Standard precast concrete bridge beams

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Research Report 364
Standard precast concrete bridge beams

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Opus International Consultants Ltd (Opus)
Acknowledgements
The financial contribution from Cement and Concrete Association of New Zealand towards completion of this project is gratefully acknowledged.
We also acknowledge the contribution made by various members of the precast industry during several workshops held during the preparation of these standard designs.

Keywords: Precast concrete, bridge decks, standard designs for New Zealand, Super T, I beams, Hollow core
Abstract
Hollow core units for bridge spans of various length.
The standardised designs for precast bridge beams presented in this publication are expected to result in significant economies for NZ Transport Agency bridge projects utilising these elements in New Zealand.
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INTRODUCTION

EXCLUDED ARE STANDARD DESIGNS FOR HOLLOW CORE, SINGLE Y AND T SINGLE PRECAST BEAMS, AND SINGLE PRECAST ARRANGEMENTS.

THE DESIGN CRITERIA ARE FOR A SINGLE PRECAST CONCRETE BEAM, 3.0 M WIDE, 2.7 M DEEP, AND A DEPTH OF 0.9 M. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. THE BEAM IS DESIGNED TO WITHSTAND A MAXIMUM LOAD OF 400 KWN. 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4. REINFORCED CONCRETE

4.1 CONCRETE STRENGTHS

Concrete strengths are specified in accordance with the current codes of practice, except where varied by the specification for the structure.

4.2 CONCRETE FINISHES

Where specified and not shown on the drawings, surface finishes shall be as follows:

- Smoothed surfaces
- Expanded formed surfaces
- Expanded lounge surfaces
- Expanded smooth surfaces
- Expanded finished surfaces
- Expanded surface to be finished on site

4.3 CONCRETE COVER TO REINFORCEMENT

Where not specified, minimum concrete cover shall be as follows:

- 60 mm to exterior
- 40 mm to interior
- 30 mm to each face
- 20 mm to each face

4.4 PLACING AND SPACING OF REINFORCEMENT

- Reinforcement, whether installed on mechanical spools, shall be carried out as shown on the drawings.
- All bars shall be provided with a stirrup or tied in accordance with the specified stirrup requirements or shown on the drawings.

4.5 LAP SPACES IN REINFORCEMENT

- Lap lengths for deformed bars shall be as shown on the drawings.
- Lap lengths for plain round bars shall be as specified on the drawings.

4.6 BENDING OF REINFORCEMENT

- Bend for all bars shall be as shown on the drawings.

4.7 REINFORCEMENT ANCHORAGE WITH STANDARD HOOKS

- Development length for horizontal bars shall be as shown on the drawings.
- Development length for plain round bars shall be as shown on the drawings.

NOTES

- Development length for plain round bars shall be as shown on the drawings.
- Development length for deformed bars shall be as shown on the drawings.

4.8 REINFORCEMENT NOTATION

- Bars shall be spaced as shown on the drawings.
- Bars shall be provided with stirrups or ties as shown on the drawings.

5. APPENDIX

- Standard precast concrete bridge beams
- General concrete notes

NZ TRANSPORT AGENCY
Waka Kotahi
OPUS
NOTES:
1. REFER TO DRAWING SD03 FOR GENERAL NOTES.
2. REFER TO DRAWING SD03 FOR CONCRETE NOTES.

BEAM ELEVATION
1:50

SYMMETRY ABOUT A-AXIS

TYPICAL SECTION
1:20

TYPICAL WEB ELEVATION
1:20

TYPICAL SECTION
1:20

STANDARD PRECAST CONCRETE BRIDGE BEAMS
SUPER T BEAM 1025 DEEP – 20m & 22.3m SPAN
REINFORCEMENT SHEET 1

NZ TRANSPORT AGENCY
OPUS
BECC
SECTION 1

SECTION 2

SECTION 4

SECTION 3

EXTERNAL BEAM END BLOCK

INTERNAL BEAM END BLOCK

ALTERNATE INTERNAL BEAM END BLOCK

NOTES:
1. Refer to drawing SOL 2 for general notes.
2. Refer to drawing SOL 3 for concrete notes.

The STANDARD PRECAST CONCRETE BRIDGE BEAMS
SUPER T BEAM 125, DEEP 20m & 22.5m SPAN
REINFORCEMENT SHEET 2

NZ TRANSPORT AGENCY
WAKA ROTAHI

OPUS

20090909
TYPICAL STRAND ARRANGEMENT

PRESTRESSING DETAILS - 25m SPAN

TYPICAL STRAND ARRANGEMENT

PRESTRESSING DETAILS - 27.5m SPAN

NOTES:
1. REFER TO DRAWING S0.013 FOR GENERAL NOTES.
2. REFER TO DRAWING S0.03 FOR CONCRETE NOTES.
1. SPECIFIED CONCRETE COMPRESSIVE STRENGTHS
    Precast Beams at Transfer = Prestressing
    30 MPa
    Precast Beams at 28 Days = 50 MPa
    Precast Concrete Class (SIA 165) at 28 Days = 40 MPa

2. REINFORCEMENT & PRESTRESSING
    a. All reinforcement shall be grade B500A.
    b. All prestressing strands shall be 15.24 mm diameter low relaxation strands.
    c. All strands shall be grade J wire strands complying with AS/NZS 4186 or SS 5886.
    d. Minimum breaking load of strand 250 kN.
    e. Area of strand immediately prior to transfer shall be 185 kN/tension.
    f. Force in strands immediately prior to transfer shall be accounted for in the lifting force required to
       achieve the breaking load. Typically, relaxation prior to transfer is in the order of
       1%, where curing at elevated temperatures is employed, higher relaxation
       rates may result and due allowance for this shall be made by the
       contractor in determining the lifting force required to achieve the minimum
       force stated above.
    g. Ends of strand shall be cut flush and protected with a minimum of 25mm
       epoxy coating.
    h. Ultor deformation of strands due to prestress is given in the beam nom.
       Table. These are estimated values. Erection and tie-in force for hog at transfer and
       100 days after hog due to allowance for increase in hog due to creep of
       concrete under sustained load.
    i. Components prepared for use in tension items. Tension shall be grade B500A to
       AS/NZS 4671.

3. CONCRETE COVER (MINIMUM)
    a. Cover to all prestressing components = 40mm
    b. Cover to all reinforcement exposed surface = 40mm
    c. Cover to all reinforcement exposed surface = 30mm
    d. Cover to all reinforcement internal surface = 15mm
    e. Cover to grout deck & all cast insets concrete = 30mm
    f. Cover to buried fixing steel within beams = 10mm

4. DESIGN LOADING
    MW-30-T (Including 2.5% live load factor of 1.35)

5. SPECIFICATION
    The design is based on NZ Transport Agency Bridge Beam Specification (2008)

6. TOLERANCES

   TOLERANCE BAND
   TOLERANCE LINES

6.1. DIMENSIONS AT TIME OF ERECTION
    a. Actual overall length and soundness
    b. The inclusion of the beam at time 700mm shall be true plane
    c. Plane surfaces, edges from 1.5mm straight edge
    d. Beam hanger (see specification)
    e. Cross section dimensions 0.5mm to 3.0mm
    f. Acceptable span of longitudinal axis

6.1. DIMENSIONS AT ERECTION
    a. Longitudinal, re-arrangement 6.0mm
    b. Location of tie in relation to any other item within its group or to
       the supports of the beam ends
    c. Prestressing prestressing strands in any direction 3.0mm

7. HANDLING
    All lifting points shown are to be attached to lift at time 500mm
    Central support position as shown is prestressed (beam in uplift position at all times).

8. METHOD OF MANUFACTURE
    Beams shall be manufactured under factory conditions.

9. SURFACE FINISHES
    a. Top surface of flange
    b. Type A Construction Joint
    c. All other surfaces

10. BEARING DESIGN DATA
    a. Load (kN) 
    b. Reaction (kN)
    c. Load (kN) 
    d. Reaction (kN)
    e. Load (kN) 
    f. Reaction (kN)

Options for Bearing Arrangement
Options for Linkage Bar Detail
ELEVATION IN SITU DIAPHRAGM

NOTES:
1. REFER TO DRAWS 5102 & 5103 FOR GENERAL NOTES.
2. REFER TO DRAWING 5103 FOR CONCRETE NOTES.
TYPICAL BRIDGE DECK SECTION
1:20

SECTION PLAN
1:20

NOTES:
1. REFER TO DRAWING SI2.03 FOR GENERAL NOTES.
2. REFER TO DRAWING SI2.03 FOR CONCRETE NOTES.
NOTES:
1. REFER TO DRAWING SL02 FOR GENERAL NOTES.
2. REFER TO DRAWING SL03 FOR CONCRETE NOTES.

TYPICAL STRAND ARRANGEMENT

STRAND LAYOUT AND DEBONDING SCHEDULE

PRESTRESSING DETAILS 30m SPAN

LEGEND:

- Prestressing strand bonded for full length of beam (no debonding)
- Prestressing strand debonded at the specified location L (5000mm measured from concrete face) each end of beam as indicated below.

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<tr>
<th>KEY</th>
<th>DESCRIPTION</th>
<th>SPAN (m)</th>
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<tbody>
<tr>
<td>A1</td>
<td>Estimated MOE of Beam</td>
<td>30</td>
</tr>
<tr>
<td>A2</td>
<td>Estimated MOE at 30%</td>
<td>30</td>
</tr>
<tr>
<td>A3</td>
<td>Estimated MOE at</td>
<td>30</td>
</tr>
<tr>
<td>A4</td>
<td>Approximate MOE of</td>
<td>30</td>
</tr>
</tbody>
</table>

TYPICAL BEAM

120

NZ TRANSPORT AGENCY
MAKA ROSTAHI

SUPER T BEAM 1225 DEEP – 30m SPAN
PRESTRESSING DETAILS

STANDARD PRECAST CONCRETE BRIDGE BEAMS

2015

I045122

51.22

scale

1:20
1. SPECIFIED CONCRETE COMpressive STRENGTHS
   CUBIC (28 Days) - 30MPa
   BEAM (7 Days) - 50MPa
   PLATE CONCRETE (28 Days) - 40MPa

2. REINFORCEMENT & PRESTRESSING
   a. All reinforcement shall be loose grade A500/C160.
   b. All prestressing strand shall be 15.24mm diameter low relaxation of grade Fe500.
   c. Tension is immediately prior to transfer shall be 350kN, tension prior to transfer shall be accounted for in the jacking force required to achieve the value.
   d. Minimum bending load of strand 250kN.
   e. Force in strands immediately prior to transfer shall be 185kN, tension.
   f. Live load due allowance for this shall be taken in the prestress in determining the jacking force required to achieve the minimum force stated above.
   g. Ends of strands shall be cut flush and protected with 25mm epoxy mortars.
   h. Upward deflection of chords due to prestress is given in the beam nom.
   i. These are estimated due, estimates are made for hog at transfer and at 100 days with due allowance for increase in live load due to creep of concrete under sustained load.

3. CONCRETE COVER (MINIMUM)
   a. To all precasting components - 40mm
   b. To all reinf. exposed surface - 40mm
   c. To all reinforcement internal surface - 30mm
   d. Cover adjacent to cores holes - 12mm
   e. Cover to bridge deck & all cast in place concrete - 50mm
   f. Cover to surface fixed steel (within barriers) - 50mm

4. DESIGN LOADING
   MW=0.75 (including SLS live load factor of 1.35)

5. SPECIFICATION
   The design is based on NZ Standards Bridge Beam Specification (2008)

6. TOLERANCES
   a. Maximum overall length - 100mm
   b. Tolerances - 50mm

6.1. DIMENSIONS AT TIME OF ERECTION
   a. The height of the beam for the end 700mm shall be true plane.
   b. The beam end surfaces shall lie within the tolerance box shown in diagram.
   c. Plane surface deviation of 1.5mm straight edge.
   d. Beam repositioning (see specification).
   e. Cross section deviations up to 0.5mm.
   f. Cross section dimensions 5mm to 25mm.
   g. Accidental bend of longitudinal axis.

6.1. DIMENSIONS AT TIME OF ERECTION
   a. Longitudinal steel arrangement.
   b. Location of any fix in relation to any other item within its group or to the nearest of the beam ends.
   c. Positioning prestressing strands in any direction.

7. HANDLING
   a. Extremes of vertical lifting points or ground support shown in red.
   b. Central support position as shown is prestressed beam in upright position at all times.

8. METHOD OF MANUFACTURE
   a. All beams shall be manufactured under factory conditions.

9. SURFACE FINISHES
   a. Top surface of flange - Type B construction joint.
   b. Hidden grooves for - Type A construction joint.
   c. Hidden finished surface - F1
   d. All other finished surface - F4

10. BEARING DESIGN DATA
   a. Bearing area:
   b. Support requirements:

---

NOTES:
1. Refer to drawing soils for general notes.
2. Refer to drawing soils for concrete notes.
NOTES:
1. DETAILS FOR TRANSVERSE CONNECTION IN OUTER UNIT SHALL BE ADAPTED TO FIT THE TYPE OF CONNECTING SYSTEM ADOPTED.
2. DRAINAGE HOLES SHALL EXTEND INTO THE VOID.
3. INSPECTION HOLES SHALL EXTEND TO THE VOID FORMER ONLY AND SHALL BE WOODEN AFTER FINAL INSPECTION OF THE UNIT.
4. INNER UNITS MAY BE REGULARIZED ON THE BASIS OF BEING SCREWED TO OTHER UNITS WHERE PLACED ALONG STREETS WHERE THEY ARE NOT TO BE USED AS SINGLE UNITS IN ASSEMBLY.

STANDARD PRECAST CONCRETE BRIDGE BEAMS
500mm DEEP SINGLE HOLLOW CORE BEAMS - 16m & 18m SPAN ARRANGEMENT & DIMENSIONS
1. PRESTRESSING FORCE AT INITIAL TENSIONING

All superstructures shall be 12.0m deep single hollow core beams, complying with AS/NZS 4677, and arranged to provide a minimum spacing of 1.5m between each new box beam. The following procedure shall be followed:

- Top two strands to be initially loaded to 1270N per strand
- Other strands to be finally loaded to 2000N per strand

2. TOLERANCES

Tolerances are to be in accordance with NZS 3109:1997 Table 8.1 unless stated otherwise below.

2.1 DIMENSIONS AT TIME OF ERECTION

Actual overall length and soundness. The unit end surfaces shall be within the tolerance zones shown in Diagram A.

- Overall Length
- Plane Surface Deviation from 12.0m Straight Edge
- Cross-sectional Dimension (Overall)
- Difference in Level of Top Surface Between Adjacent Units in Place
- Horizontal Deviation (see specification)
- Tighter Web Thickness
- Smallest Flange Thickness
- Compression Tolerance
- Tensioning Variation (see specification)
- Maximum MSG

2.2 LOCATION OF STEEL AND CAST-IN ITEMS

- Prestressing strands in any direction
- Location of any item in relation to any other within the group
- Transverse duct position
- Void positions

3. CONCRETE COVER

Cover to all prestressing components
Cover to all reinforcing steel
Cover adjacent to voids
Cover adjacent to shear keys
Cover barrier form steel (when barriers)

4. CONCRETE STRENGTH

Minimum compressive strength at transfer
Specified compressive strength at 28 Days

N.B. Provided to be manufactured in accordance with the relevant codes.

5. DESIGN LOADING

DSR-72 (including 1.2 overload factor)

6. SPECIFICATION

This design is based on materials and workmanship in accordance with the NZTA Standard Bridge Design Specification (2017).

7. HANDLING

8. SURFACE FINISHES

- Top surface - Smooth finish

9. SKYF

The maximum permissible skew of the unit shall be 1.5% of the unit's length in the direction of the skew. The end dimensions of the unit shall be trimmed to the required size - see Detail 1.

Detail 1

Detail 2

NOTES:

1. All tolerances and dimensions may be accommodated in the following criteria
2. The minimum load factor shall be 1.20
3. In the absence of an approved bridge deck, joints bearing on the beams containing service ducts shall be provided to each end of the beams when required.

Diagram A

Diagram B

Overall Length

Extremes of vertical lifting points or ground-support shown in diagram 1 - Lifting direction as horizontal as possible when handling or storing.

Diagram C

Smoothe/rough finish

Detail 1

Detail 2

SERVICE DUCTS

TRANSVERSE STRESSING DUCT

DETAIL 3 - SECTION AT END DIAPHRAGM

STRENGTH TRUNPORATAGE AGENCY

OPUS

STANDARD PRECAST CONCRETE BRIDGE BEAMS

50m Deep Single Hollow Core Beams - 16m & 18m Span Unit Data

Sheet 0

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1. PRESTRESSING FORCE AT INITIAL TENSIONING

ALL SUPEREASTRENGTH BARS 13.7mm SUPER 7 WIRE STRANDS, COMPARE WITH 45/47 at 4872.45
AND ALLOWED TO HAVE A MINIMUM WEARING BASE LOADING OF 850kN/strand WITH INITIAL LOADING AS FOLLOWS:

- TOP TWO STRANDS TO BE TENSIONED TO 1275kN PER STRAND
- OTHER STRANDS TO BE TENSIONED TO 1025kN PER STRAND

STRAINERS SHALL BE REMOVE BEFORE TRIMMING AND AFTER REMOVE SHALL BE CUT AND GROUND FRESH.
WHEN THE UNIT IS COMPLETE, A FINISHING SNIP OF BON HOE PLIERS SHALL BE APPLIED AFTER SAMPLING BEFORE THE UNIT LEAVES THE CASTING TANK.

2. TOLERANCES

TOLERANCES ARE TO BE IN ACCORDANCE WITH AS 3108:1997 TABLE S.1 UNLESS STATED OTHERWISE BELOW.

2.1 DIMENSIONS AT TIME OF ERECTION

THE UNIT END SURFACES SHALL BE WITHIN THE TOLERANCE BOXES SHOWN IN DIAGRAM A.

2.2 LOCATION OF STEEL AND CAST-IN ITEMS

- PRESTRESSING STRANDS IN ANY DIRECTION
- LOCATION OF AN END IN RELATION TO ANY OTHER WITHIN ITS GROUP
- VAD DIAMETERS
- END DiAMETERS

3. CONCRETE COVER

COVER TO ALL PRESTRESSING COMPONENTS
COVER TO ALL REINFORCING STEEL
COVER ADJACENT TO SHEAR KEYS
COVER TO BARRIER PLACING STEEL (MINIMUM 9mm)

4. CONCRETE STRENGTH

MINIMUM COMPRESSIVE STRENGTH AT TRANSFER:
SHEAR MATERIAL COVER 28 DAYS

5. DESIGN LOADING

6. SPECIFICATION

7. HANDLING

8. SURFACE FINISHES

9. SKEW

THE MAXIMUM Vs PERMISSIBLE SLOPE OF THE UNITS SHALL BE 1/10 UNLESS A SPECIFIC CODE IS MANUFACTURED IN WHICH END DIAPHRAGMS OF THE UNIT SHALL BE EXPOSED TO THE REQUIRED ANGLE - SEE DETAIL 2.

NOTES:

1. CAISONS AND SMALL SERVICES MAY BE ACCOMMODATED IN THE HOLLOW CORE PLUS SHAPE EXPAND IN THE UNIT. THE SERVICE DUCTS ARE TO BE NOT GREATER THAN 100mm IN DIAMETER AND A CLEARENCE OF 50mm FROM TRANSVERSE STRAINERS OCTS SHALL BE MAINTAINED. THE TOTAL CROSS-SECTIONAL AREA OF CAISONS AND SERVICE DUCTS WITHIN A UNIT SHALL NOT EXCEED 5% OF THE CROSS-SECTIONAL AREA OF THE UNIT.

2. THE END DIAPHRAGM SHALL BE FIXED AT THE MINIMUM CLEARANCE OF 10mm BETWEEN THE CAISONS/SERVICE DUCTS AND THE ARE OF THE CURVE.

3. THE JACKING OF THE AN ANCHOR IS A DECK IS INVOLVED IN ORDER TO EXPOSE THE NDE OF THE UNIT TO THE REPAIR UNIT FOR PROCESSING AT THE END OF THE DECK WHEN JACKING.
1. Holes for transverse connection in outer unit shall be dimensioned to suit the type of connection system adopted.
2. Inspection holes shall be provided in each unit and shall be placed after first inspection of the units.
3. Inspection holes have been designed on the basis of being covered by other units being placed and stripped against them and not to be used as single units in isolation.
4. Voids shall be cast integral with beam and any fixing or other work being carried out shall be suitably designed and supervised.
1. PRESTRESSING FORCE AT INITIAL TENSIONING

ALL SUPERFACES SHALL BE 18.7m SUPER 7 HOLLOW CORE BEAMS, COMPARE TO AS/NZS 4672 AND ADJUSTED TO MAKE A MAXIMUM DEFORMATION OF 1.2% PER STRAND WITH A MAXIMUM DEFORMATION OF 2.5% FOR SUPERFACES.

- TOP TWO STRANDS TO BE INSTALLED FIRST TO 10m PER STRAND
- OTHER STRANDS TO BE INSTALLED TO 12m PER STRAND

STRAINS SHALL BE REVEALED BY CUT-OUT AND GROUND FLUSH WITH THE CONCRETE AT THE END OF THE UNIT A TIME DURATION OF 28 DAYS FROM THE DATE THAT THE UNIT SHALL BE APPLIED AFTER CURING BEFORE THE UNIT LEAVES THE CASTING YARD.

2. TOLERANCES

TOLERANCES ARE TO BE IN ACCORDANCE WITH AS/NZS 3105:1997 TABLE 5.1 UNLESS STATED OTHERWISE BELOW.

TOLERANCE BAND WITHIN THE TOLERANCE BOXES SHOWN IN DIAGRAM A:

- ANGLE OF SLOPE
- FOR SQUARE DECK
- FOR SKewed DECK

DIAGRAM A

2.1 DIMENSIONS AT TIME OF ERECTION

- ACTUAL OVERALL LENGTH AND SLOUGHEDNESS
- THE UNIT END SURFACES SHALL BE WITHIN THE TOLERANCE BOXES SHOWN IN DIAGRAM A.

3. CONCRETE COVER

- COVER TO ALL PRESTRESSING COMPONENTS
- COVER TO ALL REINFORCING STEEL
- COVER TO ADJACENT BARS
- COVER TO BARRIER PLAIN STEEL (WITH SLAB)

4. CONCRETE STRENGTH

MAXIMUM COMPRESSIVE STRENGTH AT 28 DAYS

- LOWEST CEMENT CONTENT
- NORMAL MIX RATIO
- NON-SHUTTERED TRANSVERSE PRESTRESSING STRAND OUTFIT

5. DESIGN LOADING

M-B-12 (INCLUDING 1.25 L/E LOAD FACTOR OF 1.30)

6. SPECIFICATION

THE DESIGN IS BASED ON MATTERWORTHS AND WORKSHOP IN ACCORDANCE WITH THE NZS STANDARD BRIDGE BEAM SPECIFICATION (2007).

7. HANDLING

8. SURFACE FINISHES

- TOP SURFACE - SMOOTH FINISH
- SIDE AND UNDERSIDE SURFACE - SMOOTH/ROUGH FINISH (EXCEPT SMOOTH AT VESSELköpK SEE DETAIL 1.

9. SKEW


10. VOID FORMERS

SURFACES OF Voids ARE TO BE DRESSED IMPERVIOUS TO WATER PENETRATION FOR THE DESIGN LIFE OF THE UNIT. EITHER BY USE OF Voids TOOLS OR USE OF MILLER OF LEAD Bend VOID FORMERS AS SURFACE MATERIAL PRODESION METER SHALL BE TO THE ENGINEER'S CONSENT MAXIMUM HEIGHT OF VOID FORMER = 500m

NOTES:

1. GIRDERS AND SPAN WOULD BE SUPPORTED TO THE END OF EACH MAJOR SPAN.

2. THE SPAN WOULD BE SUPPORTED TO THE END OF EACH MAJOR SPAN.
1. SPECIFIED CONCRETE COMPRESSIVE STRENGTHS
   - Transfer + prestressing: 30 MPa
   - Transfer + curing: 30 MPa
   - In situ concrete (deck slab, parapets) at 28 days: 30 MPa

2. REINFORCEMENT & PRESTRESSING
   All superstructures shall be 1.5\(\times\)24 mm IPE 7 wire strands consisting of 60/753.672 and assumed to have a minimum breaking load of 100 kN per strand with initial loading as follows:
   - For top strands to be cured to 1250 kN per strand
   - Other strands to be cured to 500 kN per strand

3. CONCRETE COVER (MINIMUM)
   - Cover to all prestressing components: 40 mm
   - Cover to reinforcement values shown elsewhere: 40 mm
   - Cover to reinforced concrete: 50 mm
   - Cover to bridge deck & all cast in situ concrete: 50 mm
   - Cover to barrier fixing steel: (where required): 50 mm

4. DESIGN LOADING
   MN=20% (including 1.5k live load factor of 1.53)

5. SPECIFICATION
   The design is based on NZS Standards Bridge Beam Specification (2005)

6. TOLERANCES

   - Specified overall length
   - Tolerance boxes

   6.1. Dimensions at Time of Erection
   a. General overall length and dimensions:
   b. The distance between the ends of the beam shall be 300 mm.
   c. The overall length of the beam shall be 3000 mm.
   d. The beam shall have the dimensions shown in Diagram A.
   e. The beam shall be designed to carry the loads shown in Diagram A.
   f. The beam shall be designed to carry the loads shown in Diagram B.
   g. The beam shall be designed to carry the loads shown in Diagram C.
   h. The beam shall be designed to carry the loads shown in Diagram D.
   i. The beam shall be designed to carry the loads shown in Diagram E.
   j. The beam shall be designed to carry the loads shown in Diagram F.
   k. The beam shall be designed to carry the loads shown in Diagram G.
   l. The beam shall be designed to carry the loads shown in Diagram H.
   m. The beam shall be designed to carry the loads shown in Diagram I.
   n. The beam shall be designed to carry the loads shown in Diagram J.
   o. The beam shall be designed to carry the loads shown in Diagram K.
   p. The beam shall be designed to carry the loads shown in Diagram L.
   q. The beam shall be designed to carry the loads shown in Diagram M.
   r. The beam shall be designed to carry the loads shown in Diagram N.
   s. The beam shall be designed to carry the loads shown in Diagram O.
   t. The beam shall be designed to carry the loads shown in Diagram P.
   u. The beam shall be designed to carry the loads shown in Diagram Q.
   v. The beam shall be designed to carry the loads shown in Diagram R.
   w. The beam shall be designed to carry the loads shown in Diagram S.
   x. The beam shall be designed to carry the loads shown in Diagram T.
   y. The beam shall be designed to carry the loads shown in Diagram U.
   z. The beam shall be designed to carry the loads shown in Diagram V.
   aa. The beam shall be designed to carry the loads shown in Diagram W.
   bb. The beam shall be designed to carry the loads shown in Diagram X.
   cc. The beam shall be designed to carry the loads shown in Diagram Y.
   dd. The beam shall be designed to carry the loads shown in Diagram Z.

7. HANDLING
   Exposed of vertical lifting points or ground support shown marked.
   Central support position as shown is prepared (beam vertical at all times).

8. METHOD OF MANUFACTURE
   Beams shall be manufactured under factory conditions.

9. SURFACE FINISHES
   Beams shall be manufactured under factory conditions.

10. BEARING DESIGN DATA
    | SPAN (m) | REACTION (kN) | ROTATION (mm rad) |
    |--------|---------------|------------------|
    |        | LOAD END      | OVERLOAD (x3)    | OVERLOAD (x5) |
    |        | (1.6MN x 2)  | (1.6MN x 2)     | (1.6MN x 2)   |
    | 20     | 205           | 205              | 205           |
    | 20     | 205           | 205              | 205           |

11. AGE AT DECK POURING
    Deck is to be poured within 180 days of casting of the first beam.

TYPICAL END DIAPHRAGM STARTER BAR
CONNECTION FOR OUTER BEAM

DIAGRAM A

DIAGRAM B

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM

END DIAPHRAGM SET BACK FROM BEAM END
ALTERNATIVE 2 ARRANGEMENT

DIAGRAM
1. SPECIFIED CONCRETE COMPRESSIVE STRENGTHS
   - AT TRANSFER: 30MPa
   - AT 28 DAYS: 40MPa
   - IN SITU CONCRETE (DECK SLAB, DIAPHRAGM) AT 28 DAYS: 40MPa

2. REINFORCEMENT & PRESTRESSING
   - ALL SUPERHORSE WIRE TO BE 12.7mm SUPER 7 WIRE STRANDS
   - 5 WIRE GROUPS COMPLYING WITH NZS 4292 TO HAVE A MINIMUM BREAKING LOAD OF 157kN PER STRAND WITH METAL COATINGS AS FILLINGS
   - ALL SUPERHORSE WIRE TO BE 12.7mm SUPER 7 WIRE STRANDS
   - ALL SUPERHORSE WIRE TO BE 12.7mm SUPER 7 WIRE STRANDS

3. CONCRETE COVER (MINIMUM)
   - COVER TO ALL PRESTRESSING COMPONENTS: 40mm
   - COVER TO CONCRETE UNLESS SHOWN OTHERWISE: 40mm
   - COVER TO ADJACENT TO CORED HOLES: 30mm
   - COVER TO BRIDGE DECK & ALL CAST IN SITU CONCRETE: 50mm
   - COVER TO BARS: 30mm
   - COVER TO BRIDGE DECK & ALL CAST IN SITU CONCRETE: 50mm

4. DESIGN LOADING
   - Wind: 30MPa
   - 15MPa

5. SPECIFICATION
   - THE DESIGN IS BASED ON NZS 3100 STANDARD CONCRETE SPECIFICATION

6. TOLERANCES
   - SPECIFIED OVERALL LENGTH
     - FOR SQUARE DECK: ± 10mm
     - FOR SHAPED DECK: ± 10mm
   - DIAGRAM A

7. HANDLING
   - DISTANCE OF VERTICAL LIFTING POINTS OR FOUNDATION NUTS IS SHOWN
   - CENTRAL SUPPORT POINTS AS SHOWN IS PRESTRESSED (EACH VERTICAL AT ALL TIMES)

8. METHOD OF MANUFACTURE
   - BEAMS SHALL BE MANUFACTURED UNDER FACTORY CONDITIONS

9. SURFACE FINISHES
   - BEAMS: TOP SURFACE
     - AS FOR TYPE B CONSTRUCTION JOINT (AS SPECIFIED IN NZS 3100)
   - SIDE SURFACE
     - FOR EXTERIOR AREAS ON DIAGRAM B
     - INTERIOR AREAS IN SHAPES - AS FOR TYPE B CONSTRUCTION JOINT AT AREA OF CONTACT WITH DIAPHRAGMS
   - END SURFACE
     - ALL BEAMS - SMOOTH FINISH
   - ALTERNATIVE 1 ARRANGEMENT - AS FOR TYPE B CONSTRUCTION JOINT
   - ALTERNATIVE 2 ARRANGEMENT - SMOOTH FINISH WITH MINIMUM 15MM smooth finish with trimmings cut flush and protected with a minimum of 15mm smooth finish

10. BEARING DESIGN DATA
   - SPAN (m)
     - REACTION (kN)
     - ROTATION (x 10^-3)
     - LIVE LOAD (1.5 x 1.0m x 3)
     - OVERLOAD (1.0 x 1.0m x 3)
     - LIVE LOAD (1.5 x 1.5m x 2)
     - OVERLOAD (1.0 x 1.0m x 2)

11. AGE AT DECK POURING
    - DECK TO BE POURED WITHIN 180 DAYS OF CASTING OF THE FIRST BEAM

DIAGRAM A
DIAGRAM B

STANDARD PRECAST CONCRETE BRIDGE BEAMS
1300mm DEEP 1-BEAM - 22m & 26m SPAN
UNIT DATA

OPUS
TRANSPORT AGENCY

STANDARD PRECAST CONCRETE BRIDGE BEAMS
1300mm DEEP 1-BEAM - 22m & 26m SPAN
UNIT DATA

OPUS
TRANSPORT AGENCY
ELEVATION – DIMENSIONS

1:50

ELEVATION – REINFORCEMENT

DIMENSIONS

REINFORCEMENT

TYPICAL DIAPHRAGM DETAIL

1:50

NOTE:

ALL EXPOSED SHARP EDGES AND CORNERS TO HAVE 25 x 25
FILLETS OR CAMBRETS UNLESS SHOWN OTHERWISE.

STANDARD PRECAST CONCRETE BRIDGE BEAMS

1000mm DEEP T-BEAMS – 2.0m & 2.5m SPAN
MIDSPAN DIAPHRAGM DETAILS

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OPUS

BECA

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