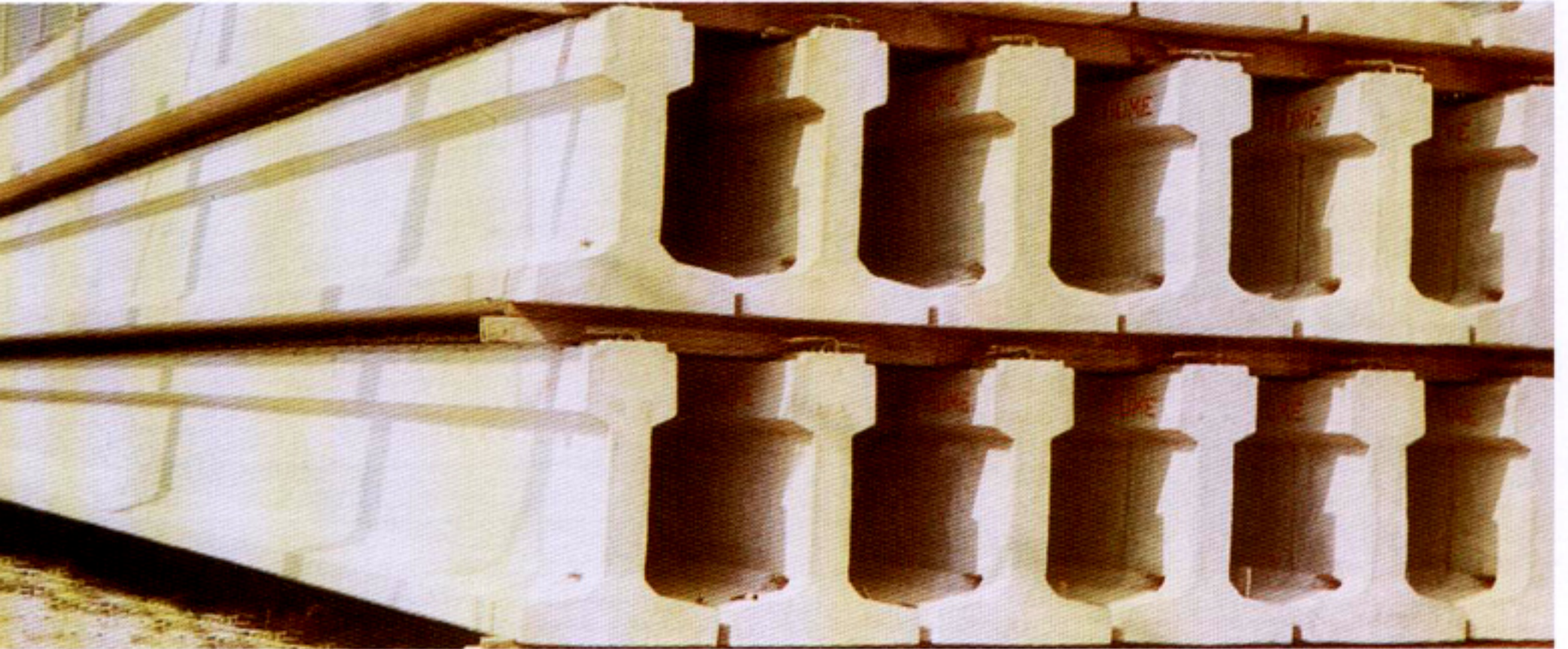


reaching out with
SOLUTIONS

Hume Prestressed Concrete Beam



M-BEAMS

DIMENSIONS AND SECTION PROPERTIES OF M2, M3, M4

DESCRIPTION		M BEAM TYPE	M2	M3	M4
SPAN RANGE	L (m)		16.0-18.0	17.5-19.5	19.0-21.5
DEPTH	D (mm)		720	800	880
WEIGHT	W (KN/m)		7.71	8.49	9.26
SECTIONAL AREA	A (mm ²)		316650	348650	380650
NEUTRAL AXIS	Yt (mm)		455	490	527
	Yb (mm)		265	310	353
MOMENT OF INERTIA	Ixx (mm ⁴)		16.20 x 10 ⁹	23.02 x 10 ⁹	30.94 x 10 ⁹
SECTION MODULI	Zt (mm ³)		35.64 x 10 ⁶	46.96 x 10 ⁶	58.77 x 10 ⁶
	Zb (mm ³)		61.04 x 10 ⁶	74.31 x 10 ⁶	87.57 x 10 ⁶

DIMENSION AND SECTION PROPERTIES OF M5, M6, M7

DESCRIPTION		M BEAM TYPE	M5	M6	M7
SPAN RANGE	L (m)		20.0-22.5	22.0-24.0	23.5-26.0
DEPTH	D (mm)		960	1040	1120
WEIGHT	W (KN/m)		8.64	9.42	10.20
SECTIONAL AREA	A (mm ²)		355050	387050	419050
NEUTRAL AXIS	Yt (mm)		603	631	660
	Yb (mm)		357	409	460
MOMENT OF INERTIA	Ixx (mm ⁴)		35.81 x 10 ⁹	47.56 x 10 ⁹	60.46 x 10 ⁹
SECTION MODULI	Zt (mm ³)		59.39 x 10 ⁶	75.39 x 10 ⁶	91.53 x 10 ⁶
	Zb (mm ³)		100.33 x 10 ⁶	116.23 x 10 ⁶	131.54 x 10 ⁶

DIMENSION AND SECTION PROPERTIES OF M8, M9, M10

DESCRIPTION		M BEAM TYPE	M8	M9	M10
SPAN RANGE	L (m)		25.0-27.0*	26.5-28.5*	28.0-29.0*
DEPTH	D (mm)		1200	1280	1360
WEIGHT	W (KN/m)		9.58	10.35	11.13
SECTIONAL AREA	A (mm ²)		393450	425450	457450
NEUTRAL AXIS	Yt (mm)		746	768	792
	Yb (mm)		454	512	568
MOMENT OF INERTIA	Ixx (mm ⁴)		65.19 x 10 ⁹	82.98 x 10 ⁹	101.88 x 10 ⁹
SECTION MODULI	Zt (mm ³)		87.39 x 10 ⁶	108.09 x 10 ⁶	128.65 x 10 ⁶
	Zb (mm ³)		143.57 x 10 ⁶	161.57 x 10 ⁶	179.36 x 10 ⁶

*Subject to transportation constraints

A range of nine M-sections, M2 to M10, are available for use by the bridge engineer to cater for various spans from 16 metres or less up to 28 metres (subject to transportation constraints). Standard web holes (see fig 1) provided at 600mm centers when necessary for threading transverse reinforcement through the bottom of the webs.

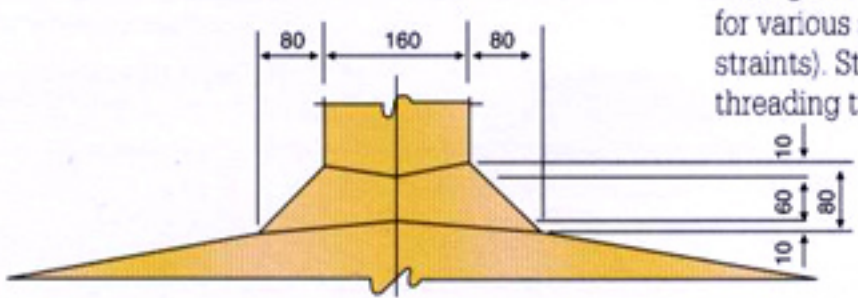
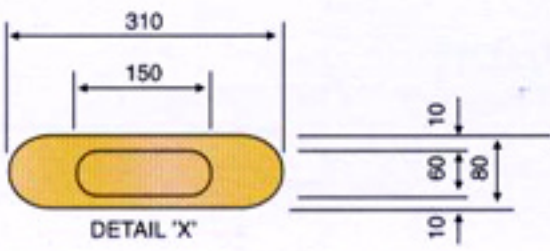
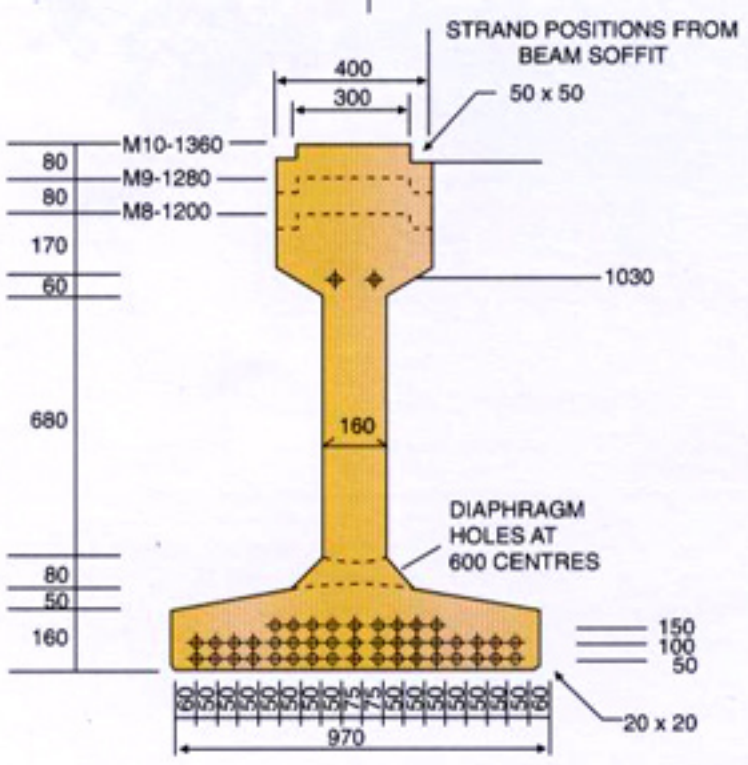
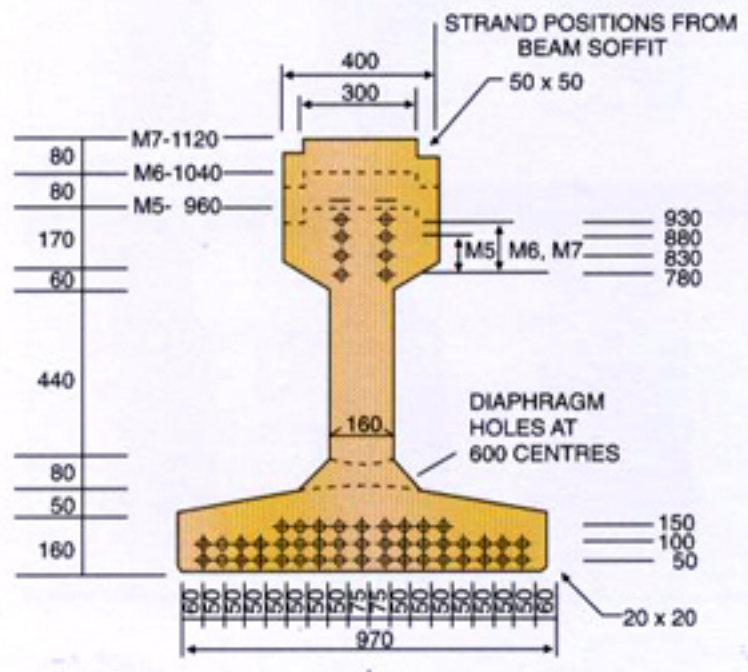
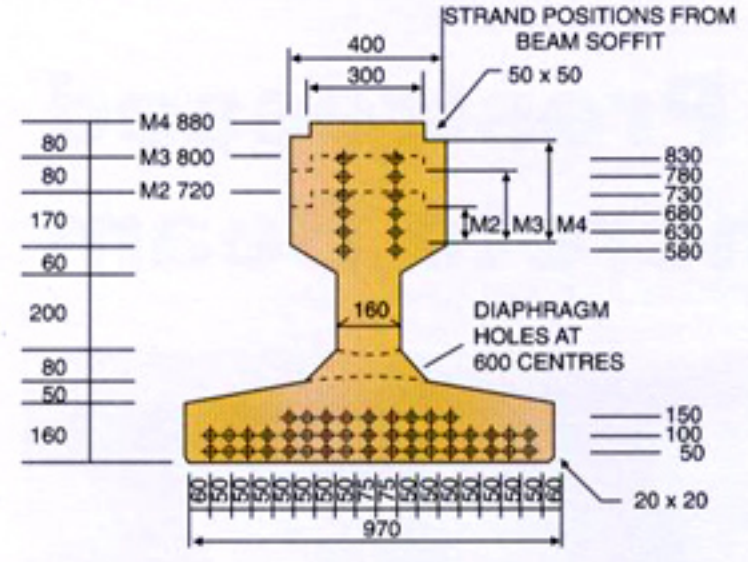
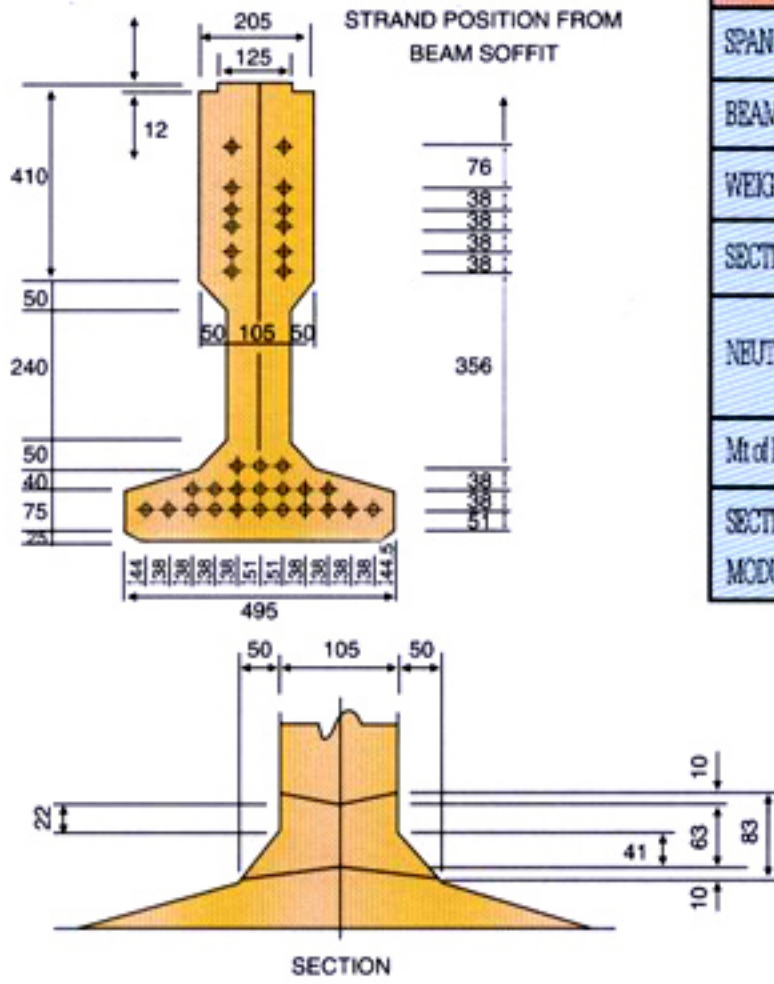


Fig 1 - Diaphragm/Web hole details

INVERTED T-BEAMS



DIMENSIONS AND SECTION PROPERTIES OF INVERTED T-BEAM								
SPAN RANGE, L (m)	5.5-12.0	9.5-13.7	11.5-14.5	13.0-15.6	14.0-17.5	14.8-18.3	15.5-18.9	17.0-19.3
BEAM DEPTH, D (mm)	535	575	615	650	685	765	840	890
WEIGHT, W (kN/m)	2.76	2.96	3.16	3.33	3.51	3.91	4.28	4.53
SECTIONAL AREA, A (mm ²)	113315	121515	129715	136890	144065	160465	175840	186090
NEUTRAL AXIS	Y _t (mm)	341.8	357.7	374.1	388.8	403.8	429.0	455.5
	Y _b (mm)	193.2	217.3	240.9	261.2	281.2	326.0	367.3
Mt of INERTIA	I _{xx} (x 10 ⁹ mm ⁴)	3.137	4.113	5.183	6.206	7.306	10.152	13.283
SECTION MODULI	Z _t (x 10 ⁶ mm ³)	9.178	11.496	13.854	15.958	18.091	23.127	28.100
	Z _b (x 10 ⁶ mm ³)	16.237	18.928	21.517	23.759	25.985	31.137	36.165

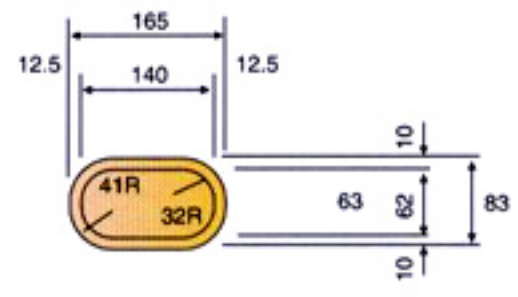
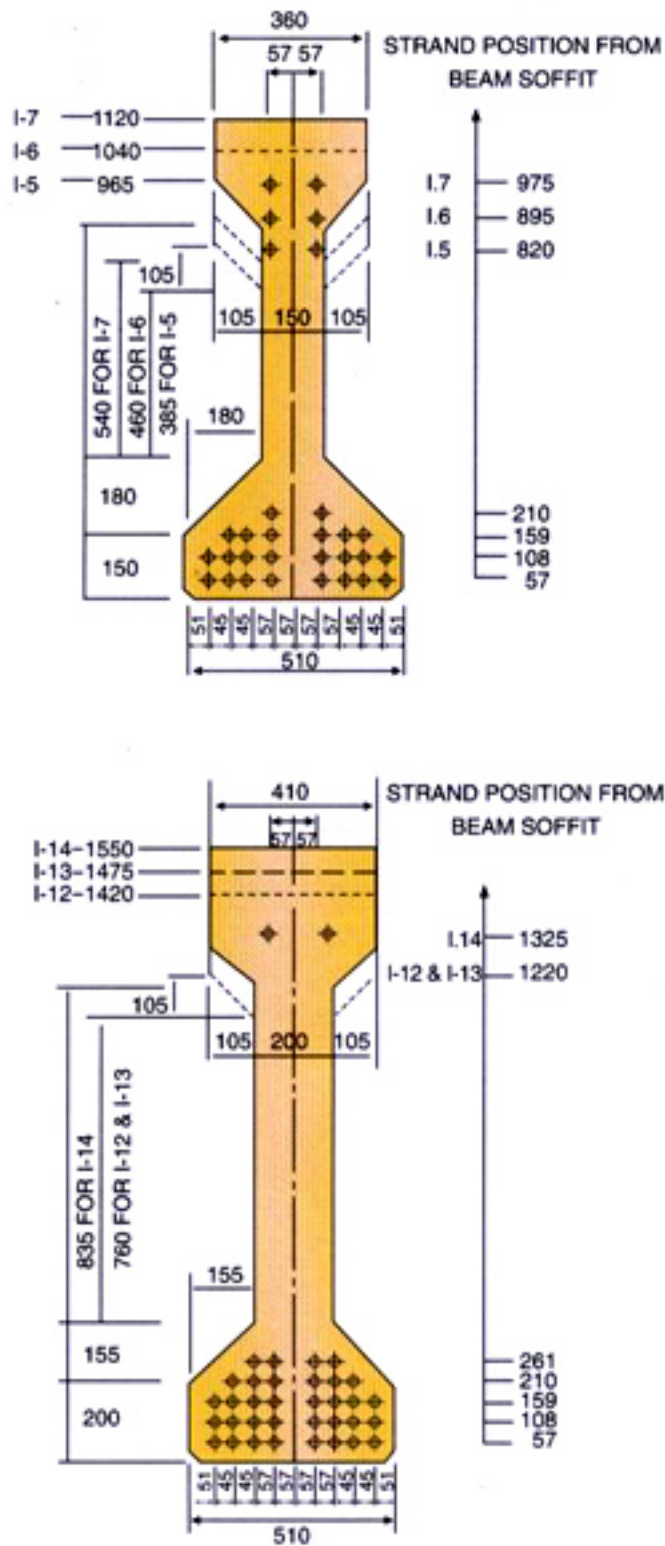


Fig 2 - Diaphragm/Web hole details

DETAIL 'Y'

A range of nine inverted T-sections, of depths ranging from 535 mm to 890 mm (as shown in table above), are available for bridge spans from 5 metres up to 19 metres. Standard web holes (see figure 2 above) are provided at 1525 mm centers for transverse reinforcement for diaphragm beams.

I BEAMS

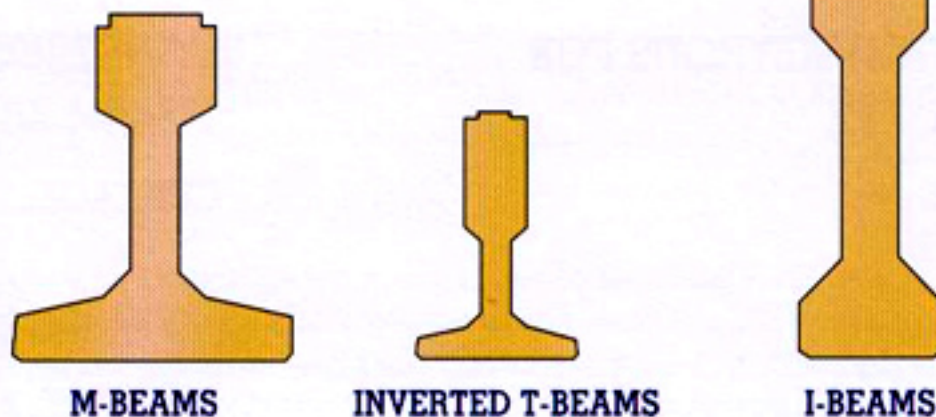


DIMENSIONS AND SECTION PROPERTIES OF I-5, I-6 AND I-7 BEAMS					
DESCRIPTION		I BEAM TYPE	I-5	I-6	I-7
SPAN RANGE	L (m)		18.3	19.8	21.3
DEPTH	D (mm)		965	1040	1120
WEIGHT	W (kN/m)		6.63	6.91	7.20
SECTIONAL AREA	A (mm ²)		272625	283875	295875
NEUTRAL AXIS	Y _t (mm)		538	579	623
	Y _b (mm)		427	461	497
MOMENT OF INERTIA	I _{xx} (mm ⁴)		28.15 x 10 ⁹	34.46 x 10 ⁹	42.09 x 10 ⁹
SECTION MODULI	Z _t (mm ³)		52.32 x 10 ⁶	59.56 x 10 ⁶	67.67 x 10 ⁶
	Z _b (mm ³)		65.80 x 10 ⁶	74.76 x 10 ⁶	84.68 x 10 ⁶

DIMENSIONS AND SECTION PROPERTIES OF I-12, I-13 AND I-14 BEAMS					
DESCRIPTION		I BEAM TYPE	I-12	I-13	I-14
SPAN RANGE	L (m)		24.4	25.9	27.4
DEPTH	D (mm)		1420	1475	1550
WEIGHT	W (kN/m)		10.30	10.84	11.21
SECTIONAL AREA	A (mm ²)		423050	445600	460600
NEUTRAL AXIS	Y _t (mm)		752	768	806
	Y _b (mm)		668	707	744
MOMENT OF INERTIA	I _{xx} (mm ⁴)		93.64 x 10 ⁹	106.61 x 10 ⁹	122.07 x 10 ⁹
SECTION MODULI	Z _t (mm ³)		124.36 x 10 ⁶	138.81 x 10 ⁶	151.34 x 10 ⁶
	Z _b (mm ³)		140.19 x 10 ⁶	150.79 x 10 ⁶	160.07 x 10 ⁶

Hume Industries Concrete Division offer designers a choice of 3 pretensioned bridge beam types for use in bridge construction.

These 3 beam types are shown below:
For each beam type, a range of sizes are available as shown in the attached tables.



M-BEAMS

INVERTED T-BEAMS

I-BEAMS

For each beam type, a range of sizes are available as shown in the attached tables.

FEATURES

- Hume Prestressed Bridge Beams are:
 - designed to BS 5400: Part 4: Code of practice for design of Concrete Bridges: 1984.
 - produced using high strength concrete with characteristic strengths of between 45 N/mm² to 50 N/mm².
 - used for the construction of highway bridges designed to MOT load requirements.

ADVANTAGES OF USING HUME PRESTRESSED BRIDGE BEAMS

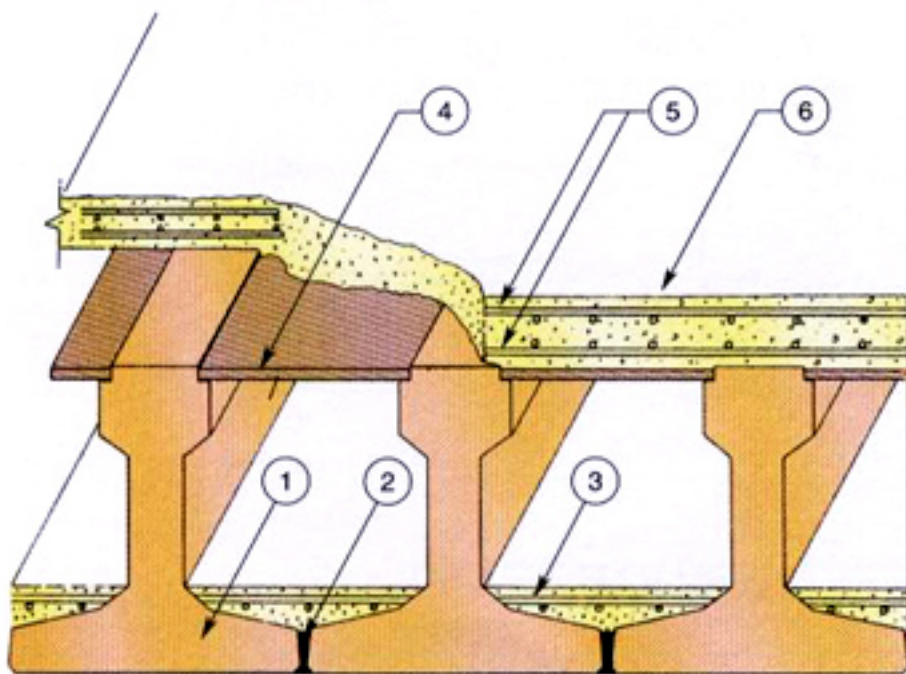
- No scaffolding/ props/ falsework required over rivers or roads.
- Reduce construction site activities.
- Minimise wet concrete works at site.
- Ease of construction.
- Minimum interruption to traffic flow.
- Cut construction time-beam production in Hume factories proceeds simultaneously with construction work at site.
- Obtain high quality factory cast beams with minimal supervision.
- No time wasted waiting for beams to gain strength.
- Working platform immediately available upon launching of beams.
- Future extension of deck easily implemented by addition of prestressed beams.

INFORMATION FOR DESIGNERS

- **Prestressing strands**
12.9 mm diameter 7-wire super strands (low relaxation) conforming to BS 5896: 1980 are used.
- **Standard Strand Pattern Positions**
Designers are recommended to choose from the 'standard' strand pattern positions shown for each beam type when finalising their combination of total prestressing force and eccentricity to meet their particular design requirements. Use of standard strand pattern positions allows a reduction in production costs, thus benefitting the client.
- **28-day concrete cube strengths**
Hume Prestressed bridge Beams are made with high strength concrete having a 28-day cube strengths of between 45 N/mm² and 50 N/mm².
- **Curing**
Hume Prestressed Bridge Beams are cured by covering and maintaining the beams in a wet condition by the application of low pressure steam until the specified transfer cube strength is reached.
- **Cubes strength of concrete at transfer**
Although achievable, transfer cube strengths above 40 N/mm² should be avoided where possible. A transfer cube strength of up to 38 N/mm² should be adequate for most cases. It may be possible to avoid high transfer cube strengths by either a small increase in the construction depth or by the use of debonding.
- **Stacking**
Each beam should be stacked on timber bearers placed at about 300 mm to 500 mm from each beam end.
- **End slots for dowels at fixed end bearings**
Slots at beam ends can be formed in the bottom flange to accommodate dowel bars at fixed bearing positions where required.
- **Beam Lengths and Transportation**
Subject to design considerations, Hume Prestressed Bridge Beams can be made to lengths (subject to end shortening upon transfer of prestress) required by the designer. Beam lengths should preferably be specified in increments of 50 mm. Maximum beam lengths of up to 27 metres have been successfully transported from Hume factories and launched. Where access to a bridge site may be a problem, it is recommended that a check be made especially when using long (>22 m) beams for remote areas. For long beams, it is highly recommended that some top reinforcement (in the form of strands/ bars) be placed near the top of the beam in order to facilitate transportation without cracking of the beams.

CONSTRUCTION METHODS FOR M-BEAM BRIDGES

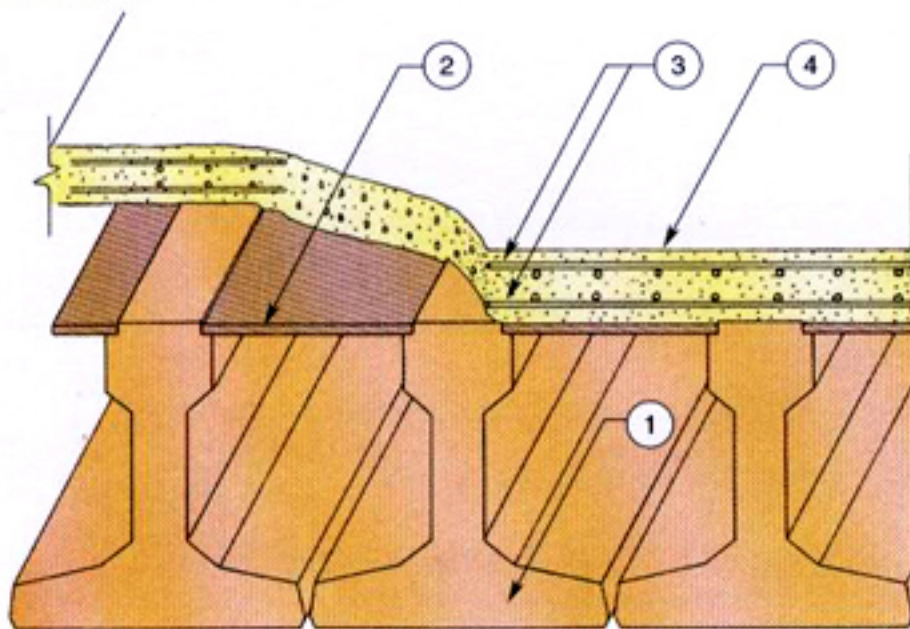
PSEUDO BOX



Construction sequence

1. M-beams are launched at 1-metre centers.
2. Fill gap between bottom flanges of adjacent beams
3. Place reinforcement through web holes & cover reinforcement with a minimum of 50mm in situ concrete.
4. Place permanent formwork between top flanges of adjacent beams
5. Place reinforcement for top slab and end diaphragm beams
6. Cast top slab and end diaphragm beams

T-BEAM



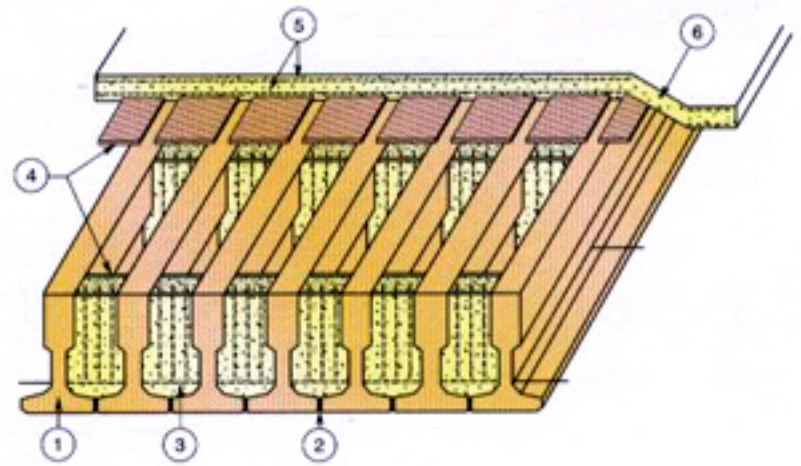
Construction sequence

1. M-beams are launched at 1-metre centers
2. Place permanent formwork between top flanges of adjacent beams
3. Place reinforcement for top slab and end diaphragm beams
4. Cast top slab and end diaphragm beams.

Note: For T-beam construction, web holes are omitted, except at the ends of the M-beam for threading through the end diaphragm beam reinforcement.

CONSTRUCTION METHODS FOR INVERTED T-BEAM BRIDGES

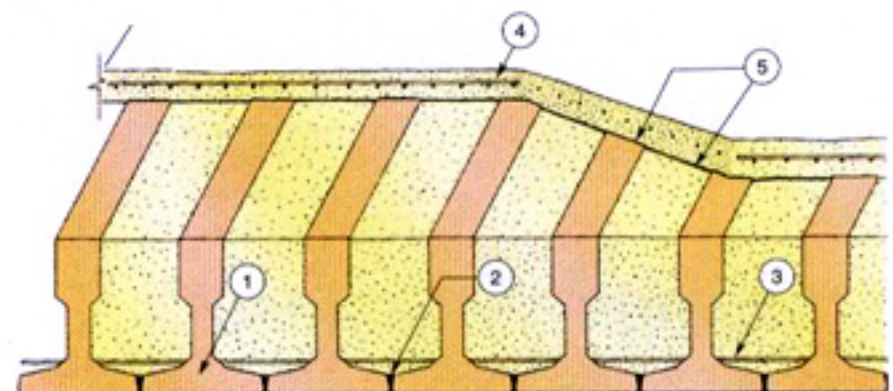
GRILLAGE



Construction sequence

1. Inverted T-beams are laid at 508mm centers.
2. Fill gap between bottom flanges of adjacent beams at positions of diaphragm beams.
3. Place diaphragm reinforcement through web holes @ 1.525m centers together with shear reinforcement.
4. Place formwork to sides of diaphragm beams and between top flanges of adjacent beams.
5. Place reinforcement for top slab.
6. Cast top slab and diaphragm beams.

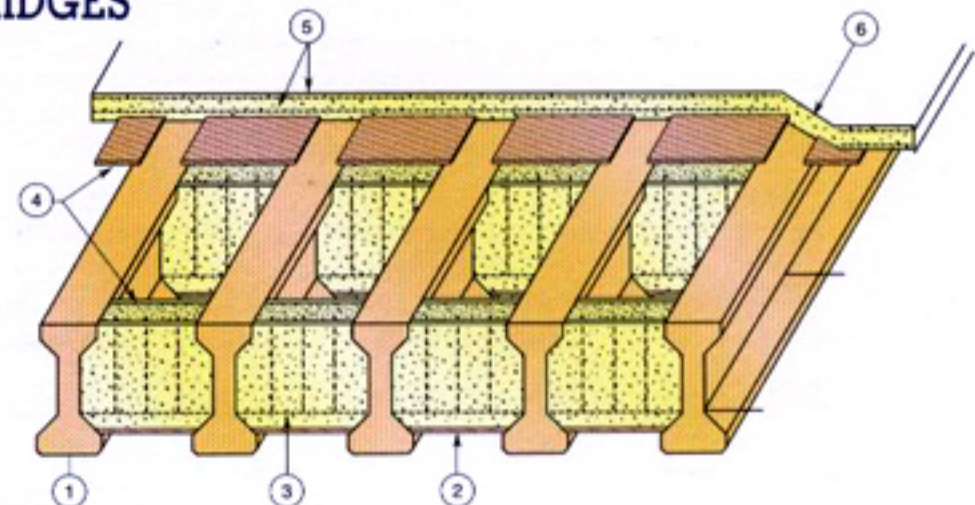
SOLID SLAB



Construction sequence

1. Inverted T-beams are laid at 508mm centers
2. Fill gap between bottom flanges of adjacent beams along length of beams
3. Place reinforcement through web holes @ 762mm centers
4. Place reinforcement for top slab
5. Cast void between contiguous beams together with top slab.

CONSTRUCTION METHODS FOR I-BEAM BRIDGES



Construction sequence

1. I-beams are launched at 1.5 metre centers (typical).
2. Soffit formwork is placed at diaphragm beam positions.
3. Reinforcement for diaphragm beams is placed.
4. Side formwork for diaphragm beams and soffit formwork for slab is placed.
5. Place reinforcement for top slab.
6. Cast top slab and diaphragm beams.

- **Diaphragm hole sizes and locations**

Standard sized diaphragm holes (see fig 1 & 2) for each beam type are located at regular spacings as shown. Adoption of these standard hole sizes and locations will allow a reduction in production cost of the beams.

- **Skewed Beam Ends**

Skewed ends to beams are expensive and should be avoided where possible. Specification of beam ends with the precise angle of skew to suit the bridge alignment generally increases the beam cost. Where skewed ends are necessary, the use of the 'rationalised skew angles' shown in the table below will help reduce beam costs with no disadvantage to the designer. The use of the rationalised skew angles below ensures that the maximum displacement 's' of the corners of the beams (see figure below) does not exceed 50 mm for M beams.

- **Reinforcement in Skewed Beams**

Only reinforcement in the end zone of the beam should be skewed. All other reinforcement in the body of the beam should be detailed square to the section.

1 Rationalised Skew angle at beam end	2 Maximum 'S' (mm) for intermediate skew angles for M-beams*	3 Skew angle at S max
0°	44	5.0°
10°	45	15.1°
20°	49	25.3°
30°	40	34.0°
37.5°	44	41.5°
45°	50	49.0°
52.5°	50	56.0°
59°		

Example: Actual skew angle = 27.5 : Use of Column 3 indicates that a skew angle of 25.3° corresponds to a displacement S of about 50 mm. To limit displacement S to below 50 mm, use a rationalised skew angle of 30°.

*For Inverted tee beams, the value of 'S' is half that in column 2.

It is our policy to continuously review and improve products and their design. Information in this leaflet is therefore subject to change without notice.

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