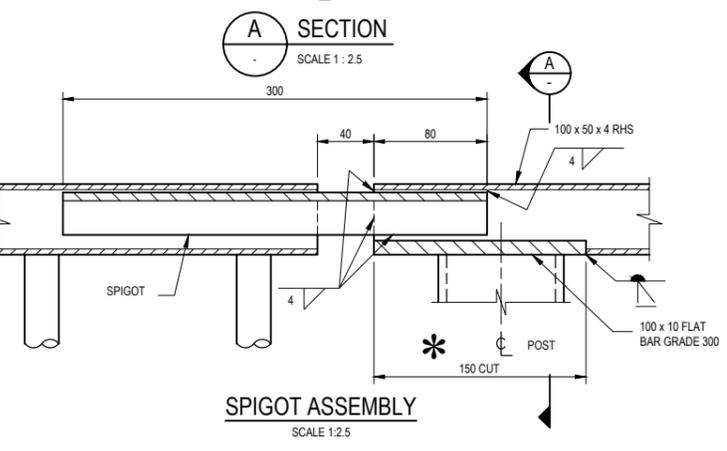
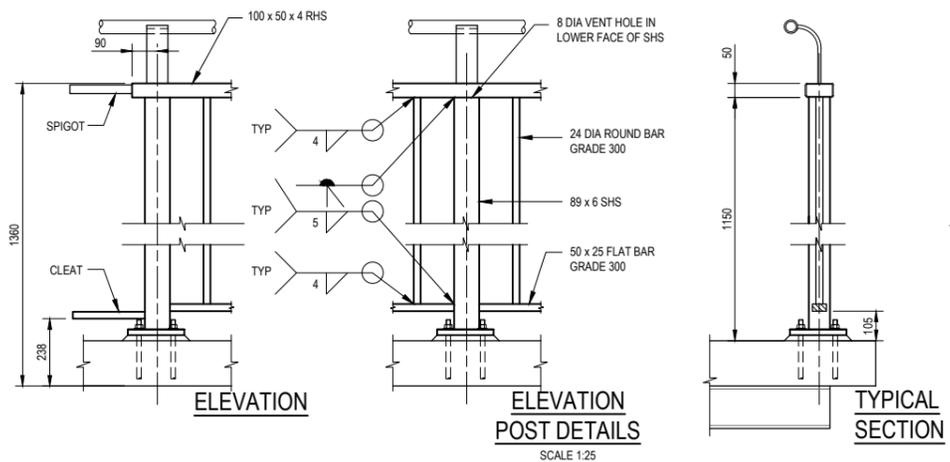
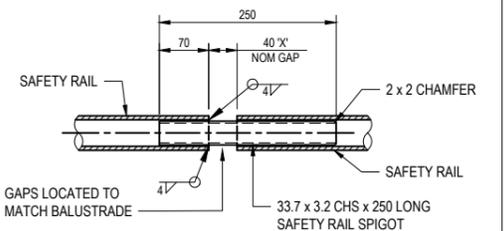
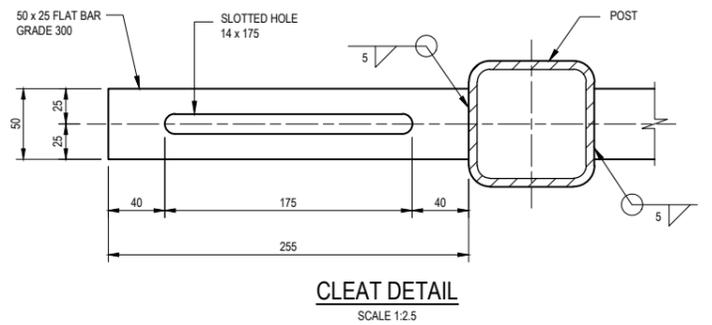
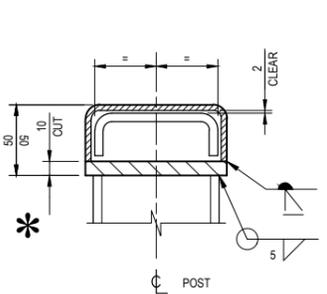
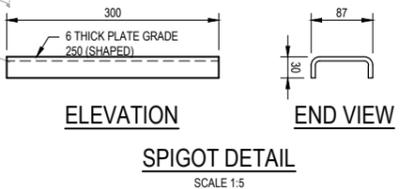
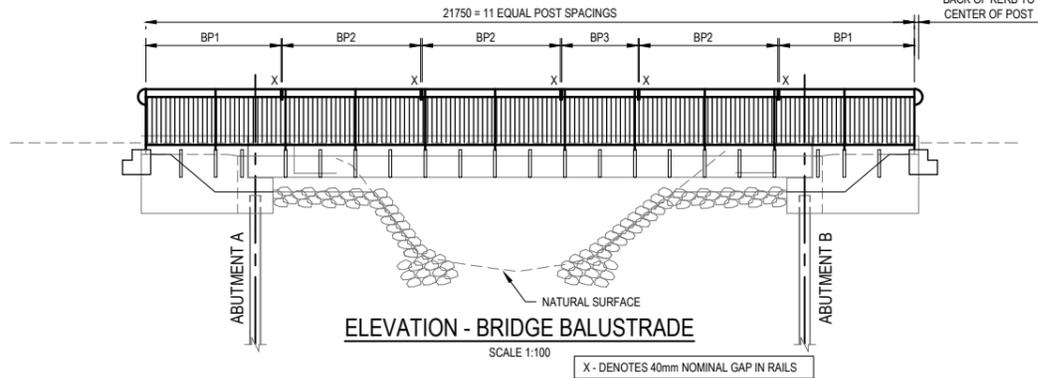
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Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
Scale	AS SHOWN		

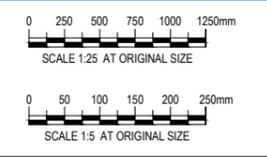
Client	DOUGLAS SHIRE COUNCIL WARNERS AND ANICHS BRIDGE UPGRADES		
Project Title	SAFETY RAILS DETAILS		
Original Size	A1	Drawing No:	12540427-S018
Rev:	0		



- NOTES**
- RHS AND SHS TUBE TO BE GRADE C450L0 TO AS/NZS 1163.
 - BASE PLATES AND RAIL CONNECTORS TO BE GRADE 350 TO AS/NZS 3678.
 - ALL OTHER PLATES AND FLAT BAR TO BE GRADE 300 TO AS/NZS 3679.1.
 - BOLTS CLASS 8.8, NUTS CLASS 8 AND WASHERS FOR CLASS 8.8 BOLTS TO AS/NZS 1252, THIN NUTS CLASS 5 TO AS 1112 AND ELS WASHERS TO AS 1237.
 - ALL BOLTS AND NUTS TO BE HOT DIP GALVANISED TO AS 1214. WASHERS TO BE HOT DIP GALVANISED TO AS/NZS 4680.
 - STEELWORK TO BE FABRICATED TO THE REQUIREMENTS OF MRTS 78 FABRICATION OF STRUCTURAL STEELWORK.
 - WELDING SYMBOLS CONFORM TO AS 1101.3. ALL WELDING TO CONFORM TO MRTS 78 AND AS/NZS 1654.1. ALL WELDS TO BE SP CATEGORY.
 - WELDING CONSUMABLES FOR GRADE C450L0 RHS/SHS TO BE CONTROLLED HYDROGEN TYPE: E49XX OR W503.
 - WELDING CONSUMABLES FOR ALL OTHER STRUCTURAL STEEL SHALL BE CONTROLLED HYDROGEN TYPE: E49XX OR W50X UNLESS SHOWN OTHERWISE.
 - MEMBERS TO BE BRANDED WITH APPROPRIATE TYPE NUMBER AFTER FABRICATION.
 - RAIL, POSTS AND CONNECTORS TO HAVE WELD SPLATTER AND WELDING SLAG REMOVED PRIOR TO HOT DIP GALVANISING TO AS/NZS 4680.
 - ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.



0	APPROVED ISSUE	WRC	*MI	*AA	12.04.21	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
Scale	AS SHOWN		

Client **DOUGLAS SHIRE COUNCIL**
Project **WARNERS AND ANICHS BRIDGE UPGRADES**
Title **ANICHS BRIDGE BALUSTRADE DETAILS**
Original Size **A1**
Drawing No: **12540427-S019**
Rev: **0**

GENERAL

- G1. READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES, THEN SPECIFICATION.
- G2. CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE LEGISLATION, STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONNEL AND GENERAL PUBLIC IN ACCORDANCE WITH ALL CURRENT WORK HEALTH AND SAFETY ACTS, LEGISLATIVE REQUIREMENTS, ASSOCIATED REGULATIONS AND CODES OF PRACTICE, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE.
- G3. REFER DISCREPANCIES TO SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
- G4. SUBMIT DETAILS OF PROPOSED CHANGES TO SCOPE, WORK METHODS OR MATERIALS etc FOR APPROVAL BEFORE PROCEEDING. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT.
- G5. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE, BUT INDICATES REQUIRED PROPERTIES OF ITEM. SIMILAR ALTERNATIVES HAVING REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.
- G6. OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. NOTIFY RELEVANT SERVICE AUTHORITIES BEFORE COMMENCING WORK ON SITE.
- G7. GIVE TWO WORKING DAYS' (48 HOURS) NOTICE SO THAT INSPECTION MAY BE MADE OF CRITICAL STAGES OF WORK.
- G8. INSPECTIONS AND REVIEWS UNDERTAKEN BY SUPERINTENDENT OR OTHERS DO NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.
- G9. DO NOT OBTAIN DIMENSIONS BY SCALING FROM DRAWINGS.
- G10. DIMENSIONS ARE IN MILLIMETRES, LEVELS ARE IN METRES UNO, CHAINAGES ARE IN METRES UNO.
- G11. DATUM FOR LEVELS IS AH (AUSTRALIAN HEIGHT DATUM), CO-ORDINATES ARE TO MGA ZONE 55.
- G12. HAVE SURVEY AND SETTING OUT UNDERTAKEN BY A REGISTERED SURVEYOR.
- G13. VERIFY ON SITE SETTING OUT DIMENSIONS AND EXISTING MEMBER SIZES SHOWN ON DRAWINGS BEFORE SHOP DRAWINGS, CONSTRUCTION AND FABRICATION IS COMMENCED. EXISTING STRUCTURES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY.
- G14. USE STANDARD BOLT PATTERNS etc THROUGHOUT THE WORKS TO AVOID CONFUSION OR AMBIGUITY.
- G15. TAKE CARE OF HAZARDS ASSOCIATED WITH BURIED, CONCEALED OR OVERHEAD SERVICES. TAKE PRECAUTIONS AND UNDERTAKE EXPLORATION TO ESTABLISH LOCATION OF AND PROTECT EXISTING SERVICES AT SITE. SERVICES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY. SERVICES OTHER THAN THOSE SHOWN MAY EXIST ON SITE. MARK LOCATIONS OF SERVICES CLEARLY ON SITE, AND ON AS-BUILT DRAWINGS. HAND EXCAVATE WITHIN ONE METRE OF IN-GROUND SERVICES.
- G16. DISPOSE OF SURPLUS MATERIAL OFF SITE IN ACCORDANCE WITH LOCAL AUTHORITY WASTE REGULATIONS.
- G17. IMPLEMENT SOIL AND WATER MANAGEMENT PROCEDURES TO AVOID EROSION, CONTAMINATION AND SEDIMENTATION OF SITE, SURROUNDING AREAS AND DRAINAGE SYSTEMS.
- G18. WORKMANSHIP AND MATERIALS TO COMPLY WITH REQUIREMENTS OF AUSTRALIAN STANDARDS, NATIONAL CONSTRUCTION CODE (NCC) AND BY-LAWS AND ORDINANCES OF RELEVANT BUILDING AUTHORITIES. ALL STANDARDS REFERRED TO ARE THOSE CURRENT (AS AMENDED) AT COMMENCEMENT OF CONTRACT.
- G19. OBTAIN REQUIREMENTS FOR SERVICES, ADJOINING ELEMENTS etc TO BE EMBEDDED IN, FIXED TO OR SUPPORTED ON WORK AND PROVIDE FOR REQUIRED FIXINGS. PROVIDE FOR TEMPORARY SUPPORT OF ADJOINING ELEMENTS DURING CONSTRUCTION. DRAWINGS DO NOT SHOW DETAILS OF ALL REQUIRED FIXTURES, INSERTS, SLEEVES, RECESSES OR OPENINGS etc.
- G20. PROTECT EXISTING STRUCTURES FROM DAMAGE OR CRACKING. MAKE GOOD ANY DAMAGE TO EXISTING ELEMENTS AT COMPLETION OF WORKS OR AS DIRECTED BY SUPERINTENDENT.
- G21. WHERE NEW WORK ABUTS EXISTING, PROVIDE SMOOTH TRANSITION FREE OF ABRUPT CHANGES.
- G22. HAVE TESTING PERFORMED BY AN INDEPENDENT NATA (NATIONAL ASSOCIATION OF TESTING AUTHORITIES) ACCREDITED AUTHORITY, AND PROVIDE TEST REPORTS TO SUPERINTENDENT.
- G23. SEPARATE METALS FROM INCOMPATIBLE MATERIALS (eg STAINLESS STEEL, GALVANIZED STEEL, UNGALVANIZED STEEL AND TREATED TIMBER etc) BY CONCEALED LAYERS OF SUITABLE INERT MATERIALS OF SUITABLE THICKNESSES. USE PLASTIC SLEEVES AND WASHERS FOR BOLTS, etc.
- G24. EXTERNAL ELEMENTS ARE THOSE EXPOSED TO WEATHER, RAIN AND WATER PENETRATION IN FINAL WORKS.
- G25. FOR EXTERNAL HORIZONTAL SURFACES, PROVIDE ADEQUATE GRADIENT TO DRAIN WATER.
- G26. UNO=UNLESS NOTED OTHERWISE, SLS=SERVICEABILITY LIMIT STATE, ULS=ULTIMATE LIMIT STATE, NSL=NATURAL SURFACE LEVEL, FSL=FINISHED SURFACE LEVEL.
- G27. SUPERINTENDENT=SUPERINTENDENT NOMINATED IN CONTRACT.
- G28. BUILD, FABRICATE AND PROCURE ONLY FROM DRAWINGS 'ISSUED FOR CONSTRUCTION'.
- G29. KEEP ON SITE A COMPLETE SET OF CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS) AND SITE INSTRUCTIONS.

TEMPORARY WORKS

- G30. THESE DRAWINGS DO NOT DETAIL TEMPORARY WORKS. CONSTRUCTION METHODS AND TEMPORARY WORKS ARE RESPONSIBILITY OF THE CONTRACTOR.
- G31. PROVIDE SCAFFOLDING, BARRIERS, FALL RESTRAINT, HAND-MID RAILS AND TOE BOARDS FOR WORK AT HEIGHT. ERECT ACCESS STAIRS AT EARLIEST OPPORTUNITY TO REDUCE OPEN SHAFT HAZARDS AND FACILITATE ACCESS. MAINTAIN SAFETY MESH AND BARRIERS TO ALL OPENINGS AND ELEVATED EDGES.
- G32. MAINTAIN STRUCTURE IN A STABLE CONDITION DURING CONSTRUCTION AND PROVIDE TEMPORARY BRACING AND / OR SUPPORT AS REQUIRED. SHOW TEMPORARY MEMBERS ON SHOP DRAWINGS. PROVIDE SPREADERS AT LOADS AND / OR LIFTING POINTS WHERE REQUIRED. ENSURE NO PART IS OVERSTRESSED. DO NOT PLACE OR STORE BUILDING MATERIALS ON, SUPPORT FORMWORK OR PROP FROM STRUCTURAL MEMBERS WITHOUT SUPERINTENDENT'S APPROVAL. PROVIDE CALCULATIONS BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO PROVE ADEQUACY OF STRUCTURE FOR PROPOSED CONSTRUCTION SEQUENCE, METHODS AND LOADS INCLUDING PROPPING, CRANE LIFTS etc.
- G33. PROVIDE TEMPORARY BRACING WHERE REQUIRED FOR STRUCTURAL ELEMENTS OR FRAMES STABILIZED BY MASONRY, PRECAST CONCRETE OR OTHER ELEMENTS CONSTRUCTED AFTER ERECTION OF THE STRUCTURAL ELEMENT OR FRAME, AND SHOW ON SHOP DRAWINGS.

DESIGN ASSUMPTIONS

- G34. STRUCTURAL WORK HAS BEEN DESIGNED FOR FOLLOWING LOADS:
 - PERMANENT DEAD LOAD OF STRUCTURE AS SHOWN ON DRAWINGS
 - LIVE LOADS:
 - T44 TRUCK LOADING & L44 LANE LOADING
 - 5 kPa ON WALKWAYS
 - HYDRAULIC LOADS:
 - WARNERS BRIDGE: 4.4 m/s (1.2 m DEBRIS MAT)
 - ANICHS BRIDGE: 4.0 m/s (2.0 m DEBRIS MAT)
 - BRIDGE EARTHQUAKE CLASSIFICATION:
 - BEDC-1 (BOTH)
 - PILE LOADING:
 WARNERS BRIDGE:
 - 500 kN COMPRESSION 250 kN TENSION (1000 kN COMPRESSION 500 kN TENSION GEOTECHNICAL LOAD).
 ANICHS BRIDGE:
 - 640 kN COMPRESSION 200 kN TENSION (1280 kN COMPRESSION 400 kN TENSION GEOTECHNICAL LOAD).

DELIVERABLES

- G35. RECORD ADOPTED CHANGES TO WORKING DRAWINGS AND SHOP DRAWINGS. ON COMPLETION OF WORKS SUBMIT A FULL SET OF 'AS CONSTRUCTED' DRAWINGS.

- G36. PREPARE WORKSHOP DRAWINGS, CALCULATIONS etc FOR PREFABRICATED COMPONENTS, INCLUDING STRUCTURAL STEELWORK, LIGHTWEIGHT STEELWORK, PRECAST CONCRETE, PRESTRESSING, FABRICATED TIMBER FRAMES etc AND SUBMIT ELECTRONIC PDF'S OR THREE PAPER COPIES OF EACH FOR SUPERINTENDENT'S REVIEW OF GENERAL COMPLIANCE WITH DESIGN CONCEPT. DO NOT COMMENCE FABRICATION UNTIL SHOP DRAWINGS AND CALCULATIONS HAVE BEEN REVIEWED. ALLOW 14 DAYS FOR SUPERINTENDENT'S REVIEW.
- G37. SUPERINTENDENT'S REVIEW OF SHOP DRAWINGS AND CALCULATIONS IS OF GENERAL CONFORMANCE WITH DESIGN CONCEPT AND GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS ONLY, AND DOES NOT INCLUDE CHECKING OF DIMENSIONS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING QUANTITIES AND DIMENSIONS, SELECTING FABRICATION PROCEDURES AND CONSTRUCTION TECHNIQUES, AND PERFORMING WORK IN A SAFE MANNER. CORRECTIONS OR COMMENTS MADE ON SHOP DRAWINGS AND CALCULATIONS DO NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR COMPLIANCE WITH REQUIREMENTS OF CONTRACT DRAWINGS AND SPECIFICATION.

SAFETY IN DESIGN

- SID1. THE SAFETY RISK MITIGATION ITEMS BELOW ARE BASED ON GHD'S DESIGN OFFICE EXPERIENCE AND DO NOT NECESSARILY ACCOUNT FOR ALL CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION SAFETY RISKS. BASED ON INFORMATION AVAILABLE WHEN THIS DRAWING WAS MADE, IN ITS CAPACITY AS DESIGNER ONLY, GHD HAS TRIED TO IDENTIFY SAFETY RISKS PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION PHASES OF THE ASSET. INCLUSION (OR NOT) OF ANY ITEM DOES NOT REDUCE OR LIMIT OBLIGATIONS OF CONSTRUCTOR, USER, MAINTAINER AND DEMOLISHER TO UNDERTAKE APPROPRIATE RISK MANAGEMENT ACTIVITIES TO REDUCE RISK AND IS NOT AN ADMISSION BY GHD THAT INCLUSION OF ANY ITEM IS DESIGNER'S RESPONSIBILITY.
- SID2. CONSTRUCT BUILDING ELEMENTS THAT CONTRIBUTE TO SAFETY, SUCH AS HANDRAILS AND TOE BOARDS, FALL ARREST SYSTEMS, ACCESS STAIRS, etc AS EARLY AS POSSIBLE.
- SID3. PROVIDE SAFETY BARRIERS AT EDGES OF OPENINGS AND ELEVATED AREAS.
- SID4. REVIEW ADEQUACY OF WORKING SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES. ENSURE SEPARATION OF PLANT AND PERSONNEL ON SITE, INCLUDING MOVEMENTS OF BOTH.
- SID5. LOCATE LIFTING SLEW AND LAY DOWN AREAS AWAY FROM REGULAR CONSTRUCTION TRAFFIC.
- SID6. PROVIDE PROTECTION TO PERSONNEL FROM PLANT AND EQUIPMENT, INCLUDING POST-TENSIONED GROUND ANCHOR INSTALLATION WORKS.
- SID7. ENSURE ISOLATION SAFE SYSTEMS OF WORK OR PROTECTIVE MEASURES ARE INSTALLED BEFORE WORKING NEAR LIVE ELECTRICAL INFRASTRUCTURE. PROVIDE PROTECTION OF ELECTRICAL OVERHEAD WIRING SYSTEMS DURING CONSTRUCTION.
- SID8. WRITTEN RISK ASSESSMENTS ARE ADVISED FOR ACCESS TO OPEN EXCAVATIONS.
- SID9. PROVIDE ACCESS AND EGRESS TO EXCAVATIONS APPROPRIATE IN CASE OF INUNDATION, COLLAPSE OR ENGULFMENT.
- SID10. LOCATE STOCKPILES AND HEAVY EQUIPMENT INCLUDING CRANES AWAY FROM BURIED SERVICES AND BUILDING BOUNDARIES WHERE ADJACENT BASEMENTS ARE PRESENT.
- SID11. SEEK ADVICE FROM SUITABLY QUALIFIED GEOTECHNICAL OR STRUCTURAL ENGINEER PRIOR TO OPERATION OF HEAVY SURFACE PLANT AND EQUIPMENT OR STOCKPILING MATERIAL NEAR OPEN EXCAVATIONS OR EXISTING RETAINING STRUCTURES.
- SID12. DO NOT STOCKPILE MATERIALS BEHIND OR EXCAVATE IN FRONT OF EXISTING RETAINING WALLS UNTIL WALL STABILITY HAS BEEN REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SID13. HAVE LOAD CAPACITY OF STRUCTURES VERIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE LOADING OR STORING MATERIALS ON EXISTING OR PARTIALLY COMPLETED STRUCTURAL ELEMENTS.
- SID14. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER IF PLANNING CRANE LIFTS OR HOIST INSTALLATION ON PARTIALLY ERECTED OR SUSPENDED STRUCTURES.
- SID15. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE CORING, CHASING, CUTTING OR REMOVAL OF EXISTING CONCRETE AND REINFORCEMENT.
- SID16. DEVELOP STEELWORK / PRECAST / TILT UP INSTALLATION SAFE WORK METHOD STATEMENT TO ELIMINATE AND MINIMISE INSTALLATION RISKS, AND HAVE REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER PRIOR TO ERECTION.
- SID17. DO NOT CUT OR UNBOLT ANY STRUCTURAL MEMBERS WITHOUT SEEKING REVIEW BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SID18. MINIMIZE SITE BASED TREATMENTS (eg WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING, etc) PROVIDE ADEQUATE PROTECTION, SCREENING AND VENTILATION TO MINIMIZE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.
- SID19. AVOID HOT WORKS ON SITE. HOT WORKS TO COMPLY WITH CLIENT PROCEDURES FOR APPLICABLE 'HOT WORKS PERMITS'.
- SID20. DETERMINE APPROPRIATE METHOD OF PAINT REMOVAL AND DISPOSAL BEFORE STRIPPING PAINT, PARTICULARLY ON HISTORIC STRUCTURES. COATINGS CONTAINING COAL TAR EPOXIES, BITUMENS AND ASPHALTS, ZINC CHROMATE AND LEAD PRESENT A HEALTH RISK. PROVIDE SCREENING TO PUBLIC AND ENVIRONMENT FOR PAINT REMOVAL AND CLEANING OPERATIONS. USE ENVIRONMENTALLY APPROPRIATE RESTORATION METHODS DURING MAINTENANCE AND REPAIR WORK.
- SID21. MAKE WORK AREAS SAFE WHERE STRUCTURAL ELEMENTS ARE DAMAGED, CRACKED OR HAVE SUFFERED SIGNIFICANT SECTION LOSS BEFORE ALLOWING GENERAL CONSTRUCTION OR REPAIR ACCESS.
- SID22. REPORT SIGNIFICANT SECTION LOSS OR CORROSION FLAKING BEFORE STARTING PAINTING OR REPAIRS. CONSULT SUITABLY QUALIFIED STRUCTURAL ENGINEER IF SECTION LOSS OR EXTENSIVE CORROSION FLAKING PRESENT BEFORE PROCEEDING WITH WORK.
- SID23. REPORT LOOSE OR MISSING BOLTS etc IN CONNECTIONS ENCOUNTERED DURING DAY TO DAY OPERATIONS.

DEMOLITION

- D1. DEMOLITION WORK TO BE TO AS2601. TAKE PRECAUTIONS NECESSARY FOR PROTECTION OF PERSONS AND PROPERTY. PREVENT DAMAGE TO CONCRETE OR REINFORCEMENT TO REMAIN WHEN CUTTING AND REMOVING OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. DO NOT COMMENCE DEMOLITION WORK BEFORE DEMOLITION PERMIT / SCAFFOLD PERMIT OBTAINED.
- D2. SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ESTABLISH CRITICAL STABILITY ELEMENTS AND ASSIST DEVELOPMENT OF DEMOLITION METHOD STATEMENT.
- D3. MAKE ALLOWANCE FOR CONDITION OF STRUCTURAL AND OTHER ELEMENTS (eg WALL TIES), INCLUDING LOSS OF CAPACITY DUE TO DETERIORATION OR AGE.
- D4. CONSIDER PROVIDING LOCAL EMERGENCY SERVICES WITH COPY OF DEMOLITION METHOD STATEMENT BEFORE COMMENCING WORK.
- D5. HAVE ADJACENT STRUCTURES REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ASSESS IMPACT OF PROPOSED DEMOLITION WORK.
- D6. PROVIDE TEMPORARY SUPPORT TO ADJOINING STRUCTURES BY SHORING, UNDERPINNING, PROPPING OR AS REQUIRED DESIGNED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ).
- D7. NOTIFY OWNERS AND OCCUPANTS OF ADJOINING PROPERTIES OF PROPOSED DEMOLITION WORKS, INCLUDING DETAILS AND TIMING OF WORKS.
- D8. DO NOT USE EXPLOSIVES.
- D9. USE DEMOLITION METHODS TO MINIMISE INTERFERENCE WITH AND PROTECT OCCUPANTS AND THEIR ACTIVITIES, INCLUDING FROM NOISE, NOXIOUS EFFECTS OF DUST, FUMES, LIQUIDS, GASES, INFECTION, FIRE, EXPLOSION, RADIATION OR OTHER HAZARDS, ETC.
- D10. CAPTURE AND DISPOSE OF SAFELY ANY DUST, DEBRIS OR SPILLAGES.
- D11. ADVISE SUPERINTENDENT IMMEDIATELY IF HAZARDOUS MATERIALS ARE FOUND ON SITE, INCLUDING ASBESTOS, FLAMMABLE OR EXPLOSIVE LIQUIDS OR GASES, TOXIC, INFECTED OR CONTAMINATED MATERIALS, RADIATION OR RADIOACTIVE MATERIALS, NOXIOUS OR EXPLOSIVE CHEMICALS, TANKS OR OTHER CONTAINERS THAT HAVE BEEN USED FOR STORAGE OF ABOVE.

- D13. GIVE NOTICE FOR INSPECTION AT THE FOLLOWING STAGES:
 -ADJOINING STRUCTURES BEFORE COMMENCEMENT OF DEMOLITION.
 -BEFORE DISCONNECTION OR DIVERSION OF SERVICES.
 -TREES SPECIFIED TO BE RETAINED BEFORE COMMENCEMENT OF DEMOLITION.
 -MEASURES TO PROTECT ADJOINING STRUCTURES IN PLACE.
 -UNDERGROUND STRUCTURES AFTER DEMOLITION OF WORK ABOVE SUCH STRUCTURE.
 -EXCAVATION REMAINING AFTER REMOVAL OF UNDERGROUND WORK.
 -SITE AFTER REMOVAL OF DEMOLISHED MATERIALS.
 -SERVICES AFTER RECONNECTION OR DIVERSION.
 ON COMPLETION OF DEMOLITION GIVE NOT LESS THAN SEVEN WORKING DAYS NOTICE SO ADJOINING STRUCTURES CAN BE INSPECTED.
- D14. REMOVE FROM SITE ALL DEMOLISHED MATERIALS NOT REQUIRED IN FINAL WORKS.
- DELIVERABLES**
- D15. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED DEMOLITION SUBCONTRACTORS.
- D16. SUBMIT ELECTRONIC PDF'S OR THREE PAPER COPIES OF PROPOSED DEMOLITION METHOD STATEMENT AT LEAST 14 DAYS PRIOR TO DEMOLITION WORK. DO NOT PROCEED WITH DEMOLITION UNTIL WRITTEN APPROVAL ISSUED. METHOD STATEMENT TO INCLUDE METHODOLOGY, PERSONNEL, EQUIPMENT, PROPOSED SEQUENCE OF WORKS, TIMES FOR DISCONNECTION AND RECONNECTION OF SERVICES, SITE SECURITY, HOT WORKS, SPLINTERS AND EXPOSED ELEMENTS, DEBRIS, TRANSPORT AND DISPOSAL, ACCESS EQUIPMENT, TEMPORARY BATTERS, AIR QUALITY AND POLLUTION CONTROL MEASURES.
- D17. HAVE CHARTERED STRUCTURAL ENGINEER REVIEW PROPOSED DEMOLITION LOADS THAT MAY AFFECT STRUCTURES AND SUBMIT REPORT TO SUPERINTENDENT PRIOR TO COMMENCEMENT OF DEMOLITION.

EARTHWORKS, FOUNDATIONS AND FOOTINGS

EARTHWORKS

- F1. EARTHWORKS TO BE TO AS3798 AND AS2870.
- F2. REMOVE TOPSOIL, MATERIAL CONTAINING GRASS ROOTS OR OTHER ORGANIC MATTER, RUBBLE AND / OR DEBRIS AND ALL UNSUITABLE MATERIAL BELOW FOUNDATIONS AND WHERE SHOWN ON DRAWINGS.
- F3. DO NOT STOCKPILE MATERIAL AGAINST RETAINING WALLS, BUILDINGS, FENCES OR TREES etc. DO NOT OBSTRUCT THE FREE FLOW OF WATER.
- F4. REFER TO GEOTECHNICAL INVESTIGATION REPORTS No. 104527.00.R.001 & 10452700.R.002 PREPARED BY DOUGLAS PARTNERS DATED FEBRUARY 2021. NOTIFY SUPERINTENDENT IF CONDITIONS ENCOUNTERED DIFFER FROM THOSE DESCRIBED IN THE REPORT AND SEEK DIRECTIONS.
- F5. NOTIFY SUPERINTENDENT IF GROUND WATER ENCOUNTERED.
- F6. DESIGN IS BASED ON DATA FROM DISCRETE LOCATIONS AS RECORDED IN GEOTECHNICAL INVESTIGATION REPORT. SUBSURFACE CONDITIONS SHOWN ON DRAWINGS IS INFERRED FROM DATA IN GEOTECHNICAL INVESTIGATION REPORT AND IS GIVEN AS A GUIDE ONLY. ACTUAL GROUND CONDITIONS MAY VARY FROM THOSE SHOWN.
- F7. PROVIDE TEMPORARY SUPPORT TO FACES OF EXCAVATIONS AS REQUIRED.
- F8. HAVE SAFETY OF PROPOSED EXCAVATIONS INCLUDING ANY TEMPORARY WORKS ASSESSED BY SUITABLY QUALIFIED GEOTECHNICAL / STRUCTURAL ENGINEER.
- F9. GENERAL FILL TO BE WELL GRADED MATERIAL, INORGANIC, LESS THAN 0.5% SULPHUR, MAXIMUM PARTICLE SIZE 75 mm, PLASTICITY INDEX < 55%.
- F10. SELECTED FILL MATERIAL SHALL COMPLY WITH THE FOLLOWING:
 -INORGANIC, LESS THAN 0.5% SULPHUR
 -MAXIMUM PARTICLE SIZE 75 mm
 -PROPORTION PASSING 0.075 mm SIEVE: 25% MAXIMUM
 -PLASTICITY INDEX: >2%, <15%
 -PROPORTION EXCEEDING PARTICLE SIZE OF 50 mm: 75% MINIMUM
- F11. PLACE FILL MATERIAL UNDER SLABS AND OTHER FOOTINGS IN LAYERS NOT EXCEEDING 150 mm THICK AND COMPACT TO AT LEAST 95% MAXIMUM DRY DENSITY (STANDARD COMPACTION) TO AS1289.
- F12. ADJUST MOISTURE CONTENT OF FILL AT TIME OF COMPACTION WITHIN THE RANGE OF 85-115% OF OPTIMUM MOISTURE CONTENT DETERMINED BY AS1289 TO ACHIEVE REQUIRED DENSITY.
- F13. SAMPLE AND TEST COMPACTION AS PER SPECIFICATION.

FOUNDATIONS

- F14. FOUNDATION LEVELS SHOWN ARE CONTRACT LEVELS. FINAL LEVELS TO BE AS DIRECTED BY SUPERINTENDENT.
- F15. AVOID OVER EXCAVATION. BACKFILL OVER EXCAVATION WITH GRADE N7 BLINDING CONCRETE.
- F16. KEEP EXCAVATIONS FREE OF WATER. PROVIDE ADEQUATE DRAINAGE TO ENSURE FORMATION IS NOT AFFECTED BY MOISTURE. PREVENT FOUNDATION DRYING OUT DUE TO EXPOSURE. PLACE BLINDING, FOOTINGS, PILES AND BACKFILL AS SOON AS PRACTICABLE AFTER EXCAVATION.
- F17. ENSURE EXCAVATIONS ARE STABLE AND PROTECT SURROUNDING PROPERTY AND SERVICES FROM ADVERSE EFFECTS OF GROUND WORKS. PROVIDE TEMPORARY WORKS AS REQUIRED. PROVIDE SHORING CERTIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ALL DEEP EXCAVATIONS.
- F18. DO NOT UNDERMINE EXISTING FOOTINGS.
- F19. PROVIDE SAFETY MESH AND OTHER PROTECTION TO PREVENT EXPOSURE OF PERSONNEL TO EXCAVATIONS DURING FOUNDATION CONSTRUCTION.
- F20. USE SUITABLE CONSTRUCTION TECHNIQUES AND EQUIPMENT FOR BACKFILLING ADJACENT TO STRUCTURES TO PREVENT OVERSTRESS AND DAMAGE. PROVIDE SUPPORT TO RETAINING WALLS IF CONSTRUCTION METHODS IMPOSE COMPACTION LOADS GREATER THAN ALLOWED (SEE DESIGN LOADS IN GENERAL NOTES). BACKFILL EVENLY TO AVOID DIFFERENTIAL SOIL PRESSURES ON STRUCTURES. BACKFILL AGAINST RETAINING WALLS ONLY AFTER SPECIFIED CONCRETE STRENGTH IS ACHIEVED, AND PERMANENT SUPPORTS INSTALLED.

SLABS AND FOOTINGS

- F21. PROOF ROLL FORMATION WITH HEAVY DUTY ROLLER.
- F22. OBTAIN APPROVAL OF FOUNDATION MATERIAL FOR THE DESIGN PRESSURES FROM SUITABLY QUALIFIED GEOTECHNICAL ENGINEER BEFORE FIXING REINFORCEMENT OR PLACING CONCRETE.
- F23. SLAB PANELS TO BE FOUNDED ON UNDISTURBED NATURAL SOIL WITH ALLOWABLE BEARING CAPACITY OF NOT LESS THAN 100 kPa. REMOVE SOFT SPOTS AND REPLACE WITH COMPACTED CRUSHED ROCK.
- F24. PROVIDE 0.2 mm HIGH IMPACT-RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 ON 50 mm SAND BLINDING WHERE SHOWN ON DRAWINGS. LAP 200 mm AND SEAL DAMP PROOF MEMBRANES, TAPE AT PENETRATIONS, etc TO ENSURE A COMPLETE VAPOUR BARRIER IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS2870. PREVENT PUNCTURING OR DAMAGE BY PLACING A PLASTIC PLATE UNDER REINFORCEMENT SUPPORTS.
- F25. SLOPE GROUND SURROUNDING APPROACHES SO WATER WILL DRAIN AWAY FROM APPROACHES TO SUITABLE DISCHARGE POINTS WITHOUT PONDING. WHERE ACHIEVED BY FILLING, FILL TO BE LESS PERMEABLE THAN UNDERLYING MATERIAL.

PILES

- F26. PILES TO BE INSTALLED BY AN APPROVED SPECIALIST SUB-CONTRACTOR IN ACCORDANCE WITH DRAWINGS, SPECIFICATION AND AS2159 OR AS5100. SUBMIT NAME AND CONTACT DETAILS OF PROPOSED SUBCONTRACTOR.
- F27. PILING CONTRACTOR TO ALLOW FOR INFORMATION IN GEOTECHNICAL INVESTIGATION REPORT AND FOR SITE CONDITIONS.
- F28. PILE CAPACITY MUST EXCEED SPECIFIED DESIGN LOAD.
- F29. PILES MUST BE CAPABLE OF RESISTING ADDITIONAL RELEVANT TEMPORARY, CONSTRUCTION AND PERMANENT LOADS, INCLUDING FORCES DUE TO ECCENTRICITY OF PILE, LATERAL SOIL LOADS AND DRAG FORCES.

- F30. INSPECTION MAY BE MADE OF THE FOLLOWING: SETTING OUT, PILES AND PILING MATERIAL AFTER DELIVERY TO THE SITE AND BEFORE INSTALLATION, INSTALLATION OF PILING, PILE HEADS AFTER PREPARATION, PILE LOAD TESTS, REINFORCEMENT CAGES AFTER ASSEMBLY AND BEFORE INSTALLATION, EXCAVATED SHAFTS, INCLUDING CASINGS AND SOCKETS BEFORE PLACING REINFORCEMENT, REINFORCEMENT IN EXCAVATED SHAFTS BEFORE CONCRETING AND CONCRETING OF PILES.
- F31. PRE-DRILLING OF DRIVEN PILES TO BE APPROVED BY SUPERINTENDENT. MAXIMUM DIAMETER OF PRE-DRILLED HOLES: 50 mm LESS THAN DIAGONAL / LARGEST DIMENSION OF PILE.
- F32. WHERE PILE CUT-OFF LEVEL IS ABOVE ADJACENT GROUND, FORM PILE ABOVE GROUND LEVEL.
- F33. MAKE ALLOWANCE FOR TRIMMING DRIVEN ENDS OF PILES AND EXTENSION OF PILE REINFORCEMENT INTO ABUTMENT AS REQUIRED. LENGTH OF REINFORCEMENT EXTENSION TO BE AS SHOWN ON DRAWINGS, 1000 mm UNO.
- F34. PILES TO PROJECT INTO 50 mm INTO ABUTMENTS UNO.
- F35. DRIVE PILES TO PROVIDE ULTIMATE RESISTANCE AS NOMINATED ON DRAWINGS. DETERMINE PILE LENGTH TO ACHIEVE THIS CAPACITY. PROVE THIS CAPACITY BY TESTING AT LEAST ONE PILE PER ABUTMENT USING P.D.A. TESTING WITH CAPWAP ANALYSIS TO CONFIRM LOAD CAPACITY AND MONITOR INTEGRITY DURING INSTALLATION. USE RESULTS OF TESTING TO ESTABLISH PILE DRIVING CRITERIA FOR REMAINING PILES.
- F36. ADVISE SUPERINTENDENT IF PILE IS DAMAGED BY DRIVING (OR IS OTHERWISE UNSOUND) AT OR BELOW CUT-OFF LEVEL.
- F37. PEG POSITION OF EACH PILE AND ESTABLISH GRID OF RECOVERY PEGS TO ENABLE SETTING OUT TO BE CHECKED.
- F38. PILE LEVELS SHOWN ARE CONTRACT LEVELS. FINAL LEVELS TO BE AS REQUIRED TO ACHIEVE SPECIFIED PILE CAPACITY. DO NOT FOUND PILES HIGHER THAN LEVELS SHOWN.
- F39. NOTE POSSIBILITY OF ENCOUNTERING BASALT COBBLES AND / OR BOULDERS IN CLAY. PRE-BORING WILL BE NOTED ON DRAWINGS IF REQUIRED.
- F40. IF DAMAGE IS CAUSED TO ADJOINING PROPERTY, STOP PILING OPERATIONS AND ADVISE SUPERINTENDENT.
- F41. PILE DRIVING HEAD TO BE DESIGNED BY PILE SUB-CONTRACTOR.
- F42. PILE SETTING OUT DIMENSIONS ARE TO CENTRELINE OF PILE AT UNDERSIDE OF PILECAP. TOLERANCE ON POSITION OF PILES ± 75 mm. MAXIMUM DEVIATION OF PILE FROM SPECIFIED INCLINATION 1 in 50.

PILING DELIVERABLES

- F43. SUBMIT CALCULATIONS AND DRAWINGS TO DEMONSTRATE THE PILE DESIGN SATISFIES THE SPECIFIED DESIGN REQUIREMENTS BEFORE COMMENCING WORK ON SITE.
- F44. SUBMIT REPORT INCLUDING PILE DRIVING RECORDS AND LOAD TEST RESULTS TO SUPERINTENDENT BEFORE BREAKING BACK PILES.
- F45. SURVEY AS CONSTRUCTED PILE POSITIONS, GROUND LEVEL AT TIME OF INSTALLATION AND CUT-OFF LEVELS, AND SUBMIT RECORDS TO SUPERINTENDENT WITHIN ONE WEEK OF COMPLETION OF PILING.

STEEL

- S1. WORKMANSHIP, FABRICATION AND MATERIALS TO COMPLY WITH AS4100, AS/NZS4600, AS/NZS1554, AS/NZS5131 AND AS4673 FOR STAINLESS STEEL.
- S2. PROVIDE STEEL IN ACCORDANCE WITH:
 - AS1163 GRADE C350 OR C450 FOR RECTANGULAR AND SQUARE HOLLOW SECTIONS,
 - AS1163 GRADE C250 OR C350 FOR CIRCULAR HOLLOW SECTIONS, AS NOTED ON DRAWINGS
 - AS1443 COLD-FINISHED BARS,
 - AS/NZS1594 GRADE 250 HOT-ROLLED STEEL FLAT PRODUCTS,
 - AS/NZS3678 FOR PLATES AND FLOOR PLATE,
 - AS/NZS3679 PART 2, GRADE 300 FOR WELDED BEAMS AND WELDED COLUMNS,
 - AS/NZS3679 PART 1 GRADE 300 OR BHP GRADE 300 PLUS FOR UNIVERSAL BEAMS, UNIVERSAL COLUMNS, PARALLEL FLANGE CHANNELS, ANGLES, FLATS, BARS AND RODS,
 - OTHERWISE TO COMPLY WITH AS/NZS3678 OR AS/NZS3679 GRADE 250 UNO.
- S3. MANUFACTURERS AND PROCESSORS OF STRUCTURAL STEEL MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH RELEVANT STANDARDS, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL STRUCTURAL STEELWORK.
- S4. MARK STEEL GRADES ON STRUCTURAL MEMBERS IN NON-CRITICAL AREAS. USE IDENTIFICATION MARKS COMPATIBLE WITH AND VISIBLE THROUGH PAINT SYSTEM.
- S5. PROVIDE 3 mm CAP PLATES SEAL WELDED TO HOLLOW SECTIONS UNO.
- S6. CARRY OUT ERECTION OF STEELWORK IN ACCORDANCE WITH AS/NZS5131 GUIDELINES FOR THE ERECTION OF BUILDING STEELWORK.
- S7. PROTECT STEELWORK FROM DAMAGE DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. SUBMIT PROPOSED METHOD TO REPAIR DAMAGE FOR APPROVAL. PROTECT STEELWORK STORED ON SITE FROM CORROSION OR DETERIORATION OF COATINGS.
- S8. SEQUENCE ERECTION WORKS TO AVOID PINCH POINTS AND SITE CONGESTION.
- S9. INSTALL BEAMS WITH NATURAL CAMBER UPWARD.
- S10. PROVIDE STEEL MEMBERS MADE FROM WHOLE LENGTHS WHEREVER POSSIBLE. SEEK APPROVAL TO MAKE LENGTHS UP OF SECTIONS JOINED BY COMPLETE PENETRATION FULL STRENGTH BUTT WELDS GROUND FLUSH WHERE REQUIRED. WHERE PROPOSED, SHOW JOINTS ON SHOP DRAWINGS. ENSURE MEMBERS ARE CONCENTRIC AT CONNECTIONS (GRAVITY- OR GAUGE-LINES TO INTERSECT) UNO. ACCURATELY PRE-FORM PARTS TO AVOID FORCE AND / OR RESTRAINT DURING JOINING.
- S11. DRILL HOLES FULL SIZE OR REAM TO FULL SIZE AFTER SUB-DRILLING OR SUB-PUNCHING. SUB-DRILLED OR SUB-PUNCHED HOLES TO BE AT LEAST 3 mm UNDERSIZE. 'OXY' OR FLAME CUTTING OF HOLES IS NOT PERMITTED. BOLT HOLE SIZE TO BE:
 - BOLT DIAMETER PLUS 2 mm FOR STEEL TO STEEL CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR STEEL TO CONCRETE CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR HOLDING DOWN BOLTS UP TO M20.
 - BOLT DIAMETER PLUS 6 mm FOR HOLDING DOWN BOLTS M24 OR LARGER.

WELDING

- S12. DEVELOP WELD PROCEDURES TO SUIT JOINT DETAILS AND SHOW ON SHOP DRAWINGS. USE PREQUALIFIED WELD PROCEDURES AND CONSUMABLES TO AS/NZS1554.1 CLAUSE 4.3 OR DEVELOP QUALIFICATION OF WELD PROCEDURE AND CONSUMABLES BY TESTING TO AS/NZS1554.1 CLAUSE 4.2. LIST APPLICABLE PARAMETERS ON WELDING PROCEDURE QUALIFICATION RECORD AND MAKE RECORD AVAILABLE FOR INSPECTION.
- S13. WELDING TO BE UNDERTAKEN BY SUITABLY QUALIFIED EXPERIENCED WELDER UNDER SUPERVISION OF QUALIFIED WELDING SUPERVISOR.
- S14. CARRY OUT WELDING TO AS/NZS1554. ALL INTERFACES BETWEEN STEEL SECTIONS TO BE CONNECTED WITH 6 mm CONTINUOUS FILLET WELDS ALL ROUND, BOTH SIDES UNO.
 - WELDS TO BE SHOP WELDED UNO.
 - WELDS TO BE CATEGORY SP.
 - BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO.
 - ELECTRODES TO BE LOW CARBON WITH TENSILE STRENGTH OF $f_{tw}=490$ MPa, PRE-APPROVED TO AS/NZS1554. eg CLASSIFICATION B - E49XX.
 EXTENT OF WELD INSPECTION / TESTING TO BE:
 - VISUAL SCANNING: 100% OF WELDS
 - VISUAL EXAMINATION: 100% OF BUTT WELDS IN TENSION MEMBERS AND 50% OF OTHER WELDS
 - RADIOGRAPHIC OR ULTRASONIC: 10% OF BUTT WELDS IN TENSION MEMBERS AND 5% OF OTHER WELDS
- S16. GRIND WELDS SMOOTH AND FLUSH WITH PARENT METAL WHERE NOMINATED ON DRAWINGS. GRIND ONLY IN LONGITUDINAL DIRECTION OF MEMBER.
- S17. REPAIR FAULTY WELDS AND DEFECTS REVEALED BY WELD INSPECTION / TESTING AND REPEAT THE EXAMINATION.
- S18. WELDS TO BE INSPECTED BY INDEPENDENT NATA ACCREDITED QUALIFIED WELDING INSPECTOR TO AS2214. PROVIDE WELDING INSPECTOR'S REPORT TO SUPERINTENDENT.
- S19. WELDING SYMBOLS ARE TO AS1101.3. 'CFW' INDICATES CONTINUOUS FILLET WELD. 'FPBW' INDICATES FULL PENETRATION BUTT WELD WHICH IS EQUIVALENT TO CPBW. 'CPBW' INDICATES COMPLETE PENETRATION BUTT WELD.

BOLTS

0	APPROVED ISSUE		WRC	*MI	*AA	12.04.21
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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DO NOT SCALE		Drawn W.CLARKE	Designer A.AHILADELLIS	Client	DOUGLAS SHIRE COUNCIL WARNERS AND ANICHS BRIDGE UPGRADES WARNERS AND ANICHS BRIDGE STRUCTURAL NOTES - SHEET 1		
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- S20. M16 AND LARGER BOLTS TO BE HIGH STRENGTH STRUCTURAL BOLTS, 8.8/8 PROCEDURE AND M12 SIZE BOLTS SHALL BE COMMERCIAL BOLTS, 4.6/5 PROCEDURE UNO.
- S21. FOR BOLTS MANUFACTURED OUTSIDE AUSTRALIA, PROVIDE LOCAL INDEPENDENT NATA-ACCREDITED LABORATORY COMPLIANCE CERTIFICATE BASED ON APPROPRIATE TESTING AND VERIFICATION.
- S22. USE BOLTS WITH THREADS IN COMPLIANCE WITH AS1275. BOLTS OF STRENGTH GRADE 4.6 TO BE COMMERCIAL GRADE BOLTS TO AS1111 AND 1112. BOLTS OF STRENGTH GRADE 8.8 TO BE HIGH STRENGTH STRUCTURAL BOLTS, NUTS AND WASHERS TO AS/NZS1252. MECHANICAL PROPERTIES OF BOLTS, NUTS, SCREWS AND STUDS TO COMPLY WITH AS/NZS4291. WASHERS TO COMPLY WITH AS1237. TIGHTENING PROCEDURES TO COMPLY WITH AS4100.
- S SNUG TIGHT.
 - TB BEARING MODE JOINT, BOLTS FULLY TENSIONED.
 - TF FRICTION MODE JOINT, BOLTS FULLY TENSIONED. (CONTACT SURFACES OF FRICTION CONNECTIONS TO BE UNCOATED AND FREE OF MILL SCALE.)
- S23. BOLT TYPE AND TIGHTENING PROCEDURE ARE DESIGNATED: NUMBER, SIZE STRENGTH GRADE / TIGHTENING PROCEDURES
- eg 4-M24 8.8/TB = 4 OFF 24 DIAMETER METRIC HIGH STRENGTH STRUCTURAL BOLTS FULLY TENSIONED IN BEARING MODE.
- S24. USE BOLT LENGTHS SO THAT PROJECTION BEYOND NUT IS AT LEAST TWO THREADS, AND NOT MORE THAN 10 mm.
- S25. USE BOLTS, SCREWS, NUTS AND WASHERS HOT DIP GALVANIZED BY MANUFACTURER TO AS1214. TAP GALVANIZED NUTS 0.4 mm OVERSIZE TO SUIT GALVANIZED THREADS TO AS1214 AND OIL FOR PROTECTION. INSTALL WASHERS UNDER BOLT HEAD OR NUT, WHICHEVER PART IS ROTATED. USE HARDENED OR PLATE WASHERS UNDER BOTH HEAD AND NUT FOR OVERSIZED AND SLOTTED HOLES TO AS4100. USE TAPERED WASHERS AS REQUIRED UNDER NON-ROTATING PART.
- S26. SLOTTED HOLES TO BE 2.5 x BOLT DIAMETER LONG UNO. BOLTS TO BE SET CENTRAL IN SLOT UNO. USE 8 mm PLATE WASHERS UNDER BOLT HEAD AND NUT TO COMPLETELY COVER HOLE.

CONNECTIONS

- S27. STEEL CONNECTION DETAILS TO BE IN ACCORDANCE WITH AS4100 AND AUSTRALIAN STEEL INSTITUTE (ASI) STRUCTURAL STEEL CONNECTION SERIES OF MANUALS AND GUIDES UNO.
- S28. PROVIDE CLEATS AND DRILL HOLES NECESSARY FOR FIXING OTHER ELEMENTS TO STEELWORK. SHOW ON SHOP DRAWINGS.
- S29. PROVIDE RADIUSED CORNERS ON EXPOSED CLEATS TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.
- S30. PROVIDE BOLTED CLEAT CONNECTIONS TO SITE WELDED CONNECTIONS CAPABLE OF BEING LOADED BEFORE OR WHILE CONNECTIONS ARE WELDED TOGETHER.
- S31. CROP INTERNAL CORNERS OF CLEATS AND STIFFENERS, etc TO FACILITATE DRAINAGE. PROVIDE DRAINAGE HOLES TO PREVENT WATER PONDING ON STRUCTURAL ELEMENTS DURING CONSTRUCTION. SHOW PROPOSED HOLES ON SHOP DRAWINGS.

STAINLESS STEEL

- S32. PROVIDE STAINLESS STEEL GRADE 316L UNO.
- S33. BOLTS AND NUTS TO BE STAINLESS STEEL GRADE A4 CLASS 50 TO ISO 3506. WASHERS TO BE STAINLESS STEEL TO ISO 7089 OR ISO 7090. AVOID GALLING BY USING METAL-FREE LUBRICATING PASTE OR OTHER METHOD APPROVED BY SUPERINTENDENT.
- S34. STAINLESS STEEL SURFACE FINISH TO BE < 12 µm AS DETERMINED ACCORDING TO AS2382. WELDS TO BE POLISHED TO MATCH ADJACENT STAINLESS STEEL ROUGHNESS AND APPEARANCE. APPLY PASSIVATION TREATMENT USING NITRIC ACID (HNO₃) SOLUTION TO ALL STAINLESS STEEL SURFACES IN ACCORDANCE WITH ASTM A380. WASH THOROUGHLY AFTER PASSIVATION. SUBMIT SAMPLES (0.1 m² MINIMUM SIZE) OF SURFACE FINISH FOR APPROVAL.
- S35. STAINLESS STEEL TO BE WELDED TO AS/NZS 1554.6. WELDS TO BE CLASS 1A FOR STAINLESS STEEL. WELD SURFACE FINISH GRADE II TO AS/NZS1554.6 CLAUSE 6.2. SURFACE ROUGHNESS (R_a) TO BE 12.5 TO AS2382. ELECTRODES TO BE E316LX UNO, PRE-QUALIFIED TO AS/NZS1554.6.
- S36. DO NOT FLAME CUT STAINLESS STEEL. KEEP STAINLESS STEEL SURFACES CLEAN AND FREE OF BLEMISHES THROUGHOUT FABRICATION.
- S37. FABRICATE STAINLESS STEEL IN WORKSHOP AREAS SEGREGATED FROM CARBON STEEL FABRICATION AREAS. USE TOOLS DEDICATED TO STAINLESS STEEL FABRICATION. WIRE BRUSHES AND WIRE WOOL USED IN FABRICATION OF STAINLESS STEEL TO BE STAINLESS STEEL OR CLEAN INERT MATERIALS.
- S38. PREVENT CONTACT BETWEEN STAINLESS STEEL AND CARBON STEEL, IRON, CHEMICALS, OILS AND / OR GREASE. REMOVE SURFACE CONTAMINANTS INCLUDING STICKERS AND MARKINGS PRIOR TO WELDING OR FABRICATION.

BASEPLATES AND HOLDING DOWN BOLTS

- S39. HOLDING DOWN BOLTS TO BE GRADE 4.6 UNO. SUPPLY HOLDING DOWN BOLTS WITH TWO CLASS 5 HEXAGONAL HEAD NUTS AND EXTRA LARGE HARDENED OR 4 mm PLATE WASHER. HOT DIP GALVANIZE HOLDING DOWN BOLTS, NUTS AND WASHERS TO AS1214. TIE HOLDING DOWN BOLT GROUPS RIGIDLY TOGETHER PRIOR TO INSTALLATION (eg. TACK WELD WITH 10 mm DIAMETER REINFORCING BAR TO FORM A RIGID CAGE) TO ENSURE CORRECT BOLT LOCATIONS, AND SET OUT USING A 3 mm MILD STEEL TEMPLATE SUPPLIED BY STEELWORK FABRICATOR. PROVIDE 4 N12 LIGATURES TO FIX HOLDING DOWN BOLT CAGE SECURELY TO SLAB / FOOTING REINFORCEMENT.
- S40. GROUT BASE PLATES, HOLDING-DOWN BOLTS, REBATES etc BEFORE LOADING COLUMNS OR ERECTING WALLS. USE APPROVED HIGH-STRENGTH (40 MPa AT 7 DAYS) NON-SHRINK PRE-MIXED RANMED GROUT. GROUT THICKNESS 15 mm MINIMUM, 40 mm MAXIMUM UNO. CHAMFER GROUT EDGES AT 45 DEGREES UNO. DO NOT LOAD GROUT UNTIL FULL STRENGTH ACHIEVED.

DURABILITY & PROTECTIVE COATINGS

- S41. HOT DIP GALVANIZE GRATING, HANDRAILS, LADDERS AND STEP IRONS etc TO AS/NZS4680. PROVIDE STAIRS, LADDERS, PLATFORMS, WALKWAYS AND HANDRAILS, etc TO AS1657.
- S42. AFTER COMPLETION OF FABRICATION, PREPARATION FOR SURFACE TREATMENT TO BE: ROUND OFF ROUGH WELDS, SHARP EDGES (ROUND TO 2 mm RADIUS) etc. SURFACE TO BE FREE OF WELDING SPATTER, SLAG, UNDERCUTS, VISIBLE PORES PITS AND CRATERS, VISIBLE SLIVERS, ROLL-OVERS, LAMINATIONS, ROLLED-IN EXTRANEANUS MATTER, GROOVES (RADIUS OF GOUGES TO BE LESS THAN 4 mm), INDENTATIONS, ROLL MARKS, BURRS, ARISES, CRACKS, etc. PREPARE WELDS, EDGES AND OTHER AREAS WITH SURFACE IMPERFECTIONS TO ISO 8501-3 PREPARATION GRADE P3.
- S43. SURFACE PREPARATION: REMOVE OIL, GREASE AND OTHER CONTAMINANTS TO AS1627.1. ABRASIVE BLAST CLEAN TO AS1627.4 CLASS SA 2½ WITH SURFACE PROFILE 40 TO 70 MICRONS OR AS SPECIFIED BY COATINGS MANUFACTURER FOR THE SERVICE CONDITIONS. ASSESS ABRASIVE BLAST CLEANED SURFACE TO AS1627.9 AND SURFACE PROFILE TO AS3894.5. FOR SMALL AREAS WHERE ABRASIVE BLAST CLEANING IS NOT POSSIBLE OBTAIN APPROVAL FROM SUPERVISOR TO USE POWER TOOL CLEANING TO AS1627.2 CLASS ST 3 / PST 3 AS DEFINED IN ISO 8501.1 FOR STEEL CLEANED TO A METALLIC FINISH WITH MINIMUM 25 MICRON SURFACE PROFILE. REMOVE DUST BY BRUSHING OR VACUUM CLEANING.
- S44. COATING REPAIRS: REINSTATE COATING TO DAMAGED AREAS TO PROTECTIVE COATINGS SPECIFICATION. FIELD WELD REPAIRS: DO NOT WELD THROUGH EXISTING GALVANIZING OR COATINGS. REMOVE WELD SPATTER, RESIDUAL FLUX etc BY CHIPPING, GRINDING OR ABRASIVE BLAST CLEANING. GRIND FLUSH ROUGH WELD BEADS. PREPARE SURFACE FOR PAINTING AS PER COATING SPECIFICATION. REMOVE RUST, LOOSE AND BURNT PAINT AND SUFFICIENT SOUND COATING SO PAINT EDGE IS FEATHERED AND SMOOTH. STRIPE COAT ALL WELDS, EDGES AND ROUGH SURFACES USING A BRUSH. REINSTATE COATING AS PER PROTECTIVE COATINGS SPECIFICATION.
- S45. WHERE NOMINATED AS GALVANIZED ON DRAWINGS, STEELWORK IS TO BE HOT DIPPED GALVANIZED TO AS/NZS4680 AND AS 1214 FOR FASTENERS. THICKNESS OF GALVANIZED COATINGS TO AS/NZS4680. ZINC IN GALVANIZING BATH TO BE NOT LESS THAN 98% PURE. BATH TEMPERATURE, TIME OF IMMERSION AND WITHDRAWAL SPEED TO BE AS REQUIRED TO ACHIEVE SPECIFIED COATING THICKNESS AND FINISH. ZINC COATING TO BE CONTINUOUS, ADHERENT, FREE FROM LUMPS, SPIKES, DAGS, RUNS, BUSTERS, ROUGHNESS, GRITTY AREAS, UNCOATED SPOTS, ACID AND BLACK SPOTS, DROSS, FLUX AND OTHER IMPERFECTIONS.
- S46. DO NOT USE HIGH STRENGTH LOW ALLOY STEELS CONTAINING HIGH SILICONE (>0.04% Si) THAT CAN PRODUCE THICKER AND / OR BRITTLE GALVANIZED COATINGS. REFER TO GALVANIZER FOR ACCEPTABLE STEEL COMPOSITIONS.
- S47. BUTT WELD END PLATES ON HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED IN LIEU OF FILLET WELD TO AVOID RISK OF CREVICE CORROSION. DO NOT USE A BACKING PLATE.

- S48. PASSIVATE GALVANIZED STEEL TO BE IN CONTACT WITH CONCRETE BY DIPPING IN 0.2% SODIUM DICHROMATE SOLUTION.
- S49. STRAIGHTEN MEMBERS DISTORTED DURING FABRICATION AND/OR GALVANIZING PROCESS USING AN APPROVED METHOD.
- S50. ANNUAL COLD WORKED ITEMS TO 650°C PRIOR TO GALVANIZING.
- S51. REPAIR DAMAGE TO GALVANIZED COATING TO AS/NZS 4680 SECTION 8 –REPAIR AFTER GALVANIZING. USE ORGANIC TWO-PACK ZINC RICH EPOXY COATING COMPLYING WITH AS/NZS 3750.9 APPLIED IN TWO COATS EACH 50 MICRON, MINIMUM TOTAL DRY FILM THICKNESS 100 MICRONS. DO NOT USE SPRAY CANS OF ‘COLD GALV’ OR ZINC ALLOY ‘SOLDER STICKS’. SURFACE PREPARATION OF EXPOSED BARE STEEL TO BE ABRASIVE BLAST CLEANED TO AS 1627.4, CLASS 2½ (PREFERRED) OR POWER TOOL CLEANED TO AS 1627.2 CLASS ST 3. LIGHTLY SWEEP BLAST GALVANIZED SURFACES.
- S52. PROVIDE DRILLED VENT / DRAIN HOLES AT TOP AND BOTTOM EXTREMITIES FOR HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED. PROVIDE RUBBER SEALS OR PLUG WELD VENT / DRAIN HOLES THAT REMAIN EXPOSED. REPAIR DAMAGE TO GALVANIZING.
- S53. PROVIDE DRILLED SUSPENSION HOLES IN END PLATES, ETC FOR ITEMS TO BE HOT DIPPED GALVANIZED.
- S54. PRIOR TO DIPPING ADVISE SUPERINTENDENT OF ANY DESIGN FEATURES THAT MAY LEAD TO DIFFICULTIES DURING GALVANIZING AND SUBMIT DETAILS FOR IMPROVEMENT.
- S55. DO NOT PAINT GALVANIZED STEELWORK UNLESS SPECIFIED ON THE ENGINEERING DRAWINGS. ADVISE GALVANIZER OF ITEMS TO BE PAINTED AFTER GALVANIZING AND FINAL ZINC PASSIVATION IS TO BE OMITTED. PREPARE GALVANIZED SURFACES TO BE PAINTED AS PER AS/NZS4680 APPENDIX I AND APPLY PAINT IN THE WORKSHOP. COATING MANUFACTURER TO PROVIDE A 10 YEAR WARRANTY OF COATING SYSTEM.
- S56. PROTECTIVE COATINGS ARE TO BE SHOP APPLIED AND CURED IN WORKSHOP IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS UNLESS APPROVED OTHERWISE IN WRITING BY SUPERINTENDENT. PROTECTIVE COATINGS ARE TO BE SMOOTH, UNIFORM AND WITHOUT RUNS, BEADS, PINHOLES, SURFACE CRACKING OR OTHER IMPERFECTIONS.
- S57. PROTECT COATINGS FROM DAMAGE AND DETERIORATION DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. REPAIR DAMAGE TO PROTECTIVE COATINGS TO REINSTATE INTEGRITY OF NOMINATED COATING IN ACCORDANCE WITH MANUFACTURERS’ RECOMMENDATIONS AND SPECIFICATION. EDGES OF PATCH REPAIRS TO BE FEATHERED.

DELIVERABLES

- S58. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED FABRICATION AND INSTALLATION SUBCONTRACTORS.
- S59. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS. REFER GENERAL-DELIVERABLES NOTES. SHOP DRAWINGS AND DESIGN CALCULATIONS TO SHOW ARRANGEMENT OF MEMBERS, MARKING PLAN, MEMBER SCHEDULE, LOCATION AND ORIENTATION OF MEMBERS IN BUILDING, REQUIRED CAMBER (WHERE APPLICABLE), RELEVANT DETAILS OF EACH ASSEMBLY, COMPONENT AND CONNECTION, DIMENSIONS OF ITEMS, LOADING PARAMETERS AND BRACING LENGTHS ASSUMED IN DESIGN, DESIGN STRESSES, STRENGTH OF MATERIALS, SIZE OF EACH MEMBER, TOLERANCES ON MEMBER SIZES, JOINT DETAILS, TRIMMERS, NOGGINGS etc, LIFTING POINTS, METHOD OF FIXING AND BRACING, DESIGN DEFLECTION, METHOD OF FABRICATION, SIZE AND SPECIFICATION OF CLEATS, BOLTS, SCREWS, WELDS, WELD CATEGORIES AND BOLTING CATEGORIES, WELD PROCEDURES (INCLUDING POST WELD HEAT TREATMENT), SURFACE PREPARATION METHODS AND PROTECTIVE COATING SYSTEM, VENT / DRAIN HOLES FOR HOT DIP GALVANIZING, PROPOSED JOINTS IN MEMBERS, TEMPORARY MEMBERS, BRACES AND FIXINGS, LOCATION OF FALL ARREST CONNECTIONS, FIXINGS FOR ADJOINING BUILDING ELEMENTS, BASE PLATE DETAILS, FIXINGS FOR PURLINS, GIRTS, LOCATION OF AND PREPARATION FOR SITE WELDS AND BRACING, METHOD OF HANDLING TEMPORARY WORKS, ASSEMBLY, TRANSPORT AND ERECTION (INCLUDING TEMPORARY BRACING IF REQUIRED), PRECAMBER, etc.
- S60. PROVIDE DOCUMENTARY EVIDENCE (INCLUDING TEST RESULTS) OF COMPLIANCE WITH RELEVANT AUSTRALIAN STANDARDS ISSUED BY MANUFACTURER FOR ALL STEELWORK AND EACH BATCH OF FASTENERS USED. EVIDENCE MUST PROVIDE CLEAR VERIFICATION THAT PRODUCT MEETS RELEVANT AUSTRALIAN STANDARDS AND BE WRITTEN IN ENGLISH ALPHANUMERIC CHARACTERS. EVIDENCE TO INCLUDE: NAMES AND ADDRESSES OF MANUFACTURER, SUPPLIER AND TESTING AUTHORITY; TEST CERTIFICATE NUMBER AND DATE WITH PAGE NUMBER ON EACH PAGE; PRODUCT TESTING SPECIFICATION AND GRADE OF STEEL; PRODUCT DESIGNATION AND RELEVANT DIMENSIONS; PRODUCT STEEL MAKING PROCESS; LENGTH, BUNDLE, PACK OR UNIQUE IDENTIFIER TO WHICH CERTIFICATE APPLIES; HEAT NUMBER (FROM CASTING); MECHANICAL PROPERTIES FROM TENSILE TEST (ALL VALUES CITED IN AS/NZ STANDARD), WHETHER EACH MEASURED MECHANICAL PROPERTY COMPLIES WITH AS/NZS STANDARD, CHEMICAL ANALYSIS RESULTS AND TYPE OF ANALYSIS UNDERTAKEN; CUSTOMER PURCHASE ORDER TO MATCH BATCH NUMBER; ANY OTHER SYSTEM REFERENCE NUMBERS AND SIGNATURE OF AUTHENTICITY.

CONCRETE

CONCRETE MIX

- C1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS3600, AS3610, AS1379, AS1478, AS3682, AS3799, AS2758.1, AS5100.5 AND AS3972.
- C2. WET CONCRETE TO BE UNIFORM, DENSE, HOMOGENEOUS, COHESIVE AND ABLE TO WORK READILY INTO CORNERS AND AROUND REINFORCEMENT COMPLETELY FILLING FORMWORK WITHOUT SEGREGATION OF AGGREGATES AND / OR FIBRES, EXCESS FREE WATER ON SURFACE, LOSS OF MATERIAL, CONTAMINATION OR OTHER VISIBLE DEFECTS.
- C3. FINISHED CONCRETE TO BE A DURABLE, DENSE, HOMOGENEOUS MASS COMPLETELY FILLING FORMWORK, EMBEDDING FIBRES, REINFORCEMENT AND TENDONS, AND FREE OF STONE POCKETS OR HONEYCOMBS, OF UNIFORM COLOUR AND TEXTURE, WITH LOW PERMEABILITY AND ADEQUATE BUT NOT EXCESSIVE STRENGTH FOR GRADE.
- C4. AIR ENTRAINMENT IS NOT PERMITTED UNLESS APPROVED IN WRITING BY SUPERINTENDENT.
- C5. QUALITY OF CONCRETE ELEMENTS TO BE AS FOLLOWS:

STRUCTURAL ELEMENT	BLINDING	PRECAST DECK UNITS	CAST INSITU CONCRETE
EXPOSURE CLASSIFICATION	B1	B2	B2
STRENGTH GRADE (MPa)	N7	S50	S40
MINIMUM DENSITY (kg/m ³)	-	2350	2350
MAX AGGREGATE SIZE (mm)	-	20	20

- C6. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY. PROVIDE CONCRETE WITH:
- AN AVERAGE COMPRESSIVE STRENGTH AT COMPLETION OF CURING NOT LESS THAN 75% OF SPECIFIED f_c.
 - A TOTAL REACTIVE ALKALI CONTENT NOT GREATER THAN 3.0 kg/m³ Na₂O (EQUIVALENT).
- C7. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY.
- DO NOT USE METAL INSERTS WITHIN COVER CONCRETE INCLUDING METAL BAR CHAIRS.
 - DO NOT ALLOW CONCRETE TO FALL VERTICALLY WHEN PLACING, OR TO ENTRAP AIR IN ANY OTHER WAY.
 - PREVENT EVAPORATION OF WATER FROM CONCRETE SURFACES IMMEDIATELY AFTER LAYING.
 - MOIST CURE CONCRETE FOR A MINIMUM OF SEVEN DAYS.
- C8. SUPPLEMENTARY CEMENTITIOUS MATERIALS INCLUDE AMORPHOUS SILICA FUME, FLY ASH, AND GROUND GRANULATED BLAST FURNACE SLAG (GGBSF OR SLAG) COMPLYING WITH AS3682.
- C9. RHEOLOGY, WORKABILITY AND SLUMP TO BE AS REQUIRED FOR PLACEMENT (eg PUMPING, CHUTE, SPRAYING etc), COMPACTION AND FINISHING. USE SUPERPLASTICISERS AND HIGH RANGE WATER REDUCERS TO AS1478 TO ACHIEVE ADEQUATE WORKABILITY.
- C10. MAXIMUM SULPHATE CONTENT OF CONCRETE TO BE LESS THAN 5% BY MASS OF ACID SOLUBLE SO₃ AS A PERCENTAGE OF CEMENTITIOUS MATERIAL.

- C11. FOR GENERAL BLENDED CEMENT (GB) CONTAINING ORDINARY PORTLAND CEMENT PLUS AT LEAST 5% SUPPLEMENTARY CEMENTITIOUS MATERIALS:
- SILICA FUME TO BE LESS THAN 10%, OR
 - FLYASH TO BE LESS THAN 25%, OR
 - GROUND GRANULATED BLAST FURNACE SLAG TO BE LESS THAN 40%.
- FOR DOUBLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN SMALLER OF PERCENTAGES GIVEN ABOVE FOR CONSTITUENTS INCLUDED.
- FOR TRIPLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN 40%.
- C12. SUPPLEMENTARY CEMENTITIOUS MATERIALS SPECIFIED IN TABLE ABOVE ARE IN ADDITION TO MATERIALS INCORPORATED IN GB CEMENT.
- C13. ADMIXTURES TO COMPLY WITH AS1478. ADMIXTURES MUST NOT REDUCE STRENGTH OF CONCRETE BELOW SPECIFIED VALUE IN SHORT OR LONG TERM. ADMIXTURES MUST NOT CONTAIN CALCIUM CHLORIDE. USE ADMIXTURES IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS. CONCRETE ADMIXTURES SHALL NOT CAUSE OR ACCELERATE CORROSION OF REINFORCEMENT, NOR BE DETRIMENTAL TO CONCRETE OR STEEL DURING EXPECTED LIFE OF STRUCTURE. DO NOT USE CHEMICAL ADMIXTURES OR OTHER MATERIALS WITHOUT SUPERINTENDENT’S WRITTEN APPROVAL.
- C14. DO NOT ADD WATER TO CONCRETE AFTER TRUCK HAS LEFT BATCHING PLANT.
- C15. MIX CONCRETE TO ENSURE UNIFORM DISTRIBUTION OF CONSTITUENTS.

CONCRETE TESTING

- C16. TEST SLUMP OF EACH BATCH OF CONCRETE DELIVERED BEFORE PLACING CONCRETE FROM THAT DELIVERY. SLUMP MEASURED TO BE NO GREATER THAN TARGET SLUMP WITHIN TOLERANCES GIVEN IN AS1379 CLAUSE 5.2.3. CONCRETE OUTSIDE SLUMP TOLERANCE LIMITS IS LIABLE TO REJECTION.
- C17. CARRY OUT PROJECT ASSESSMENT OF CONCRETE TO AS1379 CLAUSE 6.4 AND 6.5. TAKE SAMPLES AT PROJECT SITE AT POINT OF DISCHARGE FROM AGITATOR. SPREAD SAMPLING EVENLY THROUGH FOUR SAMPLE CONCRETE FOR PROJECT ASSESSMENT CONCURRENTLY WITH EACH SAMPLE TAKEN FOR PRODUCTION ASSESSMENT AT PROJECT SITE. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE FROM EACH 25 m³ OF CONCRETE DELIVERED PER DAY. NOT LESS THAN FIVE SAMPLES TOTAL FOR EACH MIX DESIGN. EACH SAMPLE TO COMPRISE FOUR CYLINDERS. TEST TWO AT 7 DAYS AND TWO AT 28 DAYS. NOTIFY SUPERINTENDENT WITHIN 2 WORKING DAYS IF 7-DAY CONCRETE TEST RESULTS INDICATE 28 DAY STRENGTHS ARE LIKELY TO BE BELOW SPECIFIED STRENGTH.
- C18. CARRY OUT DRYING SHRINKAGE TESTING TO AS1012.13. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE EVERY THREE MONTHS, OR FOR EVERY 1000 m³ OF CONCRETE PLACED, MINIMUM OF ONE SAMPLE. EACH SAMPLE TO COMPRISE THREE SPECIMENS. SAMPLE CONCRETE AT PROJECT SITE, DIRECTLY FROM DELIVERY VEHICLE. BASE ASSESSMENT ON AVERAGE OF THREE TEST RESULTS.
- C19. CONCRETE SAMPLING AND TESTING TO BE BY AN APPROVED INDEPENDENT NATA REGISTERED LABORATORY.

FORMWORK

- C20. RESPONSIBILITY FOR DESIGN, CERTIFICATION, CONSTRUCTION AND PERFORMANCE OF FORMWORK AND FALSEWORK LIES WITH CONTRACTOR.
- C21. FORMWORK TO BE DESIGNED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ) TO AS3610, AND INDEPENDENTLY CERTIFIED BY A CHARTERED ENGINEER EXPERIENCED IN FORMWORK DESIGN AND REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ). PROVIDE COPY OF DESIGN CALCULATIONS AND CERTIFICATION TO SUPERINTENDENT. DESIGN FORMWORK TO ACCOMMODATE DIMENSIONAL CHANGES AND MOVEMENTS RESULTING FROM IMPOSED ACTIONS, CONCRETE SHRINKAGE AND CREEP, TEMPERATURE CHANGES, PRESTRESSING FORCES, etc.
- C22. DO NOT SUPPORT OR RESTRAIN FORMWORK ON PERMANENT WORKS WITHOUT SUPERINTENDENT’S WRITTEN APPROVAL.
- C23. CONSTRUCT FORMWORK TO COMPLY WITH AS3610 AND CLAUSE 17.6 OF AS3600 WHERE THIS IS MORE STRINGENT SO CONCRETE WILL HAVE DIMENSIONS, SHAPE, LOCATION AND FINISH SPECIFIED.
- C24. PROVIDE OPENINGS OR REMOVABLE PANELS IN FORMWORK FOR INSPECTION AND CLEANING.
- C25. APPLY RELEASE AGENT COMPATIBLE WITH CONTACT SURFACES TO INTERIOR OF FORMWORK (EXCEPT WHERE CONCRETE IS TO RECEIVE AN APPLIED FINISH OR COATING FOR WHICH THERE IS NO COMPATIBLE RELEASE AGENT). WHERE NECESSARY CLEAN REINFORCEMENT TO REMOVE TRACES OF RELEASE AGENT.
- C26. SEAL JOINTS BETWEEN FORMWORK PANELS, AND TO HARDENED CONCRETE WITH A FLEXIBLE RUBBER STRIP. SET OUT FORMWORK TO GIVE A REGULAR ARRANGEMENT OF PANELS, JOINTS, BOLT HOLES AND SIMILAR VISIBLE ELEMENTS IN FORMED SURFACE.
- C27. DO NOT USE FORMWORK HARDWARE THAT FORMS A COMPLETE HOLE THROUGH CONCRETE ELEMENTS. DO NOT USE REINFORCEMENT TO SUPPORT FORMWORK.
- C28. PROVIDE HOLES IN REBATE FORMERS, etc. AS REQUIRED TO PREVENT AIR ENTRAPMENT.
- C29. DO NOT STRIP FORMWORK PRIOR TO 72 HOURS AFTER PLACEMENT.
- C30. DO NOT STRIP FORMWORK UNTIL CONCRETE IS HARDENED SUFFICIENTLY TO WITHSTAND MOVEMENT AND FORM REMOVE WITHOUT DAMAGE. MINIMUM STRIPPING TIMES TO BE AS PER AS3610 TABLE 5.4.1.
- C31. STRIP FORMWORK TO AS3600 CLAUSE 17.6. REMOVE FORM THE BOLTS WITHOUT DAMAGING CONCRETE. PARTS OF BOLTS LEFT IN CONCRETE MUST NOT INTRUDE INTO COVER CONCRETE. FLUSH HILIT HOLES USING PREMIXED NON-SHRINK CEMENTITIOUS APPROVED REPAIR MORTAR MATCHING CONCRETE SURFACE COLOUR, STRENGTH AND DURABILITY AND ADEQUATE BOND. SUBMIT DETAILS OF PROPOSED REPAIR METHODS TO SUPERINTENDENT FOR APPROVAL.

PLACING CONCRETE

- C32. CONSTRUCTION TOLERANCES TO BE TO AS3610.
- C33. FORMWORK, REINFORCEMENT AND COVER, DOWELS, WATERSTOPS, CAST-IN ITEMS etc TO BE INSPECTED AND APPROVED BY SUITABLY QUALIFIED GEOTECHNICAL ENGINEER / SUPERINTENDENT / BUILDING SURVEYOR BEFORE CONCRETE IS PLACED.
- C34. REMOVE FREE WATER, DUST AND DEBRIS, STAINS etc FROM FORMS, EXCAVATIONS etc BEFORE PLACING CONCRETE. IN HOT CONDITIONS DAMPEN FORMWORK AND / OR SUB-GRADE BEFORE PLACING CONCRETE.
- C35. INSTALL 0.2 mm HIGH IMPACT RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 TO BASE TO RETAIN WATER IN FRESH CONCRETE.
- C36. PLACE CONCRETE IN LAYERS LESS THAN 300 mm THICK FOR FIRST LAYER AND 75% OF IMMERSION VIBRATOR LENGTH FOR SUBSEQUENT LAYERS, AND VIBRATE EACH LAYER BEFORE PLACING NEXT.
- C37. ELAPSED TIME BETWEEN WETTING OF MIX AND DISCHARGE OF CONCRETE AT SITE MUST BE AS SHORT AS POSSIBLE, AND MUST NOT EXCEED LIMITS GIVEN WITHOUT SUPERINTENDENT’S PRIOR WRITTEN CONSENT.

CONCRETE TEMPERATURE AT TIME OF DISCHARGE (°C)	MAXIMUM ELAPSED TIME (HOURS)
10 – 24	2.00
24 – 27	1.50
27 – 30	1.00
30 - 32	0.75

- C38. ELAPSED TIME LIMITS MAY BE VARIED IF TRIALS DEMONSTRATE USE OF SET RETARDERS (TYPE R_o OR WR_R TO AS1478) PROVIDE ADEQUATE RETENTION OF WORKABILITY FOR LONGER PERIODS AT REQUIRED TEMPERATURE. SLUMP LIMITS STILL APPLY. RE-TEMPERING BEYOND MAXIMUM ALLOWED DISCHARGE TIME USING WATER OR ADMIXTURES IS NOT ALLOWED.
- C39. USE PLACEMENT METHODS THAT WILL MINIMISE PLASTIC SETTLEMENT AND SHRINKAGE CRACKING. LIMIT VERTICAL FREE FALL BY USE OF CHUTES, etc. KEEP CHUTES VERTICAL, FULL AND IMMERSED IN CONCRETE. PLACE CONCRETE IN LAYERS AND BLEND SUCCEEDING LAYERS BY COMPACTION. MAINTAIN CONCRETE EDGE IN A PLASTIC STATE. PROPERLY COMPACT CONCRETE USING MECHANICAL VIBRATORS (AND HAND METHODS IF REQUIRED AND APPROVED BY SUPERINTENDENT) TO REMOVE AIR BUBBLES AND GIVE MAXIMUM COMPACTION WITHOUT SEGREGATION OF CONCRETE. TAKE CARE TO AVOID CONTACT BETWEEN VIBRATORS AND PARTIALLY HARDENED CONCRETE, FORMWORK OR REINFORCEMENT. DO NOT USE VIBRATORS TO MOVE CONCRETE ALONG FORMS.
- C40. DO NOT DISTURB CONCRETE ONCE INITIAL SET HAS OCCURRED.
- C41. OBTAIN SUPERINTENDENT’S WRITTEN APPROVAL OF PLACEMENT METHODS FOR CONCRETE ELEMENTS GREATER THAN 1500 mm HEIGHT.

- C42. KEEP ON SITE A LOG BOOK RECORDING EACH PLACEMENT OF CONCRETE INCLUDING DATE, CLIMATIC CONDITIONS, PORTION OF WORK, SPECIFIED GRADE AND SOURCE OF CONCRETE, DELIVERY DOCKET DATA, METHODS OF PLACEMENT AND COMPACTION, PROJECT ASSESSMENT CARRIED OUT, SLUMP MEASUREMENTS, VOLUME AND OTHER NOTABLE MATTERS THAT MAY AFFECT PERFORMANCE OF CONCRETE.
- C43. IN HOT WEATHER PREVENT PREMATURE STIFFENING OF FRESH CONCRETE, REDUCE WATER ABSORPTION AND EVAPORATION LOSSES. MIX, TRANSPORT, PLACE AND COMPACT CONCRETE AS QUICKLY AS POSSIBLE. DURING PLACEMENT TEMPERATURE OF CONCRETE MUST NOT EXCEED TEMPERATURES BELOW:

CONCRETE ELEMENT	TEMPERATURE LIMIT
UNREINFORCED CONCRETE IN SECTIONS ≥ 1 METRE EACH DIMENSION.	27°C
CONCRETE f _c ≥ 40 MPa IN SECTIONS ≥ 500 mm THICKNESS	27°C
CONCRETE IN FOOTINGS, BEAMS, COLUMNS, WALLS AND SLABS f _c ≤ 32 MPa	32°C
ELSEWHERE	32°C

- DO NOT MIX CONCRETE WHEN SURROUNDING OUTDOOR SHADE TEMPERATURE ≥ 38°C. MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT ≤ 32°C BEFORE AND DURING PLACING. COOL REINFORCEMENT AND FORMWORK AS REQUIRED. MAINTAIN SPECIFIED TEMPERATURE OF PLACED CONCRETE BY:
- PLACING CONCRETE WHEN AMBIENT TEMPERATURE IS LOW (AT NIGHT)
 - COOL CONCRETE USING LIQUID NITROGEN INJECTION BEFORE PLACING, OR
 - COVER CONTAINER IN WHICH CONCRETE IS TRANSPORTED TO FORMS, OR
 - SHADING AND SPRAYING COARSE AGGREGATE USING COLD WATER, OR
 - USE CHILLED MIXING WATER.
- C44. PROTECT FRESH CONCRETE FROM PREMATURE DRYING - PARTICULARLY IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS, EXCESSIVELY HOT OR COLD TEMPERATURES, RAIN, etc. PROVIDE WIND BREAKS, MAINTAIN CONCRETE AT A REASONABLY CONSTANT TEMPERATURE WITH MINIMUM MOISTURE LOSS FOR CURING PERIOD.
- C45. FOR CONCRETE WITH WATER-CEMENT RATIO LESS THAN 0.5, IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS SPRAY EXPOSED SURFACES OF FRESH CONCRETE WITH FOG SPRAY APPLICATION OF ALIPHATIC ALCOHOL RETARDANT IMMEDIATELY AFTER PLACEMENT TO REDUCE RISK OF PLASTIC SHRINKAGE CRACKING. IN SEVERE CLIMATIC CONDITIONS CONSIDER RE-VIBRATING CONCRETE BEFORE IT REACHES INITIAL SET. COMMENCE CURING OF CONCRETE TO AS3600 AS SOON AS POSSIBLE AFTER PLACING AND FINISHING OR STRIPPING, AND WITHIN ONE HOUR. ENSURE EXPOSED SURFACES ARE NOT STAINED. ACCEPTABLE METHODS OF CURING INCLUDE:
- RETENTION OF FORMWORK
 - PONDING OR CONTINUOUS SPRINKLING WITH WATER (MOIST CURING)
 - AN IMPERMEABLE MEMBRANE (USE CLEAR, WHITE OR LIGHT COLOURED PLASTIC IN HOT CONDITIONS) SEALED AROUND EDGES
 - AN ABSORPTIVE COVER KEPT CONTINUOUSLY WET AND COVERED BY IMPERMEABLE MEMBRANE
 - STEAM CURING
 - AN APPROVED CURING COMPOUND. PROVIDE:
 - EFFICIENCY INDEX
 - CERTIFIED TEST RESULTS FOR WATER RETENTION TO AS3799 APPENDIX B
 - EVIDENCE THAT AN ACCEPTABLE FINAL SURFACE COLOUR WILL BE OBTAINED
 - EVIDENCE OF COMPATIBILITY WITH CONCRETE AND APPLIED FINISHES (IF ANY)
 - METHODS OF OBTAINING REQUIRED ADHESION FOR TOPFINISH, RENDER etc.
 - UNIFORM CONTINUOUS FLEXIBLE COATING WITHOUT VISIBLE BREAKS OR PINHOLES, WHICH REMAINS UNBROKEN FOR AT LEAST THE CURING PERIOD AFTER APPLICATION.

- C47. DO NOT USE WAX-BASED OR CHLORINATED RUBBER-BASED CURING COMPOUNDS ON SURFACES FORMING SUBSTRATES TO APPLIED FINISHES, CONCRETE TOPFINISHES AND CEMENT BASED RENDER.
- C48. CURE CONTINUOUSLY UNTIL NUMBER OF DAYS DURING WHICH AIR TEMPERATURE IS ABOVE 10°C TOTALS:
- 3 DAYS FOR EXPOSURE CLASSIFICATION A1 AND A2
 - 7 DAYS FOR EXPOSURE CLASSIFICATION B1, B2 AND C
 - 14 DAYS FOR MIXES CONTAINING GB CEMENT AND SUPPLEMENTARY CEMENTITIOUS MATERIALS.
- C49. PREVENT RAPID DRYING OUT AT END OF CURING PERIOD.
- C50. FINISH CONCRETE SURFACES TO AS3610 AND AS SHOWN BELOW:
- FORMED SURFACES:
 - EXPOSED SURFACES 2C
 - HIDDEN SURFACES 5
 - FINISHES AS LAID:
 - EXPOSED SURFACES STEEL TROWEL UNO
 - HIDDEN SURFACES WOOD FLOAT
- C51. PROVIDE EXPOSED EDGES AND RE-ENTRANT CORNERS WITH 45 DEGREES x 25 mm CHAMFERS OR FILLETS UNO.
- C52. DO NOT MAKE HOLES, PENETRATIONS, RECESSES, CHASES, NOR EMBED PIPES (OTHER THAN THOSE SHOWN ON STRUCTURAL DRAWINGS) WITHOUT APPROVAL OF SUPERINTENDENT. DO NOT PLACE CONDUITS, PIPES etc WITHIN COVER CONCRETE. LOCATE CONDUITS, PIPES etc ONLY IN MIDDLE THIRD OF SLAB OR BEAM DEPTH AND BETWEEN REINFORCEMENT LAYERS, SPACED AT 3 x PIPE / CONDUIT DIAMETER CENTRES MINIMUM. DO NOT CUT REINFORCEMENT AT PENETRATIONS WITHOUT APPROVAL.
- C53. PROVIDE DRIP GROOVES IN SOFFIT OF BEAMS AND SLABS AT EXTERNAL PERIMETER OF STRUCTURES. ENSURE COVER TO REINFORCEMENT IS ACHIEVED.

JOINTS

- C54. FORM CONSTRUCTION JOINTS AND USE ONLY WHERE SHOWN OR WHERE APPROVED BY SUPERINTENDENT. CONSTRUCTION JOINTS IN SLABS TO BE VERTICAL, STRAIGHT AND TRUE. TO ACHIEVE ADEQUATE BOND ENSURE ENTIRE SURFACE IS CLEAN, FREE OF LAITANCE AND BLEMISHES, AND INTENTIONALLY ROUGHENED TO A FULL AMPLITUDE OF NOT LESS THAN 5 mm WITH COARSE AGGREGATE EXPOSED.
- C55. IF CONSTRUCTION JOINTS PROPOSED OTHER THAN WHERE SHOWN, PROVIDE PROPOSED LOCATIONS FOR SUPERINTENDENT’S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- C56. PROVIDE JOINTING MATERIALS COMPATIBLE WHEN USED TOGETHER, AND NON-STAINING TO CONCRETE IN VISIBLE LOCATIONS.
- C57. PROVIDE DETAILS OF CONSTRUCTION JOINTS FOR SUPERINTENDENT’S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- C58. SUBMIT PROPOSALS FOR CUTTING OR CORING HARDENED CONCRETE OR SAW CUT JOINTS, INCLUDING METHODS, TIMING AND SEQUENCE AT LEAST 7 DAYS BEFORE UNDERTAKING WORKS.
- C59. SAW CUT CRACK CONTROL JOINTS AS SOON AFTER CASTING AS PRACTICABLE TO AVOID SPALLING OR RAVELLING OF JOINT EDGES, AND WITHIN 16 HOURS OF CASTING TO PREVENT THERMAL AND / OR SHRINKAGE CRACKING OF SLAB. IMMEDIATELY AFTER SAW CUTTING FLUSH OUT JOINTS TO REMOVE SAWING RESIDUE AND INSERT A TEMPORARY FOAMED PLASTIC BEAD TO KEEP JOINT CLEAN PRIOR TO FILLING OR SEALING. PROTECT SAW CUTS FROM WHEEL LOADS FOR AT LEAST ONE WEEK AFTER CUTTING.
- C60. DO NOT INSTALL SEALANTS IF EXPECTED MAXIMUM DAILY TEMPERATURE EXCEEDS 30 DEGREES C. ENSURE RECESSES ARE CLEAN AND DRY PRIOR TO INSTALLING FILLERS OR SEALANTS, AND PREPARE IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS. TOLERANCE ON SEALANT WIDTHS +5, -0 mm.

REINFORCEMENT COVER

- C61. COVER IS CLEAR DISTANCE BETWEEN ANY REINFORCEMENT (INCLUDING LIGATURES, TIE WIRE etc) AND OUTSIDE SURFACE OF STRUCTURAL CONCRETE.

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
0	APPROVED ISSUE		WRC	*MI	*AA	12.04.21



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		Approved (Project Director)	*A.AHILADELLIS	
		Date	12.04.21	
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C62. COVER MUST NOT BE LESS THAN SPECIFIED. PROVIDE MINIMUM CLEAR COVER TO REINFORCEMENT AS SHOWN BELOW, EXCEPT WHERE SPECIFIED OTHERWISE:

LOCATION	COVER (mm)
DECK UNITS	35
ABUTMENTS	65
TOPPING SLAB	50
ELSEWHERE	50

COVER GIVEN IS ONLY FOR CONCRETE CAST AGAINST FORMWORK OR CONCRETE BLINDING UNO. REQUEST REQUIRED COVER DIMENSION FROM SUPERINTENDENT WHERE CONCRETE IS CAST AGAINST GROUND OR A FLEXIBLE MEMBRANE ON GROUND. CONCRETE THICKNESSES MAY BE INCREASED.

C63. TOLERANCE ON COVER TO BE TO AS5100.5 CLAUSE 4.10.3.1

C64. PROVIDE 50 mm BLINDING CONCRETE UNDER STRUCTURAL REINFORCED CONCRETE CAST ON GROUND UNO.

DELIVERABLES

C65. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED CONCRETE SUBCONTRACTORS, INCLUDING SPRAYED CONCRETE SUB-CONTRACTORS.

C66. AT LEAST ONE WEEK PRIOR TO CONCRETE PLACEMENT SUBMIT DETAILS OF PROPOSED READY MIXED CONCRETE SUPPLIER, NAME OF CONCRETE DELIVERY SUPERVISOR, LOCATION OF BATCHING PLANT, CONCRETE MIX DESIGNS, METHOD OF CONCRETE TEMPERATURE CONTROL, MIXING, HANDLING, TRANSPORT, PUMPING, PLACEMENT / SPRAYING, COMPACTION, FINISHING, PROTECTION AND CURING, SEQUENCE AND TIMES FOR CONCRETE POURS, CONSTRUCTION JOINT LOCATIONS AT LEAST ONE WEEK PRIOR TO DELIVERY OF CONCRETE FOR SUPERINTENDENT'S APPROVAL. NOMINATE FOR EACH MIX DESIGN THE SOURCE, TYPE AND PROPORTIONS OF CONSTITUENTS, AGGREGATE GRADINGS AND SATURATED SURFACE-DRY DENSITIES, ADDITIVES AND ADMIXTURES, MAXIMUM WATER CONTENT AND MAXIMUM WATER-CEMENT RATIO, TARGET SLUMP, TARGET CHARACTERISTIC STRENGTH (f_c) AND TARGET DRYING SHRINKAGE.

C67. PROVIDE DOCUMENTARY EVIDENCE OF PREVIOUS PERFORMANCE AND RELEVANT TEST RESULTS OF MIX DESIGN TARGETS, INCLUDING 3, 7 AND 28 DAY COMPRESSIVE STRENGTHS FOR CONCRETE MIXES, CHARACTERISTIC STRENGTH, TEMPERATURE RISE, DRYING SHRINKAGE, LIMITS OF SOLUBLE SALTS AND ALKALI AGGREGATE REACTIVITY etc. BEING CERTIFIED TEST RESULTS MADE ON AT LEAST TWO SEPARATE SAMPLES FROM A NATA REGISTERED LABORATORY EITHER:

- ON CONCRETE OF SAME MIX DESIGN (IN RESPECT OF ALL DETAILS TO BE NOMINATED ABOVE) OF SAME GRADE MADE UNDER PRODUCTION CONDITIONS IN SAME PLANT WITHIN LAST SIX MONTHS, OR
- ON PRELIMINARY TESTS FROM LABORATORY OR PLANT TRIALS OF PROPOSED MIX

C68. USE READY MIXED CONCRETE MIXED BY BATCH PRODUCTION PROCESS DELIVERED IN AGITATING TRUCKS FOR EACH BATCH SUPPLY A DOCKET LISTING INFORMATION REQUIRED BY AS1379 CLAUSE 1.7.3 AND FOLLOWING:

- SERIAL NUMBER OF IDENTIFICATION CERTIFICATES OF EACH BATCH
- TIME OF BATCHING
- NAME OF CONCRETE DELIVERY SUPERVISOR
- ELEMENT FOR WHICH CONCRETE WAS ORDERED AND WHERE IT WAS PLACED
- METHOD OF PLACEMENT AND CLIMATIC CONDITIONS DURING POUR
- PROJECT ASSESSMENT CARRIED OUT
- TOTAL AMOUNT OF WATER REQUIRED BY MIX DESIGN
- ADMIXTURES TYPE AND QUANTITY
- ADDITIVES TYPE AND QUANTITY
- TOTAL AMOUNT OF WATER ADDED AT PLANT
- TOTAL FREE WATER IN CONCRETE

SUPERINTENDENT MAY NOT REQUIRE CONCRETE TRIAL MIX TESTS SUBJECT TO REVIEW OF PRODUCTION TEST RESULTS.

C69. SUBMIT DETAILS OF ALL PROPOSED CONCRETE COATINGS TO SUPERINTENDENT FOR REVIEW.

C70. PROVIDE RECORD OF SLUMP TESTING TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.

C71. FORWARD CONCRETE PROJECT ASSESSMENT INFORMATION TO SUPERINTENDENT AS PER AS1379 CLAUSE 6.3 WHEN PROJECT ASSESSMENT IS UNDERTAKEN. REFER CONCRETE TESTING NOTES.

C72. REPORT DRYING SHRINKAGE TESTING RESULTS TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.

C73. PROVIDE CONCRETE TEST RESULTS TO SUPERINTENDENT PROMPTLY, WITHIN SEVEN DAYS OF TESTING.

REINFORCEMENT

R1. SYMBOLS ON DRAWINGS FOR GRADE AND TYPE OF REINFORCEMENT ARE AS FOLLOWS:

- R: STRUCTURAL GRADE 250 PLAIN ROUND BAR TO AS/NZS4671
- N: HOT ROLLED GRADE 500 DEFORMED (RIBBED) BAR DUCTILITY CLASS N TO AS/NZS4671
- L: HOT ROLLED GRADE 500 DEFORMED BAR DUCTILITY CLASS L TO AS/NZS4671
- SL: HARD DRAWN WIRE GRADE 500 SQUARE MESH DUCTILITY CLASS L TO AS/NZS4671
- RL: HARD DRAWN WIRE GRADE 500 RECTANGULAR MESH DUCTILITY CLASS L TO AS/NZS4671
- TM: HARD DRAWN STEEL GRADE 500 TRENCH MESH DUCTILITY CLASS L TO AS/NZS4671
- W: GRADE 500 STEEL REINFORCING WIRE TO AS/NZS4671

R2. MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRE-STRESSING MATERIALS MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH AS/NZS4671, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL REINFORCEMENT. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.

R3. PROVIDE DOCUMENTATION TO SHOW THAT REINFORCEMENT SUPPLIER AND MILL COMPLY WITH AS/NZS4671.

R4. REINFORCEMENT MUST HAVE UNIQUE MARKS TO IDENTIFY SUPPLIER.

R5. DO NOT USE LOW DUCTILITY REINFORCEMENT (GRADE L) UNO.

R6. USE MESH SUPPLIED IN FLAT SHEETS UNLESS APPROVED OTHERWISE.

R7. REINFORCEMENT TO BE CLEAN, FREE OF LOOSE MILL SCALE, RUST, OIL, GREASE, MUD OR OTHER MATERIAL THAT MIGHT REDUCE BOND BETWEEN REINFORCEMENT AND CONCRETE.

R8. SUBMIT PROPOSAL FOR CUTTING OR DISPLACING REINFORCEMENT. CLEAN AND PROTECT EXPOSED CUT ENDS OF REINFORCEMENT USING 6 mm APPROVED EPOXY. REFER TO CONCRETE REPAIR NOTES FOR TREATMENT OF NEWLY EXPOSED CONCRETE AND REINFORCEMENT SURFACES AT NEW PENETRATIONS OR AREAS OF DEMOLITION.

R9. DESIGNATION OF REINFORCEMENT BARS IS AS SHOWN:

- eg 17 N20 - 350 EF
- 17: DENOTES No OF BARS AND TYPE IN GROUP
- N: DENOTES BAR GRADE AND DUCTILITY CLASS
- 20: DENOTES NOMINAL BAR DIAMETER IN mm
- 350: DENOTES SPACING IN mm
- EF: DENOTES LOCATION

R10. TO MINIMIZE TRIP HAZARDS CONSIDER MAXIMUM REINFORCEMENT BAR SPACING FOR TRAFFICABLE AREAS PRIOR TO CASTING CONCRETE OF 200 mm. ALTERNATIVELY PROVIDE SL82 ADDITIONAL IF MAIN REINFORCEMENT SPACING IS GREATER THAN 200 mm.

R11. FOLLOWING ABBREVIATIONS APPLY TO LOCATION OF REINFORCEMENT:

- EW: EACH WAY FF: FAR FACE BB: BOTTOM BOTTOM (LAID FIRST)
- EF: EACH FACE B: BOTTOM TT: TOP TOP (LAID LAST)
- NF: NEAR FACE T: TOP C OR CP: CENTRALLY PLACED

R12. PROVIDE STANDARD COGS AND HOOKS TO AS3600. TERMINATE ENDS OF COLUMN AND BEAM LIGATURES IN A HOOK OF AT LEAST 135 DEGREES. PROVIDE FIRST LIGATURE WITHIN 50 mm OF FACE OF SUPPORT.

R13. PROVIDE ONE CONTINUOUS BAR PARALLEL TO (WITHIN 75 mm OF) CONCRETE EDGES, INCLUDING CONSTRUCTION JOINTS UNO.

R14. PROVIDE N12 DIAGONAL TRIMMER BARS BY 1000 mm LONG AT EACH LAYER OF REINFORCEMENT AT RE-ENTRANT CORNERS, OPENINGS, SERVICE PENETRATIONS etc UNO.

R15. REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY IN TRUE PROJECTION. SET REINFORCEMENT OUT AT EQUAL CENTRES IF SPACING IS NOT NOMINATED.

R16. CAP STARTER BARS AND OTHER REINFORCEMENT TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.

R17. ENSURE ALL LAID REINFORCING BARS ARE RESTRAINED BEFORE STOPPING WORK TO PREVENT BARS ROLLING UNDERFOOT.

R18. SECURE REINFORCEMENT IN POSITION AGAINST DISPLACEMENT AND MAINTAIN SPECIFIED CLEAR CONCRETE COVER TO REINFORCEMENT (INCLUDING FITMENTS) BY APPROVED CHAIRS, SPACERS, LIGATURES OR TIES AT 800 mm MAXIMUM CENTRES EACH WAY UNO. PROVIDE ADEQUATE SUPPORT TO PREVENT DISPLACEMENT OF REINFORCEMENT BY WORKMEN OR EQUIPMENT DURING CONCRETE PLACEMENT.

R19. SECURELY TIE REINFORCEMENT WITH WIRE TIES. TURN ENDS OF TIE WIRES INTO CONCRETE, CLEAR OF COVER ZONE.

R20. SUPPORT REINFORCEMENT ON PROPRIETARY CONCRETE, METAL OR PLASTIC SUPPORTS ADEQUATE TO WITHSTAND CONSTRUCTION AND TRAFFIC LOADS AND MAINTAIN DURABILITY OF FINISHED CONCRETE STRUCTURE. FOR CONCRETE SURFACES WITH B2 EXPOSURE CLASSIFICATION OR GREATER, ONLY USE PROPRIETARY HIGH STRENGTH FIBRE REINFORCED CEMENT SPACER BLOCKS OR SUPPORTS.

R21. DO NOT PLACE OR MOVE REINFORCEMENT DURING OR AFTER CONCRETE PLACEMENT.

R22. ENSURE EMBEDDED ITEMS (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, DISSIMILAR METAL ITEMS, etc) IN COVER CONCRETE OR EXPOSED TO AIR ARE NOT IN CONTACT WITH REINFORCEMENT. PROVIDE ISOLATION BETWEEN DISSIMILAR METALS, AND BETWEEN REINFORCEMENT AND EXPOSED ITEMS.

R23. OBTAIN SUPERINTENDENT'S APPROVAL OF INSERTS, FIXINGS AND OTHER ITEMS EMBEDDED IN COVER CONCRETE.

R24. SPLICE REINFORCEMENT ONLY AT LOCATIONS SHOWN ON DRAWINGS OR AS APPROVED BY SUPERINTENDENT. STAGGER LAPS WHERE POSSIBLE. LAPPED SPLICE LENGTHS TO COMPLY WITH AS3600. CLEAR SPACING BETWEEN LAPPED BARS TO BE LESS THAN THREE TIMES BAR DIAMETER. WHERE BAR SIZES VARY USE LAPPED SPLICE LENGTH FOR SMALLER BAR DIAMETER.

R25. LAPPED SPLICE LENGTHS FOR HORIZONTAL BARS WITH MORE THAN 300 mm CONCRETE CAST BELOW THE BAR AND SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f _c	N12	N16	N20	N24	N28	N32
≥ 25	≥ 20	770	1150	1570	-	-	-
≥ 30	≥ 25	630	980	1350	1740	-	-
≥ 40	≥ 32	510	770	1100	1440	1810	2220
≥ 50	≥ 40	460	630	890	1200	1530	1890

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.

LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.

R26. LAPPED SPLICE LENGTHS FOR VERTICAL BARS (AND HORIZONTAL BARS WITH LESS THAN 300 mm CONCRETE CAST BELOW THE BAR) SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f _c	N12	N16	N20	N24	N28	N32
≥ 25	≥ 20	590	890	1210	-	-	-
≥ 30	≥ 25	490	750	1040	1340	-	-
≥ 40	≥ 32	390	600	840	1110	1400	1710
≥ 50	≥ 40	350	480	690	920	1180	1450

NOT APPLICABLE FOR BARS IN COLUMNS

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS.

LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT.

R27. LAY MESH REINFORCEMENT SO THAT MINIMUM COVER IS TO MAIN WIRES UNO.

R28. PROVIDE MINIMUM MESH LAPS TO CROSS WIRES OF REINFORCING MESH, SO TWO OUTERMOST WIRES OF ONE SHEET OVERLAP TWO OUTERMOST WIRES OF ADJACENT SHEET BY AT LEAST 25 mm. THUS:

MESH TYPE	END LAP	SIDE LAP
RECTANGULAR MESHES	225	125
SQUARE MESHES SL102 TO SL42	225	225
SL81	125	125
TRENCH MESH	500	N/A

USE LAP LENGTHS BASED ON LARGEST WIRE SPACING. DO NOT LAP MORE THAN THREE SHEETS AT ANY ONE POINT.

R29. ALTERNATIVELY USE N12 SPLICE BARS TO LAP ADJACENT SHEETS OF MESH, SPACING OF SPLICE BARS TO MATCH SPACING OF BARS IN MESH, SPLICE BARS TO OVERLAP MESH BY 750 mm MINIMUM UNO.

R30. DO NOT WELD REINFORCEMENT, CAST-IN ITEMS etc UNLESS SHOWN ON DRAWINGS OR OTHERWISE APPROVED BY SUPERINTENDENT. WHERE ALLOWED, WELDING OF REINFORCEMENT (INCLUDING TACK-WELDING FOR FIXING PURPOSES) TO COMPLY WITH AS3600 AND AS/NZS1554.3. DO NOT WELD REINFORCEMENT WITHIN 75 mm OF A SECTION THAT HAS BEEN BENT (100 mm FOR N28 AND N32 BARS, 125 mm FOR N36 BARS). EXTENT OF WELD INSPECTION / TESTING TO BE:

- VISUAL SCANNING 100% OF WELDS
- VISUAL EXAMINATION 50% OF WELDS
- RADIOGRAPHIC OR ULTRASONIC 5% OF FILLET WELDS AND 100% OF BUTT WELDS

R31. DO NOT BEND OR STRAIN REINFORCEMENT IN A WAY THAT MAY CAUSE DAMAGE. BEND DIAMETERS TO BE TO AS3600. BARS TO BE BENT COLD UNO. GRADE 250 BARS MAY BE BENT AT TEMPERATURES UP TO 850°C. DO NOT COOL HEATED BARS BY QUENCHING.

R32. ENSURE HOT BENDING OF REINFORCEMENT COMPLIES WITH AS3600 CLAUSE 17.2.3.1. DO NOT HEAT D500N REINFORCEMENT. USE TEMPERATURE INDICATOR PAINTS AND / OR CRAYONS TO ENSURE REINFORCEMENT TEMPERATURE DOES NOT EXCEED MANUFACTURERS' RECOMMENDED LIMITS, 450 DEGREES MAXIMUM. REINFORCEMENT THAT CHANGED COLOUR DURING HEATING MUST BE DISCARDED.

R33. DO NOT BEND REINFORCEMENT AFTER GALVANIZING OR APPLICATION OF OTHER COATINGS.

R34. PERCUSSION ROTARY DRILL HOLES FOR GROUTED BARS AND THREADED RODS (NOTE: CORED HOLES MUST BE ROUGHENED). HOLE DIAMETER AND INSTALLATION TO BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. EMBEDMENT LENGTHS AS PER DRAWINGS.

R35. ENSURE HOLES FOR GROUTED BARS AND THREADED RODS ARE DRY AND CLEANED THOROUGHLY BEFORE INSTALLING ANCHORS. WIRE BRUSH HOLES AND BLOW OUT WITH COMPRESSED AIR TO REMOVE DUST. FILL HOLE WITH ADHESIVE USING A CAULKING GUN FROM BOTTOM OF HOLE OUTWARDS. DISCARD ADHESIVE FROM FIRST TRIGGER PULL. PROVIDE BARS / THREADED RODS WITH CHAMFERED (CHISELLED) ENDS. BARS TO BE DEGREASED, AND FLAKY RUST REMOVED. ROTATE WHILE INSERTING TO ENSURE FULLY COATED AND PUSH FULLY INTO HOLE. PROTECT FROM DISTURBANCE DURING CURING. FOLLOW MANUFACTURER'S RECOMMENDATIONS.

PRESTRESSING

P1. PRESTRESSING WORKMANSHIP, MATERIALS, PROCEDURES AND EQUIPMENT TO COMPLY WITH AS3600.

P2. PRESTRESSING REINFORCEMENT RATIOS SHOWN FOR INFORMATION ONLY. CONTRACTOR IS RESPONSIBLE FOR DETERMINING PRESTRESSING REINFORCEMENT REQUIRED. CONTRACTOR TO EMPLOY SPECIALIST SUB-CONTRACTOR FOR THIS WORK.

P3. TENDONS TO BE 15.2 mm DIAMETER RELAX 2 STRAND TO AS/NZS4672.1 WITH MINIMUM BREAKING LOAD OF 250 kN, MODULUS OF ELASTICITY (E) OF 195,000 MPa.

P4. SUPPLY STRAND IN COILS SUFFICIENTLY LARGE SO STRAND RETAINS ITS PHYSICAL PROPERTIES AND IS STRAIGHT WHEN UNWOUND. PROVIDE MANUFACTURER'S TEST CERTIFICATES FOR EACH COIL. MARK STRANDS TO IDENTIFY COIL NUMBER.

P5. STRAND LENGTHS TO INCLUDE STRESSING ALLOWANCE AT EACH END.

P6. DO NOT USE GREASE TO DEBOND TENDONS.

P7. PROTECT TENDONS AND PREVENT DAMAGE.

P8. STRESS TO 100% JACKING FORCE AT f_c = 40 MPa.

P9. CONFIRM CONCRETE TRANSFER STRENGTH BY TESTING SITE-CURED CYLINDERS PRIOR TO EACH STRESSING STAGE.

P10. MINIMISE ECCENTRICITIES AND LATERAL EFFECTS WHEN TRANSFERRING PRESTRESS FORCES FROM TENDONS TO CONCRETE.

P11. MAXIMUM JACKING FORCE TO BE 85% OF MINIMUM BREAKING LOAD.

P12. TOTAL INITIAL FORCE IN TENDONS TO BE 188 kN PER STRAND AFTER ALLOWANCE FOR LOSSES IN GRIPS, JACKETS etc.

P13. CUT ENDS OF PRESTRESSING STRAND FLUSH WITH CONCRETE. CLEAN AND PROTECT EXPOSED STRAND WITH 6 mm APPROVED EPOXY.

P14. EMBEDDED FIXTURES (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, STAINLESS REINFORCING etc) WITHIN COVER CONCRETE OR EXPOSED TO AIR MUST NOT BE IN CONTACT WITH REINFORCING STEEL. PROVIDE ISOLATING STRIPS BETWEEN DISSIMILAR STEELS AND TO SEPARATE EXPOSED FIXTURES.

DELIVERABLES

P15. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS, REFER GENERAL-DELIVERABLES NOTES. DESIGN CALCULATIONS / SHOP DRAWINGS TO SHOW: MARKING PLAN, ARRANGEMENT OF MEMBERS, LOCATION OF MEMBERS IN BUILDING, LOADING PARAMETERS ASSUMED, MATERIAL PROPERTIES AND DESIGN STRESSES, SIZE OF EACH MEMBER, PRESTRESSING STRAND NUMBERS AND DRAPE DIMENSIONS, TOLERANCES, STRESSING FORCES, STAGES AND PROCEDURES, ASSUMED LOSSES FOR SHRINKAGE, CREEP, RELAXATION AND DRAW-IN, EXPECTED DEFORMATIONS, ANCHORAGE DETAILS etc.

P16. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.

P17. PROVIDE RESULTS OF STRESSING EXTENSIONS TO SUPERINTENDENT FOR APPROVAL IMMEDIATELY AFTER STRESSING.

PRECAST CONCRETE

W1. COMPLY WITH REQUIREMENTS OF AS3850 PREFABRICATED CONCRETE ELEMENTS CODE, NATIONAL CONSTRUCTION CODE (NCC), CONCRETE NOTES AND SPECIFICATION.

W2. PRECAST CONCRETE UNITS HAVE BEEN DESIGNED FOR INSTALLED CONDITIONS ONLY.

W3. PRECAST UNITS TO BE SUPPLIED BY A SPECIALIST SUB-CONTRACTOR.

W4. SUPPLIER TO DESIGN PROPS, CONNECTIONS, FIXING DETAILS AND JOINTS etc TO PROVIDE SATISFACTORY PERFORMANCE FOR STABILITY, SERVICEABILITY AND STRENGTH REQUIREMENTS DURING MANUFACTURE, STRIPPING, HANDLING, LIFTING, STACKING, TRANSPORT, ERECTION AND INSTALLATION OPERATIONS. PROVIDE TEMPORARY PROPPING AND ADDITIONAL REINFORCEMENT AS REQUIRED.

W5. USE FORMWORK BOND BREAKERS AND STRONG BACKS AS REQUIRED.

W6. DO NOT APPLY ACID TREATMENTS TO PRECAST CONCRETE SURFACES UNO.

W7. LOCATE CONNECTIONS TO FACILITATE CONCRETE PLACEMENT, EASE OF ACCESS DURING INSTALLATION AND FINAL AESTHETICS.

W8. USE CAST IN FERRULES FOR STRUCTURAL FIXINGS, NOT MECHANICAL OR CHEMICAL ANCHORS.

W9. DO NOT USE REBARS OR STRESSING TENDONS AS LIFTING LOOPS. DO NOT USE FIXINGS FOR LIFTING. USE PROPRIETARY LIFTING INSERTS WITH PUBLISHED LOAD RATINGS. LIFT OR SUPPORT PRECAST UNITS ONLY AT SPECIFIED POINTS. LOCATE LIFTING POINTS TO SUIT CENTRE OF GRAVITY OF UNIT.

W10. SUBMIT NAME, CONTACT DETAILS AND CREDENTIALS OF PROPOSED MANUFACTURER OF PRECAST UNITS.

W11. PROVIDE TEMPORARY BRACING TO AS3850 AND AS/NZS1170.2 AS REQUIRED TO ENSURE STABILITY DURING CONSTRUCTION.

W12. DO NOT PLACE LIFTING ATTACHMENTS, HOLES OR OTHER TEMPORARY FIXINGS etc ON VISIBLE FACES OF UNITS.

W13. ENSURE THAT PRECAST UNITS REMAIN UNCRACKED AND UNDAMAGED DURING MANUFACTURE, HANDLING, ERECTION AND INSTALLATION OPERATIONS. PROVIDE PROTECTION TO AVOID CRUSHING AND / OR CHAFING. PROTECT UNITS FROM STAINING, DISCOLOURATION AND OTHER DAMAGE.

W14. HOT DIP GALVANIZE CAST IN STEELWORK INCLUDING LIFTING INSERTS, FERRULES, DOWEL BARS, ANGLE CLEATS, BOLTS, NUTS WASHERS AND PACKERS etc. MINIMUM GALVANIZED COATING THICKNESS 600 gm².

W15. USE RIGID FORMWORK AND INTENSE COMPACTION, SUCH AS VIBRATING TABLES OR FORM VIBRATORS, TO AS3600.

W16. PRECAST UNIT TOLERANCES TO BE TO AS3600 EXCEPT WHERE VARIED BY SPECIFICATION.

W17. FINISH SURFACE OF PRECAST UNITS IN ACCORDANCE WITH SPECIFICATION.

W18. EACH UNIT TO HAVE LEGIBLE MARKING (HIDDEN IN COMPLETED STRUCTURE) INCLUDING UNIT THICKNESS, REINFORCING SIZES AND SPACING, NUMBER OF STRANDS AND STRAND DIAMETER, CONCRETE COVER, DATE OF CASTING, CORRECT ORIENTATION OF UNIT AND WEIGHT, POSITION FOR TEMPORARY BEARING DURING STORAGE etc.

W19. SET ASIDE DAMAGED UNITS (CRACKED, SPALLED, INADEQUATE COVER) FOR INSPECTION BY SUPERINTENDENT. REPAIR OR RE-CAST AS INSTRUCTED.

W20. ALLOW FOR DEPARTMENT OF LABOUR OR OTHER REQUIREMENTS GOVERNING HANDLING, LIFTING, ROTATION OR TRANSPORT OF PRECAST UNITS.

W21. WHERE PRECAST UNITS ARE TO BE SUPPORTED BY CONCRETE MEMBERS, DO NOT ERECT UNITS UNTIL 28 DAY STRENGTH HAS BEEN ACHIEVED.

W22. SEAL GAPS BEFORE GROUTING. USE NON-SHRINK NON-STAINING GROUT WITH 28 DAY CHARACTERISTIC STRENGTH OF 40 MPa. SUBMIT DETAILS FOR APPROVAL.

W23. JOINTS BETWEEN UNITS TO BE AS SPECIFIED ON DRAWINGS. TOLERANCE ON WIDTH +5, -0 mm. PROVIDE JOINTS IN WALL FINISHES AT JOINTS BETWEEN UNITS UNO. PLACE POLYSTYRENE IN JOINTS DURING CONSTRUCTION TO ENSURE HARD MATERIALS AND OTHER DEBRIS DOES NOT FALL INTO OR REMAIN IN JOINTS. REMOVE POLYSTYRENE PRIOR TO FILLING JOINTS, OR AT COMPLETION. MAINTAIN JOINTS FOR UNIFORM PLACEMENT OF SEALANTS.

W24. PROTECT, CLEAN AND MAINTAIN PERMANENT BEARINGS DURING CONSTRUCTION.

DELIVERABLES

W25. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS (PREPARED BY A SUITABLY QUALIFIED CHARTERED ENGINEER REGISTERED WITH REGISTERED PROFESSIONAL ENGINEER OF QUEENSLAND (RPEQ), REFER GENERAL-DELIVERABLES NOTES. DRAWINGS TO SHOW PROPOSED DETAILS FOR DESIGN, MANUFACTURE, ASSEMBLY, TRANSPORT AND INSTALLATION OF PRECAST CONCRETE ELEMENTS, INCLUDING FOLLOWING INFORMATION SPECIFIED IN AS3850.2 CLAUSE 2.10 AND APPENDIX A, PROJECT TITLE AND MANUFACTURER'S NAME, SHAPE AND PROFILE DRAWINGS INCLUDING WEIGHT OF UNITS, REINFORCEMENT AND TENDON DETAILS INCLUDING LOCATIONS, SIZES, MATERIALS, DUCTILITY AND STRESS GRADES, CAST IN ITEMS INCLUDING LOCATIONS, SIZES, DETAILS, MATERIALS, CORROSION PROTECTION AND GRADE OF FERRULES, PLATES, CUT-OUTS AND OPENINGS, ANCHORS, LIFTING DEVICES, PLUGS FOR SEALING RECESSES etc. CAST IN SERVICES, EQUIPMENT AND METHODS OF HANDLING, LIFTING, TRANSPORT INCLUDING LOCATION OF LIFTING POINTS, MAXIMUM LOADS ON LIFTING AND BRACING POINTS, EVIDENCE OF LOAD CAPACITY OF LIFTING AND BRACING INSERTS AND ATTACHMENTS IN FORM OF TEST REPORTS OR CALCULATIONS, CONCRETE MIX DESIGN, FORMWORK TYPE, SURFACE FINISH CLASS AND SURFACE TREATMENT, CURING AND PROTECTION METHODS, IDENTIFICATION MARKS, EQUIPMENT AND METHODS FOR HANDLING, TRANSPORT AND INSTALLATION, ERECTION AND INSTALLATION CONDITIONS.

W26. SUBMIT SAFE WORK METHOD STATEMENT SPECIFIC TO PROJECT FOR MANUFACTURE AND INSTALLATION OF UNITS. CARRY OUT WORK ONLY UNDER WIND AND TEMPERATURE CONDITIONS CONSISTENT WITH SAFE WORK METHOD STATEMENT AND STRUCTURAL CAPABILITY OF UNIT.

0	APPROVED ISSUE	WRC	*MI	*AA	12.04.21	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date



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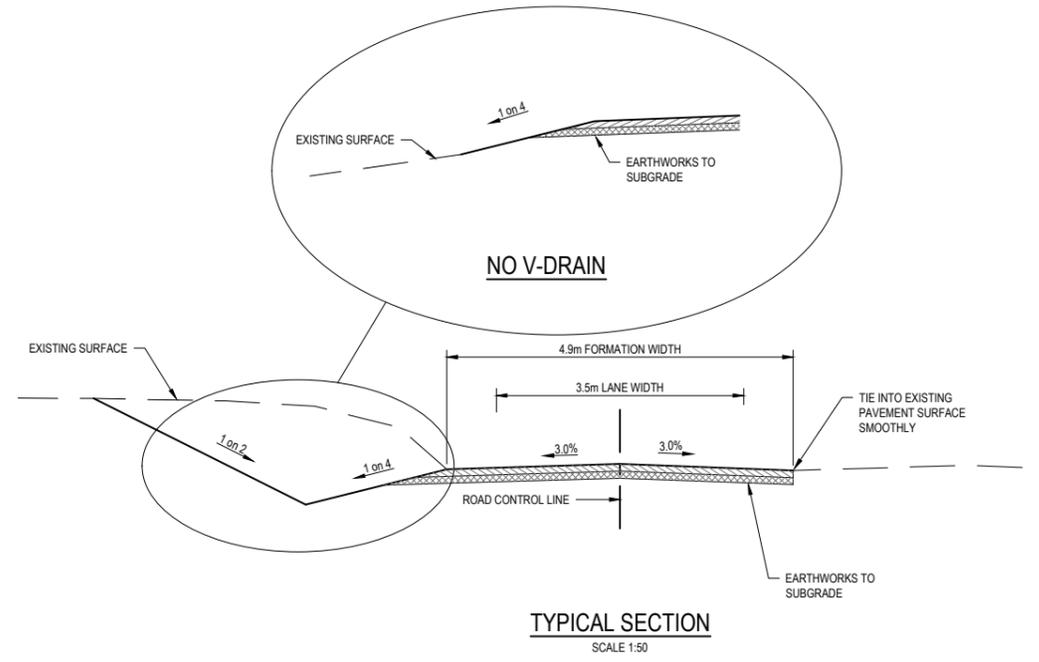
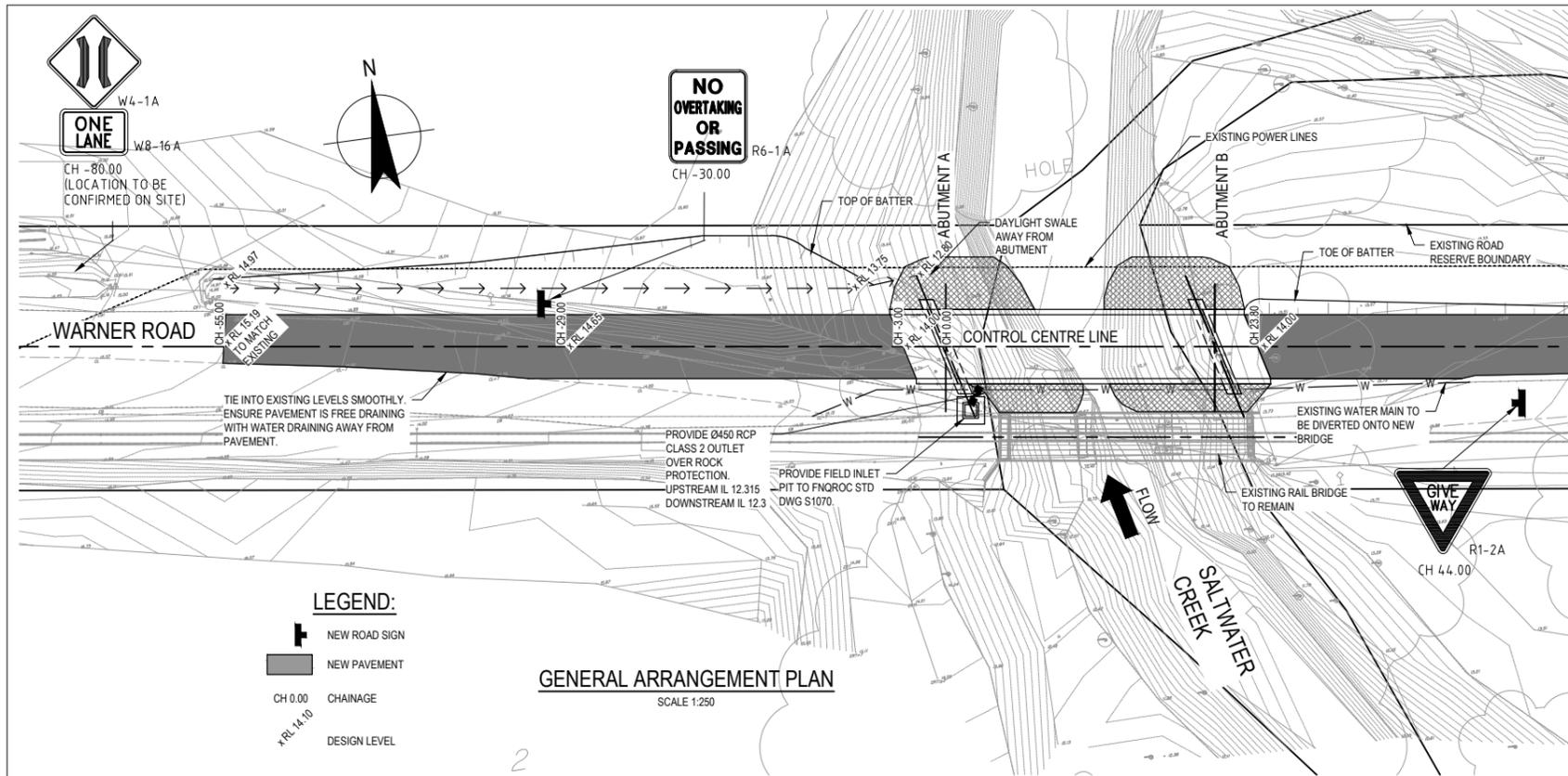
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Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
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DOUGLAS SHIRE COUNCIL
WARNERS AND ANICHS BRIDGE UPGRADES
WARNERS AND ANICHS BRIDGE
STRUCTURAL NOTES - SHEET 3

Original Size
A1 Drawing No: **12540**

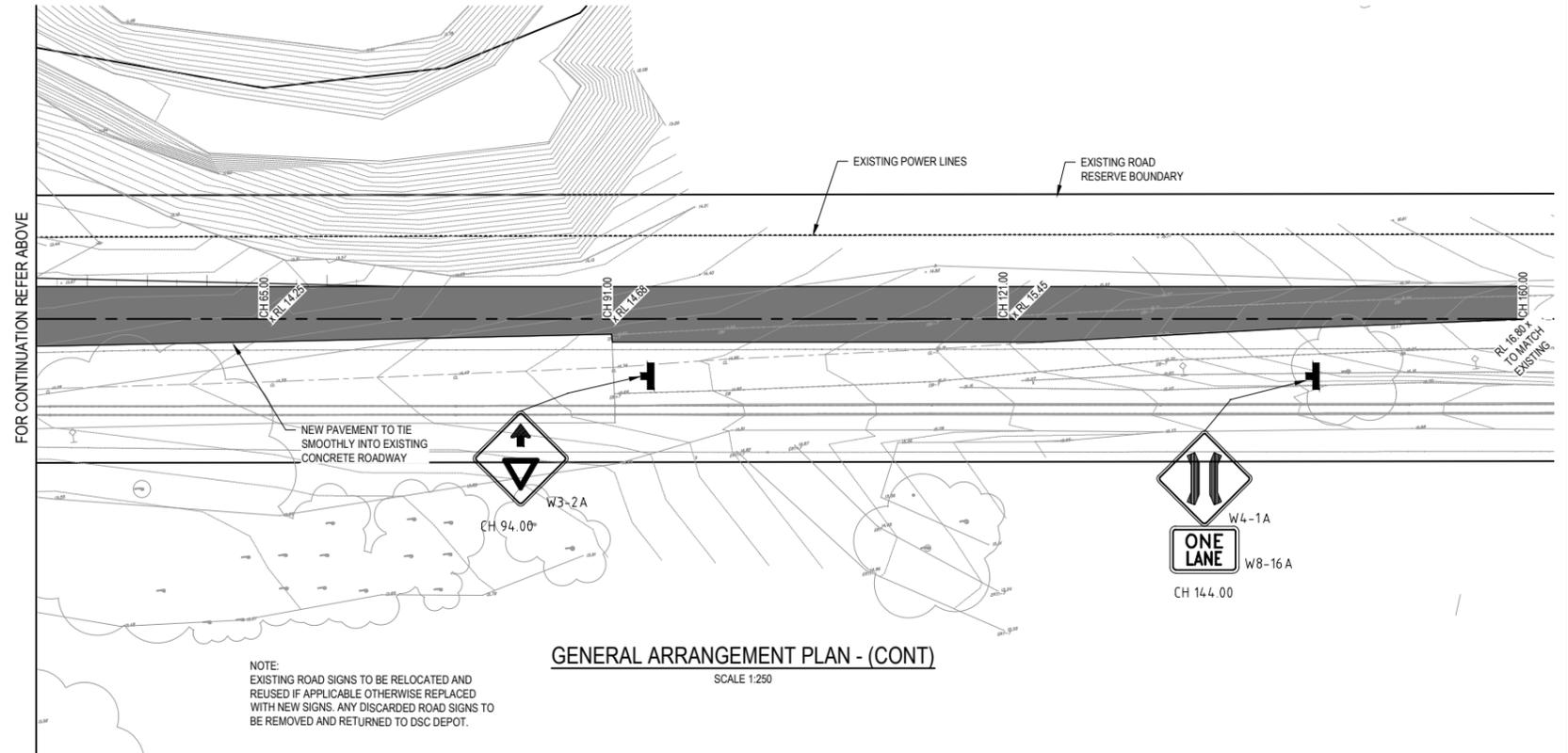
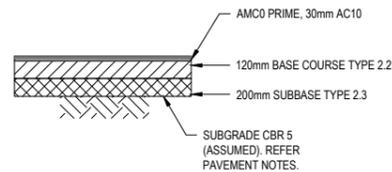


GENERAL NOTES

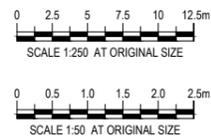
- LEVELS DATUM - AHD
ORIGIN OF LEVELS: STN Z (E:328744.272 N:8175586.355) (RL 16.478)
MERIDIAN: MGA ZONE 55
- ALL EXISTING SERVICES AND UTILITIES SHALL BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
- CONTRACTOR SHALL VERIFY ALL SETOUT DETAILS AND DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF SITE WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE SUPERINTENDENT IMMEDIATELY.
- SPOIL MATERIAL TO BE DETERMINED IF SUITABLE AND TO BE USED AS DIRECTED BY SUPERINTENDENT. IF NOT SUITABLE CONTRACTOR TO REMOVE AND DISPOSE OFF SITE AS DIRECTED BY SUPERINTENDENT.
- GRADE EVENLY BETWEEN LEVELS SHOWN.
- ALL NEW SIGNS AND PAVEMENT MARKING TO BE CONSTRUCTED IN ACCORDANCE WITH MUTCD PART 2
- ALL SIGNS TO BE INSTALLED AS PER FNQROC STANDARD DRAWING S1041.
- ALL EXISTING SIGNS TO BE RETAINED UNLESS NOTED OTHERWISE.
- ALL RRPMS TO BE INSTALLED AS PER THE MUTCD PART 2.

- PAVEMENT NOTES**
- PAVEMENT DESIGN HAS BEEN BASED ON AN ASSUMED SUBGRADE CBR 5.
 - DESIGN TRAFFIC LOADING = 1x10⁵ ESA
 - THE SUBGRADE CBR SHOULD BE CONFIRMED BY THE CONTRACTOR BEFORE COMMENCEMENT OF WORK.
 - SUBGRADE TO BE TESTED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND RESULTS GIVEN TO THE SUPERINTENDENT TO CONFIRM DESIGN BEFORE COMMENCEMENT OF PAVEMENT WORKS.
 - EMBANKMENT FILL IN ACCORDANCE WITH DTMR SPECIFICATION MRTS04
 - UNBOUND PAVEMENT IN ACCORDANCE WITH DTMR SPECIFICATION MRTS05.
 - CONTRACTOR TO ENSURE TIE INTO EXISTING PAVEMENT IS TO CLEAN EDGE AND MATCH EXISTING LEVELS.
 - CONTRACTOR TO NOMINATE SPREAD RATE AND SPRAY RATE ON-SITE TO SUIT SITE CONDITIONS.

- EARTHWORKS**
EARTHWORKS SHALL BE IN ACCORDANCE WITH A.S.3798 INCLUDING THE FOLLOWING:
- THE SITE SHALL BE STRIPPED OF ALL DEBRIS AND ALL VEGETATIVE MATTER AND THE ASSOCIATED LAYER OF TOPSOIL TO A DEPTH OF 150mm MIN. FILL HOLES LEFT FROM TREES, ETC, REMOVED DURING CLEARING TO BE BACKFILLED. FILL MATERIAL TO BE COMPACTED IN ACCORDANCE WITH NOTE 3 BELOW.
 - THE TOP 150mm OF SUBGRADE SHALL BE COMPACTED TO A DENSITY OF NOT LESS THAN 98% OF THE MAXIMUM DRY DENSITY AS DETERMINED IN ACCORDANCE WITH METHOD 5.1 OF A.S. 1289 (STANDARD COMPACTION); ANY LOOSE OR UNSUITABLE MATERIAL ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH AN APPROVED FILL MATERIAL AS PER NOTE 3.
 - FILL MATERIAL SHALL BE AN APPROVED GRANULAR MATERIAL (CBR 15) AND SHALL BE PLACED IN LAYERS NOT EXCEEDING 300mm IN THICKNESS. FILL SHALL BE COMPACTED TO 98% OF THE MAXIMUM DRY DENSITY AS PER NOTE 2 ABOVE.
 - SELECTED FILL MATERIAL SHALL COMPLY WITH THE FOLLOWING:
 - INORGANIC, LESS THEN 0.5% SULPHUR
 - MAXIMUM PARTICLE SIZE 75mm
 - PROPORTION PASSING 0.075mm SIEVE: 25% MAXIMUM.
 - PLASTICITY INDEX: 2%, 15%.
 - PROPORTION EXCEEDING PARTICLE SIZE OF 50mm: 75% MINIMUM.
 - CONFIRM THE SPECIFIED DEGREE OF COMPACTION HAS BEEN ACHIEVED BY TESTING. TESTS TO BE CARRIED OUT BY A NATA REGISTERED FIRM. CARRY OUT ONE TEST PER LAYER FOR EVERY 500 SQUARE METRES OF FILL AND FOR FILL IN EACH LOCATION.
 - ALL EARTHWORKS PERFORMED BOTH PRIOR TO CONSTRUCTION AND SUBSEQUENTLY SHOULD BE CARRIED OUT IN A RESPONSIBLE MANNER IN ACCORDANCE WITH ACCEPTED BUILDING PRACTICES AND AUSTRALIAN STANDARD AS 3798-1990 'GUIDELINES ON EARTHWORKS FOR COMMERCIAL AND RESIDENTIAL DEVELOPMENTS'. UNLESS NOTED OTHERWISE, ALL LANDSCAPED AREAS ARE TO BE GRASS SEEDDED IN ACCORDANCE WITH FNQROC SPECIFICATION S8 - LANDSCAPING.



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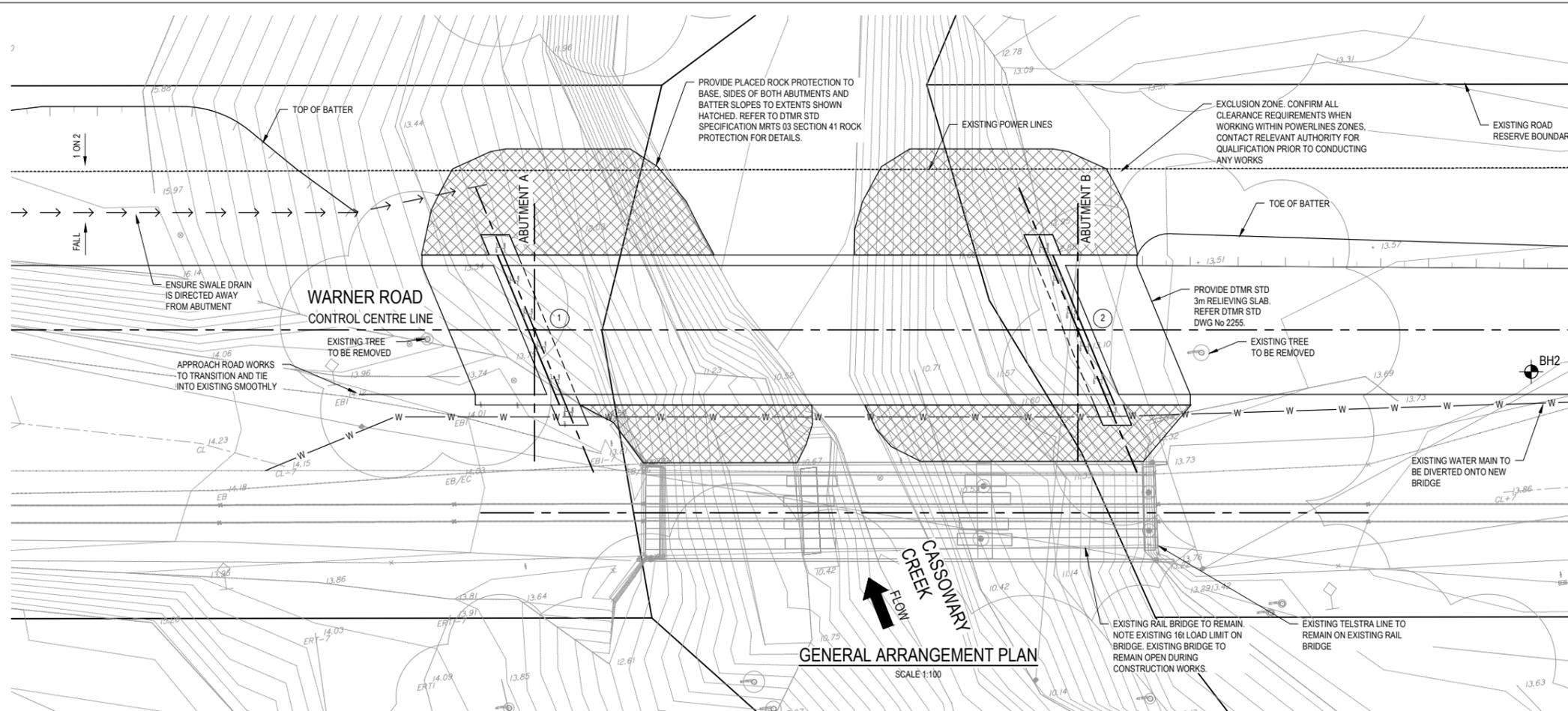
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Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
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Client **DOUGLAS SHIRE COUNCIL**
Project **WARNERS AND ANICHS BRIDGE UPGRADES**
Title **WARNERS BRIDGE GENERAL ARRANGEMENT**

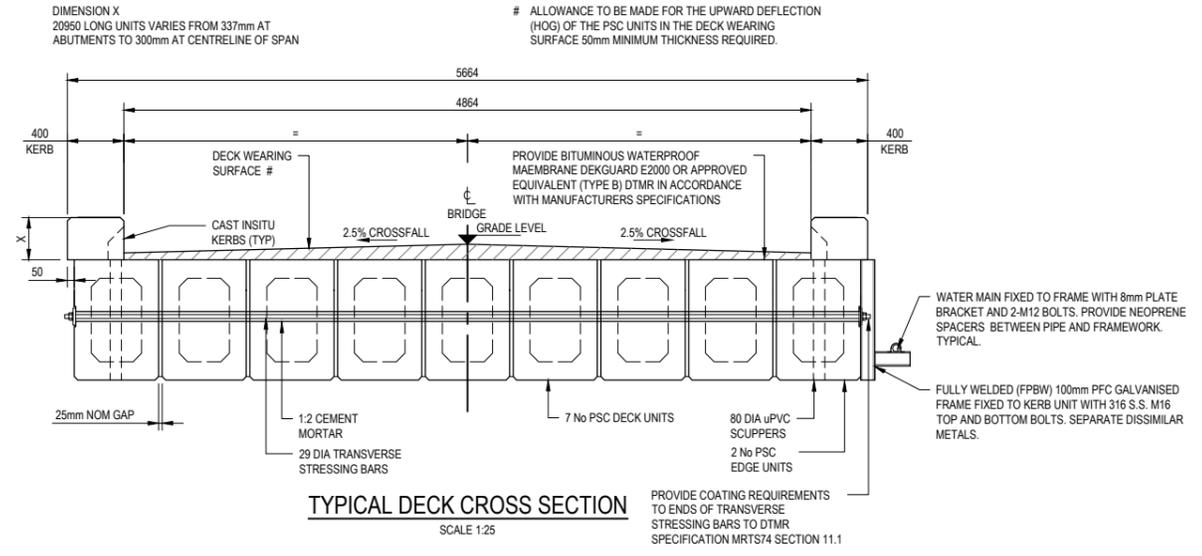
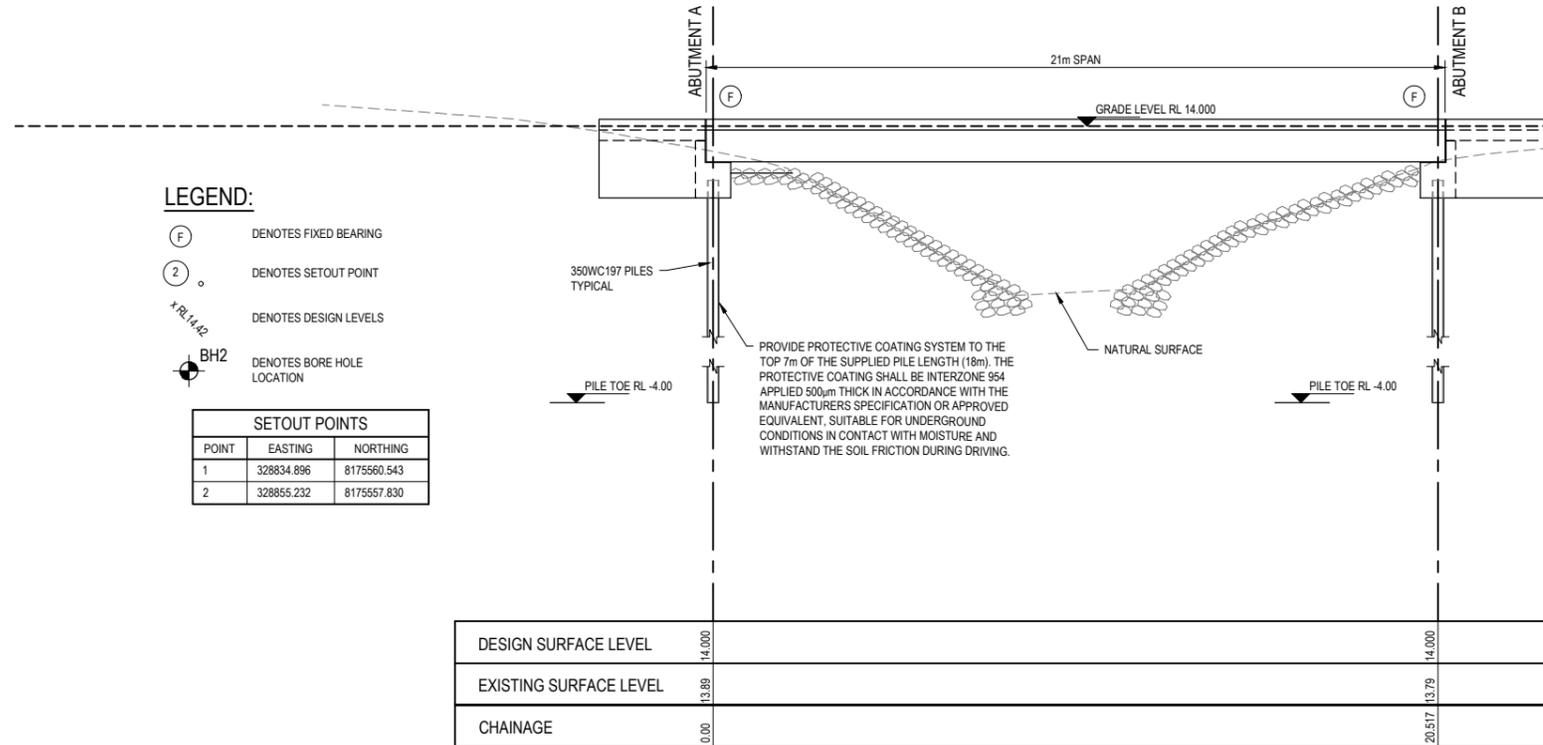
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Rev: 0



GENERAL NOTES

1. READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES THEN SPECIFICATION.
2. CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONAL AND GENERAL PUBLIC IN ACCORDANCE WITH LEGISLATIVE REQUIREMENTS, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE.
3. REFER TO GEOTECHNICAL INVESTIGATION REPORT No104527.00 PREPARED BY DOUGLAS PARTNERS DATED FEBRUARY 2021. NOTIFY SUPERINTENDENT IF CONDITIONS ENCOUNTERED DIFFER FROM THOSE DESCRIBED IN THE REPORT AND SEEK DIRECTIONS.
4. LEVELS DATUM - AHD
ORIGIN OF LEVELS: STN Z (E:328744.272 N:8175586.355) (RL 16.478)
MERIDIAN: MGA ZONE 55
5. NO FILLING TO BE PLACED ABOVE SOFFIT OF ABUTMENT HEADSTOCKS UNTIL AT LEAST TWO (2) DAYS AFTER ERECTION OF ALL SPANS AND GROUTING OF DOWEL BAR HOLES.
6. LEVELS ARE CALCULATED ALLOWING FOR BITUMINOUS CONCRETE DECK WEARING SURFACE ON ROADWAY AT ABUTMENTS TO BE 15mm THICK AT CENTERLINE OF ROAD AND 100mm THICK AT KERBS. THE THICKNESS OF DWS AT ANY POINT MUST NOT BE LESS THAN 50mm THICK.
AN ALLOWANCE OF 37mm (30 DAYS AFTER TRANSFER, 45mm AT 100 DAYS) HAS BEEN ASSUMED FOR THE UPWARD DEFLECTION (HOG) OF THE PSC UNITS IN CALCULATING LEVELS.
7. REINFORCING STEEL TO BE AUSTRALIAN MADE GRADE 500N TO AS 1302.
8. ALL BOLTS AND NUTS TO BE HOT DIP GALVANISED TO AS 1214 UNO. ALL WASHERS TO BE HOT DIP GALVANISED TO AS1650 UNO. ANY GALVANISED ELEMENT IN CONTACT WITH CEMENTITIOUS MATERIAL TO BE PASSIVATED IN 0.2% SODIUM DICHROMATE SOLUTION.
9. SPACING OF REINFORCEMENT IN HEADSTOCKS MAYBE ALTERED SLIGHTLY IF NECESSARY TO CLEAR CORED HOLES.
10. ALL EXPOSED EDGES TO HAVE 25x25 CHAMFERS UNLESS SHOWN OTHERWISE.
11. A DATE PLATE IS TO BE CAST INTO THE TOP OF THE LEFT HAND SIDE WALL AT ABUTMENT A SIMILAR TO DTMR STANDARD DATE PLATE DRAWING 2005. CONFIRM DATE PLATE WITH CLIENT.
12. A BRASS BENCH MARK IS TO BE CAST INTO THE TOP OF THE LEFT HAND WINGWALL AT ABUTMENT A.
13. LOADINGS IN ACCORDANCE WITH:
(a) DESIGN LINE LOAD IS AUSTRORoads T44 TRUCK LOADING AND L4 LANE LOADING.
(b) PILE TIP LEVELS SHOWN ARE CONTRACT LEVELS AND ARE SUBJECT TO VARIANCE AS DIRECTED BY THE SUPERINTENDENT.
(c) BRIDGE DESIGN IS DESIGNED AS SINGLE LANE IN ACCORDANCE WITH LOW TRAFFIC VOLUME AND AUSTRORoads REQUIREMENTS.
(d) DESIGN MAXIMUM STREAM VELOCITY - 4.4m/s - 1 IN 2000 YEAR EVENT
(e) BRIDGE IS DESIGNED AS SUBMERGED WITH 1.2m DEBRIS MAT
(f) BRIDGE EARTHQUAKE CLASSIFICATION - BEDC-1
(g) ULTIMATE BRAKING FORCE = 600kN
14. PILE ULTIMATE LOAD:
350WC197 PILE - 500 kN COMPRESSION 250 kN TENSION (1000 kN COMPRESSION 500 kN TENSION GEOTECHNICAL LOAD)
15. ALL EXISTING SERVICES AND UTILITIES SHALL BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
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17. SPOIL MATERIAL TO BE USED ON SITE AS DIRECTED BY SUPERINTENDENT.
18. GRADE EVENLY BETWEEN LEVELS SHOWN.

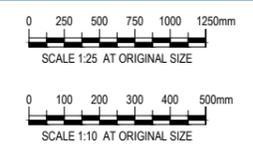


LEGEND:

- (F) DENOTES FIXED BEARING
- (2) DENOTES SETOUT POINT
- x.R.L.4.2 DENOTES DESIGN LEVELS
- BH2 DENOTES BORE HOLE LOCATION

POINT	EASTING	NORTHING
1	328834.896	8175560.543
2	328855.232	8175557.830

No	Revision	Note	Drawn	Job Manager	Project Director	Date
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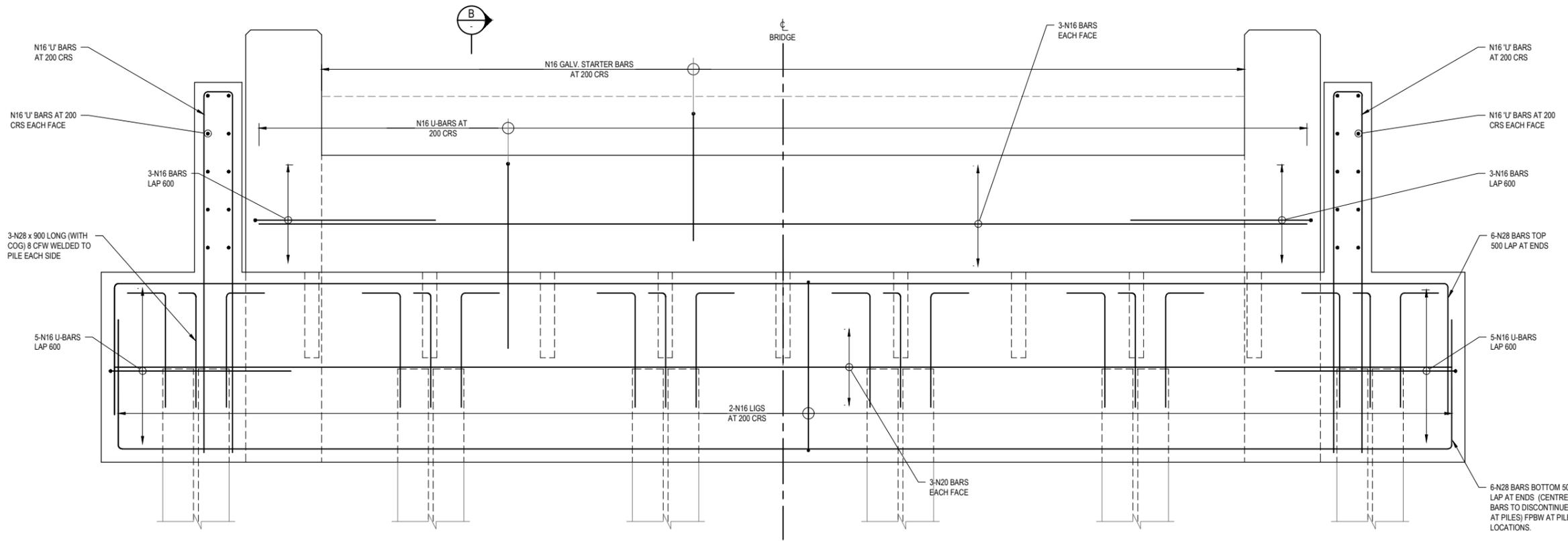
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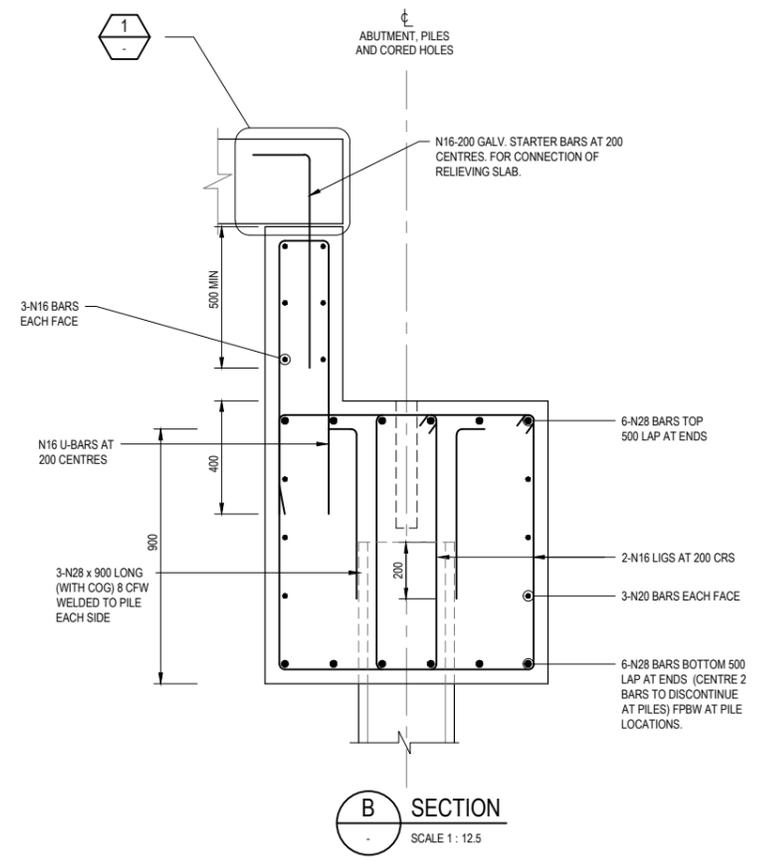
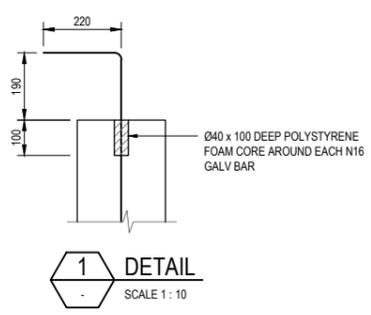
DOUGLAS SHIRE COUNCIL
WARNERS AND ANICHS BRIDGE UPGRADES
WARNERS BRIDGE
GENERAL ARRANGEMENT

Client
Project
Title
Original Size
Drawing No: **12540427-S020**
Rev: **0**

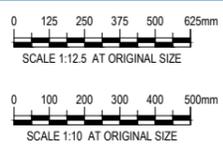
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ELEVATION - ABUTMENT B REINFORCEMENT
(ABUTMENT A SIMILAR)
 SCALE 1:12.5



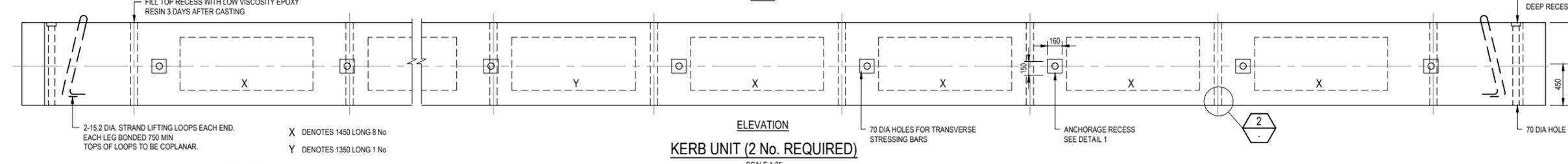
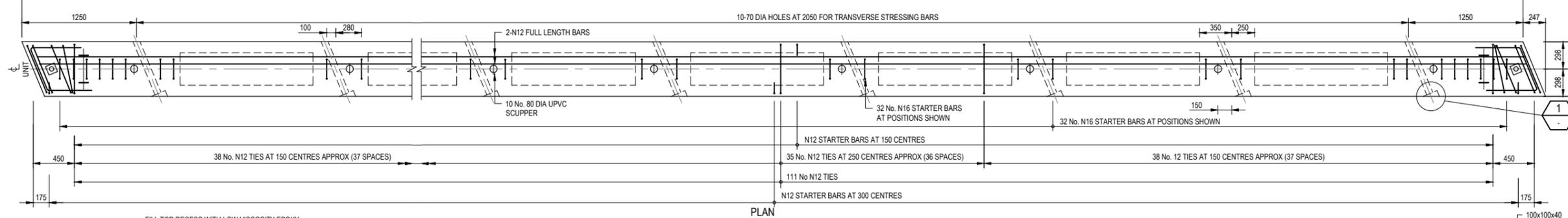
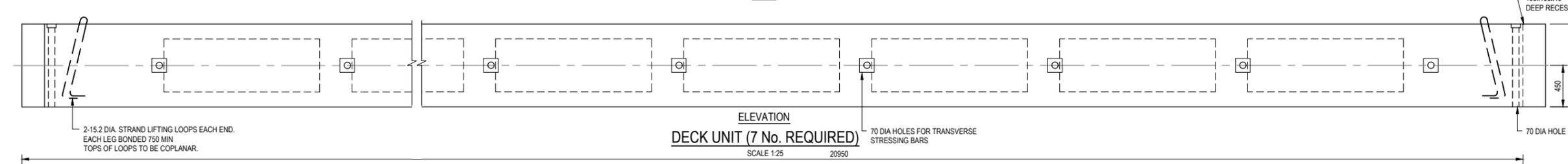
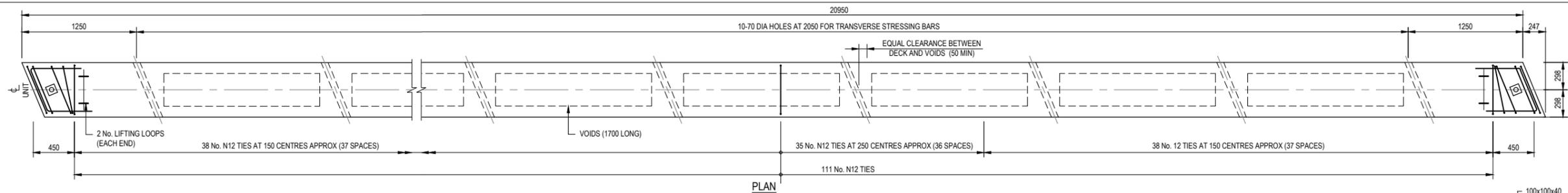
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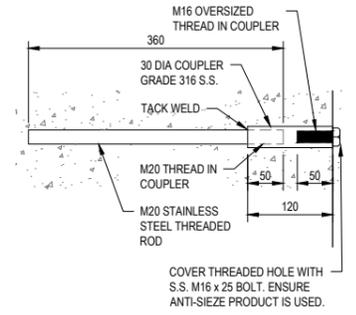
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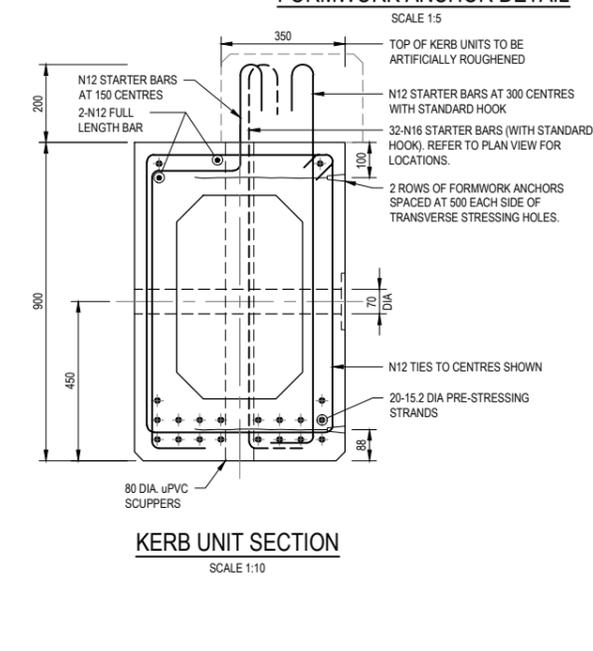
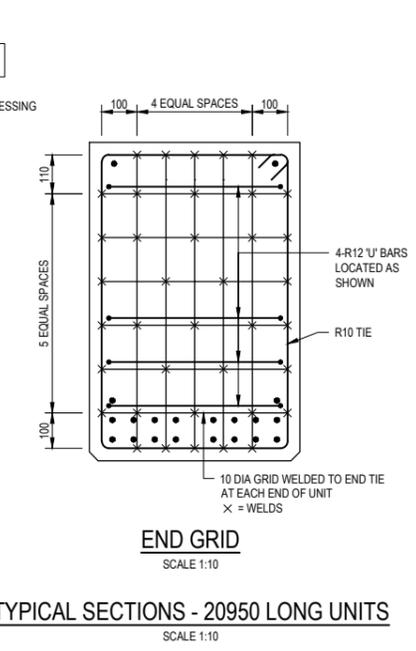
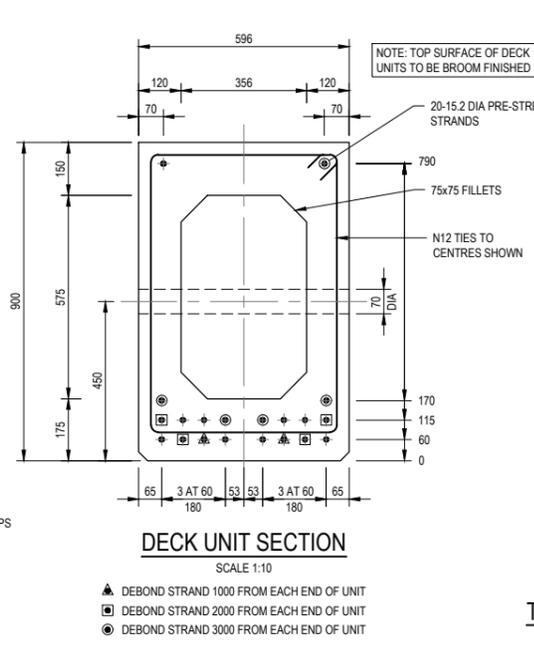
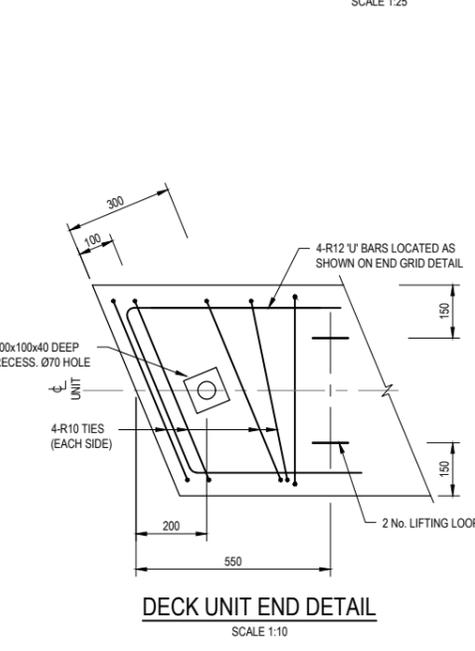
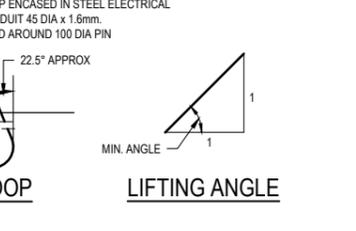
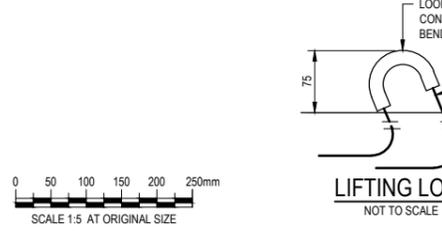
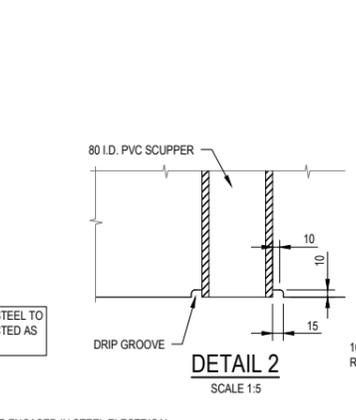
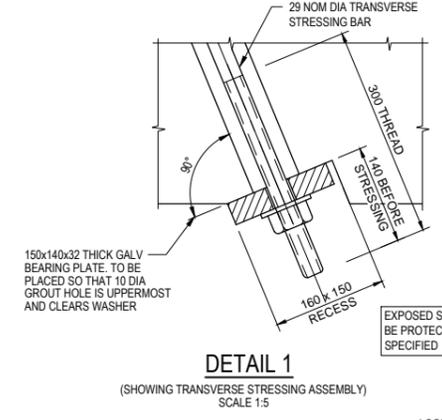
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DOUGLAS SHIRE COUNCIL	WARNERS AND ANICHS BRIDGE UPGRADES	WARNERS BRIDGE ABUTMENT DETAILS	A1	12540427-G021	0



- NOTES:**
- CONCRETE CLASS TO BE 50 MPa/20. STRENGTH AT TRANSFER TO BE 40 MPa MINIMUM. EXPOSURE CLASSIFICATION B2. CONCRETE SHALL BE CAST IN RIGID FORMS AND SUBJECTED TO INTENSE VIBRATION.
 - COVER TO REINFORCING STEEL TO BE 35mm UNO.
 - STRANDS TO AS 4672.1 & 4672.2 - 7 WIRE ORDINARY - 15.2 - 1750 - RELAX 2. PRETENSIONING FORCE AT STRESSING = 188 kN PER STRAND.
 - ALL CHAMFERS WHERE SHOWN TO BE 25mm x 25mm MAXIMUM.
 - ENDS OF STRANDS TO BE COATED WITH 0.3mm MINIMUM OF TACK EPOXY AFTER GRINDING FLUSH WITH ENDS OF UNITS (3 COATS MINIMUM).
 - SPACING OF LIGATURES IN UNITS MAY BE ALTERED SLIGHTLY TO CLEAR CORED HOLES.
 - ALL REINFORCEMENT TO CONFORM TO AS 4671. DEFORMED BARS GRADE D500N. ROUND BARS GRADE R250N.
 - COUPLERS FOR ANCHORS TO AS 1444 OR APPROVED EQUIVALENT. THREADS FOR COUPLERS TO AS 1275. TACK WELDING OF COUPLERS TO CONFORM TO AS 1554.6
 - BEARING PLATES AND WASHERS TO BE HOT DIP GALVANISED TO AS 1650 AND NUTS TO AS 1214.
 - TACK WELDING FOR LOCATION PURPOSES TO CONFORM TO AS 1554.3 CLAUSES 3.3.1 AND 3.3.2. WELDING CONSUMABLES TO BE E4916, E4918 OR W50X.
 - VOIDS SHALL BE CELLULAR POLYSTYRENE GRADE SL TO AS 1366.3.
 - WHEN CASTING UNITS, THE MANUFACTURER SHALL MAKE ALLOWANCE FOR AXIAL SHORTENING (EQUAL AMOUNTS EACH END).
 - TRANSVERSE STRESSING BARS TO AS4672.1 AND AS4672.2 - BAR - 29 - 1030 - P (COARSE THREAD). TRANSVERSE STRESSING FORCE AT LOCK OFF SHALL BE 350kN.
 - LOADING: DESIGN LIVE LOAD T44 AND L44



FORMWORK ANCHOR DETAIL



TYPICAL SECTIONS - 20950 LONG UNITS

▲ DEBOND STRAND 1000 FROM EACH END OF UNIT
 ■ DEBOND STRAND 2000 FROM EACH END OF UNIT
 ● DEBOND STRAND 3000 FROM EACH END OF UNIT

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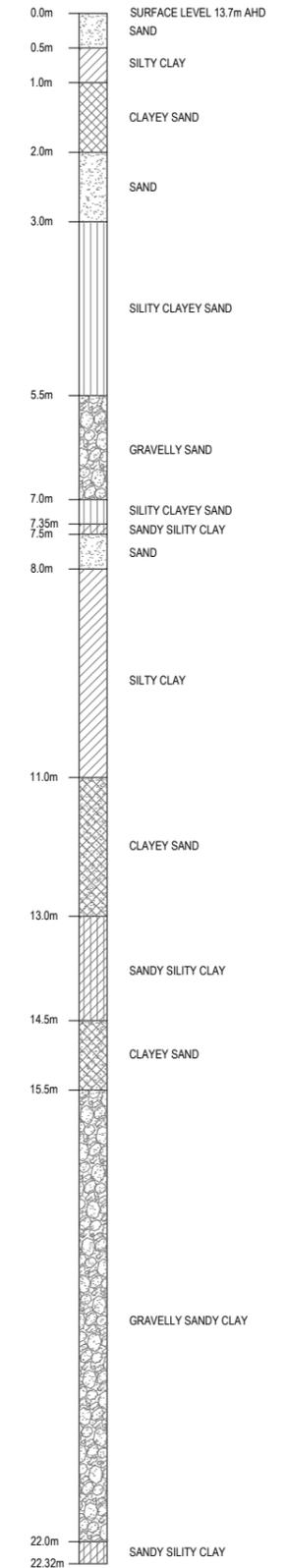
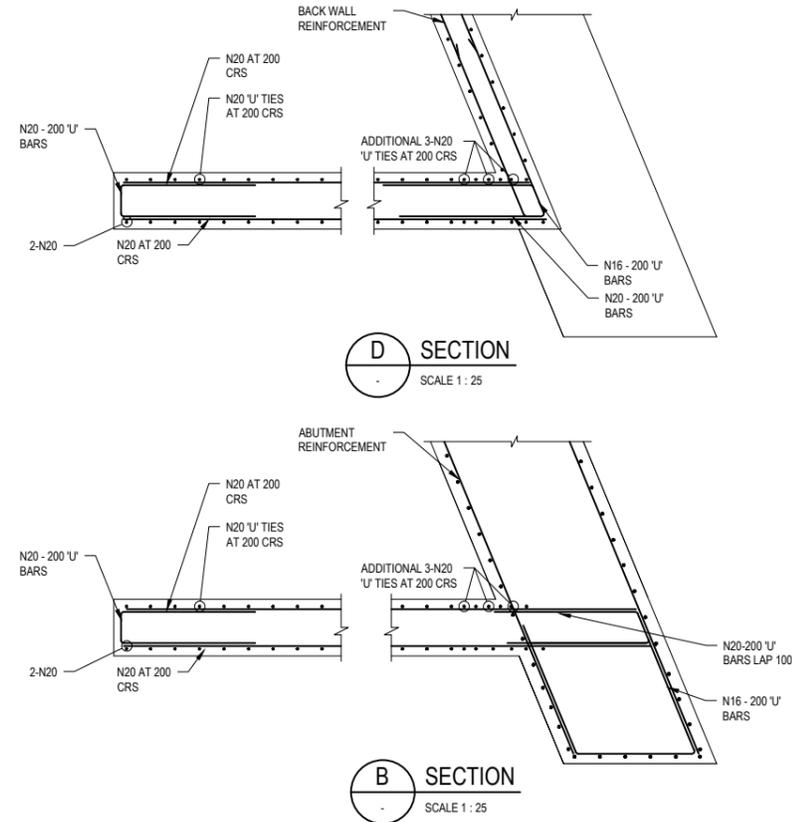
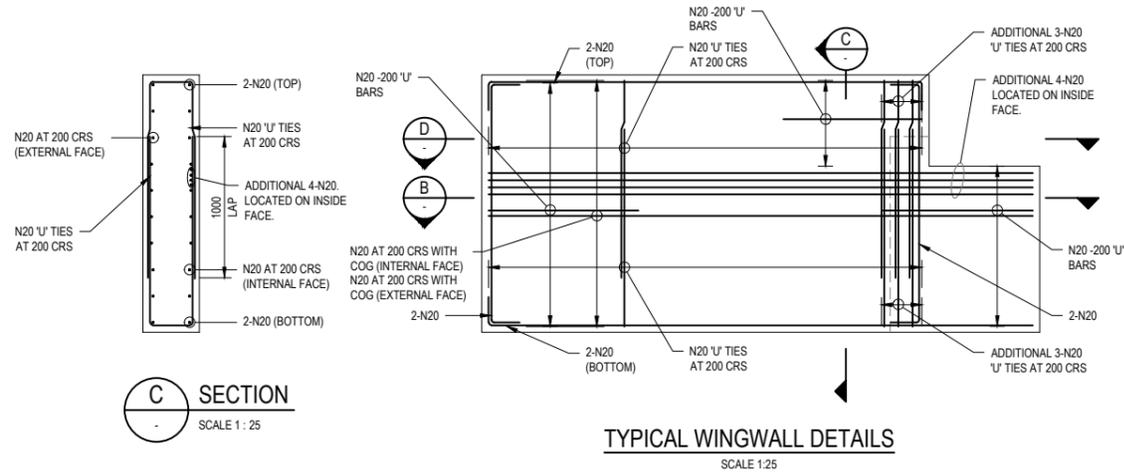


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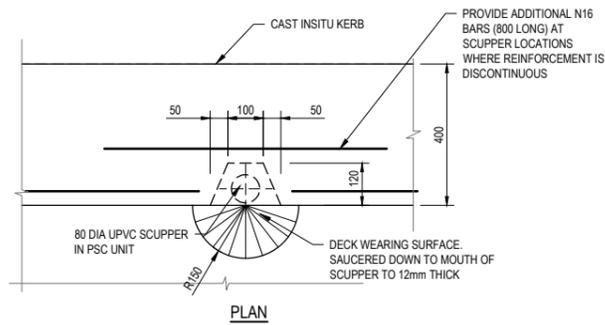
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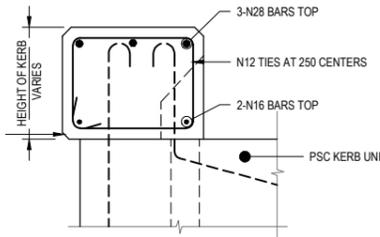
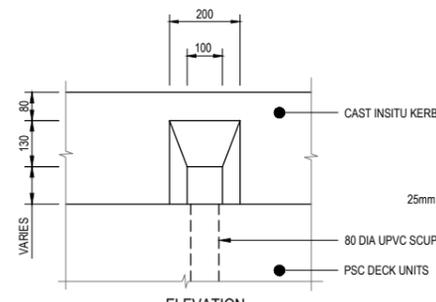
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 Project **WARNERS AND ANICHS BRIDGE UPGRADES**
 Title **WARNERS BRIDGE**
 Original Size **A1**
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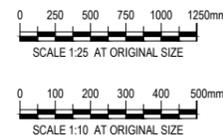
BOREHOLE INFORMATION
(EXTRACTED FROM DOUGLAS PARTNERS REPORT)
REFER TO DOUGLAS PARTNERS REPORT No. 104527.00
FEBRUARY 2021 FOR GROUND CONDITIONS.



SCUPPER RECESS DETAILS
SCALE 1:10



No	Revision	Note	Drawn	Job Manager	Project Director	Date
0	APPROVED ISSUE		WRC	*MI	*AA	12.04.21



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Approved (Project Director)	*A.AHILADELLIS		
Date	12.04.21		
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Client	Project	Title	Original Size
DOUGLAS SHIRE COUNCIL	WARNERS AND ANICHS BRIDGE UPGRADES	WARNERS BRIDGE MISCELLANEOUS DETAILS	A1
Drawing No: 12540427-S023			Rev: 0

Appendix B – Approvals Management Plans Report



Douglas Shire Council
Warners and Anichs Bridge Upgrades
Approvals Management Plan

February 2021

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1. Introduction

1.1 Background Information

Douglas Shire Council (DSC) is constructing two bridges in the Mossman Region, Warners Bridge on Warner Road and Anichs Bridge on Finlayvale Road. Both are currently dual-purpose bridges with sugar cane trains and motorists using the bridge. DSC wish to upgrade the bridge crossing by constructing a new road bridge downstream of both crossings and leaving the existing bridge to be used by the Mossman Sugar Mill, or replace the existing bridge on the same alignment as determined during the design phase.

Due to the nature of the works, environmental/planning approvals may be required for works to commence. The following provides a summary of the land tenure and environmental/planning approvals assessment for the proposed Warners and Anichs Bridge upgrades.

1.1.1 Anichs Bridge

Anichs bridge is located on Finlayvale Road approximately 2 km north-west of Mossman. The bridge is currently a single span bridge comprised of steel girders and a timber deck with a 13-tonne load limit. The existing bridge is a dual-purpose bridge with both road and rail traffic, which is also frequented by cyclists and adventure tourism. DSC requests that the load limit for the bridge be designed for minimum T44 loading to accommodate for the heavy vehicles that will use the bridge. Similar to Warners Bridge, it is understood that DSC intend to transfer ownership of the current bridge over to Mossman Sugar Mill if a new bridge is built offset to the current bridge.

1.1.2 Warners Bridge

Warners bridge is located along Warner Road approximately 4.5 km south-east of Mossman. The current bridge is a single lane, three span timber bridge with a 10-tonne load limit. DSC's intention is to construct a new road bridge separate from the rail network and downstream of the current alignment, with ownership of the current dual-purpose bridge being transferred to Mossman Sugar Mill. If the bridge cannot be built off the existing alignment then the new bridge would be replace the existing road/rail bridge. The new bridge is to remain a single lane designed for T44 loading and to have a design life of 100 years in accordance with current bridge design codes (AS5100).

1.2 Purpose of this Report

The purpose of this Approvals Management Plan (AMP) is to:

- Identify key environmental constraints and potential impacts for the project that requires detailed management actions.
- Identify approvals required under the local, State and Commonwealth Legislation for the project.
- Identify the processes required to obtain any of the approvals identified.

1.3 Scope of Works

To complete this AMP, GHD has undertaken the following scope of work:

- Desktop assessment through database searches over the proposed project area, including but not limited to:

- Department of Regional Development, Manufacturing and Water (DRDMW), Protected Matters Search Tool
- Department of Environment and Science (DES), Protected Plants Flora Survey Trigger Map
- Department of Resources (DR), Regulated Vegetation Management Map
- Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships, Cultural Heritage Search Request
- Department of State Development, Infrastructure, Local Government and Planning, State Assessment and Referral Agency (SARA) Development Assessment (DA) Mapping
- Review of legislation and identification of approvals or permits:
 - Legislation or policy and administering authority
 - Trigger for assessment under the legislation or policy
 - Further assessments required, including offsets, if applicable
 - Assessment processes and timeframes for obtaining approvals

1.4 Limitations

This report: has been prepared by GHD for Douglas Shire Council and may only be used and relied on by Douglas Shire Council for the purpose agreed between GHD and the Douglas Shire Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Douglas Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Douglas Shire Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Key Legislation Descriptions

1.5.1 Commonwealth Legislation

Environmental Protection and Biodiversity Conservation Act 1999

The *Environmental Protection and Biodiversity Act 1999* (EPBC Act) requires that a person must not take an action that has, will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) without approval from the Australian Government Minister for DAWE. An action is defined as a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things.

Native Title Act 1993

Native Title is established and regulated under the Commonwealth *Native Title Act 1993*. The *Native Title (Queensland) Act 1993* gives effect to certain provisions of the Commonwealth Act within Queensland.

The Commonwealth *Native Title Act 1993* requires the government to notify native title bodies prior to taking certain actions such as issuing of certain licences, permits and authorities. This notification allows the native title bodies to provide comments. The comments must be taken into account when deciding the licence, permit or authority.

Aboriginal Cultural Heritage Act 2003

In Queensland, both Commonwealth and State legislation protect indigenous cultural heritage. Three pieces of Commonwealth legislation serve to protect Australia's heritage. These are the EPBC Act, the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* and the *Aboriginal Cultural Heritage Act 2003* (Queensland).

Biosecurity Act 2015

The Biosecurity Act 2014 provides a comprehensive biosecurity framework to manage the impacts of animal and plant diseases and pests in a timely and effective way and ensure the safety and quality of animal feed, fertilisers and other agricultural inputs.

General Biosecurity Obligation

Under section 23 of the *Biosecurity Act 2014* all Queenslanders have a general biosecurity obligation to take all reasonable and practical measures to prevent or minimise the biosecurity risk.

1.5.2 State Legislation

Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) object is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and into the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). The EP Act and the subordinate Environmental Protection Regulation 2019 (EP Reg) is the principal environmental protection legislation for Queensland.

General Environmental Duty

Under section 319 of the EP Act, a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (the General Environmental Duty).

Planning Act 2016 and Planning Regulation 2017

The *Planning Act 2016* providing for an efficient, effective, transparent, integrated, coordinated and accountable system of land use planning and development assessment to facilitate the achievement of ecological sustainability.

The *Planning Regulation 2017* supports Queensland's principal planning laws by outlining the mechanics for the operation of the *Planning Act 2016*. It prescribes planning and development assessment matters for the state such as categorising of the development, and matters applying to assessment of development applications.

Transport Infrastructure Act 1994

The *Transport Infrastructure Act 1994* is applicable to state-controlled road infrastructure and is administered jointly by the Department of Transport and Main Roads (TMR) and the Minister for Transport.

Vegetation Management Act 1999

The purpose of the *Vegetation Management Act 1999* is to regulate the clearing of vegetation in a way that conserves remnant vegetation that is endangered, of concern or of least concern, conserves vegetation in declared areas and ensures clearing does not cause land degradation and prevents biodiversity loss. This is achieved by providing for assessment benchmarks for the Planning Act for the assessment of assessable development, the enforcement of vegetation clearing provisions and declared areas and provide a framework for decision making to prevent degradation of the environment if there are threats of serious or irreversible environmental damage.

Nature Conservation Act 1992

The object of the *Nature Conservation Act 1992* is the conservation of nature while allowing for the involvement of indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom.

Fisheries Act 1994

The purpose of the *Fisheries Act 1994* is for the management, use, development and protection of fisheries resources and fish habitats, the management of aquaculture activities and helping to prevent shark attacks, and for related purposes.

Environmental Offsets Act 2014

The *Environmental Offsets Act 2014* provides for environmental offsets to counterbalance significant residual impacts of particular activities on particular matters of national, State or local environmental significance and to establish a framework in relation to environmental offsets.

Land Act 1994

The *Land Act 1994* is required to consolidate and amend the law relating to the administration and management of non-freehold land and deeds of grant in trust and the creation of freehold land, and for related purposes.

1.5.3 Local Government – Douglas Shire Council

Douglas Shire Planning Scheme 2018

The Douglas Shire Planning Scheme 2018 has been prepared in accordance with the *Planning Act 2016* (the Act) as a framework for managing development in a way that advances its purpose. The Planning Scheme sets out the Douglas Shire Council's intention for the future

development in the planning scheme area, over the next 20 years and applies to all premises, roads, internal waterways and local government tidal areas and interrelates with the surrounding local government areas.

2. Existing Environment

2.1 Land Tenure

2.1.1 Project Location

Both bridges for this project are located in the Douglas Shire region. Anichs bridge (refer to Figure 1) is located on Finlayvale Road to the north of the Mossman township. Warners bridge (refer to Figure 2) is located on Warners road, south of the Mossman township.



Figure 1 Location of current Anichs Bridge (extract from Queensland globe)



Figure 2 Location of current Warners Bridge (extract from Queensland Globe)

2.1.2 Anichs Bridge

The proposed Anichs Bridge upgrade is to be located along Finlayvale Road. The land use in the surrounding area is primarily agricultural with small pockets of residential use with the closest adjacent lot to the road reserve being Lot 212 on SR649.

The rail bridge is not owned by the State and therefore is not classified as state rail, not triggering state railway corridor approvals or management requirements.

2.1.3 Warners Bridge

The proposed Warners Bridge upgrade is to be located along Warners Road. The land use in the surrounding area is primarily agricultural with small pockets of residential use with the surrounding adjacent lots to the road reserve being Lot 1 RP732560 and Lot 2 RP09144.

The bridge is currently being used for both road and rail traffic with the rail line being used by Mossman Sugar Mill. An additional bridge is to be constructed downstream of the current alignment to allow separation of the road and rail traffic. After construction, Council wishes to transfer ownership of the rail bridge to Mossman Sugar Mill after construction.

The rail bridge is not owned by the State and therefore is not classified as state rail, not triggering state railway corridor approvals or management requirements.

2.2 Soils

2.2.1 Anichs Bridge

2.2.1.1 Acid Sulfate Soil

The proposed works are located on land located between 5 – 20 m Australian Height Datum (AHD) with a small portion located below 5 m (DSC – Acid Sulfate Soils Overlay Map). There is a small chance that interactions with acid sulfate soils (ASS) through excavation are likely to occur.

During construction, the contractor is required to consider the risks involved in encountering ASS. If ASS is encountered, excavations are to be managed in accordance with the Queensland Acid Sulfate Soils Technical Manual.

The Geotechnical Report needs to be considered to further inform on the ASS existence.

2.2.1.2 Contaminated Land

The surrounding land usage is primarily agricultural use (sugar cane production) with a small amount of residential lots present. Possible contaminants may come from spills and leaks during construction. The risk of minor oil spills and other contaminants entering the water system from the construction of the bridge upgrade will require management to ensure further contamination does not occur.

2.2.2 Warners Bridge

The proposed works are located on land located between 5 – 20 m AHD (Douglas Shire Council – Acid Sulfate Soils Overlay Map). Interactions with excavation are unlikely although, if interaction does occur, excavation are to be managed in accordance with the Queensland Acid Sulfate Soils Technical Manual. The Geotechnical Report needs to be considered to further inform on the ASS existence.

2.2.2.1 Contaminated Land

The surrounding land use of the bridge is agricultural sugar cane production. Possible contaminants may come from spills and leaks during construction. The risk of minor oil spills and other contaminants entering the water system from the construction of the bridge upgrade will require management to ensure further contamination does not occur.

2.3 Native Title and Cultural Heritage

2.3.1 Anichs Bridge

2.3.1.1 Native title

A Native Title Search was undertaken for the project site and identified the area to have no Native Title Claims.

Upgrade works to the bridge will occur in previously disturbed areas and no further disturbances will trigger Native Title compliance procedures.

2.3.1.2 Cultural Heritage

The Development Assessment Mapping System did not identify any Queensland heritage places within the vicinity of the project area. The nearest Queensland heritage place is approximately 1.6 km south east of the site along Foxtan Avenue and Johnston Road.

A search of the Queensland Aboriginal and Cultural Heritage Register identified an artefact scatter that is about 1 km south east of the project site. However the search did not identify any Aboriginal or cultural heritage places in vicinity of the proposed project.

As the proposed works will remain in the same location, it can be categorised as Category 4 (areas previously subject to significant ground disturbance) under Department of Aboriginal and Torres Strait Islander Partnership (DATSIP) *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines, due to the project's site location and previous disturbance. In addition, the surrounding areas are being used for agricultural purposes and therefore, the surrounding areas have been developed, so no further impacts to cultural heritage is expected.

However, it has to be noted that a temporary bridge will be constructed during the Anichs' bridge upgrade to allow for vehicles to pass through. At this stage, the temporary bridge is expected to be constructed upstream of the existing bridge, which has dense vegetation. As such, new ground disturbance may occur. This will be confirmed when the final option has been decided.

2.3.2 Warners Bridge

2.3.2.1 Native title

A Native Title Search was undertaken for the project site and identified the area to have no Native Title Claims.

Upgrade works to the bridge will occur in previously disturbed areas and no further disturbances will trigger Native Title compliance procedures.

2.3.2.2 Cultural Heritage

The Queensland Aboriginal and Cultural Heritage Database and Register did not identify any Aboriginal or cultural heritage places in vicinity of the proposed project.

The proposed works would be categorised as Category 5 (activities causing additional surface disturbance) under Department of Aboriginal and Torres Strait Islander Partnership (DATSIP) *Aboriginal Cultural Heritage Act 2003* Duty of Care Guidelines, due to the project's site location and previous disturbance. In addition, the area does contain small pockets of land that have not been developed by agriculture and remain relatively intact. If a cultural heritage find is to occur, works are required to cease and appropriate consultation with local Aboriginal Torres Strait Islander parties is undertaken.

2.4 Ecological

2.4.1 Anichs Bridge

Whilst the bridge and surrounding is not mapped as regulated vegetation, within 20 m of the proposed bridge is Category R regulated vegetation. Category B vegetation containing endangered regional ecosystems is also mapped within 20 m of the proposed bridge upgrade. The same area of Category B vegetation is also identified as essential habitat.

Threatened ecological communities (TEC) in the area have been highlighted as 'Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland.

Alongside the TEC, there are 37 listed threatened species according to the Matters of National Environmental Significance (MNES), three of which are known to occur on site:

- Southern cassowary (*Casuarius casuarius johnsonii*)
- Australian lace-eyed tree frog (*Litoria dayi*)
- Spectacled flying-fox (*Pteropus conspicillatus*)

Running parallel to the bridge and surrounding road reserve, including the Category B vegetation, has been mapped by the protected plants trigger map.

Onsite, the vegetation to the north of Anichs Bridge is well-developed and relatively intact with the ground storey consisting primarily of seedlings and juveniles of sub-canopy species. The species on site are consistent with the mapped regional ecosystems (RE) of 7.3.71 (complex mesophyll vine forest with well-drained alluvium of high fertility) and 7.11.1a (mesophyll vine forest, lowlands and foothills on wet rainfall zones). Directly to the south of the bridge, is the point of outflow from the creek into the Mossman river.

During the onsite survey, no nest hollows were observed, although a substantial orange-footed scrub fowl (*Megapodius reinwardt*) mount is present on the northern side. This species is widespread and well adapted to anthropogenic disturbance.

2.4.2 Warners Bridge

The bridge and surrounding areas both upstream and downstream are mapped as Category B vegetation and essential habitat. Category R regulated vegetation is mapped within 20 m of the proposed bridge, with the possibility of overlap depending on the exact engineering alignment of the new rail bridge.

Threatened ecological communities (TEC) in the area have been highlighted as 'Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland.

Alongside the TEC, there are 32 listed threatened species according to the Matters of National Environmental Significance (MNES), three fauna species of which are known to occur on site and one flora species:

- Southern cassowary (*Casuarius casuarius johnsonii*)
- White-throated needletail (*Hirundapus caudacutus*)
- Spectacled flying-fox (*Pteropus conspicillatus*)
- *Toechima pterocarpum*

For both the current and new bridge alignments, the area is mapped by the protected plants trigger map, specifically the area also mapped as Category B vegetation containing of concern regional ecosystems.

During the survey onsite, the vegetation was confirmed to be RE 7.3.10a (mesophyll vine forest, moderately to poorly-drained alluvial plains, of moderate fertility. Lowlands of the very wet and wet zone). Mature forest of high ecological value was confirmed to be present on both sides of the bridge. The southern side contains a number of large canopy trees with two stems containing nest hollows immediately to the south-west of the current bridge.

Recorded on the northern side of the bridge is an orange-footed scrub fowl (*Megapodius reinwardt*) mount. This species is widespread and well adapted to anthropogenic disturbance.

2.5 Hydrology and Coastal

2.5.1 Anichs Bridge

Works are located along a major (purple) waterway, as mapped by Queensland waterway for waterway barrier works. The project area is not mapped in tidal or wetland areas.

It is worth noting that even the works are located in a major waterway, the proposed bridge upgrade is not considered as a waterway barrier works, as the works will be constructed as a single span bridge.

2.5.2 Warners Bridge

Works are located along a high (red) waterway, as mapped by Queensland waterway for waterway barrier works. The project area is not mapped in tidal areas or wetland areas.

It is worth noting that even the works are located in a major waterway, the proposed bridge upgrade is not considered as a waterway barrier works, as the works will be constructed as a single span bridge.

2.6 Management Actions

2.6.1 Anichs Bridge

Management actions are required to address potential environmental impacts including, but not limited to air quality and noise, water quality and ecological impact.

2.6.2 Warners Bridge

Management actions are required to address potential environmental impacts including, but not limited to air quality and noise, water quality and ecological impact.

3. Legislative Review

A review of legislations and approvals (planning and environmental) applicable to the project has been undertaken. The results are provided in Table 1.

3.1 Commonwealth Legislation

The EPBC Act is administered by DAWE, review of the project indicates that any significant impacts to Matters of National Environmental Significance (MNES) is not expected for either bridge works.

No legislative approval requirements under the EP Act have been identified, however the primary duty that applies to the works, especially given the vegetation management occurring onsite at both sites is the General Biosecurity Obligation. This is abided by and managed throughout the construction of the proposed works.

Requirements and definitions are as follows:

- **General Biosecurity Obligation** – Under section 23 of the *Biosecurity Act 2014* all Queenslanders have a general biosecurity obligation to take all reasonable and practical measures to prevent or minimise the biosecurity risk.

3.2 State Legislation

A review of legislation applicable to the project and whether approvals (planning or environmental) has been undertaken. The results for Anichs Bridge are provided in Table 1 and results for Warners Bridge are provided in Table 2, which represents as the AMP. This table may be updated depending on the pre-lodgement advice to be received from SARA.

3.3 Local Government – Douglas Shire Council

The proposed works for both Anichs and Warners bridges are located in the Douglas Shire Council Planning Scheme, in the zoning area of road reserve.

As the bridge works will require road closures for the bridge upgrades and construction, Council have the power of closure of local government areas such as roads to carry out construction works.

Local Council have power to close local government roads for ancillary works including bridge works, Local Law 11, Part 2 (Local Government Controlled Areas and Roads).

3.4 Approvals Management Plan

Table 1 presents the approvals register for the Anichs Bridge upgrade and Table 2 presents the approvals register for the Warners Bridge upgrade and new bridge construction.

Table 1 Legislative Requirements – Anichs Bridge

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>		DAWE	<p>Actions that have or are likely to have a significant impact on a MNES require approval from DAWE.</p> <p>MNES includes listed threatened species and ecological communities.</p>	<p>Not applicable</p> <p>The site has previous disturbances and is unlikely to have a significant impact on MNES values.</p>	-	-	-	-
Planning Act Approvals								
<i>Coastal Protection and Management Act 1995</i>	Operational works that are prescribed tidal works	DES	Development on land under tidal waters	<p>Not applicable</p> <p>The land is not mapped within tidal area</p>	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Operational work that is work in CMD	DES	<p>If within a CMD:</p> <ul style="list-style-type: none"> • Interfering with quarry material on state land above MHW • Disposing of dredge spoil or other solid waste in tidal water • Removing or interfering with coastal dunes in an erosion prone area 	<p>Not applicable</p> <p>The project is not located on CMD or on State Land.</p>	-	-	-	-
<i>Fisheries Act 1994</i>	Operational Work that is waterway barrier work	DAF DSDTI	Permanent works within waterways that form waterway barrier	<p>Compliance required</p> <p>Works are located on a major (purple) risk waterway. However, works are likely to meet 'What is not Waterway Barrier Works'.</p>	-	-	-	GHD design to meet permanent waterway barrier works conditions

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
			Temporary works within waterways that form waterway barrier works	<p>Compliance required</p> <p>Contractor to meet temporary waterway barrier works conditions</p> <p>The project site is mapped as a major (purple) waterway. Temporary side tracks less than 180 days won't require a permit.</p>	-	-	-	Design and contractor to meet requirements of construction works to meet the Acceptable Developmental Requirements of DAF.
	Operational work that is the removal, destruction or damage of marine plants		Removal, destruction or damaging marine plants	<p>Not applicable</p> <p>No marine plants present</p>	-	-	-	-
<i>Planning Act 2016</i> Planning regulation 2017		DSDTI Land owner	Provides legislative framework for assessment process	<p>Not applicable</p> <p>Assessable development has not been identified.</p>	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Vegetation Management Act 1999</i>	Operation work for clearing native vegetation	Department of Resources	Clearing of native vegetation assessable under the VM Act.	<p>Compliance required</p> <p>The proposed project is expected to have vegetation clearing along each bank, which are mapped as Category B and Category R regulated vegetation.</p> <p>Accepted development vegetation clearing codes (clearing for infrastructure). Although no permit is required, compliance is required</p>	-		-	<p>GHD to confirm once design footprint is known.</p> <p>Contractor required to undertake the works in accordance with an EMP</p> <p>Contractor to be made aware that clearing of vegetation is not authorised.</p>
Non-planning Act Approvals								
<i>Aboriginal Cultural Heritage Act 2003</i>	Cultural Heritage Management Plan or other agreement	DATSIP	Require those conducting disturbance activities in areas of significance to take all reasonable and practical measures to avoid harming cultural heritage	<p>Applicable (Compliance)</p> <p>Works would be categorised as Category 4 (areas previously subject to significant ground disturbance) as site is developed and has previously been disturbed.</p>	-	-	-	Contractor to meet Duty of Care Guidelines.

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Biosecurity Act 2015</i>	-	Department of Agriculture	Under section 23 of the Biosecurity Act 2014 all Queenslanders have a general biosecurity obligation to take all reasonable and practical measures to prevent or minimise the biosecurity risk.	Compliance required Contractor to meet general Biosecurity obligations				Contractor to meet general biosecurity obligations
<i>Environmental Protection Act 1994</i>	-	DES	Where 'serious and material environmental harm' is caused or threatened	Compliance Required Contractor to meet Duty of Care and Duty to Notify requirements.	-	-	-	Contractor required to undertake works in accordance with an EMP.
	-	DES	Disposal of contaminated material for land listed in the EMR or CLR	Not applicable Disposal of contaminated material is not expected as works are not located on state rail land.	-	-	-	-
	Environmental Authority for ERA	DES	Requiring Environmentally relevant activities (ERA) associated with construction or operation.	Not applicable Relevant activities do not include carrying out works involving only infrastructure such as pipes.	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Environmental Offsets Act 2014</i>	-	DES	Requirements for offsets for Prescribed Environmental Matters – Matters of State Environmental Significance (MSES)	Not applicable As the works are not assessable development, the offsets are not required.	-	-	-	Potential for offsets to be considered as part of the assessable development application (namely clearing native vegetation))
<i>Native Title (Queensland) Act 1993</i>	-	DNRME DATSIP Native Title Tribunal	Suppression of Native Title Rights and Interests that is inconsistent with the construction of the Project.	Not applicable The area has an active native title claim, however the works will occur in previously disturbed areas. As such no further disturbances will trigger compliance procedures.	-	-	-	-
<i>Nature Conservation Act 1992</i>	Clearing permit of Exempt Clearing Notification	DES	Where clearing is required of protected plants in a high risk area (or otherwise identified).	To be confirmed The site is mapped on the protected plants trigger map. Upon confirmation of the project footprint, the flora survey that has been undertaken will be reviewed to confirm if further surveys are required.	TBC	TBC	TBC	GHD

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Species Management Program	DES	Removal or disturbance of protected fauna, namely animal breeding places	Not applicable Not expected to disturb animal breeding places as the works will occur within a previously disturbed area.				Contractor to ensure risk is managed on site during clearing.
<i>Queensland Heritage Act 1992</i>	-	DES	Works associated with places registered under the Act. Incidental discovery of artefacts and their protection.	Not applicable No heritage sites in vicinity of project identified in desktop search.	-	-	-	Duty of Care required, Contractors EMP is to include accidental finds procedure.
<i>State Development and Public Works Organisation Act 1971</i>	-	Office of Coordinator General DSDTI	Applicable to works deemed state significant under the Act. Relevant for areas declared State Development Areas.	Not applicable The site is not mapped within the Cairns State Development Area	-	-	-	-
<i>Water Act 2000</i>	Riverine Protection Permit	DNRME	Destroy vegetation, excavate or place fill in a watercourse.	Applicable Vegetation will be disturbed in the bridge upgrade process. Riverine Protection Permit exemption requirements can be used for this project. Clearing is required to be less than 0.5 ha.	-	-	-	GHD to review on finalisation of design. Contractor to implement requirements

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Operation works for taking or interfering with water	DNRME	Taking or interfering with water flow.	Not applicable Works do not involve diversions or take of water.	-	-	-	-
<i>Land Act 1994</i>	Working in an easement	DNRME	Appropriate land use approval is to be in place to authorise use.	Not applicable Project is not located within an easement.	-	-	-	-
<i>Transport Infrastructure Act 1994</i>	Road Corridor Permit	TMR	Work within a state-controlled road corridor.	Not applicable Roads traversed are not mapped as a state controlled corridor.	-	-	-	-
	-	TMR	Assessable development that is within 25 m of a state-controlled road corridor and/or railway	Not applicable Project works are not being undertaken within 25 m of a state-controlled railway or 25 m of a future busway corridor. Referral not required as works are not considered assessable development.	-	-	-	-
<i>Douglas Shire Council</i> Planning Scheme and/or Local Laws	Road Permit	Douglas Shire Council	Undertaking works on a road or within a road reserve.	Not applicable Local Council have power to close local government roads for ancillary works including bridge works.	-	-	-	-

Table 2 Legislative Requirements – Warners Bridge

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Environmental Protection and Biodiversity Conservation Act 1999</i>		DAWE	<p>Actions that have or are likely to have a significant impact on a MNES require approval from DAWE.</p> <p>MNES includes listed threatened species and ecological communities.</p>	<p>Not applicable</p> <p>The site has previous disturbances and is unlikely to have a significant impact on MNES values.</p>	-	-	-	-
Planning Act Approvals								
<i>Coastal Protection and</i>	Operational works that are prescribed tidal works	DES	Development on land under tidal waters	<p>Not applicable</p> <p>The land is not mapped within tidal area</p>	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Management Act 1995</i>	Operational work that is work in CMD	DES	<p>If within a CMD:</p> <ul style="list-style-type: none"> • Interfering with quarry material on state land above MHW • Disposing of dredge spoil or other solid waste in tidal water <p>Removing or interfering with coastal dunes in an erosion prone area</p>	<p>Not applicable</p> <p>The project is not located on CMD or on State Land.</p>	-	-	-	-
<i>Fisheries Act 1994</i>	Operation Work that is waterway barrier work	DAF DSDTI	Permanent works within waterways that form waterway barrier	<p>Compliance required</p> <p>Works are located on a high (red) risk waterway. However, works are likely to meet 'What is not Waterway Barrier Works'.</p>	-	-	-	GHD design to meet permanent waterway barrier works conditions

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
			Temporary works within waterways that form waterway barrier works	Compliance required Works are located on a high (red) risk waterway. However, works are likely to meet 'What is not Waterway Barrier Works'.	-	-	-	Contractor to meet requirements of construction works to meet the Acceptable Developmental Requirements of DAF.
	Operational work that is the removal, destruction or damage of marine plants		Removal, destruction or damaging marine plants	Not applicable No marine plants present	-	-	-	-
<i>Planning Act 2016</i> Planning regulation 2017		DSDTI Land owner	Provides legislative framework for assessment process	Not applicable Assessable development has not been identified.				

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Vegetation Management Act 1999</i>	Operation work for clearing native vegetation	Department of Resources	Clearing of native vegetation assessable under the VM Act.	<p>Compliance required</p> <p>The proposed project is expected to have vegetation clearing along each bank, which are mapped as Category B and Category R regulated vegetation.</p> <p>Accepted development vegetation clearing codes (clearing for infrastructure). Although no permit is required, compliance is required</p>	-		-	<p>GHD to confirm once design footprint is known.</p> <p>Contractor required to undertake the works in accordance with an EMP</p> <p>Contractor to be made aware that clearing of vegetation is not authorised.</p>
Non-approval Act Approvals								
<i>Aboriginal Cultural Heritage Act 2003</i>	Cultural Heritage Management Plan or other agreement	DATSIP	Require those conducting disturbance activities in areas of significance to take all reasonable and practical measures to avoid harming cultural heritage	<p>Applicable (Compliance)</p> <p>Works would be categorised as Category 5 (areas previously subject to significant ground disturbance) as site is developed and has previously been disturbed.</p>	-	-	-	Contractor to meet Duty of Care Guidelines.

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Biosecurity Act 2015</i>	-	Department of Agriculture	Under section 23 of the Biosecurity Act 2014 all Queenslanders have a general biosecurity obligation to take all reasonable and practical measures to prevent or minimise the biosecurity risk.	Compliance required Contractor to meet general Biosecurity obligations				Contractor to meet general biosecurity obligations
<i>Environmental Protection Act 1994</i>	-	DES	Where 'serious and material environmental harm' is caused or threatened	Compliance Required Contractor to meet Duty of Care and Duty to Notify requirements. Downstream of the current bridge alignment would have the least impact due to the bird burrows and more established vegetation upstream.	-	-	-	Contractor required to undertake works in accordance with an EMP.
	-	DES	Disposal of contaminated material for land listed in the EMR or CLR	To be confirmed Disposal of contaminated material is not expected as works are not located on state rail land.	-	-	-	GHD to complete search when design footprint is known.

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Environmental Authority for ERA	DES	Requiring Environmentally relevant activities (ERA) associated with construction or operation.	Not applicable Relevant activities do not include carrying out works involving only infrastructure such as pipes.	-	-	-	-
<i>Environmental Offsets Act 2014</i>	-	DES	Requirements for offsets for Prescribed Environmental Matters – Matters of State Environmental Significance (MSES)	Not applicable As the works are not assessable development, the offsets are not required.	-	-	-	-
<i>Native Title (Queensland) Act 1993</i>	-	DNRME DATSIP Native Title Tribunal	Suppression of Native Title Rights and Interests that is inconsistent with the construction of the Project.	To be confirmed The area has an active native title claim, however the works will occur in previously disturbed areas.	-	-	-	GHD to confirm when footprint is known.
<i>Nature Conservation Act 1992</i>	Clearing permit of Exempt Clearing Notification	DES	Where clearing is required of protected plants in a high risk area (or otherwise identified).	To be confirmed The site is mapped on the protected plants trigger map. Upon confirmation of project footprint, the flora survey that has been undertaken will be reviewed to confirm if further surveys are required.	TBC	TBC	TBC	GHD

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Species Management Program	DES	Removal or disturbance of protected fauna, namely animal breeding places	<p>To be confirmed</p> <p>Not expected to disturb animal breeding places as the works will occur within a previously disturbed area.</p> <p>Breeding hollows are in trees upstream of the current bridge alignment, therefore it should be emphasised that for the new bridge alignment, downstream is the preferred option.</p>				GHD to consider location during design and confirm applicability after footprint is confirmed.
<i>Queensland Heritage Act 1992</i>	-	DES	<p>Works associated with places registered under the Act.</p> <p>Incidental discovery of artefacts and their protection.</p>	<p>Not applicable</p> <p>No heritage sites in vicinity of project identified in desktop search.</p>	-	-	-	Duty of Care required, Contractors EMP is to include accidental finds procedure.
<i>State Development and Public Works Organisation Act 1971</i>	-	Office of Coordinator General DSDTI	<p>Applicable to works deemed state significant under the Act.</p> <p>Relevant for areas declared State Development Areas.</p>	<p>Not applicable</p> <p>The site is not mapped within a State Development Area</p>	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
<i>Water Act 2000</i>	Riverine Protection Permit	DNRME	Destroy vegetation, excavate or place fill in a watercourse.	Applicable Vegetation will be disturbed in the bridge upgrade process. Riverine Protection Permit exemption requirements can be used for this project. Clearing is required to be less than 0.5 ha.	-	-	-	GHD to review on finalisation of design. Contractor to implement requirements.
	Operation works for taking or interfering with water	DNRME	Taking or interfering with water flow.	Not applicable Works do not involve diversions or take of water.	-	-	-	-
<i>Land Act 1994</i>	Working in an easement	DNRME	Appropriate land use approval is to be in place to authorise use.	To be confirmed Project footprint is not finalised, therefore will require further consideration.	-	-	-	GHD to review following finalisation of footprint.
<i>Transport Infrastructure Act 1994</i>	Road Corridor Permit	TMR	Work within a state-controlled road corridor.	Not applicable Roads traversed are not mapped as a state controlled corridor.	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	-	TMR	Assessable development that is within 25 m of a state-controlled road corridor and/or railway	<p>Not applicable</p> <p>Project works are not being undertaken within 25 m of a state-controlled railway or 25 m of a future busway corridor.</p> <p>Referral not required as works are not considered assessable development.</p>	-	-	-	-
<i>Douglas Shire Council</i> Planning Scheme and/or Local Laws	Road Permit	Douglas Shire Council	Undertaking works on a road or within a road reserve.	<p>Not applicable</p> <p>Local Council have power to close local government roads for ancillary works including bridge works.</p>	-	-	-	-

4. Summary and Conclusion

Review of the works proposed to be undertaken at Anichs and Warners bridge located within the Douglas Shire indicates that there are environmental and legislative compliance requirements to be met, a summary is as follows:

- Compliance required by Contractor to meet Cultural Heritage Duty of Care Guidelines
- Contractor to meet General Environmental Duty and Duty to Notify requirements under the EP Act.
- Contractor to meet General Biosecurity Obligations under the Biosecurity Act.
- GHD design to meet DAF 'What is not waterway barrier works' for single span bridges.
 - The abutments do not extend into the waterway beyond the high bank.
 - The bank revetment works do not extend beyond the top of the bank.
 - No scour protection is placed on the bed of the waterway upstream, downstream or under the structure.
- Contractor to meet requirements of construction works to meet the Acceptable Development Requirements of DAF for temporary waterway barrier works.
- A detailed Construction Environmental Management Plan is recommended to be sourced from the Contractor, which will need to include management plans for ASS, an accidental finds procedure for cultural heritage and contractor to be made aware that clearing vegetation is not authorised.
- Riverine protection exemption requirements

GHD

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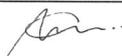
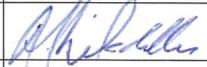
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5/https://projectsportal.ghd.com/sites/pp10_01/warnersandanichsbrid/ProjectDocs/12540427-REP_Approvals Management Plan.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	N. Schulz	M. Estrada		A. Ahiladellis		10/2/21

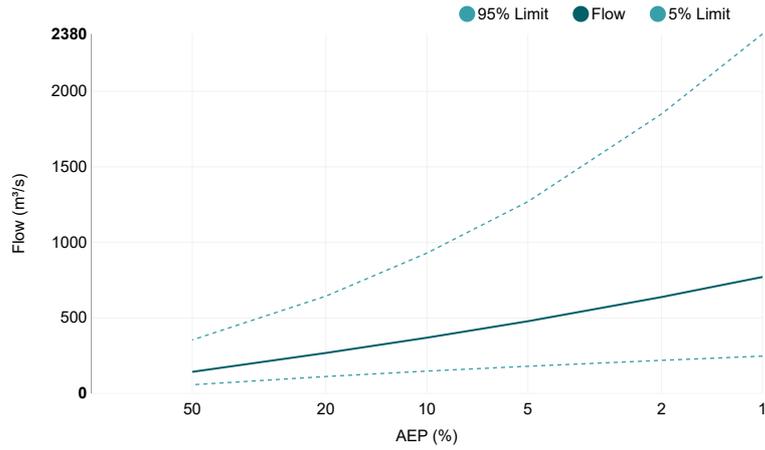
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Appendix C – Douglas Partners Geotechnical Investigation Reports

Appendix D – RFFE for Warners Bridge

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	143	57.4	354
20	268	112	644
10	369	148	929
5	478	180	1270
2	638	219	1850
1	771	247	2380

Statistics

Variable	Value	Standard Dev
Mean	4.805	0.544
Standard Dev	0.743	0.293
Skew	-0.126	0.084

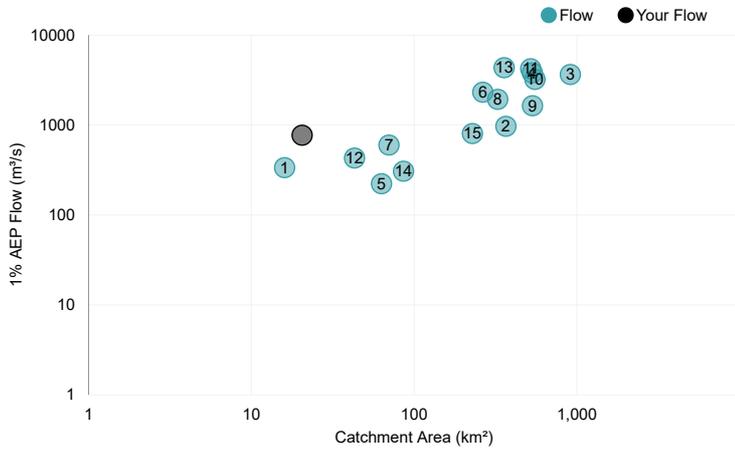
Note: These statistics come from the nearest gauged catchment. Details.

Correlation

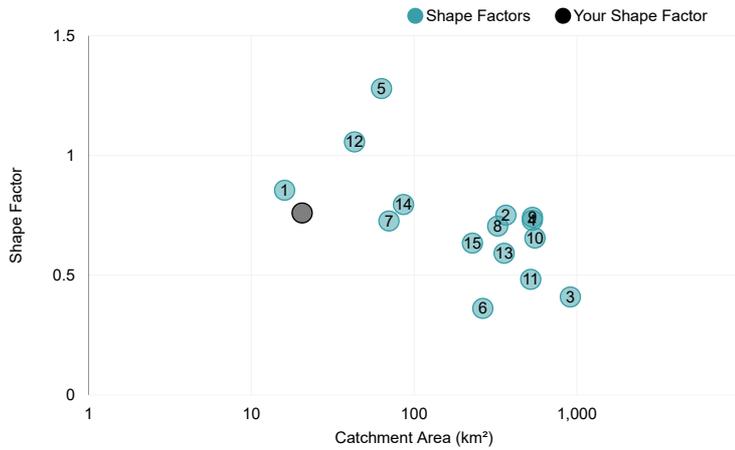
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

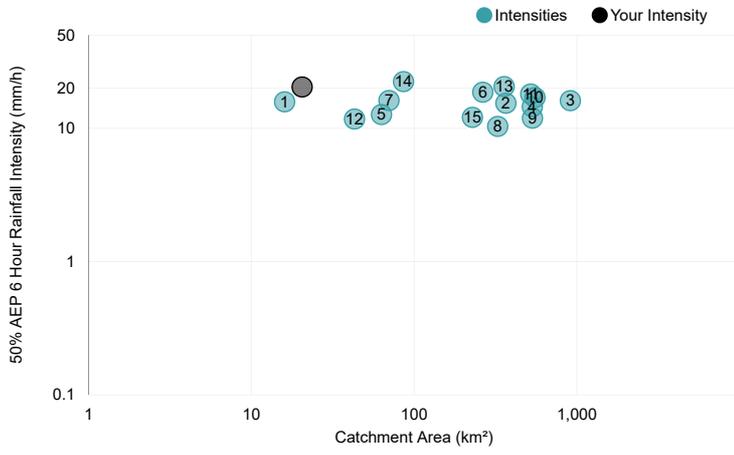
1% AEP Flow vs Catchment Area



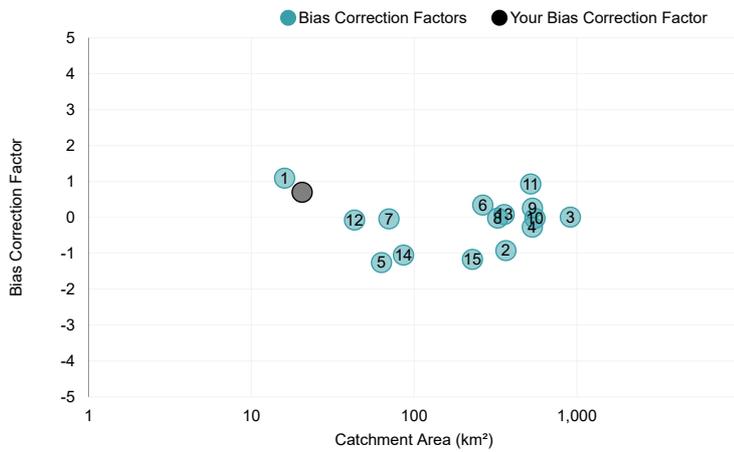
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

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- [Nearby](#)
- [JSON](#)

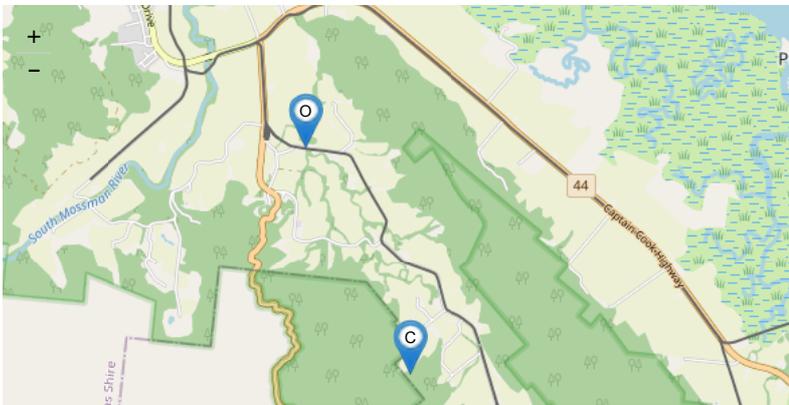
Input Data

Date/Time

2021-01-15 12:49

Input Data

Catchment Name	Warners
Latitude (Outlet)	-16.495679
Longitude (Outlet)	145.396446
Latitude (Centroid)	-16.523625
Longitude (Centroid)	145.409924
Catchment Area (km ²)	20.5
Distance to Nearest Gauged Catchment (km)	13.2
50% AEP 6 Hour Rainfall Intensity (mm/h)	20.417633
2% AEP 6 Hour Rainfall Intensity (mm/h)	42.671185
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.76
Interpolation Method	Natural Neighbour
Bias Correction Value	0.698



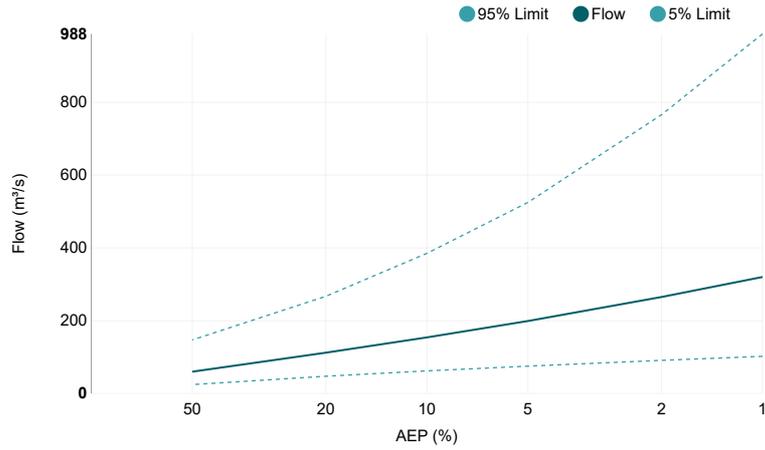
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Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



Appendix E - RFFE for Anichs Bridge

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	59.8	24.3	147
20	112	47.3	267
10	154	62.0	385
5	199	75.0	525
2	265	90.9	766
1	320	102	988

Statistics

Variable	Value	Standard Dev
Mean	4.004	0.544
Standard Dev	0.743	0.293
Skew	-0.126	0.084

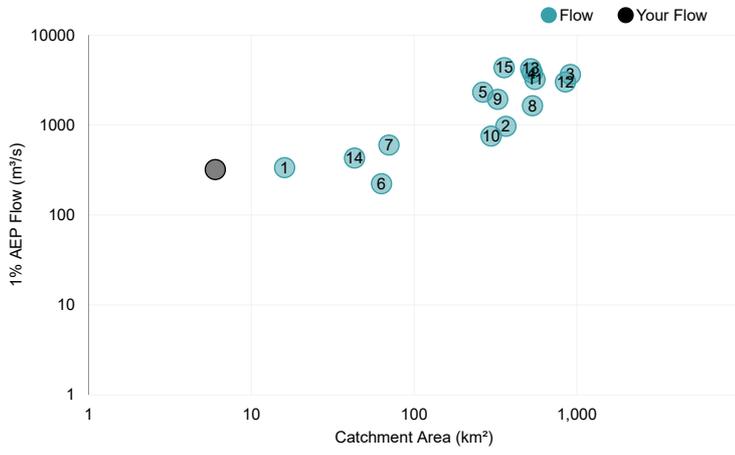
Note: These statistics come from the nearest gauged catchment. Details.

Correlation

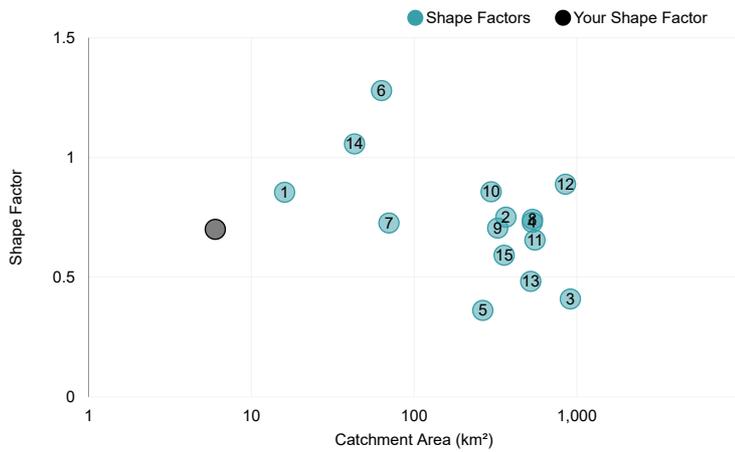
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

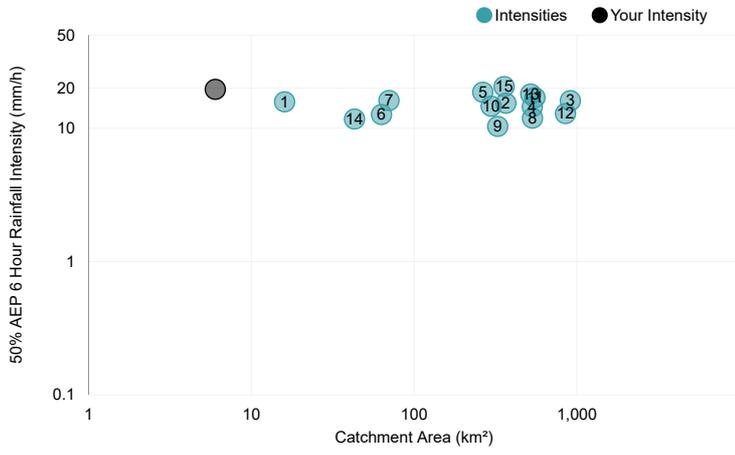
1% AEP Flow vs Catchment Area



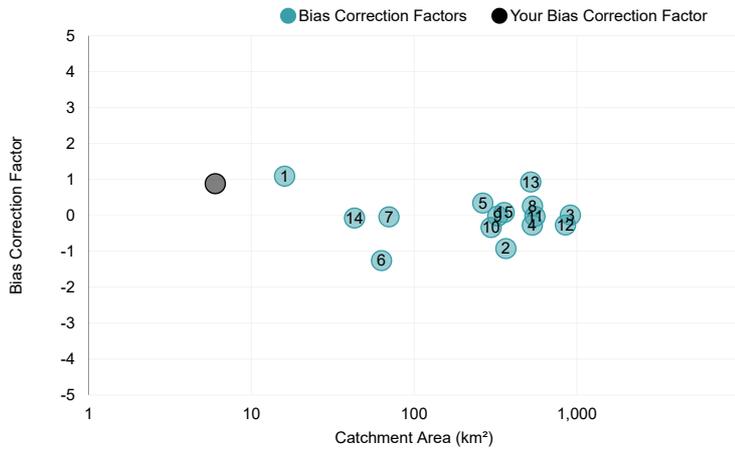
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



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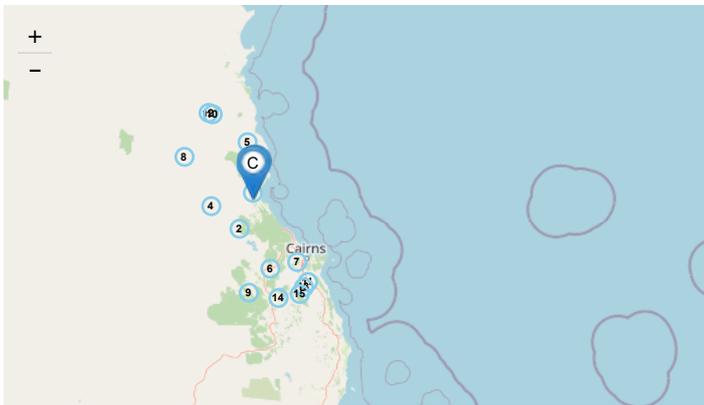
Input Data

Date/Time

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Input Data

Catchment Name	Anichs
Latitude (Outlet)	-16.450374
Longitude (Outlet)	145.359929
Latitude (Centroid)	-16.454551
Longitude (Centroid)	145.344551
Catchment Area (km ²)	6.0
Distance to Nearest Gauged Catchment (km)	6.98
50% AEP 6 Hour Rainfall Intensity (mm/h)	19.592908
2% AEP 6 Hour Rainfall Intensity (mm/h)	41.206052
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast
Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.7
Interpolation Method	Natural Neighbour
Bias Correction Value	0.882



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Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (<http://arr.ga.gov.au/revision-projects/project-list/projects/project-5>) on the ARR website. Send any questions regarding the method or project here (<mailto:admin@arr-software.org>).



Appendix F - Warners Bridge Flow Interpolation (using Rational Method flows)

Design flows

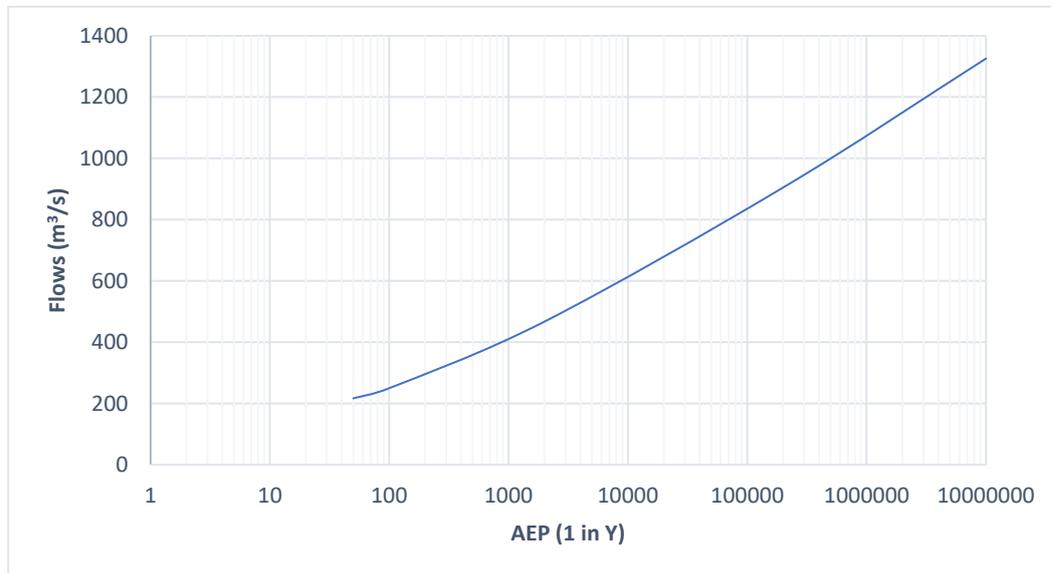
<u>Parameter</u>	<u>Value</u>	<u>Unit</u>	<u>Reference</u>
Area	20.48	km2	GIS calculations
50	217	m3/s	Rational method
100	250	m3/s	Rational method
PMP-DF	1326	m3/s	Watt, S., Sciacca, D., Hughes. M., & Pedruco. P.

Interpolation

	<u>Parameter</u>	<u>Value</u>	<u>Unit</u>
1	$\log(X_{pmp}/X_{100}) / \log(X_{100}/X_{50})$	11.8	
2	AEP of PMP	1.00E-07	
3	$\log(X_y/X_{100}) / \log(X_{pmp}/X_{100})$	1 in Y1: 0.375 1 in Y2: 0.771	1 in 2000 1 in 200000
4	Xy1	467	m3/s
	Xy2	905	m3/s

Frequency Curve

50	217
100	250
2000	467
200000	905
1.00E+07	1326



Appendix G - Anichs Bridge Flow Interpolation (using Rational Method flows)

Design flows

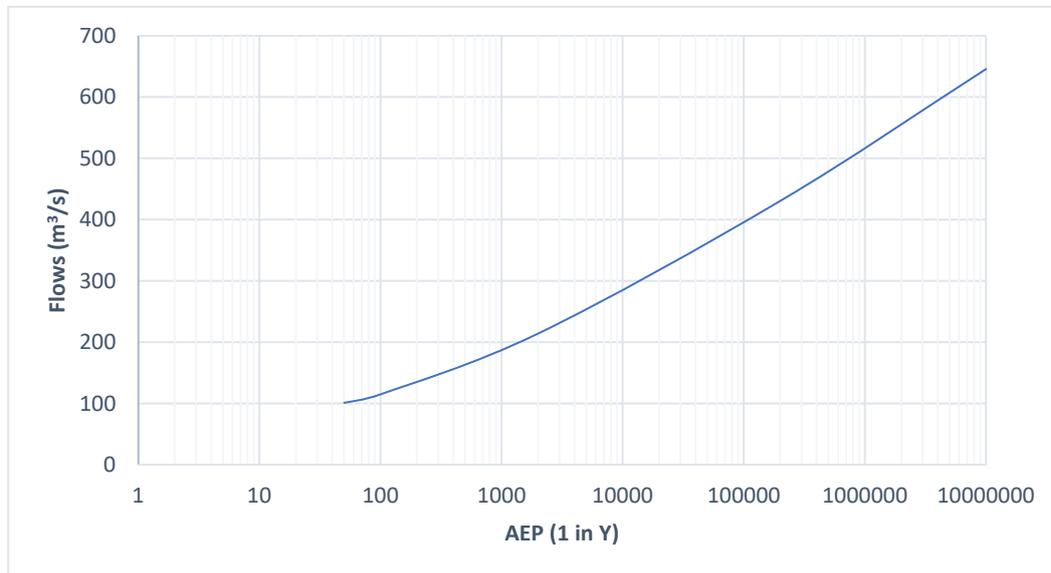
<u>Parameter</u>	<u>Value</u>	<u>Unit</u>	<u>Reference</u>
Area	6.00	km2	GIS calculations
50	101	m3/s	Rational method
100	115	m3/s	Rational method
PMP-DF	646	m3/s	Watt, S., Sciacca, D., Hughes. M., & Pedruco. P.

Interpolation

	<u>Parameter</u>	<u>Value</u>	<u>Unit</u>
1	$\log(X_{pmp}/X_{100}) / \log(X_{100}/X_{50})$	13.3	
2	AEP of PMP	1.00E-07	
3	$\log(X_y/X_{100}) / \log(X_{pmp}/X_{100})$	1 in Y1: 0.36 1 in Y2: 0.765	1 in 2000 1 in 200000
4	Xy1	214	m3/s
	Xy2	431	m3/s

Frequency Curve

50	101
100	115
2000	214
200000	431
1.00E+07	646



Appendix H – Traffic Count Data for Existing Bridges

MetroCount Traffic Executive Weekly Vehicle Counts

WeeklyVehicle-23 -- English (ENA)

Datasets:

Site: [Anich's Bridge] Anich's Bridge
Attribute: [+51.477222 +0.000000]
Direction: 4 - West bound, A trigger first. **Lane:** 2
Survey Duration: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020,
Zone:
File: Anich's Bridge 0 2020-12-24 0723.EC2 (Plus)
Identifier: HJ70WR3T MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
(7.30785)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = West, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 2205 / 2208 (99.86%)

Weekly Vehicle Counts

WeeklyVehicle-23

Site: Anich's Bridge.2.0W
Description: Anich's Bridge
Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	Mon 14 Dec	Tue 15 Dec	Wed 16 Dec	Thu 17 Dec	Fri 18 Dec	Sat 19 Dec	Sun 20 Dec	Averages 1 - 5	1 -
7									
Hour									
0000-0100	*	*	*	0	0	0	0	0.0	
0.0									
0100-0200	*	*	*	0	0	0	0	0.0	
0.0									
0200-0300	*	*	*	0	0	0	0	0.0	
0.0									
0300-0400	*	*	*	0	0	0	0	0.0	
0.0									
0400-0500	*	*	*	0	1	0	0	0.5	
0.3									
0500-0600	*	*	*	0	2	0	0	1.0	
0.5									
0600-0700	*	*	*	0	8	2	4	4.0	
3.5									
0700-0800	*	*	*	0	5	5	5	2.5	
3.8									
0800-0900	*	*	*	11	7	8	16	9.0	
10.5									
0900-1000	*	*	*	18	19	17	20	18.5	
18.5									
1000-1100	*	*	*	7	12	19	24	9.5	
15.5									
1100-1200	*	*	*	17	20	22	55	18.5	
28.5									
1200-1300	*	*	*	35	33	38	67	34.0	
43.3									
1300-1400	*	*	*	36	22	22	56	29.0	
34.0									
1400-1500	*	*	*	41	32	23	55	36.5	
37.8									
1500-1600	*	*	*	34	27	20	50	30.5	
32.8									
1600-1700	*	*	*	26	15	40	38	20.5	
29.8									
1700-1800	*	*	*	28	10	34	20	19.0	
23.0									
1800-1900	*	*	*	4	5	9	7	4.5	
6.3									
1900-2000	*	*	*	5	6	0	1	5.5	
3.0									
2000-2100	*	*	*	3	1	2	0	2.0	
1.5									
2100-2200	*	*	*	0	0	1	0	0.0	
0.3									
2200-2300	*	*	*	0	1	1	1	0.5	
0.8									
2300-2400	*	*	*	0	2	0	0	1.0	

0.5

Totals

0700-1900	*	*	*	257	207	257	413		232.0
283.5									
0600-2200	*	*	*	265	222	262	418		243.5
291.8									
0600-0000	*	*	*	265	225	263	419		245.0
293.0									
0000-0000	*	*	*	265	228	263	419		246.5
293.8									
AM Peak	*	*	*	0900	1100	1100	1100		
	*	*	*	18	20	22	55		
PM Peak	*	*	*	1400	1200	1600	1200		
	*	*	*	41	33	40	67		

* - No data.

Weekly Vehicle Counts

WeeklyVehicle-23

Site: Anich's Bridge.2.0W
Description: Anich's Bridge
Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	<u>Mon</u>	<u>Tue</u>	<u>Wed</u>	<u>Thu</u>	<u>Fri</u>	<u>Sat</u>	<u>Sun</u>	<u>Averages</u>	
	21 Dec	22 Dec	23 Dec	24 Dec	25 Dec	26 Dec	27 Dec	1 - 5	1 -
7									
Hour									
0000-0100	0	0	0	0	*	*	*		0.0
0.0									
0100-0200	0	0	1	0	*	*	*		0.3
0.3									
0200-0300	0	0	0	0	*	*	*		0.0
0.0									
0300-0400	0	0	2	0	*	*	*		0.5
0.5									
0400-0500	0	2	2	4	*	*	*		2.0
2.0									
0500-0600	9	3	4	3	*	*	*		4.8
4.8									
0600-0700	12	5	4	3	*	*	*		6.0
6.0									
0700-0800	9	8	6	0	*	*	*		5.8
5.8									
0800-0900	13	3	8	*	*	*	*		8.0
8.0									
0900-1000	13	10	15	*	*	*	*		12.7
12.7									
1000-1100	14	14	18	*	*	*	*		15.3
15.3									
1100-1200	34	19	27	*	*	*	*		26.7
26.7									
1200-1300	33	44	30	*	*	*	*		35.7
35.7									
1300-1400	36	42	30	*	*	*	*		36.0
36.0									
1400-1500	46	53	50	*	*	*	*		49.7
49.7									
1500-1600	37	39	32	*	*	*	*		36.0
36.0									
1600-1700	44	36	45	*	*	*	*		41.7
41.7									
1700-1800	34	39	37	*	*	*	*		36.7
36.7									
1800-1900	10	17	12	*	*	*	*		13.0
13.0									
1900-2000	3	1	0	*	*	*	*		1.3
1.3									
2000-2100	2	2	1	*	*	*	*		1.7
1.7									
2100-2200	0	1	5	*	*	*	*		2.0
2.0									
2200-2300	1	1	1	*	*	*	*		1.0
1.0									
2300-2400	0	0	1	*	*	*	*		0.3

0.3

Totals

0700-1900	323	324	310	*	*	*	*	317.1
317.1								
0600-2200	340	333	320	*	*	*	*	328.1
328.1								
0600-0000	341	334	322	*	*	*	*	329.4
329.4								
0000-0000	350	339	331	*	*	*	*	336.9
336.9								
AM Peak	1100	1100	1100	*	*	*	*	
	34	19	27	*	*	*	*	
PM Peak	1400	1400	1400	*	*	*	*	
	46	53	50	*	*	*	*	

* - No data.

MetroCount Traffic Executive Vehicle Counts

VehicleCount-24 -- English (ENA)

Datasets:

Site: [Anich's Bridge] Anich's Bridge
Attribute: [+51.477222 +0.000000]
Direction: 4 - West bound, A trigger first. **Lane:** 2
Survey Duration: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020,
Zone:
File: Anich's Bridge 0 2020-12-24 0723.EC2 (Plus)
Identifier: HJ70WR3T MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
(7.30785)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = West, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 2205 / 2208 (99.86%)

*** Thursday, 17 December 2020 - Total=265, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
0	0	0	0	0	0	0	0	0	11	18	7	17	35	36	41	34	26	28	4	5	3	0		
0	0	0	0	0	0	0	0	0	1	1	1	1	9	7	7	14	8	6	3	3	1	0		
0	0	0	0	0	0	0	0	0	2	9	3	5	12	4	14	10	7	6	0	1	0	0		
0	0	0	0	0	0	0	0	0	5	3	3	3	8	10	10	3	6	13	1	0	1	0		
0	0	0	0	0	0	0	0	0	3	5	0	8	6	15	10	7	5	3	0	1	1	0		

AM Peak 1145 - 1245 (37), AM PHF=0.77 PM Peak 1415 - 1515 (48), PM PHF=0.86

*** Friday, 18 December 2020 - Total=228, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
1	2	0	0	0	1	2	8	5	7	19	12	20	33	22	32	27	15	10	5	6	1	0		
1	0	0	0	0	0	0	1	1	0	4	3	4	11	5	6	6	4	3	4	3	0	0		
0	0	0	0	0	0	1	1	0	3	5	2	3	9	7	6	6	4	4	0	3	0	0		
0	0	0	0	0	1	0	1	3	2	5	1	7	4	6	14	5	5	2	1	0	0	0		
0	2	0	0	0	0	1	5	1	2	5	6	6	9	4	6	10	2	1	0	0	1	0		

AM Peak 1130 - 1230 (33), AM PHF=0.75 PM Peak 1200 - 1300 (33), PM PHF=0.75

*** Saturday, 19 December 2020 - Total=263, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
1	0	0	0	0	0	0	2	5	8	17	19	22	38	22	23	20	40	34	9	0	2	1		
1	0	0	0	0	0	0	2	0	1	4	7	1	10	10	4	3	10	12	6	0	1	0		
0	0	0	0	0	0	0	0	0	3	3	2	9	10	5	5	1	17	10	2	0	0	0		
0	0	0	0	0	0	0	0	3	1	5	5	4	9	1	8	9	5	7	1	0	1	0		
0	0	0	0	0	0	0	0	2	3	5	5	8	9	6	6	7	8	5	0	0	0	1		

AM Peak 1145 - 1245 (37), AM PHF=0.93 PM Peak 1530 - 1630 (43), PM PHF=0.63

*** Sunday, 20 December 2020 - Total=419, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
1	0	0	0	0	0	0	4	5	16	20	24	55	67	56	55	50	38	20	7	1	0	0		
1	0	0	0	0	0	0	0	0	6	3	6	11	20	24	11	16	9	9	4	0	0	0		
0	0	0	0	0	0	0	2	2	2	11	7	12	21	7	11	13	11	5	0	0	0	0		
0	0	0	0	0	0	0	0	2	1	1	2	13	16	15	16	11	8	2	3	0	0	0		
0	0	0	0	0	0	0	2	1	7	5	9	19	10	10	17	10	10	4	0	1	0	0		

AM Peak 1145 - 1245 (76), AM PHF=0.90 PM Peak 1215 - 1315 (71), PM PHF=0.74

*** Monday, 21 December 2020 - Total=350, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
1	0	0	0	0	0	9	12	9	13	13	14	34	33	36	46	37	44	34	10	3	2	0		
1	0	0	0	0	0	2	1	3	3	1	2	9	9	9	9	10	17	8	1	2	0	0		
0	0	0	0	0	0	1	3	1	5	5	4	4	5	4	5	11	10	10	6	1	1	0		
0	0	0	0	0	0	2	7	3	3	3	3	11	16	12	16	10	14	6	2	0	0	0		
0	0	0	0	0	0	4	1	2	2	4	5	10	3	11	16	6	3	10	1	0	1	0		

AM Peak 1145 - 1245 (40), AM PHF=0.63 PM Peak 1430 - 1530 (53), PM PHF=0.83

*** Tuesday, 22 December 2020 - Total=339, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
--	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

MetroCount Traffic Executive Daily Classes

DailyClass-25 -- English (ENA)

Datasets:

Site: [Anich's Bridge] Anich's Bridge
Attribute: [+51.477222 +0.000000]
Direction: 4 - West bound, A trigger first. **Lane:** 2
Survey Duration: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020,
Zone:
File: Anich's Bridge 0 2020-12-24 0723.EC2 (Plus)
Identifier: HJ70WR3T MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
(7.30785)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = West, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 2205 / 2208 (99.86%)

Daily Classes

DailyClass-25

Site: Anich's Bridge.2.0W
Description: Anich's Bridge
Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Monday, 14 December 2020

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Mon*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Tue*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Wed*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Thu	233	6	21	4	0	0	1	0	0	0	0	0	265
(%)	87.9	2.3	7.9	1.5	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	
Fri	205	5	13	0	4	0	1	0	0	0	0	0	228
(%)	89.9	2.2	5.7	0.0	1.8	0.0	0.4	0.0	0.0	0.0	0.0	0.0	
Sat	243	6	13	0	0	0	1	0	0	0	0	0	263
(%)	92.4	2.3	4.9	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	
Sun	397	4	18	0	0	0	0	0	0	0	0	0	419
(%)	94.7	1.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Average daily volume

Entire week

	270	5	16	1	1	0	1	0	0	0	0	0	294
(%)	91.7	1.8	5.5	0.3	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	

Weekdays

	219	6	17	2	2	0	1	0	0	0	0	0	247
(%)	88.8	2.2	6.9	0.8	0.8	0.0	0.4	0.0	0.0	0.0	0.0	0.0	

Weekend

	320	5	16	0	0	0	1	0	0	0	0	0	341
(%)	93.8	1.5	4.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	

* - Incomplete

Daily Classes

DailyClass-25

Site: Anich's Bridge.2.0W
Description: Anich's Bridge
Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Monday, 21 December 2020

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Mon	325	12	10	3	0	0	0	0	0	0	0	0	350
(%)	92.9	3.4	2.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Tue	318	8	8	4	1	0	0	0	0	0	0	0	339
(%)	93.8	2.4	2.4	1.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Wed	304	10	14	0	2	0	1	0	0	0	0	0	331
(%)	91.8	3.0	4.2	0.0	0.6	0.0	0.3	0.0	0.0	0.0	0.0	0.0	
Thu*	10	0	0	0	0	0	0	0	0	0	0	0	10
(%)	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fri*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sat*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sun*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Average daily volume

Entire week	316	10	11	2	1	0	0	0	0	0	0	0	340
(%)	92.8	2.9	3.1	0.7	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	
Weekdays	316	10	11	2	1	0	0	0	0	0	0	0	340
(%)	92.8	2.9	3.1	0.7	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	

Weekend No complete days.

* - Incomplete

MetroCount Traffic Executive **Speed Statistics**

SpeedStat-26 -- English (ENA)

Datasets:

Site: [Anich's Bridge] Anich's Bridge
Attribute: [+51.477222 +0.000000]
Direction: 4 - West bound, A trigger first. **Lane:** 2
Survey Duration: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020,
Zone:
File: Anich's Bridge 0 2020-12-24 0723.EC2 (Plus)
Identifier: HJ70WR3T MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
(7.30785)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = West, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 2205 / 2208 (99.86%)

Speed Statistics

SpeedStat-26

Site: Anich's Bridge.2.0W
Description: Anich's Bridge
Filter time: 0:00 Thursday, 17 December 2020 => 7:23 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 2205

Posted speed limit = 60 km/h, Exceeding = 106 (4.807%), Mean Exceeding = 64.62 km/h

Maximum = 79.8 km/h, Minimum = 16.1 km/h, Mean = 44.5 km/h

85% Speed = 53.64 km/h, 95% Speed = 59.76 km/h, Median = 44.10 km/h

20 km/h Pace = 34 - 54, Number in Pace = 1655 (75.06%)

Variance = 81.79, Standard Deviation = 9.04 km/h

Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - 10	0 0.000%	0 0.000%	2205 100.0%	0.00	0.00	0.00
10 - 20	11 0.499%	11 0.499%	2194 99.50%	0.00	0.00	0.00
20 - 30	84 3.810%	95 4.308%	2110 95.69%	0.00	0.00	0.00
30 - 40	577 26.17%	672 30.48%	1533 69.52%	0.00	0.00	0.00
40 - 50	971 44.04%	1643 74.51%	562 25.49%	0.00	0.00	0.00
50 - 60	456 20.68%	2099 95.19%	106 4.807%	0.00	0.00	0.00
60 - 70	94 4.263%	2193 99.46%	12 0.544%	0.00	0.00	0.00
70 - 80	12 0.544%	2205 100.0%	0 0.000%	0.00	0.00	0.00
80 - 90	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
90 - 100	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
100 - 110	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
110 - 120	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
120 - 130	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
130 - 140	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
140 - 150	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
150 - 160	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
160 - 170	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
170 - 180	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
180 - 190	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00
190 - 200	0 0.000%	2205 100.0%	0 0.000%	0.00	0.00	0.00

Total Speed Rating = 0.00

Total Moving Energy (Estimated) = 0.00

Speed limit fields (Partial days)

Limit	Below	Above
0 60 (PSL)	2099 95.2%	106 4.8%

MetroCount Traffic Executive Weekly Vehicle Counts

WeeklyVehicle-19 -- English (ENA)

Datasets:

Site: [Warner's Bridge] Warner's Bridge
Attribute:
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 2
Survey Duration: 14:51 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020,
Zone:
File: Warner's Bridge 0 2020-12-24 0713.EC2 (Plus)
Identifier: HJ60HHWE MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
(7.68144)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 650 / 652 (99.69%)

Weekly Vehicle Counts

WeeklyVehicle-19

Site: Warner's Bridge.2.3WE
Description: Warner's Bridge
Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	Mon 14 Dec	Tue 15 Dec	Wed 16 Dec	Thu 17 Dec	Fri 18 Dec	Sat 19 Dec	Sun 20 Dec	Averages 1 - 5	1 -
7									
Hour									
0000-0100	*	*	*	0	0	0	0	0.0	
0.0									
0100-0200	*	*	*	0	0	2	0	0.0	
0.5									
0200-0300	*	*	*	0	0	0	0	0.0	
0.0									
0300-0400	*	*	*	0	0	0	0	0.0	
0.0									
0400-0500	*	*	*	0	0	0	0	0.0	
0.0									
0500-0600	*	*	*	0	2	3	0	1.0	
1.3									
0600-0700	*	*	*	0	2	2	2	1.0	
1.5									
0700-0800	*	*	*	0	8	2	5	4.0	
3.8									
0800-0900	*	*	*	1	6	3	8	3.5	
4.5									
0900-1000	*	*	*	5	10	7	14	7.5	
9.0									
1000-1100	*	*	*	2	9	5	10	5.5	
6.5									
1100-1200	*	*	*	6	9	7	7	7.5	
7.3									
1200-1300	*	*	*	4	6	12	9	5.0	
7.8									
1300-1400	*	*	*	3	4	9	3	3.5	
4.8									
1400-1500	*	*	0	5	7	4	7	4.0	
4.6									
1500-1600	*	*	0	3	7	7	7	3.3	
4.8									
1600-1700	*	*	0	11	5	4	7	5.3	
5.4									
1700-1800	*	*	0	8	2	13	4	3.3	
5.4									
1800-1900	*	*	0	4	10	12	2	4.7	
5.6									
1900-2000	*	*	0	0	2	6	2	0.7	
2.0									
2000-2100	*	*	0	0	1	3	1	0.3	
1.0									
2100-2200	*	*	0	3	4	6	2	2.3	
3.0									
2200-2300	*	*	0	3	1	10	1	1.3	
3.0									
2300-2400	*	*	0	0	0	3	0	0.0	

0.6

Totals

0700-1900	*	*	*	52	83	85	83		57.2
69.3									
0600-2200	*	*	*	55	92	102	90		61.5
76.8									
0600-0000	*	*	*	58	93	115	91		62.8
80.4									
0000-0000	*	*	*	58	95	120	91		63.8
82.1									
AM Peak	*	*	*	1100	0900	1100	0900		
	*	*	*	6	10	7	14		
PM Peak	*	*	*	1600	1800	1700	1200		
	*	*	*	11	10	13	9		

* - No data.

Weekly Vehicle Counts

WeeklyVehicle-19

Site: Warner's Bridge.2.3WE

Description: Warner's Bridge

Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020

Scheme: Vehicle classification (AustRoads94)

Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

	<u>Mon</u>	<u>Tue</u>	<u>Wed</u>	<u>Thu</u>	<u>Fri</u>	<u>Sat</u>	<u>Sun</u>	<u>Averages</u>	
	21 Dec	22 Dec	23 Dec	24 Dec	25 Dec	26 Dec	27 Dec	1 - 5	1 -
7									
Hour									
0000-0100	0	0	0	0	*	*	*		0.0
0.0									
0100-0200	0	0	0	0	*	*	*		0.0
0.0									
0200-0300	0	0	0	0	*	*	*		0.0
0.0									
0300-0400	0	1	0	0	*	*	*		0.3
0.3									
0400-0500	0	0	0	0	*	*	*		0.0
0.0									
0500-0600	2	4	2	2	*	*	*		2.5
2.5									
0600-0700	6	7	4	7	*	*	*		6.0
6.0									
0700-0800	5	6	10	0	*	*	*		5.3
5.3									
0800-0900	8	2	2	*	*	*	*		4.0
4.0									
0900-1000	5	8	3	*	*	*	*		5.3
5.3									
1000-1100	3	8	10	*	*	*	*		7.0
7.0									
1100-1200	11	7	2	*	*	*	*		6.7
6.7									
1200-1300	0	5	5	*	*	*	*		3.3
3.3									
1300-1400	2	5	3	*	*	*	*		3.3
3.3									
1400-1500	5	5	7	*	*	*	*		5.7
5.7									
1500-1600	7	8	16	*	*	*	*		10.3
10.3									
1600-1700	8	8	5	*	*	*	*		7.0
7.0									
1700-1800	8	5	7	*	*	*	*		6.7
6.7									
1800-1900	5	8	9	*	*	*	*		7.3
7.3									
1900-2000	0	1	7	*	*	*	*		2.7
2.7									
2000-2100	6	6	2	*	*	*	*		4.7
4.7									
2100-2200	2	1	0	*	*	*	*		1.0
1.0									
2200-2300	1	1	3	*	*	*	*		1.7
1.7									
2300-2400	0	0	0	*	*	*	*		0.0

0.0

Totals

0700-1900	67	75	79	*	*	*	*	71.9
71.9								
0600-2200	81	90	92	*	*	*	*	86.3
86.3								
0600-0000	82	91	95	*	*	*	*	87.9
87.9								
0000-0000	84	96	97	*	*	*	*	90.7
90.7								
AM Peak	1100	1000	1000	*	*	*	*	
	11	8	10	*	*	*	*	
PM Peak	1700	1800	1500	*	*	*	*	
	8	8	16	*	*	*	*	

* - No data.

MetroCount Traffic Executive Daily Classes

DailyClass-20 -- English (ENA)

Datasets:

Site: [Warner's Bridge] Warner's Bridge
Attribute:
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 2
Survey Duration: 14:51 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020,
Zone:
File: Warner's Bridge 0 2020-12-24 0713.EC2 (Plus)
Identifier: HJ60HHWE MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
(7.68144)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 650 / 652 (99.69%)

Daily Classes

DailyClass-20

Site: Warner's Bridge.2.3WE
Description: Warner's Bridge
Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Monday, 14 December 2020

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Mon*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Tue*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Wed*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Thu	55	1	0	2	0	0	0	0	0	0	0	0	58
(%)	94.8	1.7	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fri	81	3	8	2	1	0	0	0	0	0	0	0	95
(%)	85.3	3.2	8.4	2.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sat	112	3	5	0	0	0	0	0	0	0	0	0	120
(%)	93.3	2.5	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sun	86	2	3	0	0	0	0	0	0	0	0	0	91
(%)	94.5	2.2	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Average daily volume

Entire week

	84	2	4	1	0	0	0	0	0	0	0	0	91
(%)	91.8	2.5	4.4	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Weekdays

	68	2	4	2	1	0	0	0	0	0	0	0	77
(%)	88.9	2.6	5.2	2.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Weekend

	99	3	4	0	0	0	0	0	0	0	0	0	106
(%)	93.8	2.4	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

* - Incomplete

Daily Classes

DailyClass-20

Site: Warner's Bridge.2.3WE
Description: Warner's Bridge
Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Monday, 21 December 2020

	1	2	3	4	5	6	7	8	9	10	11	12	Total
Mon	79	4	1	0	0	0	0	0	0	0	0	0	84
(%)	94.0	4.8	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Tue	87	5	4	0	0	0	0	0	0	0	0	0	96
(%)	90.6	5.2	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Wed	90	7	0	0	0	0	0	0	0	0	0	0	97
(%)	92.8	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Thu*	7	0	2	0	0	0	0	0	0	0	0	0	9
(%)	77.8	0.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Fri*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sat*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Sun*	0	0	0	0	0	0	0	0	0	0	0	0	0
(%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Average daily volume

Entire week

	85	5	2	0	0	0	0	0	0	0	0	0	92
(%)	92.4	5.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Weekdays

	85	5	2	0	0	0	0	0	0	0	0	0	92
(%)	92.4	5.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Weekend No complete days.

* - Incomplete

MetroCount Traffic Executive Vehicle Counts

VehicleCount-21 -- English (ENA)

Datasets:

Site: [Warner's Bridge] Warner's Bridge
Attribute:
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 2
Survey Duration: 14:51 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020,
Zone:
File: Warner's Bridge 0 2020-12-24 0713.EC2 (Plus)
Identifier: HJ60HHWE MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
(7.68144)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 650 / 652 (99.69%)

*** Wednesday, 16 December 2020 - Total=0 (Incomplete) , 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
0	0																							
0	0	0															0	0	0	0	0	0	0	0
0	0	0															0	0	0	0	0	0	0	0
0	0	0															0	0	0	0	0	0	0	0
0	0	0															0	0	0	0	0	0	0	0

*** Thursday, 17 December 2020 - Total=58, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	0	0	0	0	0	0	0	0	1	5	2	6	4	3	5	3	11	8	4	0	0	3		
3	0																							
0	0	0	0	0	0	0	0	0	0	1	0	3	1	0	1	1	2	3	1	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1	2	2	3	2	0	0	3		
1	0	0																						
2	0	0	0	0	0	0	0	0	1	1	2	1	1	1	1	0	3	1	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	2	0	4	1	1	0	0	0	0	

AM Peak 1030 - 1130 (6), AM PHF=0.50 PM Peak 1630 - 1730 (13), PM PHF=0.81

*** Friday, 18 December 2020 - Total=95, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	0	0	0	0	0	2	2	8	6	10	9	9	6	4	7	7	5	2	10	2	1	4		
1	0																							
0	0	0	0	0	0	0	0	3	2	3	3	4	0	0	0	2	2	1	2	0	1	1		
1	0	0																						
0	0	0	0	0	0	1	0	3	0	1	0	0	3	1	1	1	0	0	1	2	0	2		
0	0	0																						
0	0	0	0	0	0	0	1	1	3	2	4	2	1	3	3	4	2	0	4	0	0	1		
0	0	0																						
0	0	0	0	0	0	1	1	1	1	4	2	3	2	0	3	0	1	1	3	0	0	0		

AM Peak 0945 - 1045 (11), AM PHF=0.69 PM Peak 1445 - 1545 (10), PM PHF=0.63

*** Saturday, 19 December 2020 - Total=120, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	0	2	0	0	0	3	2	2	3	7	5	7	12	9	4	7	4	13	12	6	3	6		
10	3																							
0	0	0	0	0	0	1	0	1	2	0	1	1	4	3	2	2	1	2	2	3	0	1		
4	0	0																						
0	0	2	0	0	0	0	0	0	0	5	2	3	5	0	1	2	2	1	5	1	1	1		
3	2	0																						
0	0	0	0	0	0	2	1	0	0	1	1	0	3	1	0	3	0	5	3	2	1	0		
0	1	0																						
0	0	0	0	0	0	0	1	1	1	1	1	3	0	5	1	0	1	5	2	0	1	4		
3	0	0																						

AM Peak 1145 - 1245 (15), AM PHF=0.75 PM Peak 1730 - 1830 (17), PM PHF=0.85

*** Sunday, 20 December 2020 - Total=91, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
	0	0	0	0	0	2	5	8	14	10	7	9	3	7	7	7	4	2	2	1	2			
1	0																							
0	0	0	0	0	0	1	0	2	2	3	2	2	0	0	0	1	2	0	0	0	0	0		
0	0	0																						
0	0	0	0	0	0	0	0	1	2	4	2	1	5	0	4	1	1	0	2	1	1	1		
0	0	0																						
0	0	0	0	0	0	1	2	4	5	2	4	1	1	0	5	5	0	0	0	0	0	0		
1	0	0																						
0	0	0	0	0	0	0	2	0	3	3	0	1	2	3	1	0	2	0	1	0	1	0		
0	0	0																						

AM Peak 0915 - 1015 (15), AM PHF=0.75 PM Peak 1200 - 1300 (9), PM PHF=0.45

*** Monday, 21 December 2020 - Total=84, 15 minute drops**

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
--	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------

MetroCount Traffic Executive **Speed Statistics**

SpeedStat-22 -- English (ENA)

Datasets:

Site: [Warner's Bridge] Warner's Bridge
Attribute:
Direction: 6 - West bound A>B, East bound B>A. **Lane:** 2
Survey Duration: 14:51 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020,
Zone:
File: Warner's Bridge 0 2020-12-24 0713.EC2 (Plus)
Identifier: HJ60HHWE MC56-L5 [MC55] (c)Microcom 19Oct04
Algorithm: Factory default axle (v5.08)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
(7.68144)
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Speed range: 10 - 160 km/h.
Direction: North, East, South, West (bound), P = East, Lane = 0-16
Separation: Headway > 0 sec, Span 0 - 100 metre
Name: Default Profile
Scheme: Vehicle classification (AustRoads94)
Units: Metric (metre, kilometre, m/s, km/h, kg, tonne)
In profile: Vehicles = 650 / 652 (99.69%)

Speed Statistics

SpeedStat-22

Site: Warner's Bridge.2.3WE
Description: Warner's Bridge
Filter time: 14:52 Wednesday, 16 December 2020 => 7:13 Thursday, 24 December 2020
Scheme: Vehicle classification (AustRoads94)
Filter: Cls(1-12) Dir(NESW) Sp(10,160) Headway(>0) Span(0 - 100) Lane(0-16)

Vehicles = 650

Posted speed limit = 60 km/h, Exceeding = 66 (10.15%), Mean Exceeding = 63.42 km/h

Maximum = 82.0 km/h, Minimum = 11.5 km/h, Mean = 47.2 km/h

85% Speed = 58.14 km/h, 95% Speed = 62.72 km/h, Median = 48.24 km/h

20 km/h Pace = 41 - 61, Number in Pace = 436 (67.08%)

Variance = 114.35, Standard Deviation = 10.69 km/h

Speed Bins (Partial days)

Speed	Bin	Below	Above	Energy	vMult	n * vMult
0 - 10	0 0.000%	0 0.000%	650 100.0%	0.00	0.00	0.00
10 - 20	7 1.077%	7 1.077%	643 98.92%	0.00	0.00	0.00
20 - 30	39 6.000%	46 7.077%	604 92.92%	0.00	0.00	0.00
30 - 40	104 16.00%	150 23.08%	500 76.92%	0.00	0.00	0.00
40 - 50	213 32.77%	363 55.85%	287 44.15%	0.00	0.00	0.00
50 - 60	221 34.00%	584 89.85%	66 10.15%	0.00	0.00	0.00
60 - 70	64 9.846%	648 99.69%	2 0.308%	0.00	0.00	0.00
70 - 80	1 0.154%	649 99.85%	1 0.154%	0.00	0.00	0.00
80 - 90	1 0.154%	650 100.0%	0 0.000%	0.00	0.00	0.00
90 - 100	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
100 - 110	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
110 - 120	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
120 - 130	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
130 - 140	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
140 - 150	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
150 - 160	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
160 - 170	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
170 - 180	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
180 - 190	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00
190 - 200	0 0.000%	650 100.0%	0 0.000%	0.00	0.00	0.00

Total Speed Rating = 0.00

Total Moving Energy (Estimated) = 0.00

Speed limit fields (Partial days)

Limit	Below	Above
0 60 (PSL)	584 89.8%	66 10.2%

Appendix I – Bridge Barrier Assessment



Memorandum

08 February 2021

To	Douglas Shire Council		
Copy to	Michael Matthews		
From	Arthur Ahiladellis	Tel	+61 7 40442217
Subject	Bridge Barrier Assessment	Job no.	12540427

1 Introduction

GHD and Douglas Shire Council (Council) undertook a project start-up meeting on the 19th November 2020 for the bridge upgrade works at Warners and Anich's Bridge. During the meeting, the requirements and expected final bridge alignments were discussed. GHD advised Council within our proposal that GHD would undertake a risk assessment for the bridge barriers in accordance with current Australian Standards (AS5100.1:2017 – Bridge Design). The risk assessment includes aspects such as vehicle speed, traffic volume, debris build-up, bridge geometry, and other information as identified during the project start-up meeting.

The purpose of this document is to allow Council to undertake an internal risk assessment and to decide whether traffic barriers are to be installed onto the bridge or if the risks of not having a barrier can be mitigated by other means.

2 Bridge Barrier Assessment

GHD have undertaken a barrier performance rating assessment in accordance with current Australian Standard AS5100.1:2017. This section of the memorandum details the results from the risk assessment to provide Council with information to allow Council to undertake their internal risk assessment for the requirement of traffic barriers on the bridges.

2.1 Bridge Geometry and Site Conditions

The bridge geometry, site conditions, vehicle speeds, and other parameters that would affect the barrier assessment for the bridge rails have been summarised in Table 1 and Table 2. These parameters were used for the bridge barrier assessment with the results of the assessment outlined in Sections 2.2 and 2.3.



Memorandum

2.1.1 Warners Bridge

Table 1 Assessment parameters in accordance with barrier performance assessment

Assessment Parameter	Value
Traffic Volume	Estimated 30 year projection of <500 vehicles/day based on traffic data provided by Council.
Height of deck above invert of waterway	4.8 m at the highest point.
Alignment	Bridge alignment is straight. Approaches to either side of the bridge are straight.
Width of bridge between kerbs	4.9 m
Distance between edge of bridge and edge of traffic lanes	400 mm
Depth of water below bridge	Varies with the seasonal rainfall.
Debris build-up	Vegetation was observed on the timber decking.
Pedestrian traffic	It is assumed that no pedestrian traffic is expected apart from future maintenance and inspections.

2.1.2 Anich's Bridge

Table 2 Assessment parameters in accordance with barrier performance assessment

Assessment Parameter	Value
Traffic Volume	Estimated 30 year projection of >500 vehicles/day based on traffic data provided by Council.
Height of deck above invert of waterway	3.6 m at the highest point.
Alignment	Bridge alignment is straight. Approach road has shallow 50 degree curved to the north and has minor bend to the south.
Width of bridge between kerbs	4.9 m
Distance between edge of bridge and edge of traffic lanes	325-400 mm
Depth of water below bridge	Varies with the seasonal rainfall, with bridge becoming inundated during wet season.
Debris build-up	DSC advised that debris build-up is required to be removed from the bridge after the annual wet season.



Memorandum

Assessment Parameter	Value
Pedestrian traffic	Pedestrian and cyclists are expected to traverse the bridge frequently.



Memorandum

2.2 Bridge Barrier Risk Assessment

The parameters in Table 1 and Table 2 were compared to the bridge barrier performance requirements in outlined in AS5100.1:2017. Table 3 and Table 4 below, summarise the applicable risks to each bridge based on the bridge parameters outlined in Section 2.1.

Table 3 Barrier Risk Assessment for Warners Bridge

Barrier System	(Y/N)	Risk (in Accordance with AS5100.1:2017)	GHD Comment
No Barrier Installed onto Bridge	N	The bridge deck is less than 1.5 m above the ground or invert level of the waterway.	Deck is greater than 1.5 m above with an approximate height of 4.8 m.
	Y	Traffic volumes are less than 150 vehicles per day.	Current traffic volume being 92 vehicles/day based on traffic data provided by DSC.
	Y	The radius of curvature of the bridge is such that the road approaches have a sight distance greater than the stopping distance.	Both approaches are straight and provide sufficient stopping site distance.
	Y	The width between kerbs is not less than 6.5 m for a two-lane bridge or 4.2 m for a single lane bridge.	Width to be 4.9 m as per concept drawings.
	Y	The edge of the bridge is at least 1.0 m from the edge of traffic lanes.	Bridge has a single traffic lane with a 650 mm shoulder on either side along with a 400 mm kerb.
	Y	No pedestrian traffic is anticipated.	No requirement for pedestrian traffic.
	Y	Any water beneath the bridge is normally less than 1.2 m deep.	Normal water depths <1.2 m deep.
	Possible	The provision of barriers would prevent the passage of debris or the barriers would be frequently damaged by heavy debris or both.	Overtopping waters may be carrying large debris that could damage barriers



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Barrier System	(Y/N)	Risk (in Accordance with AS5100.1:2017)	GHD Comment
Bridge Barrier with a Low Load Requirement	Y	Bridges on roads with low traffic volumes.	Current traffic volume being 92 vehicles/day based on traffic data provided by DSC.
	Y	Bridges with low to medium height above ground or water.	Deck is approximately max 4.8 m above ground level.
	Y	Bridges with an essentially straight alignment.	Bridge will have a straight alignment.
	Y	Bridges with a width between barriers of not less than 6.5 m for a two-lane bridge or 4.2 m for a single lane bridge.	Width to be 4.9 m as per concept drawings
Bridge Barrier with a Medium Load Requirement	N	Bridges over major roadways.	N/A
	N	Bridges over high frequency passenger rail lines or goods lines carrying noxious, flammable or large volumes of freight, or over critical rail infrastructure.	N/A
	N	Bridges over high occupancy land use.	N/A
	N	Bridges more than 10 m high.	Maximum bridge height expected to be 4.8 m
	N	Bridges over water more than 3 m deep (normal flow).	Water depth expected to be <3 m deep

**The assessment for bridge railing with a Regular (intermediate between Low and Medium performance) or Special performance level have not been included in the above table as they are not applicable for this crossing.*



Memorandum

Table 4 Barrier Risk Assessment for Anichs Bridge

Barrier System	(Y/N)	Risk (in Accordance with AS5100.1:2017)	GHD Comment
No Barrier Installed onto Bridge	N	The bridge deck is less than 1.5 m above the ground or invert level of the waterway.	Deck is greater than 1.5 m above with an approximate height of 3.6 m.
	N	Traffic volumes are less than 150 vehicles per day.	Current traffic volume being 314 vehicles/day based on traffic data provided by DSC.
	Y	The radius of curvature of the bridge is such that the road approaches have a sight distance greater than the stopping distance.	Both approaches provide sufficient stopping site distance.
	Y	The width between kerbs is not less than 6.5 m for a two-lane bridge or 4.2 m for a single lane bridge.	Width to be 4.9 m as per concept drawings.
	Y	The edge of the bridge is at least 1.0 m from the edge of traffic lanes.	Bridge has a single traffic lane with a 650 mm shoulder on either side along with a 400 mm kerb.
	N	No pedestrian traffic is anticipated.	Pedestrian and cyclists are expected to traverse the bridge frequently.
	Y	Any water beneath the bridge is normally less than 1.2 m deep.	Normal water depths <1.2 m deep.
	Y	The provision of barriers would prevent the passage of debris or the barriers would be frequently damaged by heavy debris or both.	Debris build-up is noted to occur after each wet season and is required to be removed from the bridge.



Memorandum

Barrier System	(Y/N)	Risk (in Accordance with AS5100.1:2017)	GHD Comment
Bridge Barrier with a Low Load Requirement	Y	Bridges on roads with low traffic volumes.	Current traffic volume being 314 vehicles/day based on traffic data provided by DSC.
	Y	Bridges with low to medium height above ground or water.	Deck is approximately max 3.6 m above ground level.
	Y	Bridges with an essentially straight alignment.	Bridge will have a straight alignment.
	Y	Bridges with a width between barriers of not less than 6.5 m for a two-lane bridge or 4.2 m for a single lane bridge.	Width to be 4.9 m as per concept drawings
Bridge Barrier with a Medium Load Requirement	N	Bridges over major roadways.	N/A
	N	Bridges over high frequency passenger rail lines or goods lines carrying noxious, flammable or large volumes of freight, or over critical rail infrastructure.	N/A
	N	Bridges over high occupancy land use.	N/A
	N	Bridges more than 10 m high.	Maximum bridge height expected to be 3.6 m
	N	Bridges over water more than 3 m deep (normal flow).	Water depth expected to be <3 m deep

**The assessment for bridge railing with a Regular (intermediate between Low and Medium performance) or Special performance level have not been included in the above table as they are not applicable for this crossing.*



2.3 Outcome of Risk Assessment

2.3.1 Warners Bridge

Based on the risk assessment in Table 3 that primary concern with not including a traffic barrier on the bridge is the fall height from the bridge deck to the below ground level exceeds 1.5 m. As this fall height is fixed and far exceeds the 1.5 m limit (max fall height of 4.8 m), it is recommended that traffic barriers are installed along Warners Bridge in order to reduce this risk. It should be noted that the inclusion of traffic barriers introduces potential risk of damage to the traffic barriers due to debris loading experienced during flood events.

2.3.2 Anichs Bridge

It was found from the risk assessment in Table 4 that the risk for not having a traffic barrier on the bridge consists of:

1. Fall height from bridge deck level exceed 1.5 m
2. Average daily traffic volumes exceed 150 vehicles per day
3. Pedestrians are expected to cross the bridge frequently

Based on the outcomes of this assessment, it is recommended that traffic barriers are installed along Anichs Bridge in order to address the risks identified during the assessment. As the bridge becomes submerged during flood events, the traffic barriers installed will be expected to withstand debris loading.

2.4 Performance Level Required for Traffic Barriers

The assessments carried out in Table 3 and Table 4 showed that 'Low;' performance traffic barriers would be sufficient for both Warners and Anichs Bridge. A further assessment was then undertaken to determine if 'Low' performance traffic barriers would still be sufficient taking into account the expected future traffic growth. The expected future traffic volumes (Adjusted AADT) for both bridges were calculated in accordance with AS5100.1:2017 Clause A4.2.6, with the results summarised in Table 5:

Table 5 Adjusted AADT Values for Warners and Anichs Bridge

Factors	Warners Bridge	Anichs Bridge
AADT – 2% growth over a 30yr period	167 Vehicles/Day	569 Vehicles/Day
RT – Road Type Factor	Single Lane = 2.0	Single Lane = 2.0
GD – Road Grade Factor	Approach Grade < -2% = 1.0	Approach Grade < -2% = 1.0
CU – Curvature Factor	Straight Alignment = 1.0	Straight Alignment = 1.0



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US – Deck Height & Under Structure Condition Factor	Deck Height 4.6 m, Low Occupancy Land = 1.0	Deck Height 3.6 m, Low Occupancy Land = 1.0
Adjusted AADT (Vehicles / Day)	334 Vehicles/Day	1,138 Vehicles/Day

It can be seen from Figure 1 below, that the performance level requirement for the bridge railings at both bridges would need be a minimum 'Low Level' barrier.

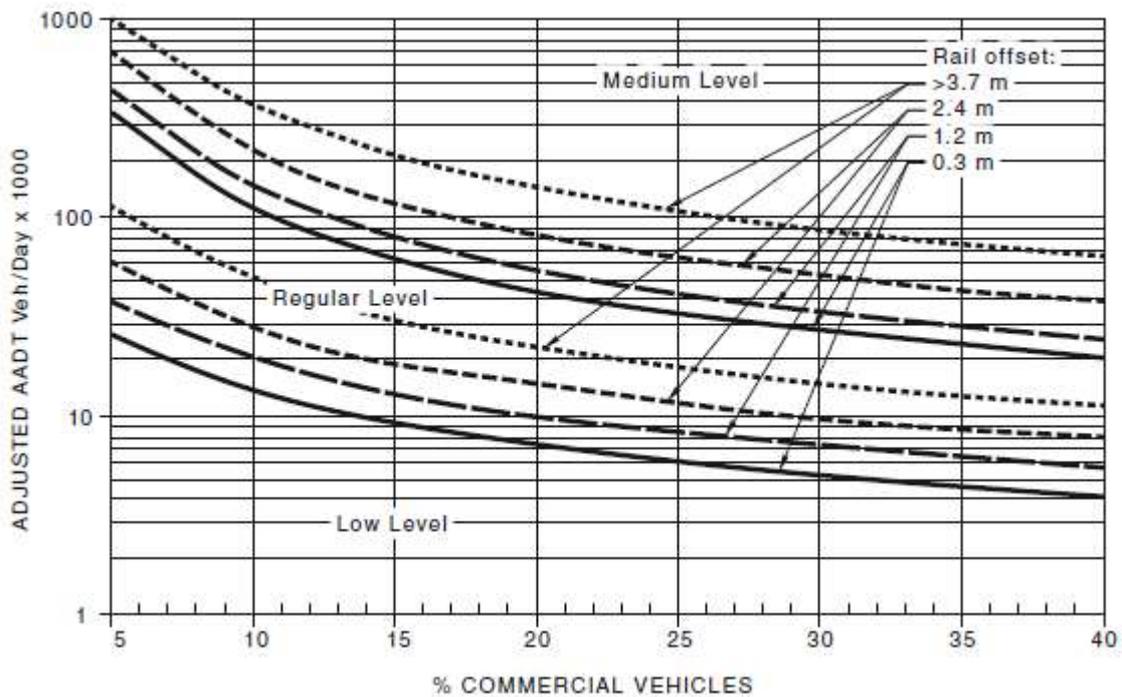


Figure 1: Threshold Limits, 60 km/hr (AS5100.1:2017, Figure A5)

2.4.1 Design Loading for Barrier

A 'Low' performance level would be suitable for a 2.27 tonne utility vehicle (i.e. work ute) at a maximum impact speed of 70 km/h with an impact angle of 25 degrees as per Table 6. It should be noted that the force imparted into the barrier is a function of the mass and the square of the velocity, so a much slower larger vehicle may also impart a similar force. For example, a 10t truck would impart a similar load travelling at 30 km/hr, as long as the barrier was high enough to contain the higher centre of gravity of the truck.

If DSC expect that the more risky vehicles using the bridge would generally be larger, then a higher performance barrier within Table 6 may be adopted. Vehicles that are taller than a standard utility



Memorandum

vehicle with a higher centre of gravity and may require a higher performing barrier system in order to contain these vehicles in the event of an impact.

Table 6 Crash test vehicles for different performance level barriers (AS5100.1:2017 Table 14.4)

Barrier performance level	Vehicles	Test speed	Impact angle	MASH 2009
		km/h	Degrees	Test level
Low	1.1 t small car	70	25	TL2
	2.27 t utility (see Note 1)	70	25	
Regular	1.1 t small car	100	25	TL4
	2.27 t utility	100	25	
	10 t rigid truck (see Note 1)	90	15	
Medium	1.1 t small car	100	25	TL5
	2.27 t utility	100	25	
	36 t articulated van (see Note 1)	90	15	
Special	Determined for specific site	Site specific	Site specific	Site specific
	1.1 t small car	100	25	(see Note 2)
	2.27 t utility	100	25	(see Note 2)
e.g. high	36 t articulated van (see Note 1)	100	15	~TL6 (see Note 3)

NOTES:

- 1 Controlling strength test vehicles.
- 2 No equivalent MASH test level.
- 3 No equivalent MASH test level. The controlling strength test vehicle may be a 44 t articulated van substituted for the 36 t tanker. For other requirements, the MASH test level 6 should be used.

3 Conclusions and Recommendations

A risk assessment was undertaken for both Warners and Anichs Bridge in accordance with Australian Bridge Standards AS5100.1:2017. This assessed the individual risks associated with each bridge to identify if traffic barriers were required. It is recommended that DSC undertake an internal risk assessment and determine if the hazards outlined in Section 2.2 can be controlled by other means (i.e. reduced speed limits, signage, etc.) or if the hazards are sufficiently low enough to accept as is. DSC should also consider potential detrimental risks associated with installing a barrier in relation to damage due to debris loading during flood events.

If DSC wish to install a traffic barrier onto one or both bridges, then the assessed performance requirement would be a 'Low' level barrier that can accommodate a 2.27 tonne utility vehicle as specified in Table 6. DSC would need to consider higher performing (and therefore stronger) barriers if the proposed vehicles at risk are taller and/or heavier than a 2.27 tonne utility vehicle.



Memorandum

We hope this assessment assists DSC with their internal risk assessment for the requirement of traffic barriers.

Feel free to contact the undersigned if you have any questions or wish to discuss.

Regards

A handwritten signature in blue ink, appearing to read 'Arthur Ahiladellis', written in a cursive style.

Arthur Ahiladellis

Lead Engineer

Appendix J – DCWC Construction Cost Estimates

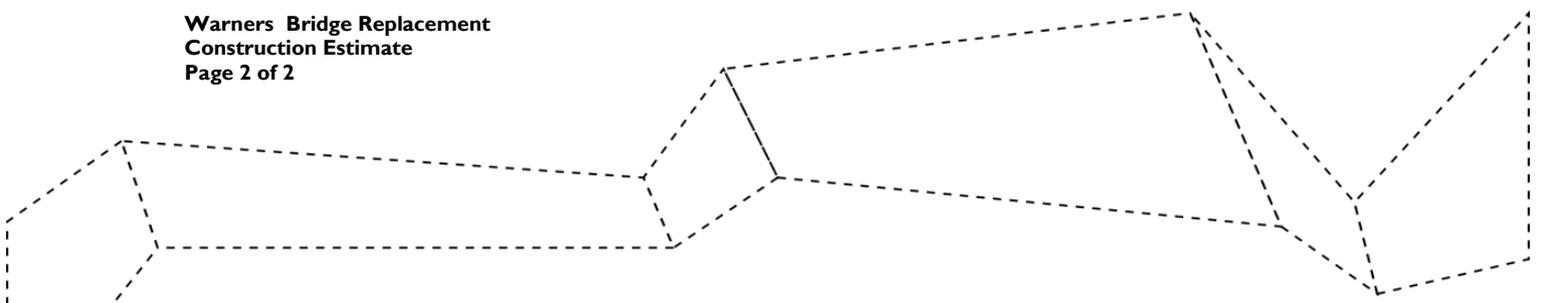
- Asbestos and/or other contaminated material removal or stabilisation

We trust the foregoing is satisfactory. Please do not hesitate to contact us should you require any further assistance.

Yours faithfully
Donald Cant Watts Corke (Qld) Pty Ltd



Jim McKiddie
Associate Director Queensland



Estimate Summary

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement Construction Estimate
Building: Q20198 Anichs & Warners Bridge Upgrade	

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
	WARNERS BRIDGE REPLACEMENT CONSTRUCTION ESTIMATE						
	Bridge Details				0		0
	MRS28 - Contractor's Site Facilities				22,300		22,300
	MRS02 - Provision for Traffic				32,050		32,050
	MRS51 - Environmental Management				55,500		55,500
	MRS52 - Erosion & Sediment Control				31,000		31,000
	MRS03 - Drainage, Retaining Structures and Protective Treatments				35,510		35,510
	MRS04 - General Earthworks				86,815		86,815
	MRS05 - Unbound Pavements				35,230		35,230
	MRS30 - Dense Graded Asphalt				44,895		44,895
	MRS84 - Deck Wearing Surface				14,124		14,124
	MRS45 - Road Surface Delineation				5,700		5,700
	MRS14 - Road Furniture				46,200		46,200
	MRS66 - Driven Steel Piles				233,003		233,003
	MRS62 - Bridge Substructure				86,147		86,147
	MRS74 - Prestressed Concrete Deck & Kerb Units				291,635		291,635
	MRS76 - Supply and Erection of Steel Girders				9,813		9,813
	MRS77 - Bridge Deck				51,627		51,627
	MRS91 - Conduits & Pits				18,215		18,215
	Subtotal						1,099,764
	Contingency	10.0	%	1,099,764.34	109,976		109,976
	Contractor's Preliminaries				109,800.00		109,800
	Contractor's Supervision	1	item	118,758.67	118,759		118,759
	Contractor's Margin	12.0	%	1,438,299.44	172,596		172,596
	Total Construction Cost						1,610,895
	Exclusions				0		0

GFA: 0.00 m2

1,610,895

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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Bridge Details

Bridge Details							
	Bridge length - Abutment A to B	21	m		Incl		0
	Bridge width	6	m		Incl		0
	New pavement	193	m		Incl		0

0

MRS28 - Contractor's Site Facilities

Site Establishment							
20101 .01	Site establishment	1	Item	2,500.00	2,500.00		2,500
20101 .02	Contractors site facilities	1	Item	19,800.00	19,800		19,800

22,300

MRS02 - Provision for Traffic

MRS02 - Traffic management							
1202. 01	Note - road closed and traffic diverted						
1202. 02	Prepare Traffic Management Plan (TMP)	1	Item	3,500.00	3,500		3,500
1202. 03	Provision for traffic	1	Item	10,000.00	10,000		10,000
1221. 01	Supply of Temporary Barriers (fencing)	214	m	30.00	6,420		6,420
1223. 01	Installation of Temporary Barriers (fencing)	214	m	45.00	9,630		9,630
20202 .02	WHS Management Plan	1	Item	2,000.00	2,000.00		2,000
20202 .03	Acid Sulphate Soils Management Plan (ASSMP)	1	Item	500.00	500.00		500

32,050

MRS51 - Environmental Management

MRS51							
1330. 01	Weekly Environmental Inspections	1	Item	4,000.00	4,000		4,000
1330. 02	Implement Environmental Management Plan (Construction)	1	Item	2,500.00	2,500		2,500
1330. 03	Monthly Environmental Reporting	1	Item	2,000.00	2,000		2,000
1330. 04	Environmental Records Management	1	Item	500.00	500		500
1330. 05	Approvals	1	Item	10,000.00	10,000		10,000
1331	Prepare Environmental Management Plan (EMP)	1	Item	3,000.00	3,000		3,000
1333	Liaison with Ergon for working in proximity to overhead power lines, including all payable fees	1	Item	3,000.00	3,000.00		3,000

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade
Building: Q20198 Anichs & Warners Bridge Upgrade

Details: Warners Bridge Replacement
 Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
MRS51 - Environmental Management (Continued)							
3101	Tree protection	1	Item	1,500.00	1,500		1,500
1341P .01	Water Quality Monitoring	1	Item	5,000.00	5,000		5,000
1341P .02	Dewatering & groundwater management	1	Item	3,000.00	3,000.00		3,000
1355P .01	Prepare Noise Assessment Report	1	Item	2,000.00	2,000		2,000
1355P .02	Implement Noise Management Plan	1	Item	500.00	500		500
1361P .01	Vibration monitoring equipment	1	Item		Nil		Nil
1361P .02	Condition Surveys, if ordered	1	Item	500.00	500		500
1361P .03	Condition Surveys on existing	1	Item		Incl.		Incl.
1362. 01	Preparation of Vibration Management Report	1	Item	2,000.00	2,000		2,000
1362. 02	Implement of Vibration Management Plan	1	Item		Nil		Nil
1375P	Fauna Management	1	Item	2,500.00	2,500		2,500
20201 .01	Geotechnical investigation	1	Item	1,500.00	1,500.00		1,500
20222 P.01	Survey and setting out of the works	1	Item	1,500.00	1,500.00		1,500
20222 P.02	As-constructed drawings (including survey)	1	Item	5,000.00	5,000.00		5,000
20202 .01	Structural certification (QBSA Form 16)	1	Item	3,000.00	3,000.00		3,000
20222 P.03	All relevant application fees, charges and levies	1	Item	2,500.00	2,500.00		2,500
20501	GBRMPA Compliance	1	Item		Nil		Nil
	Reinstatement of existing public and private infrastructure damaged during construction to pre-existing condition. Including but not limited to roads, driveways, vegetation, turf, concrete paths, kerb and channel complete	1	Item		Nil		Nil
							55,500

MRS52 - Erosion & Sediment Control

	Erosion and sediment control						
20501 .02	Allow for erosion and sediment control	1	Item	25,000.00	25,000		25,000
	Generally						
20501 .04	Inspection testing plans and records	1	Item	1,000.00	1,000.00		1,000
20501 .05	Handover data	1	Item	5,000.00	5,000.00		5,000

31,000

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS03 - Drainage, Retaining Structures and Protective Treatments

Rock Protection							
2643.01	Geofabric to rock protection	134	m2	15.00	2,010		2,010
2643.02	Rock protection to both sides of the base	134	m2	250.00	33,500		33,500

35,510

MRS04 - General Earthworks

Site clearance							
3101.01	Clearing and grubbing	1,214	m2	20.00	24,280		24,280
3101.02	Tree removal	1	Item	30,000.00	30,000		30,000
3101.03	Clear vegetation to embankments	1	Item	5,000.00	5,000		5,000
3103P.1	150mm stripping of topsoil	963	m2	5.00	4,815		4,815
3201.01	Box out for new road	243	m3	35.00	8,505		8,505
3202.01	Batter to the side of the road	38	m3	35.00	1,330		1,330
Groundworks							
3204.01	Excavate for abutments	19	m3	135.00	2,565		2,565
3204.02	Excavate for working space	48	m3	135.00	6,480		6,480
3204.03	Backfill for working space	48	m3	80.00	3,840		3,840

86,815

MRS05 - Unbound Pavements

Unbound Pavements							
4152.01	Compact subgrade	810	m2	5.00	4,050		4,050
4152.01	200mm Type 2.3 subbase	162	m3	85.00	13,770		13,770
4152.02	Compact sub base	810	m2	5.00	4,050		4,050
4153.01	120mm Type 2.2 base course	98	m3	95.00	9,310		9,310
4153.02	Compact base course	810	m2	5.00	4,050		4,050

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS05 - Unbound Pavements
(Continued)

35,230

MRS30 - Dense Graded Asphalt

Road Surface							
5405.02	AMC0 Prime	810	m2	14.00	11,340		11,340
5501.01	30mm AC10 Dense grade asphalt	810	m2	33.00	26,730		26,730
5401.01	Allow for tie connection to existing road	195	m	35.00	6,825		6,825

44,895

MRS84 - Deck Wearing Surface

MRS84 - Deck Wearing Surface							
8601.01	Bituminous waterproof membrane Dekguard E200	132	m2	45.00	5,940		5,940
8603.01	Dense graded asphalt surfacing layer, DG [14] mm mix	132	m2	57.00	7,524		7,524
8606.01	Tack Coat, 0.2 litres/m2 residual bitumen	132	m2	5.00	660		660

14,124

MRS45 - Road Surface Delineation

Road Surface Delineation (MRS45)							
6301.01	Line marking	1	Item	5,000.00	5,000		5,000
6301.02	Permanent survey mark, brass bench mark	1	No	700.00	700		700

5,700

MRS14 - Road Furniture

Signage							
6121.01	Temporary signage to side access road	1	Item	1,200.00	1,200		1,200
6101.01	Demolition of road furniture	1	Item	1,000.00	1,000		1,000
6121.02	Supply of regulatory, warning and hazard sign faces	1	Item	3,500.00	3,500		3,500
Guardrail							
6161.01	W-Beam approach rails	75	m	500.00	37,500		37,500
6163.01	ET2000 Terminal guardrail	4	No	750.00	3,000		3,000

46,200

MRS66 - Driven Steel Piles

350WC197 Driven Steel Piles							
70801	Steel piles, supply on site [12 No.]	197	m	886.50	174,641		174,641

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade
Building: Q20198 Anichs & Warners Bridge Upgrade

Details: Warners Bridge Replacement
Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
MRS66 - Driven Steel Piles (Continued)							
	Establish rig on site	1	Item	7,500.00	7,500		7,500
70802	Handling and pitching of steel piles	12	No	250.00	3,000		3,000
70803 P	Driving steel piles (Provisional quantity)	197	m	73.94	14,566		14,566
70807	Setting up for pre-boring for steel piles	1	Item	500.00	500		500
70813 P.1	Butt welded steel piles	24	No	70.70	1,697		1,697
70813 P.2	Protective coating 954	170	m2	130.00	22,100		22,100
70817	Trimming of steel pile heads including welded starter bars	12	No	750.00	9,000		9,000

233,003

MRS62 - Bridge Substructure

Blinding layer							
7314. 01	50 Concrete blinding layer to abutment	47	m2	55.00	2,585		2,585
Concrete							
7314. 02	Concrete in abutment headstock	19	m3	533.25	10,132		10,132
7314. 03	Concrete in wingwalls	19	m3	533.25	10,132		10,132
Formwork							
7314. 02	Concrete in abutment headstock	82	m2	220.00	18,040		18,040
7314. 03	Concrete in wingwalls	123	m2	220.00	27,060		27,060
Reinforcement							
7321. 01	Bar reinforcement in abutment headstock	3.87	t	3,090.00	11,958		11,958
7321. 02	Bar reinforcement in wingwalls	2.00	t	3,090.00	6,180		6,180
Surface Treatment							
7314. 04	Coat finish between wingwalls and relieving slab	4	m2	15.00	60		60

86,147

MRS74 - Prestressed Concrete Deck & Kerb Units

Prestressed Concrete Deck units							
8101. 01	Prestressed concrete deck unit, supply on site, 600 x 900mm deep, 21m long	7	No	31,185.00	218,295		218,295
8101. 02	Prestressed concrete scuppers, supply on site, 600 x 900mm deep, 21m long	2	No	31,185.00	62,370		62,370
8103. 01	Transport of prestressed concrete deck units to the Site	1	Item		Incl.		Incl.

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS74 - Prestressed Concrete Deck & Kerb Units
(Continued)

8104.01	Transport of transverse stressing units to the Site	1	Item		Incl.		Incl.
8121.01	Erection of prestressed concrete deck units 600 x 760mm deep, 19m long	7	No		Incl.		Incl.
8121.02	Erection of prestressed concrete deck units 600 x 500mm deep, 10m long	2	No		Incl.		Incl.
8131.01	Holding down bolts 900mm deep	16	No	220.00	3,520		3,520
	Miscellaneous						
8112.01	150 x 140 x 32 Thick Galv bearing plate	10	No				
8112.01	70mm Dia conduit	57	m	50.00	2,850		2,850
8112.01	80mm dia conduit cast into kerbs	92	m	50.00	4,600		4,600
8112.01	29mm Dia stressing rods, 5.7m long	10	No		Incl.		Incl.

291,635

MRS76 - Supply and Erection of Steel Girders

Structural Steelwork							
71901.01	100mm PFC galvanised frame, supply on site [21000mm long]	2	No	4,906.44	9,813		9,813
71903.01	100mm PFC galvanised frame, transport on site [21000mm long]	2	No		Incl.		Incl.
71906.01	100mm PFC galvanised frame, erection [21000mm long]	2	No		Incl.		Incl.

9,813

MRS77 - Bridge Deck

Reinforced Concrete Slab Deck							
8303.01	Concrete in kerb	4	m3	533.25	2,133		2,133
8312.01	Finish top of kerb	59	m2	20.00	1,180		1,180
	Formwork						
8303.01	Formwork to the sides of the kerb	59	m2	220.00	12,980		12,980
	Reinforcement						
8311.01	Bar reinforcement in kerb	0.79	t	3,090.00	2,441		2,441
	Relieving slab						
3221.01	50 concrete blinding layer to relieving slab	32	m2	55.00	1,760		1,760
8306.01	Concrete in relieving slab 300mm thick	10	m3	533.25	5,333		5,333

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS77 - Bridge Deck
(Continued)

8306.01	Formwork to edge relieving slab	21	m2	220.00	4,620		4,620
8313.01	Allow bar reinforcement at 150kg/m3 in relieving slab	1.43	t	3,090.00	4,419		4,419
8306.02	Finish top of relieving slab	32	m2	15.00	480		480
	Miscellaneous Cast-in Items						
8306.01	45mm dia lifting loop	4	No		Incl.		Incl.
8343.01	uPVC scupper and spout, 80mm diameter	16	No	50.00	800		800
8121.01	20mm thick mortar seating to top of headstock	22	m2	200.00	4,400		4,400
8306.02	75mm dia 450 deep core holes (with grout)	18	No	85.00	1,530		1,530
8306.03	75 x 75 x 6 Galv MS washer	36	No		Incl.		Incl.
8306.04	M36/4.6/S Galv HD bolts	18	No		Incl.		Incl.
8306.05	25x25 Chamfers	24	No		Incl.		Incl.
	Joints & Fillers						
8351.01	10mm thick compressible fillers	10	m2	200.00	2,000		2,000
8351.02	40x100mm deep dia foam core	63	No	4.00	252		252
8361.01	30mm thick sawcut joint to deck wearing surface	16	m	50.00	800		800
	Reinstatement of Electrical Items						
8382.01	Disconnection of existing Telstra line	1	Item	1,500.00	1,500		1,500
8382.02	Connection / relocation of existing telstra line	1	Item	5,000.00	5,000		5,000

51,627

MRS91 - Conduits & Pits

	Reinstatement of Existing Service						
6505.01	Existing water main to be diverted onto new bridge	51	m	165.00	8,415		8,415
6505.02	Connection of diverted water main to existing water main including any necessary valves	2	No	750.00	1,500		1,500
6505.03	8mm Plate bracket for water main	4	No	450.00	1,800		1,800
	Pit						
6555.03	1200x1200mm inlet pit up to 1000mm deep to invert including class 2 lid, inlet for 450 dia RCP pipe and outlet for 450 dia RCP pipe	1	No	6,500.00	6,500		6,500

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Warners Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS91 - Conduits & Pits
(Continued)

18,215

Contractor's Preliminaries

Contractor's Preliminaries							
	Small plant and equipment (generator, other small tools, etc)	60	day	150.00	9,000		9,000.00
	Signage	12	wk	150.00	1,800		1,800.00
	Miscellaneous	1	item	4,200.00	4,200		4,200.00
	Provision of insurances	1	Item	4,800.00	4,800		4,800
	Building & Construction Industry Levy (QLeave)	1	Item	12,000.00	Excl.		Excl.
	Spotters	2,000	hrs	45.00	90,000		90,000

109,800

Exclusions

EXCLUSIONS							
	<u>This Estimate specifically excludes:</u>						
	GST		Note				
	Construction cost escalation from todays date		Note				
	Economic and/or other impacts of Covid-19 virus		Note				
	Consultant's fees & disbursements		Note				
	Staging / phasing costs		Note				
	Major upgrades and/or alterations to other existing external services		Note				
	Relocation of other major existing external services		Note				
	Asbestos and/or other contaminated material removal or stabilisation		Note				

0

0

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REF: Q20198_Anichs Bridge
Replacement_Construction Estimate_210421

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**DONALD
CANT
WATTS
CORKE**

21st April 2021

GHD Pty Ltd
Level 6, Cairns Corporate Tower
15 Lake Street
Cairns QLD 4870

Attention: Mr Mitchell Isenbert

Dear Mitchell,

**Anichs Bridge Replacement
Construction Estimate**

As requested, we have prepared a Construction Estimate for the above project based on the information provided by yourselves.

We report our Construction Estimate as follows:

Anichs Bridge Replacement **\$1,618,512 (Excl GST)**

We have attached a copy of our Estimate Summary and a Detailed Break-up of the estimate for your information.

The following are specifically excluded from the above estimates:

- GST
- Construction cost escalation from today's date
- Economic and/or other impacts of Covid-19 virus
- Consultant's fees & disbursements
- Staging / phasing costs
- Major upgrades and/or alterations to other existing external services
- Relocation of other major existing external services



**partners for
excellence**

DONALD CANT WATTS CORKE (QLD) PTY LTD
ABN 12 091 531 823

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PERTH
SYDNEY
TOWNSVILLE

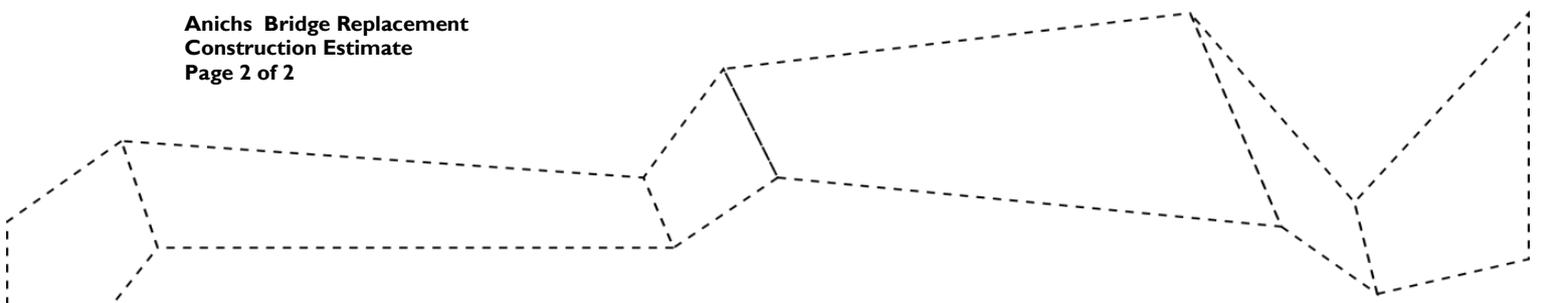
- Asbestos and/or other contaminated material removal or stabilisation
- Provision of transverse conduits and reinforcement to Anichs Bridge

We trust the foregoing is satisfactory. Please do not hesitate to contact us should you require any further assistance.

Yours faithfully
Donald Cant Watts Corke (Qld) Pty Ltd



Jim McKiddie
Associate Director Queensland



Estimate Summary

Project: Anichs & Warren Bridge Upgrade
Building: Q20198 Anichs & Warners Bridge Upgrade

Details: Anichs Bridge Replacement
 Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
	ANICHS BRIDGE REPLACEMENT CONSTRUCTION ESTIMATE						
	Bridge Details				0		0
	MRS28 - Contractor's Site Facilities				22,300		22,300
	MRS02 - Provision for Traffic				62,102		62,102
	MRS51 - Environmental Management				58,000		58,000
	MRS52 - Erosion & Sediment Control				31,000		31,000
	MRS03 - Drainage, Retaining Structures and Protective Treatments				102,965		102,965
	MRS04 - General Earthworks				111,105		111,105
	MRS84 - Deck Wearing Surface				5,400		5,400
	MRS45 - Road Surface Delineation				5,700		5,700
	MRS14 - Road Furniture				52,700		52,700
	MRS66 - Driven Steel Piles				202,847		202,847
	MRS62 - Bridge Substructure				139,947		139,947
	MRS74 - Prestressed Concrete Deck & Kerb Units				147,360		147,360
	MRS76 - Supply and Erection of Steel Girders				26,344		26,344
	MRS77 - Bridge Deck				83,590		83,590
	MRS80 - Supply & Erection of Bridge Barrier				36,790		36,790
	MRS72 - Manufacture of Precast Concrete				17,287		17,287
	Subtotal						1,105,437
	Contingency	10.0	%	1,105,436.5 1	110,544		110,544
	Contractor's Preliminaries				109,800.00		109,800
	Contractor's Supervision	1	item	119,320.21	119,320		119,320
	Contractor's Margin	12.0	%	1,445,100.3 7	173,412		173,412
	Total Construction Cost						1,618,512
	Exclusion				0		0

GFA: 0.00 m2

1,618,512

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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Bridge Details

Bridge Details							
	Bridge Length - Abutment A to B	23	m		Incl		0
	Bridge width (incl. cyclist / pedestrian paths)	4	m		Incl		0

0

MRS28 - Contractor's Site Facilities

Site Establishment							
1102.01	Site establishment	1	Item	2,500.00	2,500.00		2,500
1102.02	Contractors site facilities	1	Item	19,800.00	19,800		19,800

22,300

MRS02 - Provision for Traffic

MRS02 - Traffic management							
Note - road closed and traffic diverted							
1201.01	Provision for traffic	1	Item	10,000.00	10,000		10,000
1202.01	Prepare Traffic Management Plan (TMP)	1	Item	3,500.00	3,500		3,500
1221.01	Supply of Temporary Barriers (fencing)	207	m	30.00	6,210		6,210
1223.01	Installation of Temporary Barriers (fencing)	207	m	45.00	9,315		9,315
Construction of side access track							
1211.01	Geo-fabric membrane	278	m2	15.00	4,170		4,170
1211.02	Gravel layer	42	m3	110.00	4,620		4,620
1211.03	Leveling and compaction	278	m2	6.50	1,807		1,807
1211.04	Temporary safety rail	141	m	120.00	16,920		16,920
1211.05	Removal of side access track on completion	278	m2	20.00	5,560		5,560

62,102

MRS51 - Environmental Management

MRS51							
1330.01	Weekly Environmental Inspections	1	Item	4,000.00	4,000		4,000
1330.02	Implement Environmental Management Plan (Construction)	1	Item	2,500.00	2,500		2,500
1330.03	Monthly Environmental Reporting	1	Item	2,000.00	2,000		2,000
1330.04	Environmental Records Management	1	Item	500.00	500		500

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade
Building: Q20198 Anichs & Warners Bridge Upgrade

Details: Anichs Bridge Replacement
Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
MRS51 - Environmental Management (Continued)							
1330.05	Approvals	1	Item	10,000.00	10,000		10,000
1331.01	Prepare Environmental Management Plan (EMP)	1	Item	3,000.00	3,000		3,000
1333.01	Liaison with Ergon for working in proximity to overhead power lines, including all payable fees	1	Item	3,000.00	3,000.00		3,000
3101.01	Tree protection	1	Item	1,500.00	1,500		1,500
1341P.01	Water Quality Monitoring	1	Item	5,000.00	5,000		5,000
1341P.02	Dewatering & groundwater management	1	Item	3,000.00	3,000.00		3,000
1355P.01	Prepare Noise Assessment Report	1	Item	2,000.00	2,000		2,000
1355P.02	Implement Noise Management Plan	1	Item	500.00	500		500
1361P.01	Vibration monitoring equipment	1	Item		Nil		0
1361P.02	Condition Surveys, if ordered	1	Item	500.00	500		500
1361P.03	Condition Surveys on existing	1	Item		Incl.		Incl.
1362.01	Preparation of Vibration Management Report	1	Item	2,000.00	2,000		2,000
1362.02	Implement of Vibration Management Plan	1	Item		Nil		0
1375P	Fauna Management	1	Item	2,500.00	2,500		2,500
20201.01	Geotechnical investigation	1	Item	1,500.00	1,500.00		1,500
20222 P.01	Survey and setting out of the works	1	Item	1,500.00	1,500.00		1,500
20222 P.02	As-constructed drawings (including survey)	1	Item	5,000.00	5,000.00		5,000
20202.01	Structural certification (QBSA Form 16)	1	Item	3,000.00	3,000.00		3,000
20222 P.03	All relevant application fees, charges and levies	1	Item	2,500.00	2,500.00		2,500
20501	GBRMPA Compliance	1	Item		Nil		Nil
20501	Reinstatement of existing public and private infrastructure damaged during construction to pre-existing condition. Including but not limited to roads, driveways, vegetation, turf, concrete paths, kerb and channel complete	1	Item		Nil		Nil
20202.02	WHS Management Plan	1	Item	2,000.00	2,000.00		2,000
20202.03	Acid Sulphate Soils Management Plan (ASSMP)	1	Item	500.00	500.00		500

58,000

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS52 - Erosion & Sediment Control

Erosion and sediment control							
20501	Allow for erosion and sediment control	1	Item	25,000.00	25,000		25,000
Generally							
20501	Inspection testing plans and records	1	Item	1,000.00	1,000.00		1,000
20501	Handover data	1	Item	5,000.00	5,000.00		5,000

31,000

MRS03 - Drainage, Retaining Structures and Protective Treatments

Supply & Installation of Culverts							
2242.01	Pipe culverts, 1200 dia.	12	m	1,300.00	15,600		15,600
2242.02	Removal of pipe culverts on completion	1	Item	1,500.00	1,500		1,500
Demolition							
2107.01	Demolition & removal of guardrail	58	m	80.00	4,640		4,640
2107.02	Demolition and removal of existing cane train rails	22	m		Incl.		Incl
2107.03	Demolish existing bridge superstructure complete including kerbs, rails etc	124	m2	350.00	43,400		43,400
2107.04	Demolish existing substructure piers to bed level	1	Item	10,000.00	10,000		10,000
Rock Protection							
2643.01	Geofabric to rock protection	105	m2	15.00	1,575		1,575
2643.02	Rock protection to both sides of the base	105	m2	250.00	26,250		26,250

102,965

MRS04 - General Earthworks

Site clearance							
3101.01	Tree removal for temporary side access	1	Item	10,000.00	10,000		10,000
3101.02	Clearing and grubbing	1	Item	2,500.00	2,500		2,500
3101.03	Clear vegetation to embankments	1	Item	2,500.00	2,500		2,500
Groundworks							
3204.01	Excavate for abutments	18	m3	135.00	2,430		2,430
3204.02	Excavate for working space	55	m3	135.00	7,425		7,425
3204.04	Excavate for relieving slab	70	m3	135.00	9,450		9,450
3204.03	Backfill for working space	55	m3	80.00	4,400		4,400

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS04 - General Earthworks
(Continued)

Temporary Side Track Access							
3204.05	Allowance for clearing of creek	1	Item	2,000.00	2,000		2,000
3204.06	Geo-fabric creek bed	153	m2	15.00	2,295		2,295
3204.07	Fill to the pipe culvert embankment	364	m3	110.00	40,040		40,040
3204.08	Removal of fill on completion	364	m3	75.00	27,300		27,300
3204.09	Removal and disposal of geofabric on completion	153	m2	5.00	765		765

111,105

MRS84 - Deck Wearing Surface

MRS84 - Deck Wearing Surface							
8601.01	Bituminous waterproof membrane Dekguard E200	120	m2	45.00	5,400		5,400

5,400

MRS45 - Road Surface Delineation

Road Surface Delineation (MRS45)							
6301.01	Line marking	1	Item	5,000.00	5,000		5,000
6301.02	Permanent survey mark, brass bench mark	1	No	700.00	700		700

5,700

MRS14 - Road Furniture

Signage							
6121.01	Temporary signage to side access road	1	Item	1,200.00	1,200		1,200
6101.01	Demolition of existing road furniture	1	Item	1,000.00	1,000		1,000
6121.01	Supply of regulatory, warning and hazard sign faces	1	Item	3,500.00	3,500		3,500
Guardrail							
6161.01	W-Beam approach rails	88	m	500.00	44,000		44,000
6163.01	ET2000 Terminal guardrail	4	No	750.00	3,000		3,000

52,700

MRS66 - Driven Steel Piles

350WC197 Driven Steel Piles							
70801	Steel piles, supply on site [10 No.]	165	m	886.50	146,273		146,273
	Establish rig on site	1	Item	7,500.00	7,500		7,500
70802	Handling and pitching of steel piles	10	No	250.00	2,500		2,500

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS66 - Driven Steel Piles
(Continued)

70803 P	Driving steel piles (Provisional quantity)	165	m	73.94	12,200		12,200
70807	Setting up for pre-boring for steel piles	1	Item	500.00	500		500
70813 P.1	Butt welded steel piles	20	No	70.70	1,414		1,414
70813 P.2	Protective coating 954	192	m2	130.00	24,960		24,960
70817	Trimming of steel pile heads including welded starter bars	10	No	750.00	7,500		7,500

202,847

MRS62 - Bridge Substructure

	Blinding Layer						
7314. 02	50 Concrete blinding layer to abutment	34	m2	55.00	1,870		1,870
	Concrete						
7314. 02	Concrete in abutment headstock	36	m3	533.25	19,197		19,197
7314. 03	Concrete in wingwalls	53	m3	533.25	28,262		28,262
	Formwork						
7314. 02	Concrete in abutment headstock	69	m2	220.00	15,180		15,180
7314. 03	Concrete in wingwalls	267	m2	220.00	58,740		58,740
	Reinforcement						
7321. 01	Steel reinforcing bar in abutment headstock	2.27	t	3,090.00	7,014		7,014
7321. 02	Steel reinforcing bar in wingwall	2.93	t	3,090.00	9,054		9,054
	Surface Treatment						
2652. 01	Coat finish between wingwalls and relieving slab	21	m2	30.00	630		630

139,947

MRS74 - Prestressed Concrete Deck & Kerb Units

	Prestressed Concrete Deck units						
8101. 01	Prestressed concrete deck unit, supply on site, 600 x 600mm deep, 16m long	7	No	15,840.00	110,880		110,880
8101. 02	Prestressed concrete edge unit, supply on site, 600 x 600mm deep, 16m long	2	No	15,840.00	31,680		31,680
8103. 01	Transport of prestressed concrete deck units to the site	1	Item		Incl.		Incl.
8121. 01	Erection of prestressed concrete deck units 600 x 600mm deep, 16m long	7	No		Incl.		Incl.

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade
Building: Q20198 Anichs & Warners Bridge Upgrade

Details: Anichs Bridge Replacement
 Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
MRS74 - Prestressed Concrete Deck & Kerb Units (Continued)							
8121.02	Erection of prestressed concrete edge unit, supply on site, 600 x 600mm deep, 16m long	2	No		Incl.		Incl.
8131.01	Holding down bolts 600mm deep	18	No	220.00	3,960		3,960
8101.03	15.2mm dia pre-stressing strands	52	m		Incl.		Incl.
Steel Framing							
8112.01	100 PFC 600mm long	0.03	t	8,000.00	240		240
	Attached support brackets	6	No	50.00	300		300
	M16 Anchors	12	No	25.00	300		300

147,360

MRS76 - Supply and Erection of Steel Girders

Steel Girders							
Cyclist / Footpath							
71901.01	150 PFC S.S, supply on site [1330mm long]	21	No	310.74	6,526		6,526
71901.02	150 PFC S.S, supply on site [2100mm long]	21	No	490.64	10,304		10,304
71901.03	150 PFC S.S, supply on site [720mm long]	21	No	168.22	3,533		3,533
71901.04	100 x 50 S.S packer plates [22000mm long]	2	No	2,991.12	5,982		5,982
71903.01	150 PFC S.S, transport to the site [1330mm long]	21	No		Incl.		Incl.
71903.02	150 PFC S.S, transport to the site [2100mm long]	21	No		Incl.		Incl.
71903.03	150 PFC S.S, transport to the site [720mm long]	21	No		Incl.		Incl.
71903.04	100 x 50 S.S packer plates, transport to the site [22000mm long]	2	No		Incl.		Incl.
71906.01	150 PFC S.S, erection [1330mm long]	21	No		Incl.		Incl.
71906.02	150 PFC S.S, erection [2100mm long]	21	No		Incl.		Incl.
71906.03	150 PFC S.S, erection [720mm long]	21	No		Incl.		Incl.
71906.04	100 x 50 S.S packer plates, erection [22000mm long]	2	No		Incl.		Incl.
Fixing Accessories							
	M12 Grade 316 bolts (grouted)	252	No		Incl.		Incl.
	M16 Grade 315 S.S stud with washer	63	No		Incl.		Incl.
	75mm embedment	252	No		Incl.		Incl.

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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MRS76 - Supply and Erection of Steel Girders
(Continued)

	50 SQ x 20 recesses	126	No		Incl.		Incl.
	100 x 10 S.S	126	No		Incl.		Incl.
	50 x 50 x 5 EA trimmer	5	m		Incl.		Incl.
	6.0mm dia. S.S hooks	12	No		Incl.		Incl.
	6.0mm Plate S.S stiffeners	126	No		Incl.		Incl.

26,344

MRS77 - Bridge Deck

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
	Reinforced Concrete Slab Deck						
8302.01	40 MPa reinforced concrete slab	29	m3	533.25	15,464		15,464
8311.01	40 MPa reinforced concrete kerb	4	m3	533.25	2,133		2,133
	Formwork						
8311.02	Formwork to the sides of concrete kerb	16	m2	220.00	3,520		3,520
	Reinforcement						
8311.03	Reinforcement in concrete slab deck	4.67	t	3,090.00	14,433		14,433
8312.01	Reinforcement in concrete kerb	0.88	t	3,090.00	2,719		2,719
	Relieving slab						
	50 concrete blinding layer to relieving slab	24	m2	55.00	1,320		1,320
8306.01	Concrete in relieving slab	7	m3	533.25	3,733		3,733
8313.01	Allow bar reinforcement at 150kg/m3 in relieving slab	1.05	t	3,090.00	3,245		3,245
	Miscellaneous Cast-in Items						
8306.02	Core hole 75 dia 450 deep	18	No	85.00	1,530		1,530
8361.01	Holding down bolts - M30/4.6/S Galv HD bolts (1.1m)	18	No		Incl		Incl
8361.02	75 x 75 x 6 Galv MS washer	18	No		Incl.		Incl.
8121.01	20mm thick mortar seating to top of headstock	22	m2	200.00	4,400		4,400
8112.01	Drip groove with epoxy to scupper	16	No		Incl.		Incl.
8343.01	uPVC scupper and spout, 80mm diameter	16	No	50.00	800		800
8315.01	M20 Stainless steel 30 dia. threaded rod with coupler, 360mm long	74	No	50.00	3,700		3,700
8361.02	M16 x 25 bolts	74	No		Incl.		Incl.

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
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**MRS77 - Bridge Deck
(Continued)**

8361.03	15.2 dia strand lifting loops	18	No		Incl.		Incl.
8361.04	45 dia. x 1.6mm thick conduit	18	No		Incl.		Incl.
8306.03	70 dia hole with 100 x 100 x 40 deep recess	4	No		Incl.		Incl.
8306.04	25 x 25 chamfers	16	No		Incl.		Incl.
	Cane Rail	44	m	318.74	14,024		14,024
	Joints & Fillers						
8351.01	10mm thick compressible fillers	7	m2	200.00	1,400		1,400
8351.02	40x100mm deep dia foam core	57	No	4.00	228		228
8351.03	Backing rod between deck and relieving slab	12	m	50.00	600		600
8351.04	Sikaflex Pro joint sealant to backing rod	12	m	50.00	600		600
	Allow for tie connection to existing road	12	m	120.00	1,440		1,440
	Surface Finish						
8302.01	Rough broom finish to deck and kerbs	120	m2	15.00	1,800		1,800
	Reinstatement of Electrical Items						
8382.01	Disconnection of existing Telstra line	1	Item	1,500.00	1,500		1,500
8382.02	Connection / relocation of existing telstra line	1	Item	5,000.00	5,000		5,000

83,590

MRS80 - Supply & Erection of Bridge Barrier

	Bridge Barrier, Steel						
8401.01	Supply and fabrication of bridge traffic rail, steel	43	m	500.00	21,500		21,500
8402.01	Supply and fabrication of bridge balustrade to cyclist path, steel	23	m	550.00	12,650		12,650
8403.01	Supply and fabrication of bridge safety rail over traffic rail at pedestrian path	22	m	120.00	2,640		2,640
8404.01	Transport and erection of bridge traffic rail, steel	43	m		Incl.		Incl.
8405.01	Transport and erection of bridge balustrade to cyclist path, steel	23	m		Incl.		Incl.
8406.01	Transport and erection of bridge safety rail, steel	43	m		Incl.		Incl.

36,790

MRS72 - Manufacture of Precast Concrete

	Precast Concrete						

Detailed Breakdown

Project: Anichs & Warren Bridge Upgrade	Details: Anichs Bridge Replacement
Building: Q20198 Anichs & Warners Bridge Upgrade	Construction Estimate

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
MRS72 - Manufacture of Precast Concrete (Continued)							
	Supply and install precast concrete [1972 x 2250mm wide]	6	No	1,552.95	9,318		9,318
	Supply and install precast concrete [2215 x 2250mm wide]	2	No	1,744.31	3,489		3,489
	Supply and install precast concrete [2845 x 2250mm wide]	2	No	2,240.44	4,481		4,481
							17,287

Contractor's Preliminaries

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
Contractor's Preliminaries							
	Small plant and equipment (generator, other small tools, etc)	60	day	150.00	9,000		9,000.00
	Signage	12	wk	150.00	1,800		1,800.00
	Miscellaneous	1	item	4,200.00	4,200		4,200.00
	Provision of insurances	1	Item	4,800.00	4,800		4,800
	Building & Construction Industry Levy (QLeave)	1	Item	12,000.00	Excl.		Excl.
	Spotters	2,000	hrs	45.00	90,000		90,000
							109,800

Exclusion

Code	Description	Quantity	Unit	Rate	Subtotal	Factor	Total
EXCLUSIONS							
<u>This Estimate specifically excludes:</u>							
	GST		Note				
	Construction cost escalation from todays date		Note				
	Economic and/or other impacts of Covid-19 virus		Note				
	Consultant's fees & disbursements		Note				
	Staging / phasing costs		Note				
	Major upgrades and/or alterations to other existing external services		Note				
	Relocation of other major existing external services		Note				
	Asbestos and/or other contaminated material removal or stabilisation		Note				
	Provision of transverse conduits and reinforcement to Anichs Bridge		Note				

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13/https://projectsportal.ghd.com/sites/pp10_01/warnersandanichsbrid/ProjectDocs/12540427-REP-Warners and Anichs Bridge Detailed Design Report.docx

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Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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