PRESTRESSED CONCRETE
24 PRESTRESSED CONCRETE

24.1 GENERAL

In general, drawing practice for the detailing of prestressed concrete items shall be in accordance with the principles outlined in this Manual.

In addition to general details, further information relevant to prestressed concrete shall be shown on the drawings and this will include specifying tendon requirements as well as the detailing of appropriate anchorages.

See RTA Standard Bridge Drawing No RTAB029 for typical ‘GENERAL NOTES’ for prestressed concrete.

24.2 PRE-TENSIONED PRESTRESSED CONCRETE

24.2.1 PSC Planks

In simple cases, such as in PSC plank deck designs, no additional detailing of tendons etc. is required, as RTA Standard Bridge Drawings No RTAB060 to RTAB072 inclusive are sufficiently detailed for standard applications.

Where RTA Standard Bridge Drawings are used for "non-standard" applications, any modifications to the drawings, such as the inclusion of cast-in items must be carefully considered with respect to strand and/or void locations.

If the "Standard Drawing" is altered or added to in any way, except for title block information, the text adjacent to the title block shall be amended to read "MODIFIED RTA DRAWING No. ....". This would include variations for skew angles and reduced span lengths.

If the "Standard Drawing" is used on the basis of a one-off design where the span exceeds the standard span and/or the prestress is altered in any way, the drawing is not considered to be an RTA "Standard Drawing" and must be signed by the designer, drafter and the checkers of the design and drafting.

24.2.2 Precast Prestressed Concrete Girders

As Precast Prestressed Concrete Girders are individually designed for span requirements, no "STANDARD" drawing for a particular span exists.

Standard cross Sections of Precast Prestressed Concrete I-Girders shall conform to details as shown in AS5100 – Bridge Design, Section 5 - Appendix H.

The method of detailing Precast Prestressed Concrete I-Girders shall be as shown in Figures 24.2.2(a) and 24.2.2(b).

RTA Standard Bridge Drawing Number RTAB033 details the adopted standard cross Sections for SUPER-T Girders. The details which are shown on Drawing Number RTAB033 shall be adhered to.

Typical details (such as strand and reinforcement layout) for Super-T Girders shall be in accordance with details shown in RTA Standard Bridge Drawings RTAB033A to RTAB033F inclusive.
When detailing Precast, Prestressed Concrete items with deflected strands, the following shall be checked thoroughly:

- That the deflection point of strands is correctly dimensioned.
- That deflected strands are not fouled by elements cast into the member i.e. ducts for transverse reinforcement, ferrules, anchor bolts for bearings etc.

It should be noted that it is considered to be good practice, where possible, for the designer not to specify one single point where the strands may be deflected but a length range where the deflection is possible. Various prestressed concrete girder manufacturers have different casting beds and providing a range where the strands may be deflected reduces the need to request variations to the approved design.

### 24.3 POST-TENSIONED PRESTRESSED CONCRETE

#### 24.3.1 General

Several post-tensioning systems are currently being used in bridge applications.

Bridges are generally detailed for a typical "size" strand prestressing system and any variation to the details as shown shall be covered by an appropriate "PRESTRESSING SYSTEM" note. See RTA Standard Bridge Drawing No RTAB029 for typical ‘GENERAL NOTES’ for prestressed concrete.

When detailing post-tensioned prestressed concrete, particular attention must be given to:-

- The physical dimensions of anchorages;
- The spacing between anchorages;
- Sufficient space allowed for use of tendon jacks;
- Arrangement of end block/diaphragm reinforcement with respect to anchorages and tendons to facilitate the placement and vibration of concrete/ (large scale details are appropriate in most cases).

Sample reinforcement drawings, in accordance with the requirements of Section 23 of this Manual are provided as Figures 24.3.1(c) – 24.3.1(f) inclusive.

#### 24.3.2 Tendon Profiles

Tendon profiles shall be sufficiently detailed to enable correct stressing duct placement and careful attention must be given to minimum bend radii recommendations from post-tensioning manufacturers i.e. **SHARP BENDS SHALL BE AVOIDED**.

Comprehensive detailing in both Plan and Elevation/Section shall be provided to ensure correct placement can be achieved and that required clearances for anchorages are maintained.

See Figures 24.3.1(a) and 24.3.1(b) for the required level of detailing.
Ducting detailed on drawings shall be in accordance with stressing system manufacturer’s recommendations for the system used.

Where misalignment of ducting is possible during construction, appropriate oversize ducts shall be specified on the drawings.

Duct supports, whilst not usually detailed, shall be closely examined with regard to placement of non-stressed reinforcement to ensure correct placement is achieved.
24 ASSEMBLIES REQUIRED

1. SCHROEDER P21 CAST-IN SOCKETS
2. GIRDER TYPE A - 6 REQUIRED
3. GIRDER TYPE B - 2 REQUIRED
4. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE AT TRANSFER OF PRESTRESS SHALL BE 35MPa.
5. MINIMUM 28 DAY COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 50MPa.
6. EDGES OF SOFFIT AND ENDS ONLY SHALL BE CHAMFERED 20mm.
7. CONCRETE EXPOSURE CLASSIFICATION: B1
8. THE DIMENSIONS OF THE GIRDERS CONFORM TO AS 5100.5 TYPE 3
9. MINIMUM 28 DAY COMPRESSIVE STRENGTH OF CONCRETE SHALL BE 50MPa.
10. M16 x 100 LONG WITH ´12 x 100 LONG DOWELS OR APPROVED EQUIVALENT. 64 REQUIRED
11. IF HOLES FOR THE SUPPORT OF DECK AND PARAPET FORMWORK ARE REQUIRED THEY SHALL HAVE 30mm COVER TO REINFORCEMENT AND STRANDS. UPON REMOVAL OF FORMWORK, HOLES SHALL BE FILLED WITH DRY PACK MORTAR. THE SIZE AND LOCATION OF THESE HOLES SHALL BE SUBMITTED TO THE PRINCIPAL'S REPRESENTATIVE FOR APPROVAL PRIOR TO GIRDER MANUFACTURE
12. THE AREA SHOWN STIPPLED BOTH ENDS SHALL BE ROUGHENED TO EXPOSE THE COARSE AGGREGATE, TO AN AVERAGE DEPTH OF 3mm ON THE FACES WHERE EITHER 40 HOLES OR CAST-IN FERRULES ARE SHOWN. THE OUTER FACES OF GIRDERS TYPE B SHALL NOT BE ROUGHENED. THE METHOD OF ROUGHENING SHALL BE PROVIDED TO THE SUPERINTENDENT
13. THE EXTENT OF ROUGHENED SURFACE FOR DECK CONCRETE SHALL NOT BE PERMITTED.
14. THE MANUFACTURER'S RECOMMENDATIONS.
15. CONCRETE SHALL NOT BE DRILLED OR OTHERWISE DISTURBED ONCE INITIAL SET HAS OCCURRED.
16. STAMPED CONCRETE SOCKET ASSEMBLIES SHALL BE HOT-DIP GALVANIZED TO AS 1214. AN ALTERNATIVE TO THAT SHOWN MAY BE USED, SUBJECT TO APPROVAL BY THE PRINCIPAL'S REPRESENTATIVE.
17. HOLES FOR THE SUPPORT OF DECK AND PARAPET FORMWORK ARE REQUIRED THEY SHALL BE FILLED WITH DRY PACK MORTAR. THE SIZE AND LOCATION OF THESE HOLES SHALL BE SUBMITTED TO THE PRINCIPAL'S REPRESENTATIVE FOR APPROVAL PRIOR TO GIRDER MANUFACTURE
18. THE MANUFACTURER'S RECOMMENDATIONS.

ROADS AND TRAFFIC AUTHORITY OF NSW

FIGURE 24.2.2(a)

GIRDERS - CONCRETE

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WELDING SYMBOLS CONFORM TO AS 1101 PART 3.
DURING STORAGE, TRANSPORT AND HANDLING, GIRDERS SHALL BE IN AN UPRIGHT POSITION AND SUPPORTED NOT MORE THAN 500mm FROM EACH END. GIRDERS SHALL ONLY BE LIFTED USING LIFTING DEVICES WHICH ARE ACCEPTABLE TO RECEIVE NSW REGULATORY REQUIREMENTS AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

THE DIMENSIONS OF THE GIRDERS CONFORM TO AS 5100.5 TYPE 3
STANDARD PREDICTED PRESTRESSED CONCRETE BEAM SECTIONS. VARIATIONS IN SECTION WILL NOT BE PERMITTED.

WELDING SYMBOLS CONFORM TO AS 1101 PART 3.
SCALES AS SHOWN.

GENERAL NOTES

- DENSITY = 2600 kg/m³
- STEAM CURING AT 70°C FOR 8 HOURS AFTER CASTING.
- NO LOADS EXCEPT GIRDER SELF WEIGHT.

ENDS OF GIRDER AND EXPOSED STRANDS SEALED AGAINST CORROSION BY THE APPLICATION OF AN APPROVED EPOXY RESIN.

AFTER TRANSFER OF PRESTRESS, STRANDS SHALL BE CUT FLUSH WITH THE GIRDER IMMEDIATELY AFTER RELEASE OF THE TENSIONING JACK.

THE FORCE REMAINING IN EACH 12.7mm DIAMETER STRAND AT MIDPOINT OF THE GIRDER IMMEDIATELY AFTER RELEASE OF THE TENSIONING JACK SHALL BE 138KN.

THE CALCULATED HOG OF GIRDER AT 28 DAYS IS 33mm ASSUMING:

- ELASTIC MODULUS AT TRANSFER = 33700 MPa.
- STORAGE IN OPEN AIR, AFTER STEAM CURING, AT 20°C AVERAGE TEMPERATURE AND RELATIVE HUMIDITY IN THE RANGE OF 50%-75%.
- GIRDER SUPPORTED AT 500mm FROM EACH END.

THE GirlER REMAINS UNLOADED.

HOG OF GIRDER WILL INCREASE TO APPROX 35mm 90 DAYS AFTER TRANSFER.

PRESTRESSING NOTES

STRANDS SHALL BE 7 WIRE, ORDINARY, DIAMETER 12.7mm, TENSILE STRENGTH 1870 MPa, RELAX 2, TO AS/NZS 4672.1 WITH MINIMUM BREAKING FORCE OF 184 kN.

THE FORCE REMAINING IN EACH 12.7mm DIAMETER STRAND AT MIDPOINT OF THE GIRDER IMMEDIATELY AFTER RELEASE OF THE TENSIONING JACK SHALL BE TAKEN.

AFTER TRANSFER OF PRESTRESS, STRANDS SHALL BE CUT FLUSH WITH THE END OF GIRDER AND EXPOSED STRANDS SEALED AGAINST CORROSION BY THE APPLICATION OF AN APPROVED EPOXY RESIN.

CALCULATED HOG OF GIRDER AT 28 DAYS IS 33mm ASSUMING:

- STRANDS SHOWN IN OPEN AIR AND SEALED AGAINST CORROSION AT 20°C AVERAGE TEMPERATURE AND RELATIVE HUMIDITY IN THE RANGE OF 50%-75%.
- GIRDER SUPPORTED AT 500mm FROM EACH END.

HOG OF GIRDER WILL INCREASE TO APPROX 35mm 90 DAYS AFTER TRANSFER.

THE CALCULATED DEFLECTION DUE TO THE MASS OF DECK CONCRETE IS...

S BARS LAYOUT

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FIGURE 24.2.2(b)
**TABLE I**

<table>
<thead>
<tr>
<th>Tendon No</th>
<th>Dimension X'</th>
<th>Dimension Y1</th>
<th>Dimension Y2</th>
<th>Dimension Y3</th>
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<td>1</td>
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<tr>
<td>3</td>
<td>505</td>
<td>505</td>
<td>505</td>
<td>505</td>
</tr>
</tbody>
</table>

**GENERAL NOTES**

- **DUCTS AND GRouting:**
  - Tendon ducts shall be semi-rigid steel sheathing type with a minimum diameter. (See AS/NZS 4672.1 for detailed requirements and placing tolerances.)
  - The method of anchoring and the method of lifting and placing ducts at construction joints shall comply with the requirements of the specification. The tendon duct shall be placed to a smooth profile passing through the specified points shown on the Duct Profile.
  - Group points shall be established at all anchorage points. All bleed pipes shall be provided at all group points and each point of each duct shall be provided with an individual bleed pipe for grouting requirements.
  - Friction losses and tendon elongation:
    - The calculated maximum friction loss for tendons is 1.5%.
    - Expected total average elongation per tendon is shown.
    - If the calculated elongation is obtained at a jacking force less than the minimum required to jacking force per tendon may be taken to a maximum of 20% of the calculated value in order to overcome friction losses higher than the calculated values.

**PRESTRESSING SYSTEM**

- The bridge superstructure has been detailed for a typical 12.7mm strand prestressing system. Full details of the proposed prestressing system including any required modifications to the design size specification shall be submitted for consideration at the time of Tender.

**PRESTRESSING DATA**

- Each tendon shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).
- Tendon strength 952kN, (flexibility 71,75% of minimum breaking force of 6810 kN per tendon).

- The jacking force for each tendon shall be 5108kN (75% of minimum breaking load).

- The tendons shall be stressed from both ends and the order of stressing shall be 1, 2, 3, 4, 5, 6, 7.

- The tendon ducts shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).

- Prestressign system:
  - Each tendon shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).
  - Tendon strength 952kN, (flexibility 71,75% of minimum breaking force of 6810 kN per tendon).

- The tendon ducts shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).

- Prestressign system:
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  - Tendon strength 952kN, (flexibility 71,75% of minimum breaking force of 6810 kN per tendon).

- The tendon ducts shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).

- Prestressign system:
  - Each tendon shall be comprised of 32/7 wire (ordinary, diameter 12.7mm).
  - Tendon strength 952kN, (flexibility 71,75% of minimum breaking force of 6810 kN per tendon).
TABLE II

<table>
<thead>
<tr>
<th>TENDON No</th>
<th>ABUTMENT A</th>
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<tr>
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<td>505</td>
</tr>
<tr>
<td>8</td>
<td>505</td>
<td>315</td>
</tr>
</tbody>
</table>

OPERATION L IS THE HORIZONTAL DISTANCE MEASURED PERPENDICULAR TO CENTRE-LINE OF THE BRIDGE FROM THE END OF THE SUPERSTRUCTURE TO CENTRE OF THE ANCHOR STRESSING FACE.

GENERAL NOTES

SCALES AS SHOWN

DENOTES DIMENSION FOR TENDONS 1 AND 7

DENOTES DIMENSIONS BEFORE PRESTRESSING

FOR DIMENSION 'L' SEE TABLE II

VALUES SHOWN IN BRACKETS REFER TO ABUTMENT B

END CAP AND BLOCKOUTS SHALL BE FINISHED AFTER STRESSING AND GROUTING OF TENDONS.

FOR VALUE OF 'L' SEE TABLE II
PLAN

SHALL BE 40mm UNLESS SPECIFIED OTHERWISE.

REINFORCEMENT MAY BE DISPLACED SLIGHTLY WHERE NECESSARY TO CLEAR STEEL DOWELS, ANCHOR BOLTS, DRAINAGE PIPES, FORMED HOLES AND RECESSES.

GENERAL NOTES

SCALES AS SHOWN.

UNLESS OTHERWISE SPECIFIED, THE MINIMUM DEVELOPMENT LENGTHS AND LENGTHS OF LAPS SHALL BE AS FOLLOWS:

DENOTES VARIABLE LENGTH BAR.

BAR SIZE:

HORIZONTAL BARS WITH >300mm OF CONCRETE CAST BELOW THE BAR:

OTHER BARS:

a)...
b)...

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BUNDLE TYPE A CONSISTS OF:

BUNDLE TYPE B CONSISTS OF:

BUNDLE TYPE C CONSISTS OF:

BUNDLE TYPE D CONSISTS OF:

BUNDLE TYPE E CONSISTS OF:

BUNDLE TYPE F CONSISTS OF:

PREPARED CHECKED DESIGN DRAWING MANAGER, BRIDGE DESIGN PROJECTS

ISSUE DATE REVISION PREP AUTH
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ISSUE STATUS:

THIS DRAWING IS CONFIDENTIAL AND SHALL ONLY BE USED FOR THE PURPOSE OF THE NOMINATED PROJECT.

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FIGURE 24.3.1 (c)