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Preliminary Design Report
New Rapid Bay Jetty
Department of Transport, Energy and Infrastructure

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1. Introduction

1.1 Background

The Department for Transport, Energy and Infrastructure commissioned Connell Wagner to prepare a design of a new jetty at Rapid Bay. The jetty is to be used solely for recreational purposes, namely scuba diving and angling. The jetty design will be based upon the concept design previously developed by Connell Wagner, and involves the construction of a jetty adjacent to the existing derelict jetty. The majority of the existing jetty is in a poor condition with the outer portion being closed for public use.

This report does not address any issues relating to the demolition of the existing jetty. It is understood however that the majority of the existing jetty is to remain as it is a popular diver spot and is in an environmentally sensitive area.

1.2 Client's Requirements

The requirements are to carry out design and documentation for the construction of a new jetty directly to the east of the existing structure. The design includes the jetty superstructure, substructure, shelter, divers' stairway and lighting. Documentation is to be in the form of AutoCad drawings.

The jetty is to provide safe access for divers, anglers and tourists to the deep waters of Rapid Bay. The jetty should provide safe access for divers right to the water and provide sufficient deck space for the anglers and visitors. The length of the jetty will depend on cost but should preferably be 300m long.

The jetty is for pedestrian use only with public vehicular use prohibited. However, the jetty design caters for maintenance and emergency vehicle access.

The jetty is to be a public recreational facility. It is not for commercial use.

2. Planning and Layout

The location of the jetty is shown on Drawing 2-6763 Sheet 1 provided in Appendix A. The jetty location is in accordance with the design brief, specifically not closer than 10 metres to the existing jetty at the land end and approximately 30 metres to the east of the existing jetty at the seaward end. This alignment provides an efficient route to deep water. The jetty is to be preferably 300 metres long (depending on cost) with the end of the jetty to be over sea grass beds.

The deck is to be 3.6 metres wide (3.2 metres nominal between handrails), with the last 2 seaward spans (24 metres in total) to be 4.8 metres wide (4.4 metres nominal between handrails). The total area of the deck is approximately 1110 m^2. The deck will be at the level of the existing deck i.e. RL 5.5 CD to be clear of wave action. Chart Datum RL 0.0 m (CD) is at the lowest astronomical tide (LAT) and is equal to -1.030 AHD. A nominal 1% crossfall is provided on the deck for drainage.

A divers' access will be provided at the north-western end of the jetty and will enable divers to enter and exit the water at various tide levels. The divers' access will be along side the jetty, and will be a staircase like structure and have two landings. Mooring points will not be provided on the divers' access.

A shelter is to be provided at the end of the jetty. The shelter is to be approximately 5 metres in length, will have a central dividing wall and is to be roofed.

Solar lights will be provided along the length of the jetty. The divers access will also be lit.

3. Occupational Health and Safety

The design has taken into account the specific requirements of the principal users. The surface of the deck will be wood floated concrete which will not be slippery when wet. A 1% crossfall is provided on the deck for drainage of rainfall. The stair treads and the diving platforms will have open grating to ensure a free draining non-slip surface. Handrails will be provided along both sides of the jetty and around the end jetty and on the stairs and platforms for the divers. The hand rail system on the deck is in accordance with the DTEI Marine Facilities guidelines.

Safety ladders will be placed at 60 metre nominal centres along the length of the jetty in accordance with AS 4997. The provision of other safety aids such as life buoys will be to DTEI requirements.

4. Design Parameters

4.1 Standards

The preliminary design for the jetty generally complies with AS4997 Guidelines for the Design of Maritime Structures, except as discussed later for the deck. Loading combinations are as outlined in AS 4997 and AS 1170.0.

4.2 Design life

A design life of 40 years has been specified by DTEI. As the divers' platform is subject to high cyclic loading due to wave action, a reduced design life of 10 years has been assumed.

4.3 Structural loads

Live Loads

The deck load classification is Class 5 in accordance with AS 4997. This is applicable for public boardwalks and promenades, and caters for pedestrian crowd loading and light vehicles such as maintenance and emergency vehicles. The following live loads will apply:

- Uniformly distributed load — 5kPa
- Concentrated load — 20 kN at 1.8m centres on an area of 150mm x 150mm each.
- Diving platforms and access — 2.5 kPa (in accordance with AS1657)

Wave loads

The design wave information is based upon information previously provided by DTEI and the maximum non breaking wave that could occur at the site from the applicable water depth. Wave loads on the structure were therefore calculated based on the following:

- Annual probability of exceedence — 1/200 (Equivalent to a 50 year design life)
- Wave crest level crest — RL 4.0 CD
- Design wave height — 5.6 m
- Design water level — RL 1.2 CD
- Effective water depth for maximum wave — 8.4 m
- Wave period — 12 sec

Due to the lack of guidance in Australian Codes, wave forces have been calculated in accordance with the Coastal Engineering Manual prepared by the U.S. Army Corps of Engineers.

Current loads

Current loads due to tidal movements are considered to be non critical.

Wind loads

Wind loads have been determined from AS 4997 and AS 1170.2 for Region A1, Terrain category 2
The wind loads have been assumed to be concurrent with the wave loads in accordance with AS 4997.

Seismic loads
Seismic loads have been based on AS 1170.4 for a Type "I" structure

- Importance Factor 1.0
- Site Factor 1.0
- Acceleration Coefficient 0.1
- Design Category B

Seismic loads are considered to be non critical

5. Jetty Structure

5.1 Deck

As per the concept design, a Rocla M-Lock bridge deck system has been adopted for the deck of the jetty. This precast concrete bridge deck system allows for rapid construction and has been specifically developed for bridges. It has been used extensively for rural road projects. It is currently being used in the design of a very similar structure to the Rapid Bay Jetty on Hamilton Island, Queensland.

The jetty cross-section is to consist of 3 No. 1.2 metre wide units giving an overall width of 3.6 metres. In accordance with DTEI requirements, hand rails are to be fixed to the top of the deck resulting in a clear width between rails of approximately 3.2 metres. A cross-section of the deck is shown on Drawing 2-6763 Sheet 1 in Appendix A.

A limitation of the proprietary M-Lock system is that the cover to reinforcing can be no greater than 35 mm. As this system is a standardised design, the cover is fixed by the size of the steel moulds and the size of the reinforcement required. The following table summarises the cover requirements of various Australian Standards based upon a concrete strength of 50 MPa for precast concrete with intense vibration.

	AS 4997		AS 5100.5		AS 3600	
Exposure environment	Class	Cover	Class	Cover	Class	Cover
Air borne sea spray zone,	C1	45	B2	35	B2	25
Splash zone	C2	60	C	50	C	40
Design life	25 years		100 years		40 – 60 years	

AS 4997 Guidelines for the design of maritime structures
AS 5100.5 Bridge design – Concrete
AS 3600 Concrete structures

The deck units are in the spray zone, i.e. above the splash zone. AS 4997 however requires exposed soffits of structures over the sea to be classified as category C2.

As can be seen above, ambiguity exists in the above codes in regard to concrete cover requirements and related design lives for structures in a marine environment. As such, a review of the above codes has been undertaken by Connell Wagner's Materials specialist in regard to achieving a 40 year design life with a cover of 35 mm. Following this review, a performance specification for concrete has been developed in order to achieve a concrete with low porosity and provide sufficient resistance against chloride ion penetration. This concrete mix will result in the Rocla M-Lock units having a design life of 40 years with a cover of 35 mm. A copy of the code review and concrete performance criteria is provided in Appendix B.

5.2 Substructure

The proposed piles are 610mm diameter 12.7mm thick steel piles driven into the sea bed. No recent geotechnical data is present however the records from the construction of the original jetty indicate that rock is likely to be found close to the surface for the majority of the length of the jetty. It is anticipated that piles founded in rock will need an embedment length of 2 - 4 metres. The jetty piles are to be raked at 1 in 5 to provide lateral stability of the pile bents. The piles will have a protective coating applied which will extend to 1.0 metres below sea bed level.

A precast concrete headstock will be placed over the piles. This will incorporate voids to allow a monolithic in-situ concrete connection to be made with the piles. The reinforcement and concrete will extend about 1.8 metres into the pile as shown on Drawing 2-6763 Sheet 1. The concrete cover in the pile headstocks and reinforcement requirements will comply with AS4997.

5.3 Divers' Access Stairway

The divers' access stairway will be located at the north-western end along side the jetty. The access stairway will have 2 landings, one at deck level and the other approximately 1.5 metres above high tide level. The end of the stairway will be 0.5 metres below the lowest astronomical tide level (-0.5m CD). A ladder 1.5 metres long will be provided at the end of the stairway.

The divers' access stairway is to be designed for a live load of 2.5 kPa. The stairway will also be designed for wave and wind loadings. Due to the high cyclic loading of wave action durability of the platforms will be an issue. The design life has been assumed as 10 years, however their performance will be influenced strongly by the magnitude, duration and frequency of major storms.

The platforms will have open mesh decking to reduce the wave loads and to provide a free draining non slip surface. The platforms will be detailed to enable easy replacement of any damaged components.

Mooring points will not be provided on the divers' stairway. Signage will be required to discourage mooring of vessels.

5.4 Lighting

Grid connected solar lighting is proposed for the jetty and the divers' access stairway. The level of lighting will be suitable for pedestrian access along the jetty. A performance specification for the jetty lighting is provided in Appendix C.

5.5 Deck Amenities

Safety ladders will be installed along the length of the jetty at 60 metre centres. The aluminium ladders will extend to 500mm below chart datum.

A galvanised steel Monowills handrail will be provided along the full length of the deck.

A small shelter will be provided at the end of the jetty. The shelter is approximately 5 metres long, and will have a central dividing wall and solid end walls to provide protection from the wind.

5.6 Materials

Material selection is based on constructability and durability in a marine environment. Concrete elements will generally be precast in forms subject to intense vibration using 50MPa strength concrete.

The steel piles have been selected for their strength and durability. They will have a high quality marine grade protective coating applied to them to improve their durability.

The handrails will be galvanised steel whilst the divers' stairway access framing and other metal work will be marine grade aluminium. The decks for the divers' platforms will be FRP (fibre reinforced plastic). These are non-corrosive in a marine environment. All connections will be fully seal welded or bolted using marine grade 316 stainless steel. Separation between dissimilar metals will be made to ensure that bi-metallic actions do not occur.

6. Environmental Issues

The jetty is to be constructed in a sensitive marine environment and therefore the preliminary design has allowed for construction techniques that minimise environmental damage. The main concern is damage to the sea grass beds near the head of the jetty. The preliminary design of the jetty uses steel piles driven into the seabed supporting a precast concrete deck. The environmental impact of piling needs to be considered. There are two options for the installation of the piles. For both options the precast concrete deck units would be erected progressively off completed sections of the jetty. Thus deck placement would have little impact on the marine environment.

Although the piles could be driven progressively from the completed deck the slow construction sequence and difficult logistics in getting material out along the deck are likely to make that method prohibitively expensive. The deck units could not be placed until the precast pile caps had been placed and the infill concrete had cured. This would require a 3-4 week cycle per span, or about a 2 year construction period. Floating plant anchored to the sea bed would still be required to support the guide for the raking piles.

For piling off floating plant the plant would have to be anchored to the seabed. There would be some damage where the anchors are placed. The number of anchor points and the frequency of their relocation will need to be optimised by the contractor. If the anchors are only moved a few times long lead lines would be required and may drag on the bottom thereby causing more damage than if the anchors are moved more frequently and the lead lines keep short. The number of anchors could be reduced if the barge was moored on one side to the existing jetty. This would only be possible if the jetty has sufficient structural integrity to handle the loads. The floating plant would have to be moved to a safe mooring Wirrina Cove in the event of poor weather necessitating the raising of the anchors.

The aerial photo of the site indicates that the majority of the pile driving occurs along the rocky shoreline and sandy sea bed. It is therefore recommended that piling should be carried out off floating plant initially and the impact of the anchors and tie lines monitored. If it is considered that the environmental impacts are acceptable piling off the floating plant should be continued in the sea grass beds.

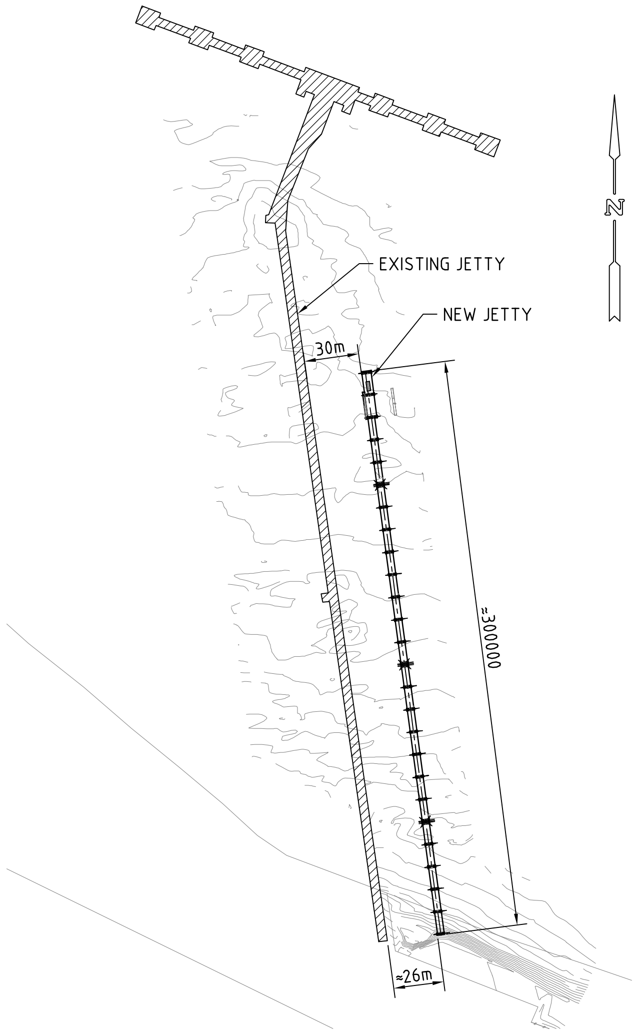
Therefore installation of the piles and pile caps from floating plant is recommended from both an environmental and economic point of view. There would be no delays for curing of concrete. The much reduced construction period would also reduce the risk of accidental environmental damage. A comprehensive construction environmental management plan would be mandatory.

No provisions have been made for collecting rainfall run off from the deck for onshore disposal as there will be very little vehicle traffic and the risk of washing harmful pollutants into the sea is very low.

No provision has been made for fish cleaning facilities.

Appendix A

General Arrangement Drawing 2-6763 Sheet 1



GENERAL PLAN
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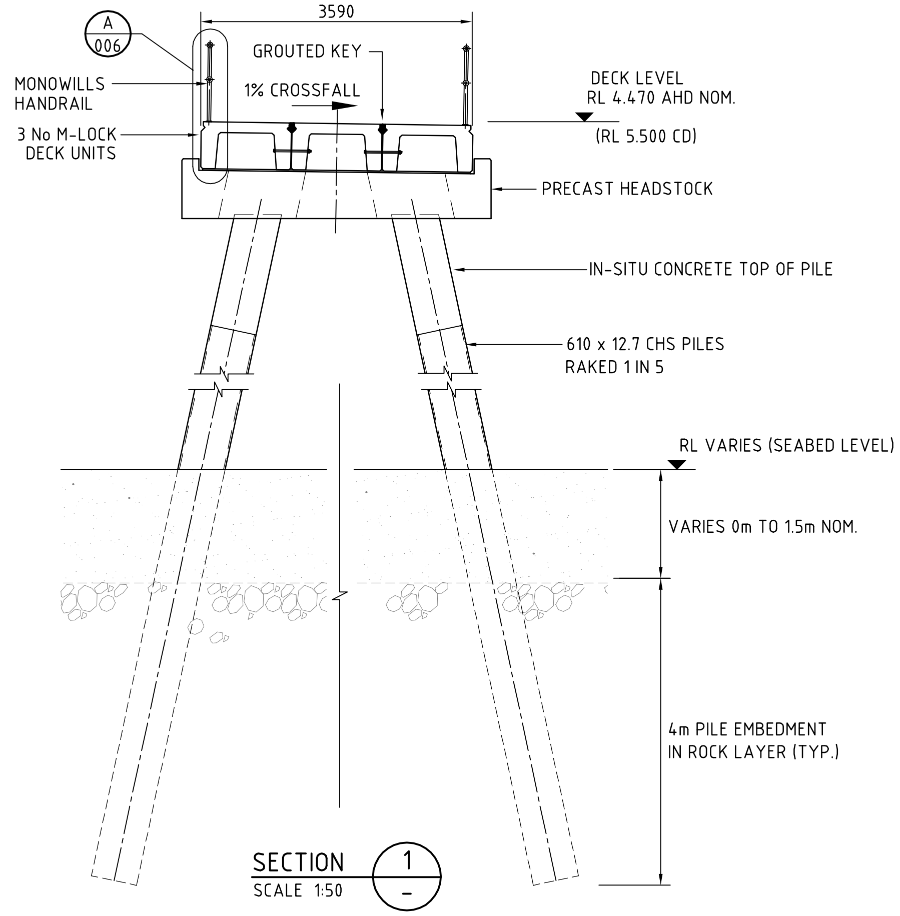
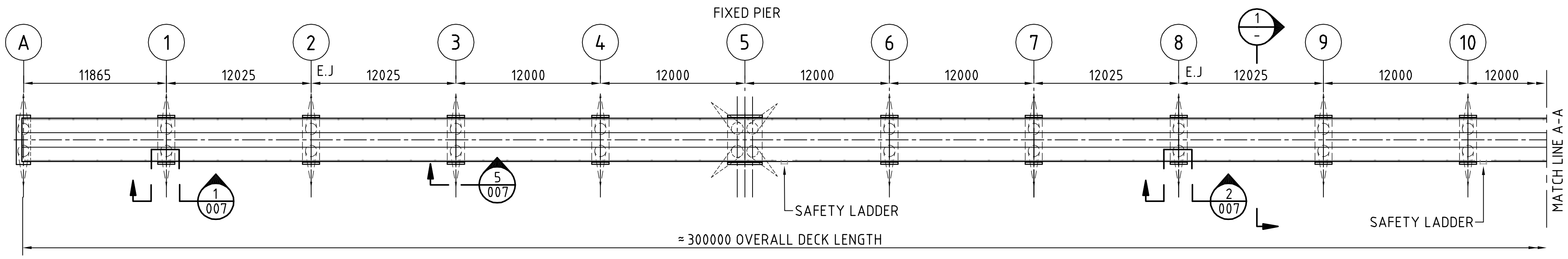


SECTION 1 / –
SCALE 1:50

LOCATION PLAN
N.T.S

SHEET INDEX

001. GENERAL ARRANGEMENT
002. ELEVATIONS & NOTES
003. PILE & SETOUT DETAILS
004. ABUTMENT & WINGWALLS
005. HEADSTOCK CONCRETE
006. HEADSTOCK REINFORCEMENT
007. DECK DETAILS & HANDRAILS
008. DIVERS PLATFORM & STAIR ACCESS
009. SHELTER ARRANGEMENT & DETAILS
010. LIGHTING



GENERAL PLAN
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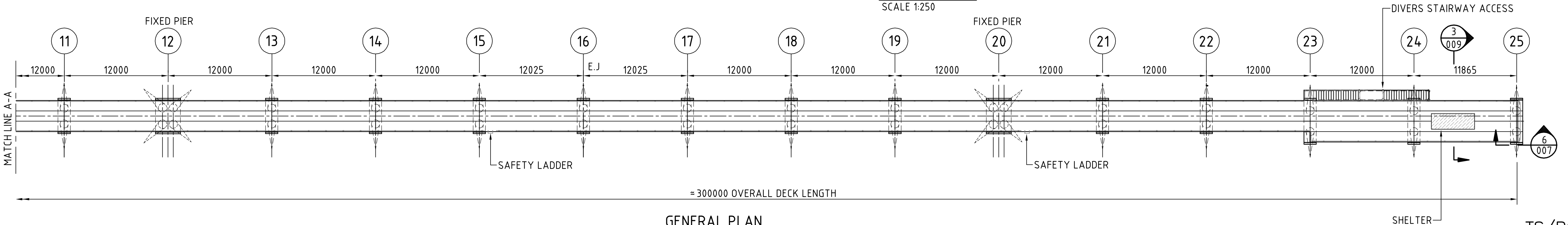

GENERAL PLAN
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PRELIMINARY DESIGN

Government of South Australia
Department for Transport, Energy and Infrastructure
Marine Facilities Section

DESCRIPTION	NO.	DATE	RESP	AUTHORISED	TCD AMENDTS APPROVED FOR E.D.	TSA 27 DATE	TECH. DETAILS APPROVED FOR E.D.	CONSTRUCTED DATE

AMENDMENTS

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Designed	B.JENNINGS	Date	01/07
Verified	–	Date	–
Approved	HCT	Date	–
Job No.	21678-002		
Issue	01		

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INDEX/LOCALITY, GEOM. LAYOUT, SURFACE LEVELS, LONG. SECTION, CROSS SECTIONS, DRAINAGE, SERVICES, SURVEY MARKS, MED. IS. S/BRS, PAVE'T. MARKING, SIGNS, LIGHTING, T. CONTROL LAYOUT, T. CONTROL INST., I'SECTION JUNC., TRAFFIC SIGS., P.A.C./S. XING, DUCT LOCATION, TREE REMOVAL, VEG. SURVEY, LANDSCAPE

DESIGN	APPROVED FOR CONSTRUCTION
DRAWN	
CHECKED	ACCEPTED TO LODGE IN DTEI BY:
PROOF CHECKED	TITLE: DATE:
DTEI CONTACT	CONSTRUCTED BY: DATE:

NEW RAPID BAY JETTY
RAPID BAY
FLEURIEU PENINSULA
GENERAL ARRANGEMENT

PROJECT START : RRD. | PROJECT END : RRD.

PROJECT NO	SURVEY	FILE	AMEND	SHEET	DRG
				001	2–6763

Appendix B

Performance requirements for M-Lock precast units for Rapid Bay Jetty

Performance requirements for M-Lock precast units for the Rapid Bay Jetty

General

The M-lock precast concrete units proposed for use at the new Rapid Bay Jetty are reinforced concrete elements with a minimum concrete cover of 35 mm from the soffit side. The units are installed on concrete headstocks using Grade 316 stainless steel bolts and fixings.

According to AS 4997, the exposure condition for the soffit is C2 and of the topside of deck slab is C1. For precast concrete, AS 4997 provides the following requirements for 50 MPa Grade concrete:

- For topside of deck slab: 50 MPa/45 mm cover
- For soffit side of deck slab: 50 MPa/60 mm cover
- Cementitious content greater than 40 kg/m^3
- Water-to-binder ratio not more than 0.40
- Drying shrinkage @ 56 days less than 600 x 10^{-6} mm/mm
- Water cured for not less than 7 days
- Minimum reinforcement diameter ≥ 16 mm for slabs
- Maximum allowable reinforcement steel stress at serviceability limit state ~ 175 MPa, 160 MPa and 150 MPa for 16 mm, 20 mm and ≥ 24 mm diameter bars respectively

In addition to the above, AS 4997 notes further that “A design life of 25 years can be expected where the above tables are adopted for cover to reinforcement. Engineering judgment is required where a longer service life is required. ….”. Although additional measures are mentioned, there are no specific procedures or methodologies recommended to achieve longer service life in AS 4997 in terms of requirements for concrete characteristics.

The M-lock precast units with a cover of 35 mm, therefore, would not satisfy the requirements of AS 4997 for exposure classification C2. Strictly speaking, with 35 mm of 50 MPa concrete cover, AS 4997 suggests that the design life would be much less than 5 years since the cover requirement for a 5 year design life is 45 mm with 50 MPa concrete (see Note 4 and using Table 6.5).

Practical experience of marine concrete structures would suggest that AS 4997 is extremely conservative. This may be justifiable for irreplaceable marine structures of national/international importance or marine structures whose loss of serviceability would lead to substantial economic/personal loss.

In this particular case, an approach to durability of marine concrete is presented. This approach is based on current understandings of performance requirements relevant to reinforced marine concrete. With the exception of concrete cover which is constrained at 35 mm minimum for the M-Lock system, other requirements given in AS 4997 for concrete will be retained as minimum benchmarks.

Requirements of concrete suitable for M-Lock precast decking system

In a marine splash zone, the main requirement of concrete performance is its resistance to chloride ion penetration. This is based on the consideration that corrosion of steel reinforcement is acknowledged as the main cause of loss of durability of marine concrete structures. There is no apparent reason to suggest that this would be different for Rapid Bay Jetty.

Procedures for prediction of service life of concrete with respect to chloride induced corrosion of steel reinforcement have been established for sometime. In this case, the service lives of marine concrete with 35 mm cover are estimated under different scenarios. The objective of this particular exercise is to determine a set of parameters from which performance criteria of concrete are derived. The performance criteria (besides the minimum levels set in AS 4997) are used to maximise the probability of achieving a 50 year service life of precast concrete in a marine environment with 35 mm minimum cover.

The results of the chloride ion penetration analysis into concrete are summarised in the following Table for an exposure period of 50 years.

Case No	Chloride Diffusion Coefficient ($m^2.s^{-1}$) after 28 days of exposure	m	C_o max % w/w concrete	Time to reach C_o (y)	Chloride concentration at 35 mm depth (w/w concrete)
1	3×10^{-12}	0.1	0.8	5	0.52
2	2×10^{-12}	0.1	0.8	5	0.46
3A	1×10^{-12}	0.1	0.8	5	0.35
4	3×10^{-12}	0.2	0.8	5	0.44
5	2×10^{-12}	0.2	0.8	5	0.37
6A	1×10^{-12}	0.2	0.8	5	0.24
7	3×10^{-12}	0.3	0.8	5	0.34
8	2×10^{-12}	0.3	0.8	5	0.27
9A	1×10^{-12}	0.3	0.8	5	0.14
10	3×10^{-12}	0.4	0.8	5	0.24
11	2×10^{-12}	0.4	0.8	5	0.17
12A	1×10^{-12}	0.4	0.8	5	0.07
3B	1×10^{-12}	0.1	0.7	5	0.31
6B	1×10^{-12}	0.2	0.7	5	0.21
9B	1×10^{-12}	0.3	0.7	5	0.12
12B	1×10^{-12}	0.4	0.7	5	0.055
3C	1×10^{-12}	0.1	0.6	5	0.26
6C	1×10^{-12}	0.2	0.6	5	0.18
9C	1×10^{-12}	0.3	0.6	5	0.105
12C	1×10^{-12}	0.4	0.6	5	0.045

With consideration to the cover of 35 mm and a high relative humidity in concrete (most probably > 95%), the chloride concentration of 0.08 % is chosen as the level of chloride which can initiate corrosion of steel reinforcement. It should be noted that a chloride threshold level of 0.05% would be more appropriate for a smaller concrete cover whilst a higher chloride level of 0.1% and greater is more reasonable for a larger concrete cover. This consideration is based on the pattern of development of corrosion rate of steel at similar chloride concentrations but at different concrete cover depth and/or at different relative humidity.

The results of the chloride analyses given above suggest clearly that in order to attain a design life of 50 years with 35 mm concrete cover, the following requirements are necessary:

- Chloride diffusion coefficient (at 28 days) of concrete mix $D_{28\ days}$ should be about 1×10^{-12} $m^2.s^{-1}$
- The value of m should be about 0.4

The m value is used for characterising the time-dependent characteristic of chloride diffusion coefficient. It is a factor dependent on the concrete mix proportion and particularly on the composition of the binder. For normal Portland cement concrete, this factor – as measured in the laboratory or as observed on real structures – is in the range of 0.3 or less. The observation of m greater than 0.3 for Portland cement concrete is very rare. On the other hand, the m factor for blended cement concrete is generally in the range of 0.5 (m ~ 0.8 has been reported/observed for blended cement concretes).

The requirement of m ~ 0.4 and greater implies that the M-Lock precast unit must be made from blended cement.

The requirement of $D_{28\ days}$ ~ 1×10^{-12} $m^2.s^{-1}$ suggest that the water-to-binder ratio of the concrete should not be higher than 0.4 and would be in the range of 0.350 to 0.375.

For a 25% fly ash concrete mix, it is possible to produce a 50 MPa grade concrete (average strength ~ 55 to 58 MPa), using about 335 kg/m^3 of portland cement, 115 kg/m^3 of fine grade fly ash (total binder content of 450 kg/m^3) and water-binder-ratio of 0.375 (up to about 170 l/m^3 of water). The resistance to fly ash concrete will be further assured by specifying a water-binder-ratio 0.35

In addition to the above, in a precast situation where a high early strength is required, it is suggest further that amorphous silica/silica fume should be considered in the concrete mix. The *optional* inclusion of silica fume – at about 22 kg/m^3 or ~ 5% to total binder of 450 kg/m^3 would lead to achievement of early strength favourable for stripping as well as improved abrasion erosion resistance. The presence of silica fume will also ensure that the m factor will be at least 0.4 as required. It is emphasised that the inclusion of silica fume is optional and is suggested for obtaining early age strength when considered necessary.

The overall concrete mix would be as follow:

- Blended cement with binder content not less than 450 kg/m^3
- Blended cement should contain 25% fine grade fly ash (112 kg/m^3) and optional 5% silica fume (22 kg/m^3) or equivalent amorphous silica when required
- W/B $\leq$ 0.35
- Water content of the concrete should not be more than 170 l/m^3

The m value of such concrete would be well above the required 0.4.

It should be noted that the above are suggested concrete mix design parameters for consideration. The objective is to match the probability of a achieving a 40 year design life to that achieved by designing the structure in strict accordance with recognised design codes. Actual mix design/proportioning should be left with the concrete supplier.

Performance criteria

The following are suggested performance criteria for concrete, which will provide sufficient resistance to chloride ion penetration for maximising the probability of achieving a design life of 40 years in marine splash zone with 35 mm cover.

Wet concrete	
Cementitious content: - minimum - maximum	400 kg/m^3 500 kg/m^3
Cementitious binder materials	GP Portland cement with 25% FA
Maximum water/cement ratio	0.35
Maximum aggregate size	20 mm
Slump to AS 1012 Part 3 prior to adding admixture	agreed mix value ± 10 mm
Slump to AS 1012 Part 3 after adding admixture	≥120 mm, ≤ 220 mm or as agreed
Air content	≤ 2%
Hardened concrete	
Compressive strength 28-day required quality control strength (Q) Measured in accordance with AS 1012 Part 9 7 day strength 56 day strength	 not < 50 MPa ≥ 70% of 28 day strength ≥ 60 MPa
Maximum drying shrinkage measured in accordance with AS 1012 Part 13: approved trial mix at 28 days in situ concrete at 28 days	 470 microstrain 500 microstrain
Curing requirements Wet curing	 Strength ≥ nominated 7 day strength
Temperature rise • Maximum temperature • Maximum temperature rise	 ≤ 65˚C ≤ 35˚C
Chloride Permeability (ASTM C1202) • at 7days • at 28 days • at 56 days Chloride Permeability (CSIRO's modified ASTM C 1202) measured at 56 days	 <2000 coulombs <1500 coulombs <1000 coulombs < 500 coulombs

In the above table, the performance criteria related to chloride permeability are based on indirect testing methods of ASTM C1202 and CSIRO's Modified ASTM C 1202. The criteria given are aimed at achieving a concrete with favourable pattern of development of chloride diffusion coefficient with time and low porosity. It is recommended that a laboratory trial concrete mix be carried out based upon the design concrete mix.

Appendix C

Lighting Performance Specification

Rapid Bay Jetty Lighting Performance Specification for D&C

General Description
This component of the project comprises the design and construction of solar, grid-connected public lighting to the new jetty. This includes liaison with ETSA Utilities to provide a new dual direction metered supply to the new jetty.

Lighting Design Solution
The design and installation shall as a minimum meet the requirements of:
1. The Service Rules and Conditions of Supply by ETSA.
2. Australian Standard AS 3000 – Wiring Rules.
3. Australian Standard AS 1158 – Lighting for Roads and Public Spaces.
4. Building Code of Australia.
5. Insurance Council of Australia Regulations.
6. Occupational Health and Safety Act.

The final lighting design solution shall meet the requirements of AS/NZS 1158, Category P4 as a minimum. High Pressure Sodium (HPS) lamps shall be utilised for the light source.

Lighting is to be controlled via a Photoelectric (PE) cell to ensure the lighting remains on between dusk and dawn only. The PE cell shall be a single item located in an appropriate location, rather than integral to each luminaire.

The final design shall take into consideration both the safety for the initial installation, but also the future maintainability of the light fittings including lamp replacement. It shall be possible to maintain the light fittings from the jetty itself without the need for expensive, cumbersome equipment. Details of the proposed maintenance strategy shall be submitted for review with the design.

Consideration shall be given to vandalism for all components of the installation both by way of access prevention to critical components and strength & resistance to accessible items such as the pole and luminaire itself.

General Luminaire Pole Construction Requirements
Light poles shall be mounted directly to the jetty and shall be designed to house all required control gear. Access panels shall be provided at low level for pole cable connections and fuses.

Poles, light fittings and connections shall be designed and constructed for a minimum design life of 25 years within the marine environment.

Solar Panels
Solar panels are to be provided on each pole, orientated to provide the maximum average sun hours over the calendar year for the installed location. A minimum of 2x80W polycrystalline solar panels shall be installed on each pole, however the final design solution shall recover a minimum of 80% energy used to operate the lamps. A larger array shall be provided to meet this requirement should it be necessary for the chosen design.

All required inverters and controls shall be installed within each pole in a location easily accessible for maintenance. A minimum inverter efficiency of 95% shall be maintained.

Consideration also needs to be given to the prevention of vandalism. Appropriate measures shall be taken in the design to discourage permanent resting of wildlife.

A minimum warranty for the design life quoted above shall be provided for the solar installation.

Cabling
All cabling shall be appropriately rated for both current carrying capacity and a maximum voltage drop of 5% to the final luminaire from the point of supply. All cabling shall be appropriately protected within conduit and be appropriately concealed within the jetty structure.

ETSA Connection & Metering
ETSA Utilities has indicated that a private supply is its preference for the new jetty lighting. Confirmation of available supply at the site shall be confirmed in the first instance with ETSA (there appears to be a supply to the existing jetty lighting).

Undertake all aspects of the ETSA connection enquiry and inform the client of the associated costs for their action. Coordinate the construction and programming of the supply to the new jetty. This shall include all requirements for the installation of dual direction metering.

A new metering enclosure shall be provided at a suitable location for the supply to the new jetty lighting. This enclosure shall be constructed of marine grade stainless steel and be appropriately sealed for its location. The enclosure shall contain dual direction metering, supply fuses (to be confirmed by ETSA), circuit protection to the new lighting circuits and associated controls for operation by the PE cell.

Documentation
The following design documentation shall be submitted as a minimum for approval prior to construction:

1. Detailed modelling results showing lux levels including details of the maximum, minimum, average and uniformity
2. Plan showing proposed pole locations
3. Technical details of the proposed luminaires
4. Technical details of the proposed solar system, including energy recovery calculations
5. Pole details, including proposed connection method
6. Details of the final power supply arrangement to the jetty
7. Construction details of the metering enclosure
8. Details of the proposed ongoing maintenance strategy

Upon completion of the project 'As Built' documentation shall be compiled for the lighting system which shall include all of the above in final format.