Douglas Shire Council

Warners and Anichs Bridge Upgrades
Concept Design Report

March 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 concept design phase and is a continuation on the Options Assessment Report issued to DSC on the 8th February 2021. The Options Assessment Report provided DSC with various replacement options for both crossings, including different alignments, and bridge systems (incl. proprietary and in-house designs). DSC have since advised their preferred option for each crossing choosing:

- Warners Bridge
    - Option 2 – Downstream Offline Replacement, with
    - Option A – PSC Deck Units with Asphalt Wearing Surface.
- Anichs Bridge
    - Option 1 – Inline Bridge Replacement, with
    - Option A – PSC Deck Units with Concrete Topping Slab.

This report outlines the design criteria, design loads, as well as details the outcomes of additional hydraulic and geotechnical investigations undertaken during the concept design phase. This additional information is accompanied by updated concept design drawings for both Warners and Anichs Bridge that 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

1.3 Purpose of Report

The purpose of this report is to outline the structural design criteria, design process and the adopted outcomes developed during the concept design of each bridge. It also summarises the associated investigative reports which have been undertaken during the concept design phase. This report will serve to assist DSC and provide DSC with the opportunity to review the updated concept design and provide comment on any of the design elements.

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 Gravely 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 ± 9~10 m[1]
- A Digital Elevation Model (DEM) of the area using 1 metre LiDAR data with a vertical accuracy of ±0.15 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 Ancichs 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 n 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.

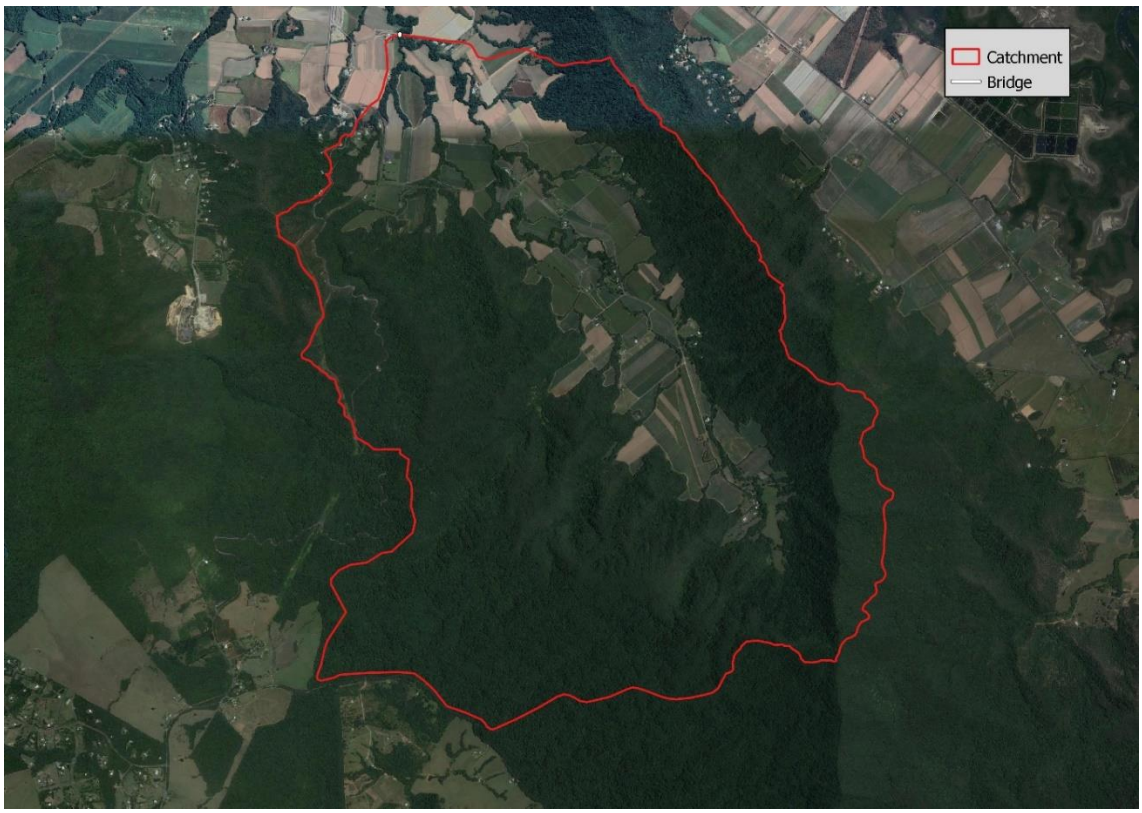


Figure 3 Warners Bridge catchment area

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 region[3]. 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.

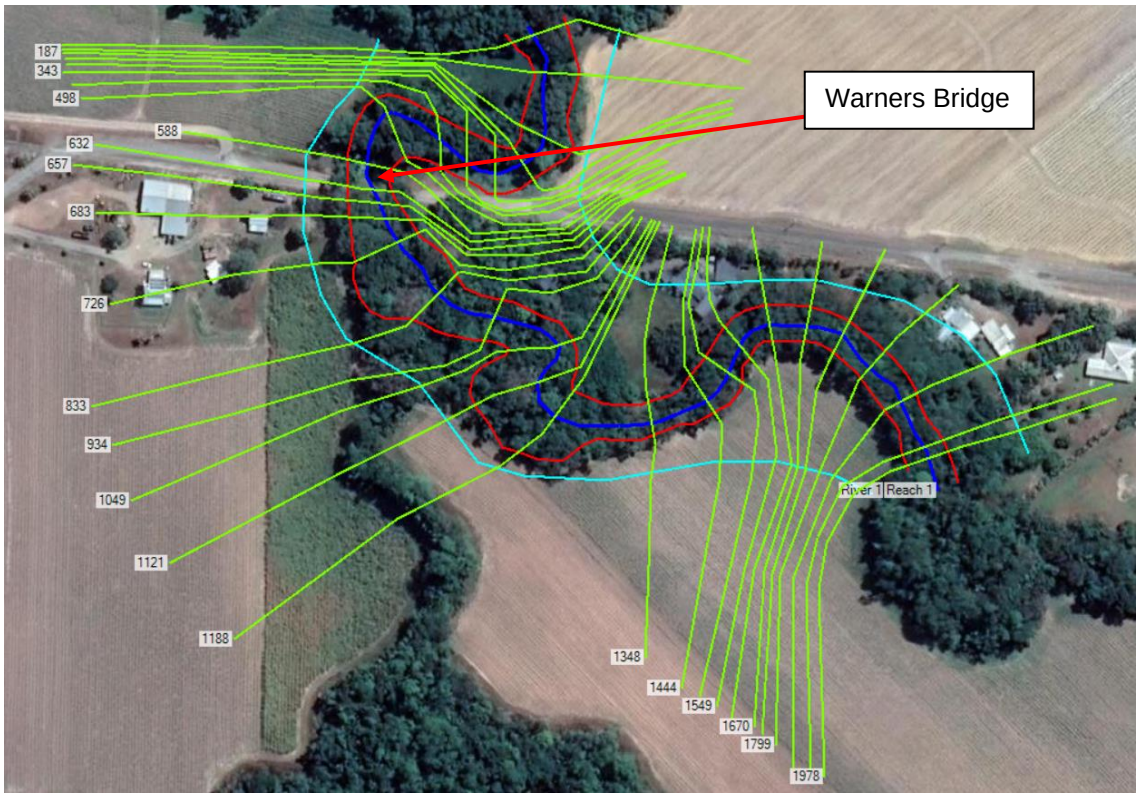


Figure 4 Warners Bridge hydraulic model extent

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 region[4]. 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.

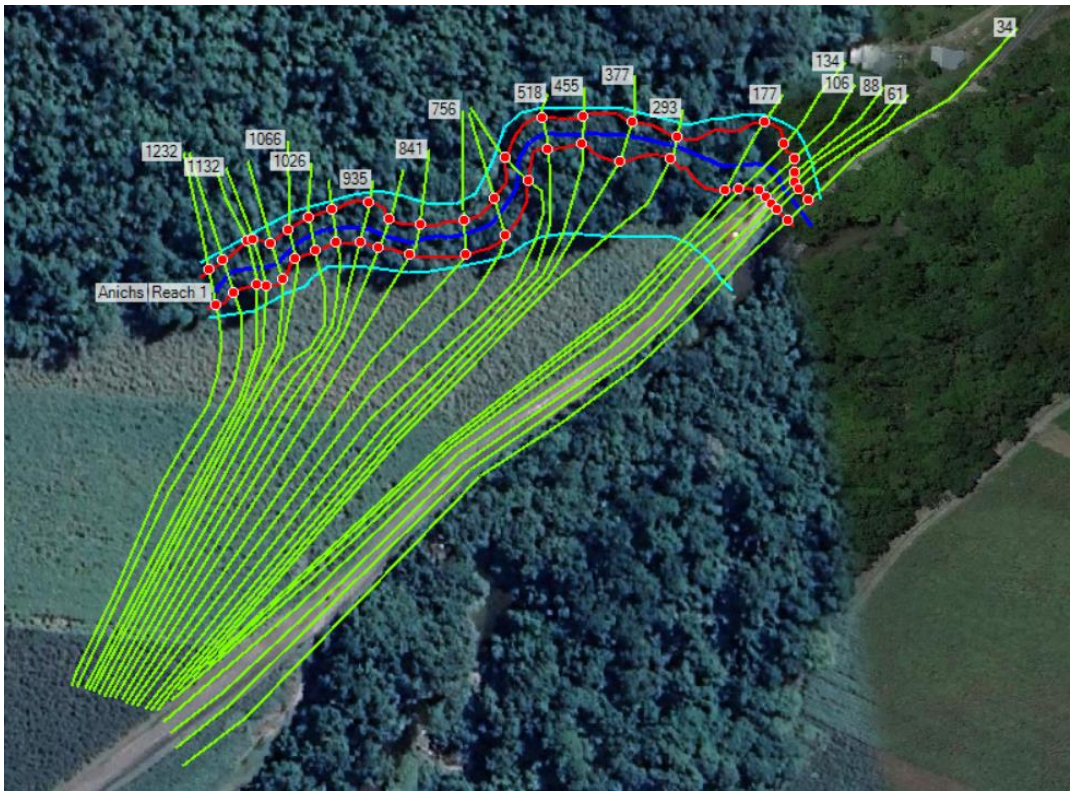


Figure 6 Anichs Bridge hydraulic model extent

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 vegetation.

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 are 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	50
	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 that 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 maybe 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.
- Cranage 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/m^3
- Density of prestressed concrete = 26.0 kN/m^3
- Density of structural steel = 79.0 kN/m^3
- 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/m^3
- 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:

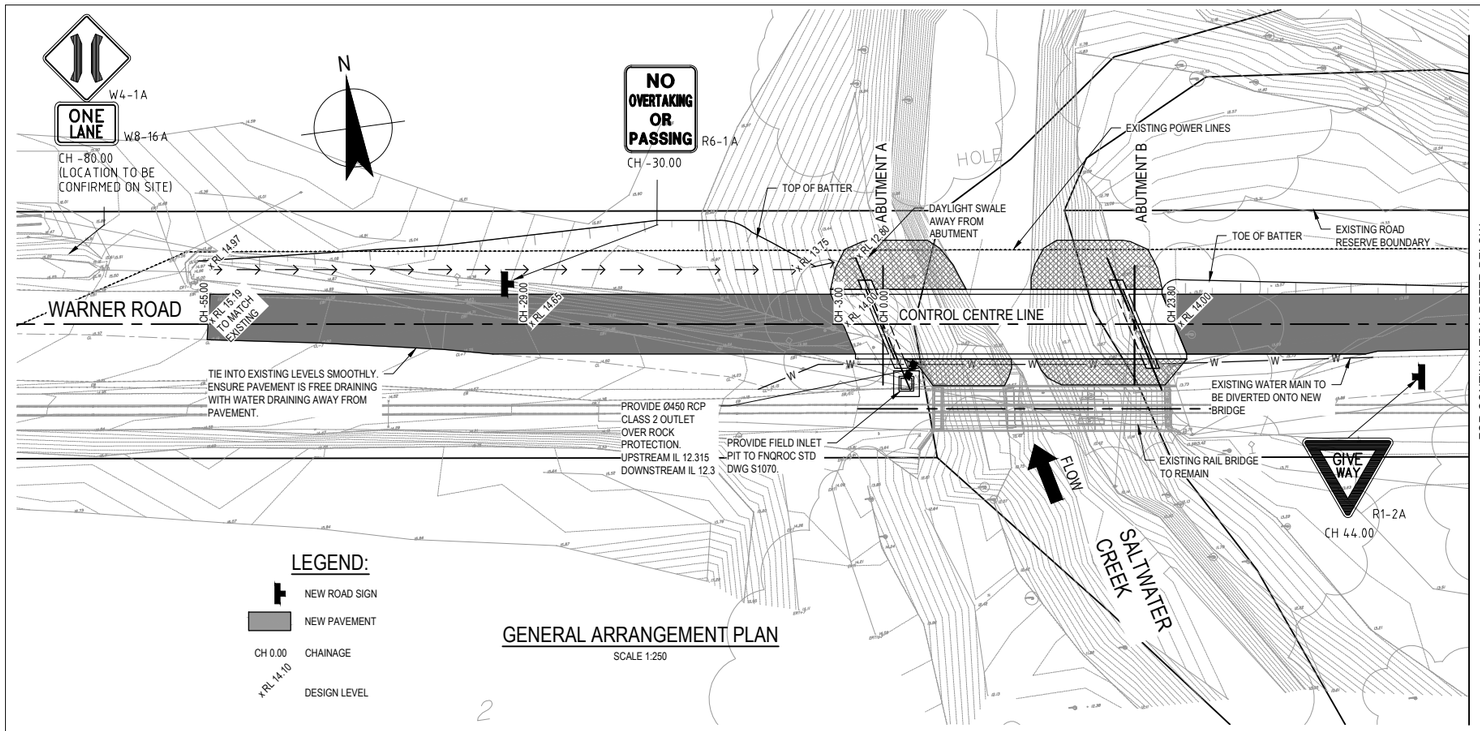
- 2/18t Double Headers directly linked to 28t Loco
- Nosing loads, braking forces, design wind load on train and ultimate design factors in accordance with “Bridge Design Criteria Mackay February 2013”.

7. Safety in Design Risk Assessment

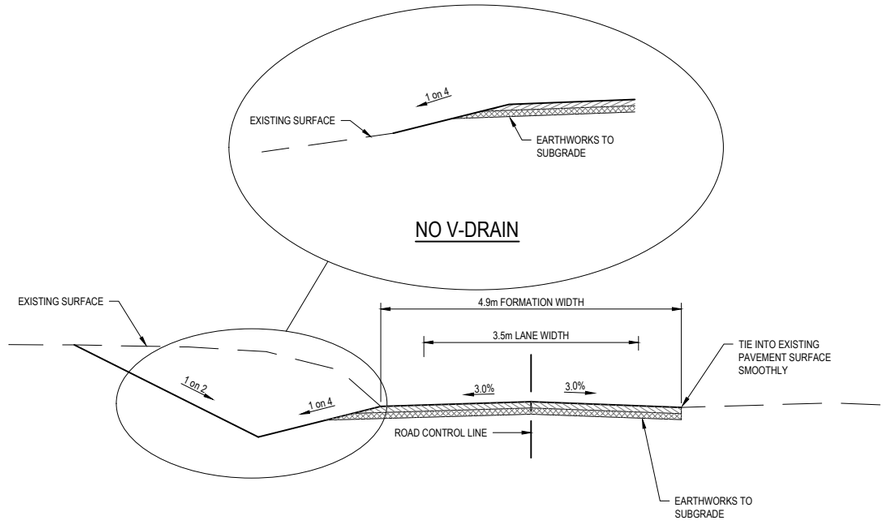
The safety in design risk assessment is displayed in this section of the report. These elements were identified both during the Options Assessment and Concept Design as potential safety issues throughout the life cycle of the bridge. It is important for DSC and the Contractor to understand these issues 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.

Appendices

Appendix A – Concept Design Drawings



GENERAL ARRANGEMENT PLAN
SCALE 1:250



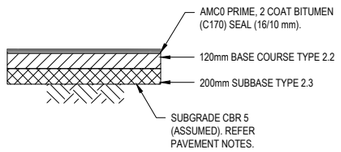
TYPICAL SECTION
SCALE 1:50

GENERAL NOTES

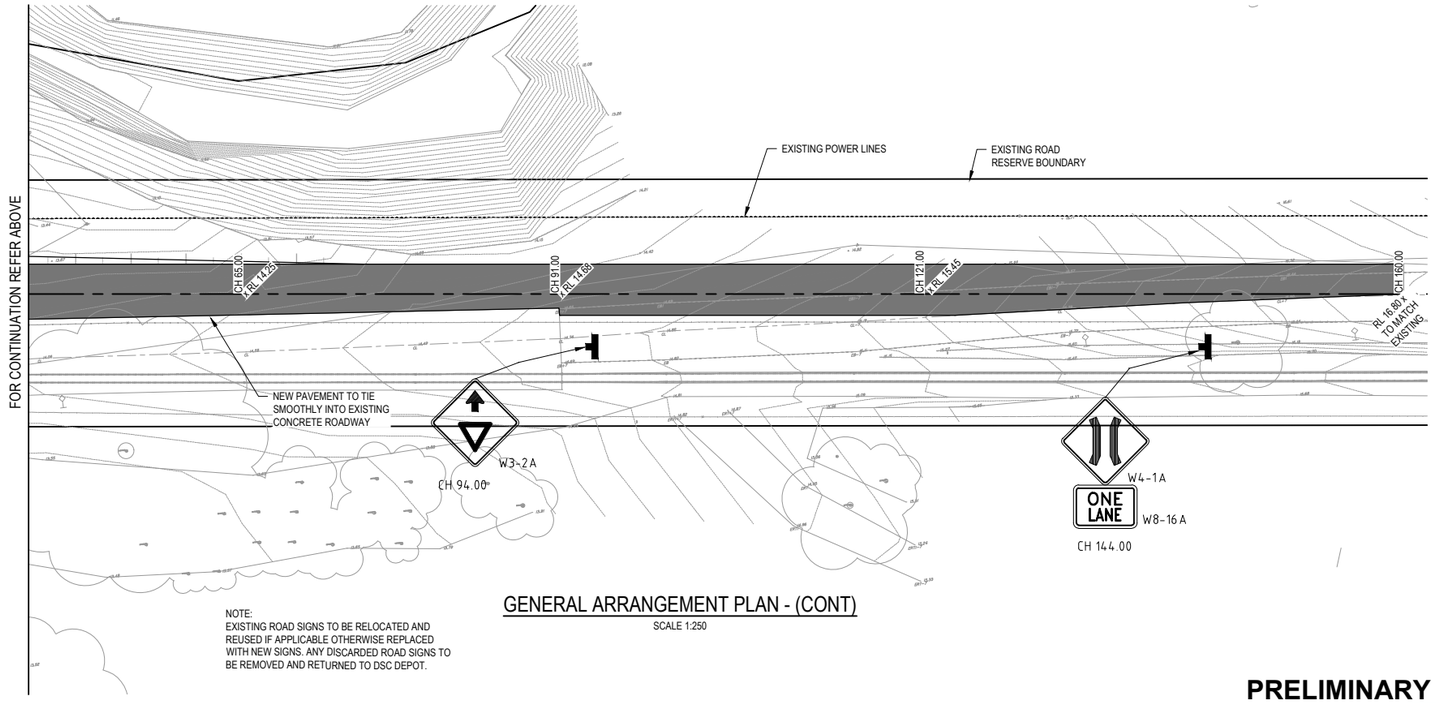
1. LEVELS DATUM - AHD
   ORIGIN OF LEVELS: STN Z (E:328744.272 N:8175586.355) (RL 16.478)
   MERIDIAN: MGA ZONE 55
2. ALL EXISTING SERVICES AND UTILITIES SHALL BE PROTECTED FROM DAMAGE BY THE OPERATIONS OF THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIR OF SERVICES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO LOCATE ALL SERVICES ON SITE PRIOR TO COMMENCEMENT OF ANY WORKS.
3. 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.
4. 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.
5. GRADE EVENLY BETWEEN LEVELS SHOWN.
6. ALL NEW SIGNS AND PAVEMENT MARKING TO BE CONSTRUCTED IN ACCORDANCE WITH MUTCD PART 2.
7. ALL SIGNS TO BE INSTALLED AS PER FNQROC STANDARD DRAWING S1041.
8. ALL EXISTING SIGNS TO BE RETAINED UNLESS NOTED OTHERWISE.
9. ALL RRPM'S TO BE INSTALLED AS PER THE MUTCD PART 2.

PAVEMENT NOTES
1. PAVEMENT DESIGN HAS BEEN BASED ON AN ASSUMED SUBGRADE CBR 5.
2. DESIGN TRAFFIC LOADING = 1x10^5 ESA
3. THE SUBGRADE CBR SHOULD BE CONFIRMED BY THE CONTRACTOR BEFORE COMMENCEMENT OF WORK.
4. SUBGRADE TO BE TESTED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND RESULTS GIVEN TO THE SUPERINTENDENT TO CONFIRM DESIGN BEFORE COMMENCEMENT OF PAVEMENT WORKS.
5. EMBANKMENT FILL IN ACCORDANCE WITH DTMR SPECIFICATION MRTS04
6. UNBOUND PAVEMENT IN ACCORDANCE WITH DTMR SPECIFICATION MRTS05.
7. CONTRACTOR TO ENSURE TIE IN INTO EXISTING PAVEMENT IS TO CLEAN EDGE AND MATCH EXISTING LEVELS.
8. 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:
1. 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.
2. 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.
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.
4. 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.
5. 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".
6. UNLESS NOTED OTHERWISE, ALL LANDSCAPED AREAS ARE TO BE GRASS SEEDED IN ACCORDANCE WITH FNQROC SPECIFICATION S8 - LANDSCAPING.



PAVEMENT DETAIL
NOT TO SCALE



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.

GENERAL ARRANGEMENT PLAN - (CONT)
SCALE 1:250

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE	WRC	*MI	*AA	06.03.21

Note: * indicates signatures on original issue of drawing or last revision of drawing

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SCALE 1:250 AT ORIGINAL SIZE

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

DOUGLAS SHIRE COUNCIL

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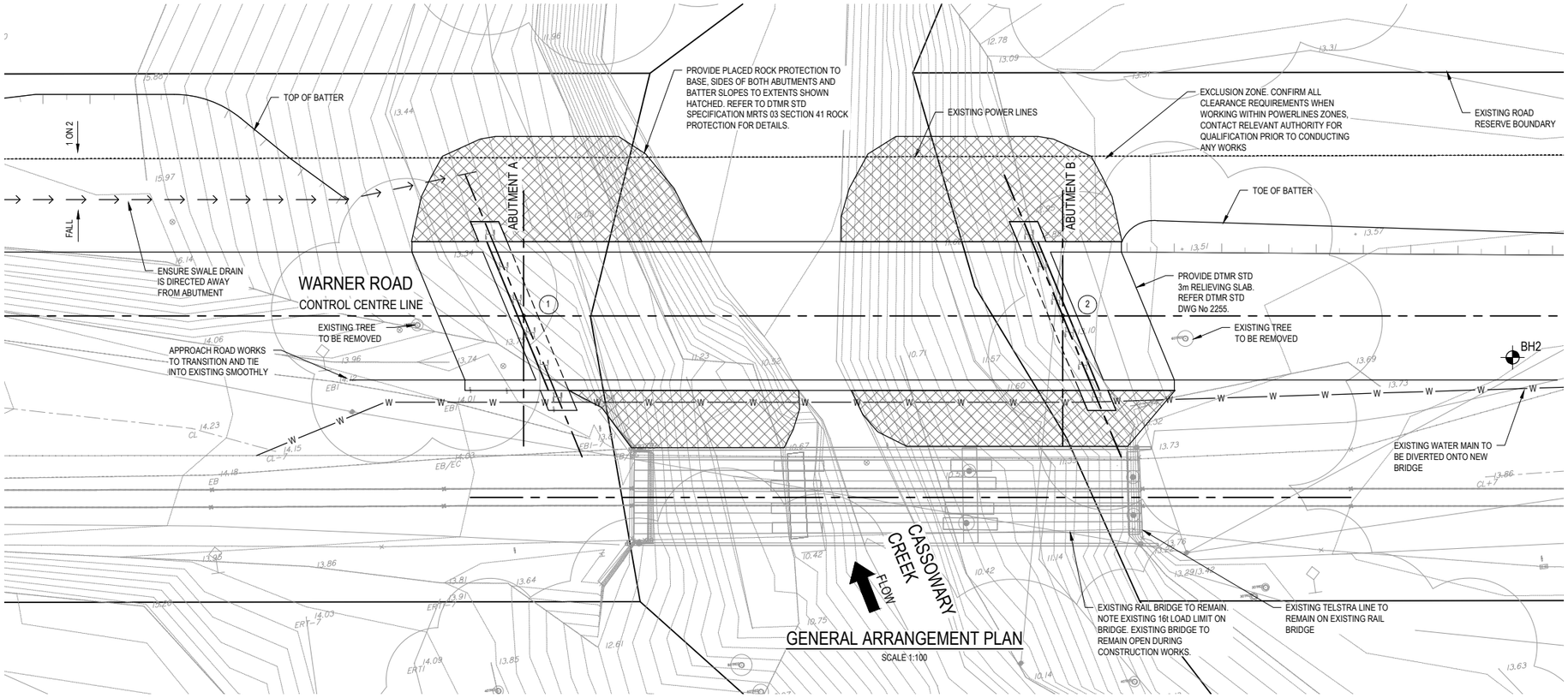
DO NOT SCALE

Drawn W.CLARKE		Designer W.CLARKE	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved		

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title WARNERS BRIDGE GENERAL ARRANGEMENT

Original Size A1 | Drawing No: 12540427-C020 | Rev: A

Plot Date: 11 March 2021 - 9:30 AM | Plotted by: Wes Clarke | Cad File No: G:\42\12540427\CADD\Drawings\12540427-C020.dwg



GENERAL ARRANGEMENT PLAN

SCALE 1:100

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 161mm 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 56mm (30 DAYS AFTER TRANSFER, 77mm 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 LIVE LOAD IS AUSTROADS T44 TRUCK LOADING AND L44 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 AUSTROADS 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.
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.

LEGEND:

- (F) DENOTES FIXED BEARING
- (2) DENOTES SETOUT POINT
- x RL14.42 DENOTES DESIGN LEVELS
- BH2 DENOTES BORE HOLE LOCATION

SETOUT POINTS		
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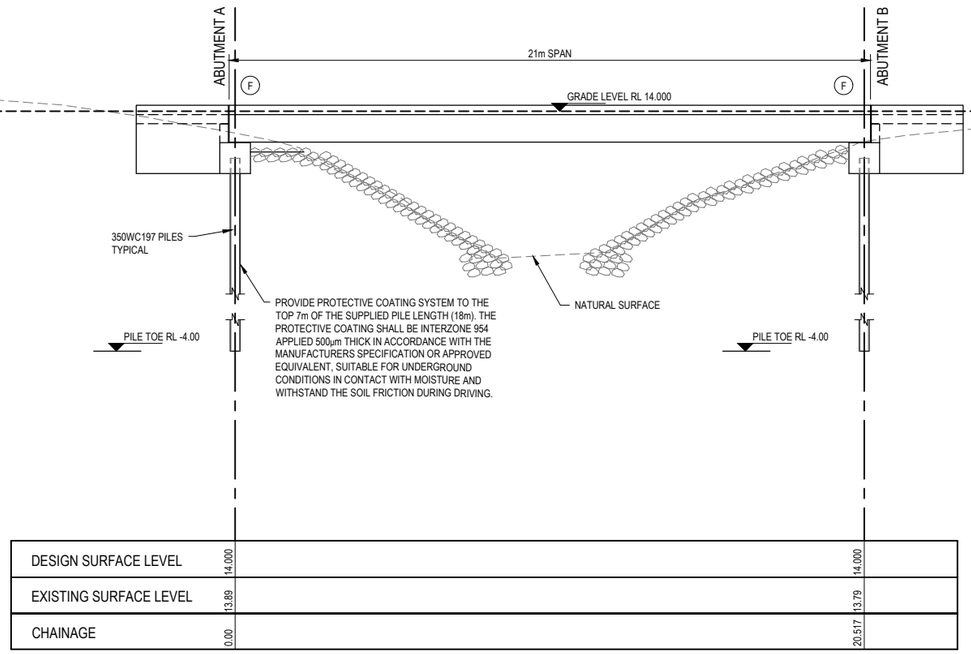
2	328855.232	8175557.830



ELEVATION

SCALE 1:100

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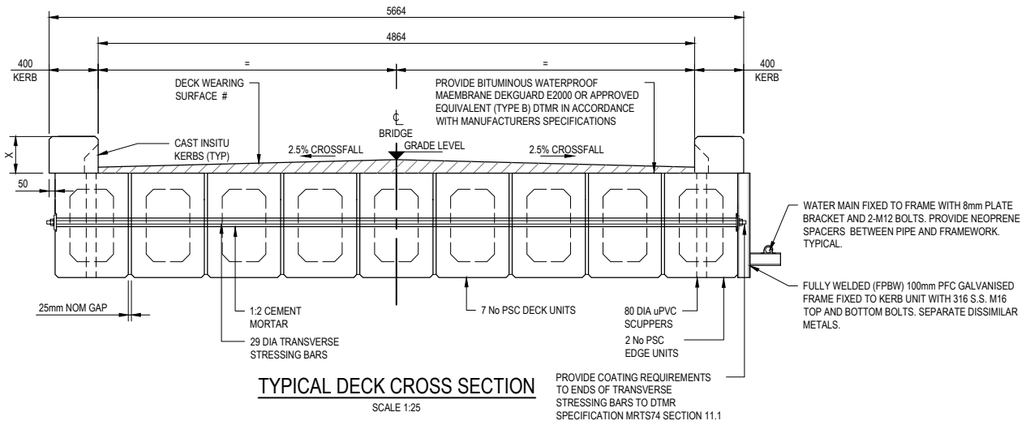

TYPICAL DECK CROSS SECTION

SCALE 1:25

PRELIMINARY

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A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

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SCALE 1:25 AT ORIGINAL SIZE

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SCALE 1:10 AT ORIGINAL SIZE

DOUGLAS SHIRE COUNCIL

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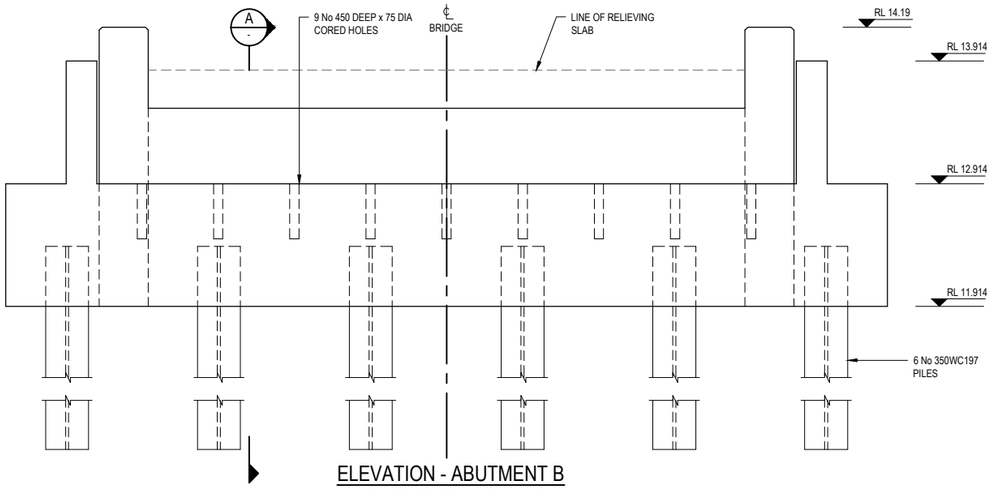
E cnsmail@ghd.com.au **W** www.ghd.com.au

Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title WARNERS BRIDGE
GENERAL ARRANGEMENT

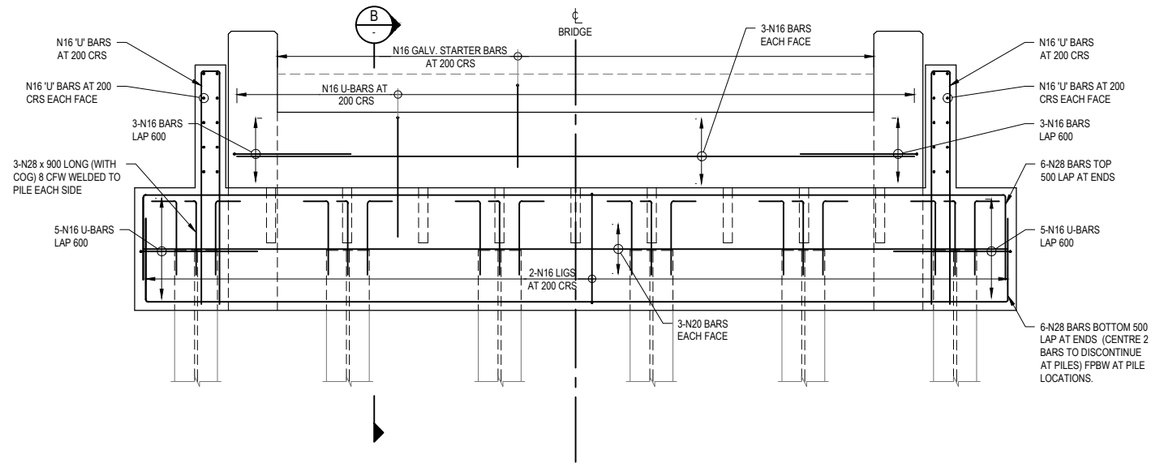
Original Size A1
Drawing No: 12540427-S020
Rev: A

Plot Date: 5 March 2021 - 3:35 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S020.dwg



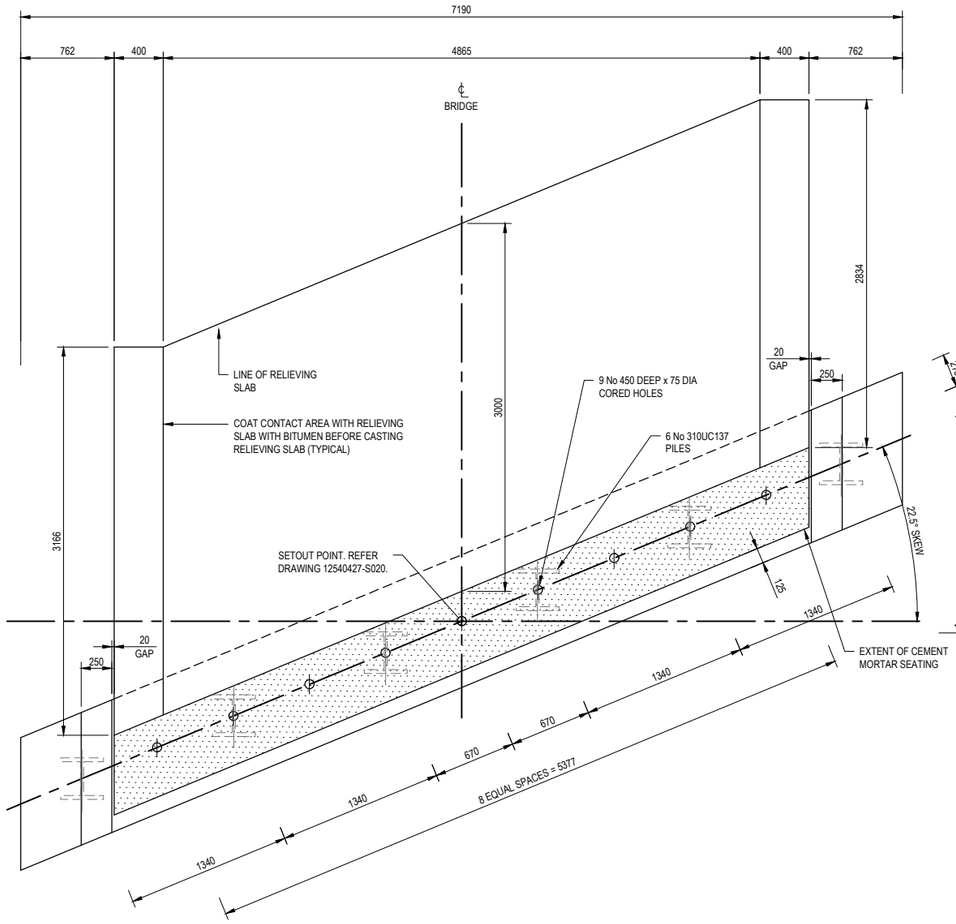
ELEVATION - ABUTMENT B
(ABUTMENT A SIMILAR)

SCALE 1:25



ELEVATION - ABUTMENT B REINFORCEMENT
(ABUTMENT A SIMILAR)

SCALE 1:25

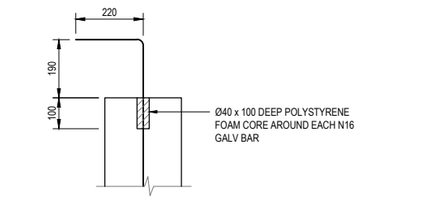


PLAN ON HEADSTOCK

SCALE 1:25

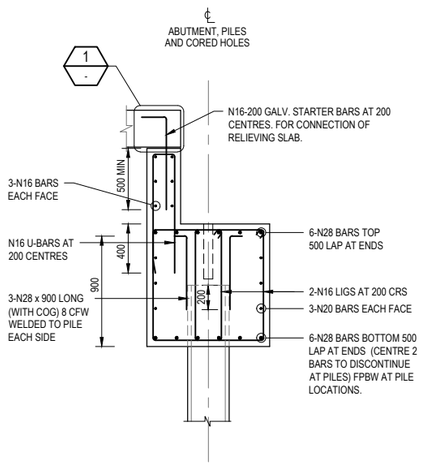
A SECTION

SCALE 1 : 25



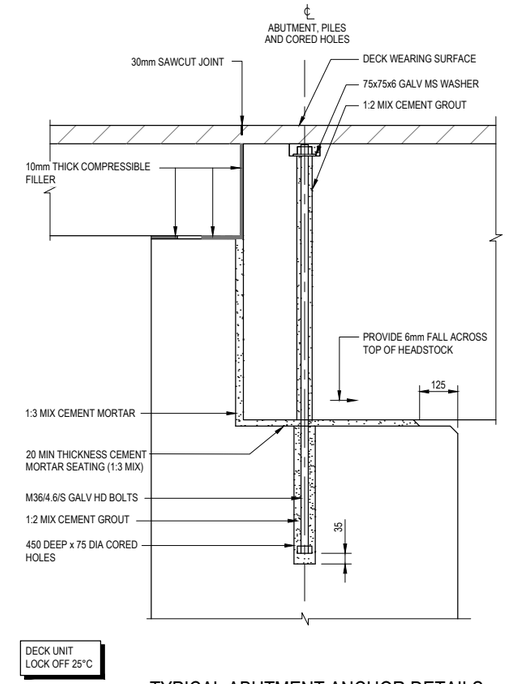
1 DETAIL

SCALE 1 : 10



B SECTION

SCALE 1 : 25



TYPICAL ABUTMENT ANCHOR DETAILS

SCALE 1:10

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

DOUGLAS SHIRE COUNCIL

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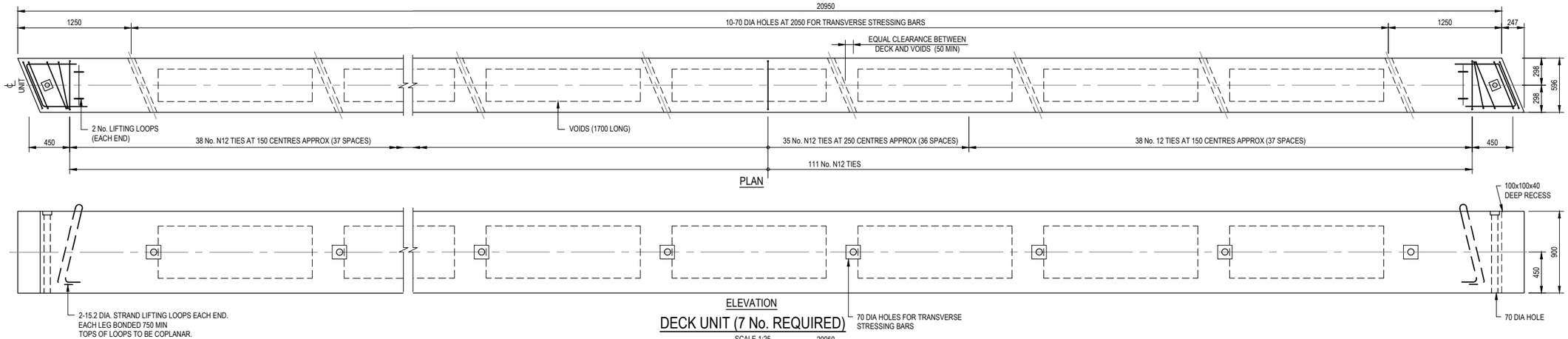
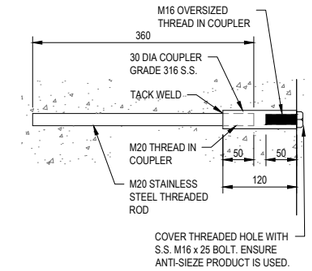
Drawn W.CLARKE	Designer A.AHILADELLIS	Client	DOUGLAS SHIRE COUNCIL
Drafting Check	Design Check	Project	WARNERS AND ANICHS BRIDGE UPGRADES
Approved (Project Director)		Title	WARNERS BRIDGE ABUTMENT DETAILS
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	Original Size A1	Drawing No: 12540427-S021 Rev: A

Plot Date: 5 March 2021 - 3:52 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S021.dwg



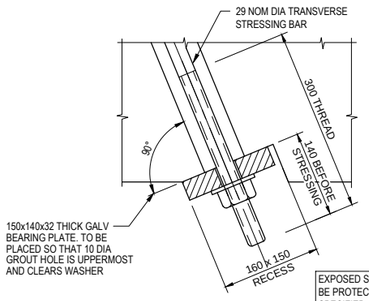
NOTES:

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.
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 CONFORM TO AS 1554.6
9. BEARING PLATES AND WASHERS TO BE HOT DIP GALVANISED TO AS 1650 AND NUTS TO AS 1214.
10. 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.
11. VOIDS SHALL BE CELLULAR POLYSTYRENE GRADE SL TO AS 1366.3.
12. WHEN CASTING UNITS, THE MANUFACTURER SHALL MAKE ALLOWANCE FOR AXIAL SHORTENING (EQUAL AMOUNTS EACH END).
13. TRANSVERSE STRESSING BARS TO AS4672.1 AND AS4672.2 - BAR - 29 - 1030 - P (COARSE THREAD). TRANSVERSE STRESSING FORCE AT LOCK OFF SHALL BE 350kN.
14. LOADING: DESIGN LIVE LOAD T44 AND L44



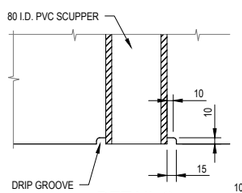
FORMWORK ANCHOR DETAIL

SCALE 1:5



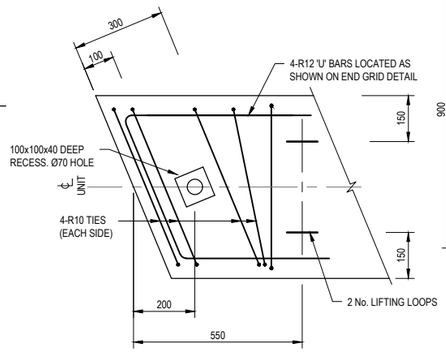
DETAIL 1

(SHOWING TRANSVERSE STRESSING ASSEMBLY)
SCALE 1:5



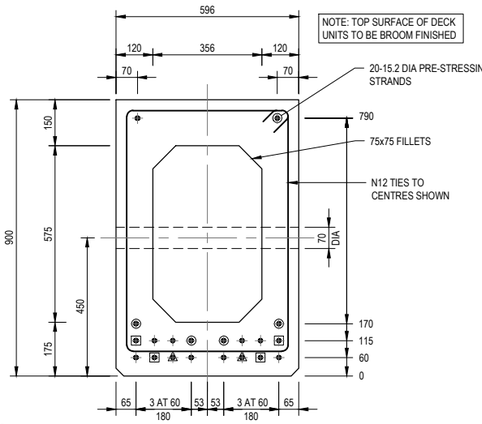
DETAIL 2

SCALE 1:5



DECK UNIT END DETAIL

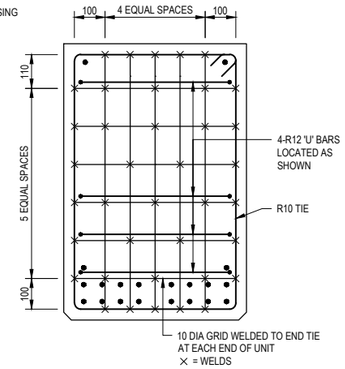
SCALE 1:10



DECK UNIT SECTION

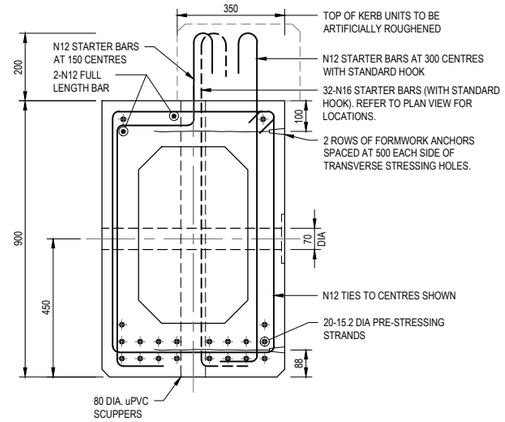
SCALE 1:10

- DEBOND STRAND 1000 FROM EACH END OF UNIT
- DEBOND STRAND 2000 FROM EACH END OF UNIT
- DEBOND STRAND 3000 FROM EACH END OF UNIT



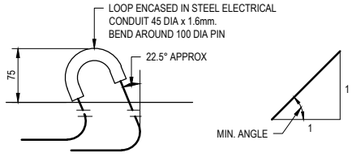
END GRID

SCALE 1:10



KERB UNIT SECTION

SCALE 1:10



LIFTING LOOP

NOT TO SCALE

LIFTING ANGLE

TYPICAL SECTIONS - 20950 LONG UNITS

SCALE 1:10

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SCALE 1:5 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

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	11.03.21

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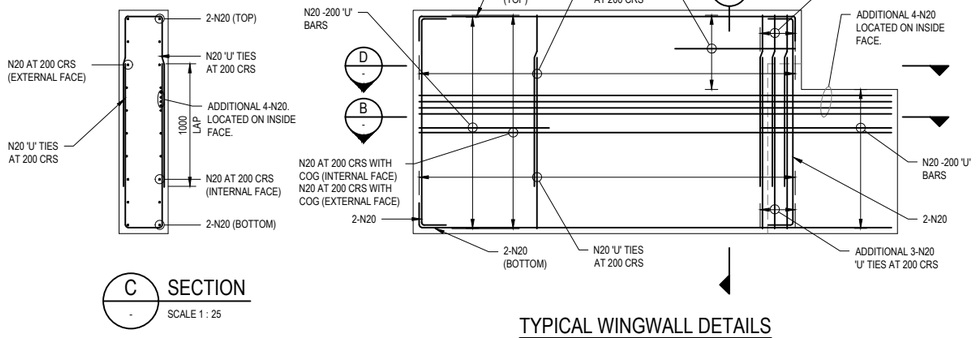
Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
Approved (Project Director)	*A.AHILADELLIS		
Date	11.03.21		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title WARNERS BRIDGE
PSC BRIDGE DECK UNITS

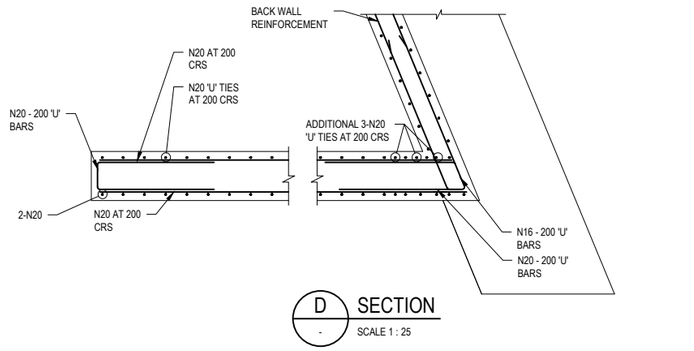
Original Size A1
Drawing No: 12540427-S022
Rev: 0

Plot Date: 11 March 2021 - 1:55 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S022.dwg

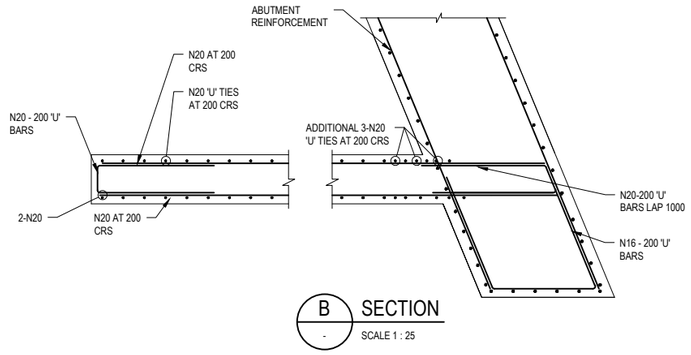


C SECTION
SCALE 1 : 25

TYPICAL WINGWALL DETAILS
SCALE 1:25



D SECTION
SCALE 1 : 25



B SECTION
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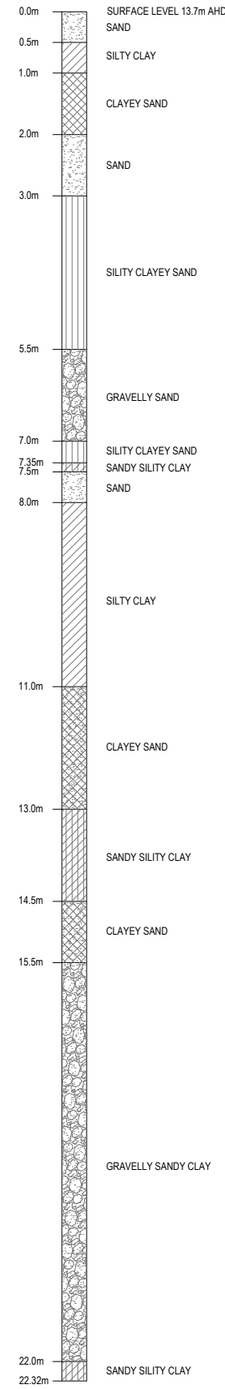
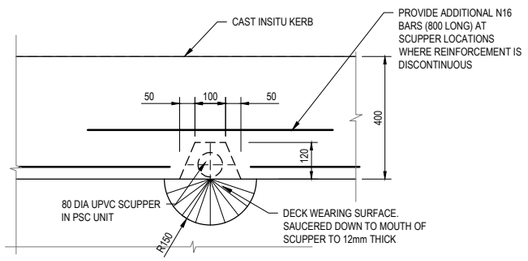
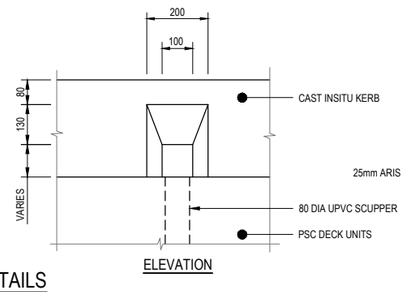


BOREHOLE BH2

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

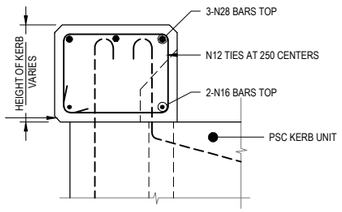


PLAN



ELEVATION

SCUPPER RECESS DETAILS
SCALE 1:10



TYPICAL KERB REINFORCEMENT
SCALE 1:10

A	PRELIMINARY ISSUE	WRC	*MI	*AA	06.03.21
No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

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DO NOT SCALE

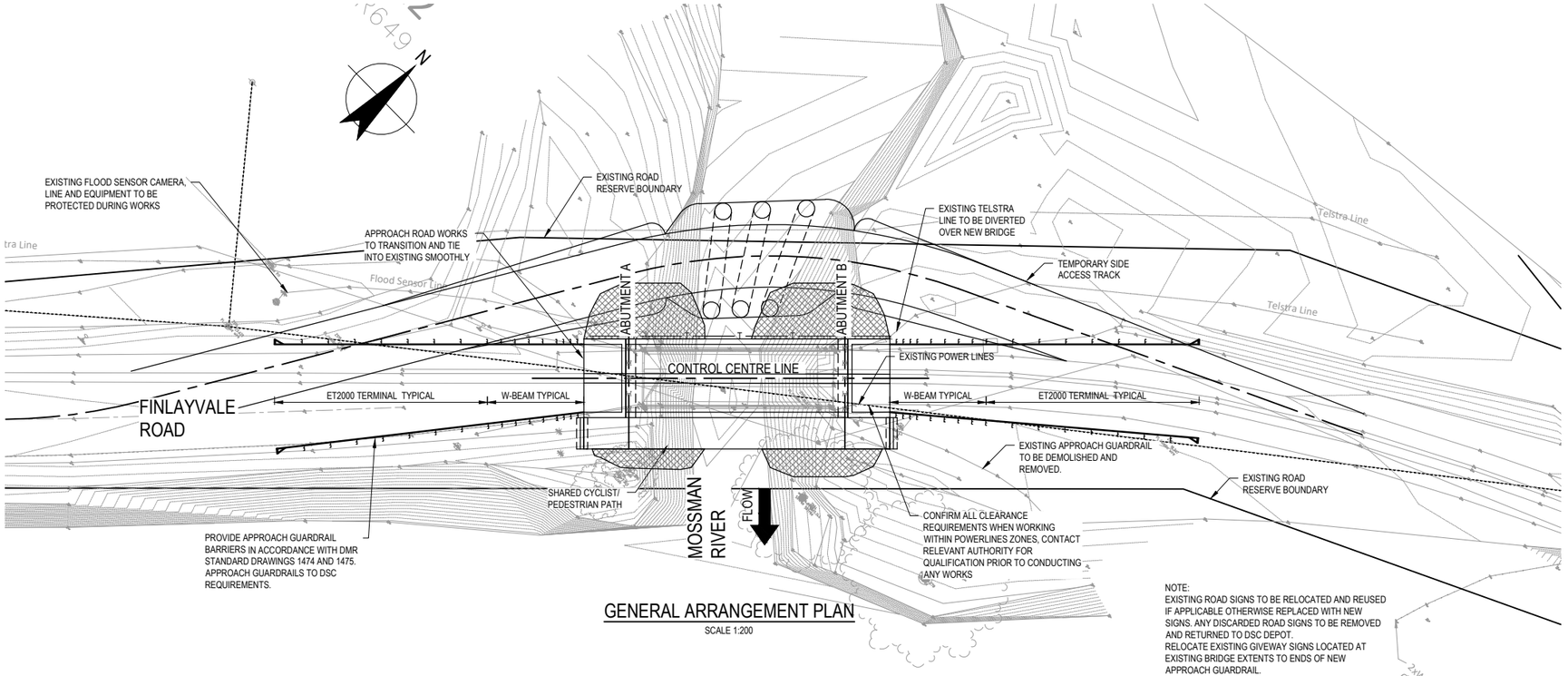
Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title WARNERS BRIDGE MISCELLANEOUS DETAILS

Original Size **A1** Drawing No: **12540427-S023** Rev: **A**

PRELIMINARY

Plot Date: 5 March 2021 - 3:55 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S023.dwg



GENERAL ARRANGEMENT PLAN

SCALE 1:200

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 NOTES

1. LEVELS DATUM - AHD
   ORIGIN OF LEVELS: STN Z (E:325055.106 N:8180675.827) (RL 10.574)
   MERIDIAN: MGA ZONE 55
2. 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.
3. 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.
4. 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.
5. GRADE EVENLY BETWEEN LEVELS SHOWN.
6. ALL NEW SIGNS AND PAVEMENT MARKING TO BE CONSTRUCTED IN ACCORDANCE WITH MUTCD PART 2.
7. ALL SIGNS TO BE INSTALLED AS PER FNQROC STANDARD DRAWING S1041.
8. ALL EXISTING SIGNS TO BE RETAINED UNLESS NOTED OTHERWISE.
9. ALL RRPM'S TO BE INSTALLED AS PER THE MUTCD PART 2.
10. FOR ET-2000 PLUS. REFER TO INGAL CIVIL PRODUCTS, GUARDRAIL EXTRUDER TERMINAL SITE PLAN DWG CAB STD-61.

EARTHWORKS

EARTHWORKS SHALL BE IN ACCORDANCE WITH A.S.3798 INCLUDING THE FOLLOWING:

1. 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.
2. 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.
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.
4. 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.
5. 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.
6. 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".
7. UNLESS NOTED OTHERWISE, ALL LANDSCAPED AREAS ARE TO BE GRASS SEEDED IN ACCORDANCE WITH FNQROC SPECIFICATION S8 - LANDSCAPING.

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 2000 4000 6000 8000 10000mm
SCALE 1:200 AT ORIGINAL SIZE

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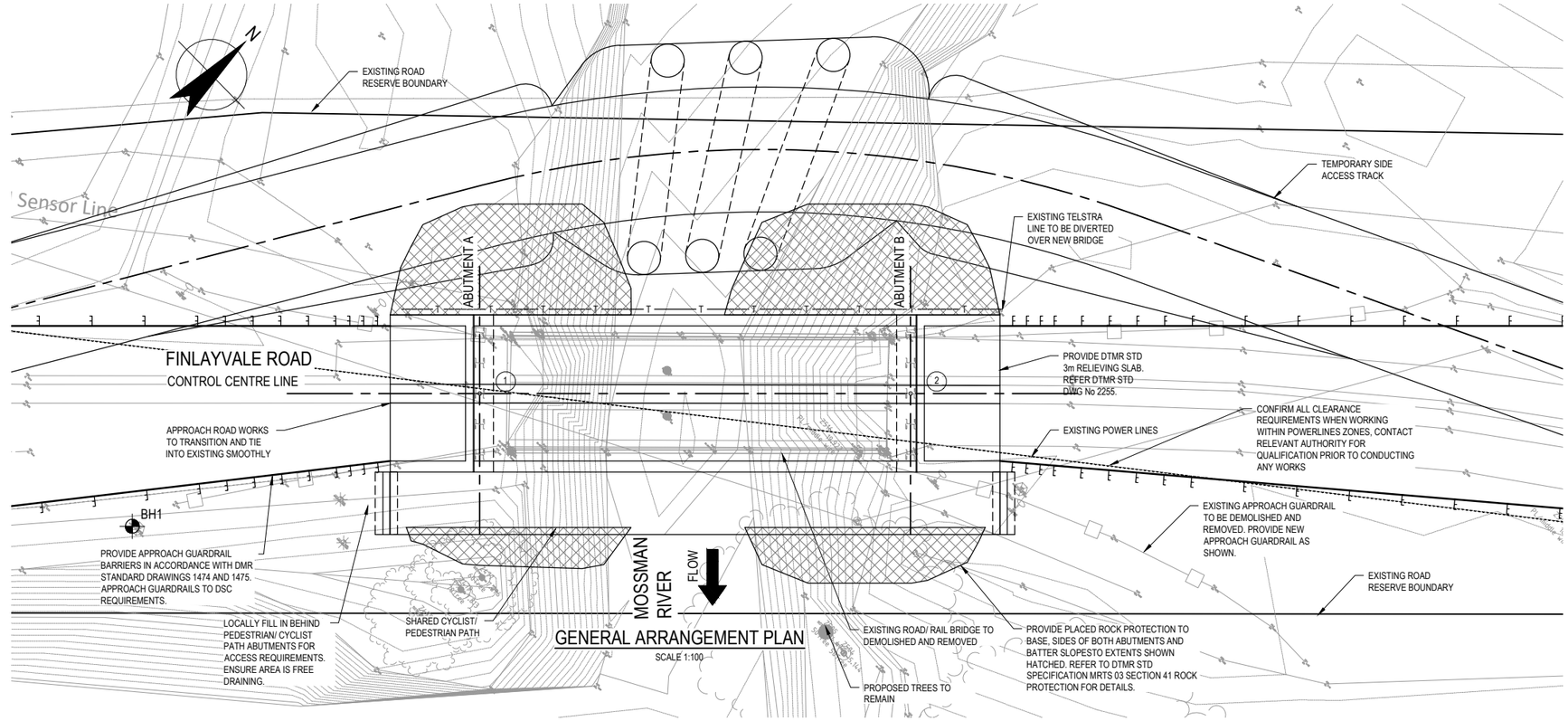
DO NOT SCALE

Drawn W.CLARKE | Designer W.CLARKE
Drafting Check | Design Check
Approved (Project Director)
Date
Scale AS SHOWN
This Drawing must not be used for Construction unless signed as Approved

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE GENERAL ARRANGEMENT

Original Size A1
Drawing No: 12540427-C010
Rev: A

Plot Date: 5 March 2021 - 4:20 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-C010.dwg



GENERAL ARRANGEMENT PLAN

SCALE 1:100

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 40mm (30 DAYS AFTER TRANSFER, 55mm 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) ROAD DESIGN LIVE LOAD IS AUSTROADS T44 TRUCK LOADING AND L44 LANE LOADING.
    (b) RAIL DESIGN LIVE LOAD IS 2/18 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 AUSTROADS 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 LIASE WITH FAR NORTHERN MILLING TIMING OF WORKS.

TEMPORARY SIDE TRACK PERFORMANCE SPECIFICATION:

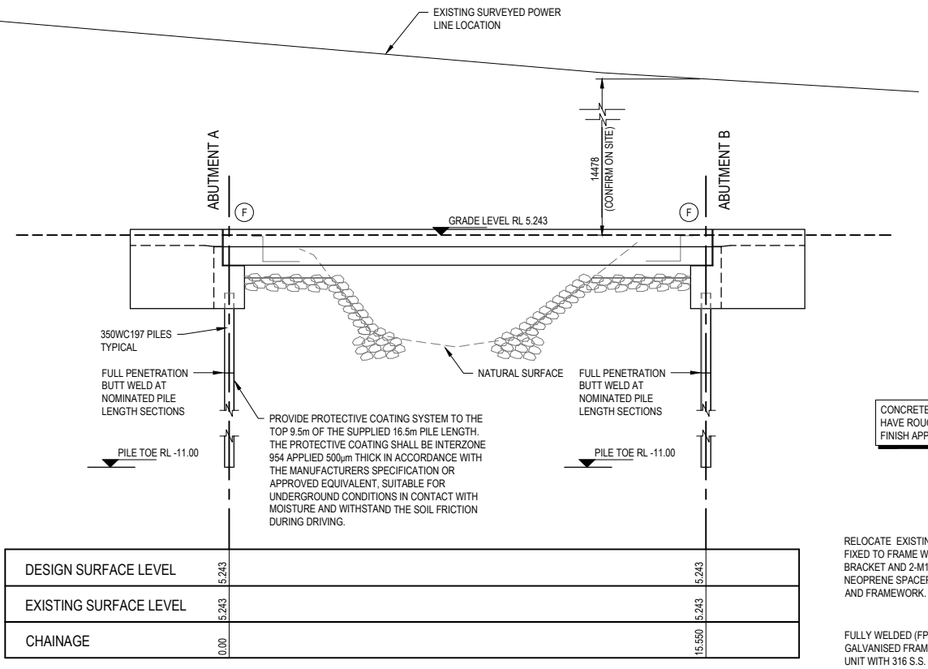
- THE GRAVEL SIDE TRACK WOULD NEED TO BE DESIGNED BY AN GEOTECHNICAL RPEQ TO WITHSTAND LOADING FROM LOCAL TRAFFIC AND CONSTRUCTION VEHICLES, FLOOD LOADING, AND TO LAST THE DURATION OF CONSTRUCTION.
- PUBLIC ACCESS IS TO BE MAINTAINED BOTH DURING AND OUTSIDE WORKING HOURS. ALL ROAD SAFETY SIGNAGE AND 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:
  - O BE 1200mm INTERNAL DIAMETER
  - O HAVE MINIMUM 900mm COVER
  - O 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:

- (F) DENOTES FIXED BEARING
- (2) ○ DENOTES SETOUT POINT
- X RL14.42 DENOTES DESIGN LEVELS
- BH1 DENOTES BORE HOLE LOCATION

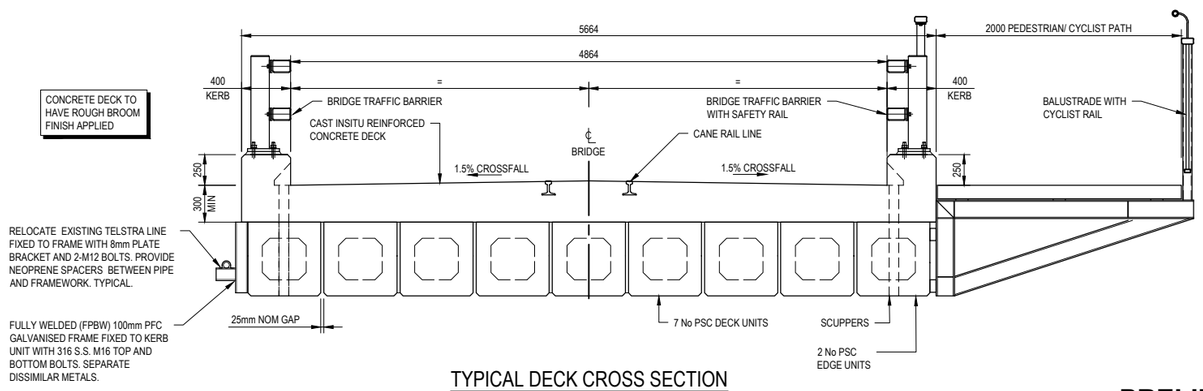
SETOUT POINTS		
POINT	EASTING	NORTHING
1	324903.350	8180528.297
2	324914.236	8180539.401

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.



ELEVATION

SCALE 1:100



TYPICAL DECK CROSS SECTION

SCALE 1:25

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE	WRC	*MI	*AA	06.03.21

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

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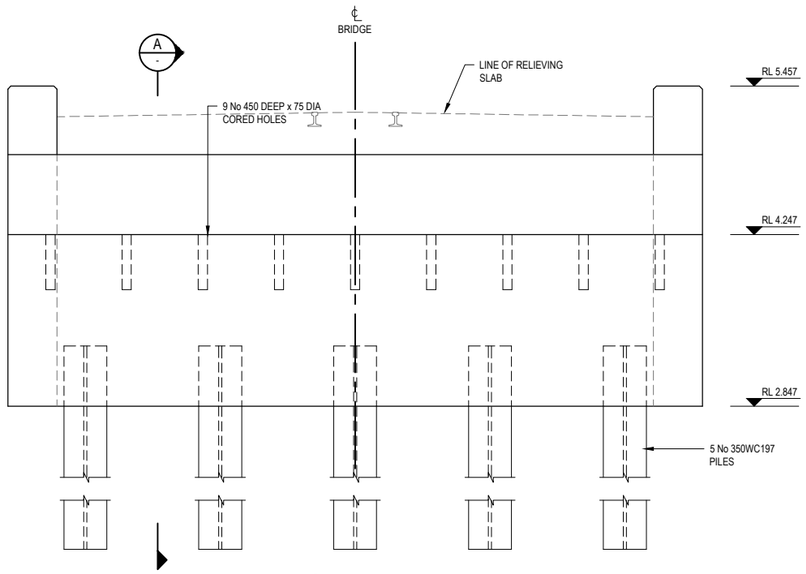
Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DOUGLAS SHIRE COUNCIL
Project: WARNERS AND ANICHS BRIDGE UPGRADES
Title: ANICHS BRIDGE GENERAL ARRANGEMENT

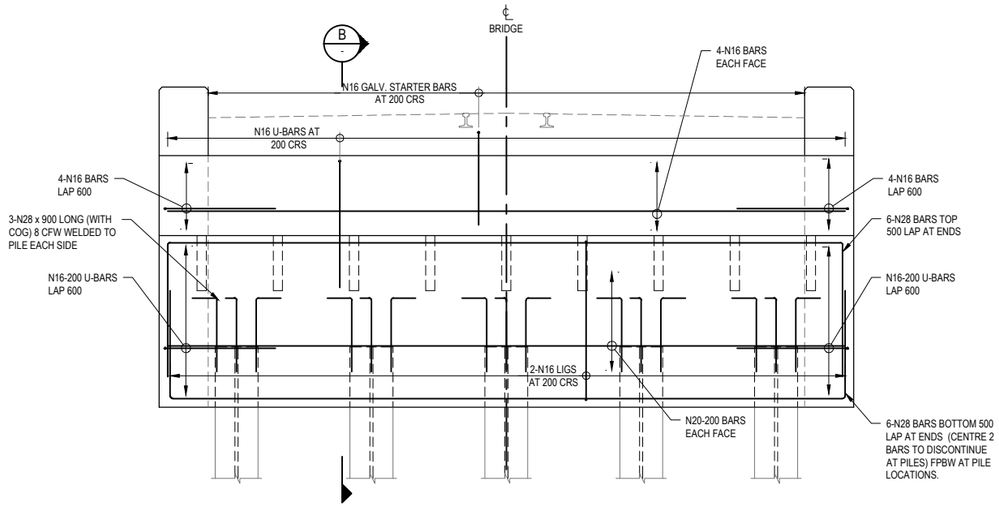
Original Size A1 | Drawing No: 12540427-S010 | Rev: A

Plot Date: 5 March 2021 - 3:57 PM | Plotted by: Wes Clarke | Cad File No: G:\42\12540427\CADD\Drawings\12540427-S010.dwg



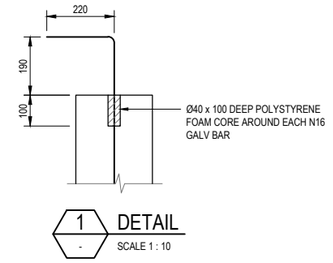
ELEVATION - ABUTMENT B (ABUTMENT A SIMILAR)

SCALE 1:25



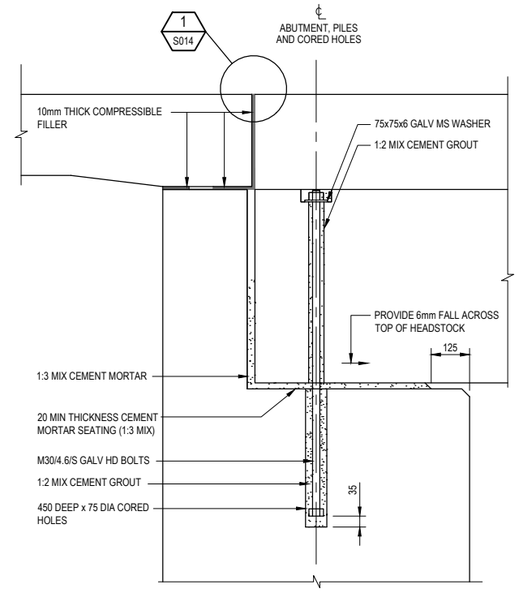
ELEVATION - ABUTMENT B REINFORCEMENT (ABUTMENT A SIMILAR)

SCALE 1:25



DETAIL

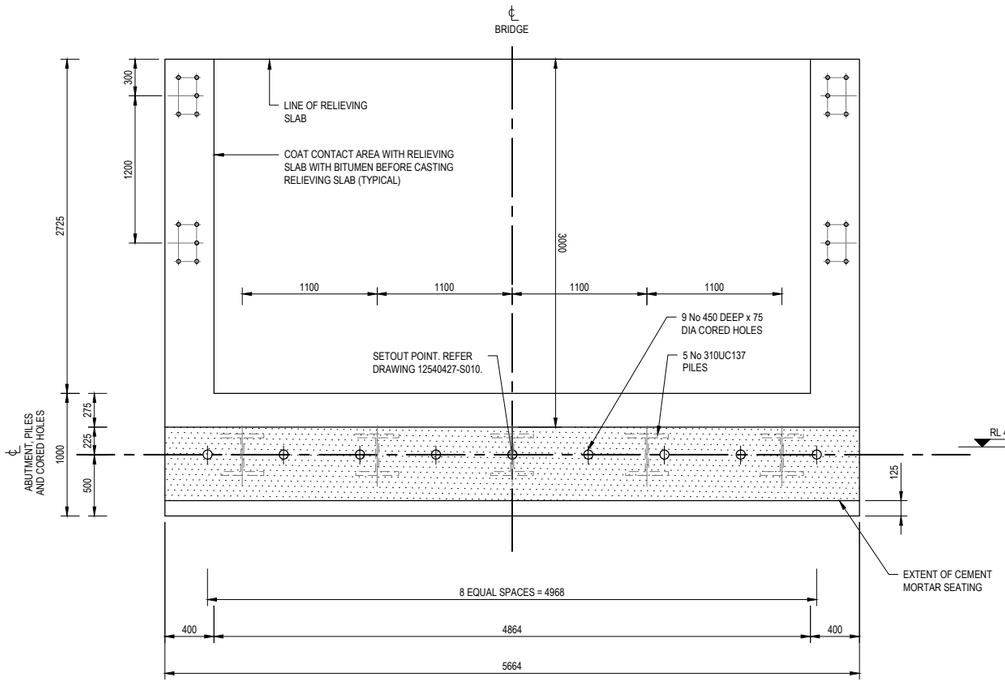
SCALE 1 : 10



TYPICAL ABUTMENT ANCHOR DETAILS

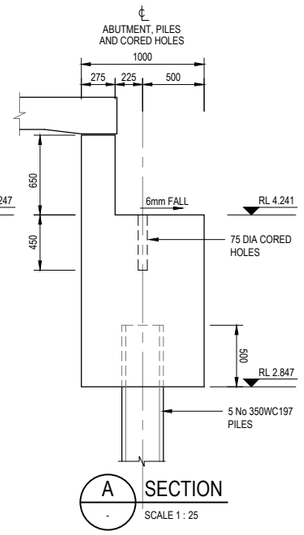
SCALE 1:10

DECK UNIT LOCK OFF 25°C



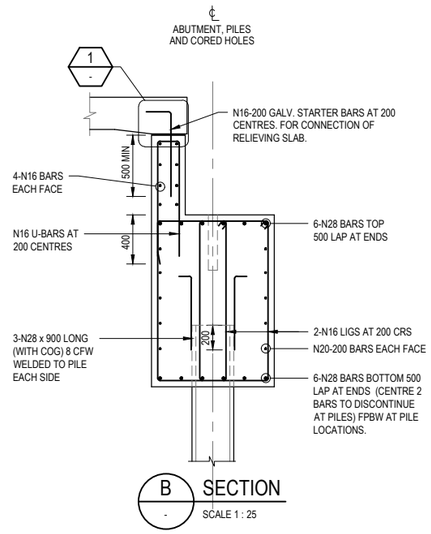
PLAN ON HEADSTOCK

SCALE 1:25



A SECTION

SCALE 1 : 25



B SECTION

SCALE 1 : 25

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

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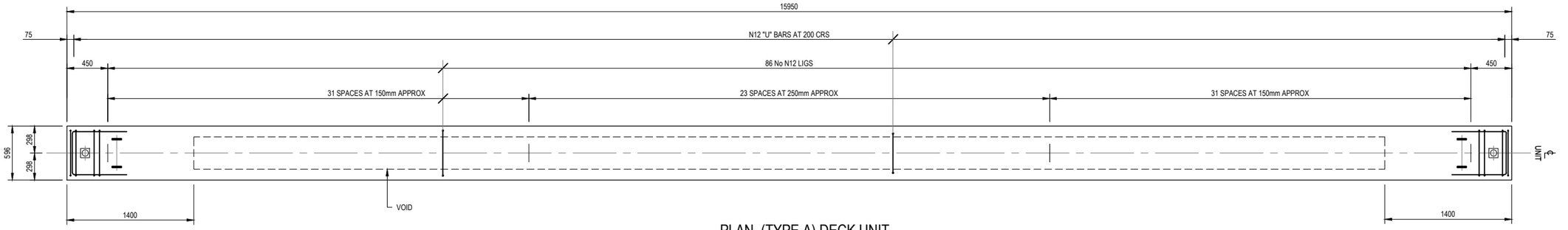
DO NOT SCALE

Drawn W.CLARKE		Designer A.AHILADELLIS	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved		

Client **DOUGLAS SHIRE COUNCIL**
Project **WARNERS AND ANICHS BRIDGE UPGRADES**
Title **ANICHS BRIDGE ABUTMENT DETAILS**

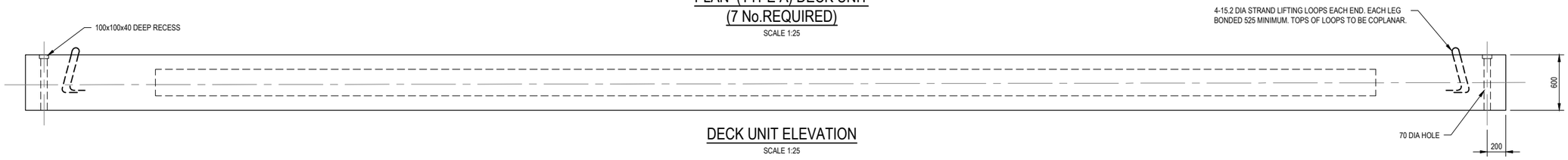
Original Size **A1** Drawing No: **12540427-S011** Rev: **A**

Plot Date: 5 March 2021 - 3:59 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S011.dwg



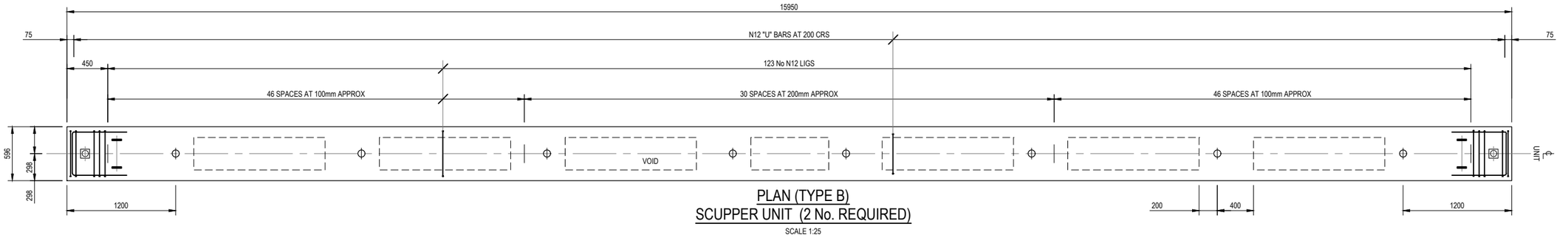
PLAN (TYPE A) DECK UNIT
(7 No.REQUIRED)

SCALE 1:25



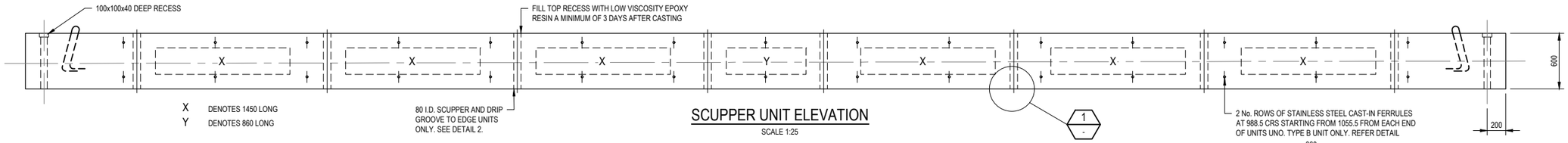
DECK UNIT ELEVATION

SCALE 1:25



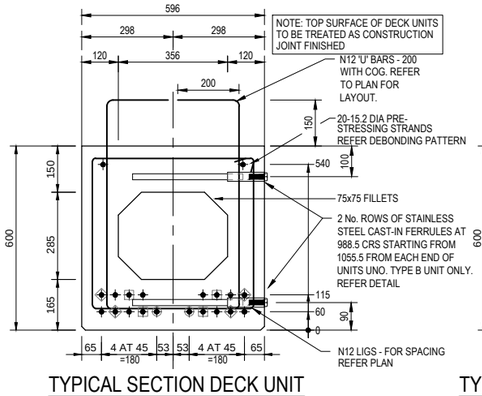
PLAN (TYPE B)
SCUPPER UNIT (2 No. REQUIRED)

SCALE 1:25



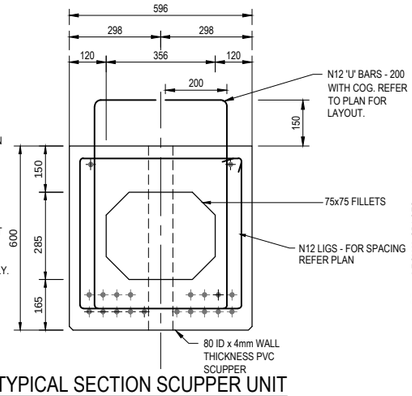
SCUPPER UNIT ELEVATION

SCALE 1:25



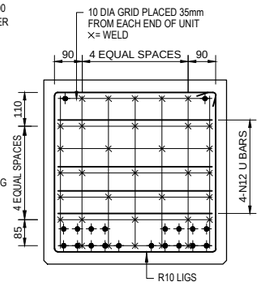
TYPICAL SECTION DECK UNIT

SCALE 1:10



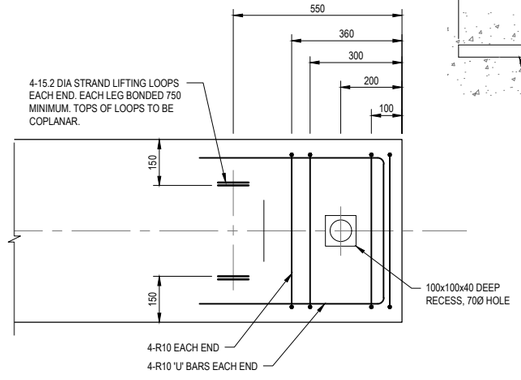
TYPICAL SECTION SCUPPER UNIT

SCALE 1:10



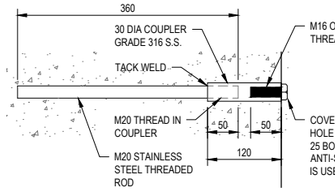
TYPICAL SECTION END GRID

SCALE 1:10



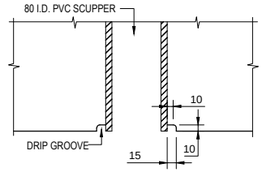
DECK UNIT END DETAIL

SCALE 1:10



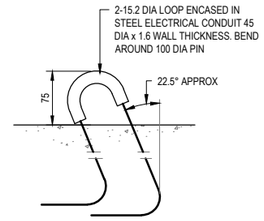
DETAIL 2

SCALE 1:5



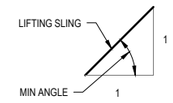
DETAIL 1

SCALE 1:5



LIFTING LOOP

SCALE 1:5



LIFTING ANGLE

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 RIDGID 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.

DEBOND STRAND 1500 FROM EACH END OF UNIT
DEBOND STRAND 3000 FROM EACH END OF UNIT
DEBOND STRAND 4500 FROM EACH END OF UNIT

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

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	11.03.21

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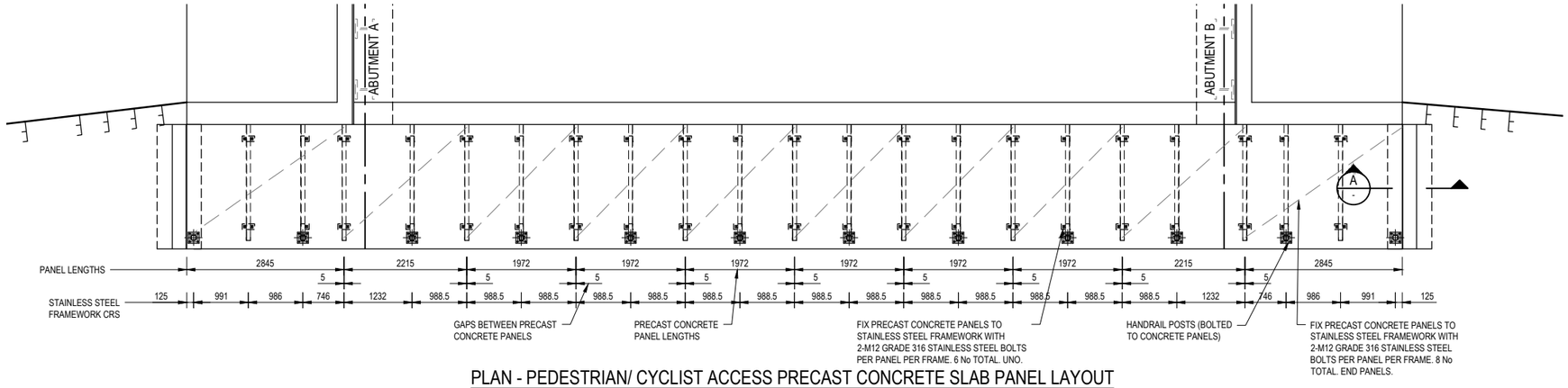
Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check	*M.ISENBERT	Design Check	*M.ISENBERT
Approved (Project Director)	*A.AHILADELLIS		
Date	11.03.21		
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE
PSC DECK UNITS

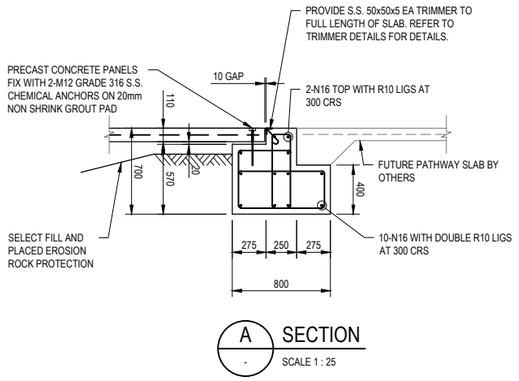
Original Size A1 **Drawing No: 12540427-S012** **Rev: 0**

Plot Date: 11 March 2021 - 1:54 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S012.dwg



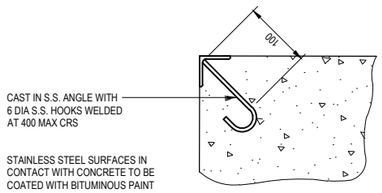
PLAN - PEDESTRIAN/ CYCLIST ACCESS PRECAST CONCRETE SLAB PANEL LAYOUT

SCALE 1:50



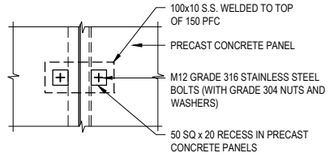
A SECTION

SCALE 1 : 25



TYPICAL TRIMMER DETAIL

SCALE 1:5



PRECAST CONCRETE PANEL FIXING DETAIL

SCALE 1:10

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.

TYPICAL PEDESTRIAN/ CYCLIST ACCESS DETAIL

SCALE 1:10

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

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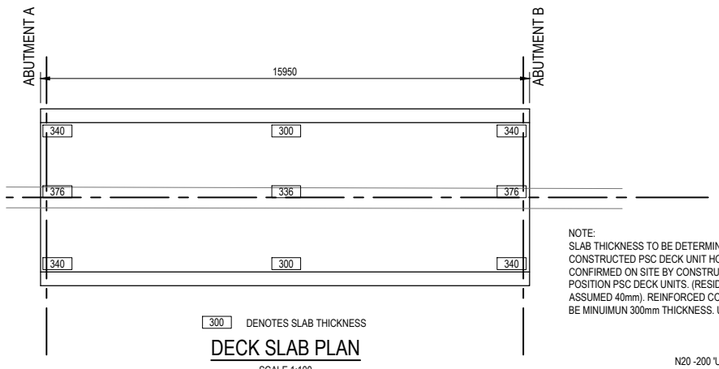
DO NOT SCALE

Drawn W.CLARKE	Designer A.AHILADELLIS	Client	DOUGLAS SHIRE COUNCIL
Drafting Check	Design Check	Project	WARNERS AND ANICHS BRIDGE UPGRADES
Approved (Project Director)		Title	ANICHS BRIDGE PEDESTRIAN/ CYCLIST ACCESS DETAILS
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	Original Size A1	Drawing No: 12540427-S013 Rev: A

Plot Date: 5 March 2021 - 4:05 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S013.dwg

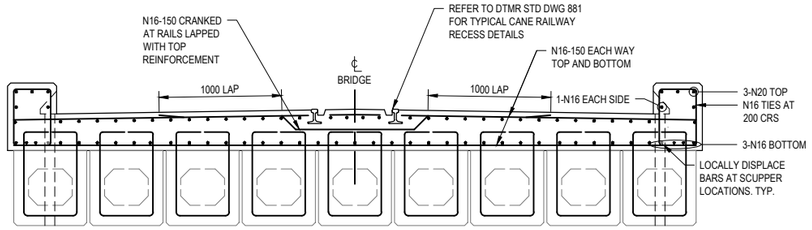


300 DENOTES SLAB THICKNESS

DECK SLAB PLAN

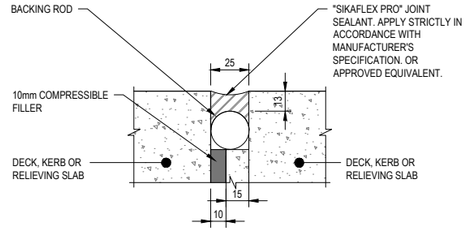
SCALE 1:100

NOTE:
SLAB THICKNESS TO BE DETERMINED BY AS CONSTRUCTED PSC DECK UNIT HOG, TO BE CONFIRMED ON SITE BY CONSTRUCTED FINAL IN POSITION PSC DECK UNITS. (RESIDUAL HOG/ ASSUMED 40mm). REINFORCED CONCRETE DECK TO BE MINUIMUN 300mm THICKNESS. UNO.

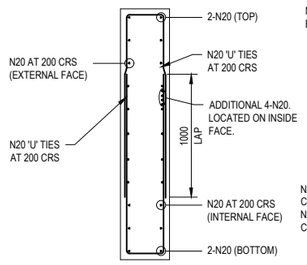


TYPICAL DECK REINFORCEMENT CROSS SECTION

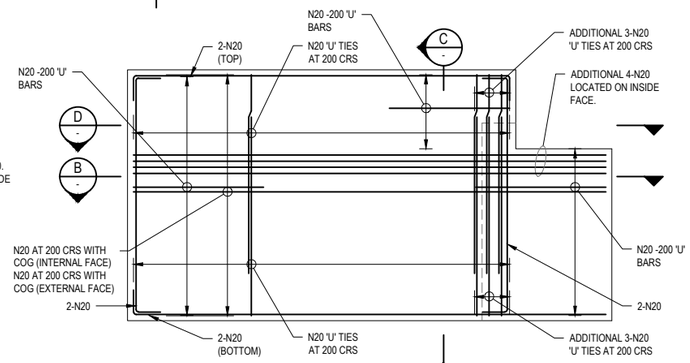
SCALE 1:25



1 DETAIL
S011 SCALE 1 : 2

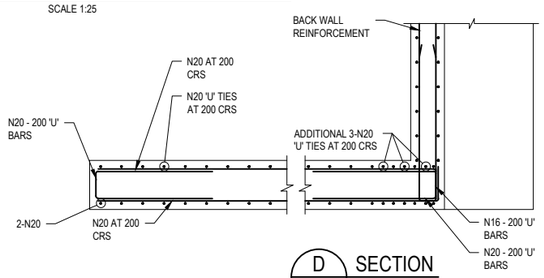


C SECTION
SCALE 1 : 25

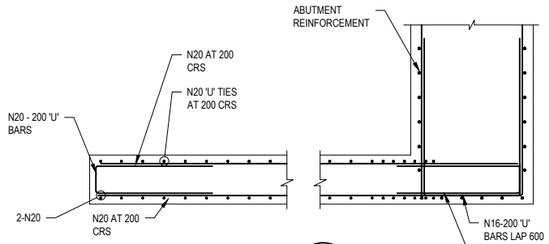


TYPICAL WINGWALL DETAILS

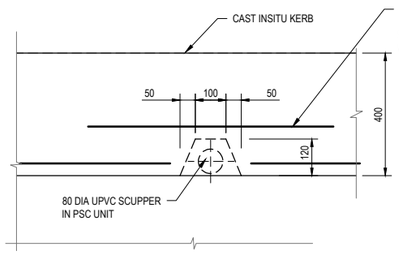
SCALE 1:25



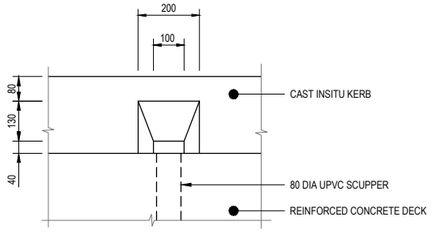
D SECTION
SCALE 1 : 25



B SECTION
SCALE 1 : 25



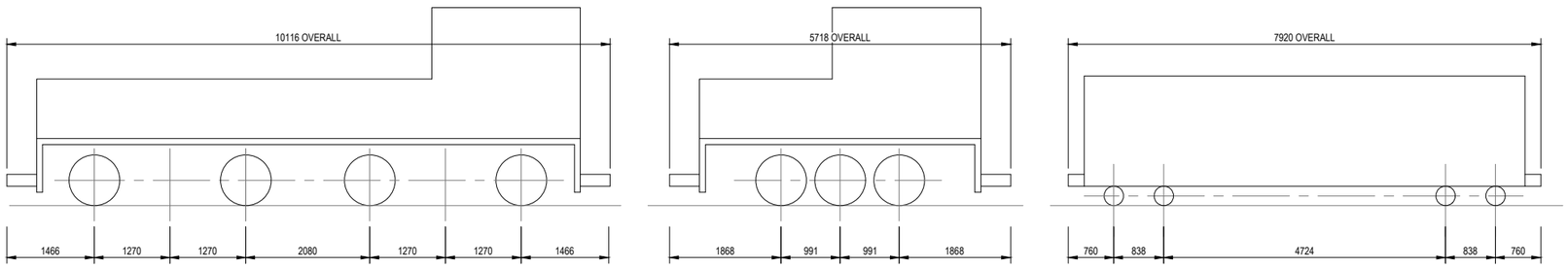
PLAN



ELEVATION

SCUPPER RECESS DETAILS

SCALE 1:10



28 TONNE LOCO

NOT TO SCALE

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

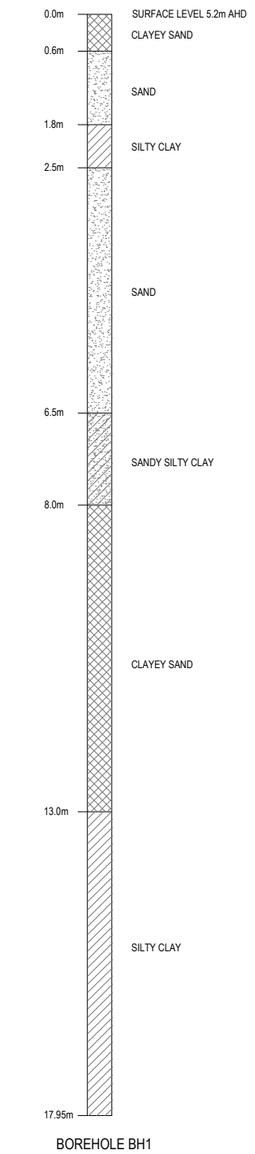
0 20 40 60 80 100mm
SCALE 1:2 AT ORIGINAL SIZE

18 TONNE LOCO

NOT TO SCALE

10 TONNE CANE BINS

NOT TO SCALE



BOREHOLE BH1

BOREHOLE INFORMATION

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

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

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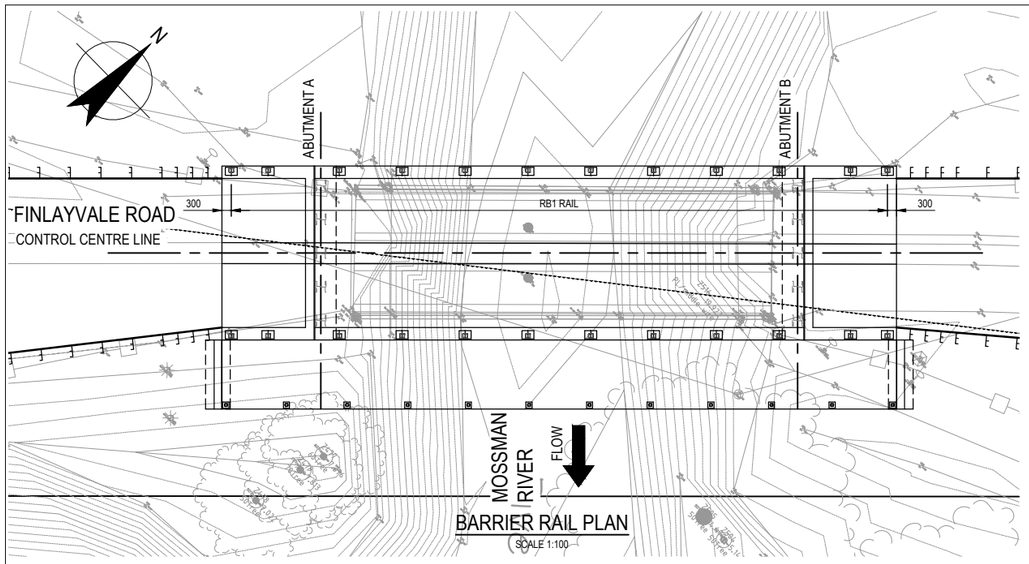
DO NOT SCALE

Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

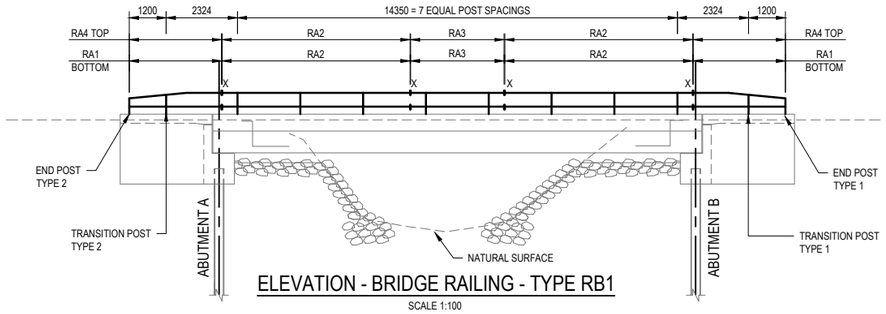
Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE MISCELLANEOUS DETAILS

Original Size A1
Drawing No: 12540427-S014
Rev: A

Plot Date: 5 March 2021 - 4:08 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S014.dwg

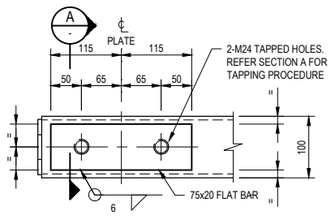


BARRIER RAIL PLAN
SCALE 1:100

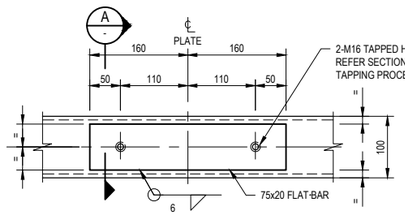


ELEVATION - BRIDGE RAILING - TYPE RB1
SCALE 1:100

X - DENOTES 20mm NOMINAL GAP IN RAILS



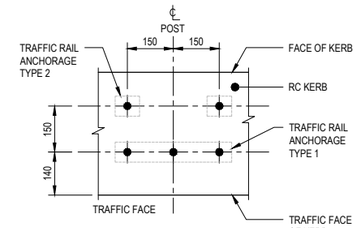
RAIL SUPPORT PLATE - TYPE 1
SCALE 1:5



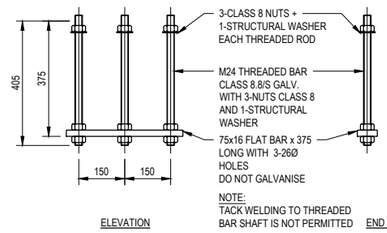
RAIL SUPPORT PLATE - TYPE 2
SCALE 1:5

NOTES

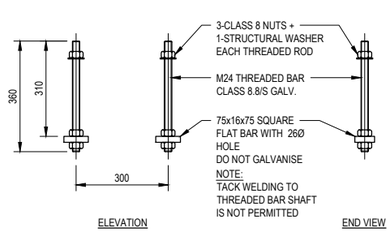
1. DELINEATION ON THE BRIDGE TRAFFIC BARRIER SYSTEM SHALL BE INSTALLED IN THE LOCATION AND TO THE SPACING SHOWN ON THE DRAWING. DELINEATORS SHALL BE CONSISTENT WITH THE REQUIREMENTS SPECIFIED IN MRTS14.
2. RHS AND SHS TUBE TO BE GRADE C450L0 TO AS/NZS 1163.
3. ALL HOLLOW SECTION MATERIAL MANUFACTURED TO AS/NZS 1163 WILL REQUIRE ABRASIVE BLASTING TO DEVELOP A SURFACE PROFILE OF 50 um 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.



TYPICAL TRAFFIC RAIL H.D. BOLT SETOUT DETAIL
SCALE 1:10



TRAFFIC RAIL ANHORAGE - TYPE 1
SCALE 1:10



TRAFFIC RAIL ANHORAGE - TYPE 2
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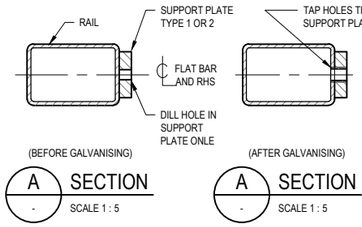
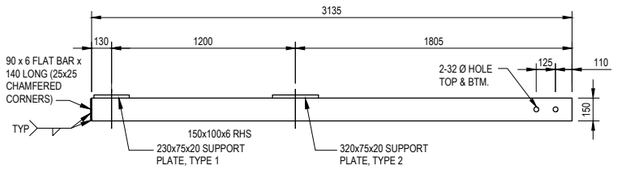


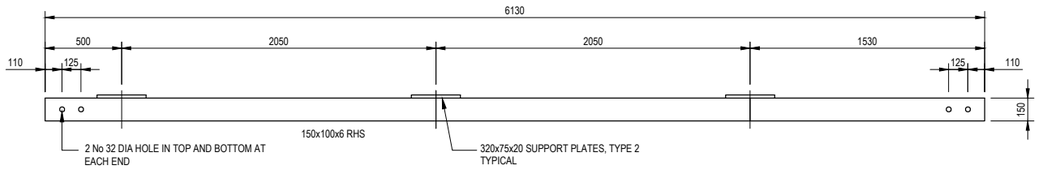
TAPPING PROCEDURE:
1. DRILL HOLES (USING CORRECT TAPPING DRILL OR SMALLER SIZE) THROUGH THE SUPPORT PLATE ONLY.
2. POSITION AND WELD THE SUPPORT PLATE TO RAIL.
3. FILL THE HOLES IN SUPPORT PLATE WITH NATURAL SILICONE.
4. GALVANISE THE RAIL.
5. DRILL AND TAP REQUIRED SIZE HOLES THROUGH SUPPORT PLATES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

A SECTION
-
SCALE 1 : 5

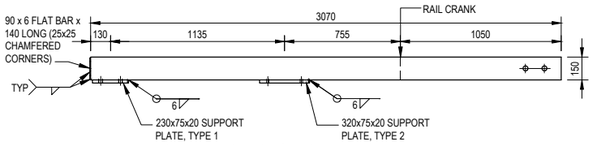
A SECTION
-
SCALE 1 : 5



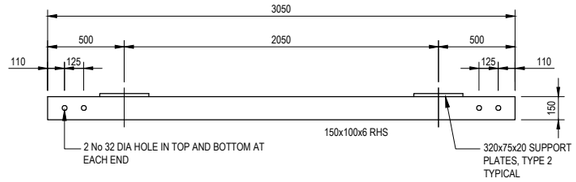
RAIL TYPE RA1 - PLAN VIEW
SCALE 1:20



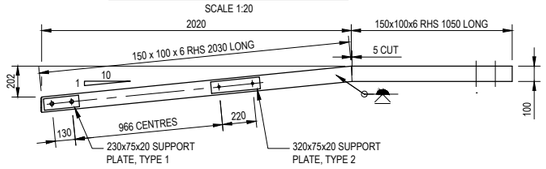
RAIL TYPE RA2 - PLAN VIEW
SCALE 1:20



RAIL TYPE RA4 - PLAN VIEW
SCALE 1:20



RAIL TYPE RA3 - PLAN VIEW
SCALE 1:20



RAIL TYPE RA4 - ELEVATION VIEW
SCALE 1:20

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

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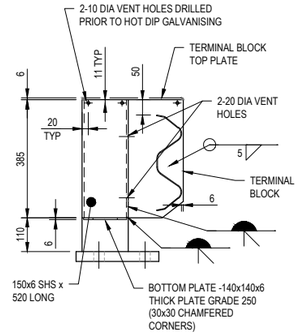
DO NOT SCALE

Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

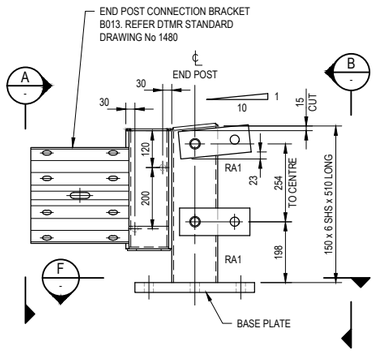
Client: DOUGLAS SHIRE COUNCIL
Project: WARNERS AND ANICHS BRIDGE UPGRADES
Title: ANICHS BRIDGE
BRIDGE TRAFFIC BARRIER

Original Size: A1
Drawing No: 12540427-S015
Rev: A

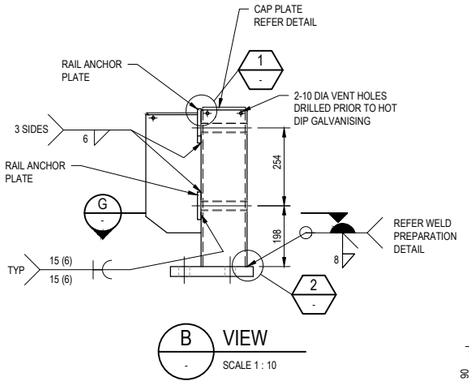
Plot Date: 5 March 2021 - 4:09 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S015.dwg



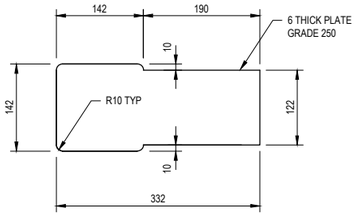
A VIEW
SCALE 1 : 10



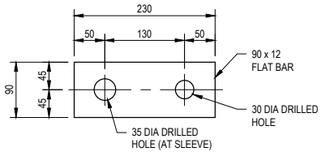
END POST - TYPE 1 ELEVATION
SCALE 1:10
END POST - TYPE 2 OPPOSITE HAND



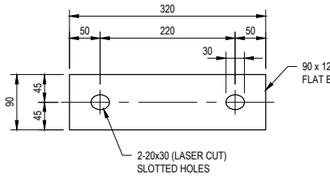
B VIEW
SCALE 1 : 10



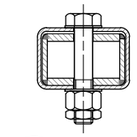
TERMINAL BLOCK TOP PLATE
SCALE 1:5



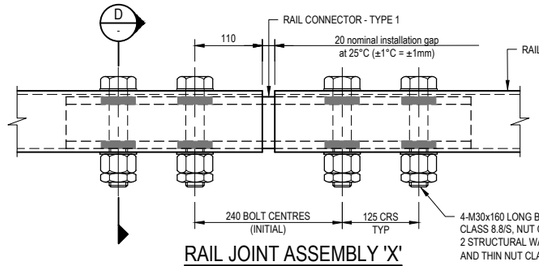
RAIL ANCHOR PLATE - RA1
SCALE 1:5



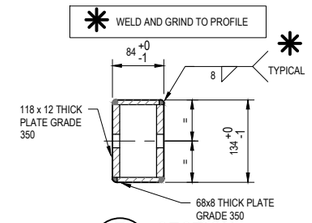
RAIL ANCHOR PLATE - RA2
SCALE 1:5



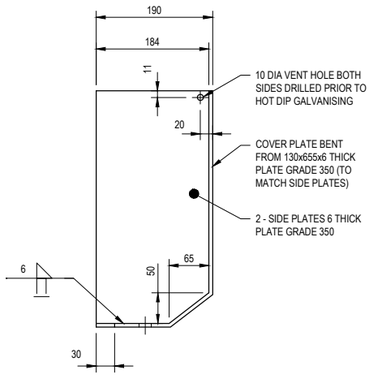
D SECTION
SCALE 1 : 10



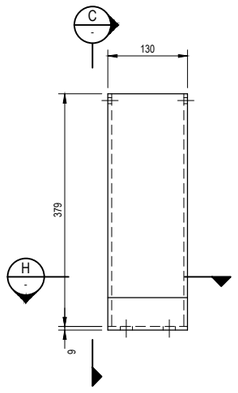
RAIL JOINT ASSEMBLY 'X' AT FIXED JOINTS
SCALE 1:10



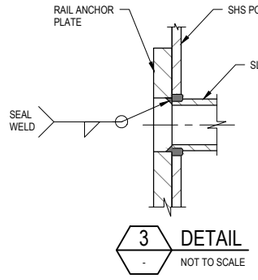
E SECTION
SCALE 1 : 5



C VIEW
SCALE 1 : 5



TERMINAL BLOCK - ELEVATION
SCALE 1:5



3 DETAIL
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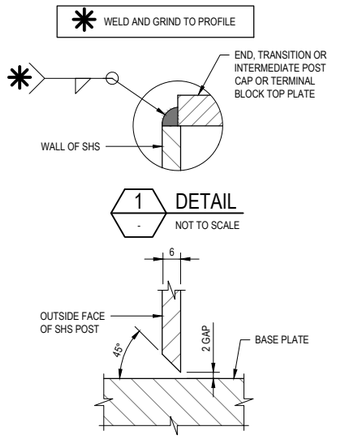
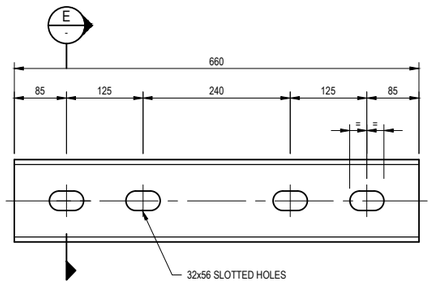


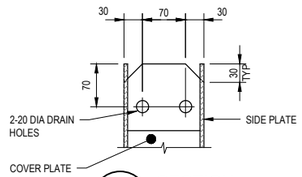
1 DETAIL
NOT TO SCALE

2 DETAIL
NOT TO SCALE

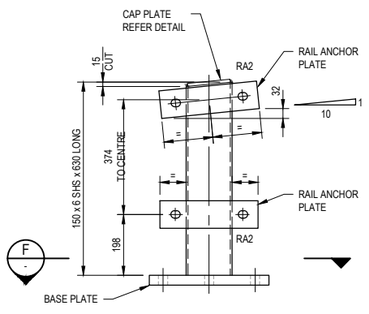
WELD PREPARATION FOR SHS POST TO BASE PLATE



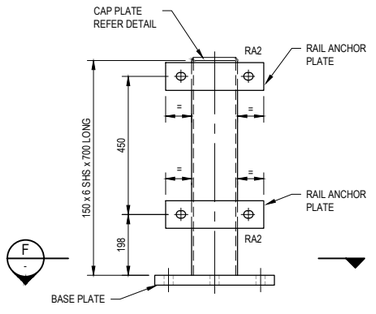
RAIL CONNECTOR PLAN - TYPE 1
SCALE 1:5



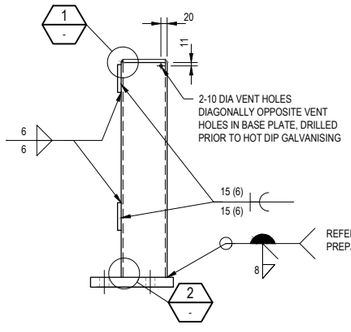
H SECTION
SCALE 1 : 5



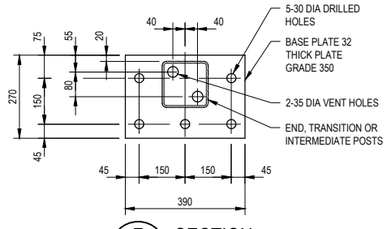
TRANSITION POSTS - TYPE 1 ELEVATION
SCALE 1:10
TYPE 2 OPPOSITE HAND



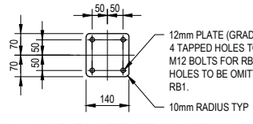
INTERMEDIATE POSTS - ELEVATION
SCALE 1:10



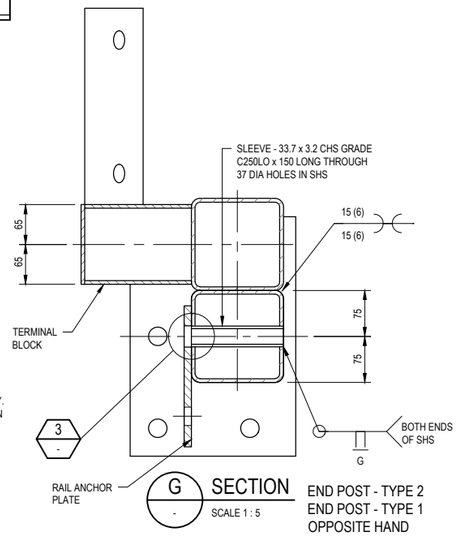
TYPICAL END VIEW TRANSITION AND INTERMEDIATE POSTS
SCALE 1:10



F SECTION
SCALE 1 : 10



PLAN - CAP PLATE TRANSITION INTERMEDIATE AND END POSTS
SCALE 1:10



G SECTION
SCALE 1 : 5

END POST - TYPE 2
END POST - TYPE 1
OPPOSITE HAND

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

DOUGLAS SHIRE COUNCIL

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E cnsmail@ghd.com.au **W** www.ghd.com.au

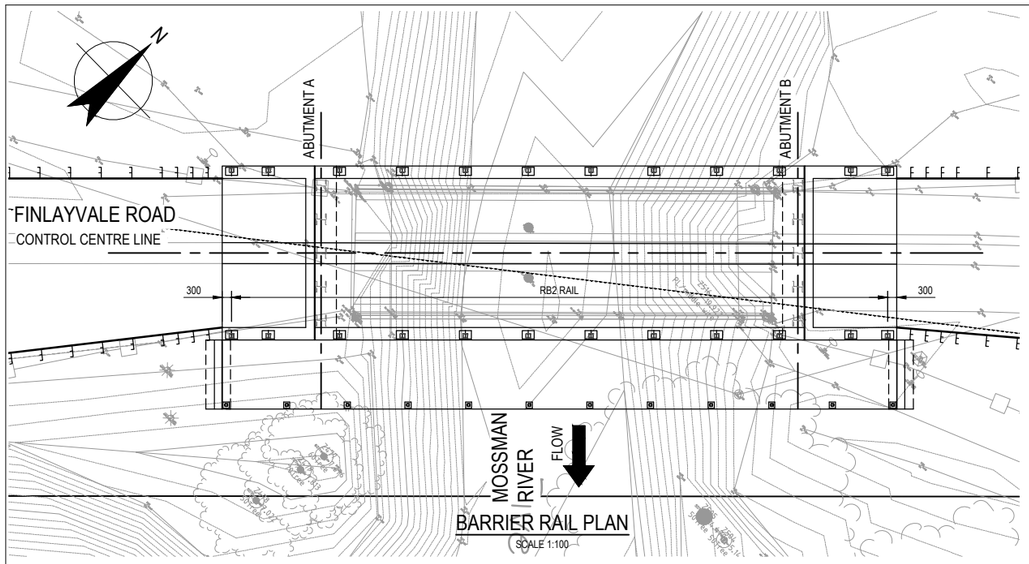
DO NOT SCALE

Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

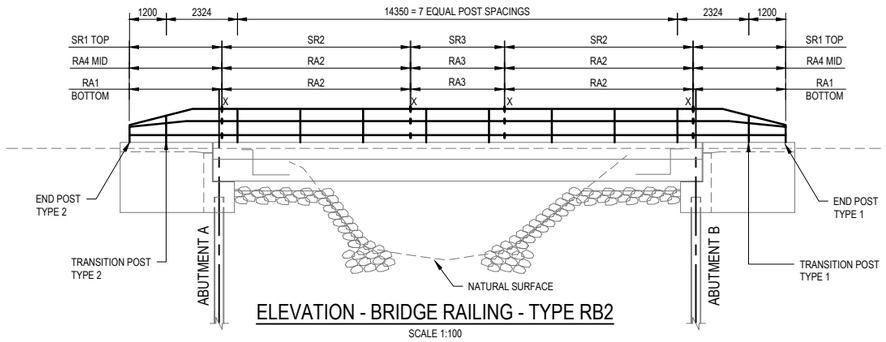
Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE
BRIDGE TRAFFIC BARRIER DETAILS

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

Plot Date: 5 March 2021 - 4:12 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S016.dwg



BARRIER RAIL PLAN
SCALE 1:100

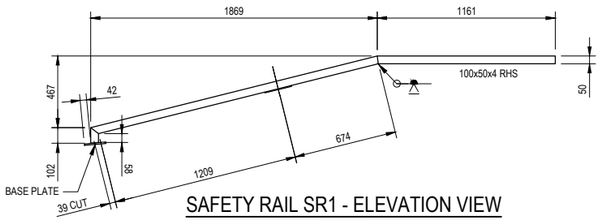


ELEVATION - BRIDGE RAILING - TYPE RB2
SCALE 1:100

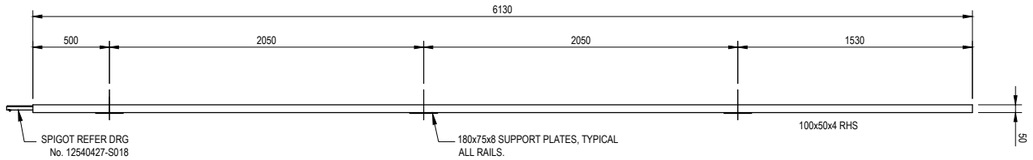
X - DENOTES 20mm NOMINAL GAP IN RAILS

NOTES

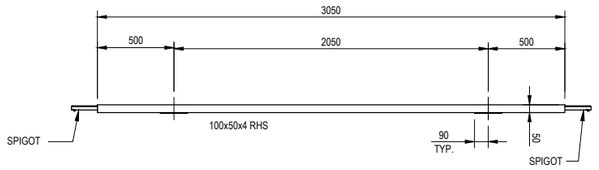
1. DELINEATION ON THE BRIDGE TRAFFIC BARRIER SYSTEM SHALL BE INSTALLED IN THE LOCATION AND TO THE SPACING SHOWN ON THE DRAWING. DELINEATORS SHALL BE CONSISTENT WITH THE REQUIREMENTS SPECIFIED IN MRTS14.
2. RHS AND SHS TUBE TO BE GRADE C450L0 TO AS/NZS 1163.
3. ALL HOLLOW SECTION MATERIAL MANUFACTURED TO AS/NZS 1163 WILL REQUIRE ABRASIVE BLASTING TO DEVELOP A SURFACE PROFILE OF 50 um 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.



SAFETY RAIL SR1 - ELEVATION VIEW
SCALE 1:20



SAFETY RAIL SR2 - ELEVATION VIEW
SCALE 1:20



SAFETY RAIL SR3 - ELEVATION VIEW
SCALE 1:20

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE	WRC	*MI	*AA	06.03.21

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

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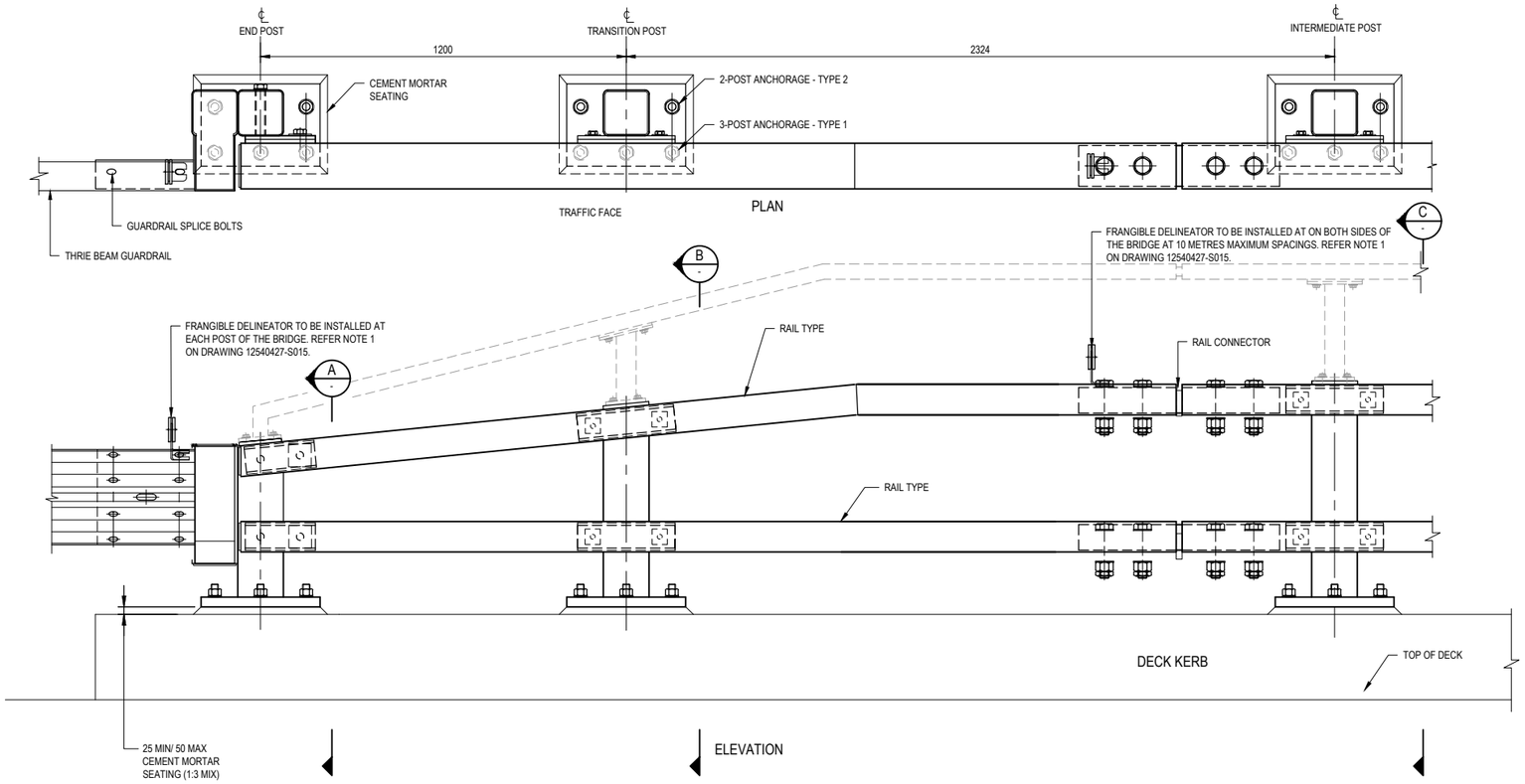
DO NOT SCALE

Drawn	W.CLARKE	Designer	A.AHILADELLIS
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE
SAFETY RAILS ARRANGEMENT

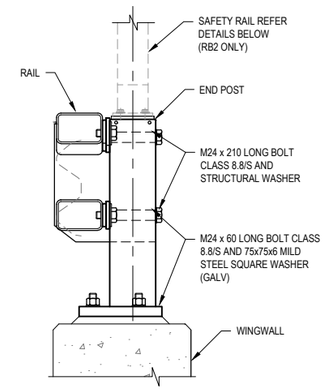
Original Size A1
Drawing No: 12540427-S017
Rev: A

Plot Date: 5 March 2021 - 4:13 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S017.dwg



TYPICAL ASSEMBLY - END, TRANSITION AND INTERMEDIATE POST

SCALE 1:10



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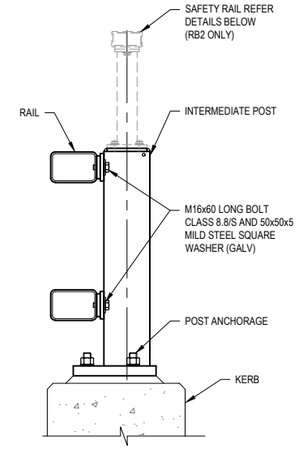
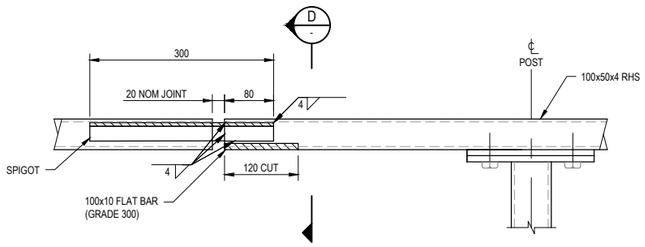
SCALE 1 : 10



SECTION B SIMILAR

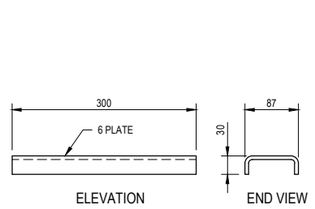
C - SECTION

SCALE 1 : 10



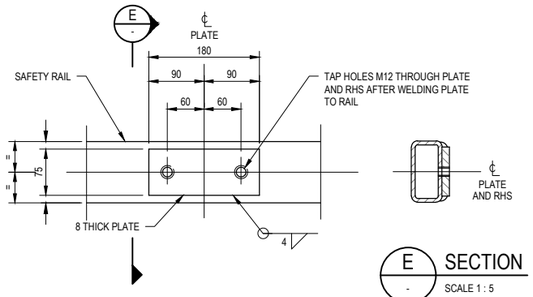
RAIL JOINT - SPIGOT ASSEMBLY ELEVATION

SCALE 1:5



SPIGOT

SCALE 1:5

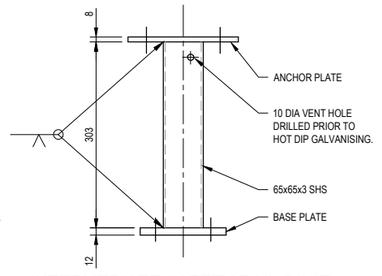


SUPPORT PLATE

SCALE 1:5

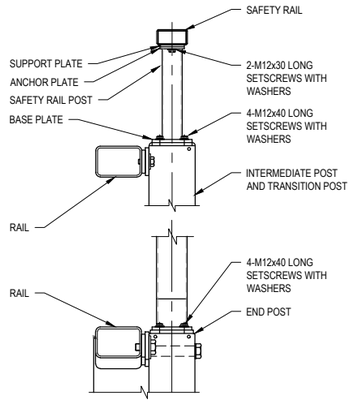
E - SECTION

SCALE 1 : 5



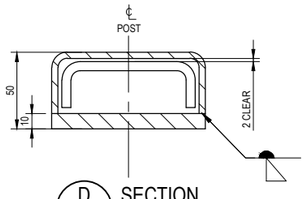
INTERMEDIATE SAFETY RAIL POST

SCALE 1:5



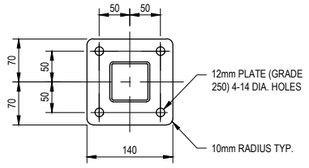
ASSEMBLY DETAILS

SCALE 1:10



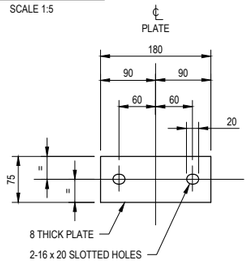
D - SECTION

NOT TO SCALE



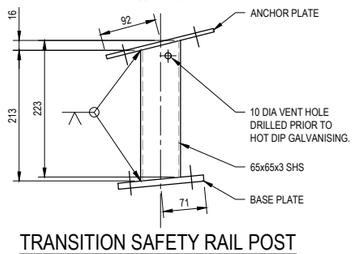
PLAN - BASE PLATE INTERMEDIATE, TRANSITION AND END POSTS

SCALE 1:5



ANCHOR PLATE

SCALE 1:5



TRANSITION SAFETY RAIL POST

SCALE 1:5

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY ISSUE		WRC	*MI	*AA	06.03.21

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

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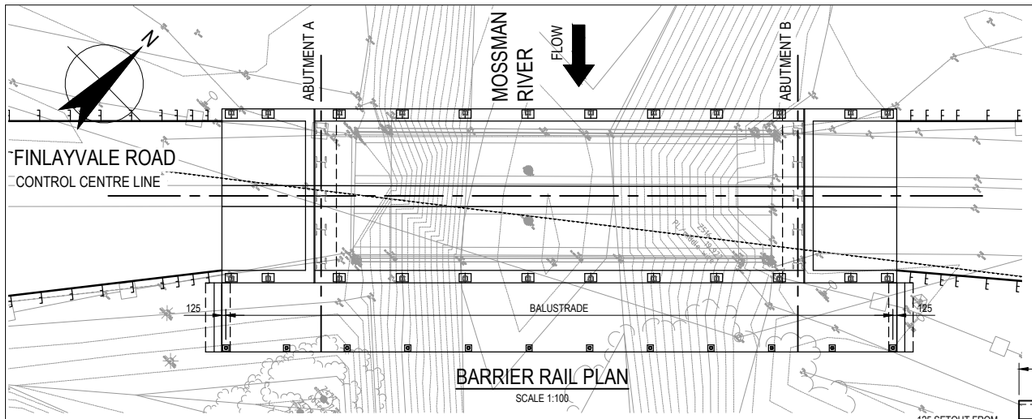
DO NOT SCALE

Drawn W.CLARKE		Designer A.AHILADELLIS	
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved		

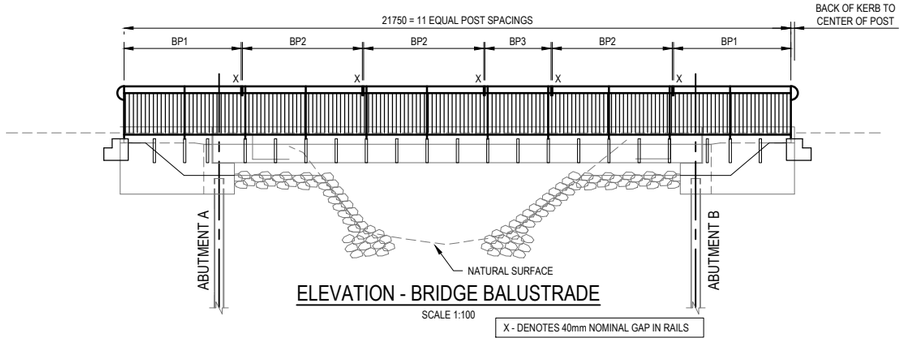
Client DOUGLAS SHIRE COUNCIL
Project WARNERS AND ANICHS BRIDGE UPGRADES
Title ANICHS BRIDGE SAFETY RAILS DETAILS

Original Size A1
Drawing No: 12540427-S018
Rev: A

Plot Date: 5 March 2021 - 4:14 PM Plotted by: Wes Clarke Cad File No: G:\42\12540427\CADD\Drawings\12540427-S018.dwg



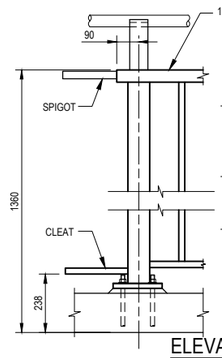
BARRIER RAIL PLAN
SCALE 1:100



ELEVATION - BRIDGE BALUSTRADE
SCALE 1:100

X - DENOTES 40mm NOMINAL GAP IN RAILS

125 SETOUT FROM BACK OF KERB TO CENTER OF POST



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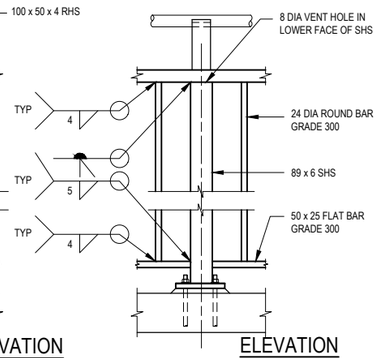
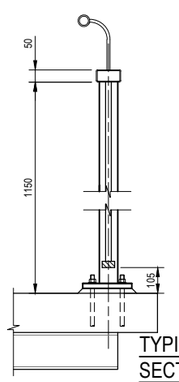
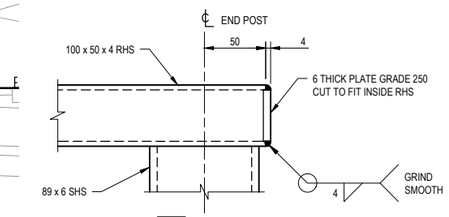


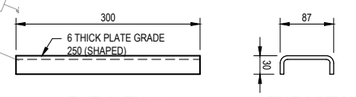
ELEVATION
POST DETAILS
SCALE 1:25



TYPICAL SECTION



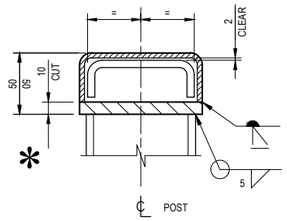
DETAIL
SCALE 1 : 2.5



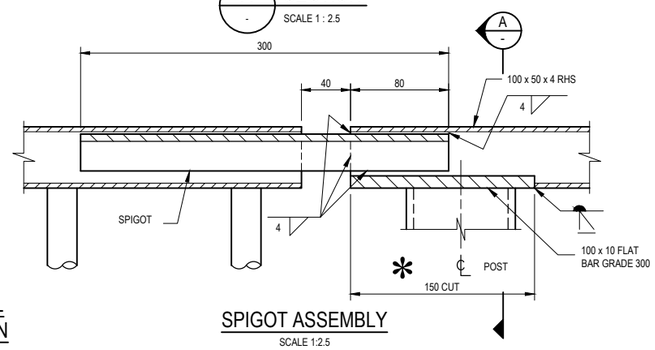
ELEVATION

END VIEW

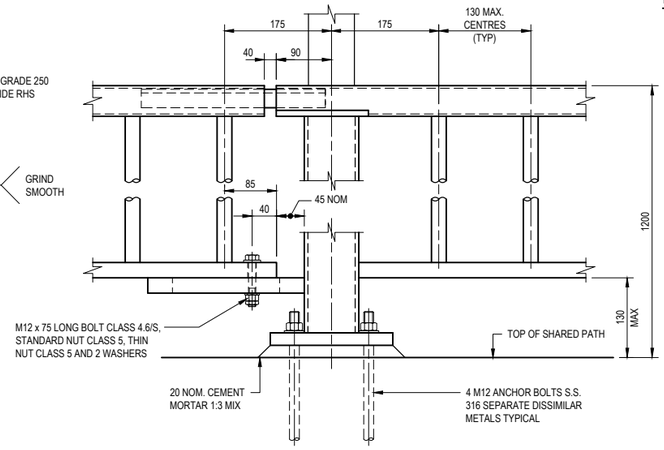
SPIGOT DETAIL
SCALE 1:5



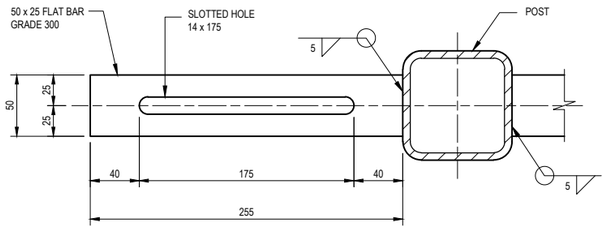
A SECTION
SCALE 1 : 2.5



SPIGOT ASSEMBLY
SCALE 1:2.5



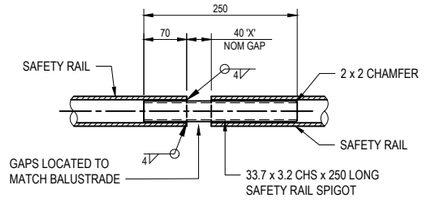
TYPICAL ASSEMBLY
SCALE 1:5

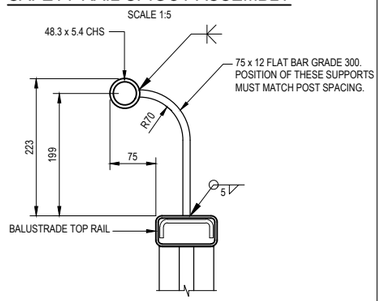


CLEAT DETAIL
SCALE 1:2.5

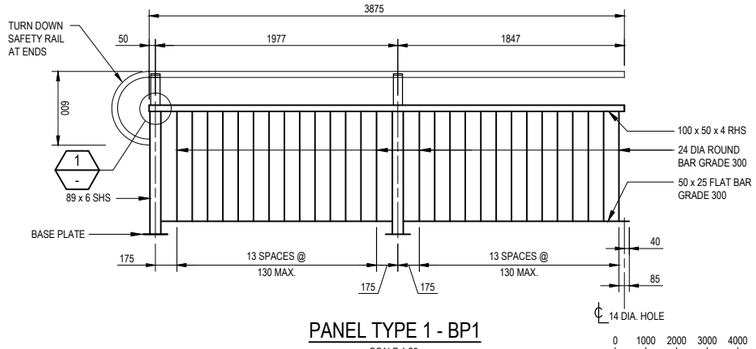
NOTES

1. RHS AND SHS TUBE TO BE GRADE C450L0 TO AS/NZS 1163.
2. BASE PLATES AND RAIL CONNECTORS TO BE GRADE 350 TO AS/NZS 3678.
3. ALL OTHER PLATES AND 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 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.
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.





SAFETY RAIL SPIGOT ASSEMBLY



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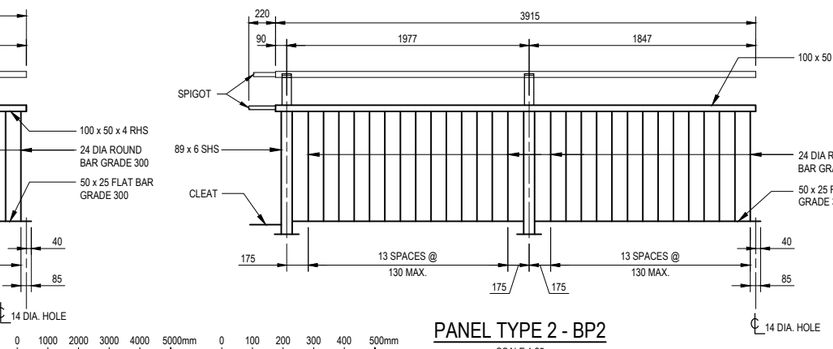

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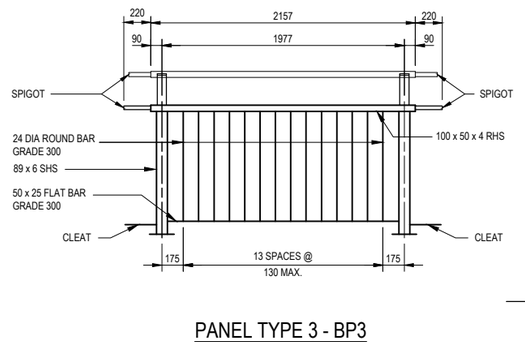

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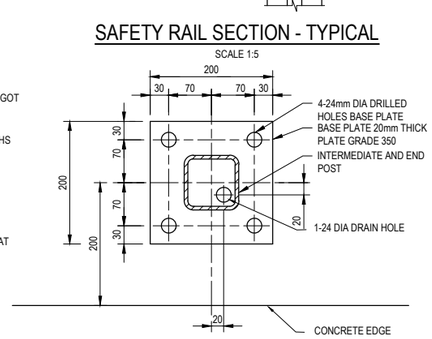

SAFETY RAIL SECTION - TYPICAL

BASE PLATE
SCALE 1:5

0 1000 2000 3000 4000 5000mm
SCALE 1:100 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

PRELIMINARY

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
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DOUGLAS SHIRE COUNCIL
Project: WARNERS AND ANICHS BRIDGE UPGRADES
Title: ANICHS BRIDGE BALLUSTRADE DETAILS

Original Size: A1
Drawing No: 12540427-S019
Rev: A

Plot Date: 5 March 2021 - 4:16 PM
Plotted by: Wes Clarke
Cad File No: G:\42\12540427\CADD\Drawings\12540427-S019.dwg

Appendix B – Approvals Management Plans Report

Douglas Shire Council

Warners and Anichs Bridge Upgrades
Approvals Management Plan

February 2021

Table of contents

Table index

Figure index

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 Queenslander's 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 the 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 of 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 Heigh 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 Foxton 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 Queenslander's 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
Environmental Protection and Biodiversity Conservation Act 1999		DAWE	Actions that have or are likely to have a significant impact on a MNES require approval from DAWE. MNES includes listed threatened species and ecological communities.	**Not applicable** The site has previous disturbances and is unlikely to have a significant impact on MNES values.	-	-	-	-
Planning Act Approvals								
Coastal Protection and Management Act 1995	Operational works that are prescribed tidal works	DES	Development on land under tidal waters	**Not applicable** The land is not mapped within tidal area	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
	Operational work that is work in CMD	DES	If within a CMD: • 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	**Not applicable** The project is not located on CMD or on State Land.	-	-	-	-
Fisheries Act 1994	Operation Work that is waterway barrier work	DAF DSDTI	Permanent works within waterways that form waterway barrier	**Compliance required** Works are located on a major (purple) risk waterway. However, works are likely to meet 'What is not Waterway Barrier Works'.	-	-	-	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** Contractor to meet temporary waterway barrier works conditions The project site is mapped as a major (purple) waterway. Temporary side tracks less than 180 days won't require a permit.	-	-	-	Design and contractor to meet requirements of construction works to meet the Acceptable Development al Requirement s of DAF.
	Operation al work that is the removal, destructio n or damage of marine plants		Removal, destruction or damaging marine plants	**Not applicable** No marine plants present	-	-	-	-
Planning Act 2016 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
Vegetation Management Act 1999	Operation work for clearing native vegetation	Department of Resources	Clearing of native vegetation assessable under the VM Act.	**Compliance required** The proposed project is expected to have vegetation clearing along each bank, which are mapped as Category B and Category R regulated vegetation. Accepted development vegetation clearing codes (clearing for infrastructure). Although no permit is required, compliance is required	-		-	GHD to confirm once design footprint is known. Contractor required to undertake the works in accordance with an EMP Contractor to be made aware that clearing of vegetation is not authorised.
Non-planning Act Approvals								
Aboriginal Cultural Heritage Act 2003	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	**Applicable (Compliance)** Works would be categorised as Category 4 (areas previously subject to significant ground disturbance) as site is developed and has previously been disturbed.	-	-	-	Contractor to meet Duty of Care Guidelines.

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
Biosecurity Act 2015	-	Department of Agriculture	Under section 23 of the Biosecurity Act 2014 all Queenslander's 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
Environmental Protection Act 1994	-	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
Environmental Offsets Act 2014	-	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))
Native Title (Queensland) Act 1993	-	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.	-	-	-	-
Nature Conservation Act 1992	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.
Queensland Heritage Act 1992	-	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.
State Development and Public Works Organisation Act 1971	-	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	-	-	-	-
Water Act 2000	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.	-	-	-	-
Land Act 1994	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.	-	-	-	-
Transport Infrastructure Act 1994	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.	-	-	-	-
Douglas Shire Council 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
Environmental Protection and Biodiversity Conservation Act 1999		DAWE	Actions that have or are likely to have a significant impact on a MNES require approval from DAWE. MNES includes listed threatened species and ecological communities.	**Not applicable** The site has previous disturbances and is unlikely to have a significant impact on MNES values.	-	-	-	-
Planning Act Approvals								
Coastal Protection and	Operational works that are prescribed tidal works	DES	Development on land under tidal waters	**Not applicable** The land is not mapped within tidal area	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
Management Act 1995	Operational work that is work in CMD	DES	If within a CMD: • 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	**Not applicable** The project is not located on CMD or on State Land.	-	-	-	-
Fisheries Act 1994	Operation Work that is waterway barrier work	DAF DSDTI	Permanent works within waterways that form waterway barrier	**Compliance required** Works are located on a high (red) risk waterway. However, works are likely to meet 'What is not Waterway Barrier Works'.	-	-	-	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	-	-	-	-
Planning Act 2016 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
Vegetation Management Act 1999	Operation work for clearing native vegetation	Department of Resources	Clearing of native vegetation assessable under the VM Act.	**Compliance required** The proposed project is expected to have vegetation clearing along each bank, which are mapped as Category B and Category R regulated vegetation. Accepted development vegetation clearing codes (clearing for infrastructure). Although no permit is required, compliance is required	-		-	GHD to confirm once design footprint is known. Contractor required to undertake the works in accordance with an EMP Contractor to be made aware that clearing of vegetation is not authorised.
Non-approval Act Approvals								
Aboriginal Cultural Heritage Act 2003	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	**Applicable (Compliance)** Works would be categorised as Category 5 (areas previously subject to significant ground disturbance) as site is developed and has previously been disturbed.	-	-	-	Contractor to meet Duty of Care Guidelines.

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
Biosecurity Act 2015	-	Department of Agriculture	Under section 23 of the Biosecurity Act 2014 all Queenslander's 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
Environmental Protection Act 1994	-	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.	-	-	-	-
Environmental Offsets Act 2014	-	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.	-	-		-
Native Title (Queensland) Act 1993	-	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.
Nature Conservation Act 1992	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	**To be confirmed** Not expected to disturb animal breeding places as the works will occur within a previously disturbed area. 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.				GHD to consider location during design and confirm applicability after footprint is confirmed.
Queensland Heritage Act 1992	-	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.
State Development and Public Works Organisation Act 1971	-	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 a State Development Area	-	-	-	-

Legislation	Approval	Authority	Trigger	Applicability	Licence/Permit Required	Timeframe	Fee	Party/Phase to Action
Water Act 2000	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.	-	-	-	-
Land Act 1994	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.
Transport Infrastructure Act 1994	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	**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.	-	-	-	-
Douglas Shire Council 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.	-	-	-	-

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 tow 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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12540427-2057-5/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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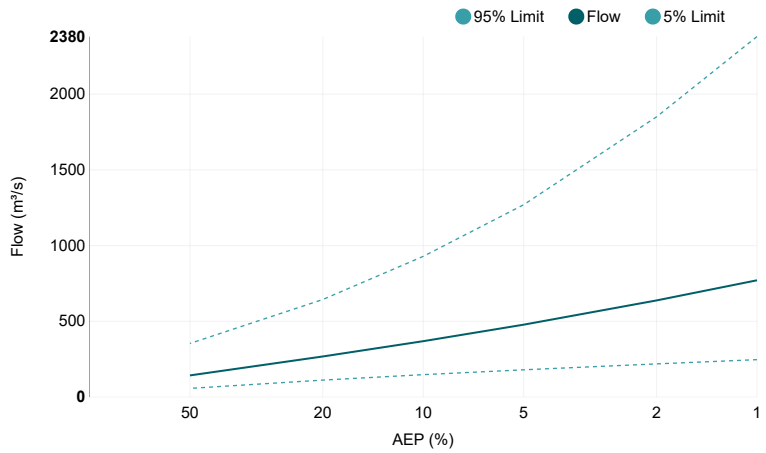
Appendix C – Douglas Partners Geotechnical Investigation Reports

Appendix D – RFFE for Warners Bridge

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/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

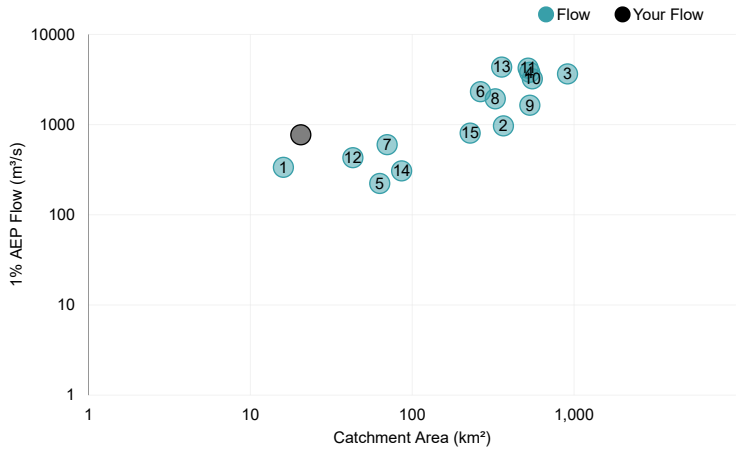
Variable	Value	Standard Dev
Mean	4.805	0.544
Standard Dev	0.743	0.293
Skew	-0.126	0.084

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

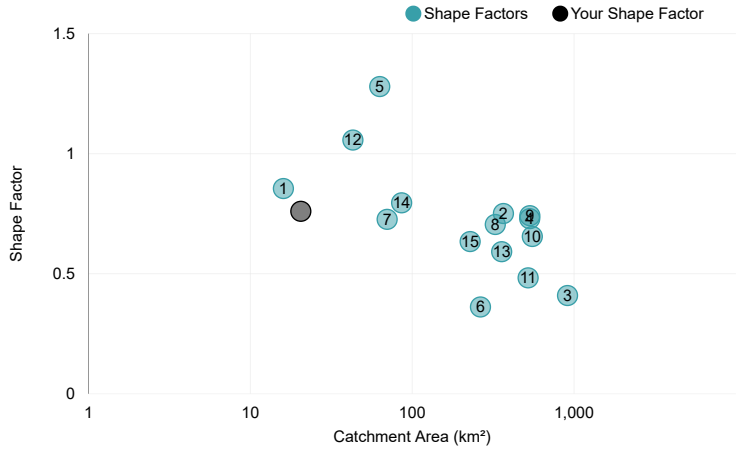
Correlation		
1.000		
-0.330	1.000	
0.170	-0.280	1.000

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

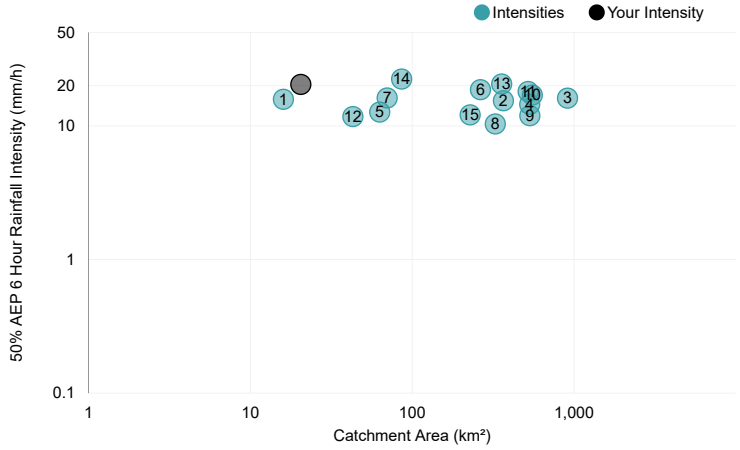
1% AEP Flow vs Catchment Area



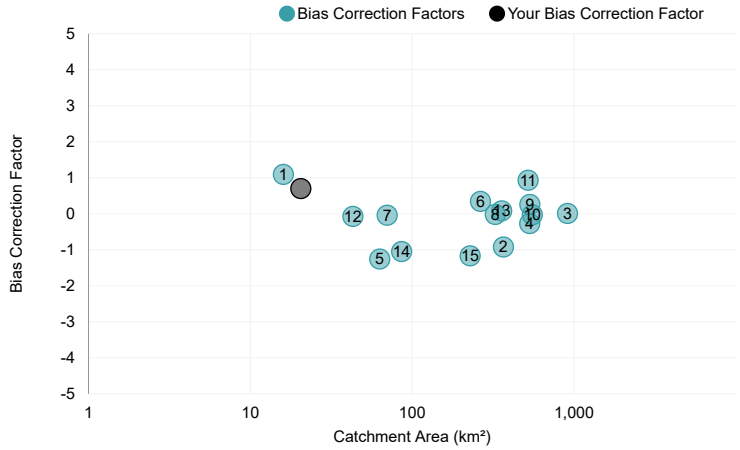
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

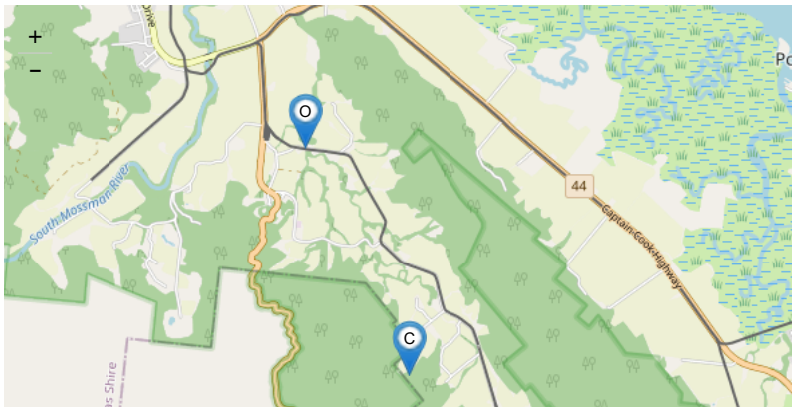
TXT Nearby JSON

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



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).

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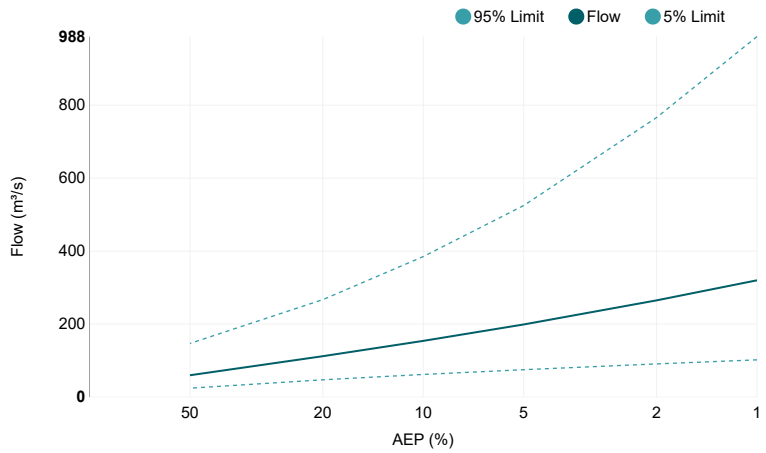
Appendix E - RFFE for Anichs Bridge

Results | Regional Flood Frequency Estimation Model



AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/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

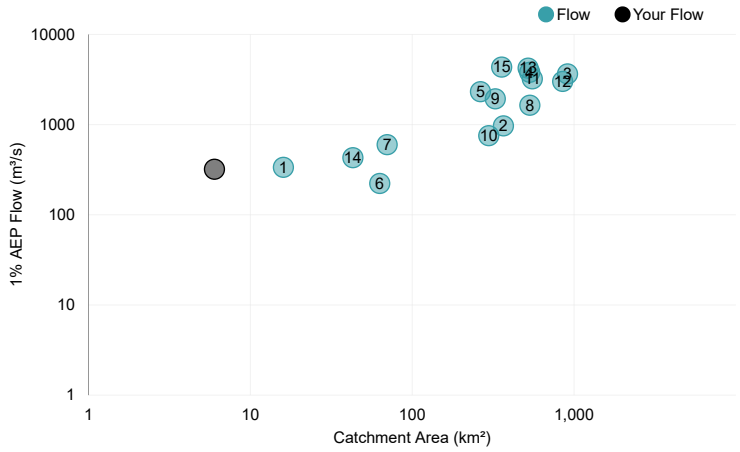
Variable	Value	Standard Dev
Mean	4.004	0.544
Standard Dev	0.743	0.293
Skew	-0.126	0.084

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

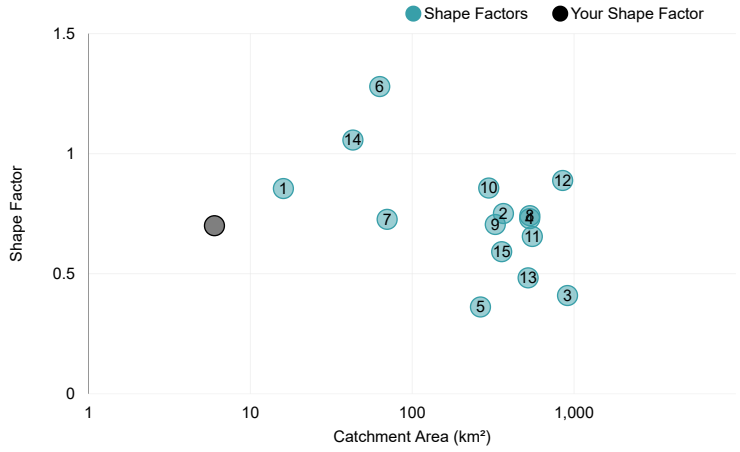
Correlation		
1.000		
-0.330	1.000	
0.170	-0.280	1.000

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

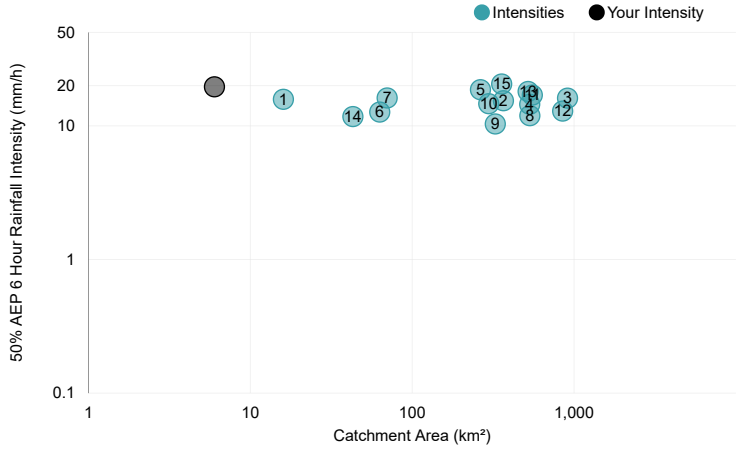
1% AEP Flow vs Catchment Area



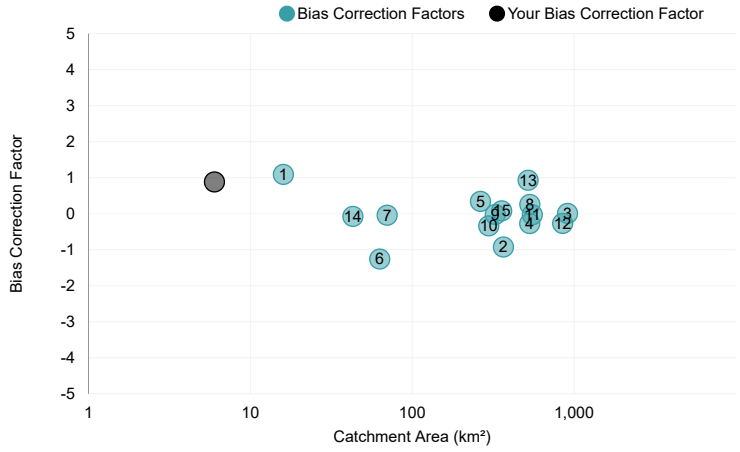
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

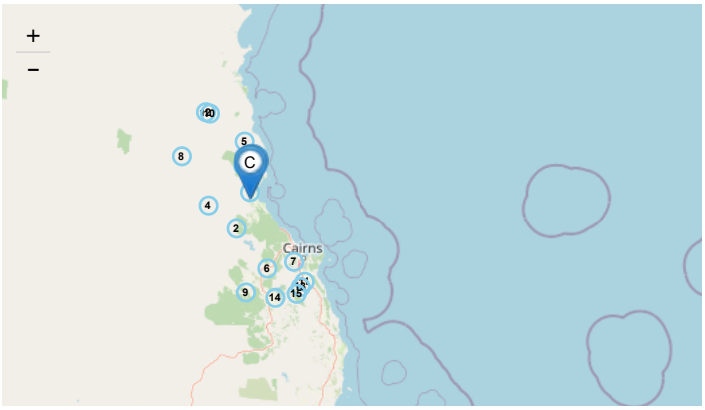
TXT Nearby JSON

Input Data

Date/Time	2021-01-15 12:44

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



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).

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

Design flows

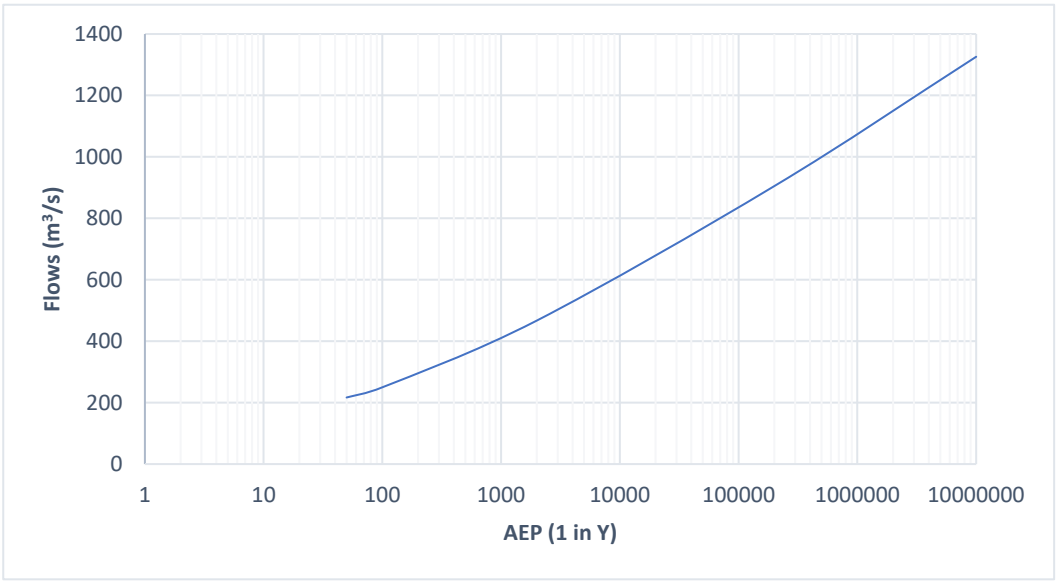
Parameter	Value	Unit	Reference
Area	20.48	km2	GIS calculations
50	217	m3/s	Rational method
100	250	m3/s	Rational method
PMP-DF	1326	m3/s	Watt, S., Sciacca, D., Hughes, M., & Pedruco, P.

Interpolation

	Parameter		Value		Unit
1	log(Xpmp/X100) / log(X100/X50)		11.8		
2	AEP of PMP		1.00E-07		
3	log (Xy/X100) / log(Xpmp/X100	1 in Y1	0.375	1 in 2000	
		1 in Y2	0.771	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

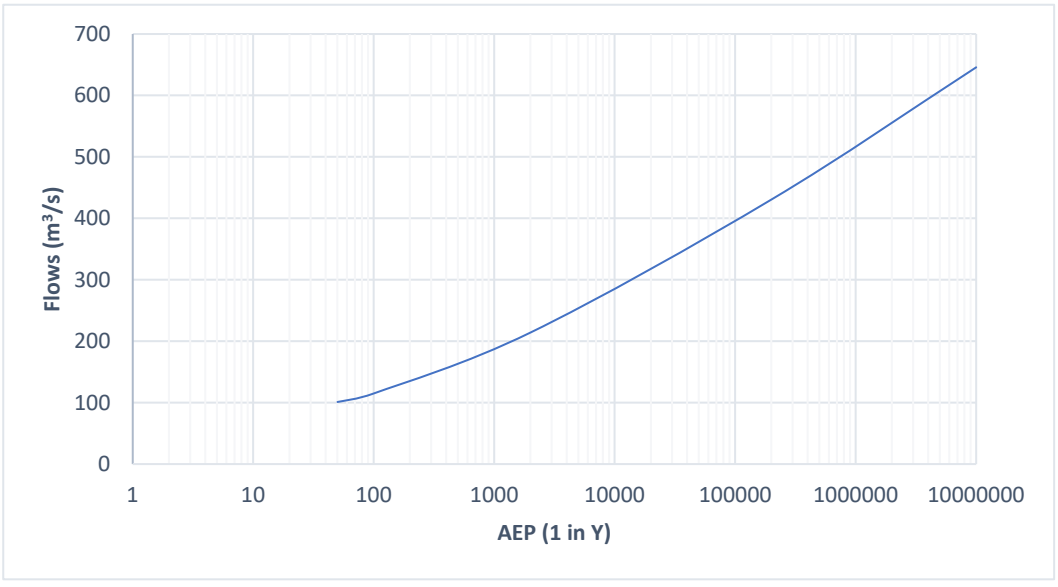
Parameter	Value	Unit	Reference
Area	6.00	km2	GIS calculations
50	101	m3/s	Rational method
100	115	m3/s	Rational method
PMP-DF	646	m3/s	Watt, S., Sciacca, D., Hughes, M., & Pedruco, P.

Interpolation

	Parameter		Value		Unit
1	log(Xpmp/X100) / log(X100/X50)		13.3		
2	AEP of PMP		1.00E-07		
3	log (Xy/X100) / log(Xpmp/X100	1 in Y1	0.36	1 in 2000	
		1 in Y2	0.765	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-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	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
	14 Dec	15 Dec	16 Dec	17 Dec	18 Dec	19 Dec	20 Dec	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	

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)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
	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	

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

* 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	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	0	0	0	0	0	0	0	1	1	**2**	1	1	1	1	0	**3**	1	0	0	0	0	2	0
0	0	0	0	0	0	0	0	0	2	**0**	1	0	1	2	0	**4**	1	1	0	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	3	2	3	**3**	4	0	0	0	**2**	2	1	2	0	1	1	1	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	1	1	3	2	**4**	2	1	3	3	**4**	2	0	4	0	0	1	0	0
0	0	0	0	0	1	1	1	1	**4**	2	3	2	0	**3**	0	1	1	3	0	0	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	1	0	1	2	0	1	1	**4**	3	2	2	1	2	**2**	3	0	1	4	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	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	1	1	1	1	1	**3**	0	5	1	0	1	**5**	2	0	1	4	3	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**	**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	1	2	**4**	2	1	**5**	0	4	1	1	0	2	1	1	1	0	0
0	0	0	0	0	0	1	2	4	**5**	2	4	**1**	1	0	5	5	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

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

0	**0**	**0**	**0**	**0**	**2**	**6**	**5**	**8**	**5**	**3**	**11**	**0**	**2**	**5**	**7**	**8**	**8**	**5**	**0**	**6**	**2**	**1**	**0**
0	0	0	0	0	0	0	0	4	2	0	**4**	0	1	0	1	**0**	1	3	0	0	1	0	0
0	0	0	0	0	0	2	1	0	0	0	**1**	0	0	1	2	**4**	1	2	0	2	1	0	0
0	0	0	0	0	2	3	2	2	2	0	**5**	0	1	3	1	**4**	3	0	0	1	0	1	0
0	0	0	0	0	0	1	2	2	1	**3**	1	0	0	1	**3**	0	3	0	0	3	0	0	0

AM Peak 1045 - 1145 (13), AM PHF=0.65 PM Peak 1545 - 1645 (11), PM PHF=0.69

* Tuesday, 22 December 2020 - Total=96, 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**	**1**	**0**	**4**	**7**	**6**	**2**	**8**	**8**	**7**	**5**	**5**	**5**	**8**	**8**	**5**	**8**	**1**	**6**	**1**	**1**	**0**
0	0	0	1	0	0	0	2	2	1	**1**	2	1	0	3	**4**	1	2	1	0	0	0	1	0
0	0	0	0	0	0	6	2	0	1	**4**	2	1	3	0	**1**	4	1	4	1	3	1	0	0
0	0	0	0	0	4	1	1	0	**4**	2	3	1	1	1	**3**	3	1	2	0	3	0	0	0
0	0	0	0	0	0	0	1	0	**2**	1	0	2	1	**1**	0	0	1	1	0	0	0	0	0

AM Peak 0930 - 1030 (11), AM PHF=0.69 PM Peak 1445 - 1545 (9), PM PHF=0.56

* Wednesday, 23 December 2020 - Total=97, 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**	**4**	**10**	**2**	**3**	**10**	**2**	**5**	**3**	**7**	**16**	**5**	**7**	**9**	**7**	**2**	**0**	**3**	**0**
0	0	0	0	0	1	1	**4**	1	0	5	1	1	0	1	**4**	0	4	4	3	0	0	3	0
0	0	0	0	0	0	1	**2**	0	1	2	0	1	1	1	**8**	2	2	2	3	0	0	0	0
0	0	0	0	0	1	1	**3**	0	1	1	0	1	0	**4**	2	1	0	2	1	0	0	0	0
0	0	0	0	0	0	**1**	1	1	1	2	1	2	2	**1**	2	2	1	1	0	2	0	0	0

AM Peak 0645 - 0745 (10), AM PHF=0.63 PM Peak 1430 - 1530 (17), PM PHF=0.53

* Thursday, 24 December 2020 - Total=9 (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**	**2**	**7**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
0	0	0	0	0	0	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0	0	0	0	0	0	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0	0	0	0	0	1	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0	0	0	0	0	1	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

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%

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	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
	14 Dec	15 Dec	16 Dec	17 Dec	18 Dec	19 Dec	20 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	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)

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Averages	
	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**	**11**	**18**	**7**	**17**	**35**	**36**	**41**	**34**	**26**	**28**	**4**	**5**	**3**	**0**	**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	0	2	9	3	5	**12**	4	**14**	10	7	6	0	1	0	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	0	3	5	0	**8**	6	15	**10**	7	5	3	0	1	1	0	0	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
0	**0**	**0**	**0**	**1**	**2**	**8**	**5**	**7**	**19**	**12**	**20**	**33**	**22**	**32**	**27**	**15**	**10**	**5**	**6**	**1**	**0**	**1**	**2**
0	0	0	0	0	0	1	1	0	4	3	4	**11**	5	6	6	4	3	4	3	0	0	1	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	0	1	0	1	3	2	5	1	**7**	**4**	6	14	5	5	2	1	0	0	0	0	0
0	0	0	0	0	1	5	1	2	5	6	**6**	**9**	4	6	10	2	1	0	0	1	0	2	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
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	0	2	0	1	4	7	1	**10**	10	4	3	**10**	12	6	0	1	0	1	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	0	3	1	5	5	4	**9**	1	8	**9**	5	7	1	0	1	0	0	0
0	0	0	0	0	0	0	0	2	3	5	5	**8**	9	6	6	**7**	8	5	0	0	0	1	0

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
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	0	6	3	6	11	**20**	**24**	11	16	9	9	4	0	0	0	1	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	0	0	2	1	1	2	13	**16**	15	16	11	8	2	3	0	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	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
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	0	2	1	3	3	1	2	9	**9**	9	9	**10**	17	8	1	2	0	0	1	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	0	2	7	3	3	3	3	11	**16**	12	**16**	10	14	6	2	0	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	0	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

0	**0**	**0**	**0**	**2**	**3**	**5**	**8**	**3**	**10**	**14**	**19**	**44**	**42**	**53**	**39**	**36**	**39**	**17**	**1**	**2**	**1**	**1**	**0**
0	0	0	0	0	1	2	3	0	3	5	1	**14**	**12**	9	5	9	13	6	1	0	1	1	0
0	0	0	0	0	0	3	3	1	3	1	4	**6**	**17**	14	11	9	10	6	0	2	0	0	0
0	0	0	0	2	1	0	1	2	1	4	6	**9**	7	11	15	5	9	5	0	0	0	0	0
0	0	0	0	0	1	0	1	0	3	4	**8**	**15**	6	19	8	13	7	0	0	0	0	0	0

AM Peak 1145 - 1245 (37), AM PHF=0.66 PM Peak 1230 - 1330 (53), PM PHF=0.78

* Wednesday, 23 December 2020 - Total=331, 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	**1**	**0**	**2**	**2**	**4**	**4**	**6**	**8**	**15**	**18**	**27**	**30**	**30**	**50**	**32**	**45**	**37**	**12**	**0**	**1**	**5**	**1**	**1**
0	0	0	0	0	0	0	0	1	6	5	**8**	6	9	**18**	11	12	15	5	0	0	4	1	1
0	0	0	0	1	0	2	0	2	6	3	**7**	7	10	**11**	8	19	10	6	0	0	1	0	0
0	0	0	2	1	1	1	3	0	2	9	**5**	4	5	**9**	7	6	6	0	0	1	0	0	0
0	1	0	0	0	3	1	3	5	1	1	**7**	13	6	**12**	6	8	6	1	0	0	0	0	0

AM Peak 1100 - 1200 (27), AM PHF=0.84 PM Peak 1400 - 1500 (50), PM PHF=0.69

* Thursday, 24 December 2020 - Total=10 (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**	**4**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
0	0	0	0	0	0	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	4	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	0	0	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	0	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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%

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.

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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.

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

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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.*

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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.

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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 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.*

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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 barries 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.

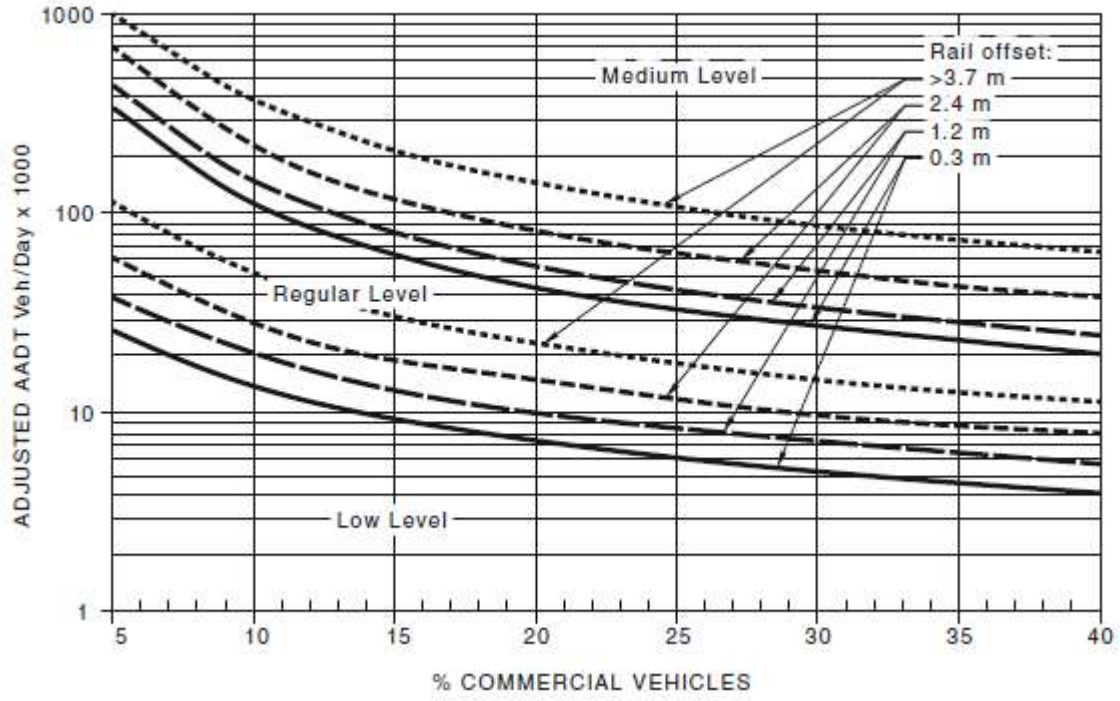

Figure 1: Threshold Limits, 60 km/hr (AS5100.1:2017, Figure A5)

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

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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 km/h	Impact angle Degrees	MASH 2009 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	
	2.27 t utility	100	25	TL4
	10 t rigid truck (see Note 1)	90	15	
Medium	1.1 t small car	100	25	
	2.27 t utility	100	25	TL5
	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 is 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.

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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

Arthur Ahiladellis
Lead Engineer

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Document Status

Revision	Author	Reviewer		Approved for Issue		
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