Catherine Hill Bay Jetty - Structural Condition Report

Prepared for NSW Department of Planning and Environment

July 2023
Project Number: N23028
Version: Rev A

OPPORTUNITIES THROUGH EXCELLENCE

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BG&E

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Document Control				
Revision	Date	Prepared	Reviewed	Approved
A	21/07/2023	ZS	NS	ZA

1. Executive Summary

BG&E were engaged by the NSW Department of Planning and Environment to undertake a structural condition assessment of the Catherine Hill Bay jetty. The objective of this assessment was to provide viable options pertaining to adaptive reuse or demolition of the jetty. Additionally, quantity surveying has also been completed for the viable options to provide a commercial perspective to the recommendations. The jetty structure consists of a total of 28 steel bents (or frames) at up to 13.7m spans. Between each bent, reinforced precast panels sit on top of a sub-structure consisting of various sized steel members. Based on the existing drawings, it appears that the water at the seaward end of the jetty is 10m deep, and the jetty projects 10m above the low-tide sea level.

Limited documentation was available regarding the original structure and member sizes. Consequently, BG&E conducted an extensive inspection of the jetty to gather missing information. The majority of our calculations have been based on measurements taken on site with minor information extracted from existing drawings and reports. BG&E have also had to make some educated assumptions. However, it should be noted that many connection details could not be accurately measured due to the advanced state corrosion and access constraints.

Overall, the structure has deteriorated significantly. The jetty was originally designed for large live loads associated with loading coal and mooring large vessels. This has allowed the structure to maintain some capacity despite the high levels of corrosion and deterioration of some members (secondary steel members) to failure. BG&E note that the connections between UC's and underdeck steel members over the land portion of the jetty are experiencing the most significant deterioration. Having said this, there is potential to rectify the existing structure, but this will require significant temporary works, to clean, coat, replace, and strengthen existing members and connections. The UC's are extensively corroded, and it is difficult to envisage an economical repair that does not involve dismantling of the existing columns and bracing over the land portion.

2. Introduction

2.1 Site Background and History

Catherine Hill Bay is a heritage mining village in Lake Macquarie, NSW. The current steel and concrete jetty is the second marine coal loading iteration, built in the mid-1970's to replace an older timber jetty. The current jetty was used for loading coal until 2002, and the last remaining parts of the original timber jetty were destroyed by fire in October 2013. When it was last operating as a coal loader, the jetty supported a 115T ship loader consisting of a boom conveyor with a 1400mm wide, 35º trough, 3m/s belt; designed to load shipping of up to 5,400T capacity.

The jetty was maintained to minimise dilapidation until 2009, including regular replacing of underwater sacrificial zinc anodes, placing corrosion inhibitors on the outside of the steel tubular columns every 3 months, and sandblasting and repainting the steel work every 10 years. Previous major structural engineering reports were undertaken in July 2009 (Structural Engineers Report – Condition of Catherine Hill Bay Jetty for Lake Coal Pty Ltd, by CSG Engineers, July 2009)and September 2016 (Structural Engineers Report for the Catherine Hill Bay Jetty for Lake Coal Pty Ltd, by CSG Engineers, 23rd of September 2016) both by CSG Engineers, with the last report (Structural Engineers Report for the Catherine Hill Bay Jetty for Lake Coal Pty Ltd, by CSG Engineers, 23rd of September 2016) detailing a significant increase in deterioration. BG&E then produced a report in August 2017 (N17009-REP-001) detailing another significant increase in deterioration.

The ongoing level of deterioration appears to be consistent with the deterioration levels found following the suspension of maintenance in 2009.

For further information on the history of Catherine Hill Bay jetty please refer to N23028-REP-M-0001 – History and Background.

2.2 Scope Of Works

The scope of works for the structural engineering assessment included:

- Visual inspection of structural elements (concrete and steel,) and connection points. This was performed via UAV footage and site inspections via underdeck scaffolding.
- Analysis of existing drawings.
- Measurements taken to determine size of structural elements.
- Reinforcement breakouts at each concrete testing location (one panel at the shoreline, one panel about midway along, and one panel at the furthest extent of the jetty) to assess the reinforcement condition, size, spacing, and cover.
- Concrete sampling via core extraction to determine the compressive strength of the precast panels. This was completed to understand if there was any strength reduction from the original design strength.
- Hand calculations in accordance with relevant Australian Standards.
- Use of design software, including SpaceGass and RAPT, to confirm calculations.
- Application of reduction factors to account for the loss of section due to corrosion.

3. Jetty Observations

3.1 Description of Structural Elements

The following description is based upon visual observations made during the site inspections, in conjunction with drawings, and previous reports supplied to BG&E.

Based upon the existing drawings it appears that the water at the seaward end of the jetty is 10m deep, and the jetty projects 10m above the low-tide sea level. It is noted that a detailed bathymetry survey was not available to confirm these depths.

The jetty structure consists of a total of 28 steel bents (or frames) typically at 12.2m centres and up to 13.7m. Each span consists of continuous primary steel beams in the longitudinal direction between each bent and secondary steel work spanning to the primary beams and supporting precast planks over.

The original drawings, drafted by Theiss, were numbered with Bent 1 being the outermost seaward support frame and Bent 28 being the land abutment. In this report the same numbering convention has been applied. An annotated photo is provided below for additional information.

Figure 1 - Jetty Overview

Between Bents 1 to 18, transverse secondary beams span between the primary beams and support tertiary beams in the longitudinal direction. From Bents 1 to 11 there are two tertiary longitudinal beams and from Bent 12 to 18, where the jetty becomes wider, there are three tertiary longitudinal beams. The primary and tertiary longitudinal beams support the precast concrete deck.

Figure 2 - Primary, secondary and tertiary beams

Between Bents 18 and 28 there are only primary beams supporting the precast concrete, with no secondary or tertiary beams.

For the full extent of the jetty, plan bracing is provided to resist lateral loads. The plan bracing sits clear of the precast concrete over.

The basic structure is indicated in extracts from original Thiess Bros. drawings, provided below. It is noted that the resolution of the provided drawings was poor and in-part illegible, however basic information about the overall framing can be gleaned.

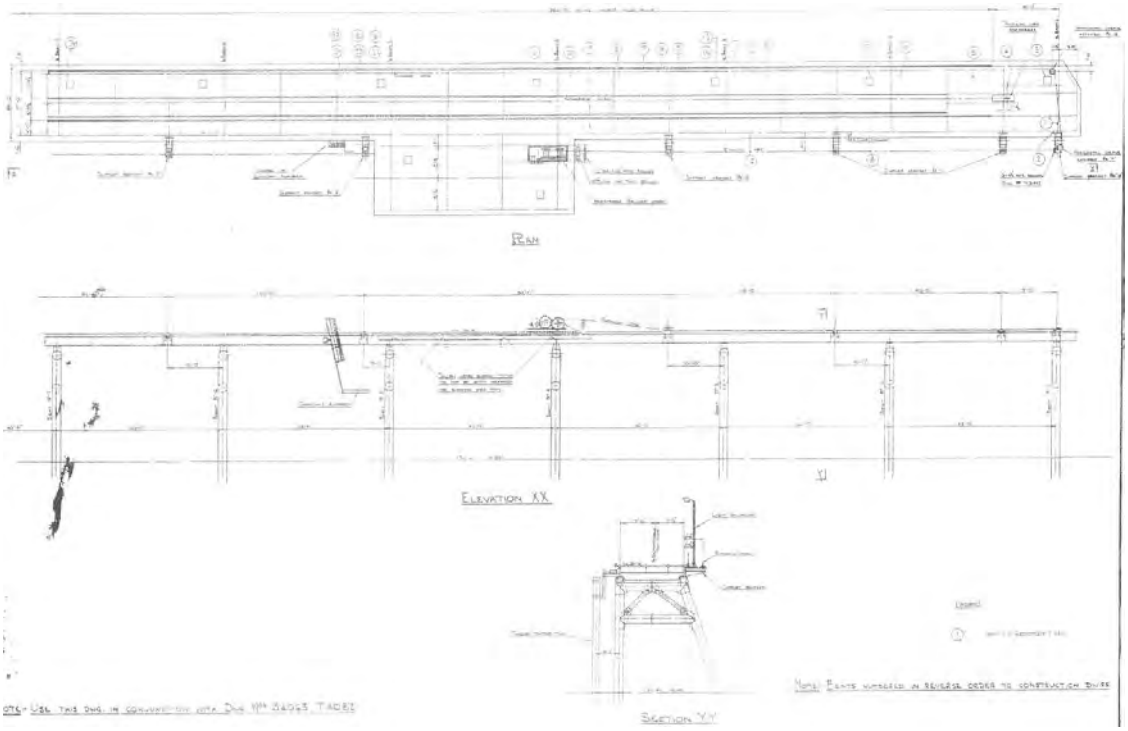


Figure 3 - Bents 1 to 7, extracts from original Thiess Bros Drawings

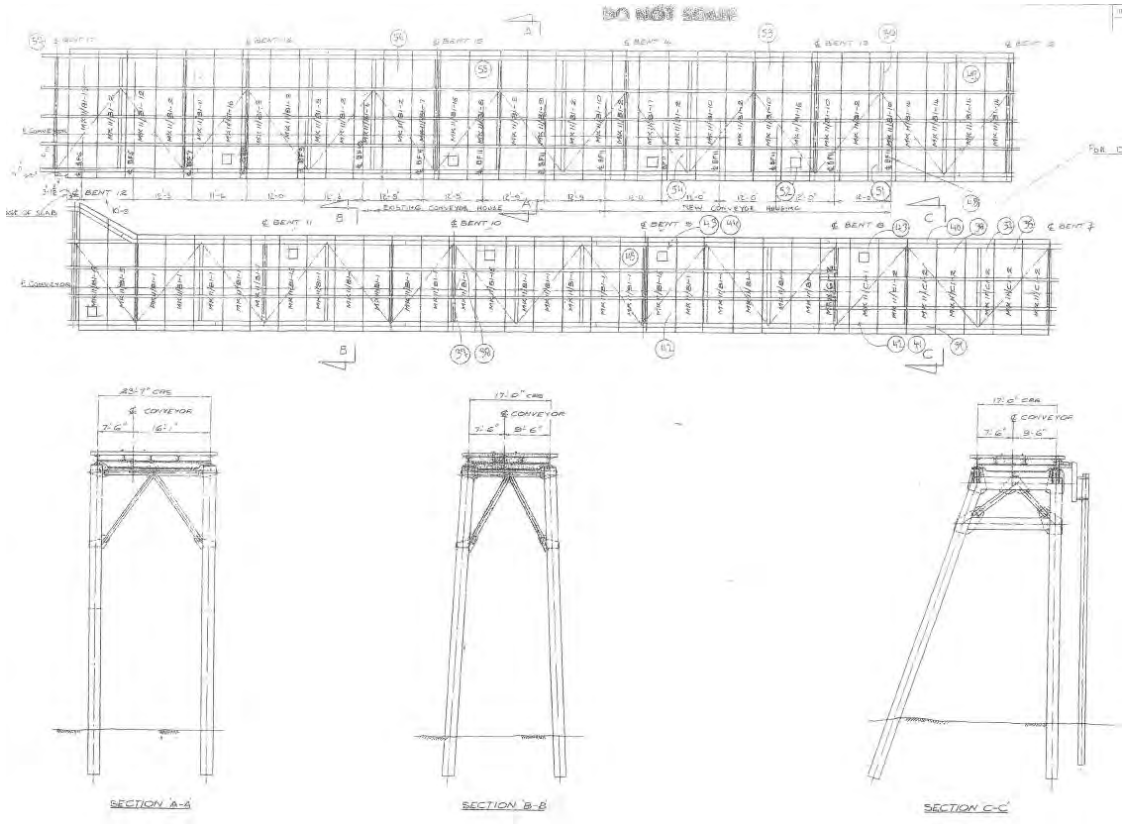


Figure 4 - Bents 7 to 17, extracts from original Thiess Bros Drawings

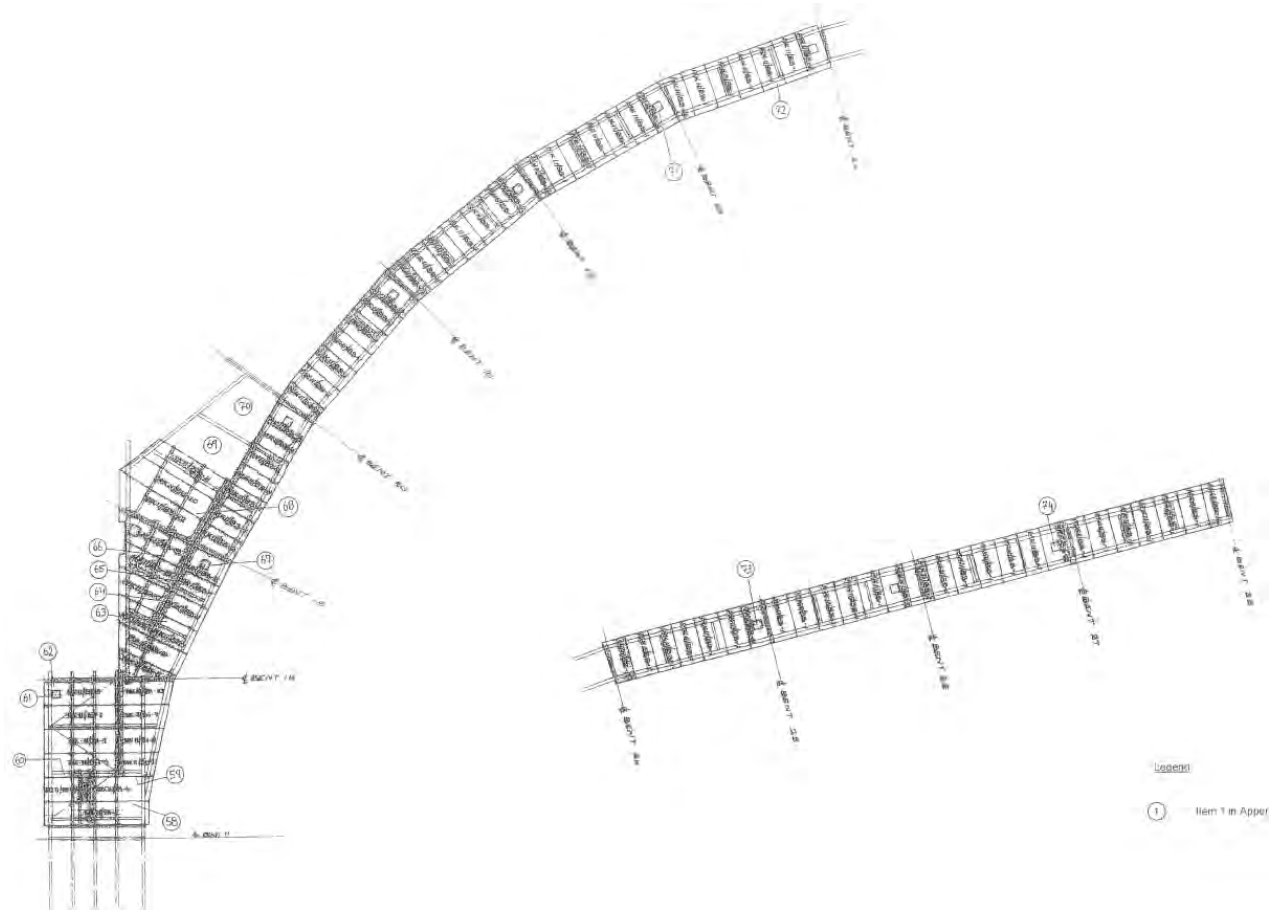


Figure 5 - Bents 17 to 28, extracts from original Thiess Bros Drawings

According to the original drawings, the columns of Bents 1 to 17 were fabricated from 760x20mm and 760x14 circular hollow sections (CHS) embedded 3.5m into bedrock. Previous CSG Engineers reports, however, refer to the sections being 760x14.3mm CHS. Studies from BG&E subcontracted divers, show Bent 1 and Bent 5 to be approximately 18.9mm thick to 19.9mm thick, whereas Bent 11 was recorded as varying between 14.1mm thick to 14.5mm thick. Previous reports also note that the hollow columns are open to seawater internally and require regular addition of a corrosion inhibitor. Where the hollow steel tubes are socketed into rock, they are filled with reinforced concrete internally to a height of 23ft (7m) above the toe of the pile. Due to the lack of maintenance, the corrosion inhibitor may no longer be working effectively and the corrosion rate inside the hollow tubes is likely to increase dramatically. It is also anecdotally noted that freshwater has been introduced to the internal CHS voids but it is unlikely that this has been maintained. BG&E could not confirm the presence of either corrosion inhibitor or freshwater.

Original drawings indicate 273x9.3CHS vertical bracing in a ‘K’ configuration is used to provide lateral stability.

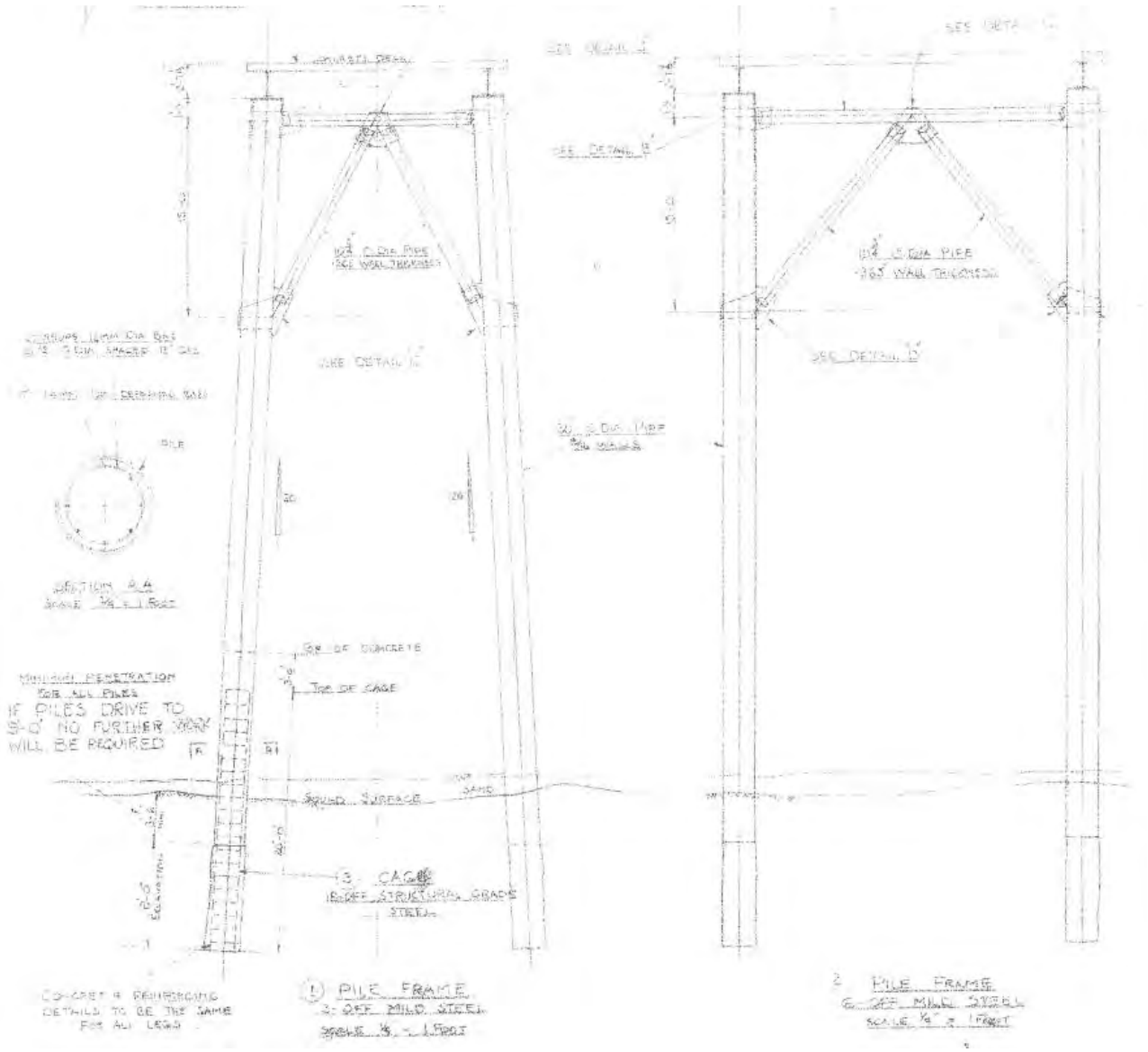


Figure 6 - Extract from original Thiess Bros. drawing, Bents 9 to 17

There is a movement joint at Bent 17, including a steel corbel in the primary beams.

Figure 7 - Bent 17 Movement Joint

Figure 8 - Bent 17 movement joint

Between Bents 20 and 28 the precast deck is narrower measuring at approximately 3,350mm wide. In this area, the bents comprise 310UC118 columns driven into rock, supporting two 610UB125 primary beams and plan bracing.

The columns are externally encased in concrete from the top of the bedrock to above the tidal range. Based on existing drawings it is suggested that all piles are driven a minimum of 2.7m into rock, but this would need to be confirmed with insitu pile testing to ascertain.

The primary beams are simply supported and span approximately 12m. 219CHS vertical bracing connects to the columns with 20mm thick slotted cleat plates.

Figure 9 - Bents 24 to 28, typical inner Bent framing

Figure 10 - Bents 24 to 28, typical inner Bent framing

The jetty top deck is constructed of precast concrete panels, 180mm thick and 1,820mm wide (measured parallel with the jetty longitudinal axis). The length of the precast panels varies depending on the location along the jetty, with the panels typically spanning the full width. The gap between adjacent panels is approximately 5mm. Each precast panel is connected to the supporting steelwork via studs projecting from the primary beams, seated in grout-filled tubes. The details of the studs could not be ascertained in this investigation, apart from the location of the grout tubes. Due to the small number of studs and the 5mm gap between the precast panels it can be assumed that there is no flexural composite action between the precast concrete panels and the supporting steel members.

From Bents 19 to 28 the precast panels span transversely between the primary steel beams. From Bents 1 to 19 the precast panels span transversely between the primary and tertiary longitudinal beams.

The top reinforcing for the precast panels was found during the cover investigation (refer to N23028-REP-M-003 – Materials Engineering) to comprise N20 bars at 180mm centres in primary direction, with 55mm typical top cover, in the panel's primary span direction (transverse to the jetty's longitudinal axis). In the secondary direction, N20 bars were found at 250mm centres with 70mm typical top cover.

There are several access walkways, gantries, ladders, platforms and support structures located on or under the superstructure, particularly adjacent the location of the former coal loader on the seaward end of the jetty. Most of these additional structures are comprised of steel, with some timber elements also present. Please refer to N23028-LTR-0002 – High-Risk Items for further details on miscellaneous items.

3.2 Observations of Deterioration

The TfNSW Bridge Inspection Manual rating systems were used as a datum to rate the condition states of the existing steel and concrete elements and are reproduced below for reference.

For reinforced concrete elements the following condition states apply (where the reference to “bridge” can be replaced by “jetty”):

Condition state descriptions

Condition State	Description
1	The element shows no deterioration. There may be discolouration, efflorescence, and/or superficial cracking.
2	Minor cracks and spalls may be present but there is no exposed reinforcement or surface evidence of corrosion of reinforcement.
3	Some delaminations, significant cracks or spalls may be present or some reinforcement may be exposed. Corrosion of reinforcement may be present but loss of section is minor and is not sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.
4	Advanced deterioration. Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Figure 11 - TfNSW Bridge Inspection Manual - Concrete Condition States

For steel elements the following condition states apply:

Condition state descriptions

Condition State	Description
1	There is no evidence of section loss or damage or cracking.
2	Surface rust or minor pitting has formed or is forming. There is no measurable loss of section. There may be minor deformations that do not affect the integrity of the element. There are no cracks in the steel or welds. All bolts and rivets are in sound condition.
3	Heavy pitting may be present. Some measurable section loss is present locally, but not critical to structural integrity and/or serviceability of the element. There may be some loose or missing bolts or rivets. Defects have been assessed as not sufficient to impact on the ultimate strength and/or serviceability of the element.
4	Section loss is sufficient to warrant analysis to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge. There may be cracks and/or deformations in the steel or welds. There may be numerous failed or missing bolts or rivets. Defects may impact on the ultimate strength and/or serviceability of the element.

Figure 12 – TfNSW Bridge Inspection Manual – Steel Condition States

3.2.1 Observations of Bents 1-17

The comments below relate to the seaward part of the jetty, Bents 1 to 17, with driven steel circular hollow sections and generally wider access. Overall, this area is in better condition than the landward part of the jetty, Bents 18 to 28, which are dealt with separately in this report.

Smaller elements such as knee-braces bolted to the primary beams, steel walkways at jetty level, and suspended steel gantries were generally more deteriorated than the main structural steel framing. Their removal would not affect the structural capacity. Such elements were of a Condition State 4 and would need to be removed and/or replaced.

None of the steel access platforms and walkways at deck level or underneath the deck were in a safe state to walk on.

The fender piles indicated on the northern side of the jetty in the original drawings have already been removed.
The main 760CHS support columns typically have patches of local corrosion blistering, where the coating has failed, of a typical size of around 100mm x 100mm, distributed fairly evenly across the surface of the steel casing. Typically, based on site observations the damage would be classified as Condition State 2 or 3. The following figure is an image captured using a drone and shows the deterioration looking from the water at Bent 1.

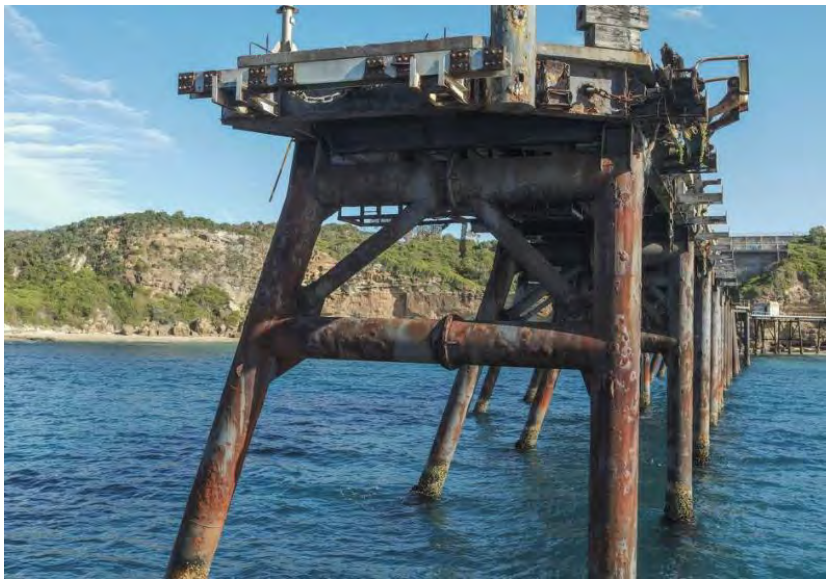


Figure 13 – Bent 1 Drone Captured Image

Corrosion was more severe at the connection point of the horizontal and vertical bracing. The welded plate connection was often heavily corroded and would correlate to condition state 4.

Figure 14 – CHS Tie Brace to CHS Column Connection

Moderate blistering and lamination were observed in primary, secondary, and tertiary beams, and was typically more severe on the lower flange. In this instance, these were generally assigned condition stage 2, rising to condition state 4 in more severe areas. Generally, the loss of section appears to be relatively minor (less than 20%) but this will need to be ascertained in a subsequent investigation and the beams downgraded accordingly. This would require extensive cleaning and removal of corroded material to ascertain. BG&E were only able to spot clean corroded areas.

Figure 15 – Typical Layout of Deck Types DA1 and DA2

It was observed that from below the deck the primary beams and connection were far less corroded on the inside face of the southern side of the jetty compared to the inside face of the northern side. This is likely due to wind

conditions and suggest that beams exposed to southerly winds had experienced greater corrosion. The external face of the southern side was only accessible in two locations and it was determined that corrosion was more severe than on the internal face.

Moderate corrosion was almost always present where the plan bracing connects with the secondary beams, and was frequently present where transverse beams crossed primary beams, i.e., at steel connections and contact points. The plan bracing tended to be more severely affected by corrosion due to its smaller size and thinner plate sections, and most of the plan braces would be considered condition state 3 with many rising to condition state 4.

Figure 16 – Connection Between Plan Bracing, Secondary Beam and Primary Beam, Deck Type DB

The connection between tertiary beams and secondary beams appeared to be significantly corroded in almost all cases. This would generally be classified as condition state 4, dropping down to 3 in some instances. The connections between secondary beams and primary beams were also noted to be heavily corroded. It was noted that one of the

secondary beams had completely rusted through and lost its bottom flange at the connection point. Fatigue caused by high localised concentrations of stress applied cyclically by wind, waves, boat forces and mechanical actions such as the conveyor and ship loader forces can cause fatigue corrosion which can increase the rate of environmental corrosion. Also, the different grades of plate steel compared with the hot-rolled sections may be more prone to corrosion initiating, causing trapped seawater in the pitting lamination that may affect adjacent materials. All similar connections would need to be analysed further to determine if it was a common trend or localised incident.

Figure 17 – Connection Between Secondary Beam and Primary Beam, Deck Type DA1

Figure 18 - Connection Between Secondary Beam and Primary Beam, Deck Type DA1

Figure 19 - Connection Between Plan Bracing, Secondary Beam and Primary Beam, Deck Type DB

Beam splices were also more heavily corroded than the rest of the members. These splices will need to be assessed after cleaning to better analyse the remaining thickness of the metal and the butt weld connection. The level of deterioration looks to be high in the bolts, but it is thought that these bolts were installed for the temporary state and the beams were then full butt weld. It is noted that welds are more prone to fatigue failure than plain metal, and in the presence of higher corrosion should be subject to greater ongoing scrutiny.

Figure 20 – Primary Beam Splice, Deck Type DB

The precast panels also had localised deterioration in the form of soffit spalls and delamination, probably initiated by reinforcing corrosion and expansion. In some sections the concrete had experienced significant deterioration which had led to loss of concrete section and exposed reinforcement. The reinforcement was seen to be corroded and experiencing section loss in these locations. This would fall under condition state 4 and would need to be assessed and panels either rectified or replaced.

The corrosion appears quite random in its extent and severity, with adjacent beams sometimes displaying very different corrosion states which may be due to factors in the original construction such as concrete quality, cover, and workmanship.

3.2.2 Observations of Bents 18-28

Corrosion was generally more severe for steelwork within the tidal and splash zone, which included all the columns between Bents 18 and 27. Apart from the known tendency for corrosion to be most severe in the intertidal zones due to presence of oxygen and chloride ions, this could be caused by abrasion of the steel's coating by suspended sand within the turbulent water leaving the steel unprotected, as well as abrasion of the steel itself. Wind blowing sand and salt would also rise as it reaches the shoreline and cliff result in more significant corrosion. The columns in this area generally exhibit widespread corrosion pitting and flange lamination, causing significant section loss. Most of the columns in this area display signs of section loss would be classified as condition state 4. These columns will need to be cleaned and assessed further to better determine the remaining thickness of the metal. However, based on what we can observe it appears that material loss exists in the web and flanges and elsewhere the base metal thickness would be greatly reduced on a widespread scale. It is unlikely that these columns could be strengthened and reused. BG&E did not witness any significant failure in the universal columns such as cracking, deformation, or splitting.

Figure 21 - 310 UC Column, Typical of Bents 18-28

Figure 22 - 310 UC Column, Typical of Bents 18-28

Plan bracing has been heavily corroded in many places and in some areas, it is no longer present at all. It is not known if the bracing has been removed to avoid safety risks or if it fell off on its own accord. The report produced by BG&E in 2017 recommended certain sections be removed due to safety concerns. All sections would be classed as condition state 4 and many are now in a dangerous condition. This has been highlighted as an immediate safety concern for pedestrian traffic below the jetty. Again, the corrosion was particularly evident at the connection plates. These angles and beams provide stiffness in plan against lateral forces such as wind and wave action, and provide resistance to lateral torsional buckling of the primary beams under vertical loading. The poor condition of these braces therefore significantly weakens the lateral-torsional buckling capacity of the beams, and hence their loadbearing capacity. These plan braces would need to be replaced prior to significant loads being applied to this part of the jetty.

Figure 23 – Plan Bracing Missing Beneath Typical Deck Type DC

The vertical bracing between columns varied from condition state 2 and 4. These members varied greatly in their degree of deterioration, with several sections exhibiting material loss and displaying almost complete section loss. Other sections showed relatively minor section loss. These members again would need to be cleaned and the thicknesses measured to better understand their integrity. The bracings poor condition would significantly decrease the lateral capacity of the frame as a whole and it would need to be rectified or replaced before any significant loads are applied to the structure.

Figure 24 – CHS Vertical Bracing with Heavy Corrosion, Typical of Bents 18-28

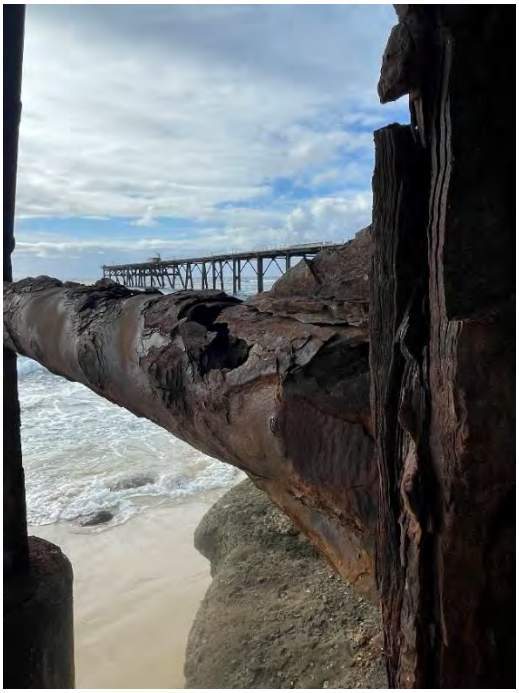


Figure 25 - CHS Horizontal Tie Bracing with Heavy Corrosion, Typical of Bents 18-28

The back-to-back PFC members present near the top of bents 19 to 26 were observed to be heavily corroded and, in some areas, appear to have completely peeled away from the columns. This again is an immediate risk of falling on pedestrians. It appears that these were previously part of a cantilever supporting a side platform. The corrosion states of these channels were condition state 4. As they now appear to be redundant, they should be removed entirely.

Figure 26 – Back-to-Back PFC, Visibly Detached from UC Columns, Typical of Bents 18-28

Members cantilevering near bent 20 are present. These were retained elements that one supported a Bondek slab that is discussed in our 2017 report (N17009-REP-001) but has since been removed. These members show significant corrosion and connections in some places have corroded through completely. These members are all condition state 4 and should be removed for the safety of pedestrians walking under the jetty.

Figure 27 – Cantilever Beams to be Removed

Support columns for Bents 18-28 appear to have been installed in unreinforced mass concrete piers embedded to rock, as is evident by hand excavation to the side of the concrete encasement beside Bent 26. Concrete encasement of the support columns appears to be constructed through a 750mm diameter concrete pipe and in-filled after installation with reinforced concrete. This concrete 'pot' installation is the likely reason for the sleeve appearance of the concrete encasement, where the external concrete layers have cracked and broken away from the concrete infill. The uppermost sections of the concrete infill also appear to be progressively spalling away from the exposed steel columns. The loss of concrete section suggests these encasements are condition state 4. It is believed that these concrete encasements are to protect the steel from corrosion and to achieve a sufficiently large bearing sleeve/base in the founding material. Therefore, the loss of concrete to-date does not appear to be critical but should at least be made-good to fulfill its original purpose of protecting the steel column. Given that we advise the demolition of the steel columns, new piers to rock would likely need to be constructed. Alternatively, the existing piers/columns could be demolished down to a level where steel corrosion is acceptable and new columns spliced to it. This would need further breakouts to investigate.

Figure 28 – Concrete Encasement for Corrosion Protection around UC Columns, Typical of Bents 18-28

The connection points of steel again displayed greater corrosion, probably due to retention of salt water on horizontal surfaces. Almost all connection were severely corroded and showing significant section loss. All would need to be cleaned and the thickness and section loss measured to ascertain a more accurate understanding of how well they may be working.

4. Structural Investigation Methodology

4.1 Assumptions and Loads

Various Australia Standards were used to determine appropriate loads for the structural assessment, including but not limited to; AS1170.1, AS1170.2, AS1170.4, AS3600, AS4100, AS4997, and AS5100. A nominal superimposed dead load of 0.5kPa and live load of 5kPa was used throughout the analysis process.

4.2 Original Structure under As Built Conditions

To be able to successfully model the structure and assess its current capacity it was important to first understand how the structure was originally built. BG&E had limited access to existing structural drawings and the drawings that we were able to get were of very poor quality and were often illegible. Section sizes were measured from scaffolding platforms installed beneath the deck. These measurements combined with a photogrammetry model were used to establish the geometry. Assumptions had to be made for several of the connections between steel members using a combination of visual assessments, existing structural drawings, site measurements, and engineering assumptions. It was very difficult to understand exactly how the connections were working without having original drawings with legible information, so a conservative approach had to be adopted and where information was unavailable the most adverse likely case was adopted. Steel members were generally modelled as simply supported beams based on observations of the connection detailing. Bracing was not modelled as its assumed that the precast planks can provide lateral stability acting as an in-plane diaphragm, although the condition of the cast-in studs will need later investigation to verify this assumption (noting that in the case that the studs are adequate, post fix studs can be installed from the soffit with relative ease). It is also believed that with the sizing of the bracing members it is likely that they were installed for lateral support in the temporary state during construction and are now redundant.

BG&E developed structural models and conducted analysis on the structure as it would have been built in the mid-1970's. SpaceGass was used to model the steel members and RAPT was used to analyse the precast concrete panels. Hand calculations were also performed to verify the results from the programs. The SpaceGass model produced by BG&E is shown below.

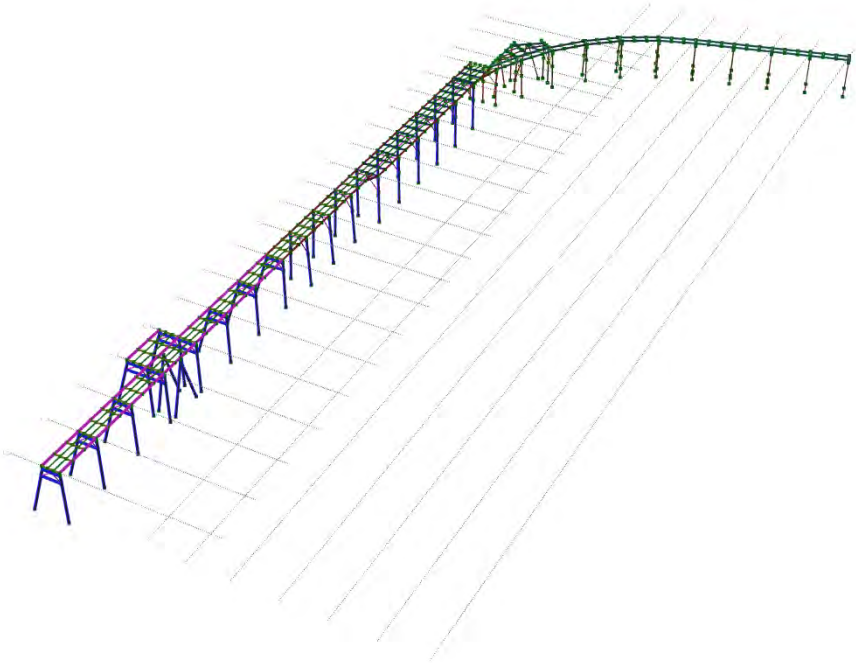


Figure 29 – SpaceGass Model of Catherine Hill Bay Jetty Produced by BG&E

SpaceGass was also used to isolate and analyse members to look at how they are performing individually. There was observed to be 4 main deck types:

- Bent 1 to Bent 8 – This section was labelled deck type DA1. It was noted that between Bents 4 and 5 there is an extension to the deck however the main structure of the deck is still continuous in this section. This section consisted of two primary beams on the edges, two secondary beams spanning between the primary beams and then two tertiary beams spanning between the secondary beams with precast panels on top. It was observed that the primary beams in this section had an additional plate welded on to the top and bottom flange to provide additional capacity. The thickness of the additional plates was not able to be measured due to being unable to access.
- Bent 9 to Bent 12 - This section was labelled deck type DA2. The primary beams in this section decreased in size compared to DA1 but the layout was the same. The decreased size is likely due to being designed for decreased loads as it was beyond the section of the jetty that was used to load the ships.
- Bent 12 to Bent 17 - In this section the deck widened, and an additional tertiary beam was used. The member sizes all remained the same as those found from bent 8 onwards in deck type DA2. This section had additional steel plates welded to the bottom and top flanges of the secondary beam. This would be to provide additional capacity required to account for the larger span.
- Bent 18 to Bent 26 – This section did not have any tertiary beams. The concrete spanned between primary members as the span was much narrower. There were still secondary beams at bents and plan bracing was present originally but now are essentially obsolete or missing completely.

4.3 Accounting for Deterioration of Structure

Once the initial model was generated, decreased member capacity, flange thicknesses, concrete strength and various other reductions were applied to the model to provide a more accurate depiction of how the structure would perform in its current state. Material testing and analysis was used to try to enumerate values for the capacity of elements in the current state. A conservative estimate was used to account for the corrosion as noted on sections below. The level of corrosion varied locally, and some sections of beams were far worse than others. Before any significant loads are applied to the structure it should first be cleaned and member conditions inspected again as there is a high degree of variability.

5. Results of Investigation

5.1 Loading

SW: weight of steel beam and concrete planks
SDL: 0.5kPa allowance for extra steel and weight over the structure
LL: 5kPa

The structure was analyzed both as a continuous steel frame deck to account for continuity of the members and stiffness of the elements in load distribution and as simplified models. The results in both cases were similar and the detailed analysis and capacity calculations with section losses was undertaken for the simplified models using conservative assumptions on the member continuity and connections.

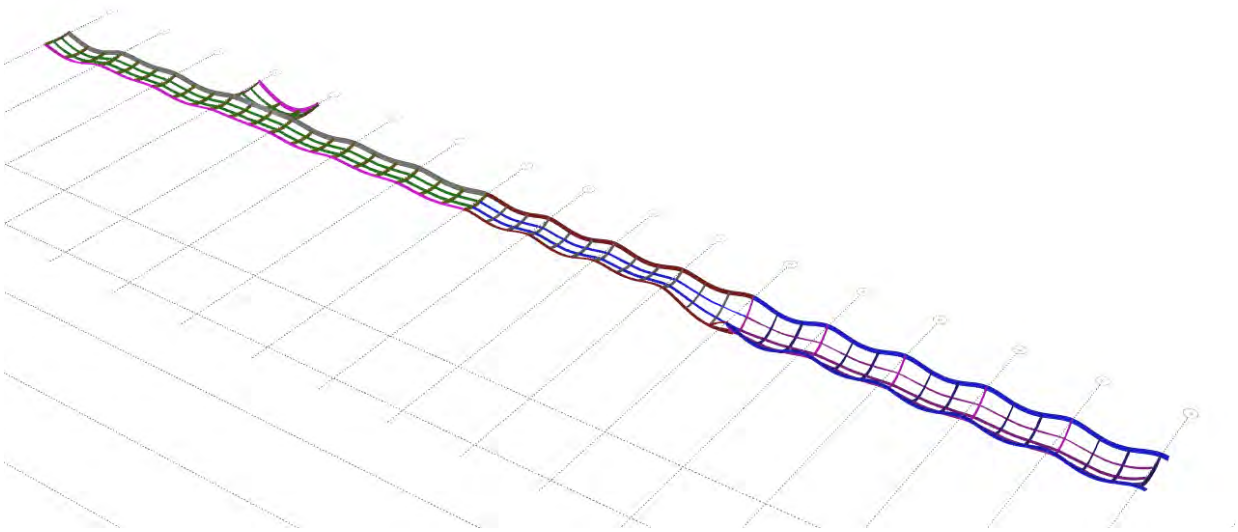


Figure 30 – Deflection Diagram Produced using SpaceGass for Continuous Deck , Bent 1-17

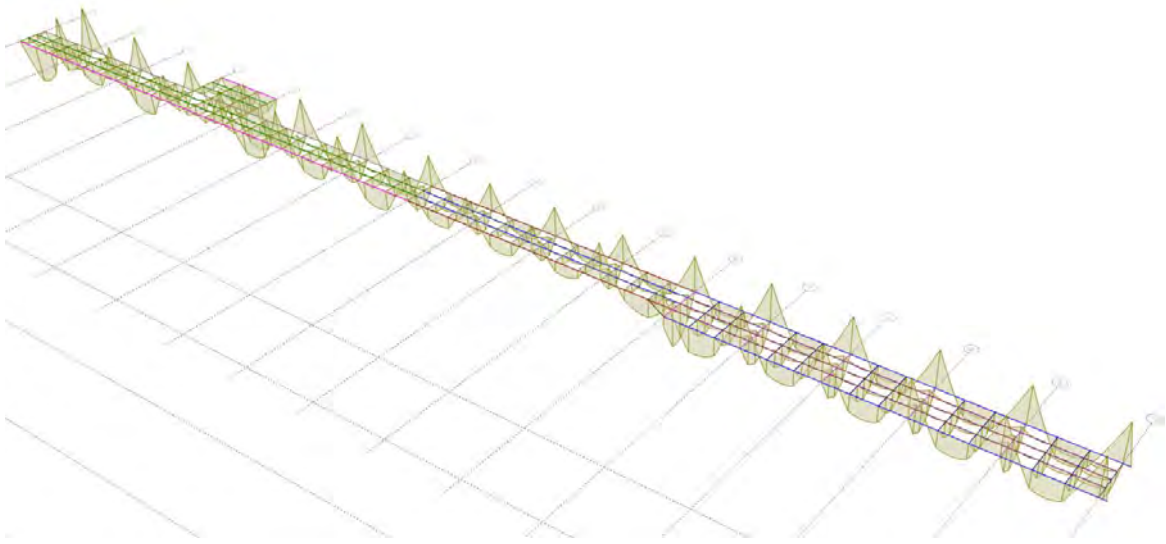
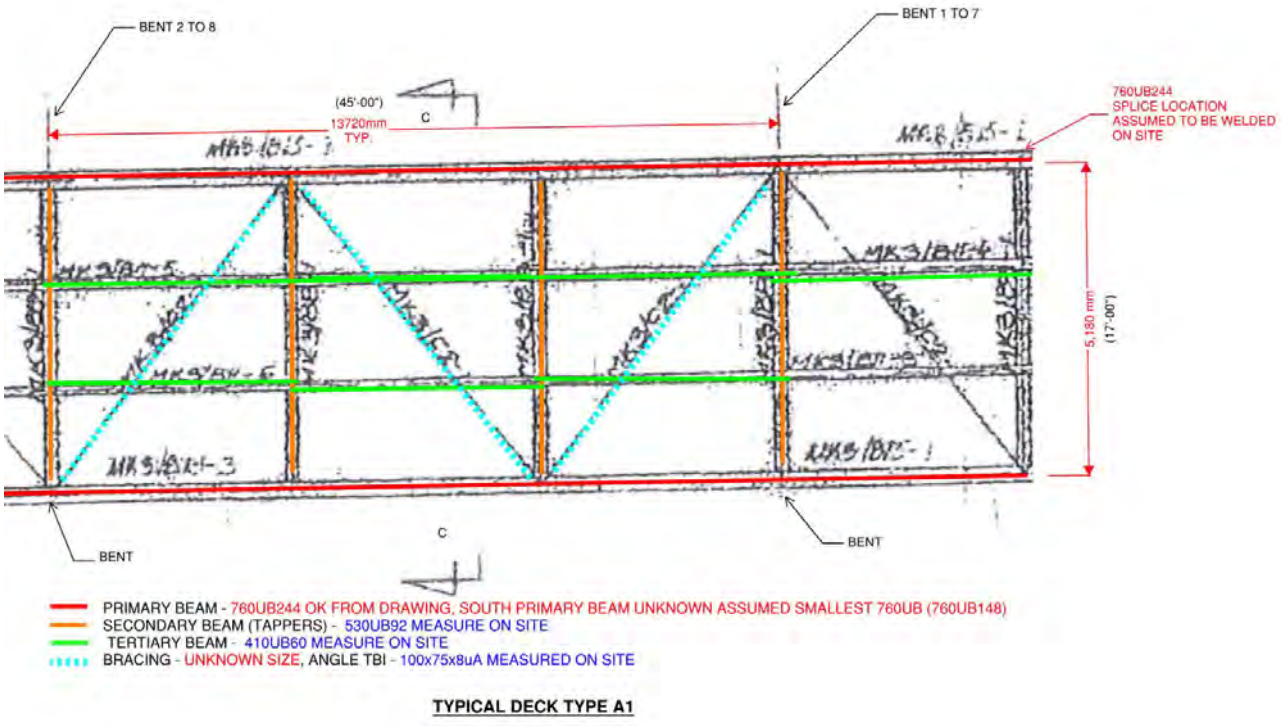


Figure 30 – Bending Moment Diagram Produced using SpaceGass for Continuous Deck , Bent 1-17

5.2 Deck Type DA1

5.2.1 Structural arrangement plan



TYPICAL DECK TYPE A1

5.2.2 Primary beam analysis

Existing structural drawings show a 760UB244 Grade 250 for the North primary beam of the jetty and an illegible beam on the South primary beam. Following site inspections, the 760UB244 was confirmed but there was no access to the South primary beam. A 760UB197 was assumed. The splice connection details appear to be butt welded on site (flanges and web). It is assumed that the top flange its laterally restraint by the concrete planks.

The beam has been analyzed as an end span which is the most conservative assumption.

5.2.2.1 Ultimate Bending Moment Diagram

5.2.2.2 Shear Force Diagram

5.2.2.3 Capacity of existing beam and connections

Both members have sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom and top flanges. Both sections have capacity considering a 20% loss of the flanges.

There are large section losses to the beam bottom flange at the connection to the bents. The bottom flange of the beam needs to be replaced or rectified at the support and the following strengthening plates are required on each connection.

This is typical on all primary member to bent connections.

- Flanges: 2 x 150w x 1500Lx 32thk Plates
- Connection: 2 x 500w x 500h x 20thk Side Plates
  1 x 600w x 600l x 32thk End Plate

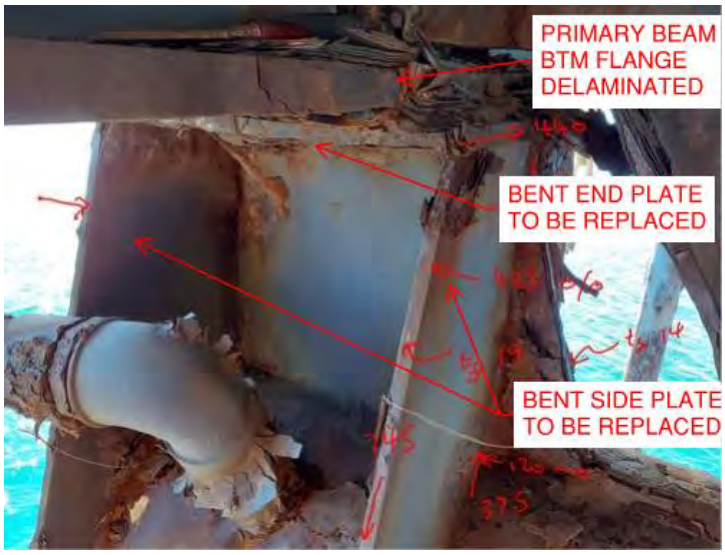
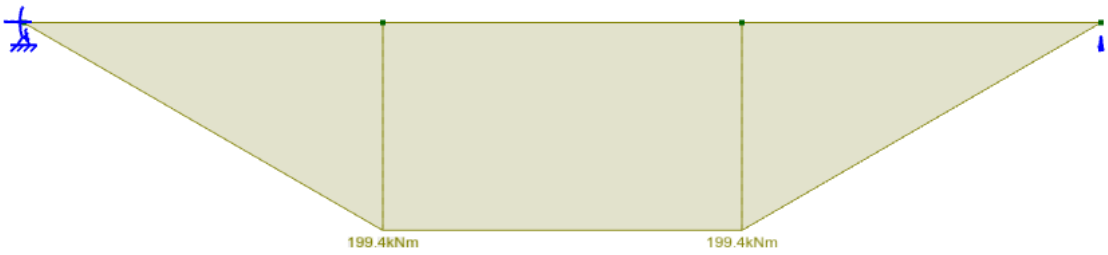


Figure 31 – Primary Beam to Bent Connection, Deck Type DA1

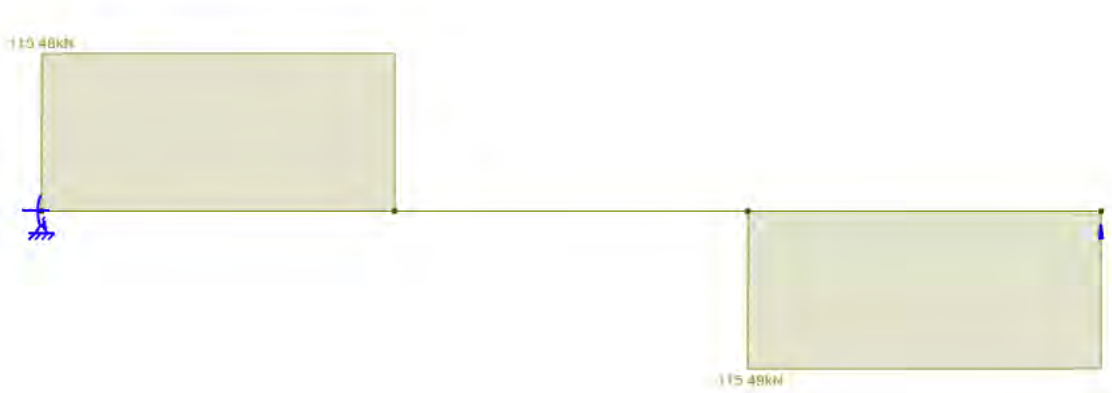
5.2.3 Secondary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the members appear to be a 530UB92 Grade 250 in overall ok condition.

5.2.3.1 Ultimate Bending Moment Diagram



5.2.3.2 Shear Force Diagram



5.2.3.3 Capacity of existing beam

The member has sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom flange. Considering a 20% loss of the flange, the section still has sufficient capacity.

There are large section losses at the connection to the primary beams and in several cases the sections has lost completely its bottom flange. The following strengthening plates and bolts are required on each connection:

- Flanges: 2 x 100w x 1000Lx 15thk Plates
- End connection: 1 x 300w x 600h x 20thk Plate
- Bolts: 10M20 Bolts

This is typical on all secondary to primary member connections.

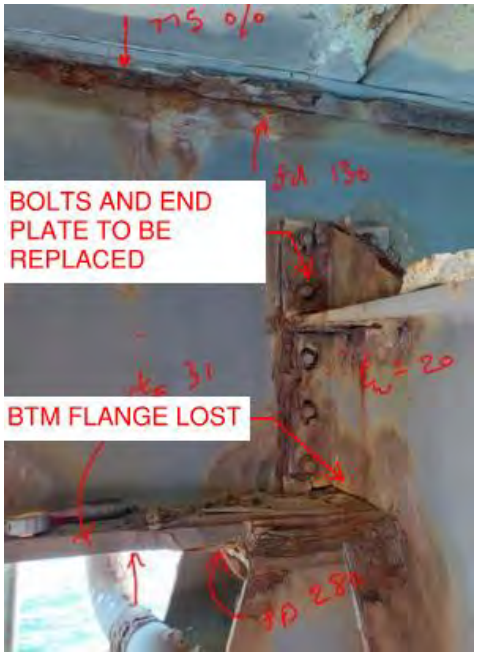
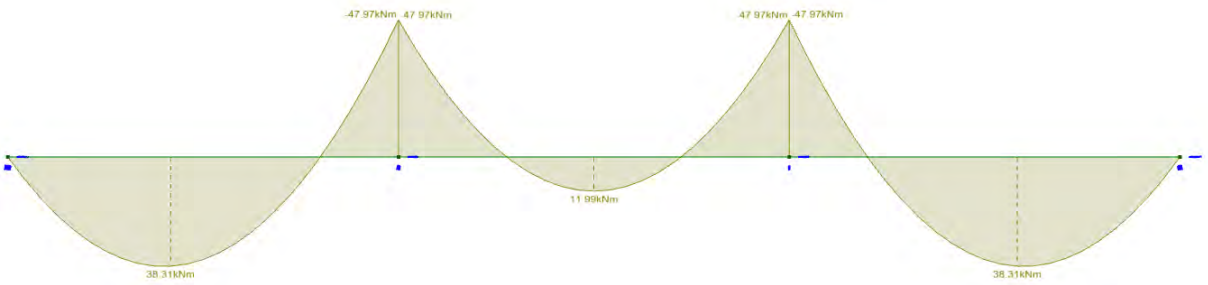


Figure 32 – Secondary Beam to Primary Beam Connection, Deck Type DA1

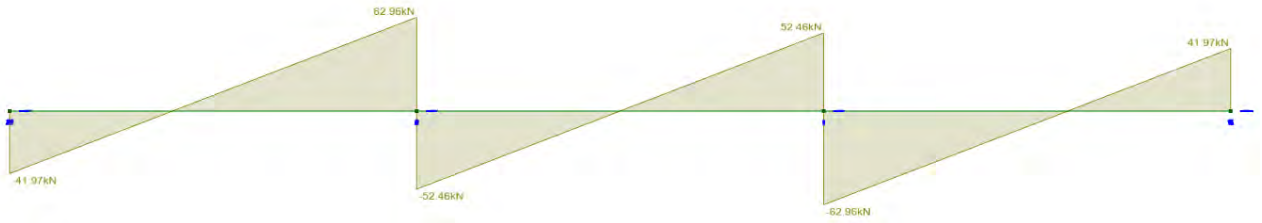
5.2.4 Tertiary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the member appears to be a 410UB60 Grade 250 in overall bad condition. The splice connection details appear to be all butt welded on site (flanges and web). It's assumed that the top flange its laterally restraint by the concrete planks.

5.2.4.1 Ultimate Bending Moment Diagram



5.2.4.2 Shear Force Diagram



5.2.4.3 Capacity of existing beam

The member has sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the top and bottom flanges. Considering a 30% loss of the flange or a minimum section thickness of 8mm, the section still has sufficient capacity.

Connection to the secondary beams show corrosion and section loss to the stiffeners. The following strengthening plates and bolts are required on each connection:

- Stiffener: 2 x 150w x 400h x 15thk Plates
- Bolts: 4M20 Bolts

This appear to be typical across all tertiaries to secondary member connections.

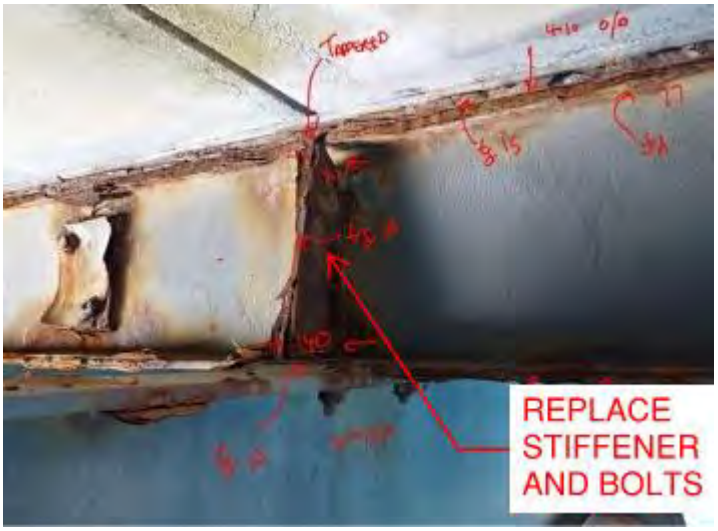


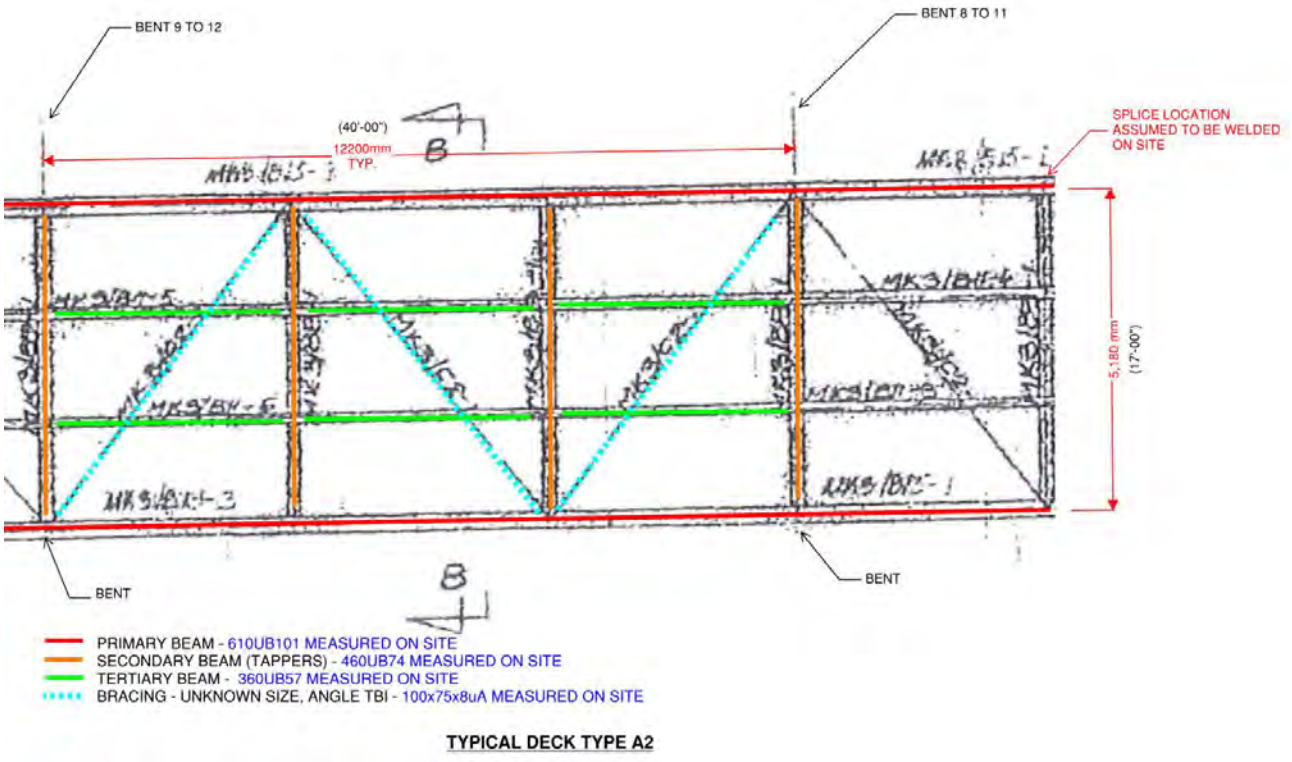
Figure 33 – Tertiary Beam to Secondary Beam Connection, Typical of Deck Type DA1

5.2.5 Bracing

It is assumed that all bracing members are to be removed. The structure diaphragm appears to have sufficient lateral capacity in the stud connections of the primary and tertiary to the concrete planks, to be confirmed through additional breakouts as discussed previously.

5.3 Deck Type DA2

5.3.1 Structural arrangement plan



TYPICAL DECK TYPE A2

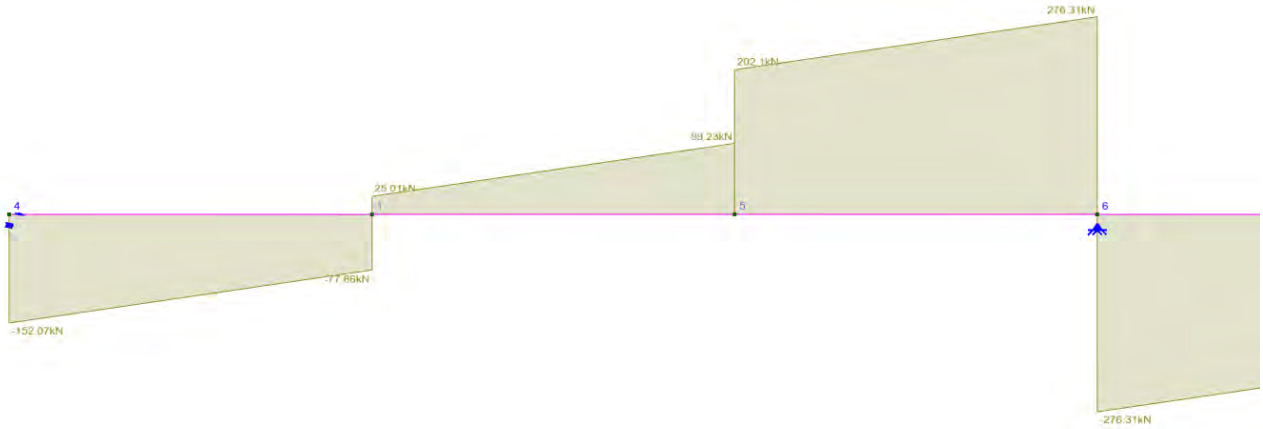
5.3.2 Primary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the member appears to be a 610UB113 Grade 250 in overall bad condition. The splice connection details appear to be butt welded on site (flanges and web). It's assumed that the top flange its laterally restraint by the concrete planks.

The beam has been analysed as an end span which is the most conservative assumption.

5.3.2.1 Ultimate Bending Moment Diagram

5.3.2.2 Shear Force Diagram



5.3.2.3 Capacity of existing beam and connections

The members have sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom and top flanges. The 610UB113 do not have sufficient capacity for any section loss, however it is noted on site that strengthening bottom plates have been installed and these could assist to provide additional strength for section loss.

There are large section losses to the beam bottom flange at the connection to the bents. The bottom flange of the beam needs to be replaced and the following strengthening plates are required on each connection.

This is typical on all primary member to bent connections.

- Flanges: 2 x 100w x 1500Lx 20thk Plates
- Connection: 1 x 600w x 600l x 32thk End Plate

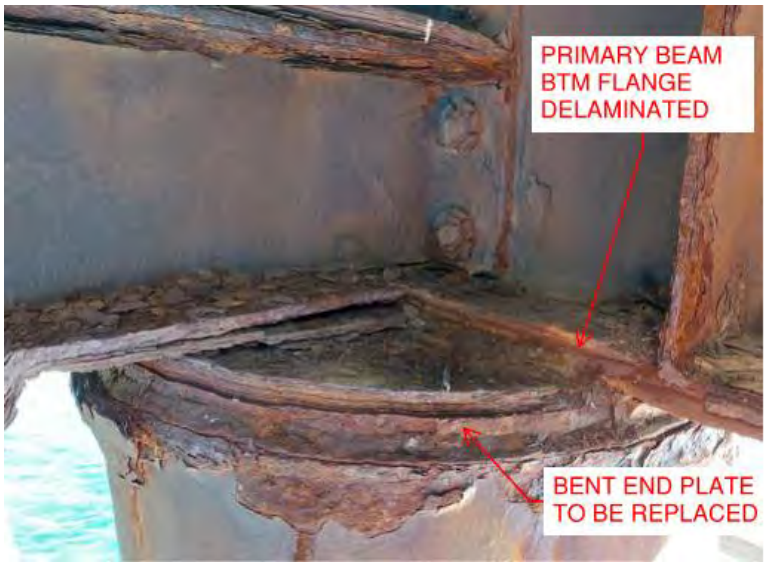
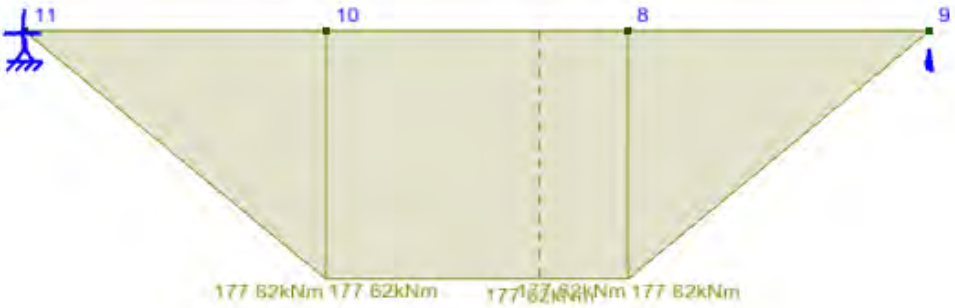


Figure 34 - Primary Beam to Bent Connection, Deck Type DA2

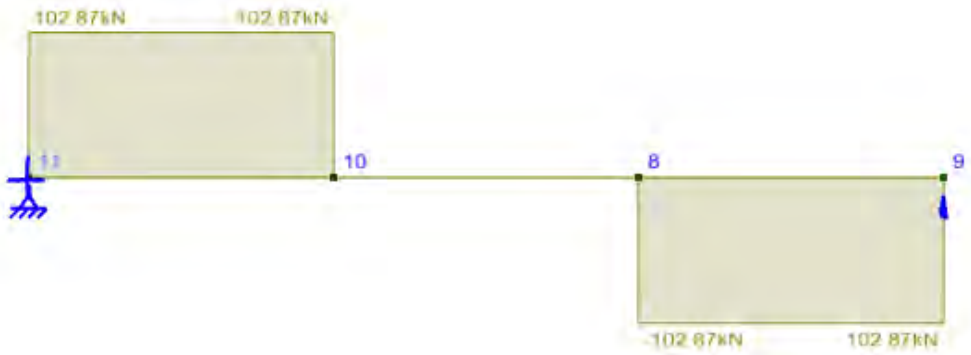
5.3.3 Secondary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the members appear to be a 460UB74 Grade 250 in overall ok condition.

5.3.3.1 Ultimate Bending Moment Diagram



5.3.3.2 Shear Force Diagram



5.3.3.3 Capacity of existing beam

The member has sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom flange. Considering a 20% loss of the flange, the section still has sufficient capacity.

There is large section losses at the connection to the primary beams and in several cases the sections has lost completely its bottom flange. The following strengthening plates and bolts are required on each connection:

- Flanges: 2 x 100w x 1000Lx 15thk Plates
- End connection: 1 x 300w x 500h x 20thk Plate
- Bolts: 8M20 Bolts

This is typical on all secondary to primary member connections.

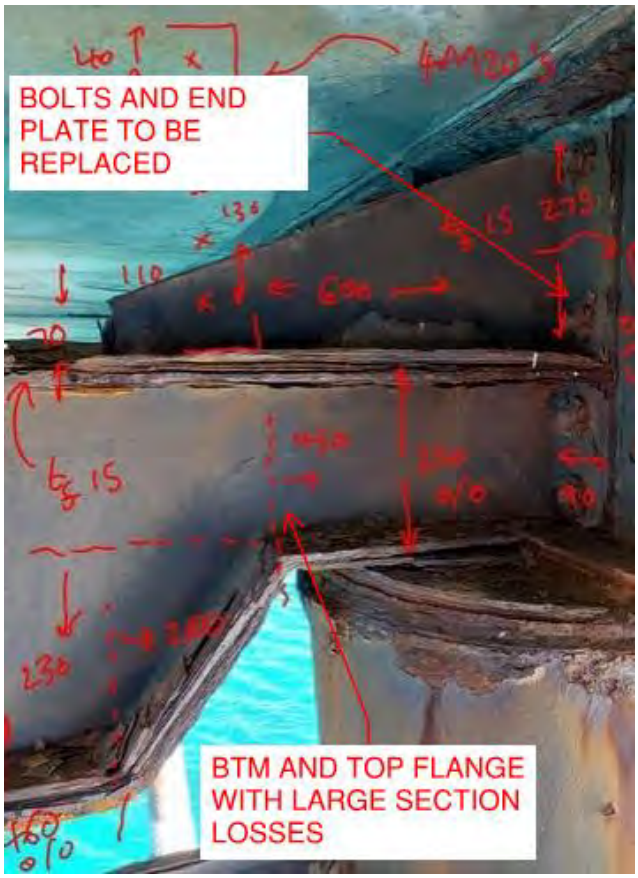
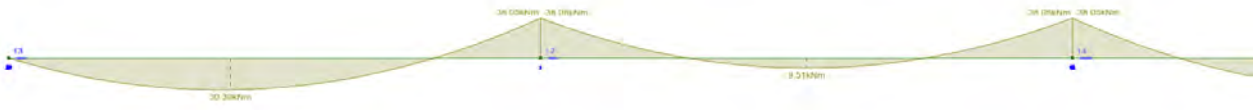


Figure 35 - Secondary Beam to Primary Beam Connection, Deck Type DA2

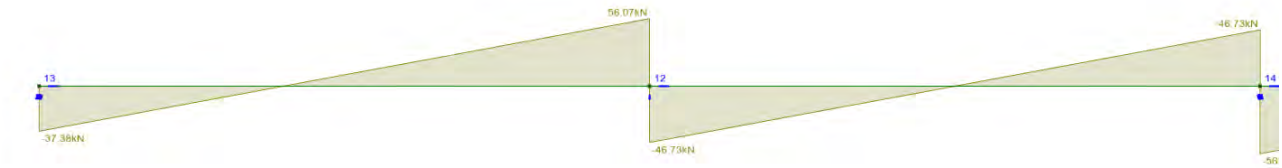
5.3.4 Tertiary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the member appears to be a 360UB57 Grade 250 in overall bad condition. The splice connection details appear to be all butt welded on site (flanges and web). It is assumed that the top flange its laterally restraint by the concrete planks.

5.3.4.1 Ultimate Bending Moment Diagram



5.3.4.2 Shear Force Diagram



5.3.4.3 Capacity of existing beam

The member has sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the top and bottom flanges. Considering a 30% loss of the flange or a minimum section thickness of 8mm, the section still has sufficient capacity.

Connection to the secondary beams show corrosion and section loss to the stiffeners. The following strengthening plates and bolts are required on each connection:

- Stiffener: 2 x 100w x 350h x 12thk Plates
- Bolts: 4M20 Bolts

This appear to be typical across all tertiaries to secondary member connections.

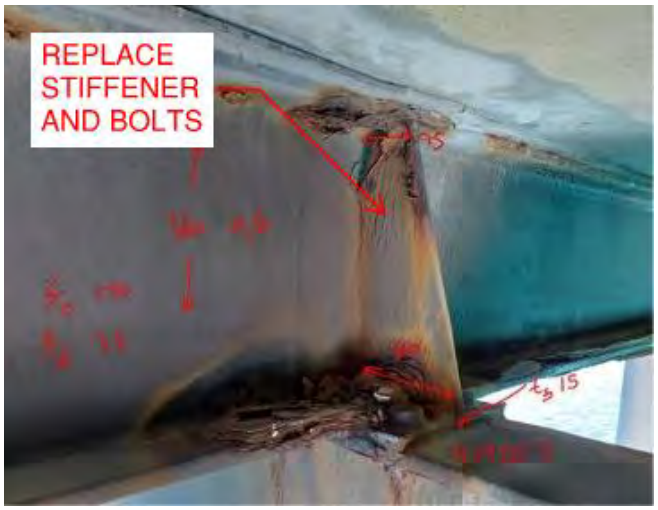


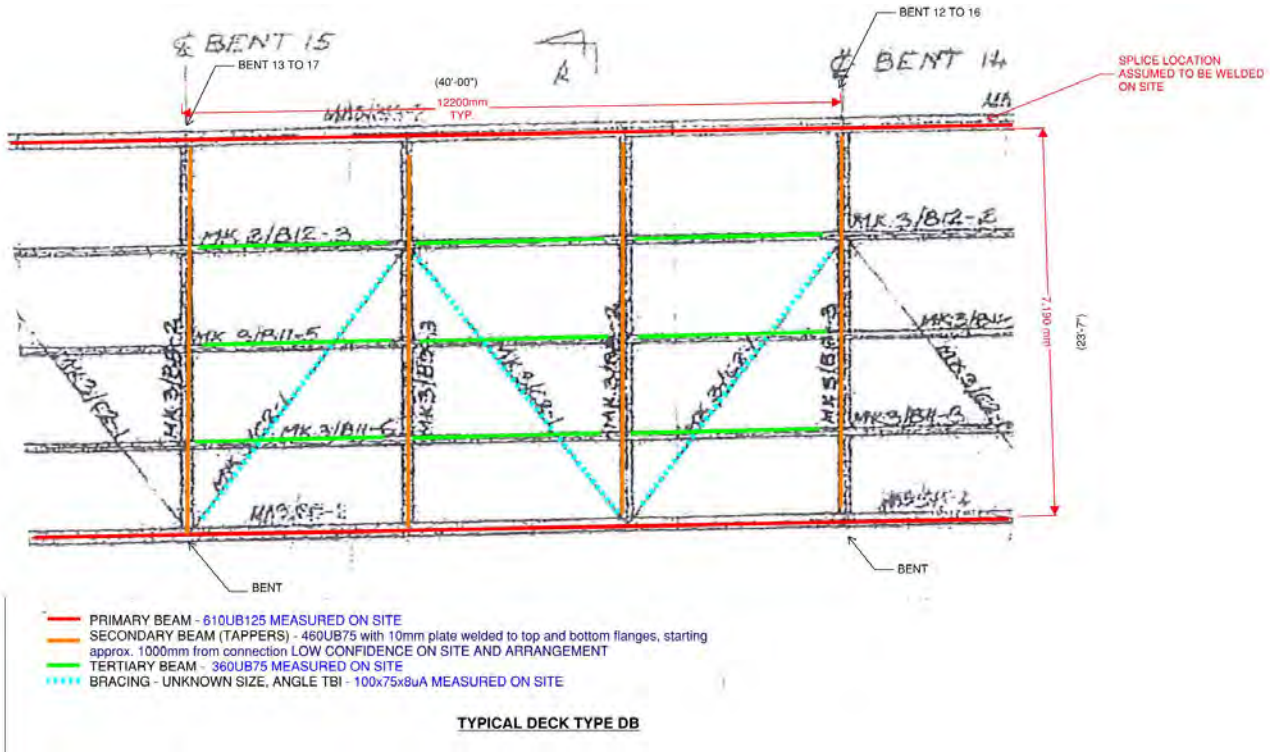
Figure 36 - Tertiary Beam to Secondary Beam Connection, Typical of Deck Type DA2

5.3.5 Bracing

It is assumed that all bracing members are to be removed. The structure diaphragm has sufficient lateral capacity in the stud connections of the primary and tertiary to the concrete planks.

5.4 Deck Type DB

5.4.1 Structural arrangement plan

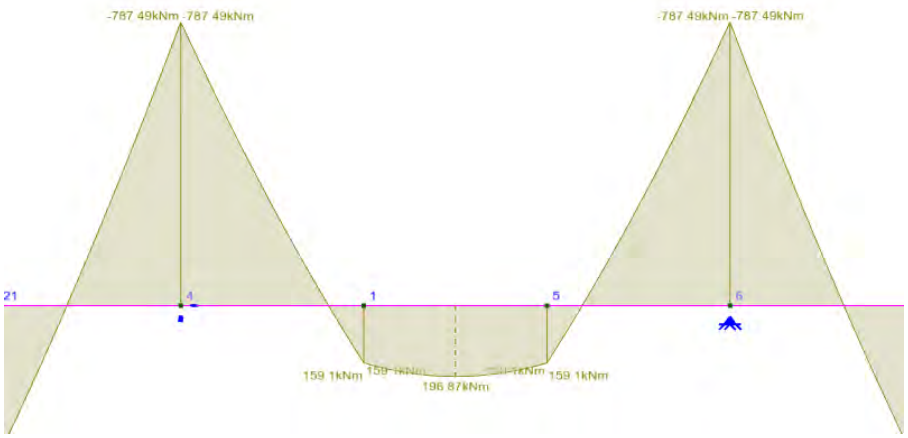


5.4.2 Primary beam analysis

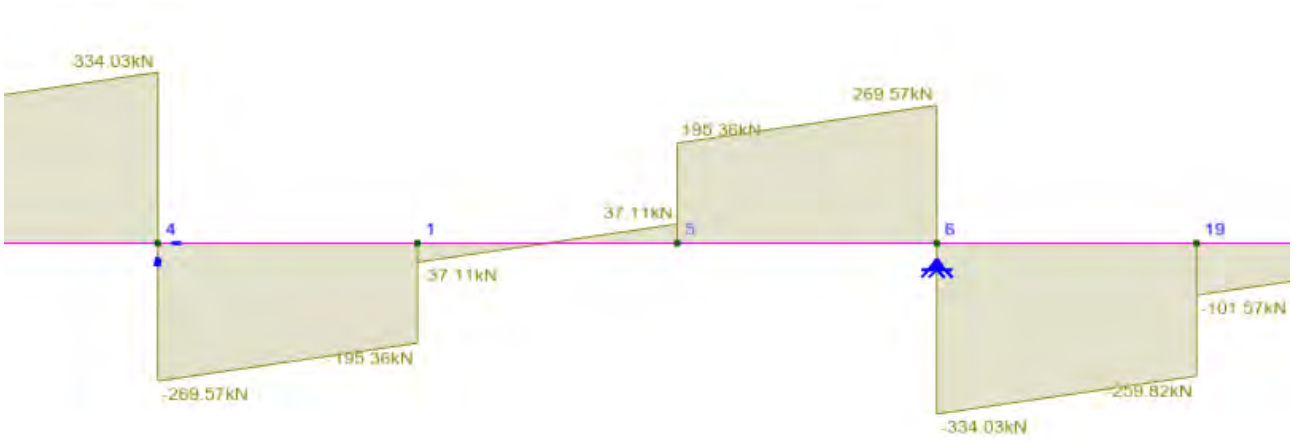
There was no information on the existing structural drawings about the member size. Following site inspections, the member appears to be a 610UB125 Grade 250 in overall bad condition. The splice connection details appear to be butt welded on site (flanges and web). It's assumed that the top flange its laterally restraint by the concrete planks.

The beam has been analyzed as continuous.

5.4.2.1 Ultimate Bending Moment Diagram



5.4.2.2 Shear Force Diagram



5.4.2.3 Capacity of existing beam and connections

The members have sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom and top flanges. The 610UB125 do not have sufficient capacity for any section loss, however it is noted on site that strengthening bottom plates have been installed and these could assist to provide additional strength in any section loss. Additional top and bottom plates can be welded to strengthening these members flanges, i.e., 1 x 200w x 3000L x 25hk bottom and 2 x 100w x 3000L x 25thk Top.

There are large section losses to the beam bottom flange at the connection to the bents. The bottom flange of the beam needs to be replaced and the following strengthening plates are required on each connection.

This is typical on all primary member to bent connections.

- Flanges: 2 x 100w x 1500Lx 25thk Plates
- Connection: 1 x 600w x 600l x 40hk End Plate

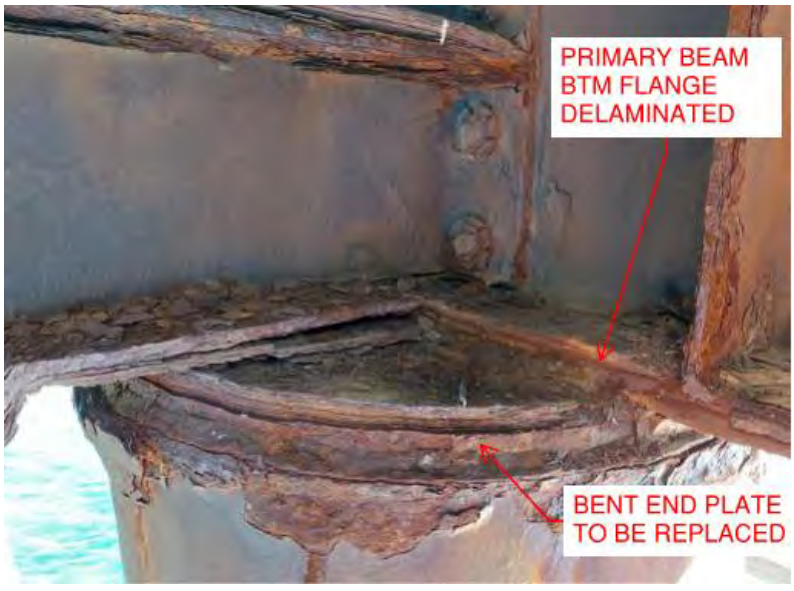


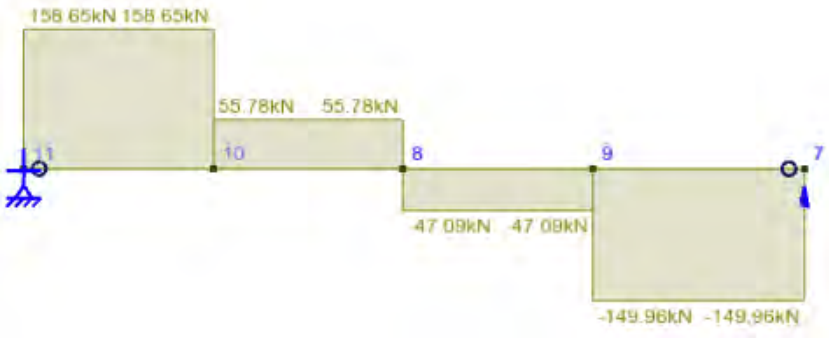
Figure 37 - Primary Beam to Bent Connection, Deck Type DB

5.4.3 Secondary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the members appear to be a 460UB74 Grade 250 in overall ok condition. It is noted that a bottom plate is welded to the bottom flange.

5.4.3.1 Ultimate Bending Moment Diagram

5.4.3.2 Shear Force Diagram



5.4.3.3 Capacity of existing beam

The member has sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom flange. Considering a 20% loss of the flange, the section does not have sufficient capacity. Additional top and bottom plates can be welded to strengthening these members flanges, i.e. 1 x 150w x 1500L x 15hk bottom and 2 x 100w x 1500L x 20thk Top.

There is large section losses at the connection to the primary beams and in several cases the sections has lost completely its bottom flange. The following strengthening plates and bolts are required on each connection:

- Flanges: 2 x 100w x 1000Lx 15thk Plates
- End connection: 1 x 300w x 500h x 20thk Plate
- Bolts: 8M20 Bolts

This is typical on all secondary to primary member connections.

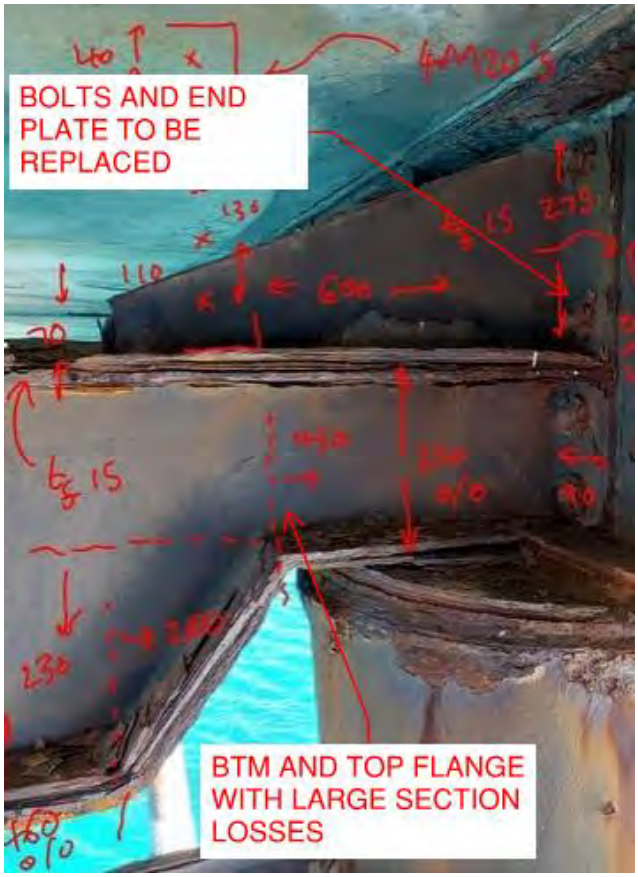


Figure 38 - Secondary Beam to Primary Beam Connection, Deck Type DB

5.4.4 Tertiary beam analysis

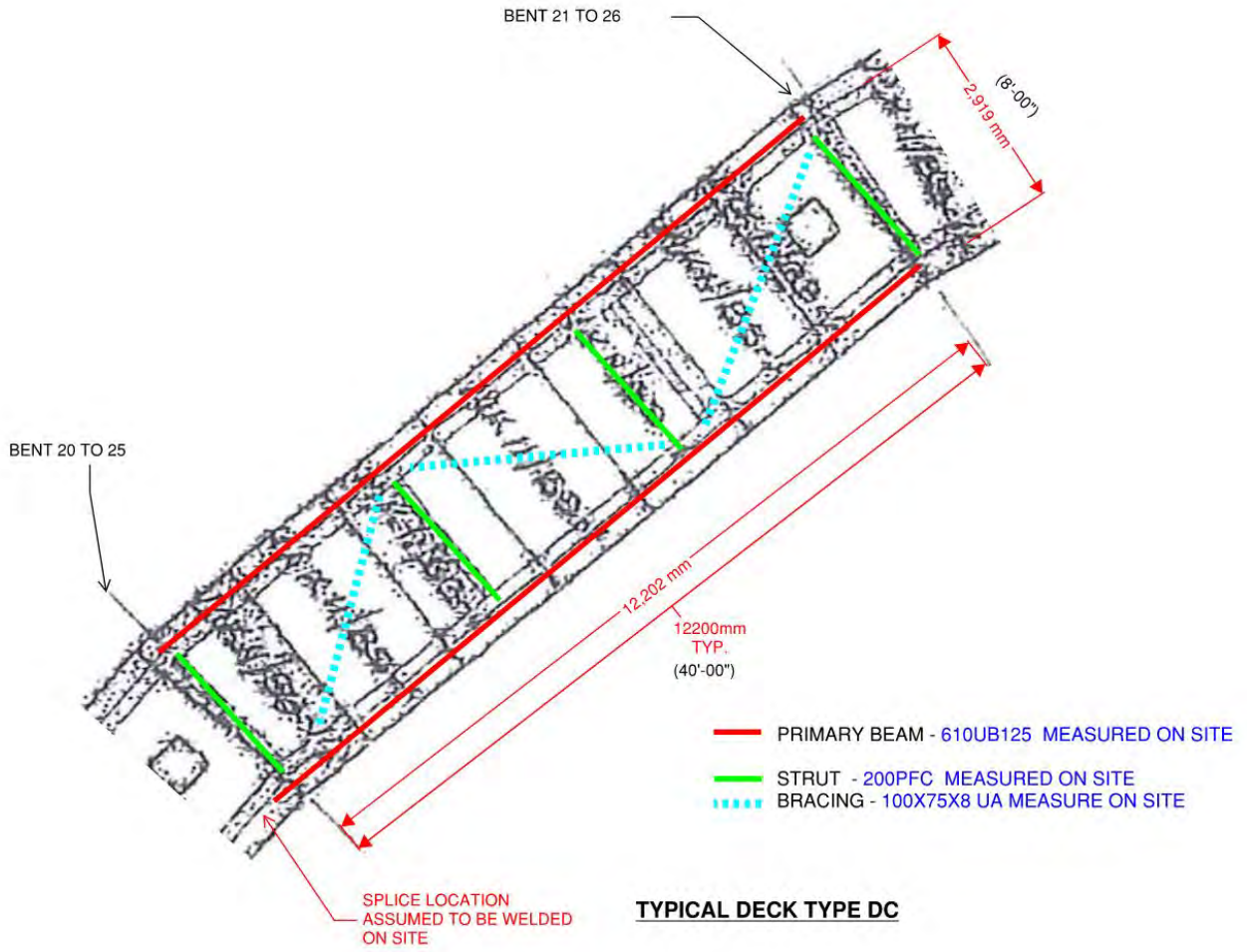
Refer to Deck Type DA2 Tertiary beam analysis.

5.4.5 Bracing

It is assumed that all bracing members are to be removed. The structure diaphragm has sufficient lateral capacity in the stud connections of the primary and tertiary to the concrete planks.

5.5 Deck Type DC

5.5.1 Structural arrangement plan



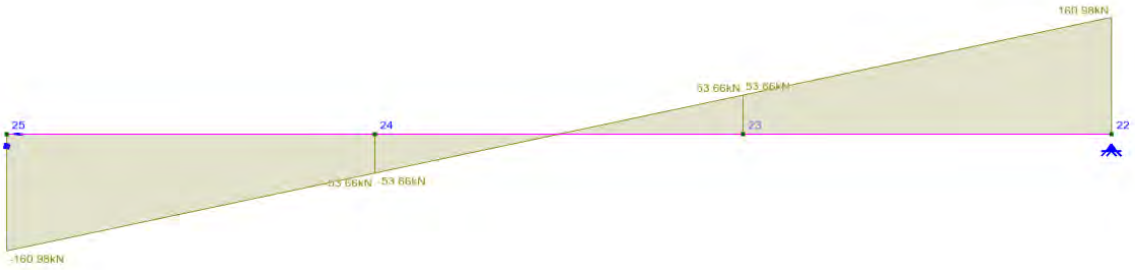
5.5.2 Primary beam analysis

There was no information on the existing structural drawings about the member size. Following site inspections, the member appears to be a 610UB125 Grade 250 in overall bad condition. The splice connection details appear to be butt welded on site (flanges and web). It's assumed that the top flange its laterally restraint by the concrete planks.

The beam has been analyzed as a simply supported span which is the most conservative assumption.

5.5.2.1 Ultimate Bending Moment Diagram

5.5.2.2 Shear Force Diagram



5.5.2.3 Capacity of existing beam and connections

The members have sufficient capacity considering its initial state (no section loss).

Site inspection show some corrosion at the bottom and top flanges. Considering a 20% loss of the flanges, the section does have sufficient capacity.

There are large section losses to the beam bottom flange at the connection to the bents. The bottom flange of the beam needs to be replaced and the following strengthening plates are required on each connection.

This is typical on all primary member to bent connections.

- Flanges: 2 x 100w x 1500Lx 20thk Plates
- Connection: 1 x 400w x 400l x 25hk End Plate

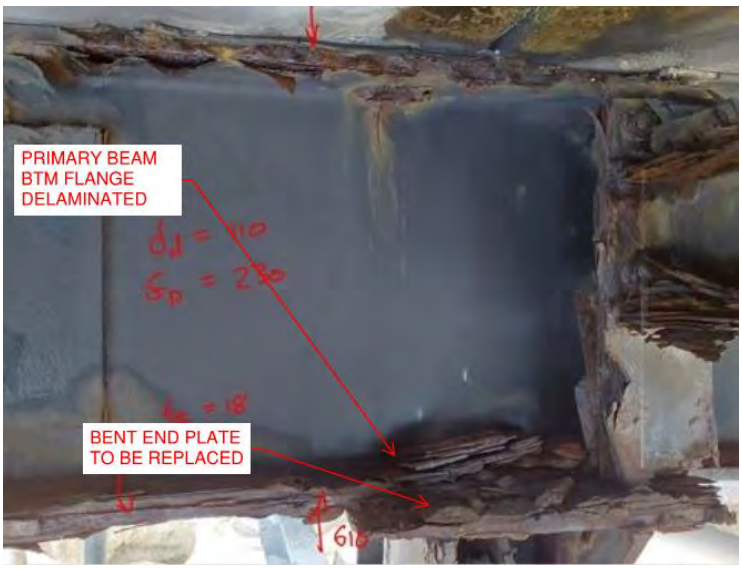


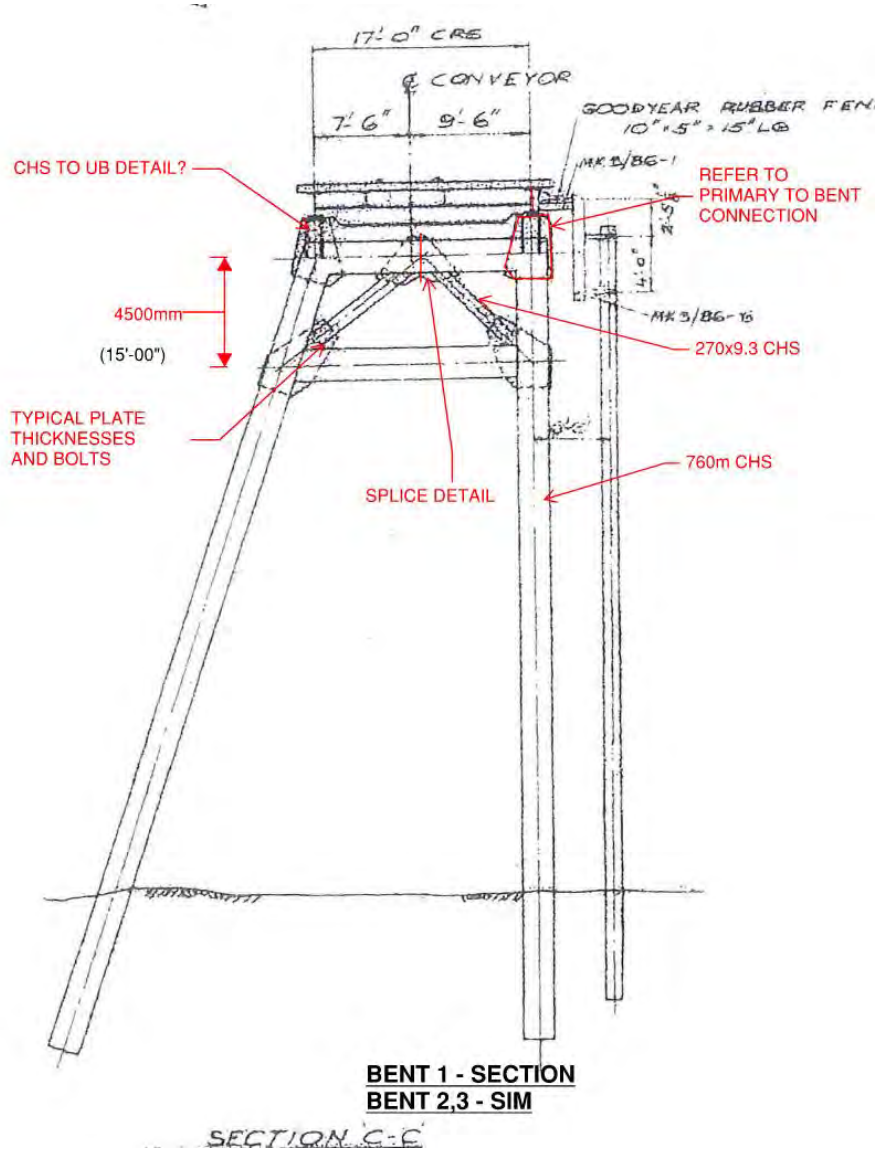
Figure 39 - Primary Beam to Bent Connection, Deck Type DC

5.5.3 Bracing

It is assumed that all bracing members are to be removed. The structure diaphragm has sufficient lateral capacity in the stud connections of the primary and tertiary to the concrete planks.

5.6 Bent Type 1 (Bents 1 to 8)

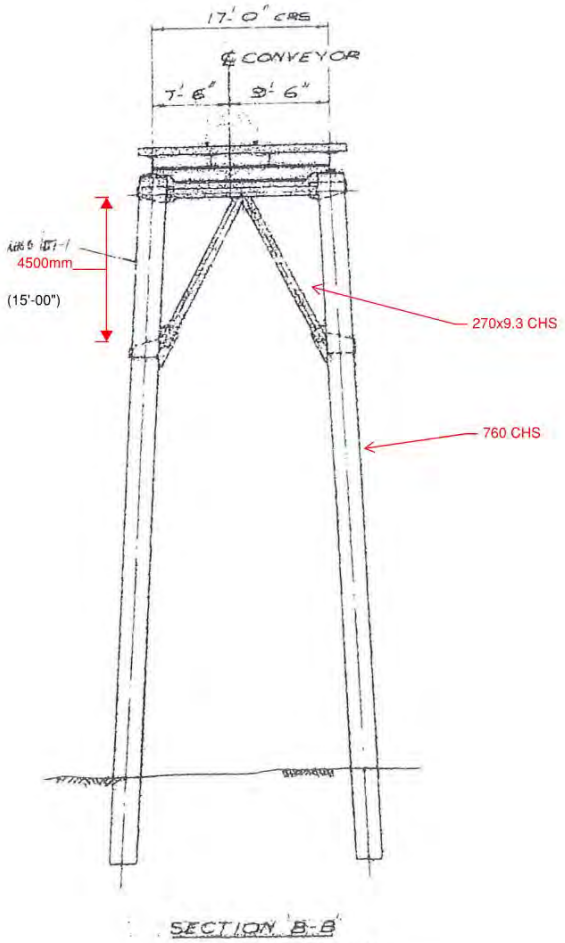
5.6.1 Structural arrangement



The bent main member 760CHS has sufficient capacity to carry the proposed loads. Assessing the capacity of the founding sand and rock is outside the scope of this report in the absence of geotechnical data. Based on site inspection minor rectification works to the structural bracing are required. Additionally, allowance must be made for bearing replacement on each connection of primary beam to bent.

5.7 Bent Type 2 (Bents 9 to 11)

5.7.1 Structural arrangement



BENT 9 - SECTION

The bent main member 760CHS has sufficient capacity to carry the proposed loads. Assessing the capacity of the founding sand and rock is outside the scope of this report in the absence of geotechnical data. Based on site inspection minor rectification works to the structural bracing are required. Additionally, allowance must be made for bearing replacement on each connection of primary beam to bent.

5.8 Movement joint

A visual inspection of the movement joint on both primary beams on Bent 17 show large corrosion and section losses that requires complete replacement of the sections, stiffeners and bearings.

Figure 40 - Bent 17 Movement Joint

Figure 41 - Bent 17 movement joint

5.9 Bent Type 4 (Bents 18 to 28)

All structural members that comprise bents 18 to 28 are to be replaced due to heavy corrosion and section loss.

The vertical members, 310UC118, have lost sections of flanges and web and are susceptible to buckling on their minor axis considering section loss.

All bracing members, 230 CHS and 200PFCs are heavily corroded with section losses.

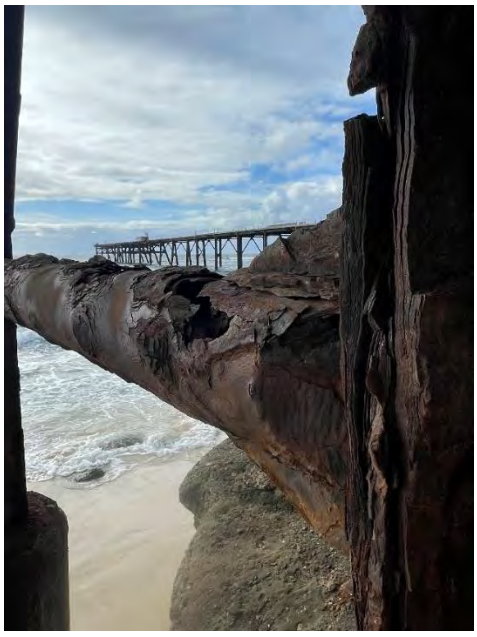


Figure 42 – CHS Tie Bracing Member, Typical of Bents 18-28

Figure 43 – Back-to-Back PFC, Visibly Detached from UC Columns, Typical of Bents 18-28

5.10 Concrete planks

Heavy corrosion under the planks has reduced the concrete cover to a point where the reinforcement is exposed and corroded. Under this case the planks have no capacity locally to carry the proposed loads.

We estimate that a significant number of planks (in the order of 20-30% across the whole Jetty) are to be either replaced or strengthened with carbon fiber reinforcement grooved-in steel reinforcement or alternative methods.

Figure 44 - Precast Panels Showing Deterioration with Reinforcement Exposed, Deck Type DC

Figure 45 - Precast Panels Showing Deterioration with Reinforcement Exposed, Deck Type DB

6. Recommendations

Analysis of the available information suggests that the jetty would require substantial work to make it safe for public use. Whilst the Jetty has experienced significant deterioration, many of the steel members and precast panels appear to be in adequate condition to support the required design loads, however most of the connections and all the bents on the beach section of the Jetty are to be replaced.

6.1 Recommendations for Various Structural Items

6.1.1 Precast Panels

Observations and testing conducted on the precast panels suggest that many panels were in adequate condition to maintain. Due to access below the deck being limited to five locations it was difficult to accurately enumerate the precast panels that were deteriorated to sufficiently warrant being repaired or replaced. From observations it has been estimated that at least 15% of the precast panels will require reparation and possibly be replaced. With the Jetty extending approximately 342 metres, and the precast panels being 1.82 metres wide, it has been estimated that there is a total of 188 precast concrete panels along the Jetty. This equates to roughly 28 panels that are likely to need replacement or reparation.

6.1.2 Primary Beams

All the primary beams of all deck types of the structure, while showing signs of localised corrosion, have capacity to carry the required design loads. Primary beams on deck type DB require strengthening for the proposed loads due to their current state. As not every primary beam could be accessed to gain a more comprehensive impression of localised corrosion, it would be recommended that the beams be assessed for any areas of particular concern regarding localised corrosion. All primary beams had severe corrosion and delamination of the bottom flange at the connection to the flange and need to be rectified, strengthened or replaced. The primary beams, while in reasonable condition, will need a corrosion inhibitor applied to all surfaces of the beams to prevent any further corrosion and a subsequent maintenance program developed.

6.1.3 Tertiary Beams

The tertiary beams of the structure appeared to generally be in a reasonable state to be able to be maintained. Localised corrosion was more significant in tertiary beams and the smaller section size meant the corrosion was more noticeable. Much the same as the primary beams, the tertiary beams will need a corrosion inhibitor applied to all surfaces of the beams to prevent any further corrosion and a subsequent maintenance program developed. It has been determined that even with the reduced section size the tertiary beams should still have ample capacity to carry the design loads, however, thorough cleaning and investigation should still be performed to assess areas of higher localised corrosion and section loss.

6.1.4 Secondary Beams (Bents 1-17)

The secondary beams were generally more heavily corroded then the other steel beams. The corrosion was critical where the section size decreased going up to the connection point. In one of the scaffolding locations, it was observed in some locations that the bottom flange of the secondary beam had completely corroded away. The connection between the secondary beams and the primary beams was one of the sections of steel that was working the hardest and it is believed that fatigue corrosion played a role in the increased rates of corrosion and section loss. All connections are required to either be replaced or remediated by welding additional steel to the beam and replacing the bolts. All secondary beams on deck type DB are to be strengthened.

6.1.5 Secondary Beams (18-28)

The secondary beams in bents 18-28 were observed to be in worse condition. These members don't carry vertical loads and are to be replaced in conjunction with all UC columns, refer to sections 6.1.9)

6.1.6 CHS Columns (Bents 1-17)

The CHS columns from Bents 1-17 of the jetty were generally observed to be in reasonable condition and have the potential to be maintained. The main concern for these members is the corrosion inhibitor on the inside no longer being effective as it is supposed to be regularly filled up. More information will be needed to properly determine whether the section loss is sufficient to warrant issues. Readings of the thickness were taken at various bents by divers as well as at locations of the scaffolding below the deck. However, localised corrosion above the water level is somewhat unknown. Measurements of the thickness, where it was possible to take them, suggest that the CHS columns are in an acceptable condition to justify maintenance. Localised blistering could be observed on the external faces of the CHS columns, but it is not believed to be cause for immediate concern. The CHS columns have been determined to have capacity to carry the required design loads for pedestrian traffic. A maintenance schedule will need to be developed and a corrosion inhibitor applied to the exterior as well as interior of the columns. Further assessment of localised corrosion and areas of potential section loss is recommended.

6.1.7 Vertical CHS Bracing and CHS Tie Beams (Bents 1-17)

These members generally showed higher rates of localised corrosion due to the smaller section size and possibly due to being closer to the water level. The section loss did not appear to be at a critical state, but the thickness of these members was not able to be measured due to access.

6.1.8 Plan Bracing

The plan bracing along the entire length of the jetty, all deck types, was in very poor condition and in many cases, it had completely rusted through at points and was hanging down. This has been noted as a cause for immediate concern and the will all need to be removed. The plan bracing in deck types DA1, DA2 and DB have been noted as not required for the stability of the design and were likely installed to account for the stability in the temporary state. As a result, they will not need to be replaced, however, if the precast panels are removed during the remediation process the structure will need additional lateral stability in the temporary state.

Plan bracing between bents 18-28, deck type DC is more critical to the lateral stability of the structure and would needs to be replaced. With these members being roughly 4.9 metres long and having 3 in each 12-metre span, this would relate to approximately 120 metres of 100EA bracing.

6.1.9 UC Columns (Bents 18-28)

The UC Columns were observed to be in very poor condition and show high levels of corrosion and section loss. Due to their height, the section loss and lack of bracing/restraint, these members have limited capacity to carry axial loads and are susceptible to buckle in their weak axis. The location of the columns in the tidal and splash zones mean that the rates of corrosion are faster, and it can be seen when analysing the past reports that since maintenance has ceased the rates of corrosion have increased even further. Due to the visible delamination and generally poor condition of these members they are most likely going to have to be replaced completely. There are 22 columns in this section that would need replacing or significant work to clean and remediated.

6.1.10 Vertical Bracing and Tie Beams (Bents 18-28)

The vertical bracing and tie beams in this section of the jetty are also all very highly corroded with several of the CHS members being corroded to the point of holes forming. It has been estimated that only about 20% of these members have the potential to be reused. The members that have potential to be reused will need to be cleaned and reanalysed to determine the resulting section capacity. Any members that are to be reused will need to have a corrosion inhibitor

applied and a maintenance schedule developed. With approximately 30 bracing members, it has been approximated that 24 members will need to be replaced.

6.1.11 Back-to-Back PFC Beams

These members were installed to support a cantilevered section of the jetty that has since been removed. They are no longer required and in very poor condition. All these members will need to be removed.

6.2 Summary of Recommendations for Structural Elements

A summary of the elements to can be found in the excel spreadsheet produced by BG&E. This spreadsheet should be read in conjunction with this report. It has been formulated as a guide to assist a quantity surveyor in providing cost estimates for the remediation of the Jetty.

See Spreadsheet: “Summary of Members to be Replaced or Maintained”.

Appendix A - **Sketches**

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

DRAWING INDEX	
DRG No.	TITLE
MT-0001	TITLE AND DRAWING INDEX
MT-1000	OVERALL PLAN AND ELEVATION
MT-1010	GENERAL ARRANGEMENT PLAN - SHEET 1
MT-1011	GENERAL ARRANGEMENT PLAN - SHEET 2
MT-1100	GENERAL SECTIONS - SHEET 1

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	AVD
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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BG&E

PROJECT: CATHERINE HILL BAY WHARF
CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

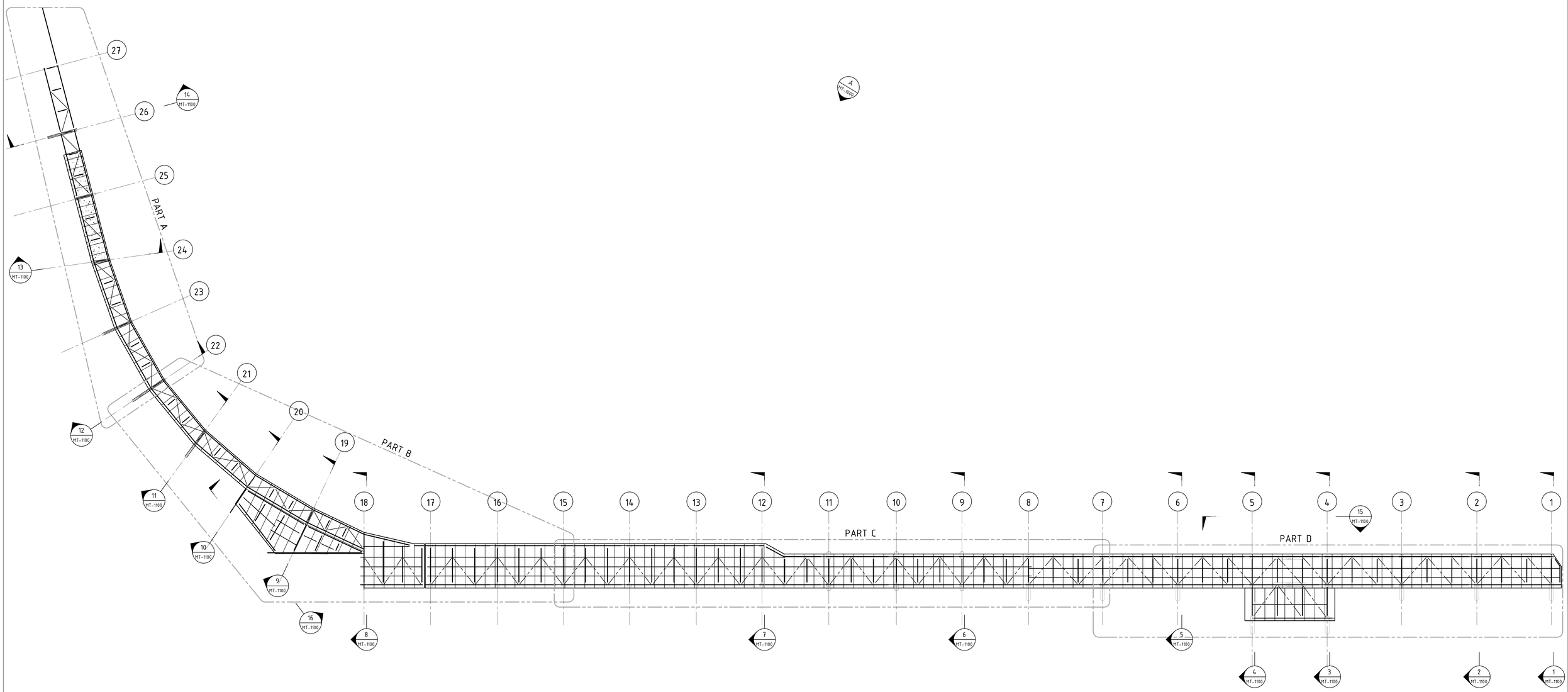
DATUM	GRID	SCALE
		NTS

A1 A0 SIZE

TITLE: TITLE AND DRAWING INDEX

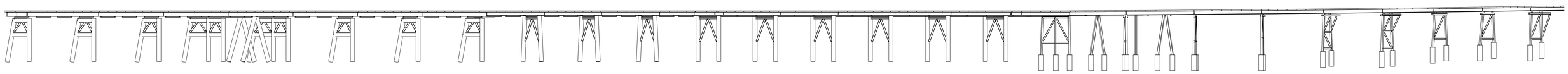
PROJECT No.	DRAWING No.	REV.
N23028	MT-0001	B

19/09/2023 2:08:43 PM Catherine Hill Bay Jetty



OVERALL PLAN

SCALE 1 : 250



GENERAL ARRANGEMENT ELEVATION

ELEVATION A MT-1000

SCALE 1 : 250

REV	DATE	DESCRIPTION	RVD
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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PROJECT

CATHERINE HILL BAY WHARF

CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE @ A1 A0 SIZE

TITLE: OVERALL PLAN AND ELEVATION

PROJECT No. N23028 | DRAWING No. MT-1000 | REV B

DRAWING TO BE PRINTED IN COLOUR

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DISCLAIMER:
STEEL FRAMING INFORMATION TAKEN FROM EXISTING DRAWINGS AND LIMITED SITE INVESTIGATIONS.
ALL MEMBERS SIZE AND DETAILS OF CONNECTIONS TBC

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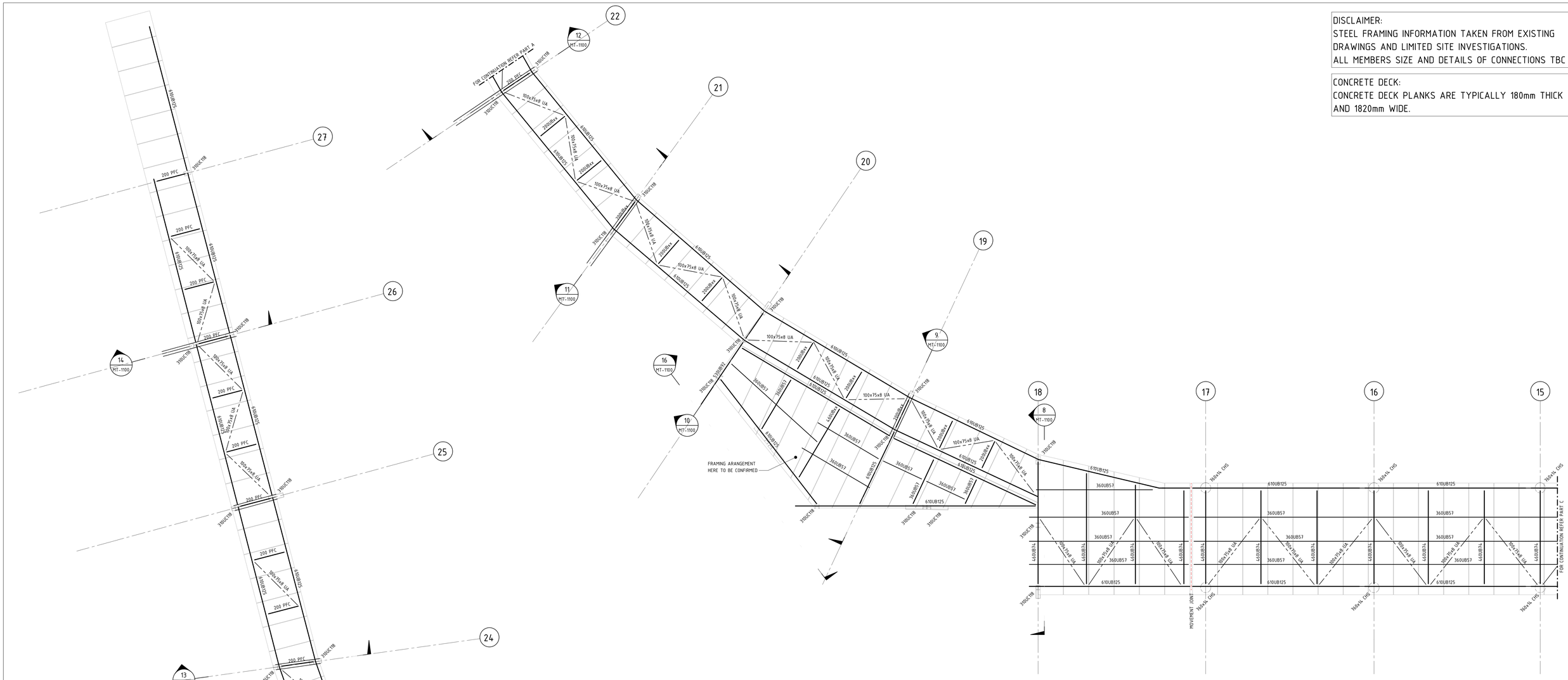
CONCRETE DECK PLANKS ARE TYPICALLY 180mm THICK AND 1820mm WIDE.



GENERAL ARRANGEMENT PLAN - PART A
SCALE 1 : 100

GENERAL ARRANGEMENT PLAN - PART B
SCALE 1 : 100

REV	DATE	DESCRIPTION	BVD
B	19.09.23	ISSUED FOR INFORMATION	MC
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CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE: AT A0 SIZE

TITLE: GENERAL ARRANGEMENT PLAN - SHEET 1

PROJECT No: N23028 | DRAWING No: MT-1010 | REV: B

DRAWING TO BE PRINTED IN COLOUR

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ALL MEMBERS SIZE AND DETAILS OF CONNECTIONS TBC

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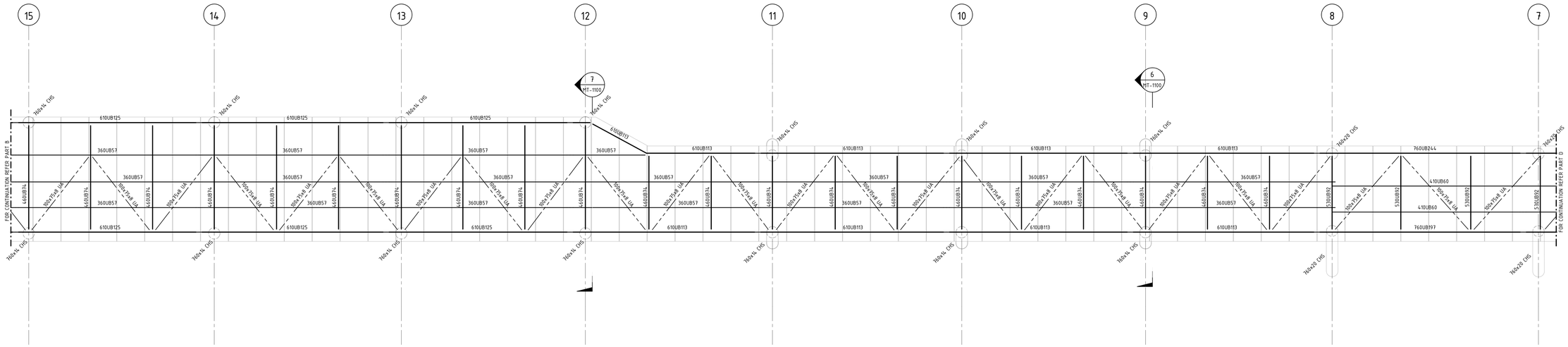
CONCRETE DECK PLANKS ARE TYPICALLY 180mm THICK AND 1820mm WIDE.



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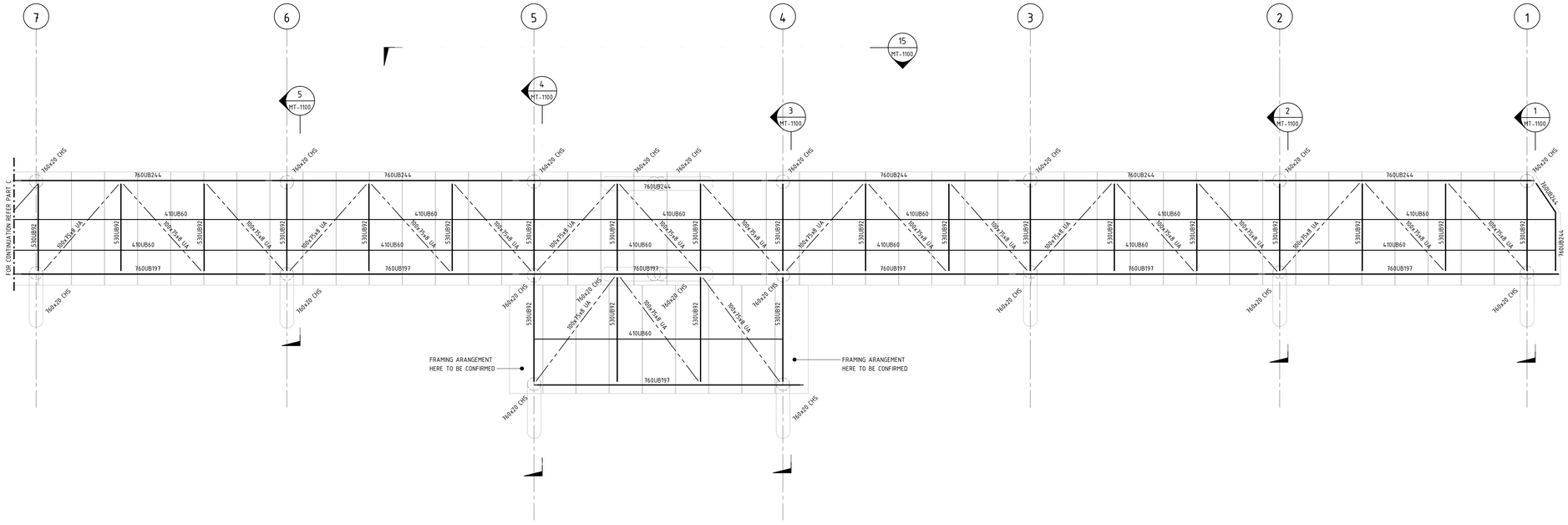

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SCALE 1 : 100

REV	DATE	DESCRIPTION	BY/D
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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PROJECT
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CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE | A1 A0 SIZE

TITLE: GENERAL ARRANGEMENT PLAN - SHEET 2

PROJECT No. N23028 | DRAWING No. MT-1011 | REV B

DRAWING TO BE PRINTED IN COLOUR

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DISCLAIMER:
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ALL MEMBERS SIZE AND DETAILS OF CONNECTIONS TBC

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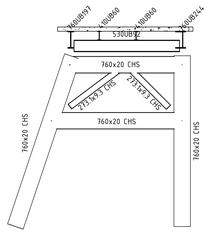
CONCRETE DECK PLANKS ARE TYPICALLY 180mm THICK AND 1820mm WIDE.



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SECTION 1 (MT-1000)
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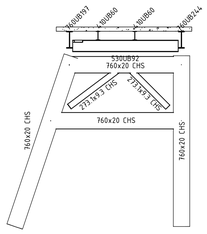

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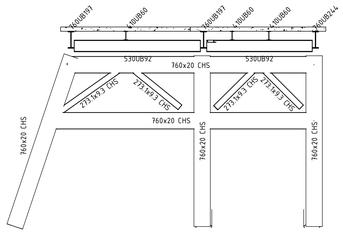

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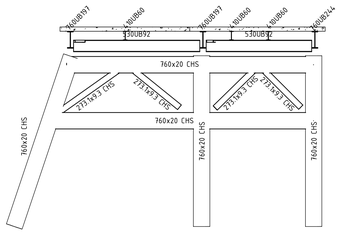

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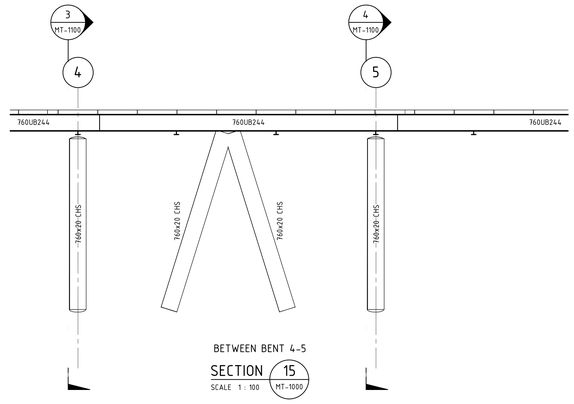

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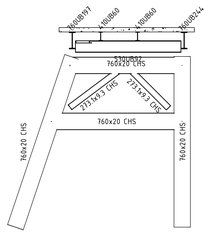

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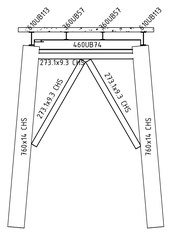

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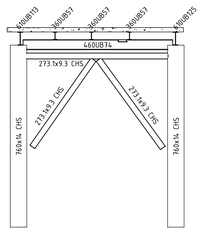

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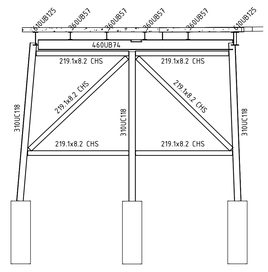

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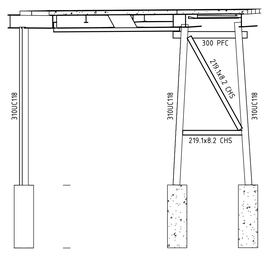

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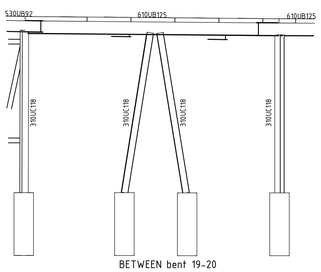

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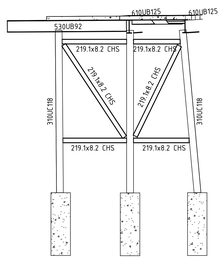

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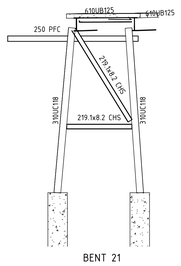

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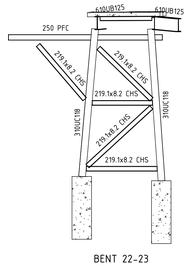

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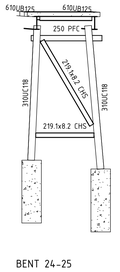

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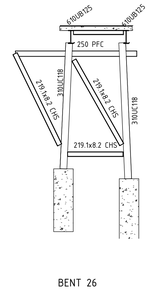

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REV	DATE	DESCRIPTION	RVD
B	19.09.23	ISSUED FOR INFORMATION	MC
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PROJECT
CATHERINE HILL BAY WHARF
CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE | AT A0 SIZE

TITLE: GENERAL SECTIONS - SHEET 1

PROJECT No. N23028 | DRAWING No. MT-1100 | REV B

DRAWING TO BE PRINTED IN COLOUR

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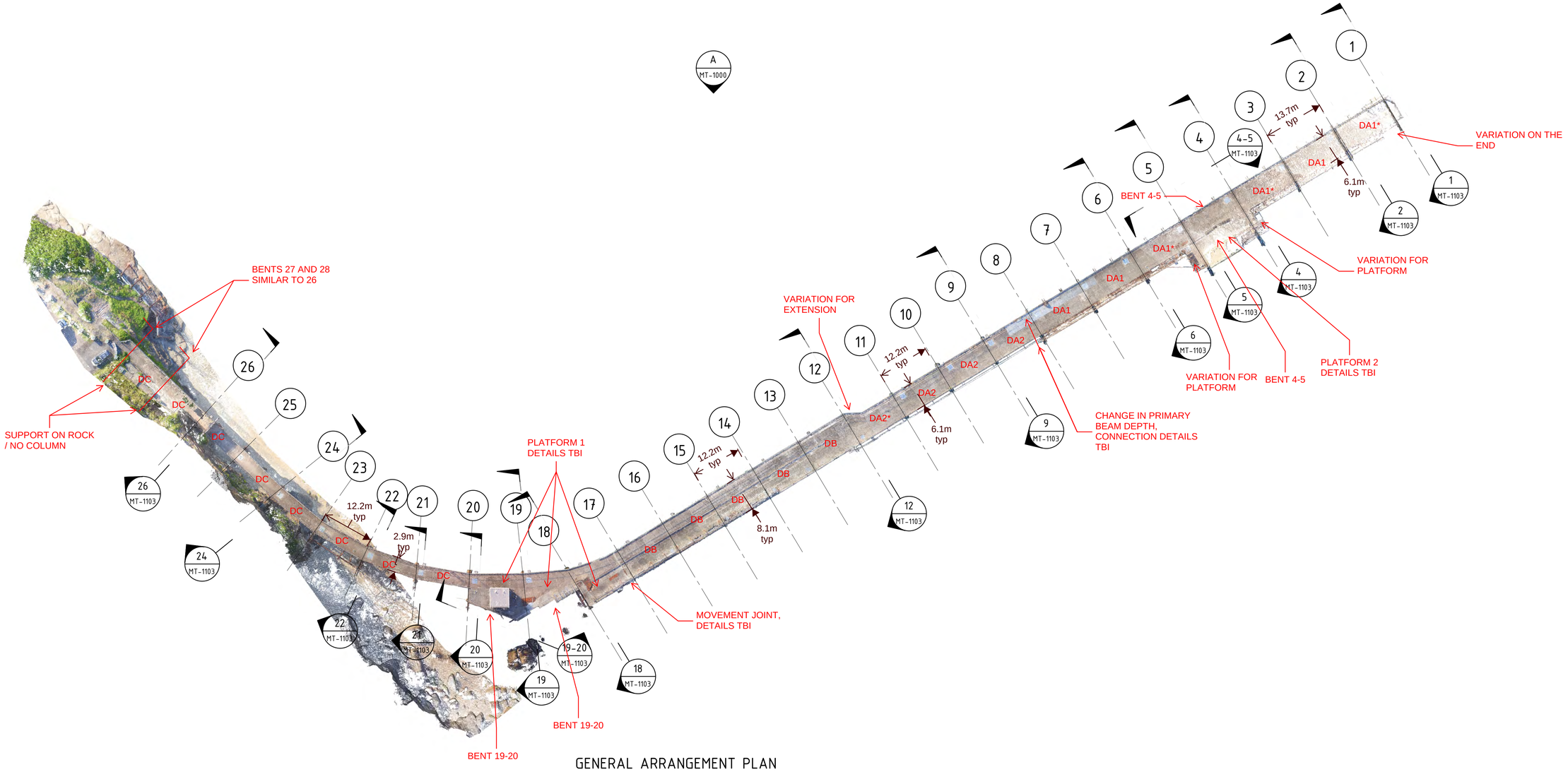

GENERAL ARRANGEMENT PLAN

SCALE 1 : 500

GENERAL ARRANGEMENT ELEVATION

ELEVATION A — MT-1000

SCALE 1 : 500

Revision In Progress

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PROJECT

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

STATUS

ISSUED FOR INFORMATION

NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.1	A

TITLE

GENERAL ARRANGEMENT

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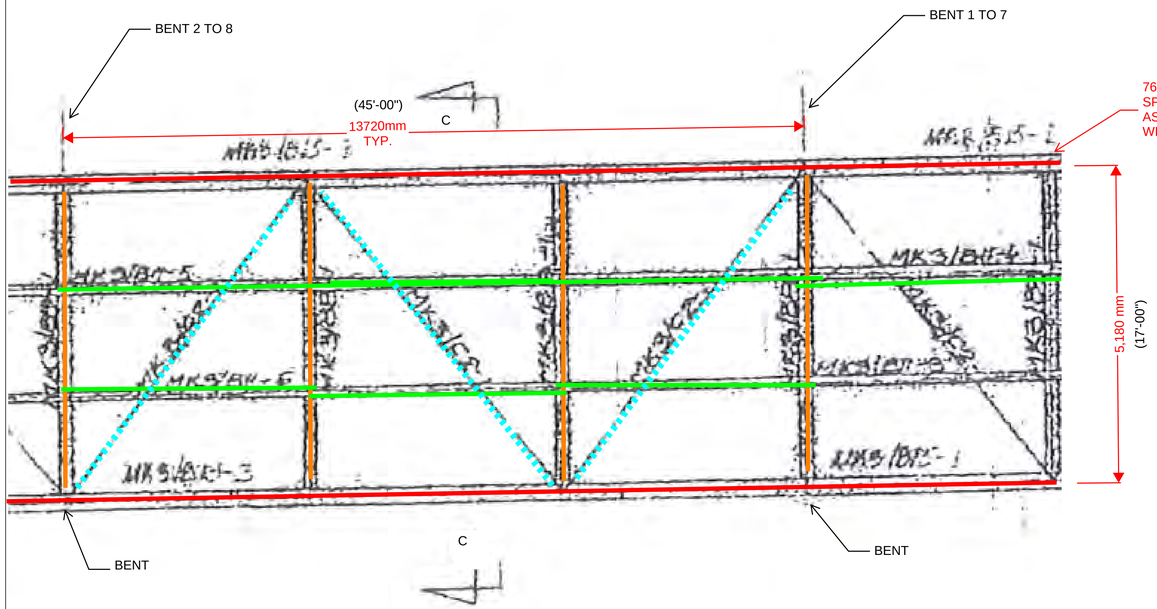
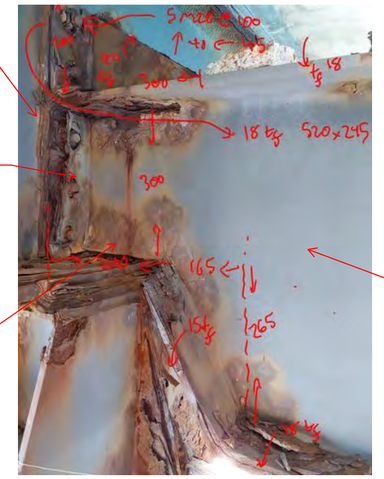
1/06/2023 4:43:57 PM

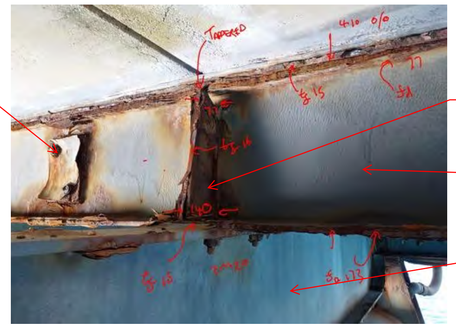


PRIMARY BEAM - 760UB244 OK FROM DRAWING, SOUTH PRIMARY BEAM UNKNOWN ASSUMED SMALLER 760UB (760UB197)
SECONDARY BEAM (TAPPERS) - 530UB92 MEASURE ON SITE
TERTIARY BEAM - 410UB60 MEASURE ON SITE
BRACING - 100x75x8uA MEASURED ON SITE

TYPICAL DECK TYPE A1



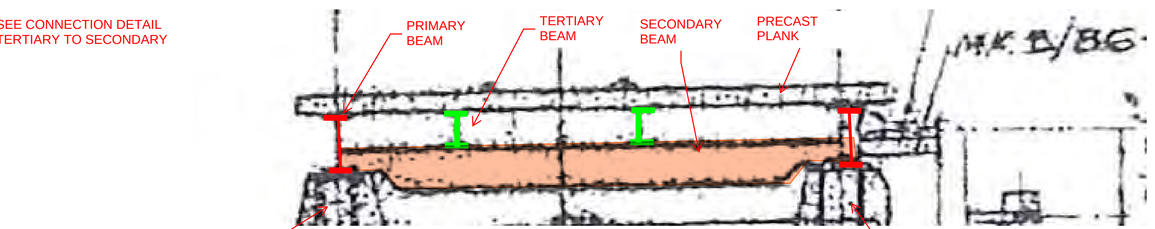
CONNECTION DETAIL - SECONDARY TO PRIMARY BEAM



CONNECTION DETAIL - TERTIARY TO SECONDARY BEAM

SITE INSPECTION AND CONDITIONS

TYPICAL DECK TYPE A1
OR A2 - SITE PHOTO



TYPICAL CROSS SECTION

DRAWING TO BE PRINTED IN COLOUR

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PROJECT: CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM | GRID | SCALE AT A1 SIZE

TITLE: **TYPICAL DECK TYPE A1**

PROJECT No. N23028 | DRAWING No. **ST-001.2** | REV. **A**

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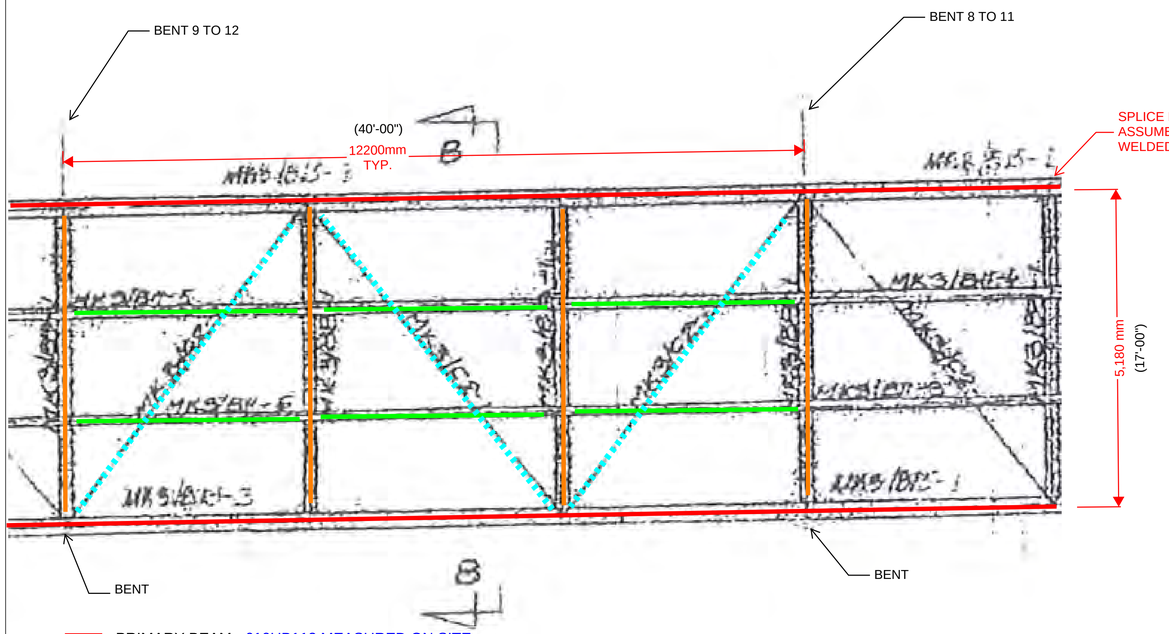
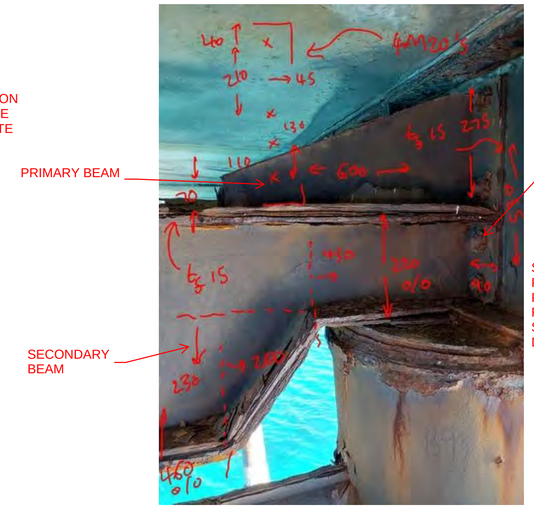
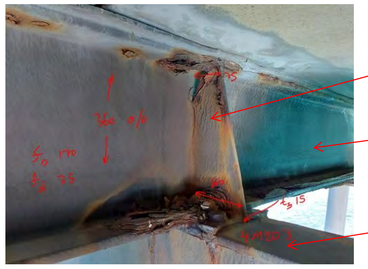
1/06/2023 4:43:57 PM



TYPICAL DECK TYPE A2



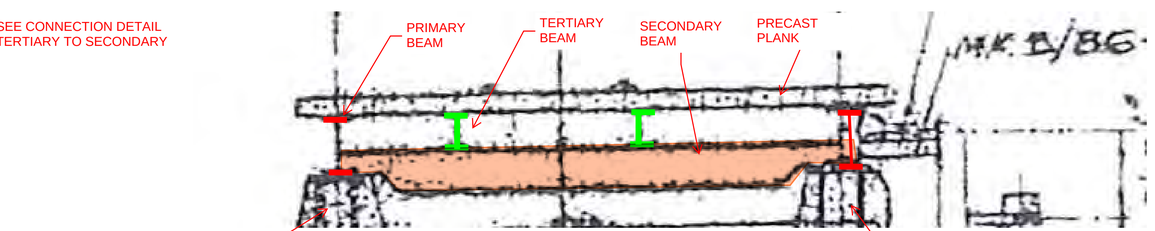
CONNECTION DETAIL - SECONDARY TO PRIMARY BEAM



CONNECTION DETAIL - TERTIARY TO SECONDARY BEAM

SITE INSPECTION AND CONDITIONS

**TYPICAL DECK TYPE A1
OR A2 - SITE PHOTO**



TYPICAL CROSS SECTION

REV	DATE	DESCRIPTION	RVD

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PROJECT
CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

STATUS
ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.3	A

TITLE
TYPICAL DECK TYPE A2

DRAWING TO BE PRINTED IN COLOUR

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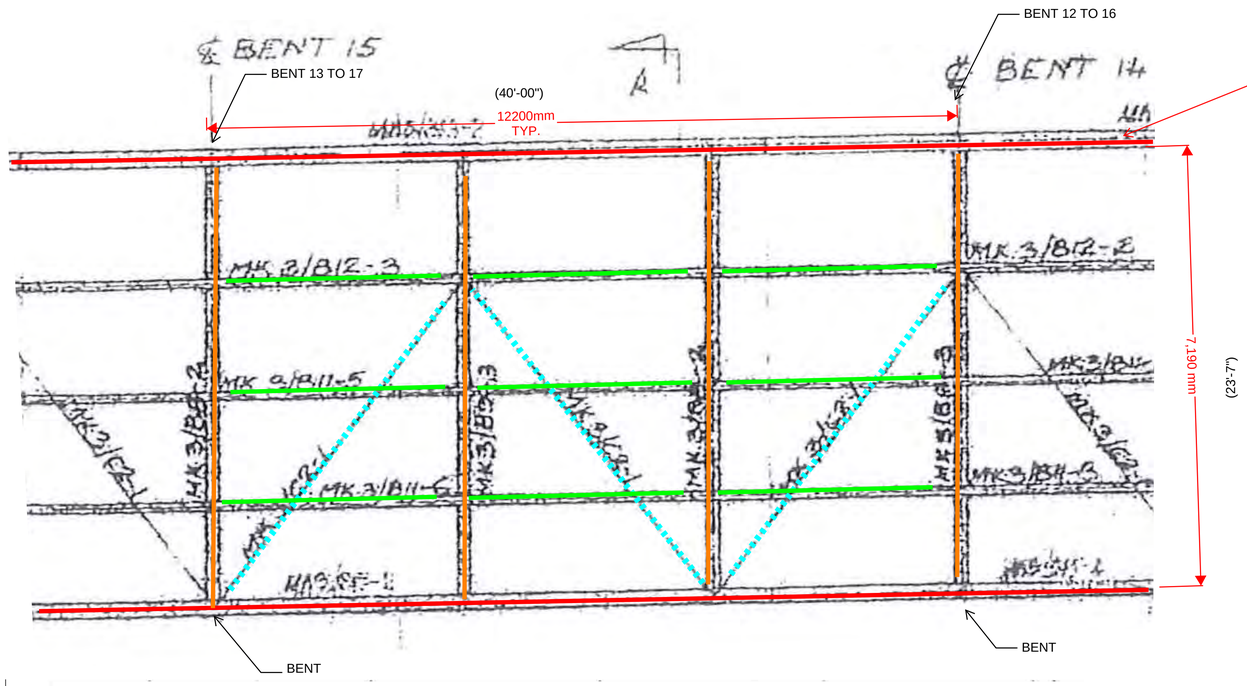
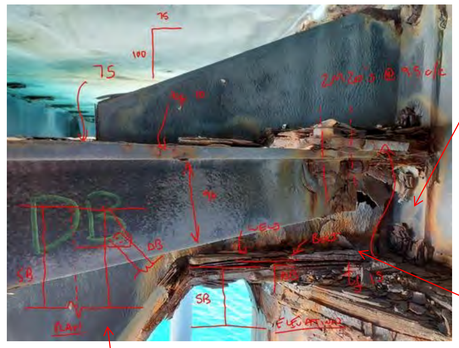
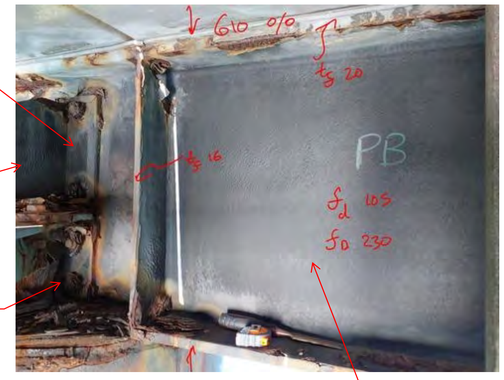


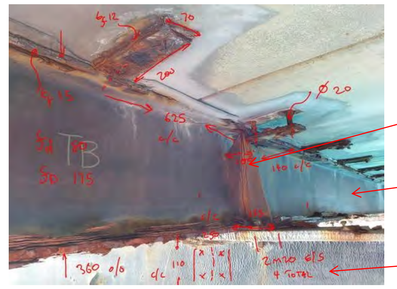
PRIMARY BEAM - 610UB113 MEASURED ON SITE
SECONDARY BEAM (TAPPERS) - 460UB75 (A 10mm PLATE WAS OBSERVED IN CERTAIN LOCATIONS WELDED TO THE TOP AND BTM FLANGES)
TERTIARY BEAM - 360UB75 MEASURED ON SITE
BRACING - 100x75x8uA MEASURED ON SITE

TYPICAL DECK TYPE DB



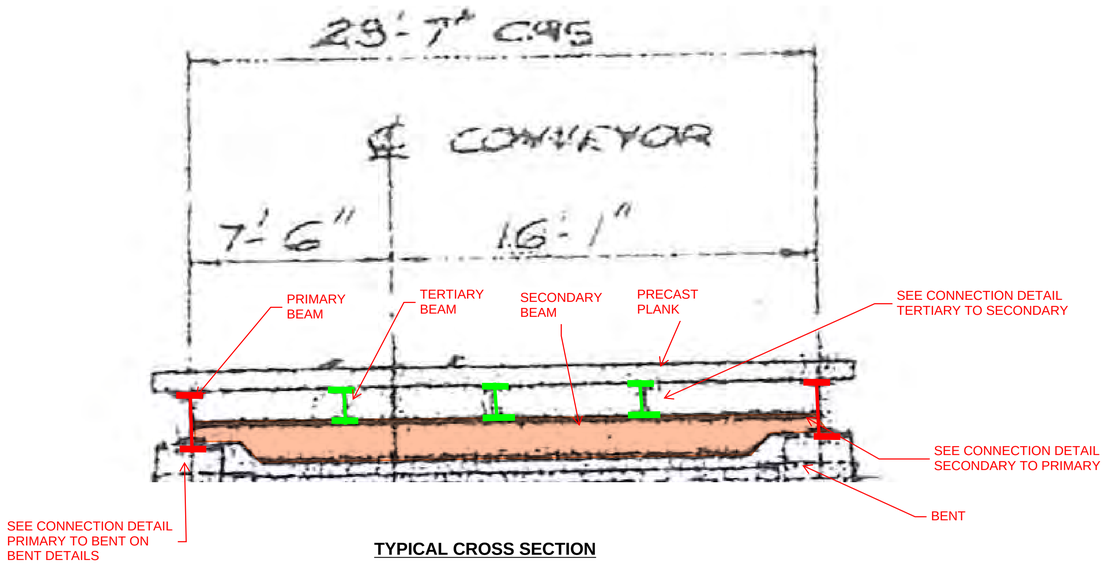


CONNECTION DETAIL - SECONDARY TO PRIMARY BEAM



CONNECTION DETAIL - TERTIARY TO SECONDARY BEAM

SITE INSPECTION AND CONDITIONS



TYPICAL CROSS SECTION

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT

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bgeeng.com —

PROJECT
CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

STATUS
ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM | GRID | SCALE AT A1 SIZE

TITLE
TYPICAL DECK TYPE DB

PROJECT No. N23028 | DRAWING No. **ST-001.4** | REV. **A**

DRAWING TO BE PRINTED IN COLOUR

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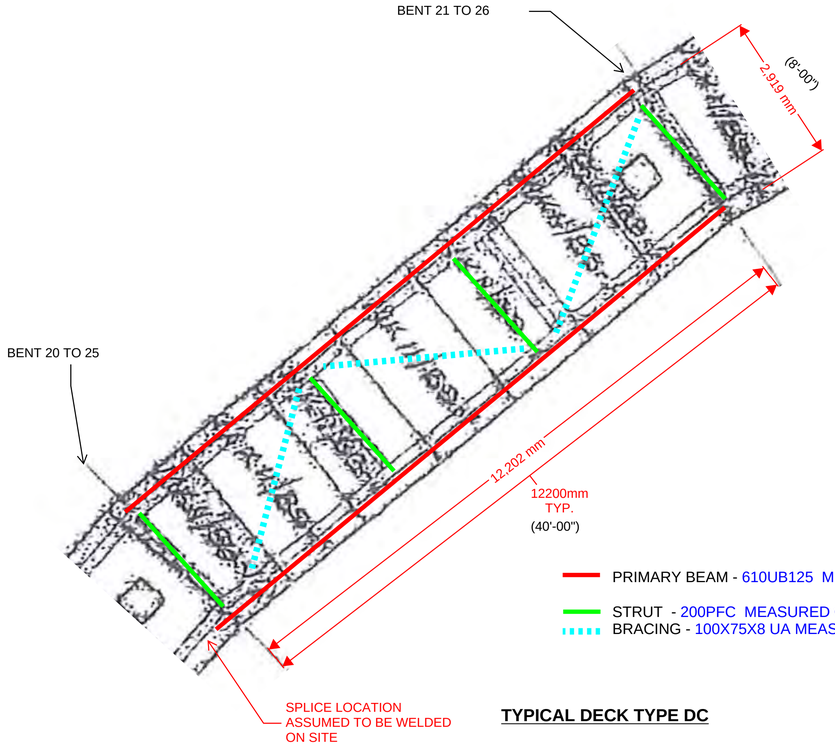
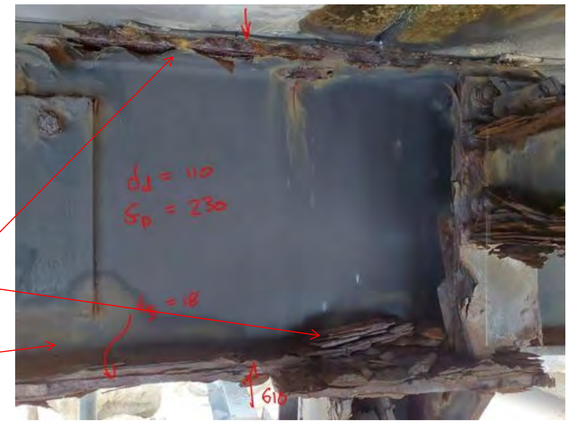
1/06/2023 4:43:57 PM



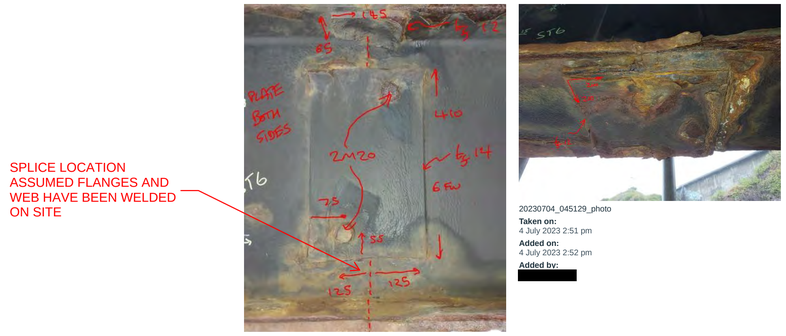
PRIMARY BEAM - 610UB125 MEASURED ON SITE

STRUT - 200PFC MEASURED ON SITE
BRACING - 100X75X8 UA MEASURE ON SITE

TYPICAL DECK TYPE DC



PRIMARY BEAM



20230704_045129_photo
Taken on:
4 July 2023 2:51 pm
Added on:
4 July 2023 2:52 pm
Added by:
[redacted]

PRIMARY BEAM - SPLICE

SITE INSPECTION AND CONDITIONS

TYPICAL DECK TYPE DC
- SITE PHOTO

REV	DATE	DESCRIPTION	RVD

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CATHERINE HILL BAY, NSW

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NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.5	A

TITLE
TYPICAL DECK TYPE DC

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1/06/2023 4:43:51 PM

There is a movement joint at Bent 17, including a steel corbel in the primary beams.

MOVEMENT JOINT SITE PHOTOS

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	RVD

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PROJECT

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

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DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE
		AT A1 SIZE

TITLE

BENT 17 MOVEMENT JOINT DETAILS

PROJECT No.	DRAWING No.	REV.
N23028	ST-001.6	A

Catherine Hill Bay Jetty
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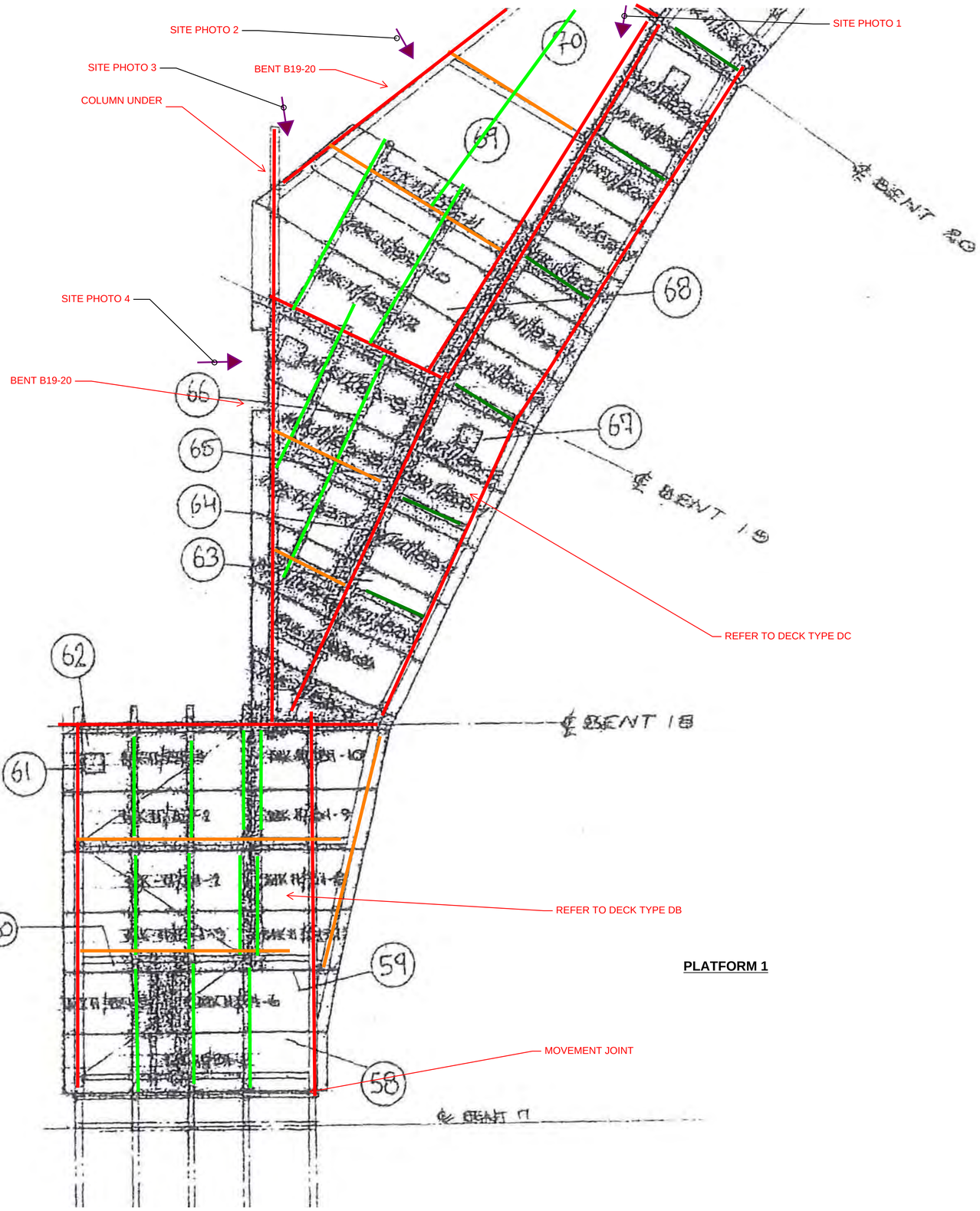

PLATFORM 1

SITE PHOTO 1

SITE PHOTO 2

SITE PHOTO 3

SITE PHOTO 4

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	RVD

REVISIONS

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PROJECT
CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

STATUS
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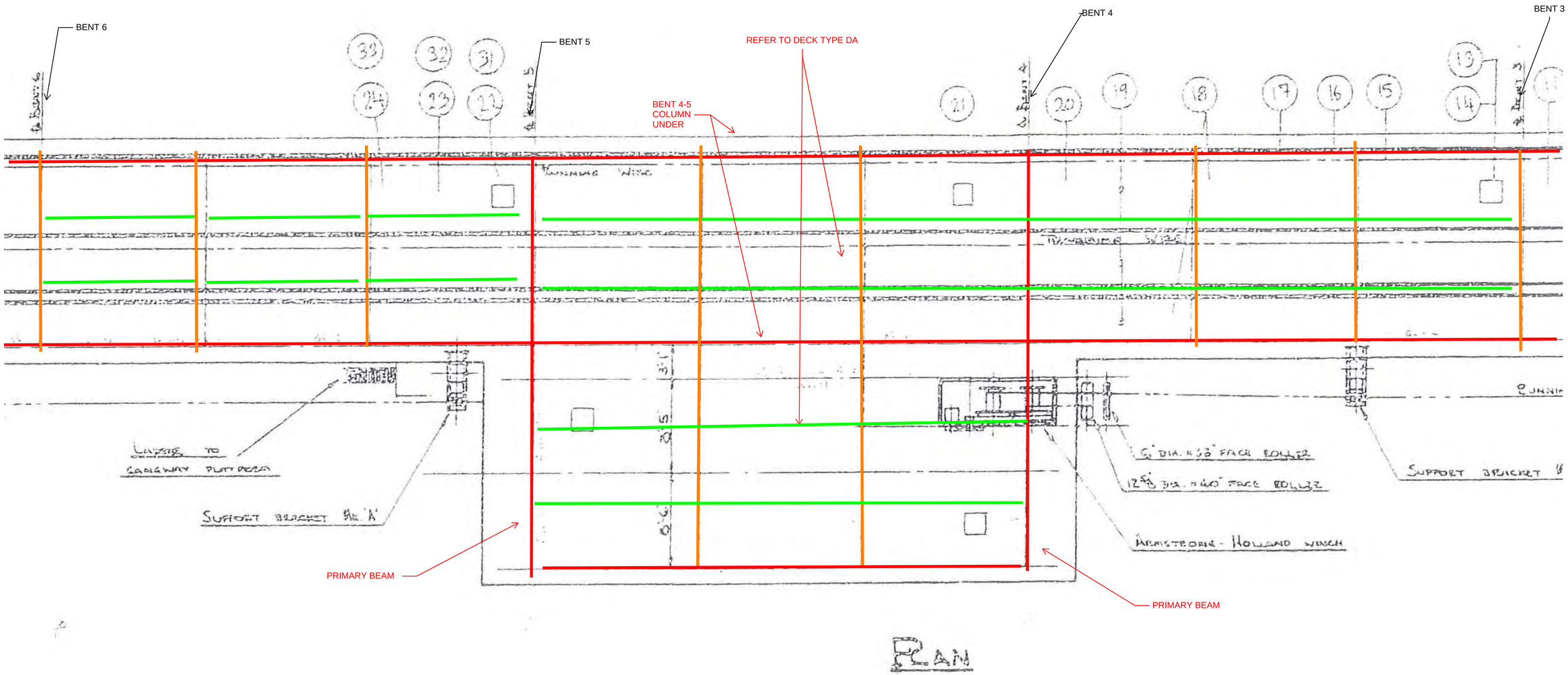
NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.7	A

TITLE
PLATFORM 1

1/06/2023 4:43:57 PM Catherine Hill Bay Jetty



PLAN

PLATFORM 2

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	RVD

REVISIONS

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bgeeng.com —

PROJECT: CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

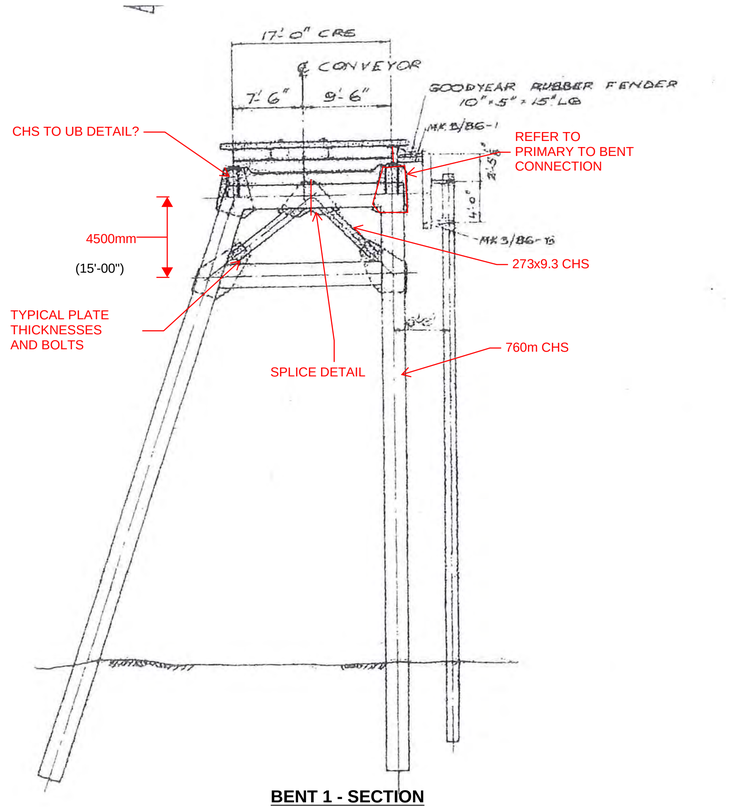
STATUS: ISSUED FOR INFORMATION
NOT TO BE USED FOR CONSTRUCTION

TITLE: **PLATFORM 2**

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.8	A

Catherine Hill Bay Jetty
1/06/2023 4:43:57 PM

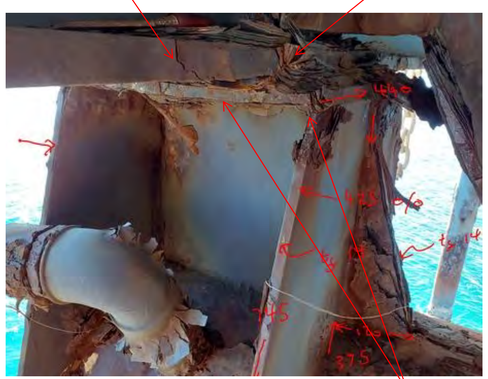


BENT 1 - SECTION
BENT 2,3 - SIM

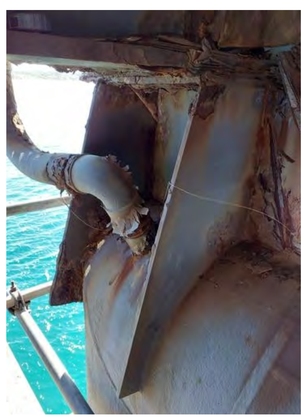
SECTION C-C

LOCALIZED
CRACKS

PRIMARY BEAM BTM FLANGE
SHOWS SEVERE DELAMINATION

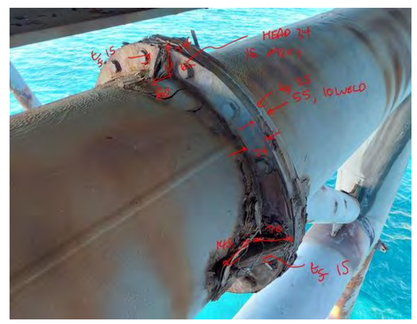


END AND SIDE PLATES
BENT AND RUSTED. SOME
LOSS OF SECTION



CONNECTION DETAIL - PRIMARY BEAM TO BENT

DUE TO THE SEVERE
DELAMINATION OF THE BTM
FLANGE IT IS NOT POSSIBLE TO
DETERMINE IF THE PRIMARY
BEAMS ARE BOLTED/WELDED
OR SITTING ON A BEARING TO
THE BENTSN



BENT CHS SPLICE DETAIL

SITE INSPECTION AND CONDITIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

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PROJECT
CATHERINE HILL BAY JETTY
CATHERINE HILL BAY, NSW

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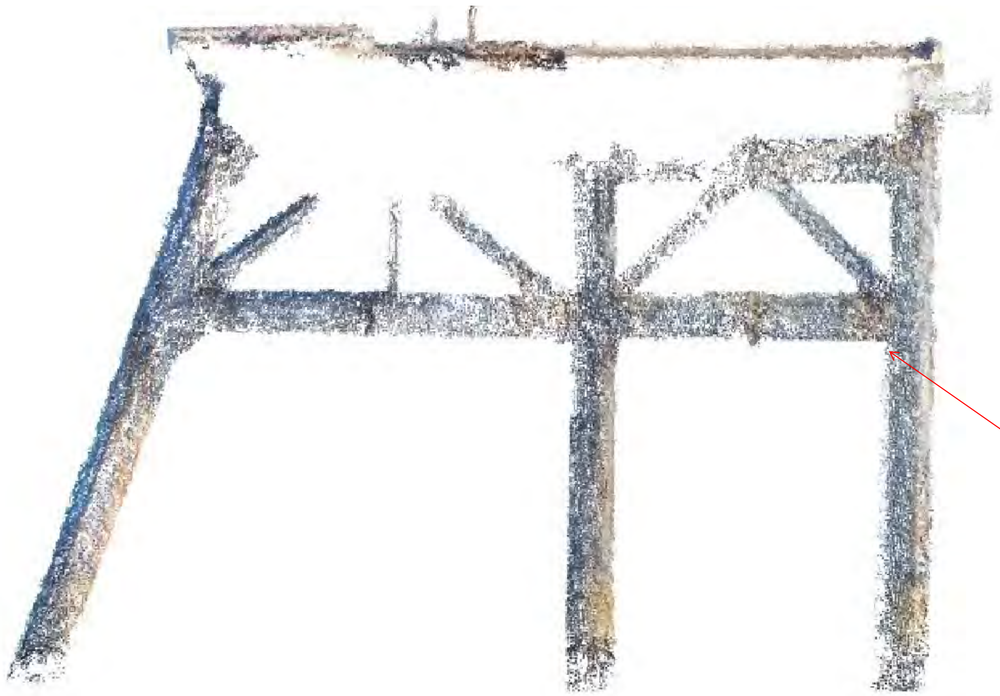
DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.9	A

TITLE
BENTS 1 TO 3

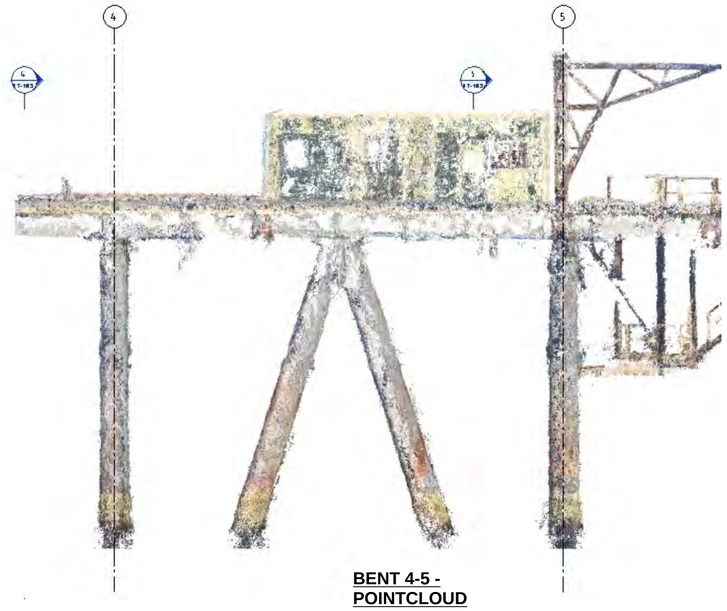
DRAWING TO BE PRINTED IN COLOUR

Catherine Hill Bay Jetty
1/06/2023 4:43:57 PM



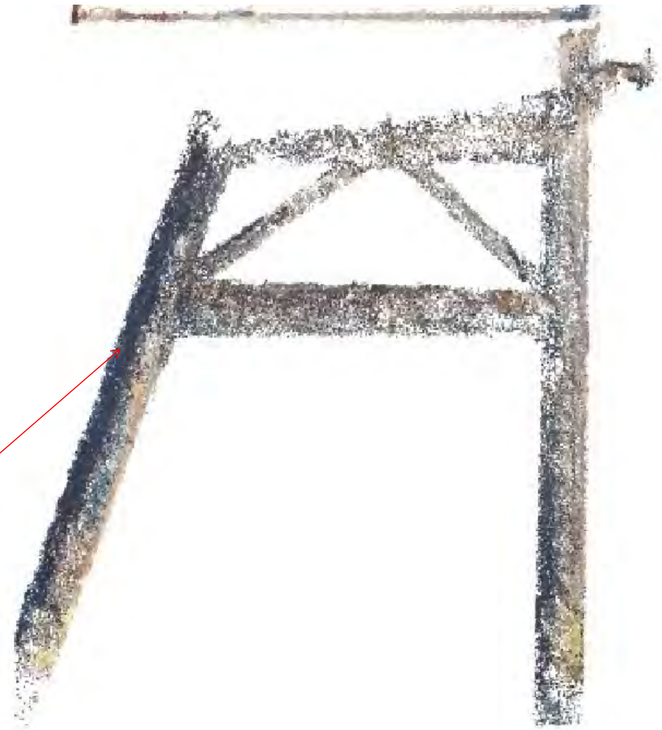
BENT 4 - POINTCLOUD

BENT 5 - SIM



BENT 4-5 - POINTCLOUD

INFORMATION FROM POINT CLOUD, ASSUMED SIMILAR SECTIONS AND CONDITIONS TO BENT 1



BENT 6 - POINTCLOUD

BENT 7,8 - SIM

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	RVD

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PROJECT

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

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NS	-	-	-

DATUM | GRID | SCALE AT A1 SIZE

TITLE

BENTS 4 AND 5
BENTS 6 TO 8

PROJECT No. N23028 | DRAWING No. **ST-001.10** | REV. **A**

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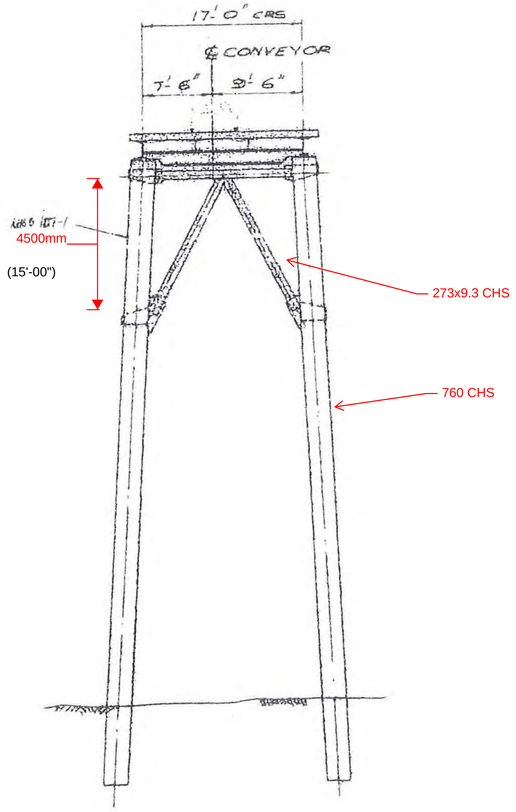
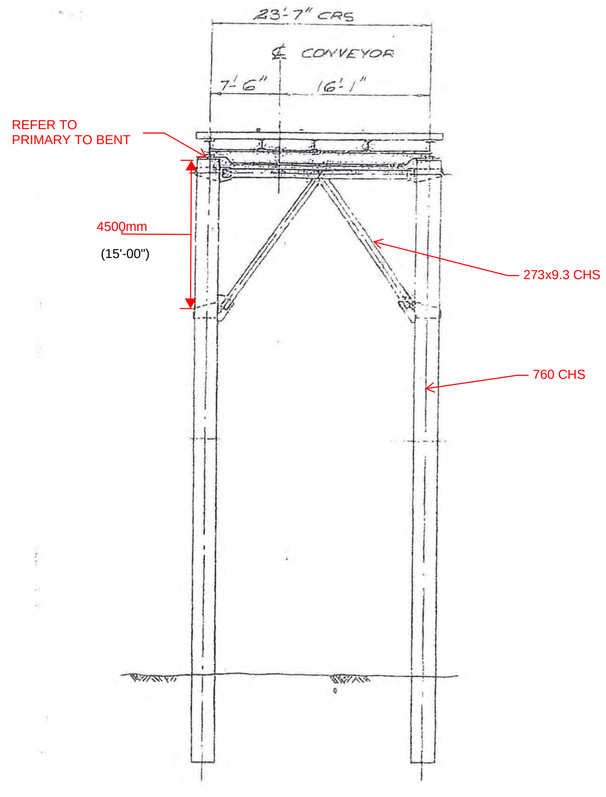
1/06/2023 4:43:57 PM



SECTION 'B-B'

BENT 9 - SECTION

BENT 10,11 - SIM



SECTION 'A-A'

BENT 12 - POINTCLOUD

BENT 13,14,15,16,17 - SIM

DUE TO THE SEVERE DELAMINATION OF THE BTM FLANGE IT IS NOT POSSIBLE TO DETERMINE IF THE PRIMARY BEAMS ARE BOLTED/WELDED OR SITTING ON A BEARING TO THE BENTSN

CONNECTION DETAIL - PRIMARY BEAM TO BENT

BRACING CONNECTION

SITE INSPECTION AND CONDITIONS

REV	DATE	DESCRIPTION	RVD

REVISIONS

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PROJECT

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

STATUS

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DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

DATUM	GRID	SCALE
		AT A1 SIZE

TITLE

BENTS 9 TO 11
BENTS 12 TO 17

PROJECT No.	DRAWING No.	REV.
N23028	ST-001.11	A

DRAWING TO BE PRINTED IN COLOUR

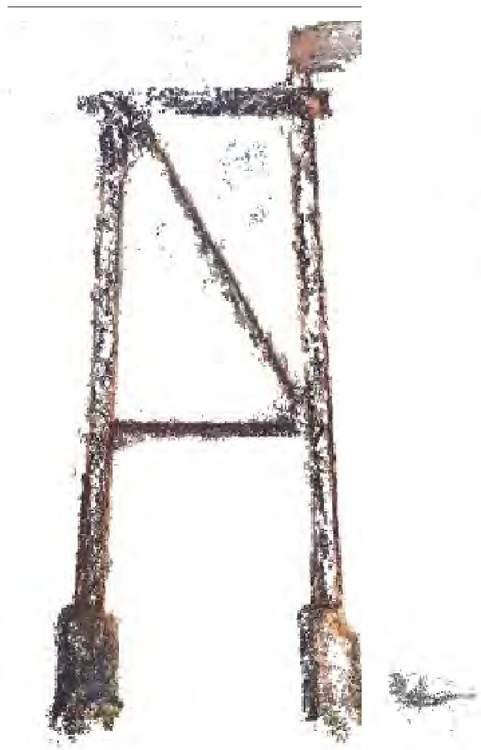
Catherine Hill Bay Jetty
1/06/2023 4:43:51 PM

BENT 18

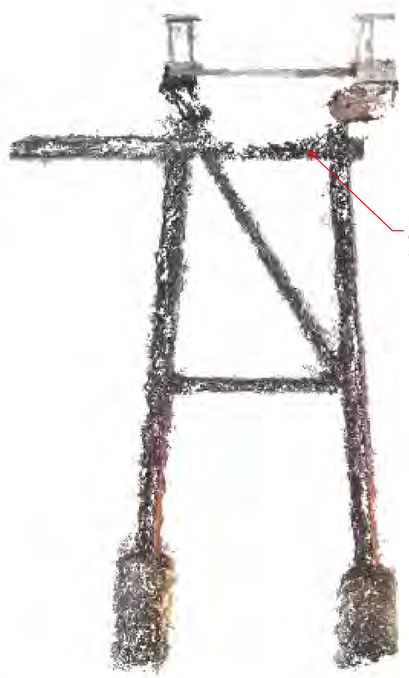
SECTION 18

SCALE 1 : 50 HT-001

BENT 18 - POINTCLOUD



BENT 19 - POINTCLOUD

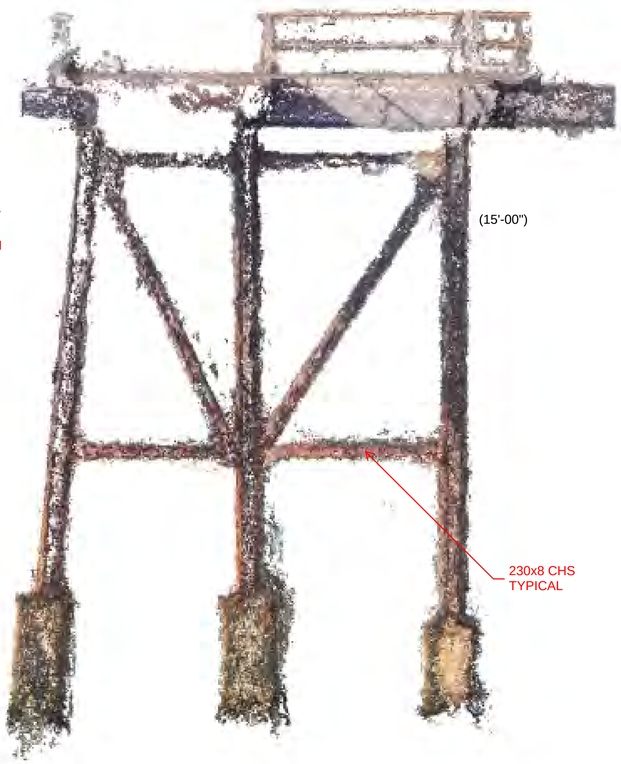


BENT 21

SECTION 21

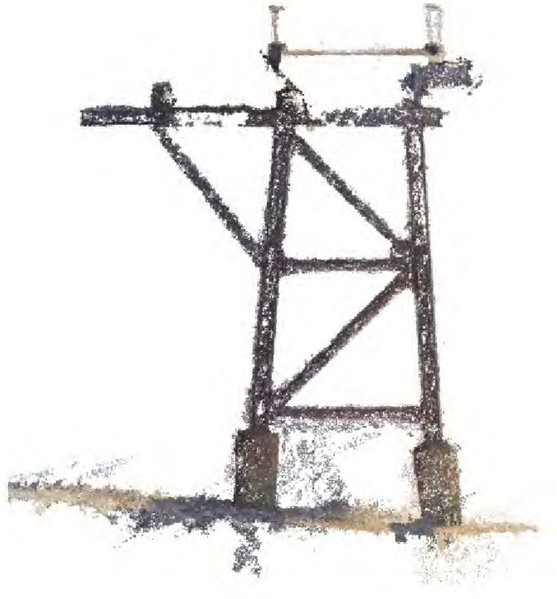
SCALE 1 : 50 HT-001

BENT 21 - POINTCLOUD



BENT 20 - POINTCLOUD

ALL COLUMNS ARE 310UC118 IN BAD CONDITIONS WITH LOSS OF SECTION IN THE FLANGE



BENT 22 AND 23 - POINTCLOUD

BENT 24 AND 25 - POINTCLOUD

BENT 26 - POINTCLOUD

ALL BRACING HAVE LOSS OF SECTIONS (HOLES) AND SEVERELY DAMAGED

TYP COLUMN / BRACING / ENCASEMENT

SITE INSPECTION AND CONDITIONS

DRAWING TO BE PRINTED

REV	DATE	DESCRIPTION	RVD

REVISIONS

CLIENT

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PROJECT

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

STATUS

ISSUED FOR INFORMATION

NOT TO BE USED FOR CONSTRUCTION

DRAWN	DESIGNED	CHECKED	APPROVED
NS	-	-	-

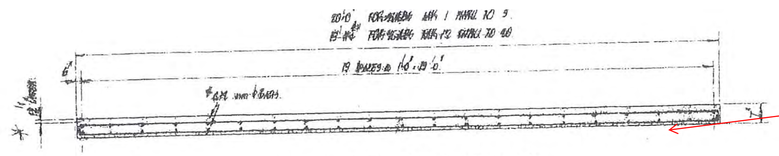
DATUM | GRID | SCALE AT A1 SIZE

TITLE

BENTS 18 TO 26

PROJECT No.	DRAWING No.	REV.
N23028	ST-001.12	A

1/06/2023 4:43:57 PM Catherine Hill Bay Jetty



178thk PRECAST PLANK
CONFIRM THICKNES, REO AND
f'c=30MPAa
BTM REO IS EXPOSED IN SOME AREAS

GENERAL NOTES:-

1. THE COMPRESSIVE STRENGTH OF THE CONCRETE IN THE SLABS SHALL BE F'c = 40 MPa IN ACCORDANCE WITH THE LATEST AMENDMENTS TO AS 1379
2. UNLESS OTHERWISE NOTED ALL SLABS TO BE 6-1/4" x 19-1/2" LG. ALL CORNERS TO BE 1" x 45° CHAMFER
3. CLEAR COVER TO REINFORCEMENTS SHALL BE 1"
4. WHERE NECESSARY REINFORCEMENT BARS ARE TO BE BENT AROUND BOLT PEDESTALS & RECESSES.
5. REINFORCEMENT BARS TO BE DEFORMED COLD WORKED BARS TO GRADE 500 N. AS/NZS 4671.

PRECAST PLANKS
TYP ALL JETTY

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	RVD

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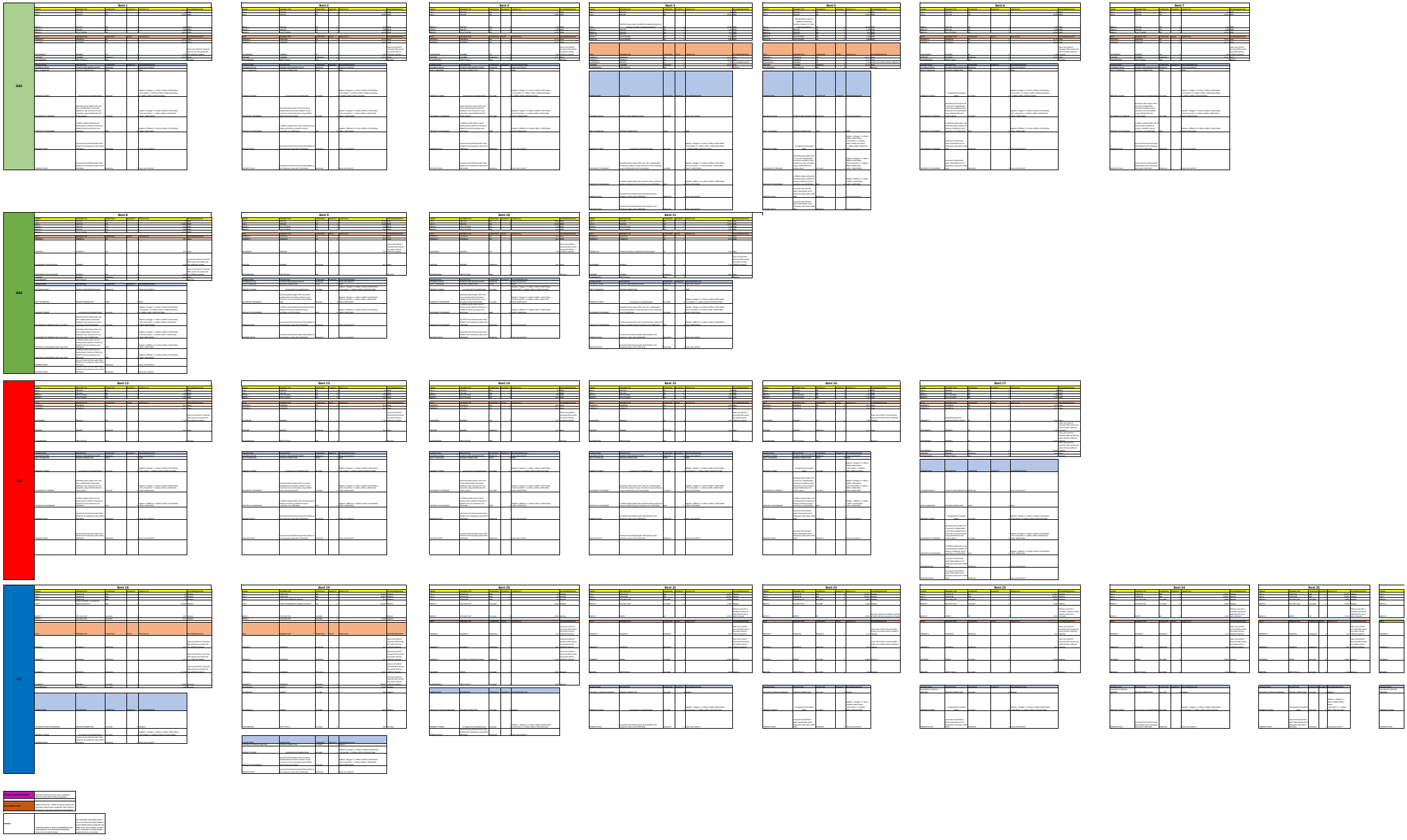
NS	-	-	-

DATUM	GRID	SCALE	PROJECT No.	DRAWING No.	REV.
		AT A1 SIZE	N23028	ST-001.13	A

TITLE
PRECAST PLANKS

Catherine Hill Bay Jetty
1/06/2023 4:43:51 PM

Appendix B -
Summary of Members to be Replaced or Maintained


Bent 1
Bent 2
Bent 3
Bent 4
Bent 5
Bent 6
Bent 7
DA1
Bent 8
Bent 9
Bent 10
Bent 11
DA2
Bent 12
Bent 13
Bent 14
Bent 15
Bent 16
Bent 17
DB
Bent 18
Bent 19
Bent 20
Bent 21
Bent 22
Bent 23
Bent 24
Bent 25
DC

Bent 26

MEMBER TYPE	CONDITION	QUANTITY	LENGTH (m)	RECOMMENDATION
310UC118	Bad	1	12.027	Replace
310UC118	Bad	1	12.027	Replace
219.1x8.2 CHS	Very Bad	1	3.093	Replace
219.1x8.2 CHS	Very Bad	1	9.504	Replace
200PFC	OK	2	2.454	Remove, were for a cantilever section of slabe that has since been removed

MEMBER TYPE	CONDITION	TOTAL	LENGTH (m)	RECOMMENDATION
610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
200UB	Very Bad	3	2.493	Remove
100*75*8 UA	Very Bad	3	4.65	Remove

DESCRIPTION	CONDITION	QUANTITY	RECOMMENDATION
WELDED CONNECTION	Very Bad	4	Replace
Arrangement of welded plates	Very Bad	2	Replace: --Flanges: 2 x 100w x 1500Lx 20thk Plates -Connection: 1 x 400w x 400l x 25hk End Plate
Assumed to be full butt weld, Plate bolted on for temporary state with 2 M20 bolts	Moderate	1	Clean and Confirm*

Bent 27

FRAME	MEMBER TYPE	CONDITION	QUANTITY	LENGTH (m)	RECOMMENDATION
COL 1	310UC118	Bad	1	12.027	Replace
COL 2	310UC118	Bad	1	12.027	Replace
BRACE 1	219.1x8.2 CHS	Very Bad	1	3.093	Replace
BRACE 2	219.1x8.2 CHS	Very Bad	1	9.504	Replace
BRACE 3	200PFC	OK	2	2.454	Remove, were for a cantilever section of slabe that has since been removed

DECK	MEMBER TYPE	CONDITION	TOTAL	LENGTH (m)	RECOMMENDATION
PRIMARY 1	610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
PRIMARY 2	610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
TIE BRACE	200UB	Very Bad	3	2.493	Remove
BRACING	100*75*8 UA	Very Bad	3	4.65	Remove

CONNECTIONS	DESCRIPTION	CONDITION	QUANTITY	RECOMMENDATION
COLUMN TO VERTICAL BRACING	WELDED CONNECTION	Very Bad	4	Replace
PRIMARY TO BENT	Arrangement of welded plates	Very Bad	2	Replace: --Flanges: 2 x 100w x 1500Lx 20thk Plates -Connection: 1 x 400w x 400l x 25hk End Plate
PRIMARY SPLICE	Assumed to be full butt weld, Plate bolted on for temporary state with 2 M20 bolts	Moderate	1	Clean and Confirm*

Bent 28

FRAME	MEMBER TYPE	CONDITION	QUANTITY	LENGTH (m)	RECOMMENDATION
COL 1	310UC118	Bad	1	12.027	Replace
COL 2	310UC118	Bad	1	12.027	Replace
BRACE 1	219.1x8.2 CHS	Very Bad	1	3.093	Replace
BRACE 2	219.1x8.2 CHS	Very Bad	1	9.504	Replace
BRACE 3	200PFC	OK	2	2.454	Remove, were for a cantilever section of slabe that has since been removed

DECK	MEMBER TYPE	CONDITION	TOTAL	LENGTH (m)	RECOMMENDATION
PRIMARY 1	610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
PRIMARY 2	610UB125	Moderate	1	12.2	Clean and confirm* Assumed 20% section loss which still has sufficeint capacity
TIE BRACE	200UB	Very Bad	3	2.493	Remove
BRACING	100*75*8 UA	Very Bad	3	4.65	Remove

CONNECTIONS	DESCRIPTION	CONDITION	QUANTITY	RECOMMENDATION
COLUMN TO VERTICAL BRACING	WELDED CONNECTION	Very Bad	4	Replace
PRIMARY TO BENT	Arrangement of welded plates	Very Bad	2	Replace: --Flanges: 2 x 100w x 1500Lx 20thk Plates -Connection: 1 x 400w x 400l x 25hk End Plate
PRIMARY SPLICE	Assumed to be full butt weld, Plate bolted on for temporary state with 2 M20 bolts	Moderate	1	Clean and Confirm*

Appendix C -
Visual Representation

CATHERINE HILL BAY JETTY

CATHERINE HILL BAY, NSW

DRAWING INDEX	
DRG No.	TITLE
MT-0001	TITLE AND DRAWING INDEX
MT-1000	OVERALL PLAN AND ELEVATION
MT-1010	GENERAL ARRANGEMENT PLAN - SHEET 1
MT-1011	GENERAL ARRANGEMENT PLAN - SHEET 2
MT-1100	GENERAL SECTIONS - SHEET 1

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	AVD
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

REVISIONS

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PROJECT: CATHERINE HILL BAY WHARF
CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

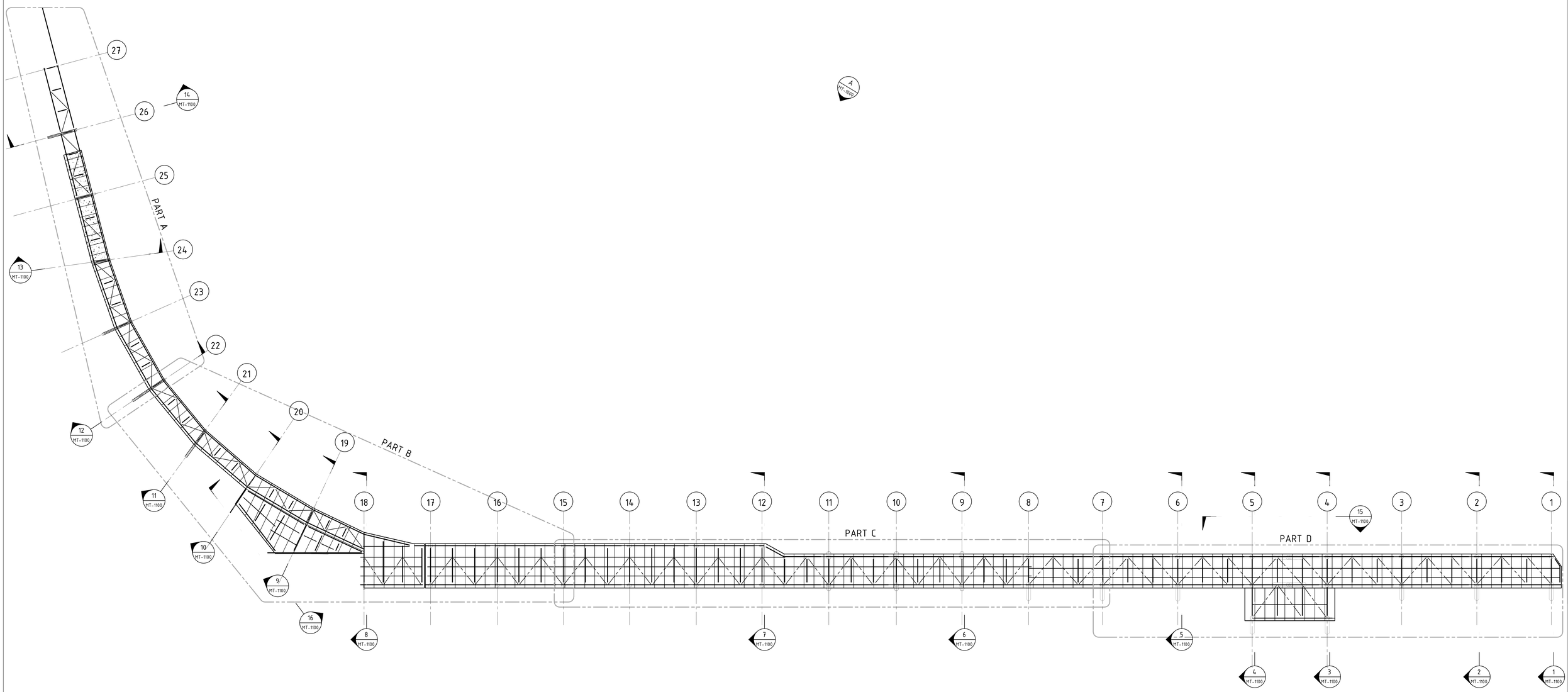
DATUM	GRID	SCALE
		NTS

A1 A0 SIZE

TITLE: TITLE AND DRAWING INDEX

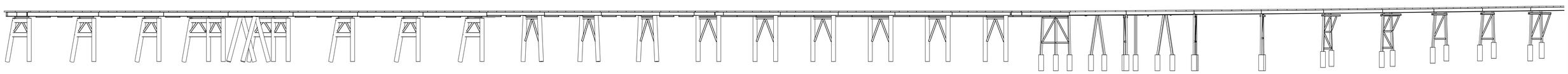
PROJECT No.	DRAWING No.	REV.
N23028	MT-0001	B

19/09/2023 2:08:43 PM Catherine Hill Bay Jetty



OVERALL PLAN

SCALE 1 : 250



GENERAL ARRANGEMENT ELEVATION

ELEVATION A MT-1000

SCALE 1 : 250

REV	DATE	DESCRIPTION	RVD
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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PROJECT

CATHERINE HILL BAY WHARF

CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE @ A1 A0 SIZE

TITLE: OVERALL PLAN AND ELEVATION

PROJECT No. N23028 | DRAWING No. MT-1000 | REV B

DRAWING TO BE PRINTED IN COLOUR

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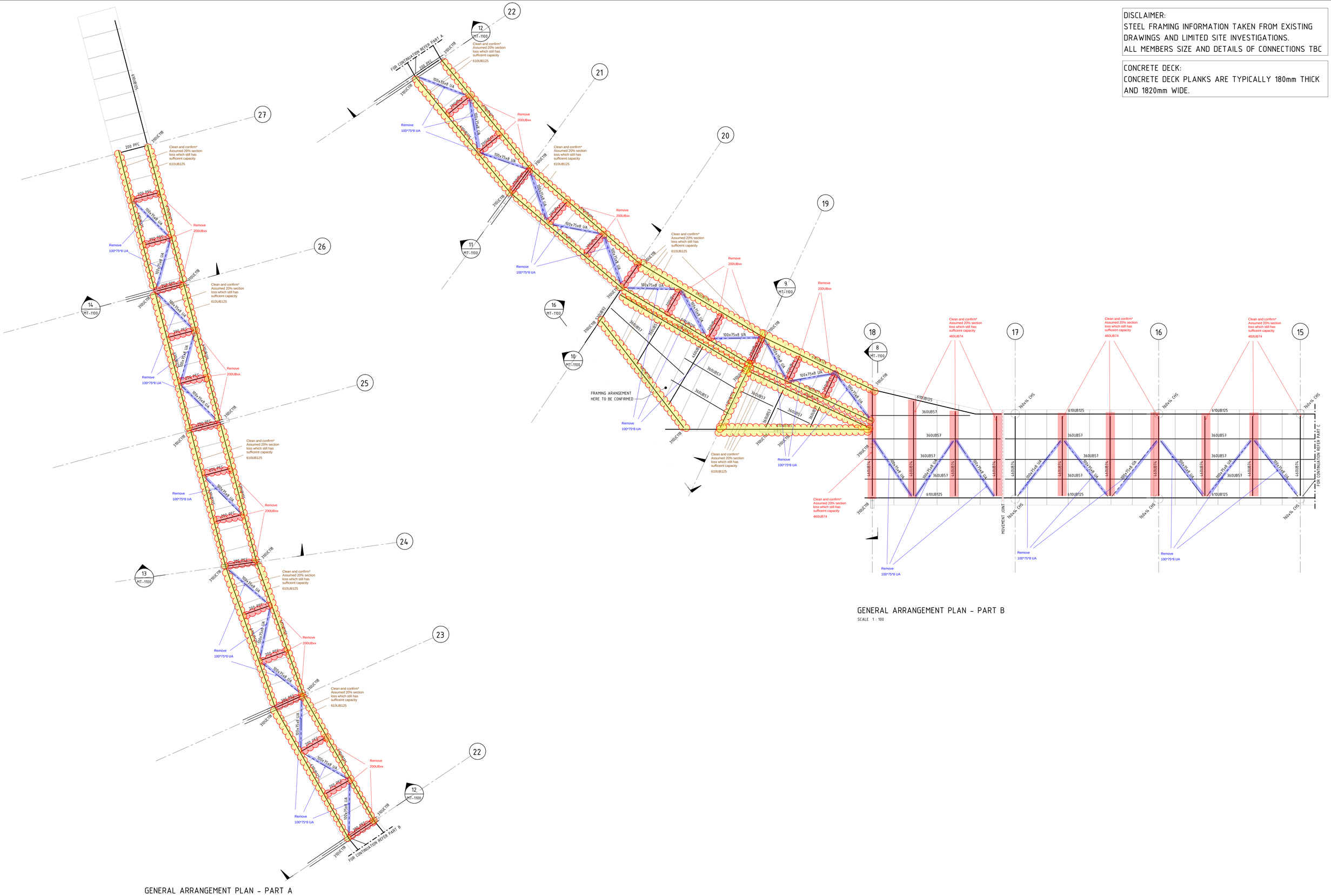
ALL MEMBERS SIZE AND DETAILS OF CONNECTIONS TBC

CONCRETE DECK:
CONCRETE DECK PLANKS ARE TYPICALLY 180mm THICK AND 1820mm WIDE.



GENERAL ARRANGEMENT PLAN - PART A
SCALE 1 : 100

GENERAL ARRANGEMENT PLAN - PART B
SCALE 1 : 100

DRAWING TO BE PRINTED IN COLOUR

REV	DATE	DESCRIPTION	BVD
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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PROJECT
CATHERINE HILL BAY WHARF
CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE (AT A0 SIZE)

TITLE: GENERAL ARRANGEMENT PLAN - SHEET 1

PROJECT No: N23028
DRAWING No: MT-1010
REV: B

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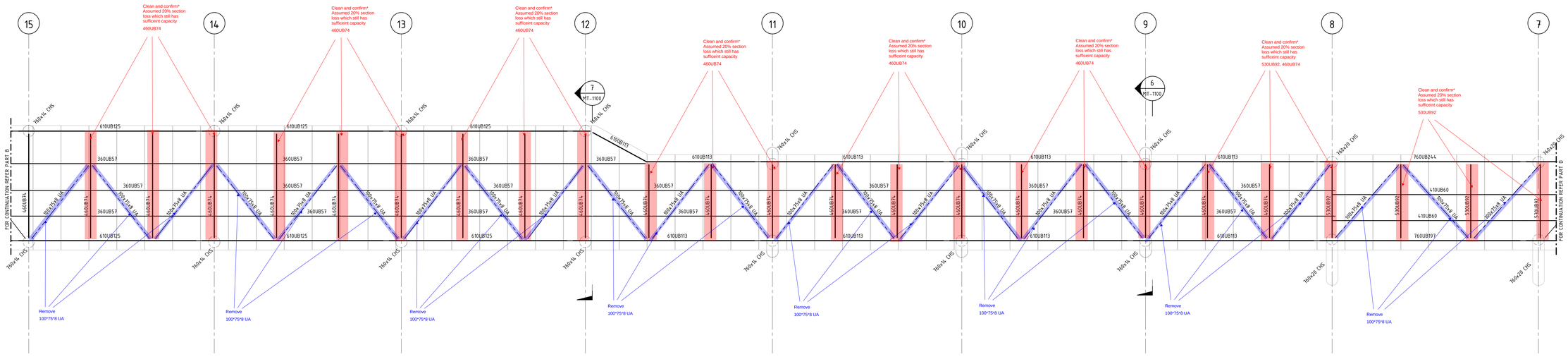
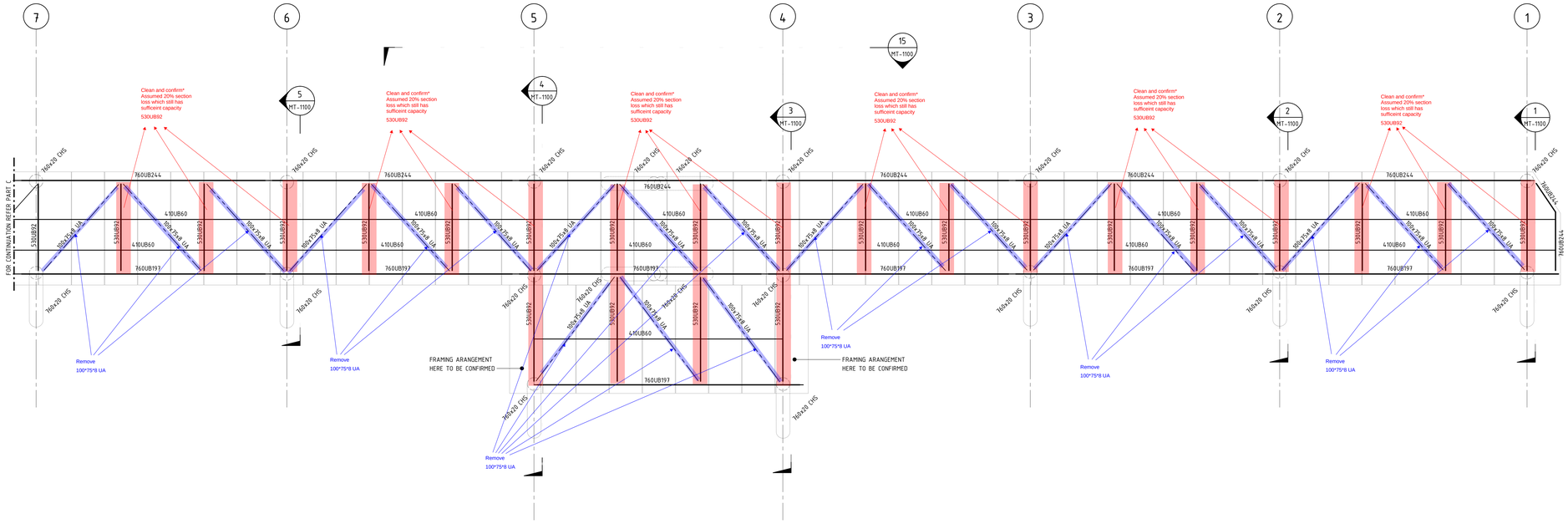


GENERAL ARRANGEMENT PLAN - PART C
SCALE 1 : 100



GENERAL ARRANGEMENT PLAN - PART D
SCALE 1 : 100

REV	DATE	DESCRIPTION	BY/D
B	19.09.23	ISSUED FOR INFORMATION	MC
A	31.07.23	ISSUED FOR INFORMATION	MC

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PROJECT
CATHERINE HILL BAY WHARF
CATHERINE HILL BAY, NSW

STATUS
AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE | A1 A0 SIZE

TITLE
GENERAL ARRANGEMENT PLAN - SHEET 2

PROJECT No. N23028 | DRAWING No. MT-1011 | REV B

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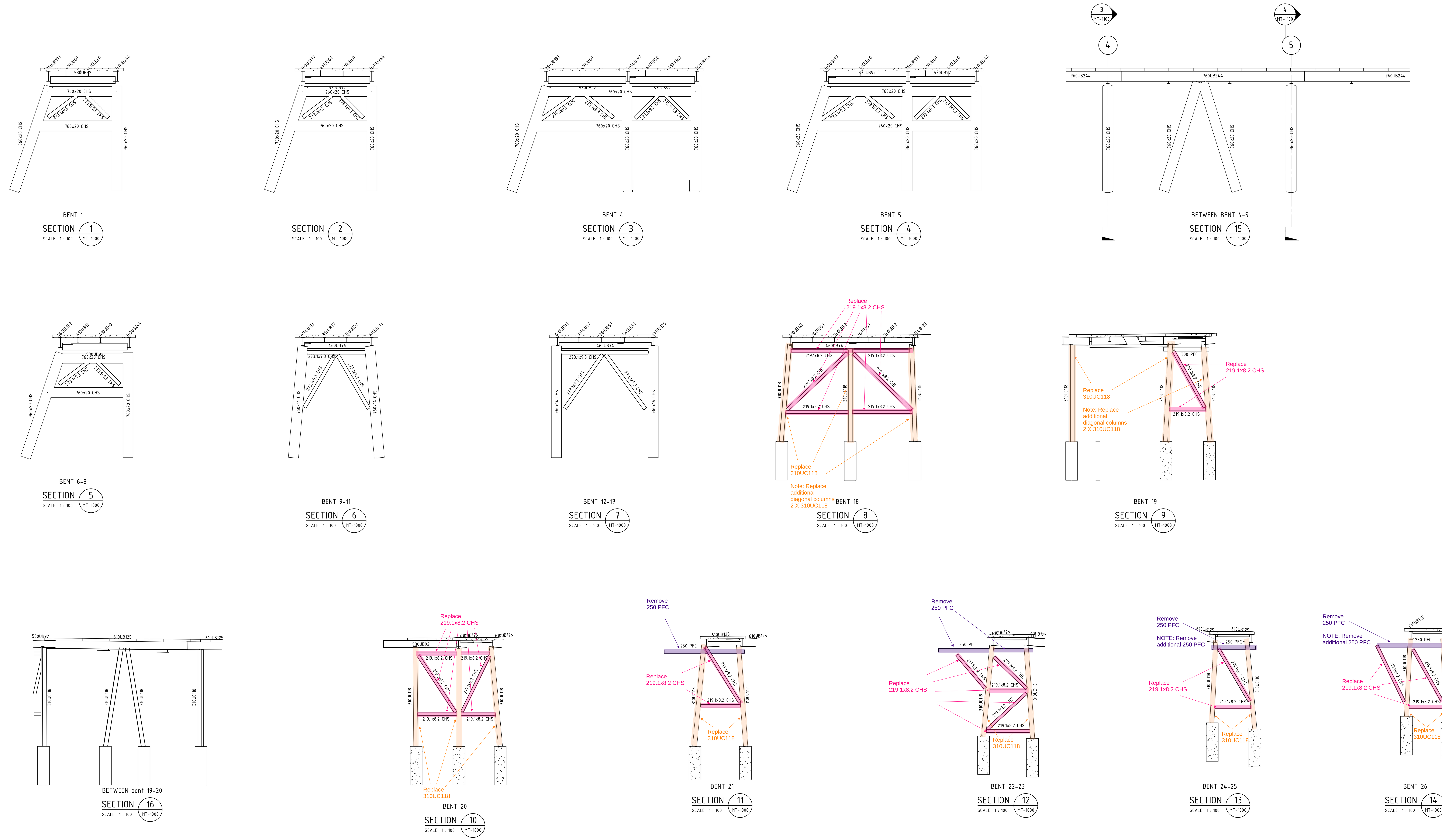

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PROJECT
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CATHERINE HILL BAY, NSW

STATUS: AS CONSTRUCTED

DRAWN	DESIGNED	CHECKED	APPROVED
MC	N/A	NS	N/A

DATUM | GRID | SCALE | AT A0 SIZE

TITLE
GENERAL SECTIONS - SHEET 1

PROJECT No. N23028 | DRAWING No. MT-1100 | REV B

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At BG&E, we are united by a common purpose – we believe that truly great engineering takes curiosity, bravery and trust, and is the key to creating extraordinary built environments.

Our teams in Australia, New Zealand, South East Asia, the United Kingdom and the Middle East, design and deliver engineering solutions for clients in the Property, Transport, Ports and Marine, Water, Defence, Renewables and Resources sectors.

We collaborate with leading contractors, developers, architects, planners, financiers and government agencies, to create projects for today and future generations.

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