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**S10 EARTHWORKS FOR STRUCTURES**

*Example from Blanchetown Bridge:*

***EXCAVATION***

*Excavated material must be used in accordance with Clause R10.4 "Materials for Earthworks". The allowable tolerances on excavations must be + 0, - 50 mm.*

***BACKFILL***

***1. Extent***

*For the purpose of this Clause, all fill works required to achieve the required design levels after the removal of the surcharge material on the Waikerie embankment must be treated as backfill.*

*The following backfill must be carried out prior to launching any segments:*

1. *To the underside of the slope protection in front of the Waikerie abutment.*
2. *To a level not less than 1.0 m below the top of the Waikerie abutment sill and extending a minimum of*
3. *16 m behind the back face of the abutment. This requirement is to be maintained throughout all launching operations to ensure adequate resistance is achieved during launching.*

***2. Material***

*Backfill material must be classified, placed and compacted in accordance with Part R10 "Construction of Earthworks"*

*Example from Port Road Bridge:*

***EXCAVATION BATTERS***

*Excavation batter slopes must be no steeper than:*

1. *one vertical to one horizontal on the northern side of the river*
2. *one vertical to one and a half horizontal on the southern side of the river.*

*Following completion of excavation to the piling bench level, a* ***hold point*** *shall apply to allow an inspection of the cut batter face. As a result of these inspections, the Contractor may be directed to:*

1. *Spray sections of batter slopes with bitumen emulsion to prevent erosion.*
2. *Spray sections of batter slopes with shotcrete to provide local stability*
3. *Undertake additional excavation to adjust batter slopes or provide benching.*

*The Contractor must take measures to prevent excessive wetting of all slopes by appropriate grading of the surrounding area and the installation of top-of-slope cut-off drains.*

*\_\_\_\_\_\_\_\_\_\_\_\_*

**S15 DRIVEN PILES**

*Example from Blanchetown Bridge:*

*A permanent land spit may be constructed to the extent shown on Drawing No. 2-5941, sheet 1 prior to driving piles for piers 2 and 3.*

*The spit may be constructed using Type B and Type C Material provided the Contractor can show that imported material will not be required for the approach roadworks as a result of this work, otherwise imported Material must be used.*

*The spit must be constructed to match the top of the pile cap (RL 4.9 m) at piers 2 and 3 and must be graded at 3% so as to drain away from the pile caps.*

*The depth of the River Murray in the location of the spit varies between 1 m and 2 m when the river is at normal pool levels (RL 3.2 m).*

*If the Contractor elects not to construct the above spit then the pilecaps for piers 2 and 3 must be constructed as detailed for pier 4 including precast skirts.*

*Payment for the construction of the spit or the extra cost to construct river pile caps in lieu of land pile caps will be made as part of the Lump Sum.*

*In addition to the tree removal required in the Murray River, the Contractor must ensure the river bed is clear of obstructions in the vicinity of the pile driving at all pile locations.*

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**S16 CAST-IN-PLACE-CONCRETE PILES**

*Include:*

*any requirements or restrictions not shown on the drawings regarding construction techniques*

*any requirements for ultimate resistance testing or test piles.*

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**S20 REINFORCED SOIL STRUCTURES**

*e.g. Abutment loading on wall, texture finish on concrete panels, any requirements for testing of Shear Strength and Coefficient of Friction or any other additional tests*

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**S22 SOIL NAIL WALL STRUCTURES**

*e.g., texture finish on facing*

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**S25 PRE-TENSIONED CONCRETE**

***SPECIAL REQUIREMENTS FOR HANDLING, STORAGE AND TRANSPORTING***

*For specific requirements for prestressed concrete piles, refer to Clause S15.2.2 "Handling and Stacking of Piles".*

*Where not specifically shown on the Drawings, details of proposed methods for lifting and supporting the members must be submitted for approval.*

***TRIAL STRESSING REQUIREMENTS***

*None required.*

***TESTING OF GROUT***

*The frequency of testing during construction must be as follows:*

1. *Compressive Strength*
2. *Bleeding*

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 **INCREMENTALLY LAUNCHED STRUCTURES**

*Example from Blanchetown Bridge:*

***LAUNCHING PROCEDURE***

*The design and detailing of this structure has been undertaken to suit conventional prestress jacks.*

***LIMITATIONS ON CONSTRUCTION SEQUENCE AND LAUNCHING***

*Sections of bridge superstructure must be completed with kerbs, barriers, footpath and drainage units prior to each segment being launched beyond the Adelaide extremity of the Waikerie abutment, i.e. M001 chainage 2 664.00 m.*

*During launching and until completion of Stage 2 prestressing the sum of the variation from specified launch bearing levels for any pair of longitudinal supports along the bridge must not exceed 10 mm.*

***RESTRICTIONS ON TEMPORARY WORKS***

*Over-excavation at the Adelaide cutting will be required to provide clearance for the launching nose for the final launching operations.*

***LAUNCHING NOSE - DESIGN ASSUMPTIONS***

1. *The length of the launching nose is 30 m from the centreline of the nose jack to the rear of the launching nose.*
2. *The mass and mass distribution of the launching nose lies below the maximum values shown in the Table below.*
3. *The second moment of area of the launching nose at any point lies between the maximum and minimum values shown in the Table below.*
4. *The connection between the launching nose and the girder has been designed for the loads shown in the Table below.*
5. *The launching nose must be designed to take the shear forces and bending moments shown in the Table below.*

|  |
| --- |
| **DESIGN ENVELOPES FOR LAUNCHING NOSE** |
| Distance from Nose / Concrete Connection (m) | 0 | 7.5 | 15.0 | 22.5 | 30.0 |
| Launching Nose Max | 19.62 | 17.22 | 14.81 | 12.41 | 10.00 |
| Weight (kN/m) Min | 14.10 | 11.95 | 9.80 | 7.64 | 5.49 |
|  |  |  |  |  |  |
| Second moment Max | 0.36 | 0.28 | 0.20 | 0.12 | 0.04 |
| of area (m4) Min | 0.22 | 0.17 | 0.12 | 0.07 | 0.01 |
|  |  |  |  |  |  |
| Shear force (kN) | 5 860 | 4 120 | 2 400 | 1 380 | 0 |
|  |  |  |  |  |  |
| Bending Tension bottom | 35 770 | 19 320 | 8 680 | 3 380 | 0 |
| moment (kN/m) Tension top | -6 130 | -3 300 | -1 360 | -410 | 0 |

NOTE: Values in this table apply for the full launching nose cross section - i.e. two girders.

***LOAD CHECK ON LAUNCHING NOSE BARS***

**1. Location of Segment/Nose Joint for Load Check**

The load check must be carried out when the segment/nose joint is at the following locations:

1. Pier 8
2. Pier 6
3. Pier 3.

**2. Specific Bars to be Checked**

The load in one bottom bar in each launch nose girder must be checked at each of the above locations.

***SPECIAL REQUIREMENTS FOR PERMANENT BEARING INSTALLATION***

During the installation of the permanent bearings, the bridge must be fixed at the launch abutment.

The tolerance on the level of the girder soffit at pier/abutment supports must be ± 10 mm from the theoretical level.

Not withstanding the above, during the removal of the launching bearings and the installation of the permanent bearings the girder must be lifted by an equal amount under each web at all times and must not be raised by more than 10 mm at one pier or abutment relative to the adjacent piers. The level of the webs at the same pier/abutment location must not differ by more than 1 mm during the installation of permanent bearings.

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**S28 FIBRE REINFORCED POLYMER COMPOSITE STRENGTHENING OF CONCRETE STRUCTURES**

***1. MATERIAL PROPERTIES***

*The Fibre Reinforced Polymer Composite material must have the following properties:*

1. *Carbon Fibre Laminate (Carbon fibre reinforced with epoxy matrix)*
	* 1. *Be available in a range of modulii and strength grades, widths and thicknesses.*
		2. *Elastic Modulus - not less than 205 000 MPa.*
		3. *Tensile Strength - not less than 2 400 MPa.*
		4. *Elongation at Break - not less than 1.2%*
		5. *A volumetric fibre fraction of not less than 70%*
		6. *Temperature Resistance - Between 150oC and 500oC.*
2. *Carbon Fibre Fabric (High strength carbon fibres)*
3. *Elastic Modulus - not less than 20 000 MPa.*
4. *Tensile Strength - not less than 2 400 MPa.*
5. *Elongation at Break - not greater than 1.6%*
6. *Thickness for static design - not less than 0.055 mm (per 100g/m2)*
7. *A fibre density not less than 1.6 g/m3*
8. *Adhesive for Carbon Fibre Laminate*
9. *Adhesive Strength - not less than 3.5 MPa; or concrete failure*
10. *Shear Strength - not less than 15 MPa or concrete failure*
11. *Compressive Strength - not less than 60 MPa at 7 days*
12. *Tensile Strength - not less than 30 MPa at 7 days*
13. *Static E-Modulus - not less than 12 000 MPa*
14. *Coefficient of Thermal Expansion - 9 x 10 -5 per oC*
15. *Ability to be built up to 20 mm thickness without additional filler.*
	1. *Saturating Resin*
16. *Adhesive Strength - not less than 1.5 MPa; or concrete failure*
17. *Tensile Strength - not less than -30 MPa at 7 days*
18. *Flexural E-Modulus - not less than 3,800 MPa (cured at 7 days)*
19. *Flexural Strength - not less than 40 Mpa at 7 days*
20. *Compressive Strength - not less than 60 MPa at 7 days*
21. *Viscosity - not greater than 2 000 cps @ 25°C*
22. *Application Temperature - between 5°C and 35°C ambient and substrate*
	1. *Primer*
23. *Adhesive Strength - not less than 1.5 MPa or failure in concrete*
24. *Tensile Strength - not less than 30 MPa at 7 days*
25. *Flexural E-Modulus - not less than 3 800 MPa (cured at 7 days)*
26. *Flexural Strength - not less than 40 MPa at 7 days*
27. *Compressive Strength - not less 60 MPa at 7 days*
28. *Viscosity - not greater than 2 000 cps @ 25oC*
29. *Application Temperature - between 5oC & 35oC ambient and substrate.*
30. *Putty Filler*
31. *Compressive Strength (24 hr) - not less than 56 MPa*
32. *Compressive Strength (7 days) - not less than 92 MPa*
33. *Tensile strength (7 days) - not less than 60 MPa*

***2. TRIAL SYSTEM APPLICATION***

*The test area must be located on the first joint at the southern end of the east bridge. 3 test strips must be applied in accordance with the requirements of the Specification and Drawings.*

*All inspection and testing requirements of the Specification must be carried out on the trial strips.*

*Epoxies and resins must be sampled and tested in accordance with Clause 7.5.*

*Two adhesion (pull off) tests must be conducted on the trial strips.*

***3. INSPECTION AND TESTING***

*Test locations must be determined by the Superintendent.*

*The frequency of testing of FRPC strips must be two tests on the underside of each span and one test at the top of each pier (i.e. 8 tests per bridge).*

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**S30 THE FABRICATION AND ERECTION OF STRUCTURAL STEELWORK**

***FIELD WELDING***

*Field welding of beams must not be permitted except as indicated on the Drawings.*

*All field welding must be carried out inside a shelter which must offer complete protection from the elements including wind.*

*Field splice welding may be required for splicing of piles, if additional lengths are required.*

*All field welding for piles must be full penetration butt welds.*

***ERECTION REQUIREMENTS***

***SPECIFIC WELDING REQUIREMENTS***

*The 9 mm web to flange fillet welds must be made by fully automatic welding processes. The Contractor must demonstrate by means of a macro test on a production run, that a deep penetration weld with a D2 value of at least 2 mm (Figure 3.3.2 AS 1554.1) has been achieved.*

*On completion of the macro test and prior to commencement of fabrication, a* ***hold point*** *shall apply.*

*Low hydrogen welding process must be used throughout. The minimum yield strength of electrodes used must be 350 MPa.*

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**S35 PROTECTIVE TREATMENT**

***1. EXTENT OF TREATMENT***

1. ***SERVICE ENVIRONMENT***

*The structure should be treated as being in an atmospheric environment*

*The following surfaces should be treated as being in an immersed in water/buried in soil/other environment*

***2. PROTECTIVE TREATMENT***

All paints used in the system shall be from the one manufacturer and shall be applied in accordance with the manufacturer’s recommendation, AS 2312 and as specified herein.

*The coating system used for this contract must be selected from those detailed in the following table:*

***OPTION 1***

|  |  |
| --- | --- |
| ***MANUFACTURER*** | ***COATING SYSTEM*** |
| ***Internal*** | ***Minimum dry film thickness*** | ***External*** | ***Minimum dry film thickness*** |
|  |  |  |  |  |
|  |  |  |  |  |

OPTION 2

The protective treatment system offered for this project shall be selected from AS/NZS 2312.1 to achieve a life of 25+ years to first maintenance in a C3 environment.

Paints with APAS certification (refer Clause 3 “Materials” of Part S35) would be preferred.

A graffiti resistant top coat is required.

The system chosen shall take into account likely climate conditions at the expected time of painting.

1. ***STRIPE COATING***

Notwithstanding Part S35:

Stripe coating is also required….

Stripe Coating is not required….

1. ***CONTINUITY TESTING***

*The following surfaces require continuity testing:*

***3. COLOUR***

The colour of the finish coat shall be AS 2700 - XXX, XXX*.*

All pigments used shall be colourfast. Tinted products shall comply with all requirements of this Specification.

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**S36 PROTECTIVE TREATMENT (PREVIOUSLY COATED)**

1. ***PCCP ACCREDITATION LEVEL REQUIREMENTS***

*The PCCP Accreditation level required for this Contract is 5.*

1. ***SERVICE ENVIRONMENT***

*The structure should be treated as being in an atmospheric environment*

*The following surfaces should be treated as being in an immersed in water/buried in soil/other:*

1. ***EXISTING PAINT***

*The existing paint is…. It contains … and is/is not to be treated as a lead risk job.*

1. ***RESTRICTED ACCESS AREAS***
2. ***CONTAINMENT LEVEL***

The Contractor must implement Emission Control Level A in accordance with AS 4361.1.

1. ***SURFACE FINISH CLASS***

*The surface finish required is* Class Sa 2½.

1. ***PROTECTIVE TREATMENT***

All paints used in the system shall be from the one manufacturer and shall be applied in accordance with the manufacturer’s recommendation, AS 2312 and as specified herein.

***OPTION 1***

|  |  |
| --- | --- |
| ***MANUFACTURER*** | ***COATING SYSTEM*** |
| ***Internal*** | ***Minimum dry film thickness*** | ***External*** | ***Minimum dry film thickness*** |
|  |  |  |  |  |
|  |  |  |  |  |

*Note: the "International" system was previously used on this structure (1999-2000) and is the preferred option*

OPTION 2

The protective treatment system offered for this project shall be selected from AS/NZS 2312.1 to achieve a life of 25+ years to first maintenance in a C3 environment.

Paints with APAS certification (refer Clause 3 “Materials” of Part S36) would be preferred.

A graffiti resistant top coat is required.

The system chosen shall take into account likely climate conditions at the expected time of painting.

1. ***STRIPE COATING***

Notwithstanding Part S36:

Stripe coating is also required….

Stripe Coating is not required….

1. ***CONTINUITY TESTING***

*The Contractor must undertake continuity testing on the following surfaces:*

1. ***SEALING OF NODES***
2. ***COLOUR***

The colour of the finish coat shall be AS 2700 - XXX, XXX*.*

All pigments used shall be colourfast. Tinted products shall comply with all requirements of this Specification.

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**S37 GALVANIZING**

**Note to Specifiers:** The painting of galvanized products is generally not recommended. However, if painting is required, the galvanized substrate must be prepared in accordance with AS 4680, Appendix I. Note that the surface imperfections of galvanizing may be reflected through a painted finish.

If not specified on the drawings, provide the following information, as required in Appendix A of AS 4680:

* *The nature, chemical composition and mechanical properties of the product to be galvanized, and its end use;*
* *Any mechanical work required, such as drilling;*
* *Any special requirements for frequency of testing;*
* *Whether a passivation coating is required;*
* *Whether removal of surplus zinc on threads is required (refer Clause 6.3 of AS 4680);*
* *Whether an additional test for uniformity or adherence of the coating is required;*
* *Any special coating thickness requirements; and*
* *Any special or supplementary requirement of the coating, e.g. for a special finish such as powder coating, or requirements for pretreatment or post-treatment.*

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