BANAGHER
PRECAST CONCRETE

Bridge Beam Manual

3rd Edition

PRECAST **CONCRETE SPECIALISTS**

#ChallengeUs

PRECAST **CONCRETE SPECIALISTS**

Contents

Introduction

Banagher Precast Concrete is the largest precast concrete manufacturer in Ireland and the UK. Our track record in the field of precast concrete manufacture is exceptional. We have established an internationally recognised reputation for innovation in design, manufacture and installation of precast components.

The Banagher Precast Concrete team, comprising of experienced chartered structural engineers, graduates and technicans, is continually working on enhancing our range of products to meet the latest demands. We also offer early stage design assistance to consultant engineers and contractors.

Our team of expert Engineers and Estimators thrive on value engineering, when involved early in a project they can assist with designs and offer advice or alternatives which will optimise time efficiencies, cost savings, site safety and reduce carbon footprint without compromising the overall design.

- *Trusted and experienced supply partner with vast experience. Bridge beams have been manufactured in Banagher for over 60 years.*

- *Largest Bridge beam manufacturing facility in Ireland and the UK with capacity to manufacture 2.5 km of bridge beams per week.*

- *All beams are designed to British and Eurocode standards by our Design Team.*

- *All beam sections and profiles are available in BIM format.*

- *All Precast elements including Bridge Beams have CE marking and concrete is certified to EN 206. We operate and maintain ISO 9001 Quality Assurance standards.*

- *All our Bridge beam sections including the W beam and MY Beams (designed and developed by Banagher) are recognised and used in Computer Bridge Beam design packages.*

Brief History of Prestressed Bridge Beams

Pretensioned prestressed concrete bridge beams were introduced into many countries in the period 1948 to 1995. In the period after the War, infrastructure which had been damaged or neglected had to be replaced. The newly developed pretensioning technique was put to use in the manufacture of beams which could be used for a variety of bridging and decking problems.

At first, manufacturers rushed in competition to develop their own sections, which provided choice but only at the provisional layout stage. In some countries this was seen as a major disadvantage, compared with standard steel sections which could be specified and bought freely and competitively at the time of construction. Industry groups, with the blessing of National Authorities, removed this disincentive by developing a series of beam sections which could be made by any manufacturer. The Standard Bridge Beam was born.

In Ireland the first prestressed concrete bridge beam project was the "OB56 Dublin to Cork Line at Sallins" in 1952. It consisted of 15 number I Beams, 11430mm long weighing 4.5 tonne. The beams were 560mm deep and 460mm wide with a prestressing force of 950 kilonewtons and 4 number prestressing bars per beam.

In the UK the first Standard beams were developed by the PCBDG (Prestressed Concrete Bridge Development Group) and were an Inverted T beam for a solid slab deck, an I beam for a beam and top slab deck and a Box Beam for a voided deck. In the USA an I beam, a Box beam and a Bulb T were similarly developed. The PCBDG Inverted T beam is still made today, after 60 years of excellent service.

In the UK and Ireland by 1973, the M Beam, a larger version of the Inverted T for beam and slab and voided decks and a U Beam which provided a voided deck of more elegant appearance had been introduced.

By the mid 1980's, it became clear that although bridge beams were performing well, the joints between decks and their supporting abutments tended to leak and winter road salt was being allowed to penetrate down to bearing shelves and substructures causing corrosion damage. This problem applied to bridges of all forms of construction, insitu concrete and steel included.

The way forward was to provide continuity in decks over supports of multi span bridges and at abutments.

For this and other reasons a new beam the Y Beam was introduced with variants for Solid Slab - TY, Beam and slab - Y and for spans up to 40 metres – SY. At the same time, experience in the USA with a compromise form of continuity, Integral Construction, was brought across the Atlantic. This was followed by back up research and finally a presumption that Integral Construction should be used for all bridges of any material up to lengths of 60 metres.

Transport and crane capabilities have now increased to the extent that spans in excess of 45 metres can now be delivered and erected with beams weighing 150 tonnes. The Banagher Precast Concrete W Beam was brought to the market in 2005 and has successfully taken advantage of this change in scope.

The W Beam bridge beam was designed and developed exclusively by Banagher Precast Concrete. The first ever W Beam was produced by Banagher Precast Concrete in 2005 and was manufactured for the Kinsale Road Flyover on the outskirts of Cork City.

There was considerable research, design and investment required to bring this new and unique Bridge Beam to the UK and Irish markets. The W Beam was developed by Banagher Precast Concrete as a more economical solution to traditional bridge beam types existing in the market. It is also capable of spanning up to 50 m, which is beyond the range of other beam types.

As well as these benefits the W Beam is inherently more stable during transportation and erection on site, thus providing for better Health and Safety on sites. Designed and developed by Banagher Precast Concrete the W Beam has become an industry standard.

In 2007 the MY Beam bridge beam was designed and developed by Banagher Precast Concrete. The MY Beam was developed as a more economical solution to traditional 'Inverted T Beam' and 'TY Beam' type bridge beams which existed in the market place. For spans up to approximately 15 m the MY Beam provides a more efficient solution than traditional beams, reducing the amount of precast concrete required. The MY Beam is a more environmentally friendly beam with a smaller carbon footprint than other beam types for similar spans.

The Pretensioned Prestressed Bridge Beam has been with us for over 70 years and with its original sound engineering background still has proven excellent durability to this day.

Banagher Precast Concrete Bridge Beams

Quick Reference Guide. Beams arranged in order of maximum span capability

The information provided below will enable our customers to make a preliminary assessment of the suitability of one or more beam types for a particular bridge design requirement. The detailed cross sections, section properties, notional load span tables and normal methods of use are given in the following pages.

The chart below gives a guide to the span range of all of the Banagher Precast Concrete Bridge Beam types, designed to the Eurocode loading outlined in the technical section for each beam. The final choice of beam and the detailed design will be determined by the relevant performance specification.

Bridge Beam Type

Span Ranges

MY & MYE Edge Beam. Page 10

For Solid Slab Construction

Designed & Developed by Banagher Precast Concrete

T Beam. Page 16

For Solid Slab Construction

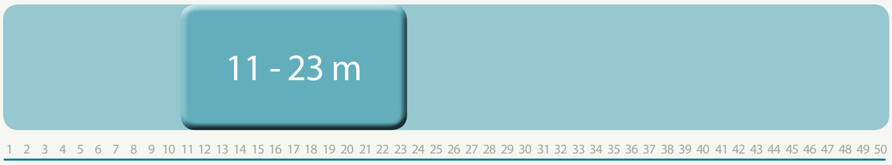
Special Order

TB Beam . Page 18

For Solid Slab Construction

Designed & Developed by Banagher Precast Concrete

Special Order

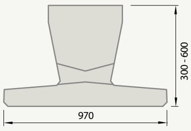
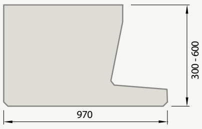
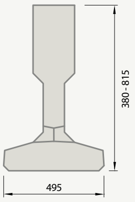
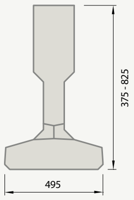
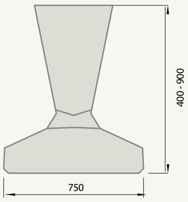
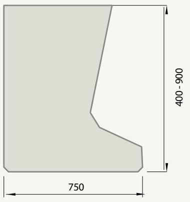
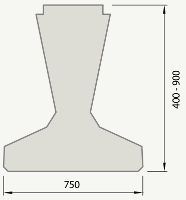
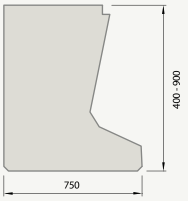


TY & TYE Edge Beam. Page 22

For Solid Slab Construction

TY & TYE Edge Beam. Page 20

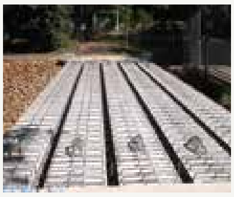
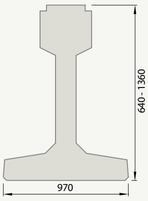
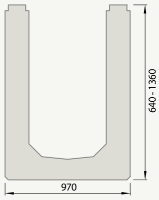
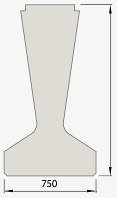
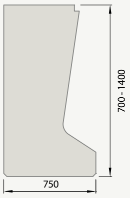
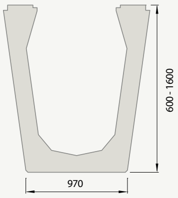
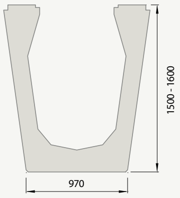
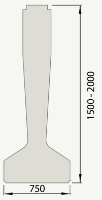
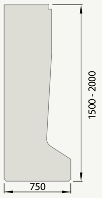
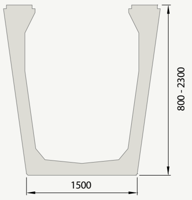
For Beam and Slab Construction

Typical Applications	Advantages	Typical Construction Details	Photo
Solid slab construction for short and medium span bridges. road and railway overbridges.	A more economical solution to traditional T Beam and TY Beam Bridge Construction which exist in the market place. Provides a flat soffit with no need for formwork. Very good resistance in marine environments.	 **MY Beam**  **MYE Beam**	
Solid slab construction for short and medium span bridges, jetties, marine docks and loading bay construction.	A very robust bridge construction. No need for formwork. Very good resistance in marine environments. Can be easily designed for continuity.	 **T Beam**	
Solid slab construction for short and medium span bridges, jetties, marine docks and loading bay construction.	A very robust bridge construction. No need for formwork. Very good resistance in marine environments. Can be easily designed for continuity.	 **TB Beam**	
Solid slab construction for short and medium span bridges, jetties, marine docks and loading bay construction.	A very robust bridge construction. No need for formwork. Very good resistance in marine environments. Can be easily designed for continuity.	 **TY Beam**  **TYE Beam**	
Beam and slab construction for short and medium span bridges.	Underside of deck and surfaces of beams and bridge bearings are fully visible for inspection and maintenance. Good capacity for negative bending at supports.	 **TY Beam**  **TYE Beam**	

Banagher Precast Concrete Bridge Beams

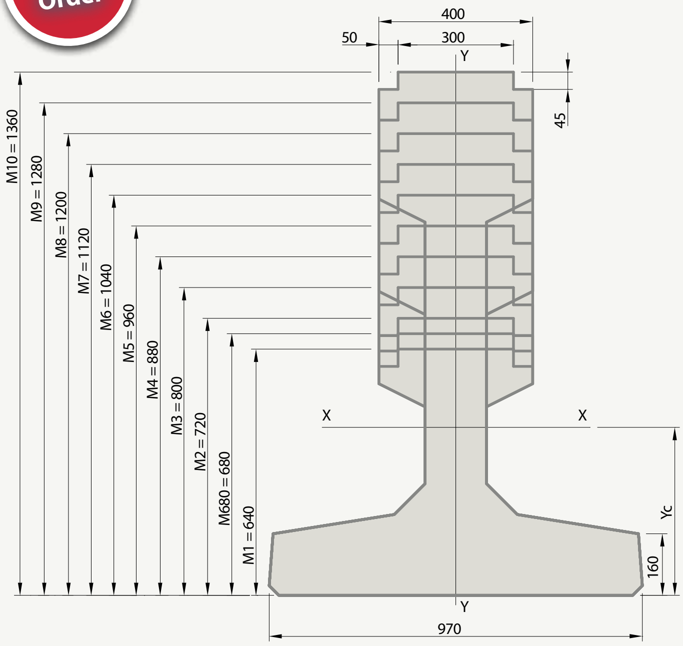
Quick Reference Guide. Beams arranged in order of maximum span capability

Bridge Beam Type	Span Ranges
Solid Box Beam. Page 12	10 - 35 m
M & UMB Edge Beam. Page 8 For Beam and Slab Construction Special Order	16 - 35 m
Y & YE Edge Beam. Page 32	16 - 40 m
U & SU Beam. Page 24	13 - 41.5 m
SY & SYE Edge Beam. Page 14	16 - 45 m
W Beam. Page 28 Designed & Developed by Banagher Precast Concrete	17 - 50 m

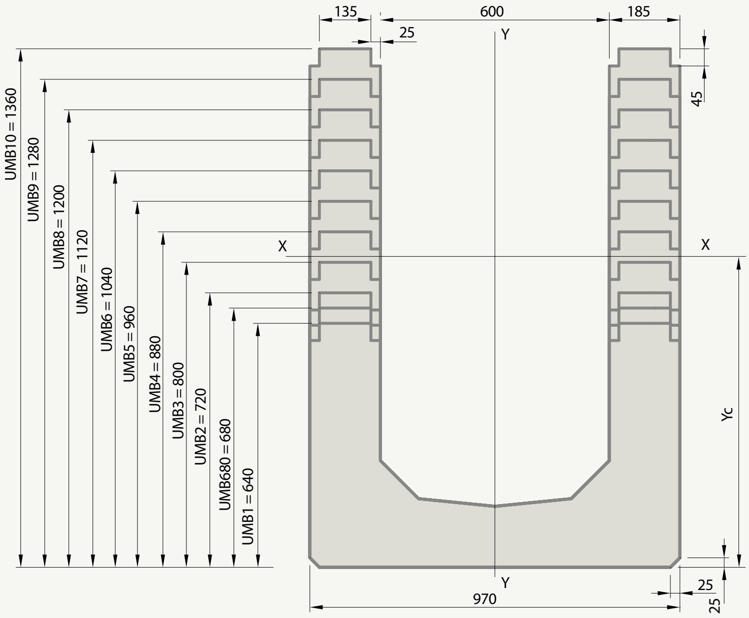
Typical Applications	Advantages	Typical Construction Details	Photo
Solid slab construction for short span bridges, railway over bridges, jetties, marine docks and loading bay construction.	A very robust bridge construction. No need for formwork. Very good resistance in marine environments. Can be easily designed for continuity. High span to depth ratio but costly to produce .	 **Solid Box Beam**	
Provides a voided bridge deck with a closed soffit for beam and slab construction for medium and long span bridges.	Very Efficent Span - Weight Ratio. The UMB beam acts as an edge beam giving a fair faced precast finish to the bridge deck.	 **M Beam**  **UMB Beam**	
Beam and slab construction for short and medium span bridges.	Underside of deck and surfaces of beams and bridge bearings are fully visible for inspection and maintenance. Good capacity for negative bending at supports.	 **Y Beam**  **YE Beam**	
Beam and slab construction for long span bridges and major motorway schemes.	Suitable for skew decks and where torsion is high. Visually pleasing.	 **U Beam**  **SU Beam**	
Beam and slab construction for long span bridges.	Underside of deck and surfaces of beams and bridge bearings are fully visible for inspection and maintenance. Good capacity for negative bending at supports. Followed on from the successful Y Beam when the need for longer spans arose. Practical and economical solution for spans up to 45 m.	 **SY Beam**  **SYE Beam**	
Beam and slab construction for long span bridges and major motorway schemes.	The W Beam was developed by Banagher Precast Concrete as a more economical solution to traditional bridge beam types existing in the market. It is also capable of spanning up to 50 m, which is beyond the range of other beam types. As well as these benefits the W Beam is inherently more stable during transportation and erection on site, thus providing for better Health and Safety on sites.	 **W Beam**	

M & UMB Edge Beam for Beam and Slab Construction

Special Order



Full M Beam Range



Full UMB Beam Range

Section	Depth	Area	Ht. centroid over soffit	Section modulus - (mm3 x 106) Top fibre	Bottom fibre	Second Moment of Area	Approximate self-weight	Web Height
	(mm)	(mm²)	Yc (mm)	Z t	Z b	I xx (mm⁴ x 10⁹)	(kN/m)	H (mm)
M1	640	284650	220.1	24.72	47.17	10.381	7.12	200
M680	680	300650	242.9	30.14	54.24	13.173	7.52	200
M2	720	316650	265.4	35.64	61.04	16.202	7.92	200
M3	800	348650	309.8	46.96	74.32	23.020	8.72	200
M4	880	380650	353.4	58.76	87.56	30.944	9.52	200
M5	960	355050	357.0	59.39	100.33	35.813	8.88	440
M6	1040	387050	409.2	75.39	116.23	47.559	9.68	440
M7	1120	419050	459.6	91.52	131.53	60.446	10.48	440
M8	1200	393450	454.1	87.39	143.57	65.187	9.84	680
M9	1280	425450	512.3	108.09	161.96	82.977	10.64	680
M10	1360	457450	568.0	128.65	179.36	101.880	11.44	680
UMB1	640	345675	243.4	29.34	47.79	11.635	8.64	-
UMB680	680	360475	260.1	33.25	53.70	13.964	9.01	-
UMB2	720	375275	276.9	37.41	59.85	16.573	9.38	-
UMB3	800	404875	311.4	46.42	72.86	22.685	10.12	-
UMB4	880	434475	346.5	56.37	86.78	30.071	10.86	-
UMB5	960	464075	382.3	67.22	101.56	38.830	11.60	-
UMB6	1040	493675	418.6	78.95	117.19	49.059	12.34	-
UMB7	1120	523275	455.4	91.56	133.64	60.856	13.08	-
UMB8	1200	552875	492.4	105.03	150.92	74.318	13.82	-
UMB9	1280	582475	529.8	119.36	169.00	89.540	14.56	-
UMB10	1360	612075	567.4	134.52	187.90	106.620	15.30	-

M & UMB-BEAM - BEAM AND SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 1300 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 1000 mm TO 1600 mm c/c's

Metres	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
M1	🟩	🟩	🟨	🟨	🟨															
M680	🟩	🟩	🟩	🟨	🟨	🟨	🟨⬜													
M2	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨												
M3	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨										
M4	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨⬜								
M5	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨							
M6	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨⬜					
M7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨				
M8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨⬜		
M9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	
M10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 1.3 m centres
- C40/50 Insitu deck slab 200 mm over beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the figues given above
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- M-Beams can be poured to any beam depth from 640 mm to 1400 mm deep if it is found necessary to match the depths to those of other beams like Y-Beams, W-Beams etc..
- This table also covers UMB-Beams

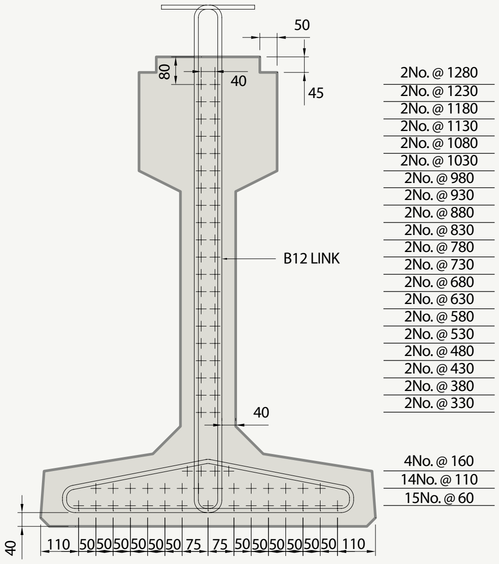
Alternative Spacings & Spans:

» To determine the beam length "L_{adj}" for a beam spacing "S" other than 1.3 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(1.3/S)^{0.5}$

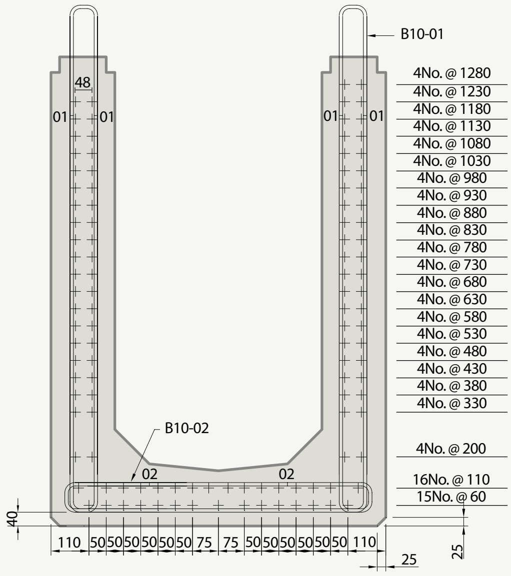
» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 1.3 m spacing from the above chart. $S=1.3(L/L_g)^2$

» In order to keep control of deck slab moments, beam interface shear links and to use standard 50/20 ribbed FRC shutter BPC recommends a general beam spacing in mm of 1350+0.28D for M-beams where D= beam depth. Beam spacings greater than this may be used but the permanent shutter will have to be either 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.

» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40mm wide x 50 mm deep to 60mm wide x 75 mm deep. This also requires the shear links to be narrowed and some adjustment of the top strand locations.



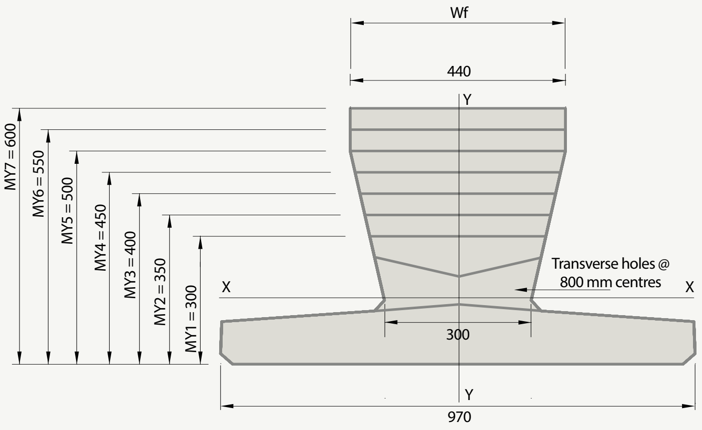
M Beam Showing All Possible Strand Locations



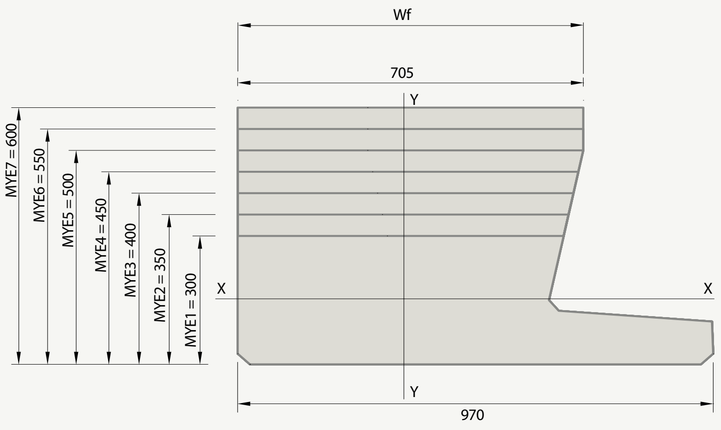
UMB Beam Showing All Possible Strand Locations

MY & MYE Edge Beam for Solid Slab Construction

Designed & Developed by **Banagher Precast Concrete**



Full MY Beam Range



Full MYE Beam Range

Section	Depth (mm)	Area (mm²)	Ht. centroid over soffit Y_c (mm)	Dist. centroid to vertical face X_c (mm)	Section modulus - (mm3 x 106) Top fibre Z_t	Bottom fibre Z_b	Second Moment of Area I_{xx} (mm⁴ x 10⁹)	Approximate self-weight (kN/m)	Top Flange Width W_f (mm)
MY1	300	170000	111.7	485.0	6.39	10.78	1.2033	4.25	360.0
MY2	350	188500	132.6	485.0	9.05	14.84	1.9681	4.71	380.0
MY3	400	208000	155.4	485.0	12.31	19.39	3.0123	5.20	400.0
MY4	450	228500	179.6	485.0	16.18	24.37	4.3753	5.71	420.0
MY5	500	250000	205.0	485.0	20.67	29.74	6.0972	6.25	440.0
MY6	550	272000	230.9	485.0	25.61	35.40	8.1425	6.80	440.0
MY7	600	294000	256.6	485.0	30.83	41.26	10.587	7.35	440.0
MYE1	300	230190	136.0	399.1	10.78	12.99	1.7667	5.75	665.0
MYE2	350	263690	160.1	391.0	14.84	17.61	2.8186	6.59	675.0
MYE3	400	297690	184.6	385.2	19.58	22.85	4.2180	7.44	685.0
MYE4	450	332190	209.6	381.0	25.01	28.69	6.0128	8.30	695.0
MYE5	500	367190	234.9	378.0	31.13	35.13	8.2517	9.18	705.0
MYE6	550	402440	260.3	375.8	37.85	42.13	10.9661	10.06	705.0
MYE7	600	437690	285.6	373.9	45.11	49.66	14.1830	10.94	705.0

MY BEAM SOLID SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH
FOR GENERAL APPLICATION OF 985 mm SPACING

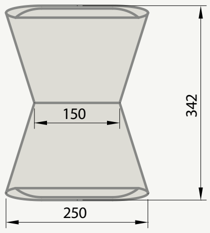
Metres	9	10	11	12	13	14	15	16	17	18	19
MY1	🟩	🟩🟨	🟨	🟨⬜							
MY2	🟩	🟩	🟩	🟨	🟨						
MY3	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨⬜				
MY4	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨			
MY5	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨		
MY6	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	
MY7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

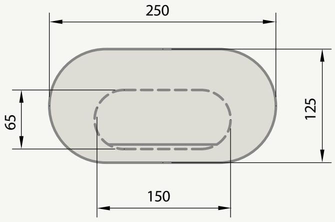
- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 985 mm centres
- C40/50 Insitu infill solid slab deck to 150 mm over the beam
- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

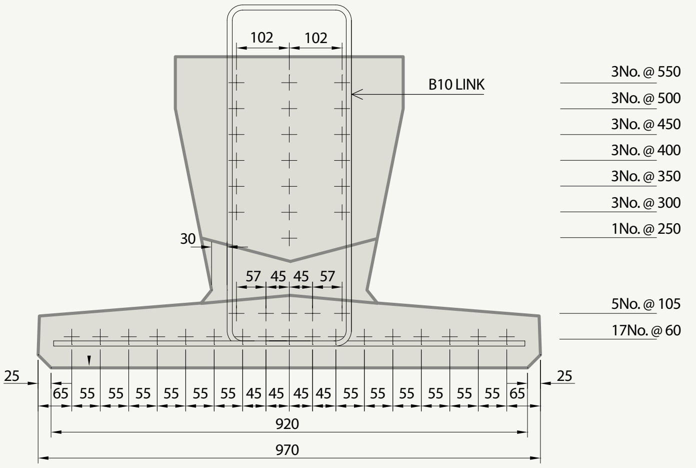
- The above figures are for actual beam length
- The clear span will be 1m less than the figues given above
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- Longer spans can be achieved by propping the beams while pouring the insitu concrete
- MY-Beams have been designed specifically for solid slab construction. The bottom flange thickness and link shape are not sufficent for beam and slab construction.
- If beam and slab construction is preferred please use the TY-Beam version.
- This table also covers MYE-Beams, but please note that when dealing with MYE-Beams the prestressing force should be centred on the lateral (transverse) centroid Xc
- Default strand size is 12.9 mm. Use 12.9 mm for the smaller sizes and spans less than approximately 12 m. Adopt 15.7 mm when the number of 12.9 mm required exceeds 17.



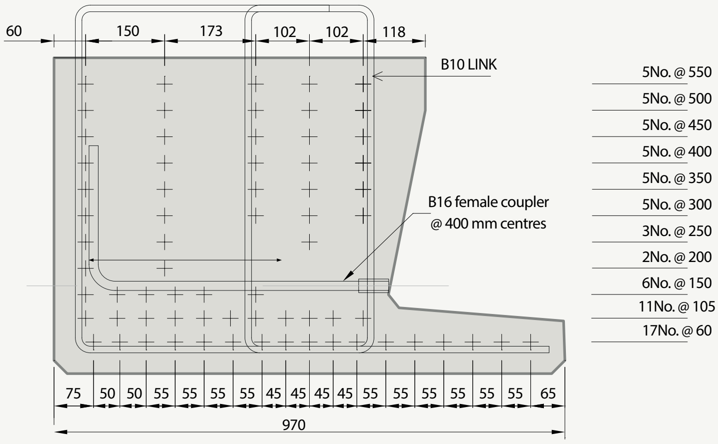
Plan of Transverse Holes @ 800 mm c/c's



Elevation of Transverse Holes @ 800 mm c/c's

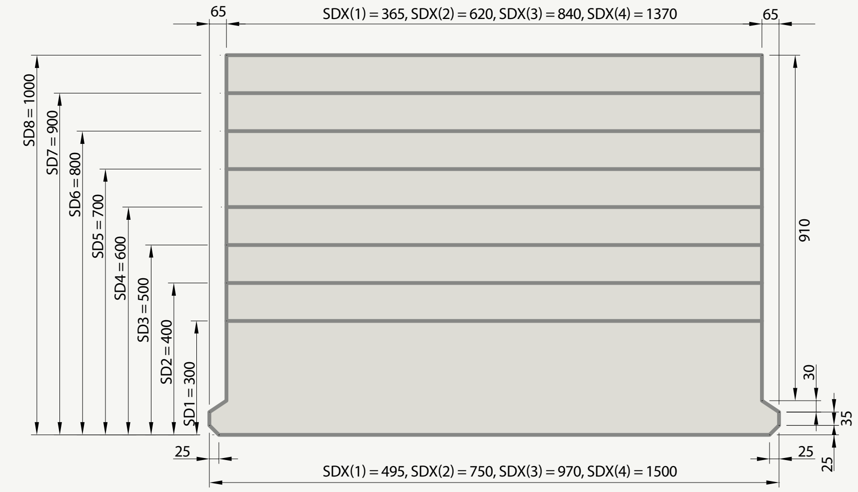


Section Through MY Beam Range
Showing All Strand Locations



Section Through MYE Beam Range
Showing All Strand Locations

Solid Box Beam



750MM AND 970MM PREFERRED SIZES

SOLID BOX BEAM (GENERIC)

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Section modulus - (mm^3 x 10^6)		Approximate self-weight (kN/m)
				Top fibre Z_t	Bottom fibre Z_b	
SD1 (1)	300	118630	141.5	5.85	6.55	2.97
SD2 (1)	400	155130	190.6	10.37	11.39	3.88
SD3 (1)	500	191630	240.0	16.11	17.46	4.79
SD4 (1)	600	228130	289.6	23.09	24.75	5.70
SD5 (1)	700	264630	339.3	31.28	33.26	6.62
SD6 (1)	800	301130	389.1	40.70	42.98	7.53
SD7 (1)	900	337630	438.9	51.34	53.93	8.44
SD8 (1)	1000	374130	488.8	63.19	66.09	9.35
SD1 (2)	300	195125	144.9	9.70	10.39	4.88
SD2 (2)	400	257125	194.3	17.19	18.20	6.43
SD3 (2)	500	319125	244.0	26.77	28.09	7.98
SD4 (2)	600	381125	293.8	38.42	40.05	9.53
SD5 (2)	700	443125	343.6	52.15	54.09	11.08
SD6 (2)	800	505125	393.5	67.94	70.19	12.63
SD7 (2)	900	567125	443.4	85.81	88.36	14.18
SD8 (2)	1000	629125	493.3	105.74	108.60	15.73
SD1 (3)	300	261125	146.2	13.01	13.69	6.53
SD2 (3)	400	345125	195.8	23.07	24.07	8.63
SD3 (3)	500	429125	245.5	35.95	37.26	10.73
SD4 (3)	600	513125	295.4	51.64	53.25	12.83
SD5 (3)	700	597125	345.3	70.13	72.05	14.93
SD6 (3)	800	681125	395.2	91.43	93.66	17.03
SD7 (3)	900	765125	445.1	115.52	118.06	19.13
SD8 (3)	1000	849125	495.1	142.42	145.26	21.23
SD1 (4)	300	420350	147.5	20.98	21.68	10.51
SD2 (4)	400	557350	197.3	37.24	38.26	13.93
SD3 (4)	500	694350	247.2	58.08	59.41	17.36
SD4 (4)	600	831350	297.1	83.49	85.14	20.78
SD5 (4)	700	968350	347.0	113.48	115.44	24.21
SD6 (4)	800	1105400	397.0	148.03	150.31	27.64
SD7 (4)	900	1242400	446.9	187.15	189.74	31.06
SD8 (4)	1000	1379400	496.9	230.84	233.74	34.49

SOLID BOX BEAMS SPAN CHART - BASED ON ACTUAL BEAM LENGTH
FOR GENERAL APPLICATIONS SPACED SIDE BY SIDE

Metres	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
SD 1 300 mm Deep	🟩	🟨	🟨																							
SD 2 400 mm Deep	🟩	🟩	🟩	🟩	🟨	🟨	🟨																			
SD 3 500 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨																
SD 4 600 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨												
SD 5 700 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨									
SD 6 800 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨					
SD 7 900 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨		
SD 8 1000 mm Deep	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

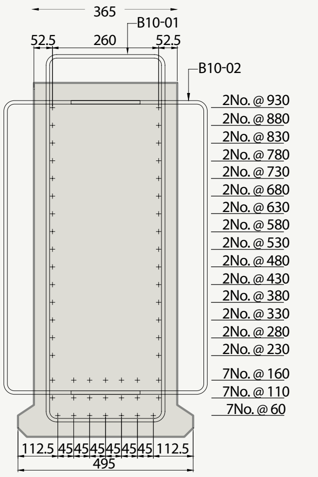
NOTE: Intermediate Beam depths from 350 mm to 950 mm in 100 mm steps are also available and can be produced - contact Banagher Precast Concrete for further details.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 510 mm, 770 mm, 990 mm and 1520 mm centres depending on beam width
- C40/50 Insitu infill between beams - 125 mm to 200 mm topping assummed. Can also have zero topping with infill only.

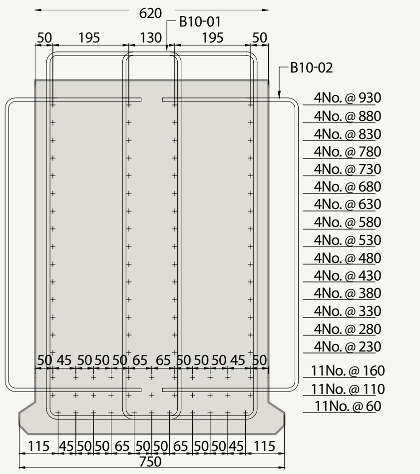
- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

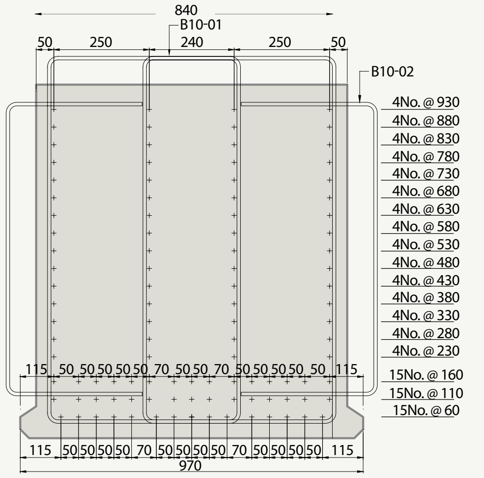
- The above figures are for actual beam length
- The clear span will be 1m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- Longer spans can be achieved by propping the beams while pouring the insitu concrete



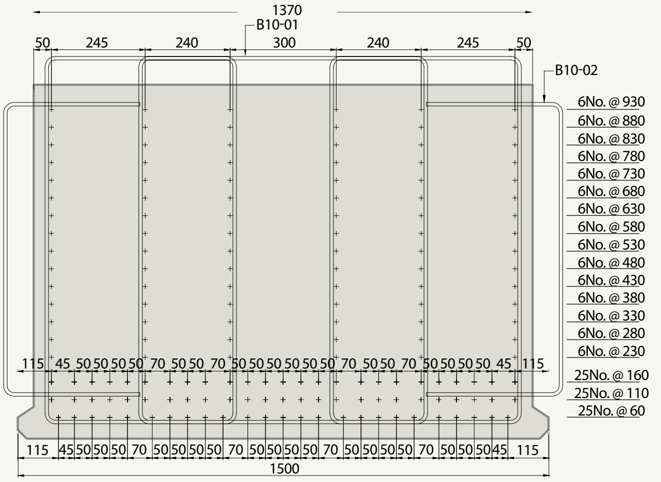
SD8(1) Beam Showing All Possible Strand Locations



SD8(2) Beam Showing All Possible Strand Locations

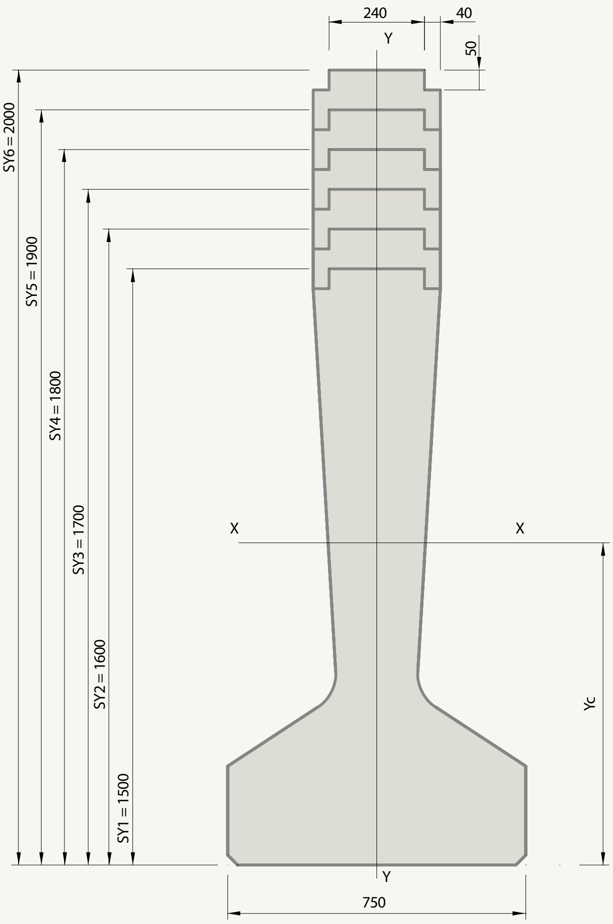


SD8(3) Beam Showing All Possible Strand Locations

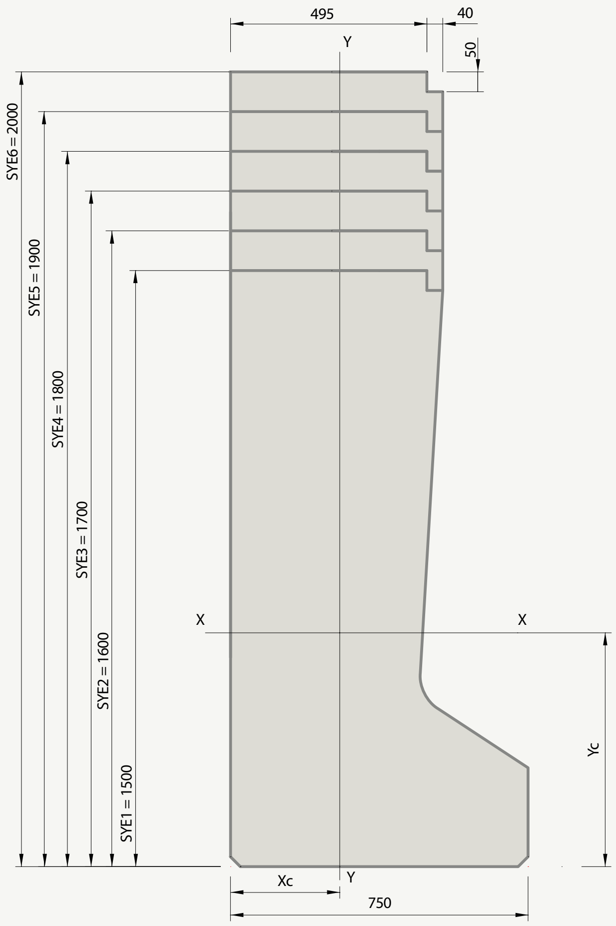


SD8(4) Beam Showing All Possible Strand Locations

SY & SYE Edge Beam



Full SY Beam Range



Full SYE Beam Range

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Dist. centroid to vertical face X_c (mm)	Section modulus - (mm^3 x 10^6)		Second Moment of Area I_{xx} (mm^4 x 10^9)	Approximate self-weight (kN/m)
					Top fibre Z_t	Bottom fibre Z_b		
SY1	1500	550090	597.6	-	132.69	200.39	119.750	13.75
SY2	1600	582090	649.2	-	154.09	225.66	146.510	14.55
SY3	1700	614090	700.7	-	176.30	251.41	176.170	15.35
SY4	1800	646090	752.1	-	199.35	277.77	208.910	16.15
SY5	1900	678090	803.3	-	223.28	304.82	244.870	16.95
SY6	2000	710090	854.4	-	248.10	332.65	284.220	17.75
SYE1	1500	837240	700.2	287.7	211.91	242.05	169.490	20.93
SYE2	1600	890740	751.0	286.5	242.10	273.68	205.540	22.27
SYE3	1700	944240	801.7	285.4	273.90	306.88	246.040	23.61
SYE4	1800	997740	852.4	284.4	307.36	341.70	291.260	24.94
SYE5	1900	1051240	903.0	283.6	342.49	378.17	341.470	26.28
SYE6	2000	1104740	953.5	282.8	379.30	416.30	396.940	27.62

SY-BEAM-BEAM AND SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 1200 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 800 mm TO 1600 mm c/c's

Metres	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
SY1	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩										
SY2	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩								
SY3	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩						
SY4	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩				
SY5	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩		
SY6	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 1.2 m centres
- C40/50 Insitu deck slab 200 mm over beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- We do not normally recommend using C57/70 concrete with high levels of prestress in SY-beams due to their slenderness in handling and transportation

Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- This table also covers SYE-Beams, but please note that when dealing with SYE-Beams the prestressing force should be centred on the lateral (transverse) centroid Xc

Alternative Spacings & Spans:

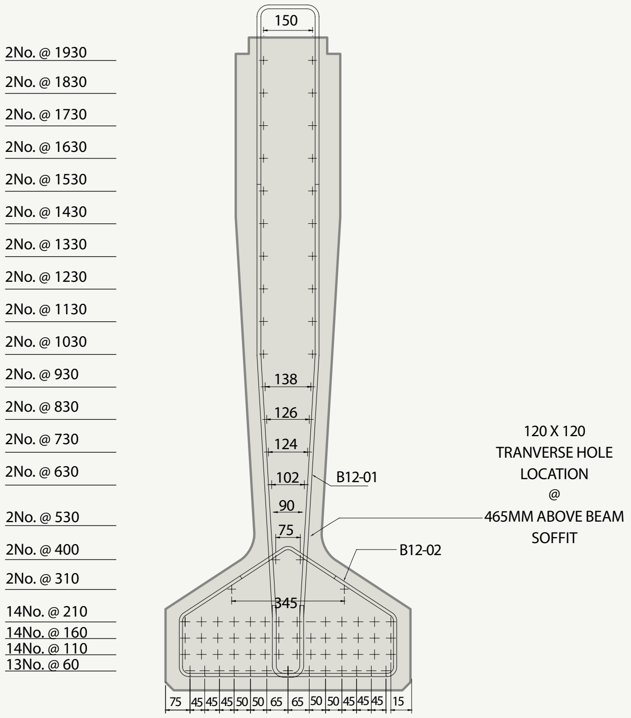
» To determine the beam length "L_{adj}" for a beam spacing "S" other than 1.2 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(1.2/S)^{0.5}$

» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 1.2 m spacing from the above chart. $S=1.2(L/L_g)^2$

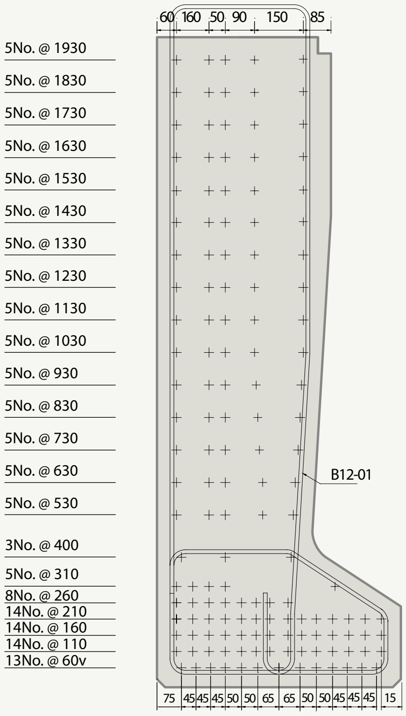
» In order to keep control of deck slab moments, beam interface shear links and touse standard 50/20 ribbed FRC shutter BPC recommends a general maximum beam spacing in mm of 1600 mm for SY-beams.

» Beam spacings greater than this may be used but the permanent shutter will either have to be 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.

» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40 mm wide x 50 mm deep to 60 mm wide x 75 mm deep. This also requires the shear links to be narrowed and some adjustment of the top strand locations.



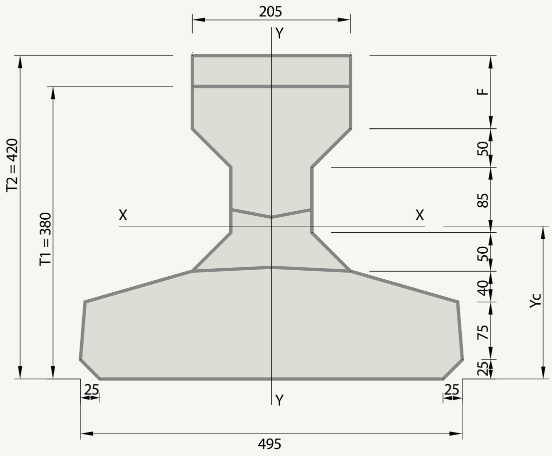
SY Beam Showing All Possible Strand Locations



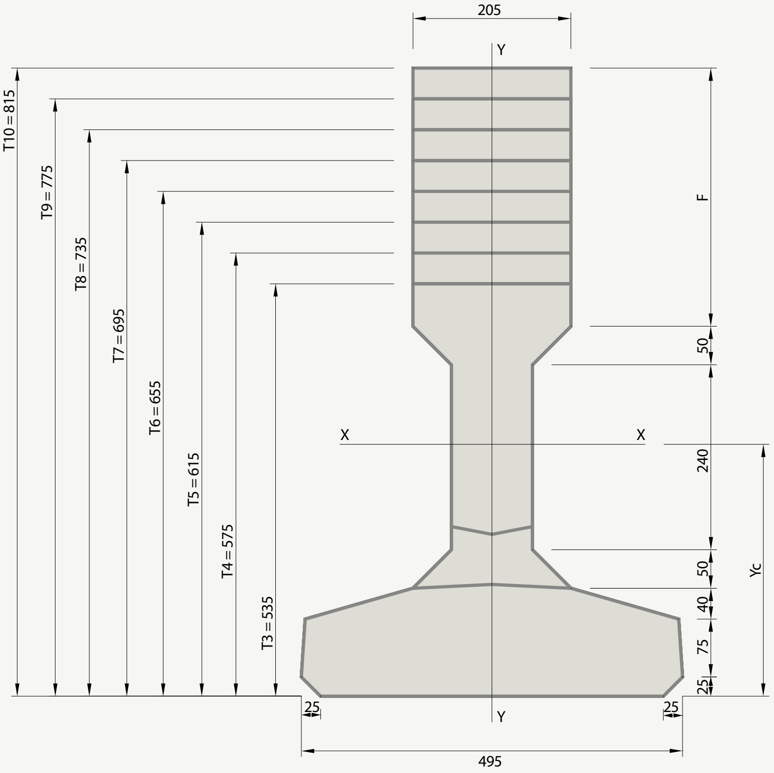
SYE Beam Showing All Possible Strand Locations

T Beam for Solid Slab Construction

Special Order

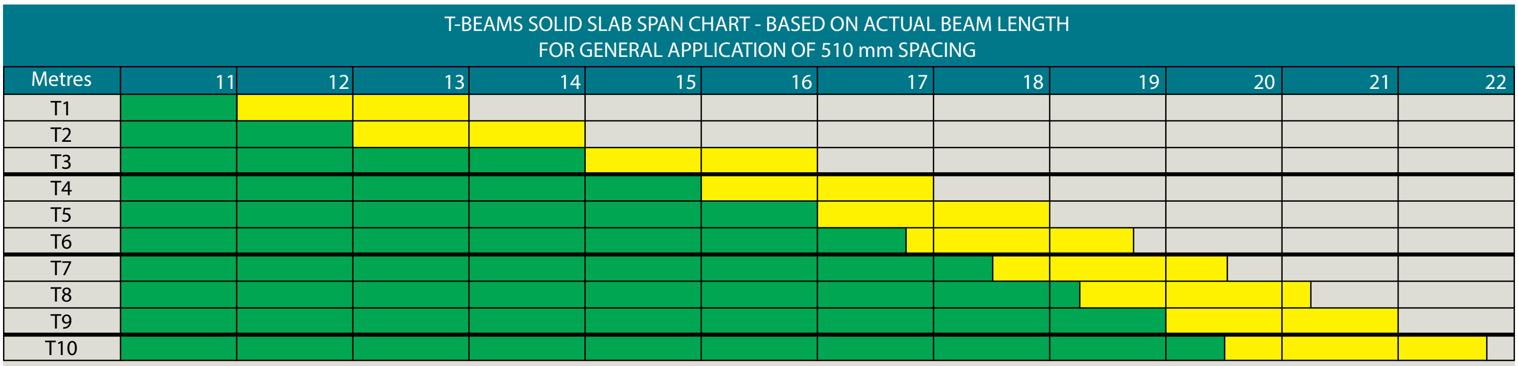


T Beam Range From T1 To T2



T Beam Range From T3 To T10

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Section modulus - (mm3 x 106) Top fibre Z_t	 Bottom fibre Z_b	Second Moment of Area I_{xx} (mm^4 x 10^9)	Approximate self-weight (kN/m)	Web Height H (mm)	Flange Height F (mm)
T1	380	98000	139.9	5.18	8.89	1.2443	2.45	85	55
T2	420	106200	160.0	6.76	10.98	1.7572	2.66	85	95
T3	535	114275	196.0	9.57	16.55	3.2440	2.86	240	55
T4	575	122475	220.0	11.92	19.23	4.2310	3.06	240	95
T5	615	130675	243.6	14.30	21.81	5.3126	3.27	240	135
T6	655	138875	266.7	16.73	24.36	6.4959	3.47	240	175
T7	695	147075	289.5	19.20	26.91	7.7878	3.68	240	215
T8	735	155275	311.9	21.74	29.48	9.1954	3.88	240	255
T9	775	163475	334.2	24.33	32.10	10.726	4.09	240	295
T10	815	171675	356.2	26.99	34.77	12.385	4.29	240	335



T-BEAMS SOLID SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH
FOR GENERAL APPLICATION OF 510 mm SPACING

Metres	11	12	13	14	15	16	17	18	19	20	21	22
T1	🟩	🟨	🟨									
T2	🟩	🟩	🟨	🟨								
T3	🟩	🟩	🟩	🟩	🟨	🟨						
T4	🟩	🟩	🟩	🟩	🟩	🟨	🟨					
T5	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨				
T6	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨			
T7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨		
T8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	
T9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	
T10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨

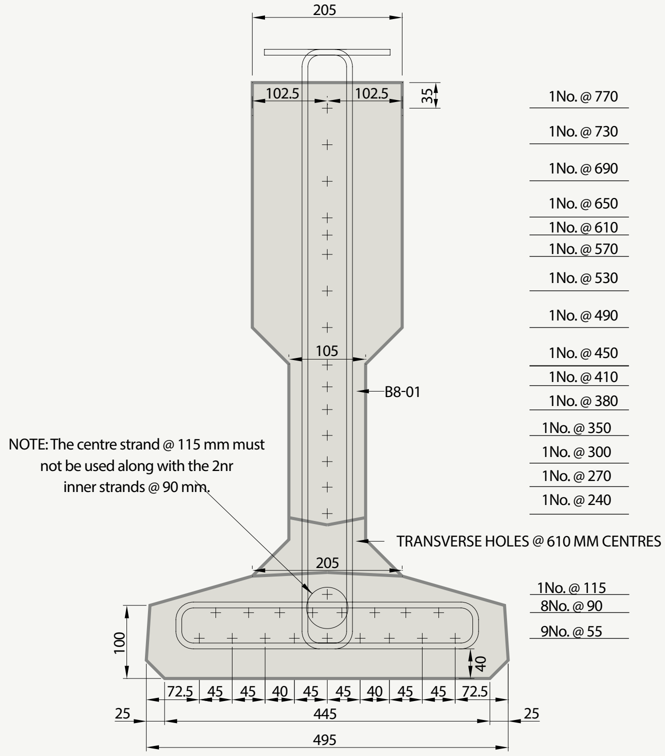
The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 510 mm centres
- C40/50 Insitu infill solid slab deck to 125 mm over the beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

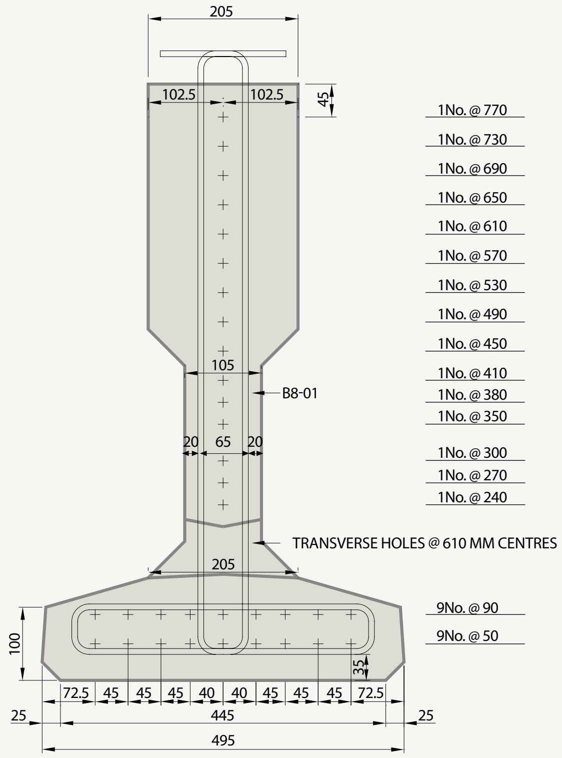
Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- Longer spans can be achieved by propping the beams while pouring the insitu concrete



NOTE: The centre strand @ 115 mm must not be used along with the 2nr inner strands @ 90 mm.

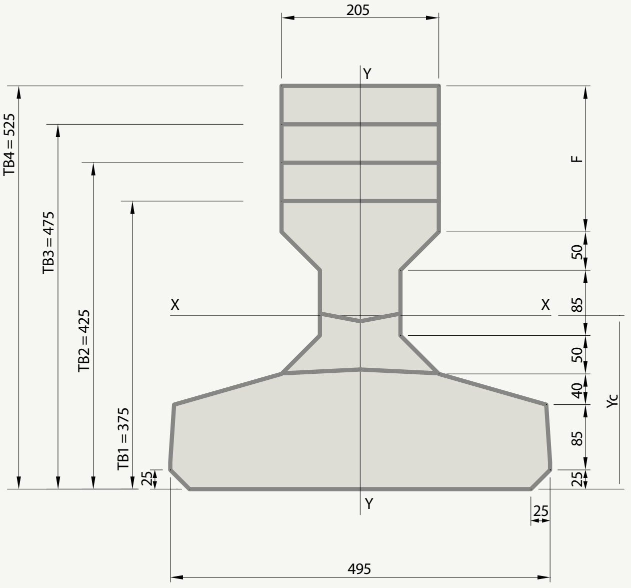
T Beam Showing All Possible Strand Locations
This Option Will Give 40 mm Cover With 12.9 mm Dia. Strand & B8 Links Only



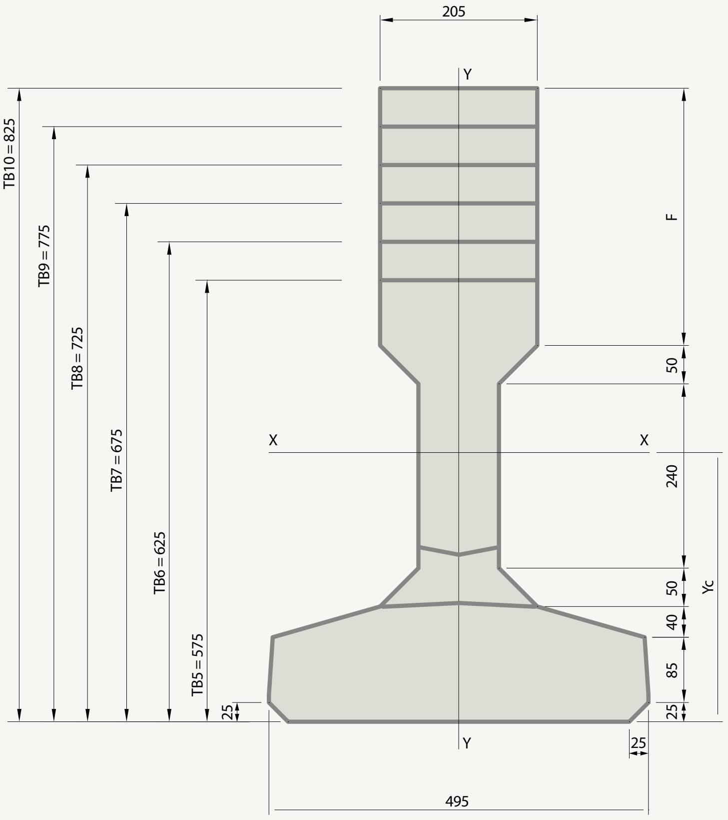
T Beam Showing All Possible Strand Locations
This Option Will Give 35 mm Cover With 12.9 mm Dia. Strand & B8 Links Only

TB Beam for Solid Slab Construction

Special Order

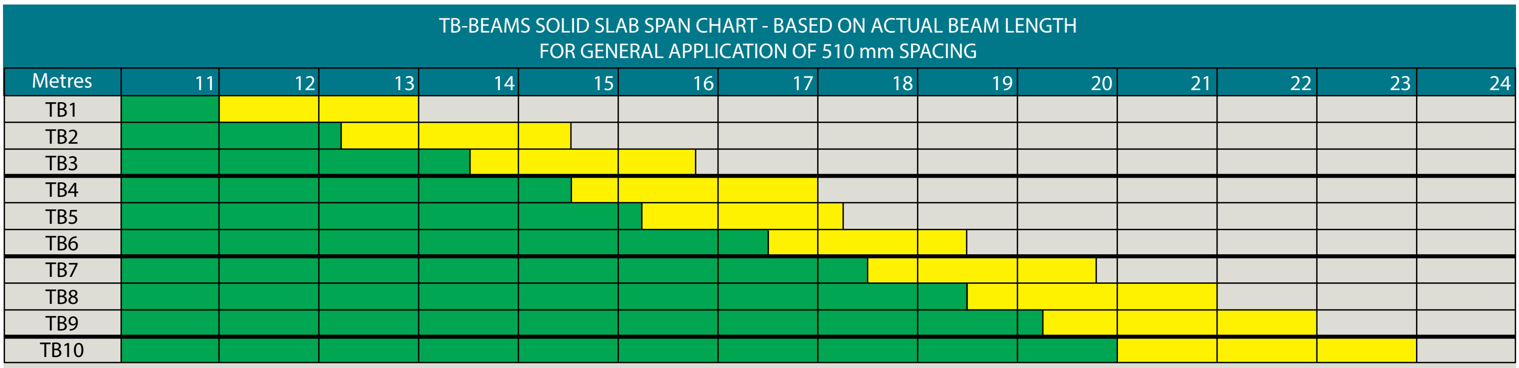


TB Beam Range From TB1 to TB4



TB Beam Range From TB5 to TB10

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Section modulus - (mm3 x 106) Top fibre Z_t	Bottom fibre Z_b	Second Moment of Area I_{xx} ($mm^4 \times 10^9$)	Approximate self-weight (kN/m)	Web Height H (mm)	Flange Height F (mm)
TB1	375	99875	135.70	4.85	8.55	1.1599	2.50	85	40
TB2	425	110125	160.3	6.84	11.30	1.8116	2.75	85	90
TB3	475	120375	184.90	8.97	14.07	2.6010	3.01	85	140
TB4	525	130625	209.7	11.23	16.89	3.5408	3.27	85	190
TB5	575	125375	215.5	11.69	19.50	4.2014	3.13	240	85
TB6	625	135625	244.60	14.73	22.92	5.6045	3.39	240	135
TB7	675	145875	273.0	17.85	26.27	7.1732	3.65	240	185
TB8	725	156125	301.10	21.04	29.63	8.9212	3.90	240	235
TB9	775	166375	328.7	24.34	33.04	10.8620	4.16	240	285
TB10	825	176625	356.10	27.74	36.53	13.0080	4.42	240	335



TB-BEAMS SOLID SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH
FOR GENERAL APPLICATION OF 510 mm SPACING

Metres	11	12	13	14	15	16	17	18	19	20	21	22	23	24
TB1	🟩	🟨	🟨											
TB2	🟩	🟩	🟩🟨	🟨	🟨									
TB3	🟩	🟩	🟩	🟩🟨	🟨	🟨								
TB4	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨							
TB5	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨						
TB6	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨					
TB7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨				
TB8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨			
TB9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨		
TB10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

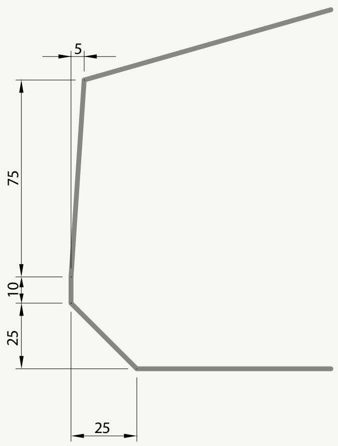
- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 510 mm centres
- C40/50 Insitu infill solid slab deck to 125 mm over the beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

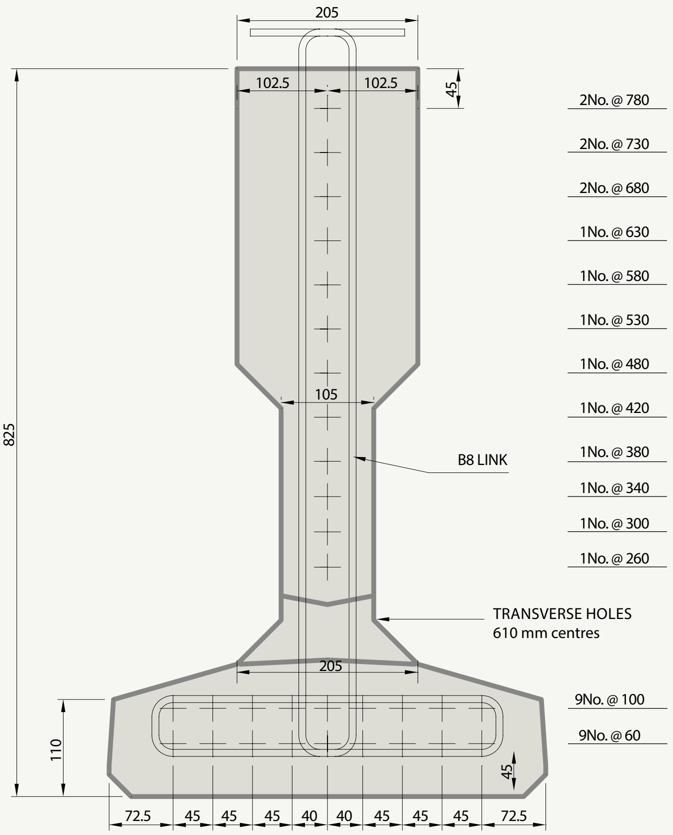
Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- Longer spans can be achieved by propping the beams while pouring the insitu concrete

Note:
This beam is the old T beam with a 10 mm deeper bottom flange to give at least 40 mm cover.

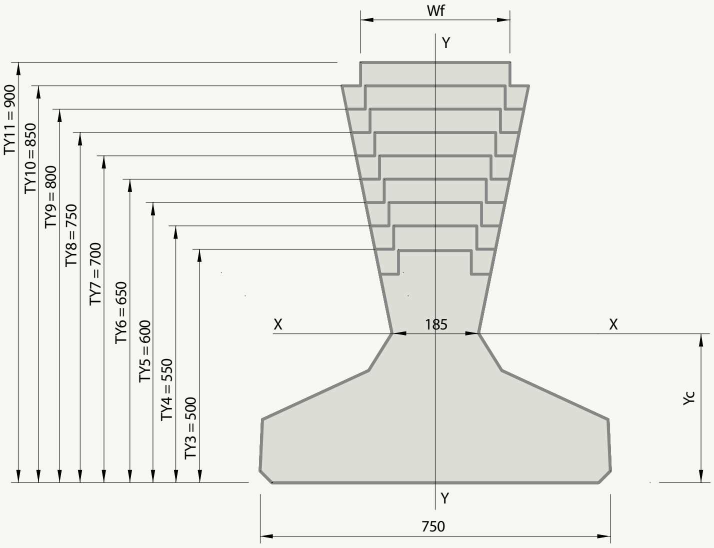


TB Base Detail

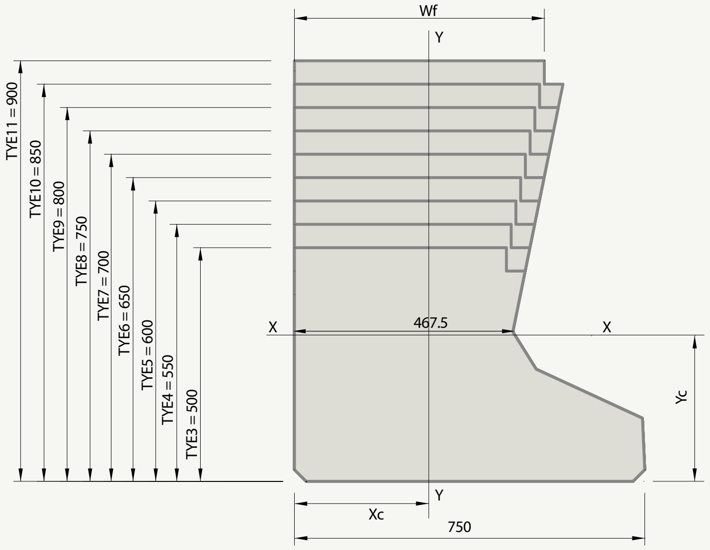


TB Beam Showing All Possible Strand Locations
Note: 12.9 mm strand and B8 or B10 links only.

TY & TYE Edge Beam for Beam and Slab Construction



Full TY Beam Range



Full TYE Beam Range

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Dist. centroid to vertical face X_c (mm)	Section modulus - (mm3 x 106) Top fibre Z_t	Bottom fibre Z_b	Second Moment of Area I_{xx} (mm^4 x 10^9)	Approximate self-weight (kN/m)	Top Flange Width W_f (mm)
TY3	500	208050	173.31	-	10.863	20.477	3.5489	5.2	157.7
TY4	550	221460	193.6	-	13.96	25.69	4.9742	5.54	178.0
TY5	600	235880	216.0	-	17.71	31.48	6.7991	5.9	198.3
TY6	650	251320	240.2	-	22.13	37.74	9.0670	6.28	218.6
TY7	700	267770	266.1	-	27.24	44.41	11.819	6.69	238.9
TY8	750	285230	293.4	-	33.06	51.44	15.095	7.13	259.1
TY9	800	303710	322.0	-	39.61	58.8	18.935	7.59	279.4
TY10	850	323210	351.7	-	46.91	66.47	23.375	8.08	299.7
TY11	900	343710	382.24	-	54.96	74.44	28.454	8.59	320.0
TYE3	500	291210	222.9	304.1	21.87	27.19	6.0598	7.28	453.9
TYE4	550	316670	246.8	300.0	26.87	33.01	8.1459	7.92	464.0
TYE5	600	342630	271.3	296.9	32.48	39.34	10.674	8.57	474.2
TYE6	650	369100	296.4	294.5	38.70	46.17	13.685	9.23	484.3
TYE7	700	396070	321.9	292.8	45.55	53.50	17.222	9.90	494.4
TYE8	750	423550	347.8	291.6	53.02	61.31	21.325	10.59	504.6
TYE9	800	451540	374.0	290.8	61.13	69.62	26.039	11.29	514.7
TYE10	850	480040	400.6	290.4	69.89	78.41	31.408	12.00	524.9
TYE11	900	509040	427.4	290.3	79.30	87.69	37.476	12.73	535.0

TY-BEAMS BEAM & SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 1200 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 800 mm TO 1600 mm c/c's

Metres	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
TY3	🟩	🟩🟨	🟨	🟨												
TY4	🟩	🟩	🟩🟨	🟨	🟨	🟨⬜										
TY5	🟩	🟩	🟩	🟩	🟨	🟨	🟨									
TY6	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨⬜							
TY7	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨						
TY8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨⬜				
TY9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨⬜			
TY10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨		
TY11	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨⬜

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

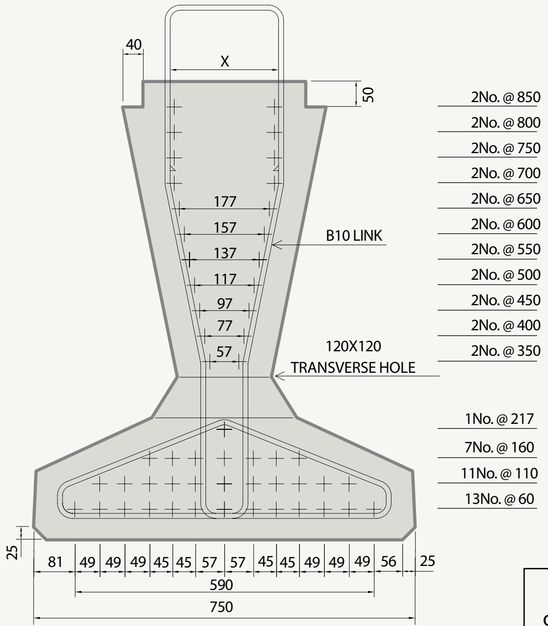
- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 1.2m centres
- C40/50 Insitu deck slab 200 mm over beam
- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- This table also covers TYE-Beams, but please note that when dealing with TYE-Beams the prestressing force should be centred on the lateral (transverse) centroid Xc
- Default strand size is 12.9 mm. Use 12.9 mm for the smaller sizes and spans less than approximately 15 m. Adopt 15.7 mm when the number of 12.9 mm required exceeds 13.

Alternative Spacings & Spans:

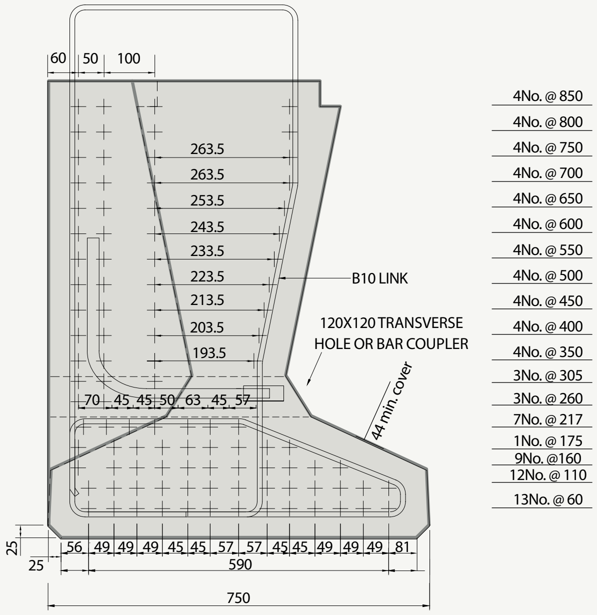
» To determine the beam length "L_{adj}" for a beam spacing "S" other than 1.2 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(1.2/S)^{0.5}$
» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 1.2 m spacing from the above chart. $S=1.2(L/L_g)^2$
» In order to keep control of deck slab moments, beam interface shear links and to use standard 50/20 ribbed FRC shutter BPC recommends a general maximum beam spacing in mm of 1300+0.4D where D= beam depth. Beam spacings greater than this may be used but the permanent shutter will have to be either 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.
» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40 mm wide x 50 mm deep to 60 mm wide x 75 mm deep.



TY Beam
Showing All Possible Strand Locations for 15.7mm diameter strands

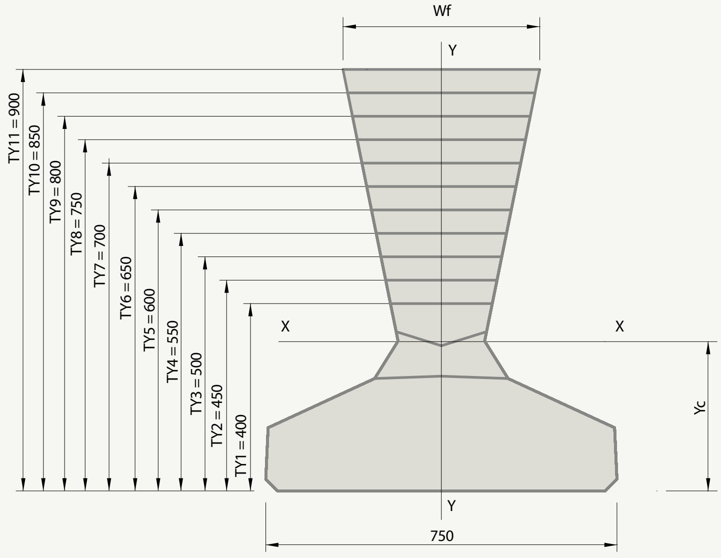
Beam	X
TY11	197
TY10	177
TY9	157
TY8	137
TY7	117
TY6	97
TY5	77
TY4	57
TY3	57

Note: For a 12.9 mm diameter strand layout please see appendix A

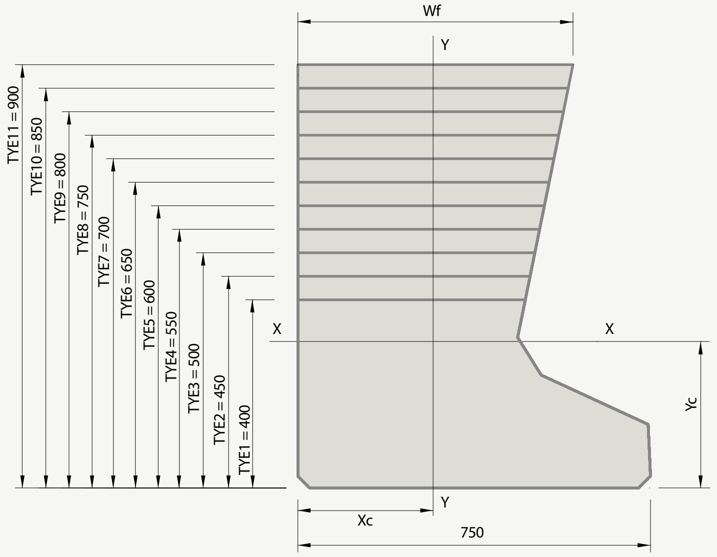


TYE Beam
Showing All Possible Strand Locations for 15.7 mm diameter strands

TY & TYE Edge Beam for Solid Slab Construction



Full TY Beam Range



Full TYE Beam Range

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Yc (mm)	Dist. centroid to vertical face Xc (mm)	Section modulus - (mm3 x 106)		Second Moment of Area I xx $(mm^4 \times 10^9)$	Approximate self-weight (kN/m)	Top Flange Width Wf (mm)
					Top fibre Z t	Bottom fibre Z b			
TY1	400	188790	145.5	-	7.69	13.46	1.9581	4.72	217.5
TY2	450	200170	161.4	-	9.71	17.35	2.8011	5.00	237.7
TY3	500	212560	179.7	-	12.35	22.00	3.9538	5.31	258.0
TY4	550	225970	200.2	-	15.62	27.28	5.4630	5.65	278.3
TY5	600	240390	222.7	-	19.54	33.10	7.3730	6.01	298.6
TY6	650	255830	247.0	-	24.14	39.38	9.7266	6.40	318.9
TY7	700	272280	272.9	-	29.42	46.04	12.565	6.81	339.2
TY8	750	289740	300.2	-	35.41	53.06	15.926	7.24	359.4
TY9	800	308220	328.6	-	42.11	60.40	19.851	7.71	379.7
TY10	850	327710	358.2	-	49.56	68.05	24.375	8.19	400.0
TY11	900	348220	388.6	-	57.76	76.01	29.539	8.71	420.3
TYE1	400	244080	179.2	317.3	14.23	17.54	3.1420	6.10	483.7
TYE2	450	268520	201.6	310.6	18.07	22.28	4.4905	6.71	493.9
TYE3	500	293470	224.8	305.4	22.54	27.60	6.2035	7.34	504.0
TYE4	550	318920	248.8	301.4	27.62	33.45	8.3207	7.97	514.2
TYE5	600	344880	273.3	298.2	33.31	39.81	10.882	8.62	524.3
TYE6	650	371350	298.4	295.8	39.62	46.68	13.929	9.28	534.4
TYE7	700	398330	323.9	294.1	46.54	54.04	17.503	9.96	544.6
TYE8	750	425810	349.8	292.8	54.09	61.88	21.646	10.65	554.7
TYE9	800	453800	376.0	292.0	62.27	70.21	26.401	11.35	564.9
TYE10	850	482290	402.6	291.6	71.10	79.03	31.814	12.06	575.0
TYE11	900	511300	429.4	291.5	80.59	88.33	37.928	12.78	585.1

TY-BEAMS SOLID SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH
FOR GENERAL APPLICATION OF 765 mm SPACING

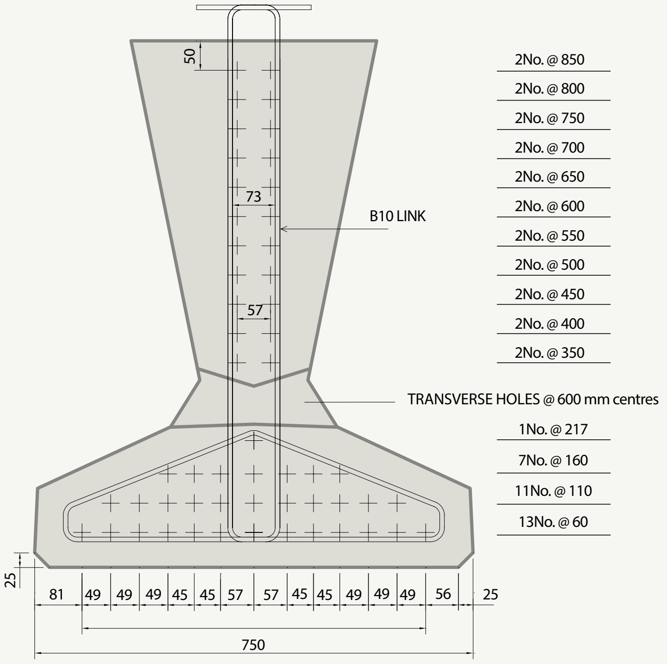
Metres	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
TY1	🟩	🟨	🟨												
TY2	🟩	🟩	🟩🟨	🟨											
TY3	🟩	🟩	🟩	🟩🟨	🟨										
TY4	🟩	🟩	🟩	🟩	🟩🟨	🟨									
TY5	🟩	🟩	🟩	🟩	🟩	🟩	🟨								
TY6	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨						
TY7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨					
TY8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨			
TY9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨		
TY10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	
TY11	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

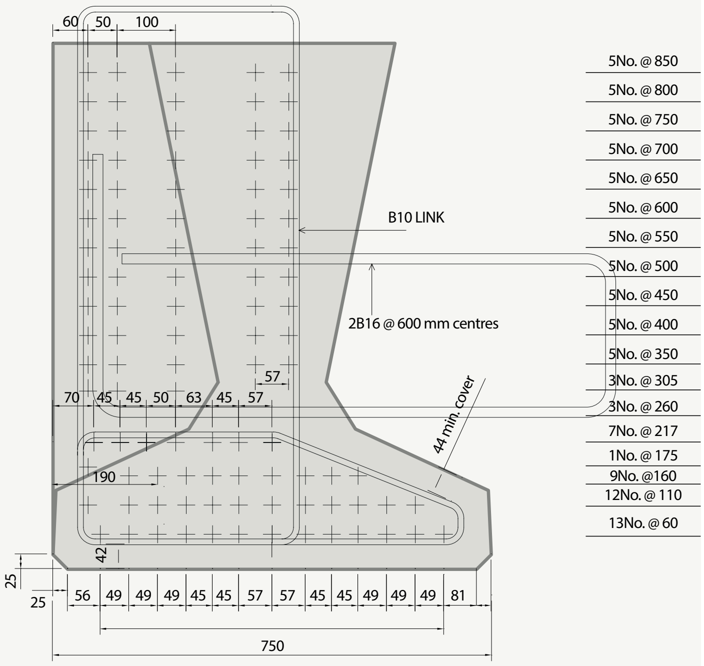
- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 765 mm centres
- C40/50 Insitu infill solid slab deck to 150 mm over the beam
- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

- The above figures are for actual beam length
- The clear span will be 1 m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- Longer spans can be achieved by propping the beams while pouring the insitu concrete
- This table also covers TYE-Beams, but please note that when dealing with TYE-Beams the prestressing force should be centred on the lateral (transverse) centroid Xc
- Default strand size is 12.9 mm. Use 12.9 mm for the smaller sizes and spans less than approximately 14.5 m. Adopt 15.7 mm when the number of 12.9 mm required exceeds 13.

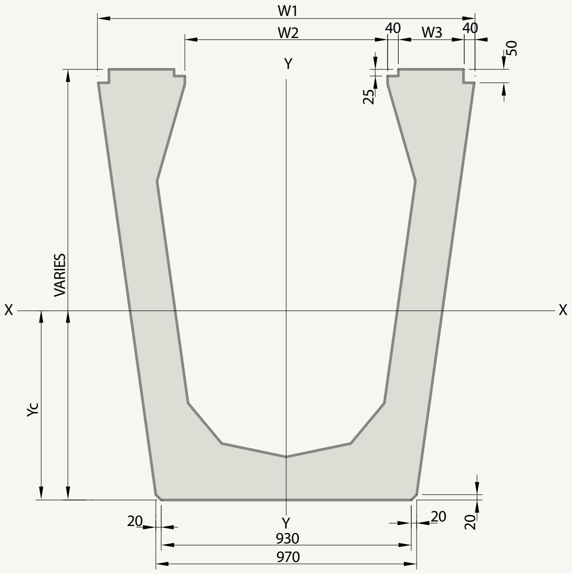


TY Beam
Showing All Possible Strand Locations
for 15.7 mm diameter strands

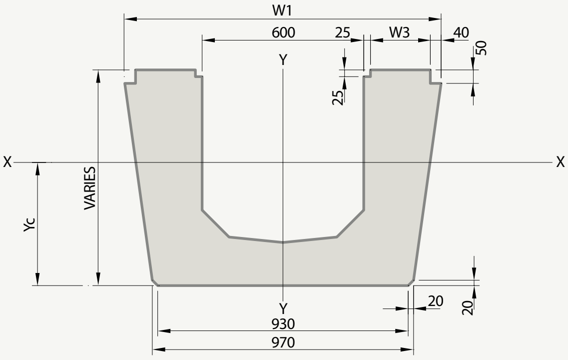


TYE Beam
Showing All Possible Strand Locations
for 15.7 mm diameter strands

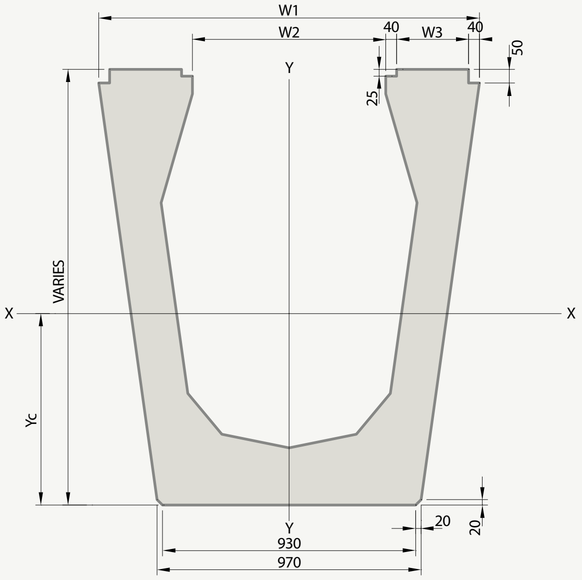
U & SU Beam



Applies To Beams U3-U12



Applies To Beams U600-U1



Applies To Beams SU11 & SU12

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Yc (mm)	Section modulus - (mm3 x 106)		Second Moment of Area	Approximate self-weight (kN/m)	Beam Top Dimensions		
				Top fibre Z_t	Bottom fibre Z_b	I_{xx} (mm^4 x 10^9)		Overall Width W1 (mm)	Inner Width W2 (mm)	W3 (mm)
U600	600	377100	248.4	33.20	47.00	11.674	9.43	1118.4	600.0	194.2
U700	700	431740	298.0	47.42	63.97	19.063	10.79	1146.4	600.0	208.2
U1	800	489180	350.0	64.58	83.05	29.065	12.23	1174.4	600.0	222.2
U3	900	509650	396.3	83.29	105.88	41.958	12.74	1202.4	558.0	242.2
U5	1000	543170	442.7	101.27	127.50	56.441	13.58	1230.4	586.0	242.2
U7	1100	576690	489.5	120.60	150.42	73.628	14.42	1258.4	614.0	242.2
U8	1200	610210	536.7	141.23	174.58	93.687	15.26	1286.4	642.0	242.2
U9	1300	643730	584.1	163.14	199.95	116.790	16.09	1314.4	670.0	242.2
U10	1400	677250	631.8	186.29	226.49	143.100	16.93	1342.4	698.0	242.2
U11	1500	710770	679.8	210.66	254.21	172.800	17.77	1370.4	726.0	242.2
U12	1600	744290	727.9	236.24	283.07	206.040	18.61	1398.4	754.0	242.2
SU11	1500	772730	681.0	231.22	278.08	189.37	19.32	1370.4	682	264
SU12	1600	806250	728.8	259.28	309.96	225.89	20.16	1398.4	710	264

U & SU BEAMS - BEAM AND SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 2000 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 1600 mm TO 2400 mm c/c's

Metres	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
U600	🟩	🟩	🟨	🟨	🟨																									
U700	🟩	🟩	🟩	🟩	🟨	🟨	🟨																							
U1	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨																				
U3	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨																		
U5	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨															
U7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨													
U8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨											
U9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟨									
U10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨								
U11 (SU11)	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥	🟥		
U12 (SU12)	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟥	🟥	🟥	🟥	🟥

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 2.0 m centres
- C40/50 Insitu deck slab 200 mm over beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨
- SU11 & SU12 = C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟥

Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the figues given above
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures

---

Alternative Spacings & Spans:

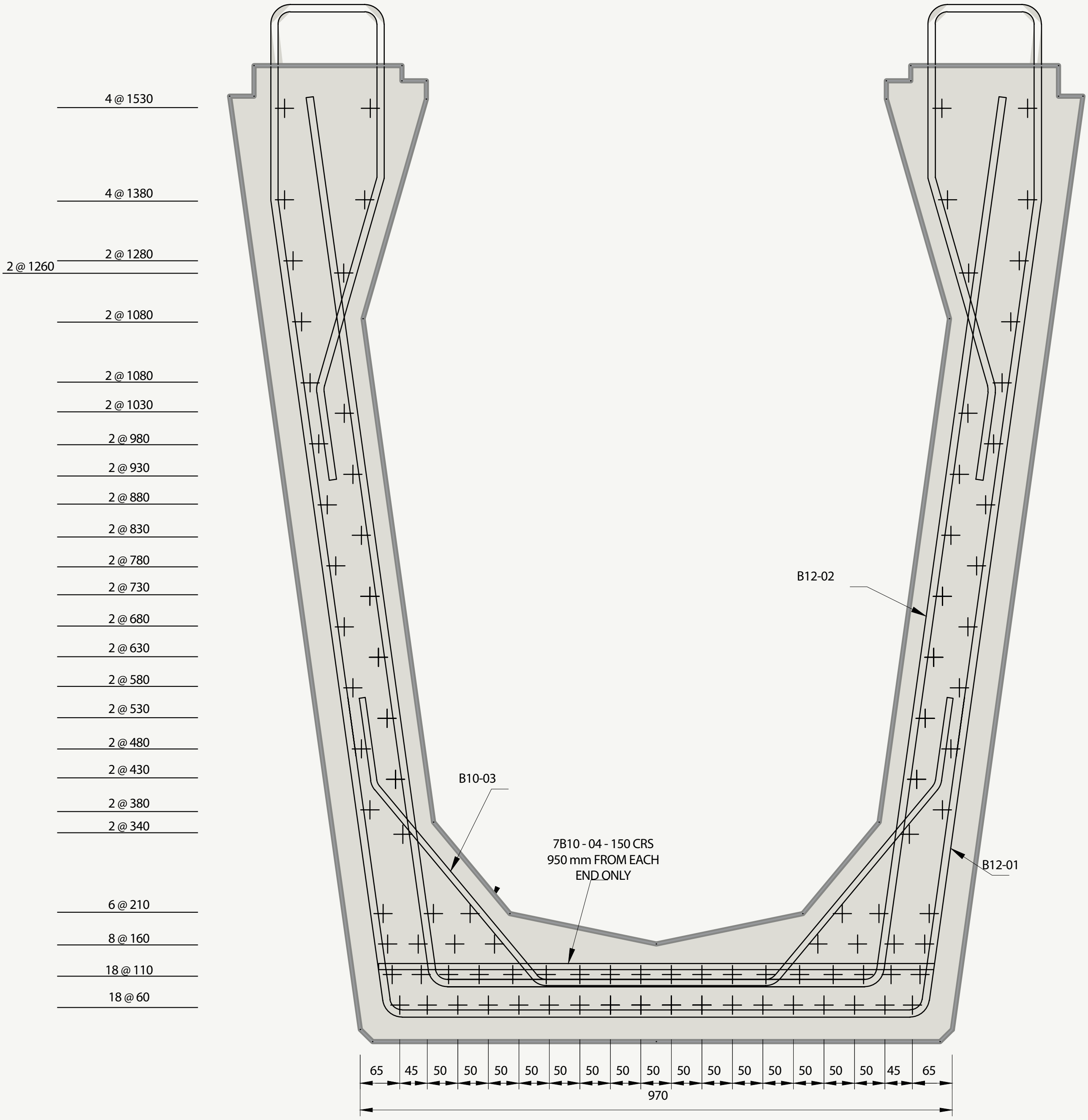
» To determine the beam length "L_{adj}" for a beam spacing "S" other than 2 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(2/S)^{0.5}$

» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 2 m spacing from the above chart. $S=2(L/L_g)^2$

» In order to keep control of deck slab moments, beam interface shear links and to use standard 50/20 ribbed FRC shutter BPC recommends a general maximum beam spacing in mm of 2200+0.28D where D= beam depth. Beam spacings greater than this may be used but the permanent shutter will have to be either 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.

» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40 mm wide x 50 mm deep to 60 mm wide x 75 mm deep. This also requires the shear links to be narrowed and some adjustment of the top strand locations.

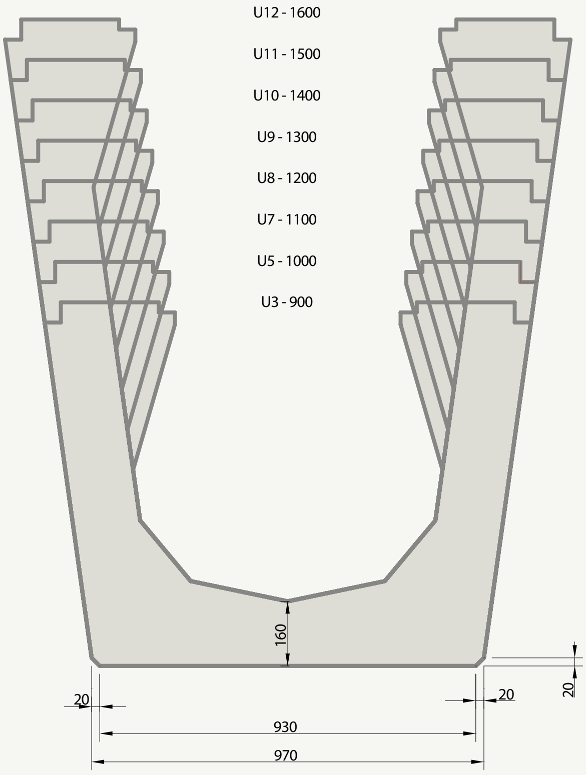
U & SU Beam



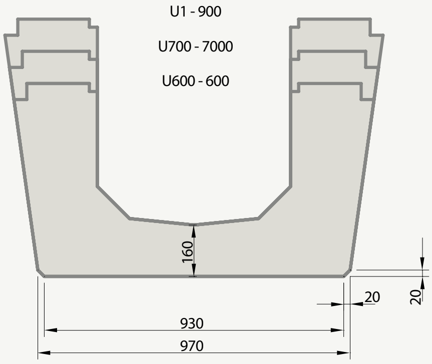
Section Through U12 Beam showing all possible Strand Locations

Note:

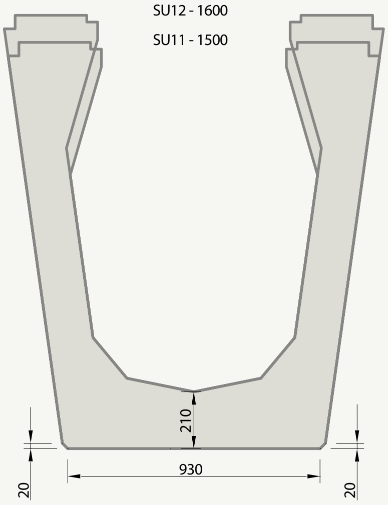
For full U and SU beam range see appendix B



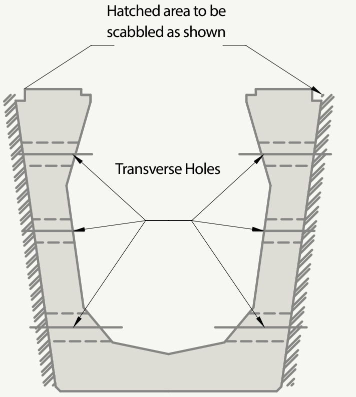
U Beam Range From U3 - U12



U Beam Range For U600, U700 & U1 Beam



Full SU Beam Range

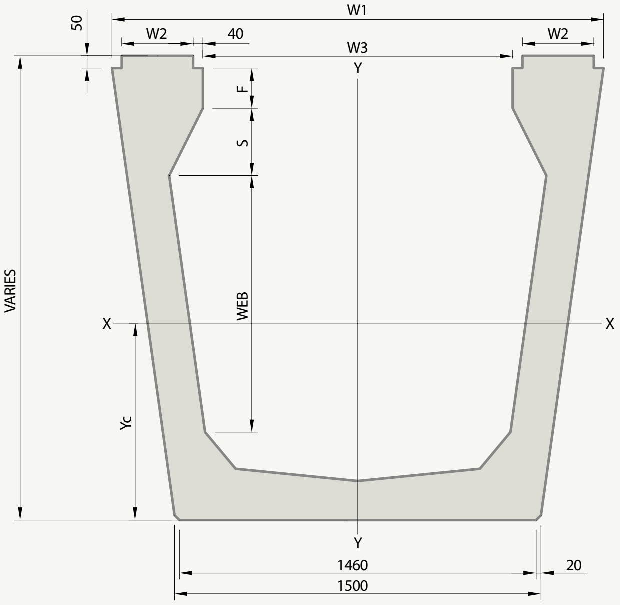


Section Showing Transverse Holes & Scabbling Details

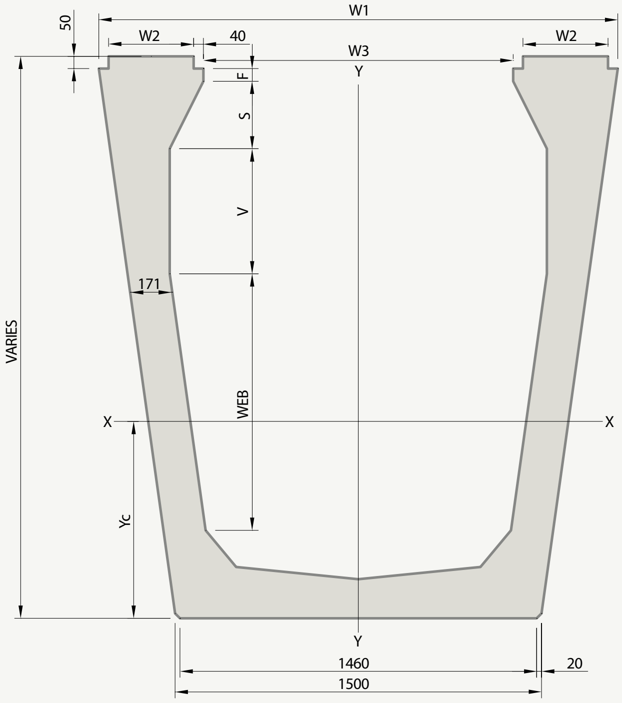
Elevation Showing Transverse Holes & Scabbling Details

W Beam

Designed & Developed by Banagher Precast Concrete



Applies To Beams W1-W15



Applies To Beams W16-W19

Section	Depth	Area	Ht. centroid over soffit	Section modulus - (mm3 x 106)		Second Moment of Area	Approximate self-weight	Beam Top Dimensions						
	(mm)	(mm^2)	Y_c (mm)	Top fibre Z_t	Bottom fibre Z_b	I_{xx} (mm^4 x 10^9)	(kN/m)	Overall Width W1 (mm)	W2 (mm)	W3 (mm)	Web	S	F	V
W1	800	572360	305.3	71.88	116.46	35.556	14.31	1704.4	243.2	1058	100	220	70	-
W3	900	606880	345.9	89.54	143.43	49.614	15.17	1732.4	243.2	1086	200	220	70	-
W5	1000	641400	387.5	108.76	171.88	66.610	16.04	1760.4	243.2	1114	300	220	70	-
W7	1100	692030	440.2	136.21	204.15	89.871	17.30	1788.4	250.2	1128	350	220	120	-
W8	1200	726550	484.2	159.46	235.73	114.140	18.16	1816.4	250.2	1156	450	220	120	-
W9	1300	761070	528.7	184.11	268.56	142.000	19.03	1844.4	250.2	1184	550	220	120	-
W10	1400	812400	585.2	219.51	305.62	178.850	20.31	1872.4	257.2	1198	600	220	170	-
W11	1500	846920	631.3	248.01	341.33	215.460	21.17	1900.4	257.2	1226	700	220	170	-
W12	1600	881440	677.6	277.84	378.23	256.280	22.04	1928.4	257.2	1254	800	220	170	-
W13	1700	933470	736.7	321.13	419.90	309.340	23.34	1956.4	264.2	1268	850	220	220	-
W14	1800	975150	790.6	362.63	462.97	366.030	24.38	1984.4	278.2	1268	950	248	192	-
W15	1900	1016060	844.3	405.70	507.30	428.300	25.40	2012.4	292.2	1268	1050	276	164	-
W16	2000	1057970	898.6	451.09	552.89	496.830	26.45	2040.4	306.2	1268	1050	276	136	128
W17	2100	1102680	954.5	499.74	599.75	572.450	27.57	2068.4	320.2	1268	1050	276	108	256
W18	2200	1150190	1011.8	551.68	647.82	655.490	28.75	2096.4	334.2	1268	1050	276	80	384
W19	2300	1213750	1081.1	622.31	701.68	758.560	30.34	2124.4	348.2	1268	1050	276	100	464

W BEAMS-BEAM & SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 3000 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 2200 mm TO 3200 mm c/c's

Metres	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
W1	🟩	🟩	🟨	🟨	🟨																													
W3	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨																										
W5	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨																								
W7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟥																					
W8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟥	🟥																		
W9	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟥	🟥																
W10	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨	🟥	🟥														
W11	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥												
W12	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨	🟥	🟥	🟥										
W13	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥								
W14	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨	🟥	🟥	🟥	🟥						
W15	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥					
W16	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥	🟥			
W17	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥	🟥		
W18	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥	🟥	
W19	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥	🟥

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a full design.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 3.0 m centres
- C40/50 Insitu deck slab 200 mm over beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨
- Modification to internal shutter to create a "Super-W-Beam" - see 🟥

Note:

- The above figures are for actual beam length
- The clear span will be 1m less than the figues given above
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures

---

Alternative Spacings & Spans:

» To determine the beam length "L_{adj}" for a beam spacing "S" other than 3 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(3/S)^{0.5}$

» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 3 m spacing from the above chart. $S=3(L/L_g)^2$

» In order to keep control of deck slab moments, beam interface shear links and to use standard 50/20 ribbed FRC shutter BPC recommends a general maximum beam spacing in mm of 2750+0.28D where D= beam depth. Beam spacings greater than this may be used but the permanent shutter will have to be either 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.

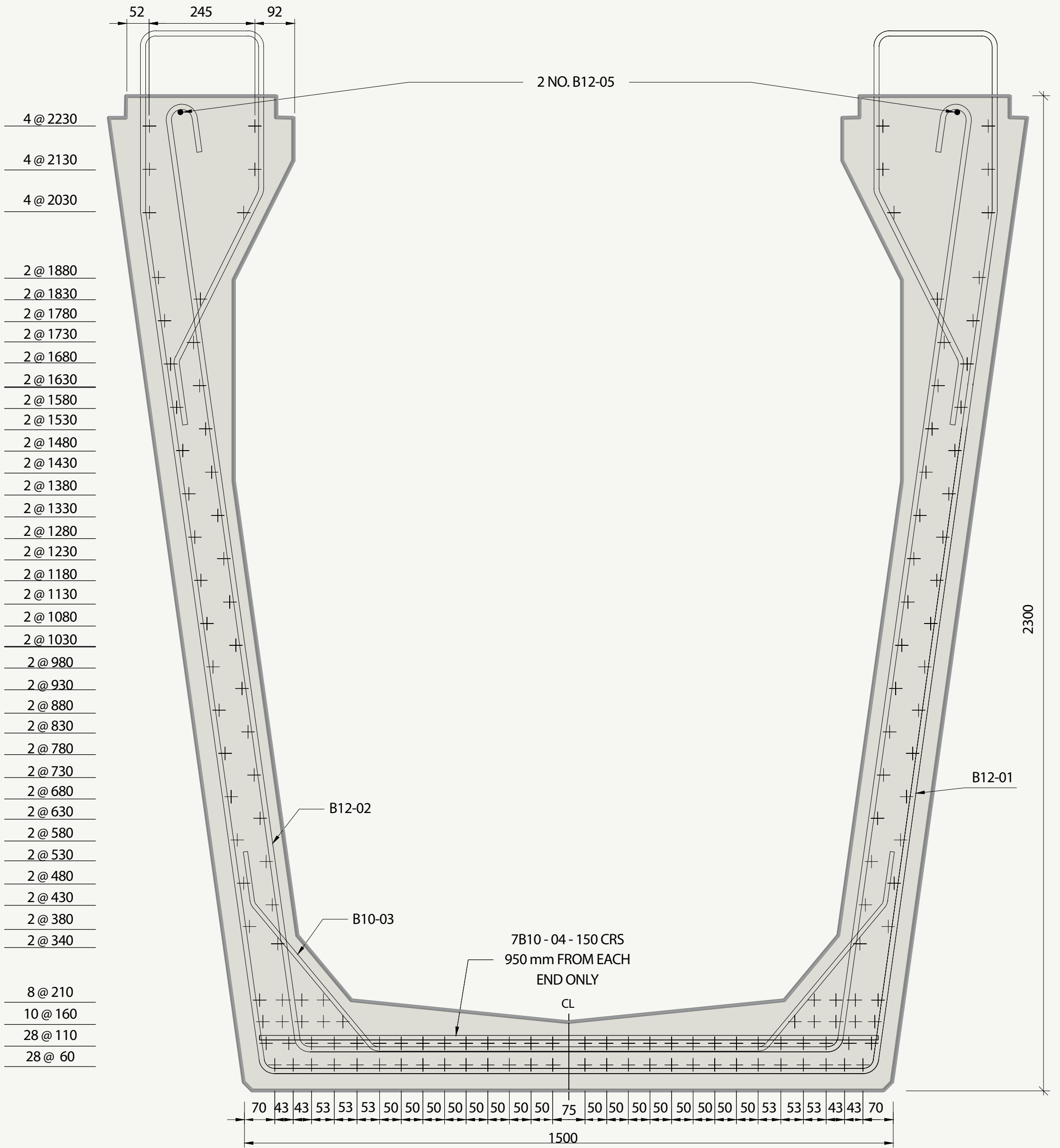
» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40 mm wide x 50 mm deep to 60 mm wide x 75 mm deep. This also requires the shear links to be narrowed and some adjustment of the top strand locations.

Building Information Modelling (BIM)

Banagher Precast Concrete are operating in BIM – we can produce drawings in 3D to Autodesk Revit and Tekla Structures.

The BIM concept envisages virtual construction of a project prior to its actual physical construction, in order to reduce uncertainty, improve safety, work out problems, and simulate and analyse potential impacts. Banagher Precast Concrete can input critical information into the model before beginning construction, resulting in a more efficient end product.

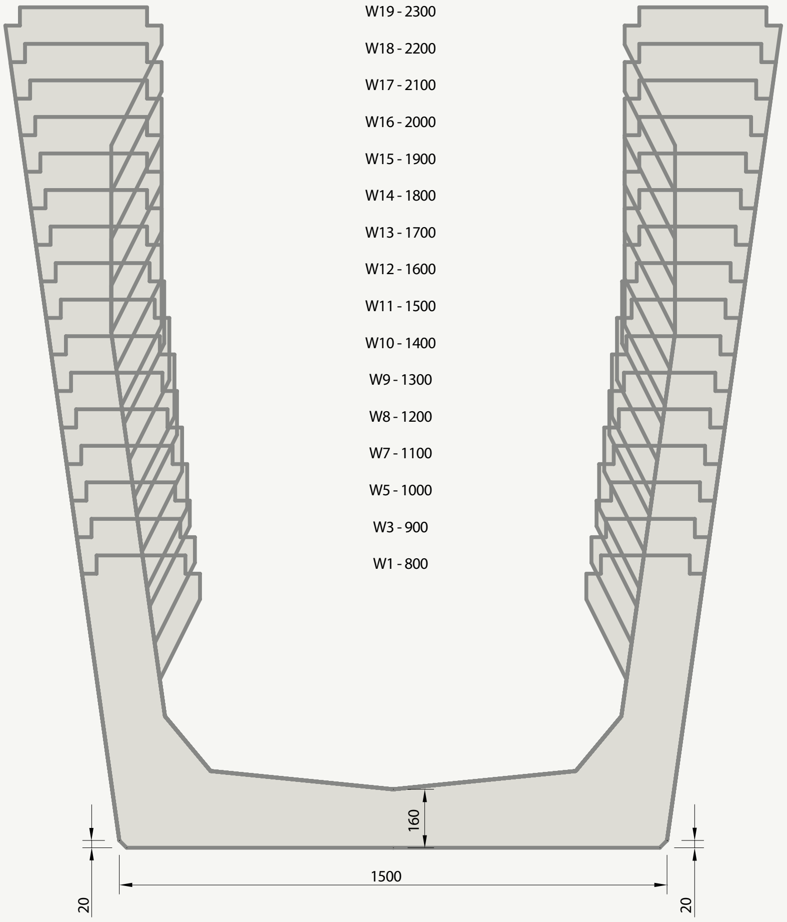
W Beam



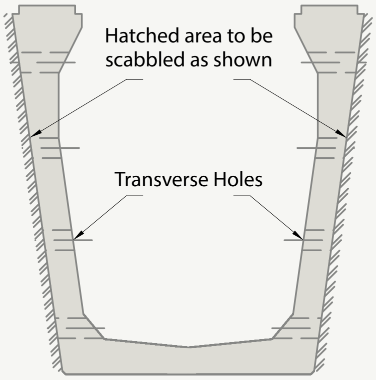
Section Through W19 Beam showing all possible Strand Locations

Note:

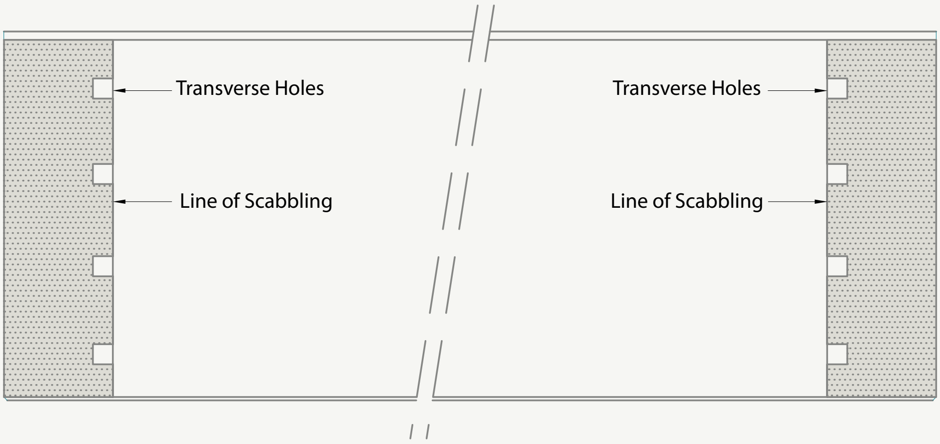
For full W beam range see appendix C



Full W Beam Range

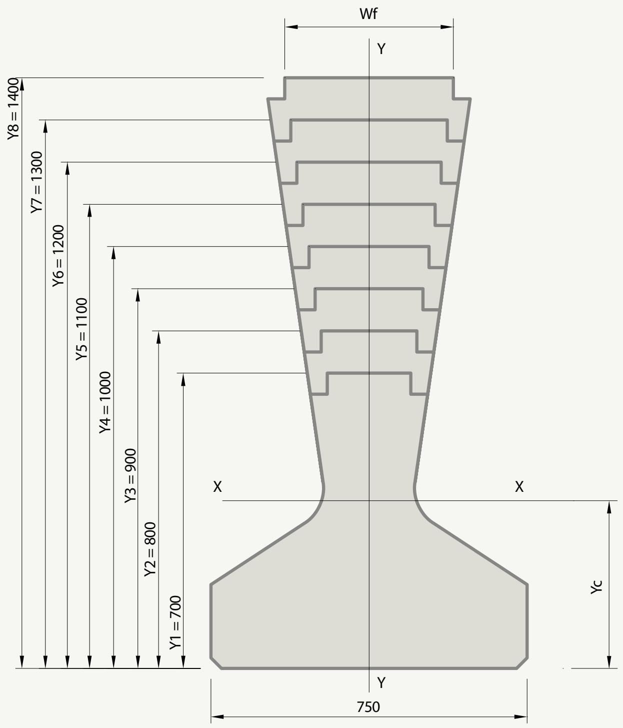


Section Showing Transverse Holes & Scabbling Details

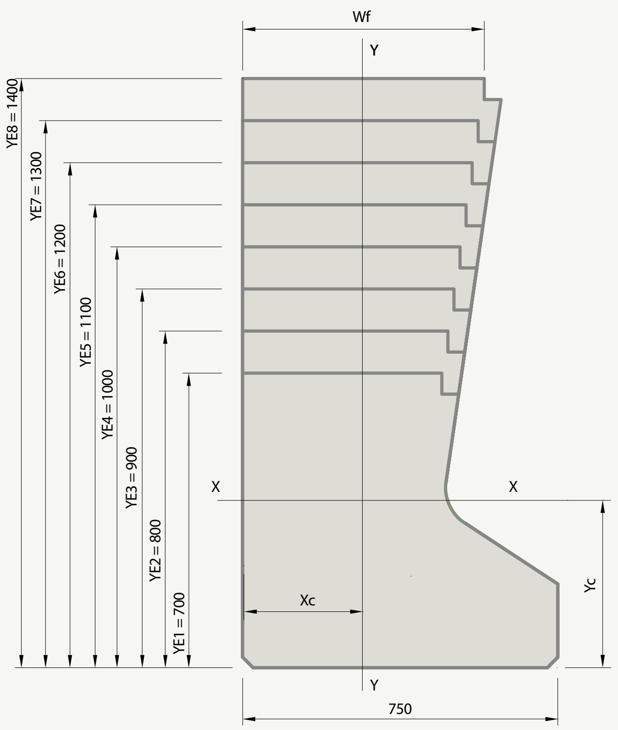


Elevation Showing Transverse Holes & Scabbling Details

Y & YE Edge Beam

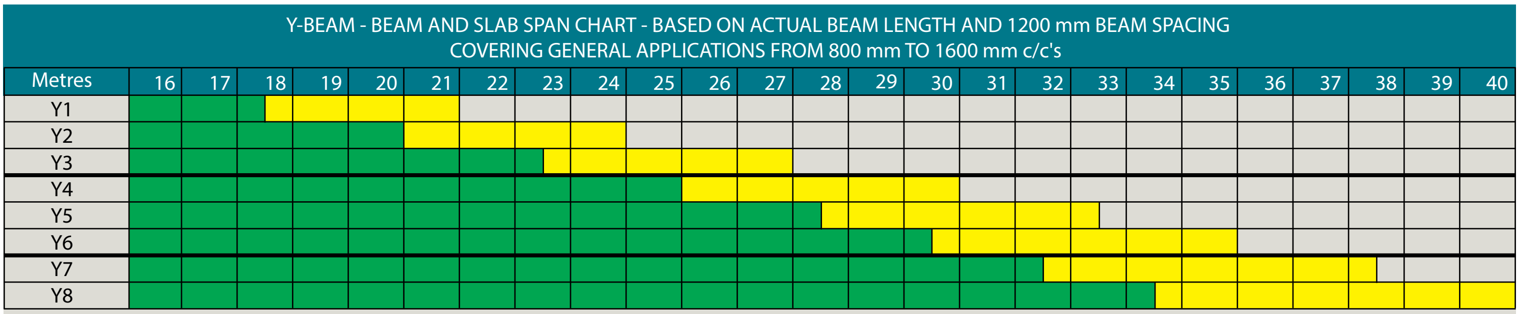


Full Y Beam Range



Full YE Beam Range

Section	Depth (mm)	Area (mm^2)	Ht. centroid over soffit Y_c (mm)	Dist. centroid to vertical face X_c (mm)	Section modulus - (mm3 x 106)		Second Moment of Area I_{xx} $(mm^4 \times 10^9)$	Approximate self-weight (kN/m)	Top Flange Width W_f (mm)
					Top fibre Z_t	Bottom fibre Z_b			
Y1	700	310140	255.0	-	24.88	43.42	11.073	7.75	198.1
Y2	800	340830	298.4	-	35.07	58.96	17.593	8.52	227.0
Y3	900	374420	346.8	-	47.95	76.51	26.530	9.36	255.8
Y4	1000	410880	399.3	-	63.63	95.72	38.220	10.27	284.7
Y5	1100	450230	455.2	-	82.19	116.40	52.990	11.26	313.5
Y6	1200	492460	514.0	-	103.73	138.45	71.160	12.31	342.3
Y7	1300	537580	575.0	-	128.35	161.83	93.052	13.44	371.2
Y8	1400	585580	637.8	-	156.12	186.56	118.990	14.64	400.0
YE1	700	417260	315.0	309.5	44.43	54.31	17.106	10.43	474.1
YE2	800	470100	363.4	304.4	59.28	71.21	25.879	11.75	488.5
YE3	900	524400	413.4	300.9	76.61	90.18	37.278	13.11	502.9
YE4	1000	580130	464.6	298.7	96.45	111.15	51.641	14.50	517.3
YE5	1100	637300	516.8	297.5	118.85	134.13	69.316	15.93	531.8
YE6	1200	695920	569.8	297.1	143.86	159.10	90.659	17.40	546.2
YE7	1300	755980	623.6	297.3	171.55	186.08	116.040	18.90	560.6
YE8	1400	817480	678.0	298.0	201.98	215.10	145.830	20.44	575.0



Y-BEAM - BEAM AND SLAB SPAN CHART - BASED ON ACTUAL BEAM LENGTH AND 1200 mm BEAM SPACING
COVERING GENERAL APPLICATIONS FROM 800 mm TO 1600 mm c/c's

Metres	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Y1	🟩	🟩	🟩🟨	🟨	🟨	🟨																			
Y2	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨																
Y3	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨													
Y4	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨										
Y5	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨							
Y6	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨					
Y7	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨	🟨		
Y8	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩🟨	🟨	🟨	🟨	🟨	🟨	🟨

The above span table is for guideline purposes only and is based on the below criteria, please contact Banagher Precast Concrete with job specific information for a more accurate evaluation.

- Traffic loading as per Eurocode 1
- Design to Eurocode 2
- Simply supported bridge beam structure
- Beams spaced at 1.2 m centres
- C40/50 Insitu deck slab 200 mm over beam

- C50/60 precast concrete grade @ 28 days with up to C32/40 @ transfer - see 🟩
- C57/70 precast concrete grade @ 28 days with up to C45/55 @ transfer - see 🟨

Note:

- The above figures are for actual beam length
- The clear span will be 1 m less than the above figures
- The centre to centre of bearing in a simply supported structure will be 500 mm less than the above figures
- The pier to abutment centres will be perhaps 500 mm greater than the above figures
- This table also covers YE-Beams, but please note that when dealing with YE-Beams the prestressing force should be centred on the lateral (transverse) centroid Xc

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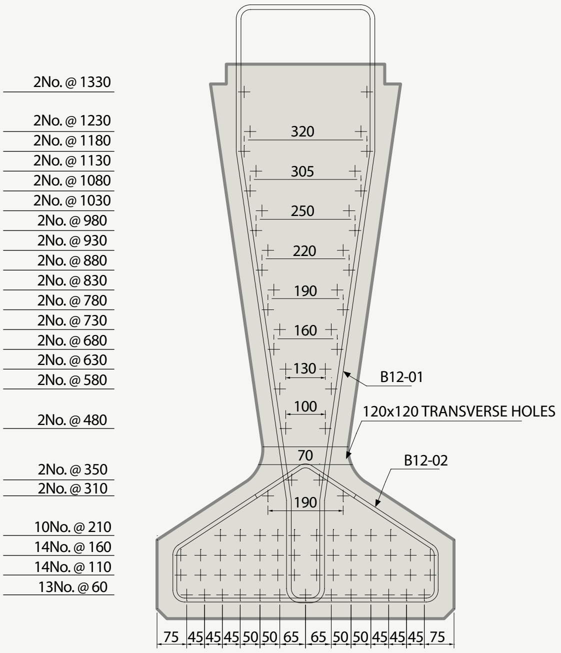
Alternative Spacings & Spans:

» To determine the beam length "L_{adj}" for a beam spacing "S" other than 1.2 m adjust the actual beam length "L" above using the following formula. $L_{adj} = L(1.2/S)^{0.5}$

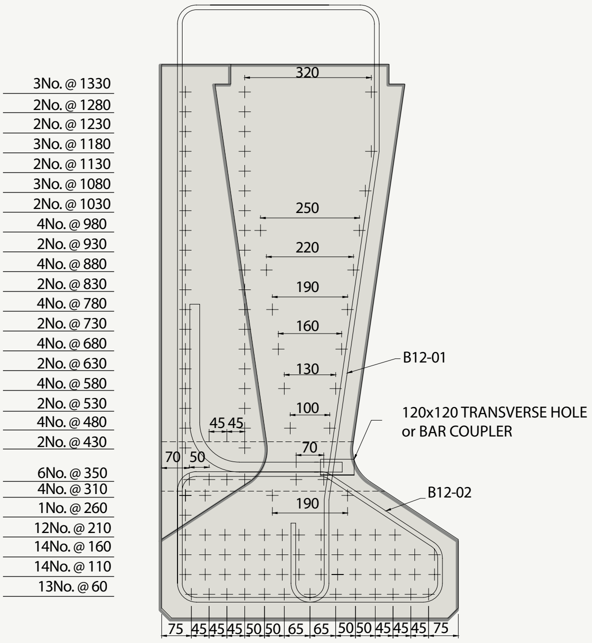
» To determine the required beam spacing for a given beam length "L_g" and beam size use the following formula where L = beam length for a 1.2 m spacing from the above chart. $S=1.2(L/L_g)^2$

» In order to keep control of deck slab moments, beam interface shear links and to use standard 50/20 ribbed FRC shutter BPC recommends a general maximum beam spacing in mm of 1350+0.28D for Y-beams where D= beam depth. Beam spacings greater than this may be used but the permanent shutter will either have to be 75 mm deep ribbed FRC or prestressed wide slab with a corresponding increase in deck slab thickness over the beam up to 250 mm.

» If using prestressed 75 mm wideslab permanent shutter the outside beam face shutter rebates will have to be increased in size from the standard 40 mm wide x 50 mm deep to 60 mm wide x 75 mm deep. This also requires the shear links to be narrowed and some adjustment of the top strand locations.



Y Beam Showing All Possible Strand Locations
In all beams superimposed. For individual beams please ask.

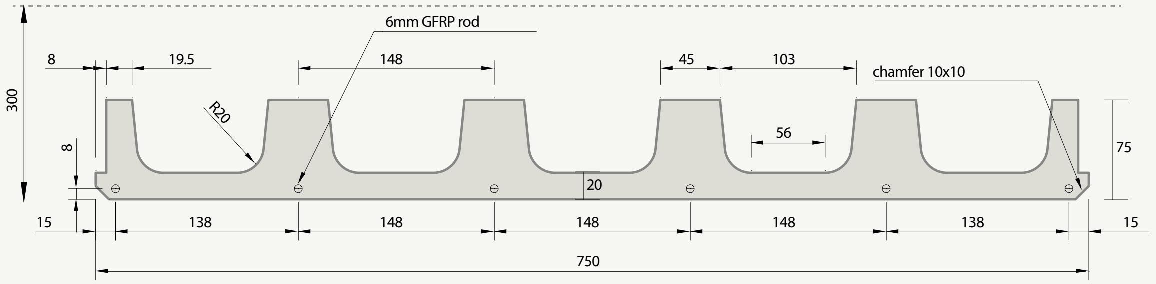


YE Beam Showing All Possible Strand Locations
In all beams superimposed. For individual beams please ask.

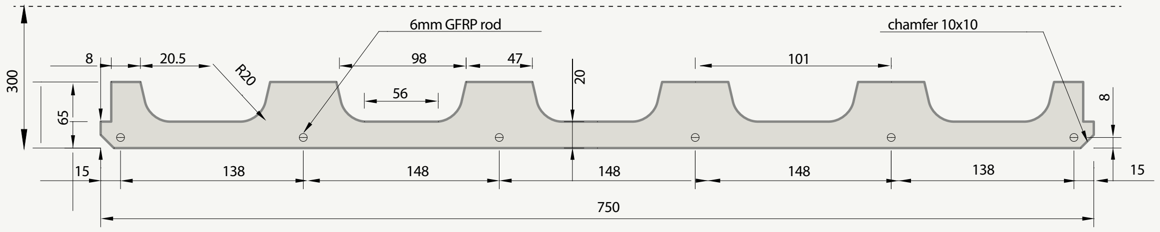
Fibre Reinforced Concrete Permanent Shutter

Introduction

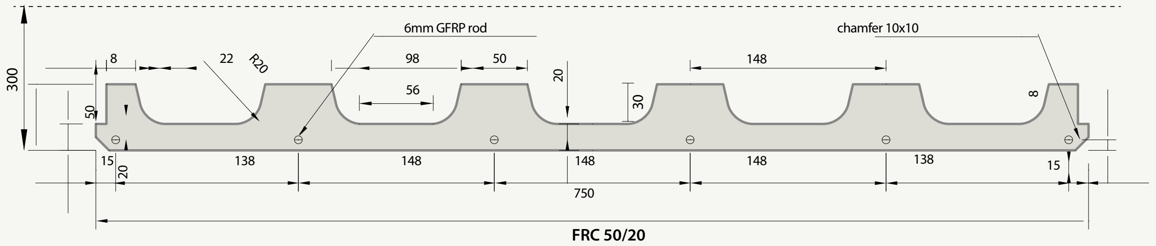
FRC is a flat or ribbed product designed to facilitate the pouring of in-situ deck slabs between prestressed bridge beams. The shutter is designed to carry the immature concrete and associated construction loadings. It is intended that the shutter will be left in place following completion of the bridge. Banagher Precast Concrete FRC shutter is made from 60N (C50/60) self-compacting concrete with 5 kg/m3 of synthetic fibre and glass fibre reinforced polymer bars. These products were chosen for their structural properties and long-lasting durability. Specifications for all of the components can be sought from Banagher Precast Concrete.



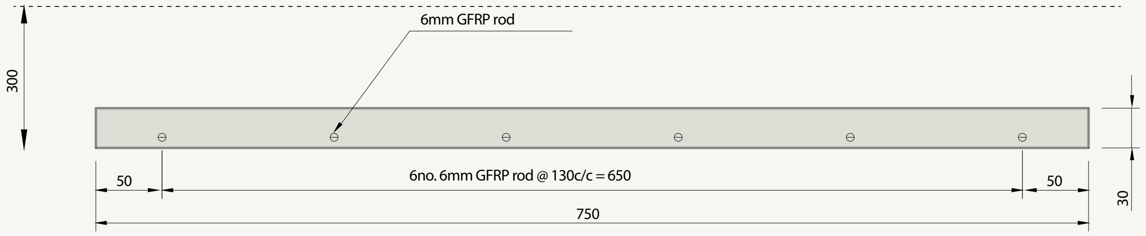
FRC 75/20



FRC65/20



FRC 50/20

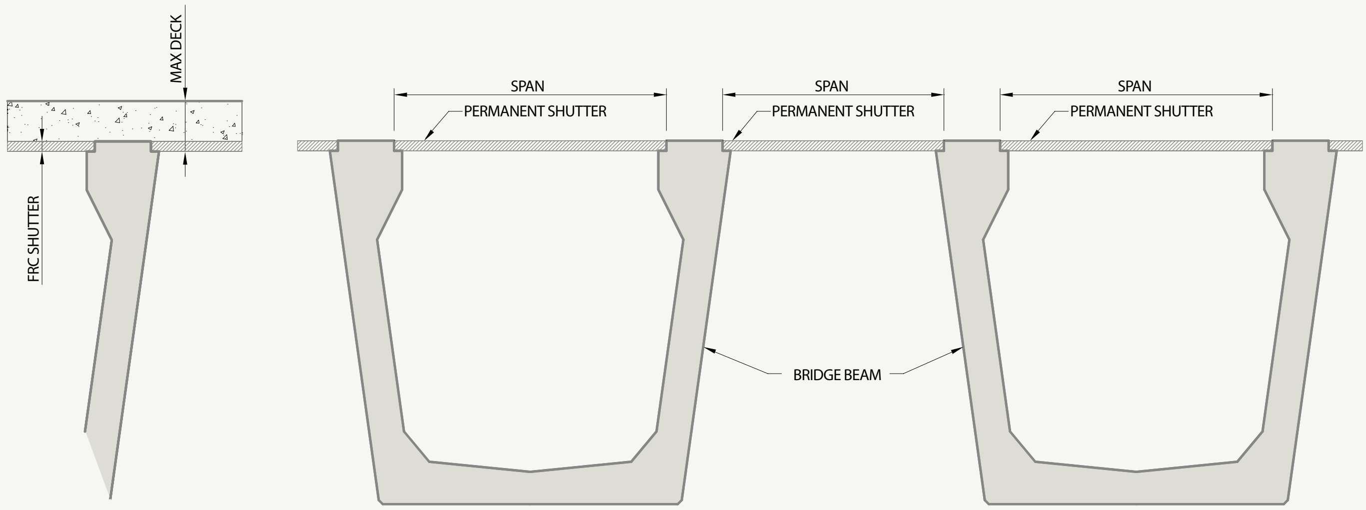


FRC Flat 30

(For U-beam internal void only)

Load Span Tables

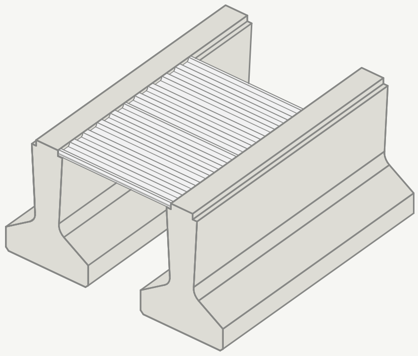
Product	Maximum Length (mm)	Max deck thickness including FRC shutter (mm)
30mm Flat	850	300
50/20	1350	300
65/20	1650	300
75/20	1850	300



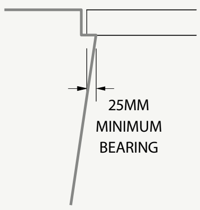
Design

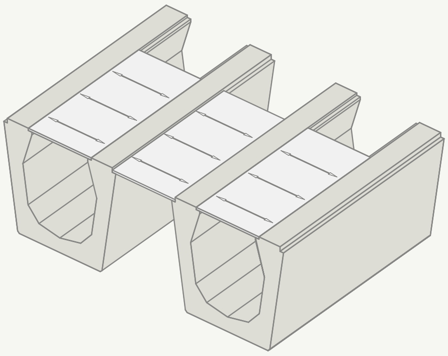
Design loads:- Live load – 1.5 kN/m2
Dead load – Thickness of insitu slab * 25 kN/m3

Material Safety Data



WARNING



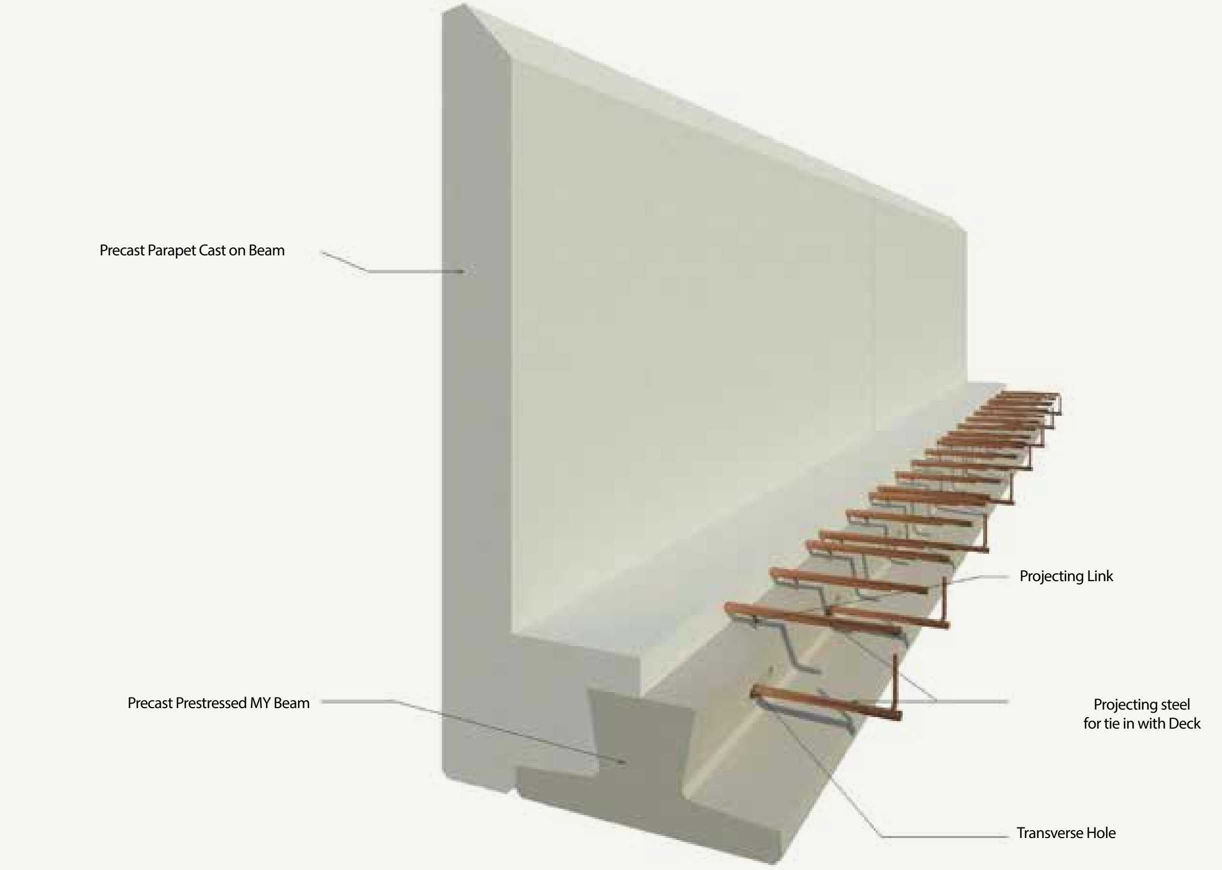


- **Cutting altering of FRC panels may cause structural failure and is not permitted without written approval from Banagher Precast Concrete Ltd.**
- **FRC should always be placed with arrows/ribs directed transversely across the span –see figure.**
- FRC products must not be subjected to excessive point loads (live load not to exceed 150 Kg/m2)
- FRC Products should be inspected for damage.
- All surfaces to receive FRC should be cleaned to remove all loose material and inspected for damage.
- The bearing should be no less than 25 mm at each side of the FRC, and must be level with the underside of the FRC- See figure.
- FRC product must not be subject to shock loading.
- FRC is only suitable for intended use.
- Spacers should always be placed on the beams not the FRC.
- Concrete must not be heaped on the FRC.
- Material must not be stacked or elements must not be propped on the FRC.
- Storage of materials on deck must be supported by beams not FRC.
- Bedded in mortar.

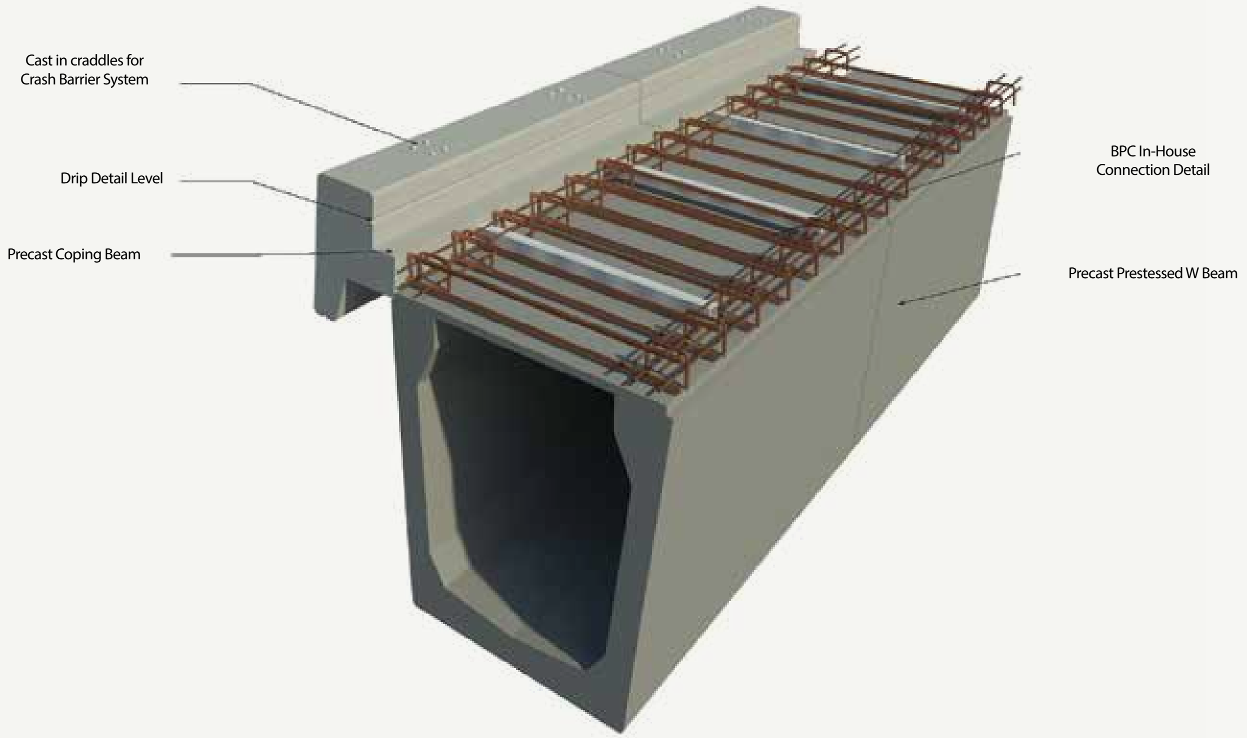
Precast Parapet, Coping and Edge Beam Details

More and more contractors are using the option of factory manufactured concrete cast on or individually cast parapets, copings and edge beams. Banagher Precast Concrete parapets, copings and edge beams can be any profile, we do carry standard sizes and we would offer these first but bespoke sizes can also be catered for.

Cast on parapets, copings and edge beams are typically precast onto our standard range of prestressed bridge beams as a secondary process which can be seen here and on the next five pages.



Section Through MY Beam Showing Cast On Parapet (This Detail Can Also Be Used With The TY & Y Beams)

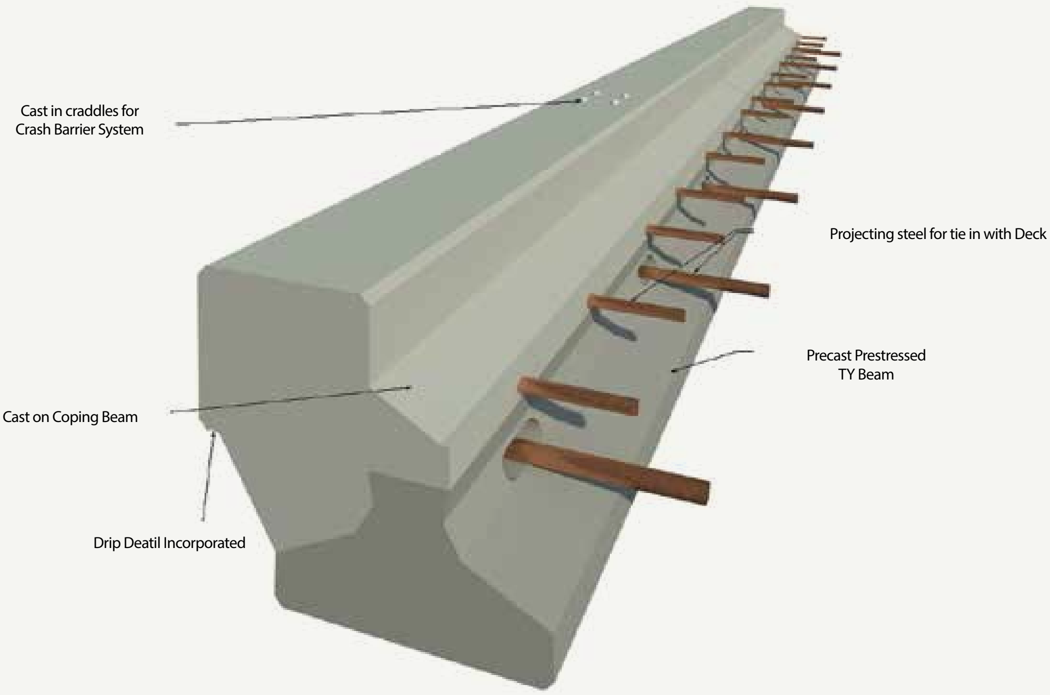


Section Through W Beam Showing Precast Coping
(This Detail Can Also Be Used With The U Beam)

Precast Parapet, Coping and Edge Beam Details

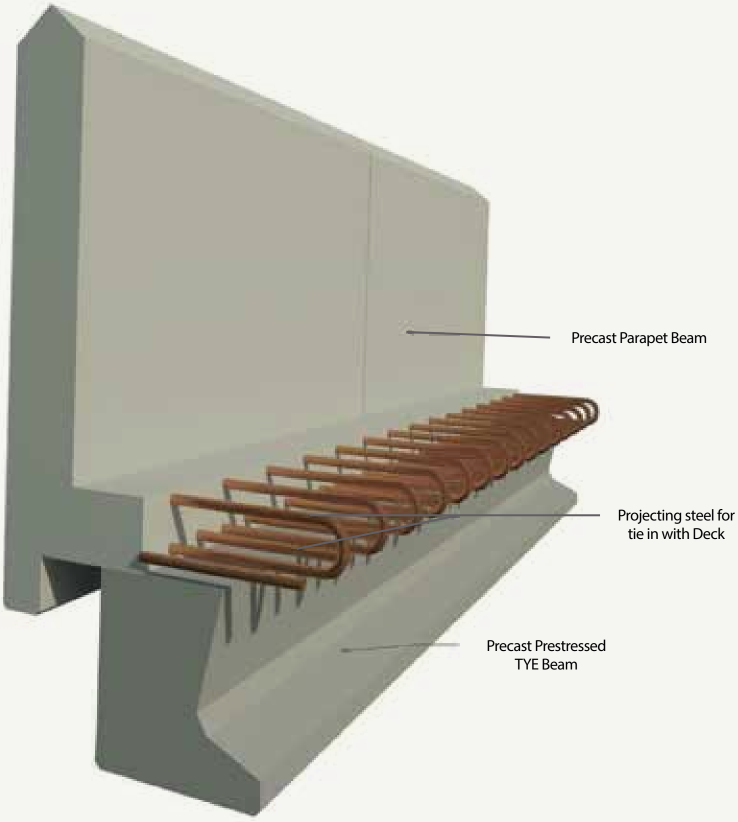
Typical advantages of precast concrete parapets, copings and edge beams:

1. Factory produced
2. Ensure a quick erection process
3. Alternative finishes and profiles available to suit local conditions
4. Can take cast in items for light fixings and crash barrier systems.



Section Through TY Beam Showing Cast on Precast Coping
(This Detail Can Also Be Used With The MY & Y Beam)

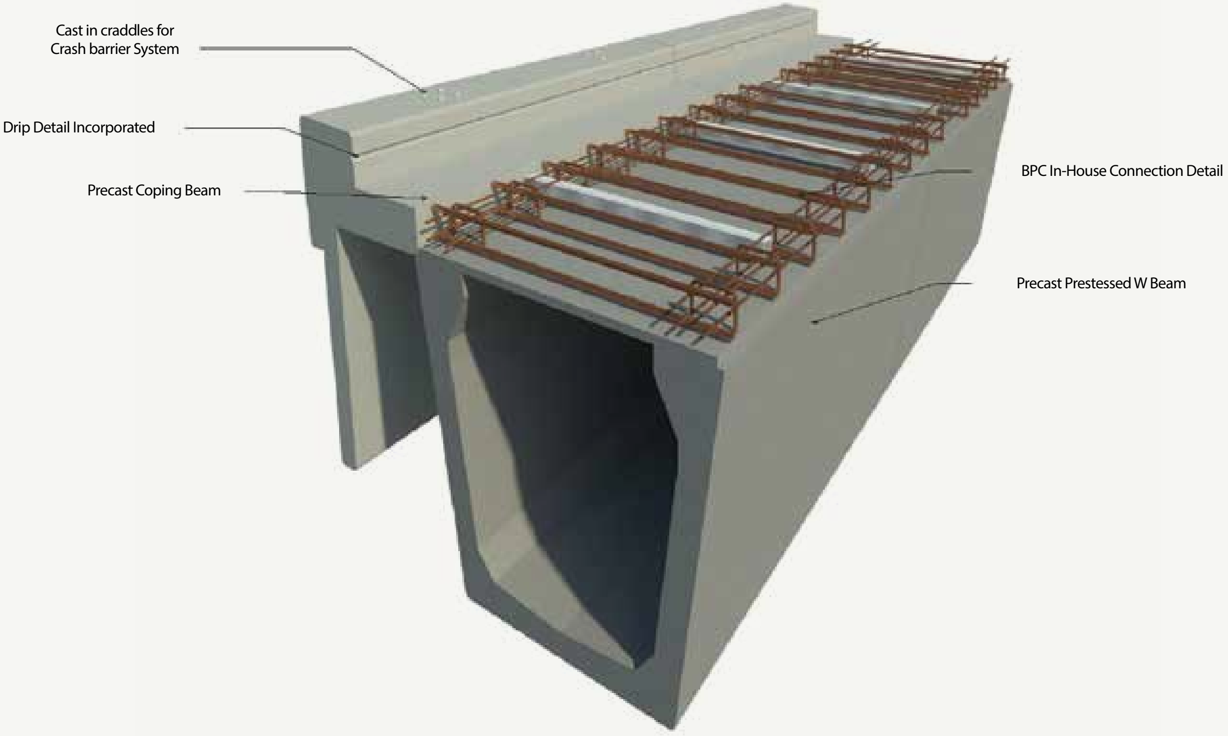
Banagher Precast Concrete manufacture parapets like below for use over Railways where a steeple top is required to prevent people being able to stand on top of the parapet. These units can have an F4 finish on both faces or a U4 finish on one.



Section Through TY Beam Showing Precast Parapet (This Detail Can Also Be Used With The MYE & YE Beam)

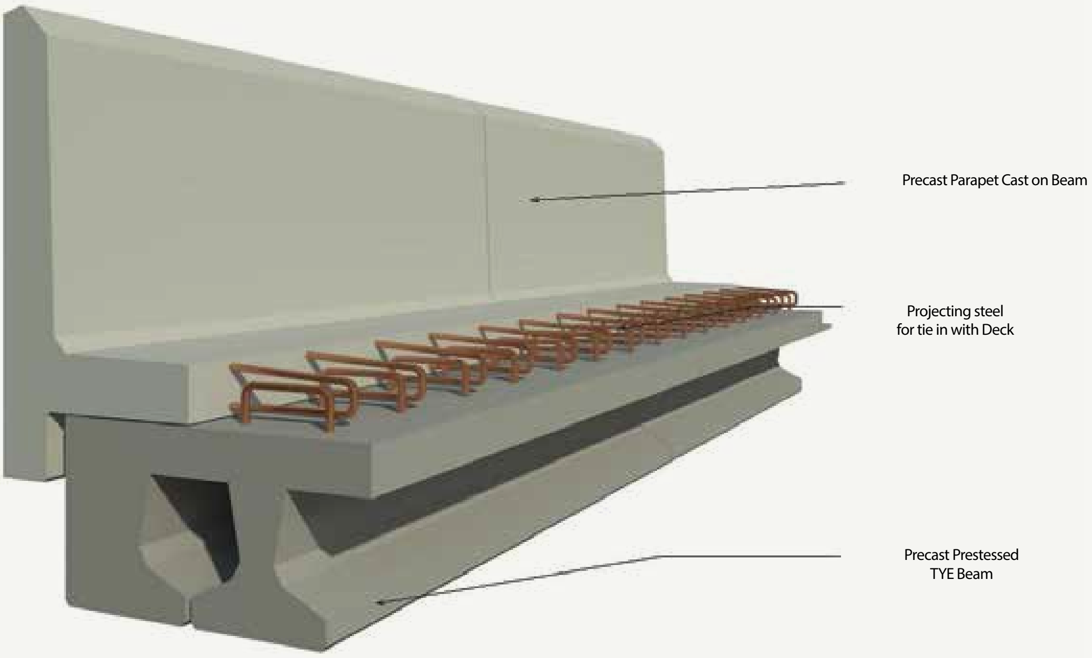
Precast Parapet, Coping and Edge Beam Details

Banagher Precast Concrete can offer pattern profiled finishes, exposed aggregate finishes, brick sandwich panels and as shown below curved panels as well. Whatever your criteria please give our technical team a call for a precast solution.



Section Through W Beam Showing Precast Coping
(This Detail Can Also Be Used With The U Beam)

There are many forms of connection details for the parapet to the deck. Banagher Precast Concrete pride themselves on offering the client the best and most user friendly solution for on site conditions. A precast seating and a stitch detail can help in the temporary case and give the client edge protection at an early stage allowing work on the deck to start straight away.



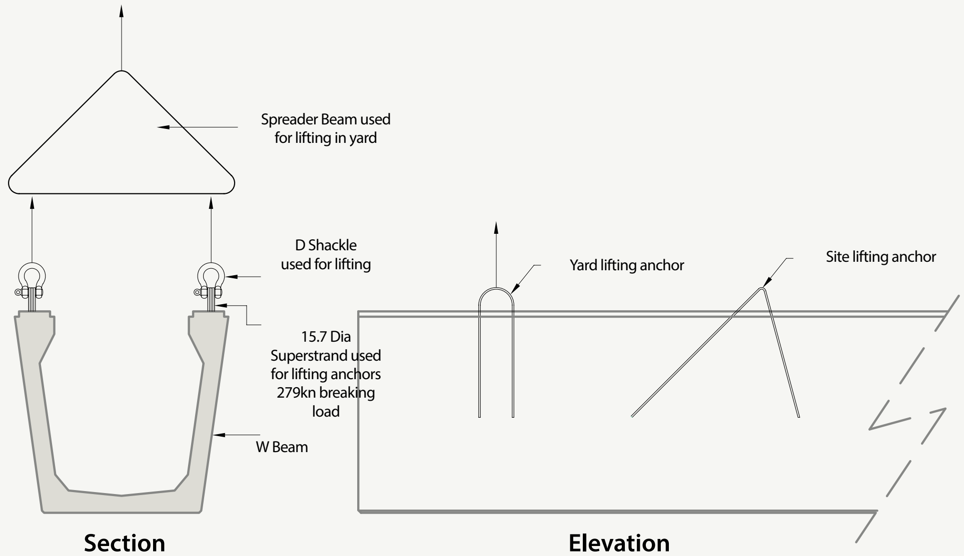
Section Through TY & TYE Bridge Deck Showing Precast Parapet (This Detail Can Also Be Used With The MY & Y Beam)

Lifting and Handling Details

U and W Beams

W Beam manufacture is identical to U Beam manufacture but due to the larger section, extra care must be taken in lifting and stacking of W Beams. The units are manufactured with two sets of lifting anchors (see Fig. 1). The lifting anchors positioned closest to the ends are used at the manufacturing yard and should not be used on site, except in special agreed circumstances. The site lifting anchors are positioned further in along the beam. The location and Lifting Angle for these positions are noted on the relevant production drawing.

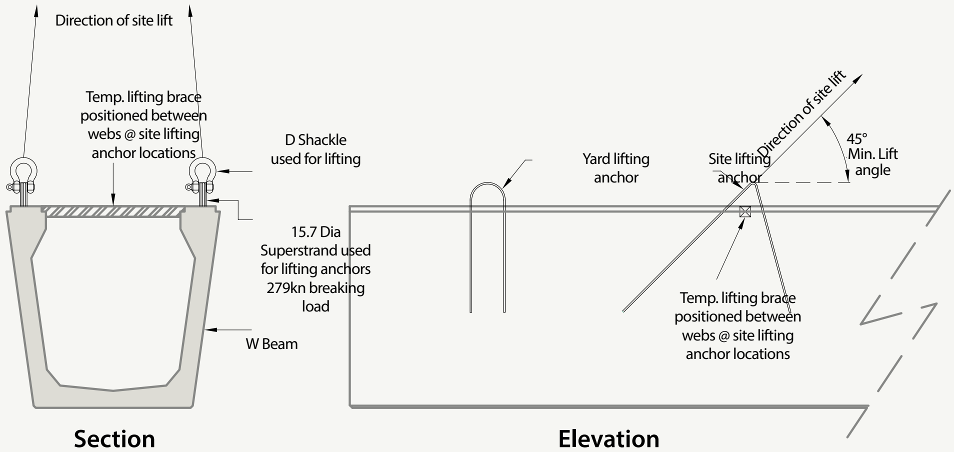
When lifting the beams at the production yard, a spreader beam is used. This spreader beam has been manufactured, tested and certified for this specific task and lifts straight up causing no inward or outward stress to the beam. This system is used for lifting the beam from the production line into storage. Typical support arrangement for temporary storage is shown in Fig. 3. The beam must be supported under the end lifting anchor and the supports should provide sufficient ground clearance to avoid any bearing along its length. Bearing should only take place at these two points, no further bearing should be provided along the length of the beam. Support should be provided either across the full width of the W Beam soffit (see Fig. 4a) or directly under the two webs (see Fig. 4b) and NOT be positioned along the centre line of the beam (see Fig. 4c). When transporting to site a temporary brace is positioned between the two site lifting anchors (Fig. 2). This is an adjustable steel frame that is easily fixed and removed when the beam is in position. The brace must remain in place when lifting on site and slings can be attached as normal. Once the beam has been landed on its support this brace can be removed easily and returned to the yard. Site work may commence.



Section

Elevation

Fig 1.



Section

Elevation

Fig 2.

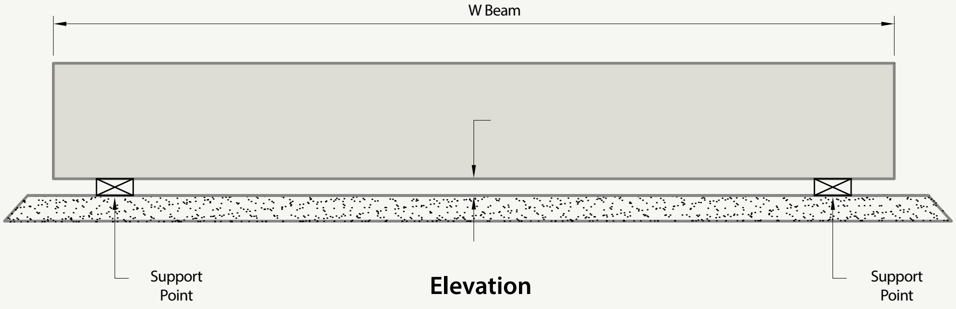


Fig 3.

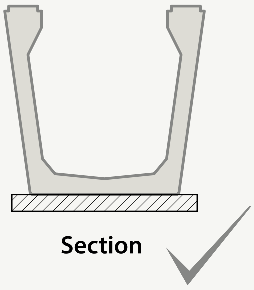


Fig 4a.

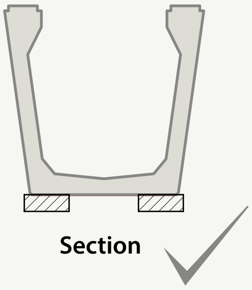


Fig 4b.

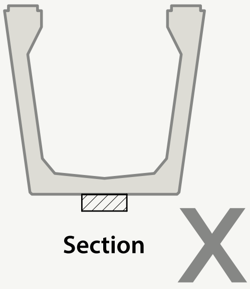
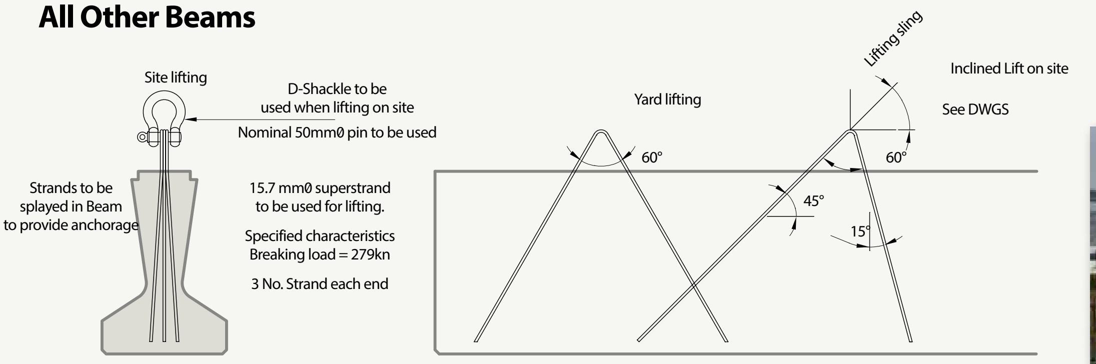
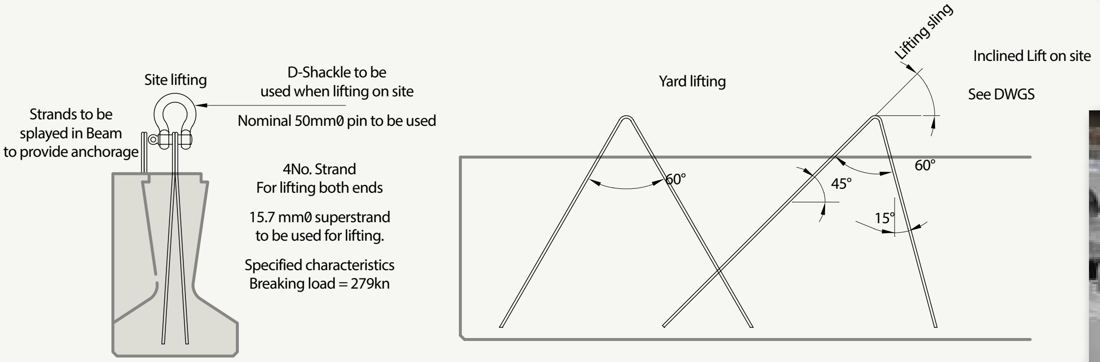


Fig 4c.

All Other Beams



Prestressed Bridge Beam Lifting Details



Prestressed Bridge Edge Beam Lifting Details

Delivery and Installation

Transportation to Site:

In almost all cases it is the responsibility of Banagher Precast Concrete to deliver the bridge beams to site. The handling of the units on site, preparation of suitable access roads, cranage and further site operations is the responsibility of the contractor. Banagher Precast Concrete are on hand to advise in relation to any of the points above.

The precast beams are delivered to site on special vehicles with the load supported and restrained appropriately. On site, the access road to the point of unloading must be appropriate for road vehicles, i.e. adequate hardstanding to be provided for by the main contractor.

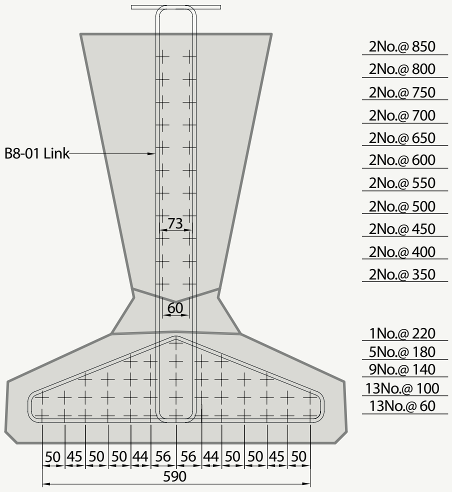
Roadways with crossfalls or corners with severe changes of level should be avoided as these may impose torsional stresses on the beams. The unloading area should be on level ground and appropriate space for turning should be available.

Handling and Erection on Site:

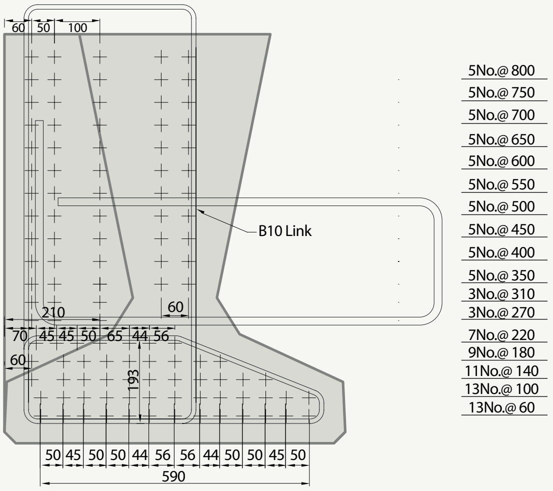
Lifting and handling operations must be reviewed by a competent person. Cranes should be positioned such that the erection of the beams can take place safely, within the safe working load and radius of the crane. Beam weights for lifting are given on the Banagher Precast Concrete production drawings. The angle of lift is also defined on the drawings. Bridge beam lifts are often critical with respect to road or rail closures, it is recommended therefore that the crane has some additional capacity. The contractor should allow for an additional 10% of weight to that on the production drawings, if necessary, Banagher Precast Concrete can weigh the beams. The bridge beams have lifting strands cast in, these again are identified clearly on the production drawings. It is up to the crane supplier to provide all of the lifting gear.

Bridge beams should be placed in position as soon as they are delivered to site but often this is not possible as large numbers of beams may take days to be delivered in full if the haulier doesn't have adequate numbers of trailers therefore it may be required to store a number of beams until all of the beams have been delivered and then can be placed at the same time. Storage areas should be cordoned off and beams should be supported on timber skids with appropriate foundation strips, Banagher Precast Concrete are available to liaise on the type and size of timbers that need to be used, often these timbers will be on the delivery wagon and can be kept and used on site. Tall beams should be stabilised with props and all beams should be supported only under the lifting points as shown in our section on "Lifting and Handling Details" in this brochure.

Appendix A - TY Beams using 12.9 mm diameter strand

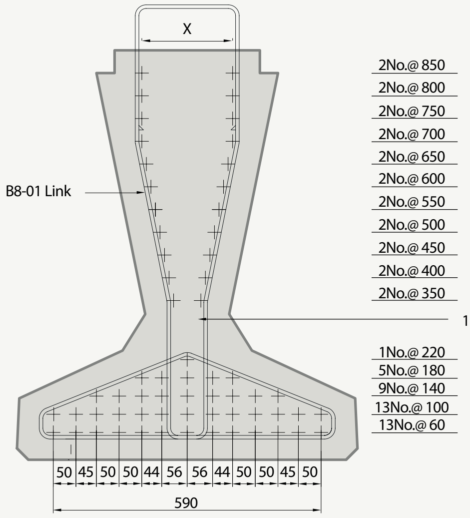


TY Beam
Showing all possible strand locations
for 12.9 mm diameter strand

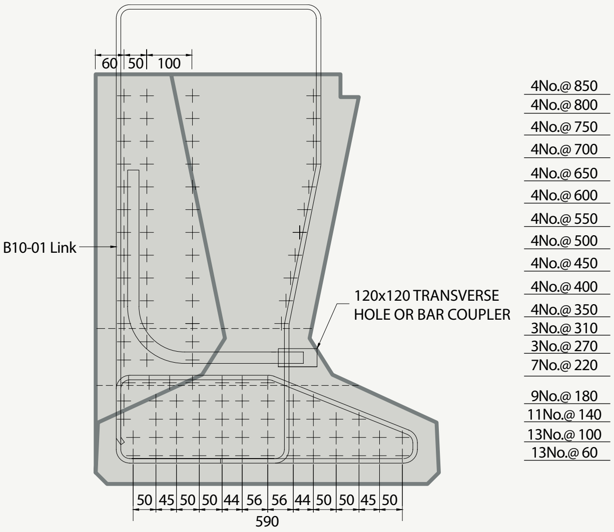


TYE Beam
Showing all possible strand locations
for 12.9 mm diameter strand

Beam	X
TY11	200
TY10	180
TY9	160
TY8	140
TY7	120
TY6	100
TY5	80
TY4	60
TY3	60

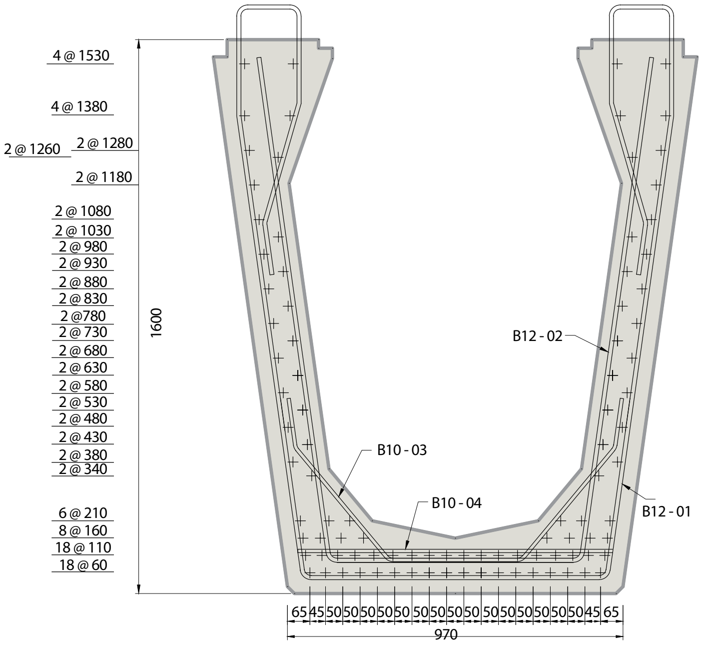


TY Beam
Showing all possible strand locations
for 12.9 mm diameter strand

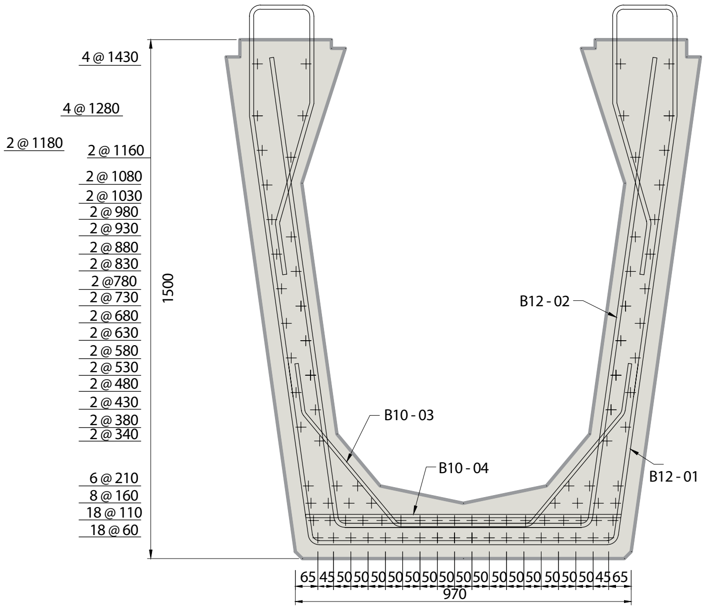


TYE Beam Showing all possible strand
locations for 12.9 mm diameter strand

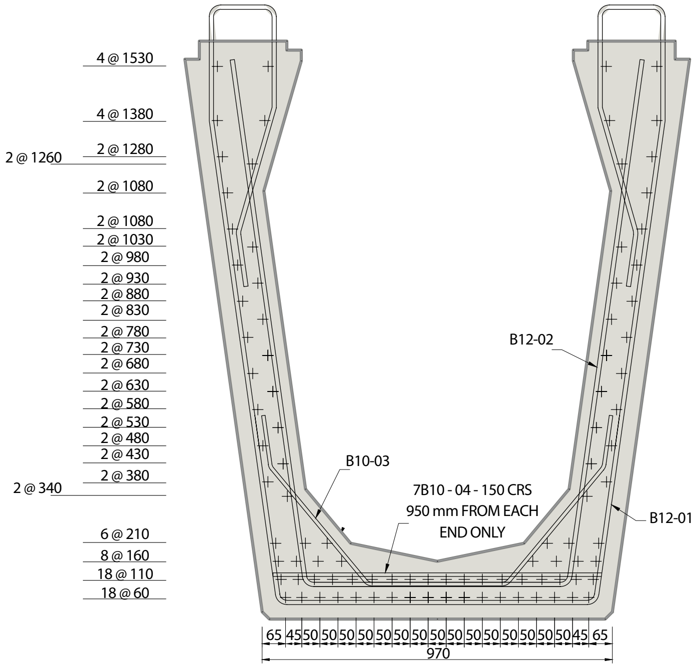
Appendix B - Full U Beam Range



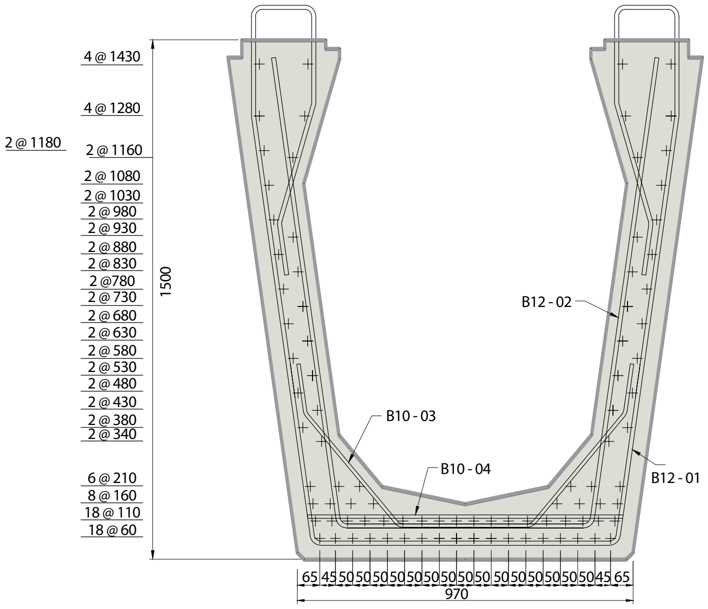
Section Through SU12 Beam showing all possible Strand Locations



Section Through SU11Beam showing all possible Strand Locations

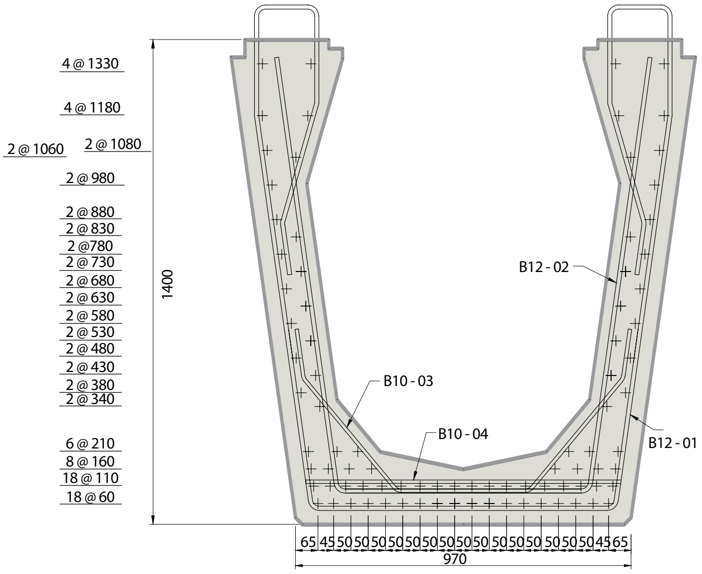


Section Through U12 Beam showing all possible Strand Locations

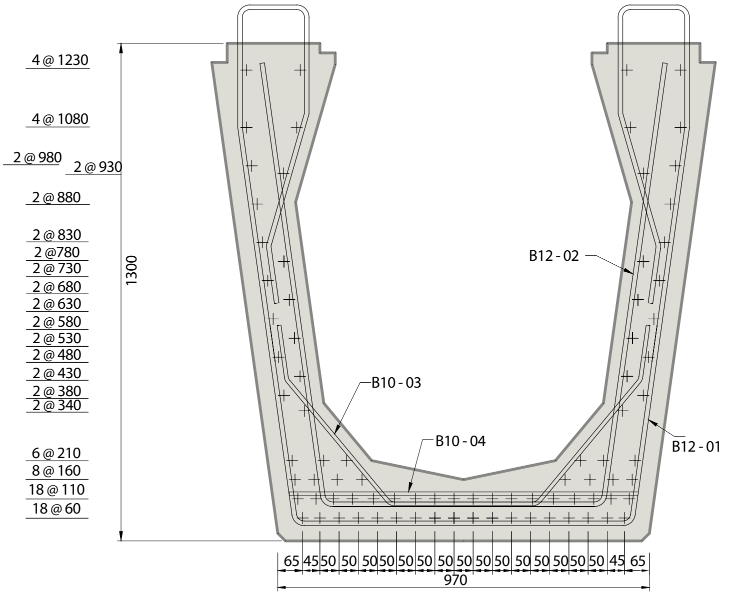


Section Through U11 Beam showing all possible Strand Locations

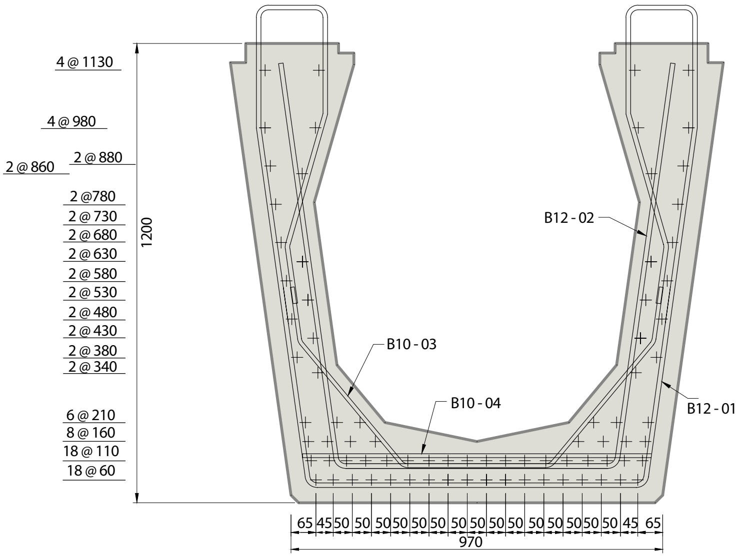
Appendix B - Full U Beam Range



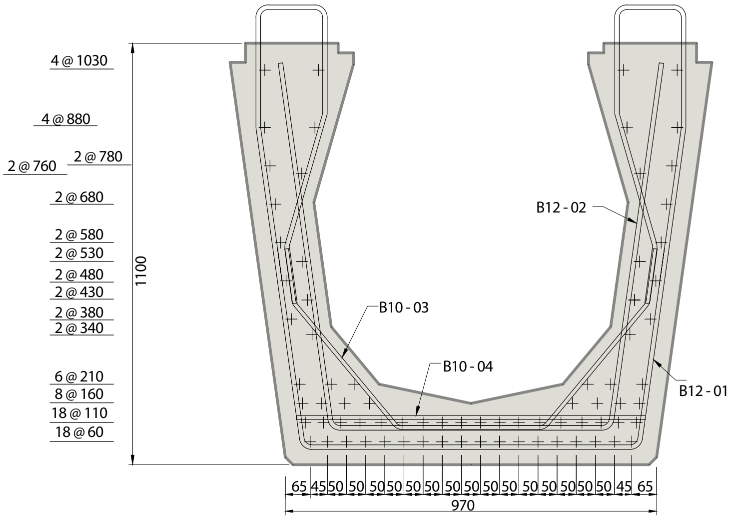
Section Through U10 Beam showing all possible Strand Locations



Section Through U9 Beam showing all possible Strand Locations

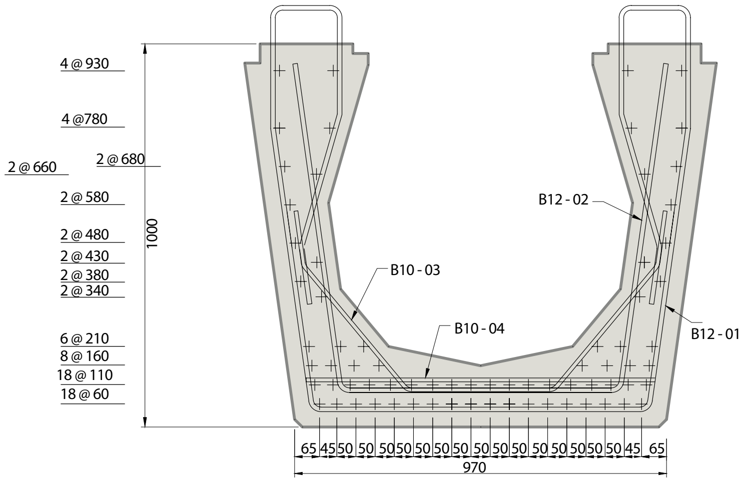


Section Through U8 Beam showing all possible Strand Locations

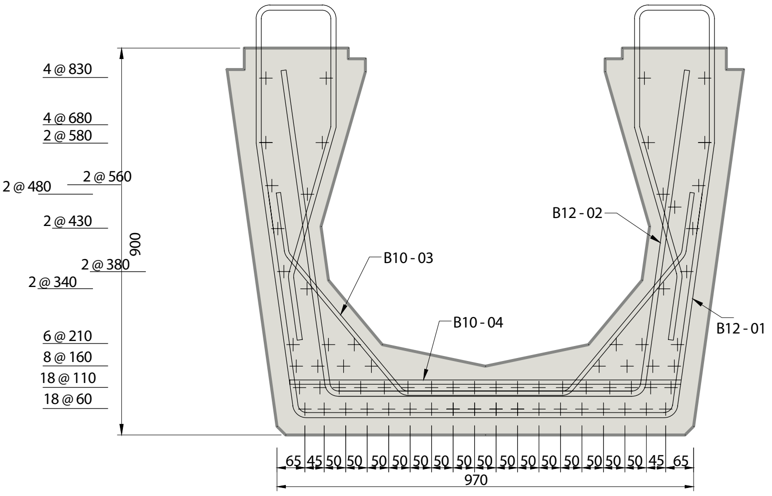


Section Through U7 Beam showing all possible Strand Locations

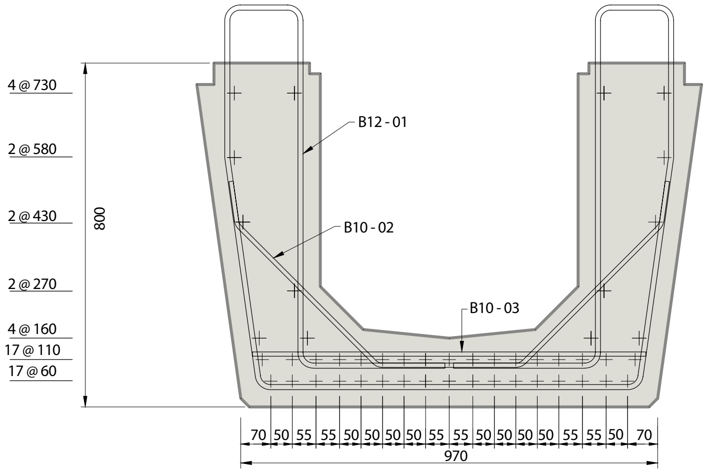
Appendix B - Full U Beam Range



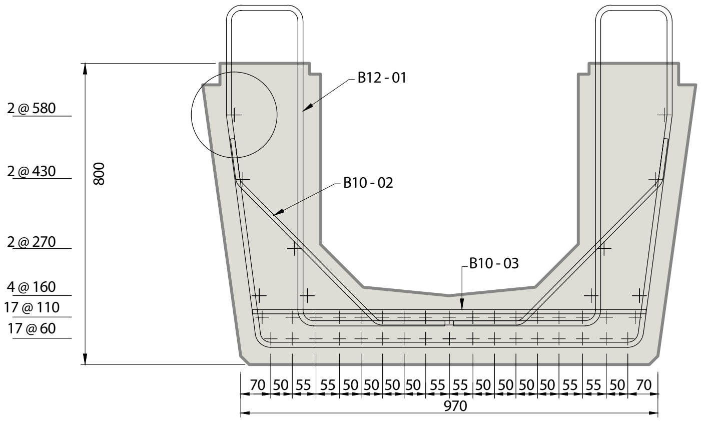
Section Through U5 Beam showing all possible Strand Locations



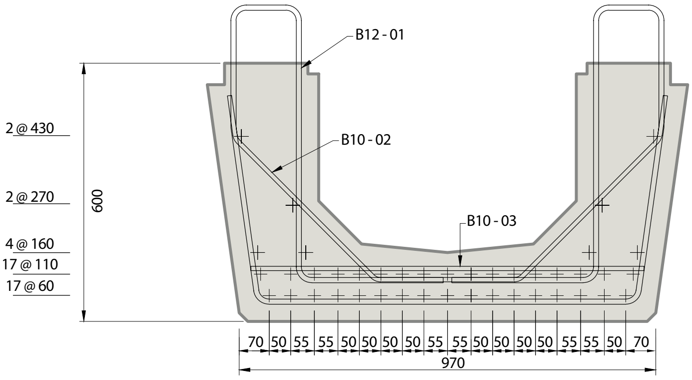
Section Through U3 Beam showing all possible Strand Locations



Section Through U1 Beam showing all possible Strand Locations

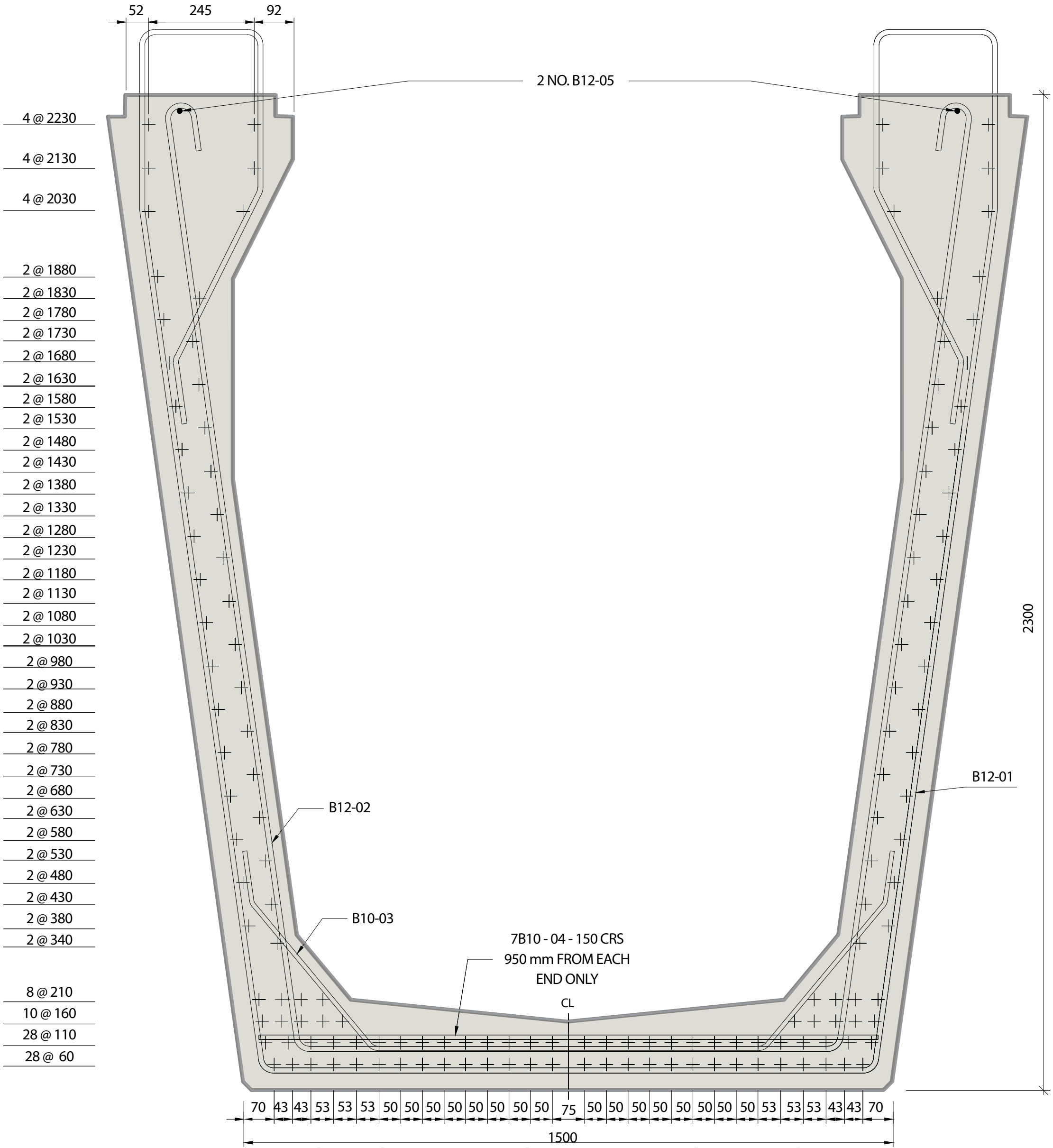


Section Through U700 Beam showing all possible Strand Locations

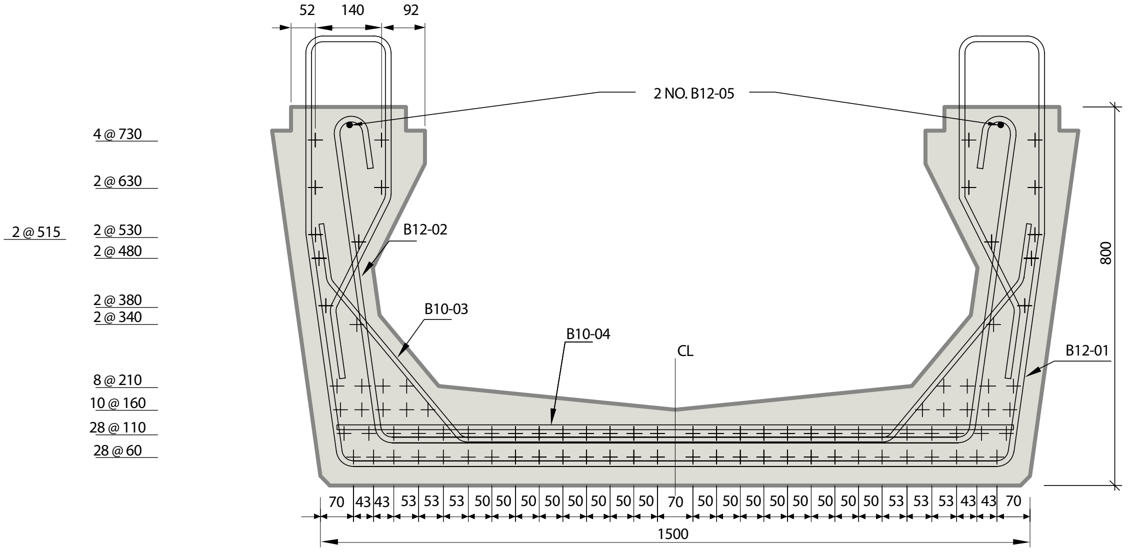


Section Through U600 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

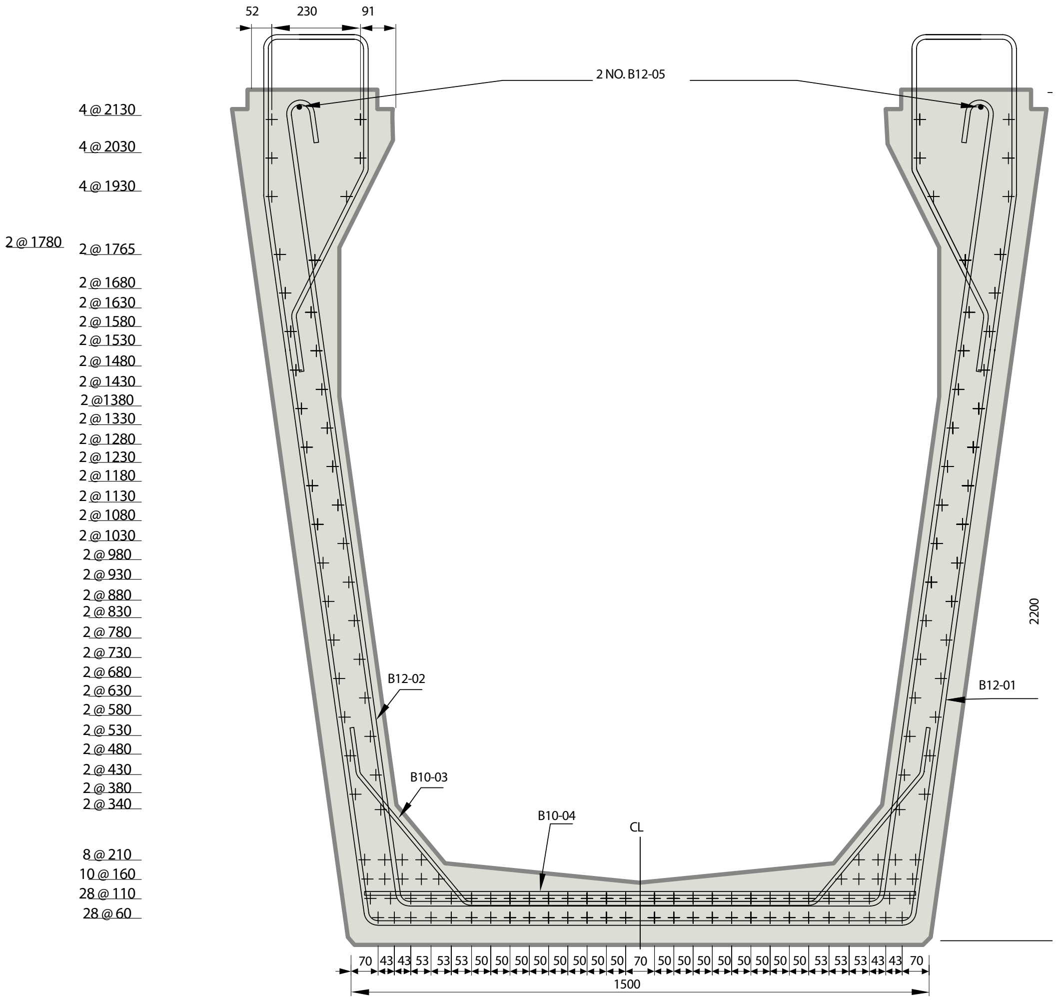


Section Through W19 Beam showing all possible Strand Locations

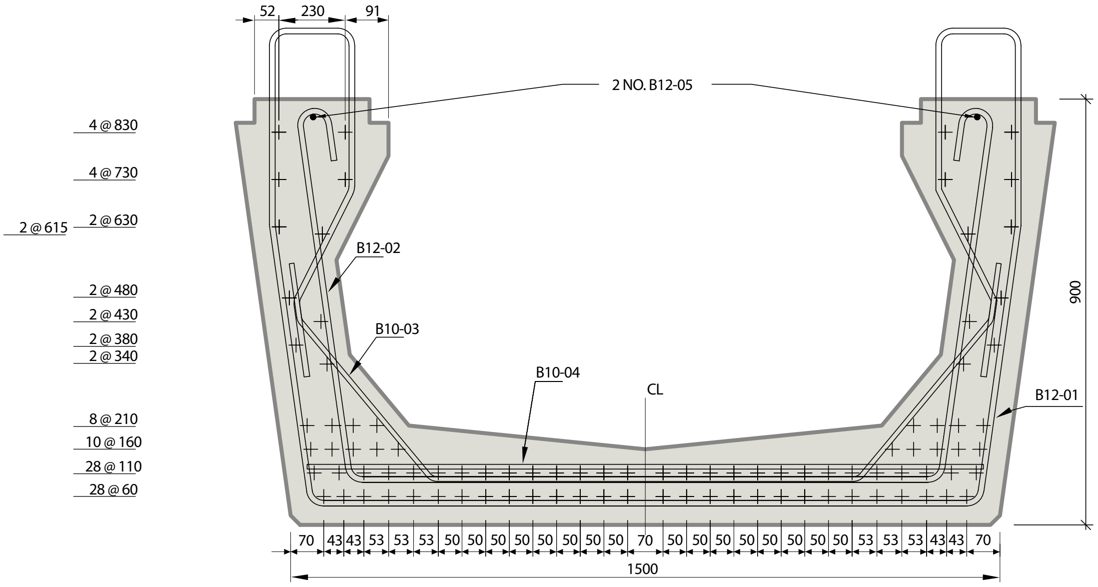


Section Through W1 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

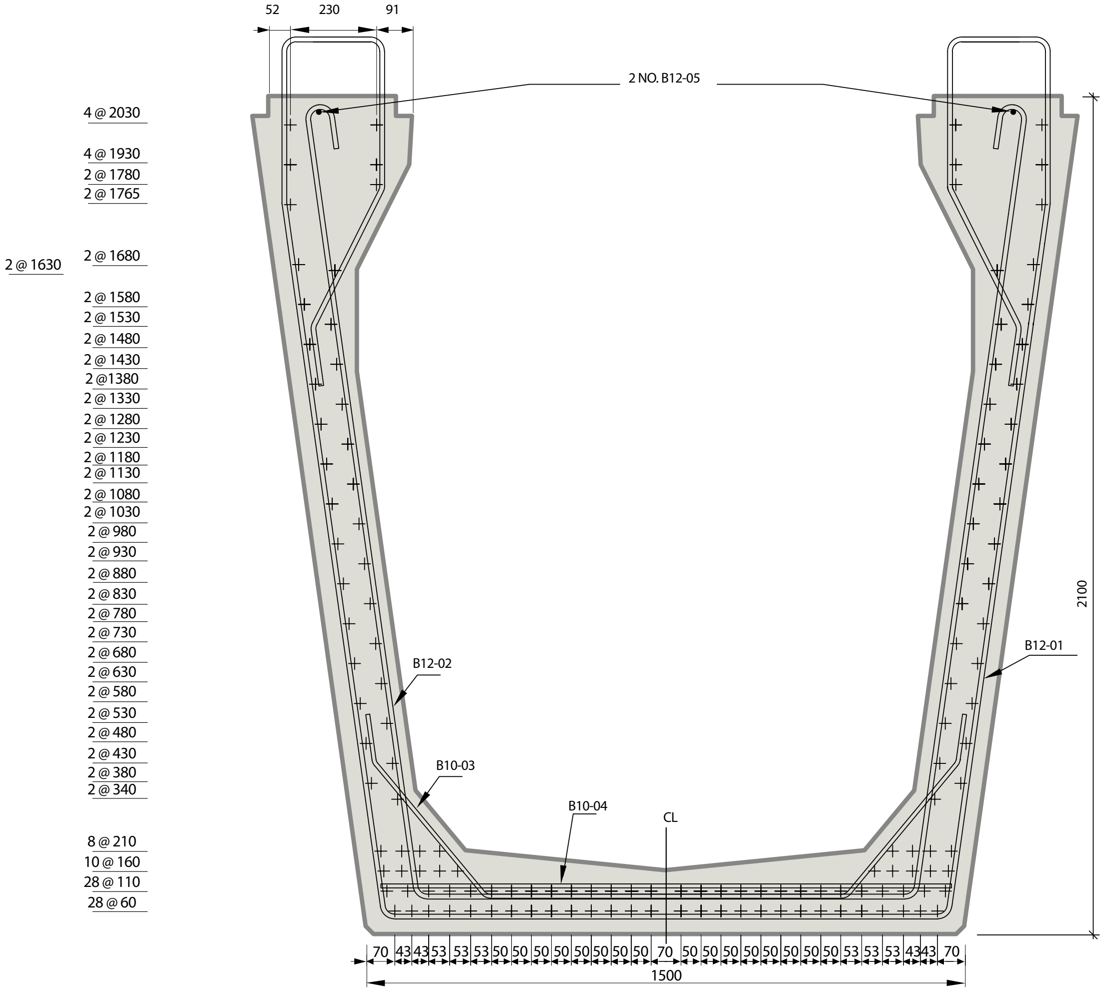


Section Through W18 Beam showing all possible Strand Locations

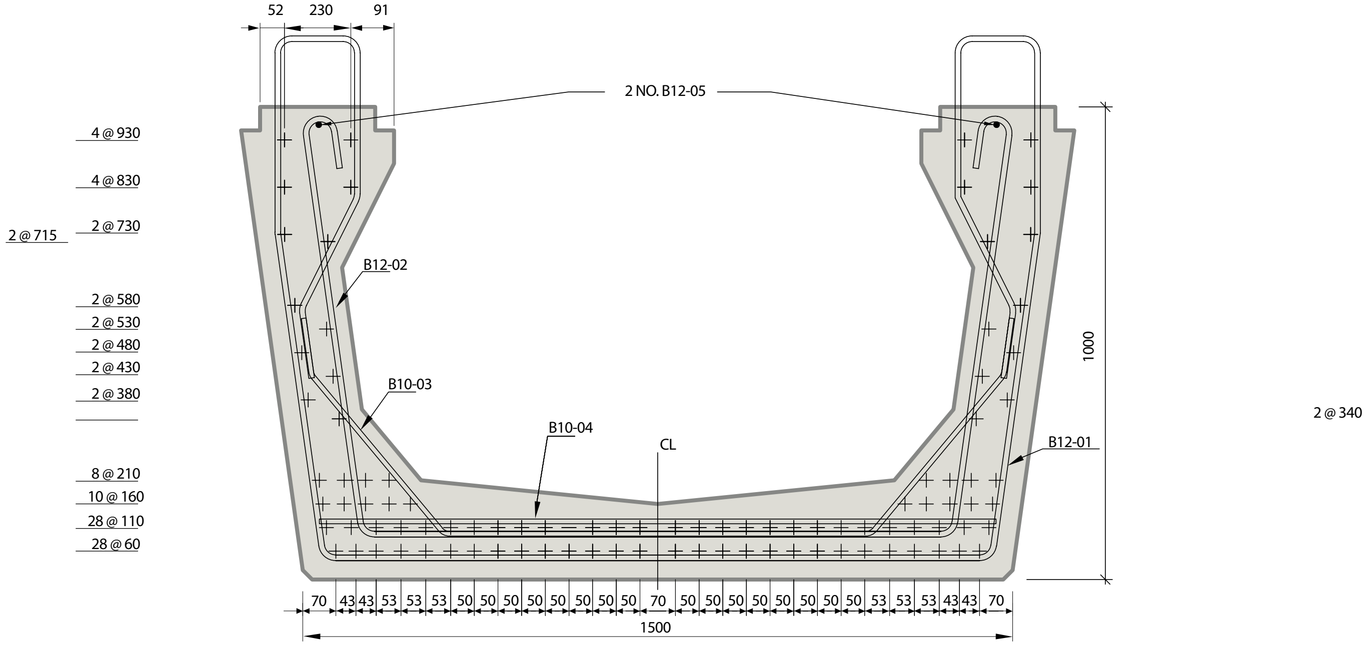


Section Through W3 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

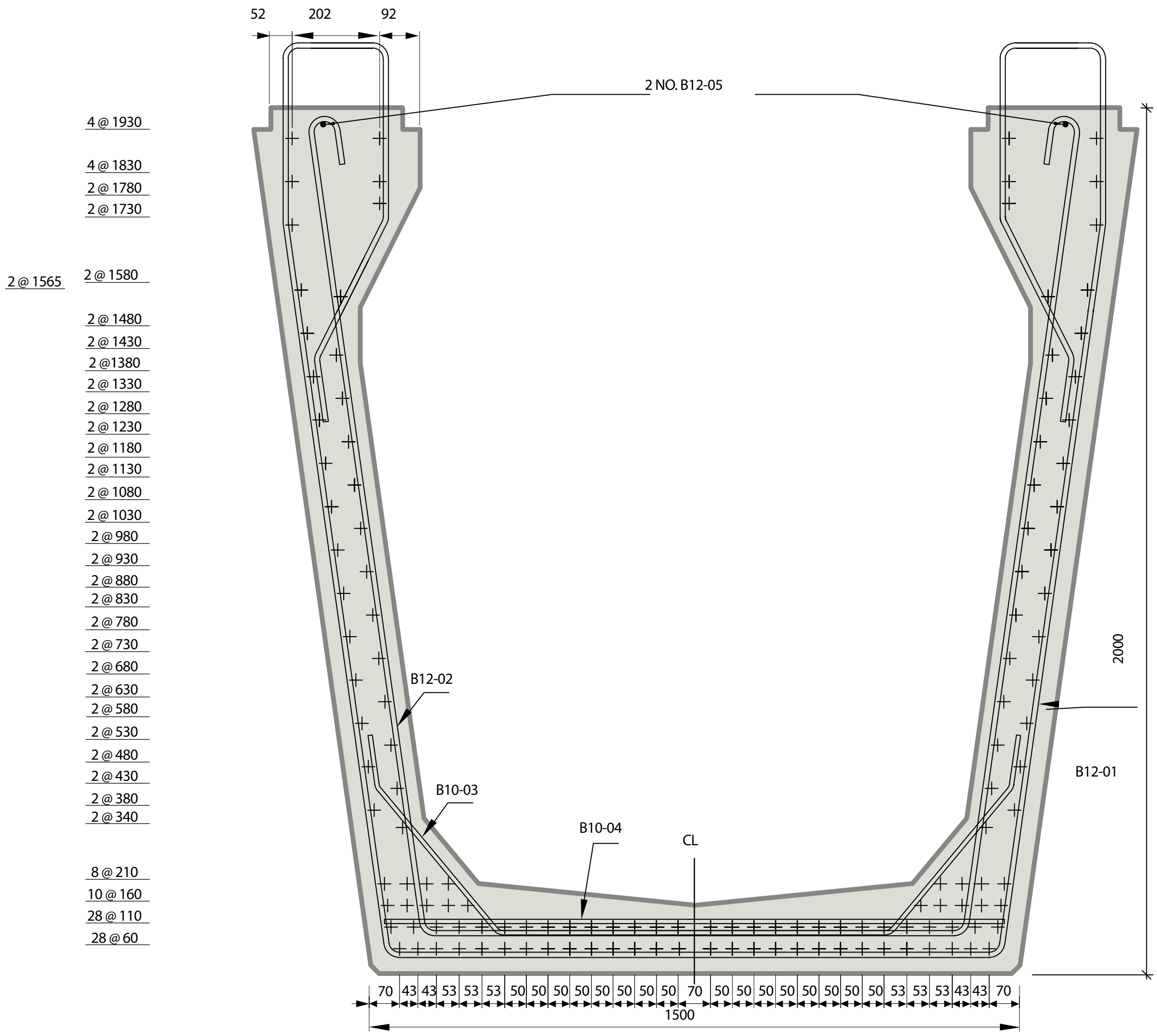


Section Through W17 Beam showing all possible Strand Locations

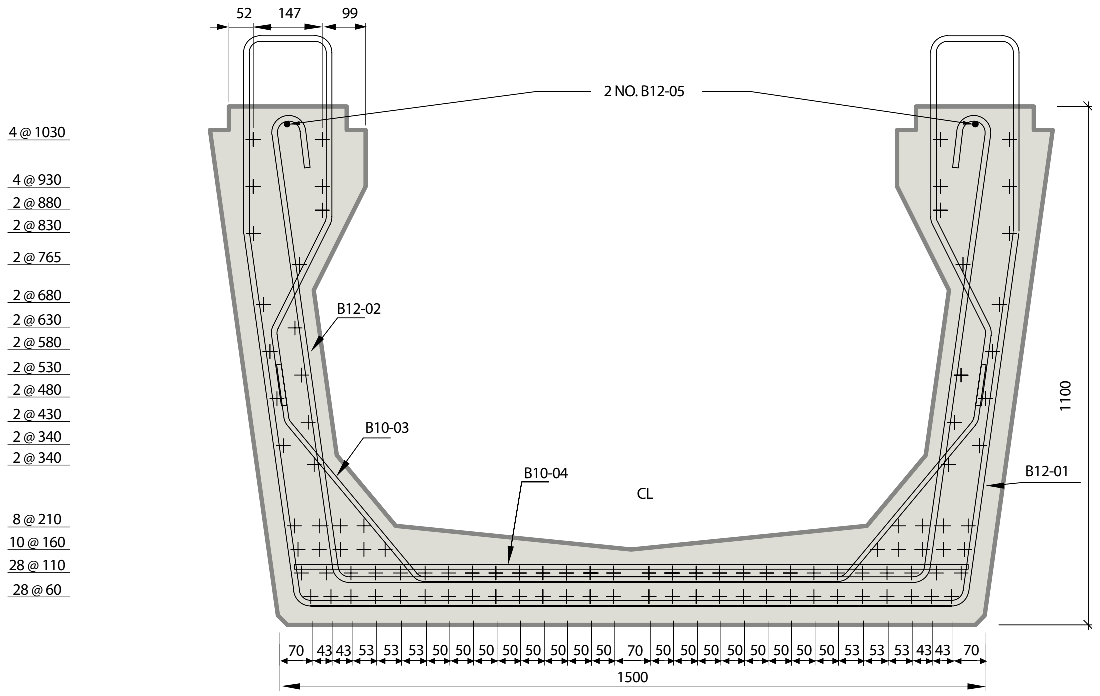


Section Through W5 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

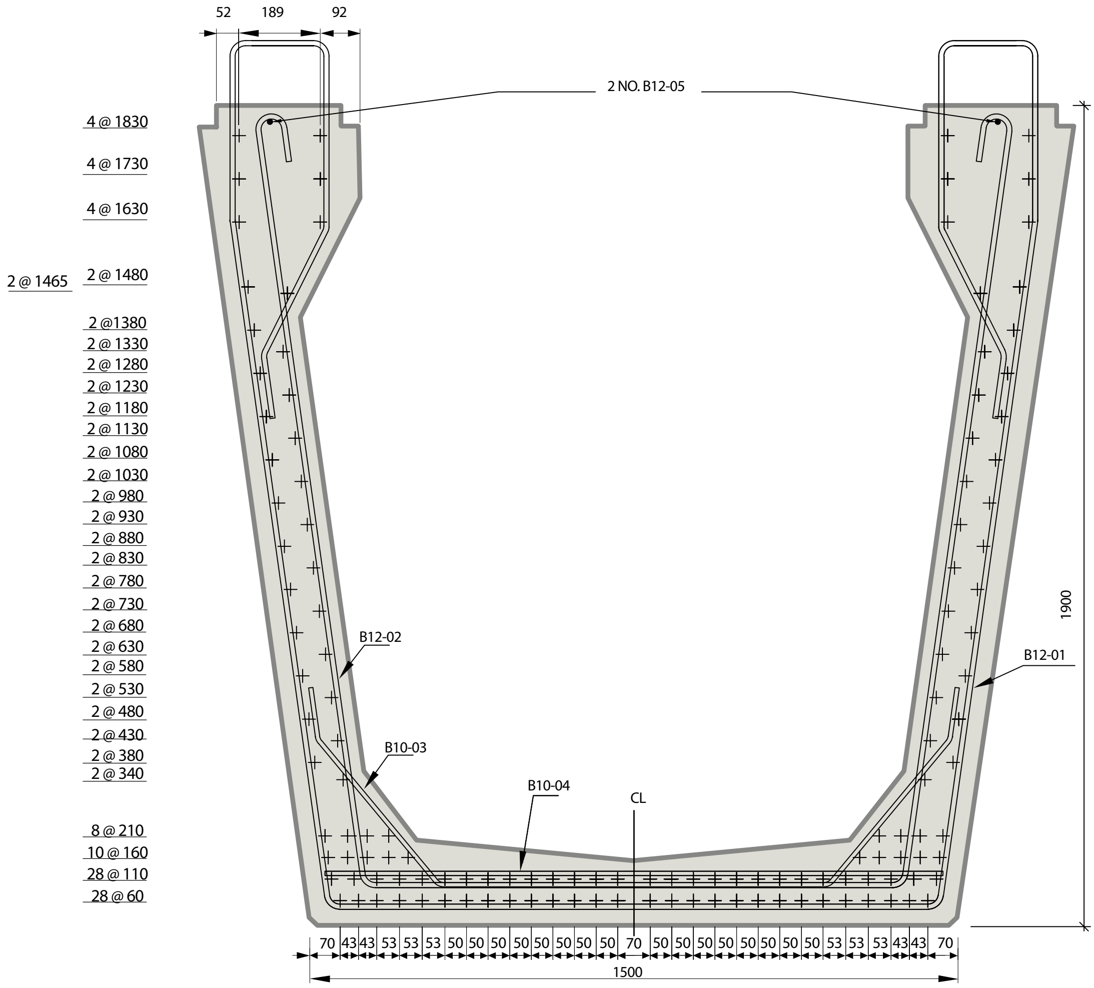


Section Through W16 Beam showing all possible Strand Locations

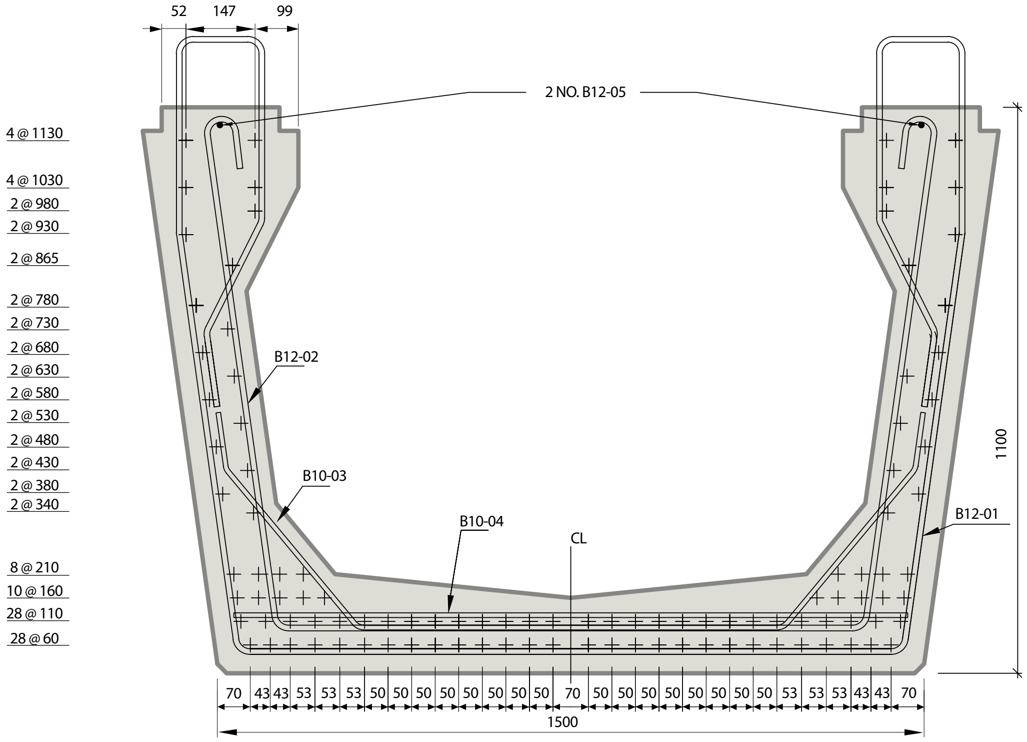


Section Through W7 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

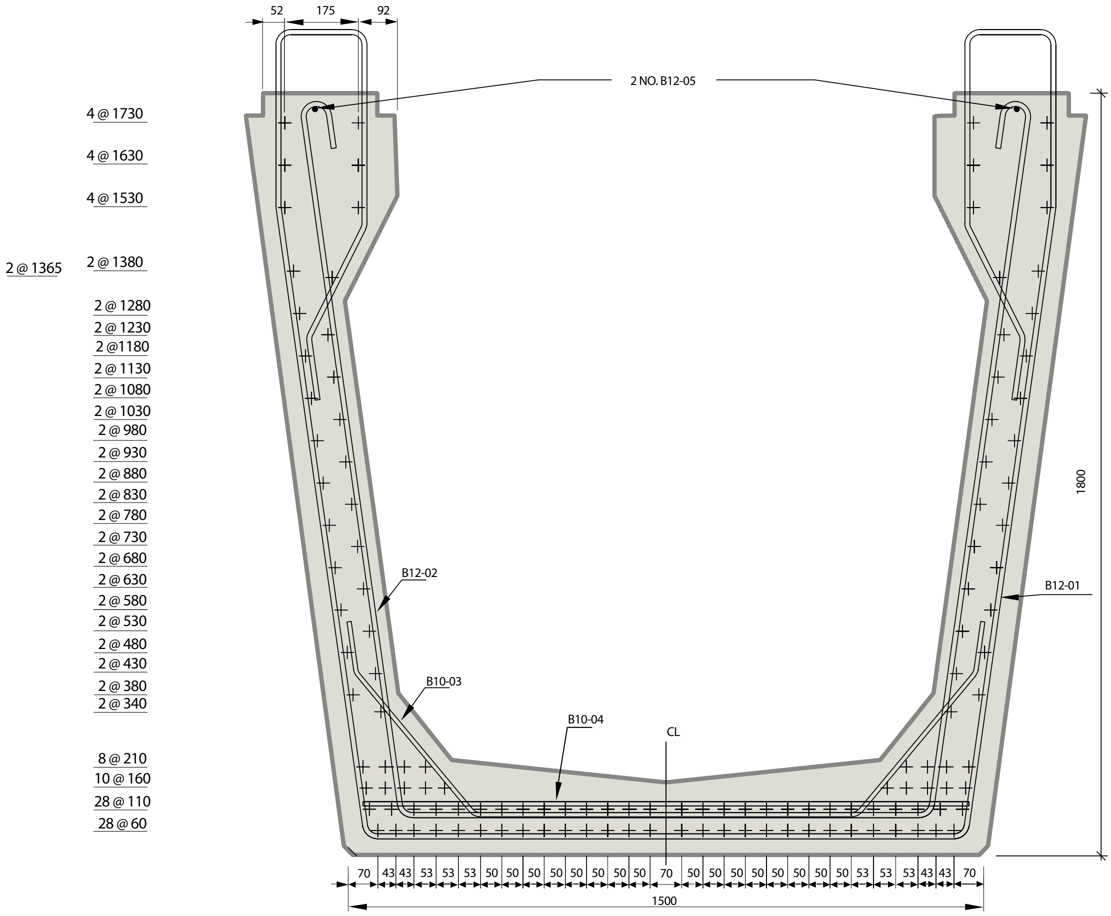


Section Through W15 Beam showing all possible Strand Locations

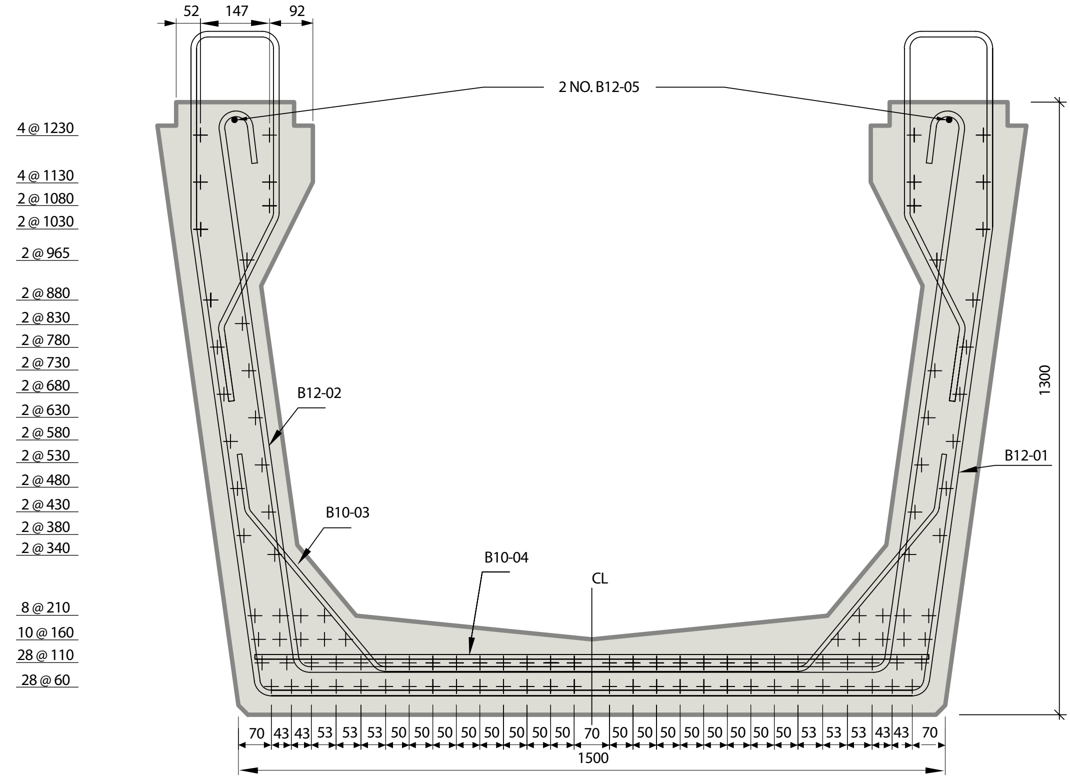


Section Through W8 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

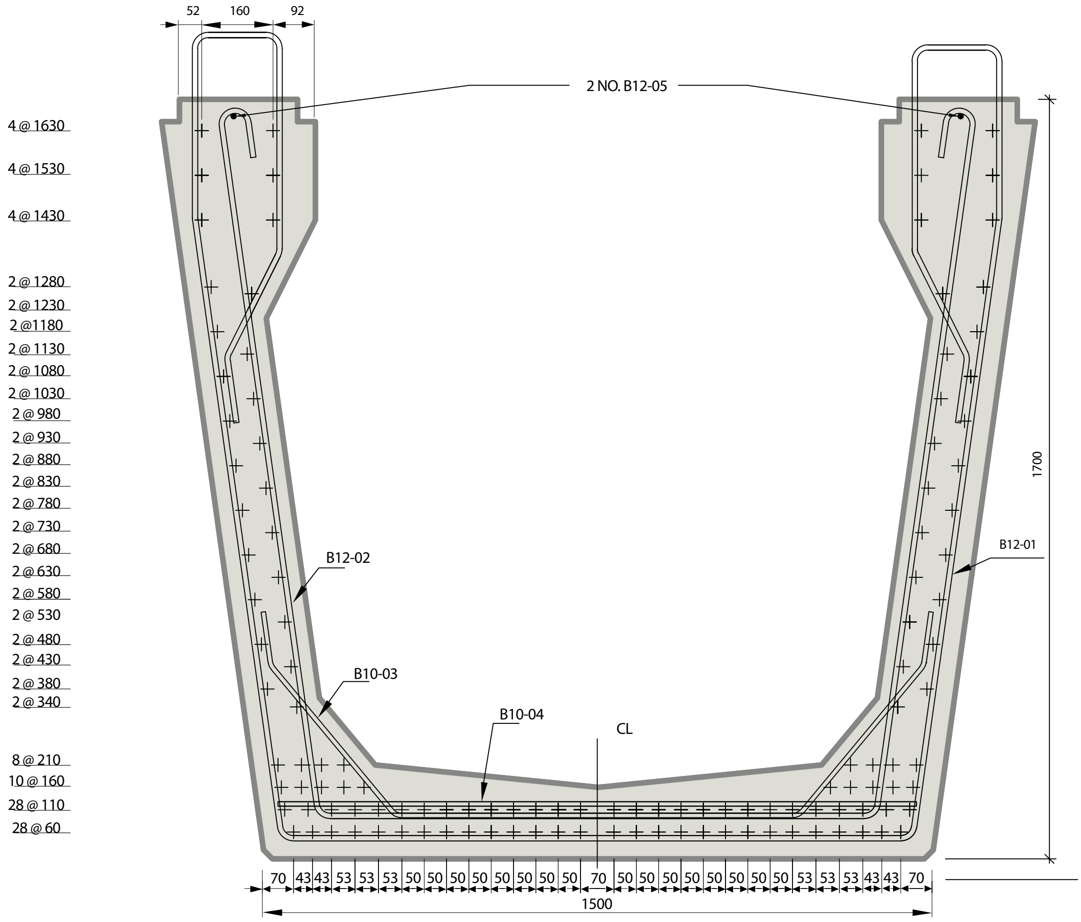


Section Through W14 Beam showing all possible Strand Locations

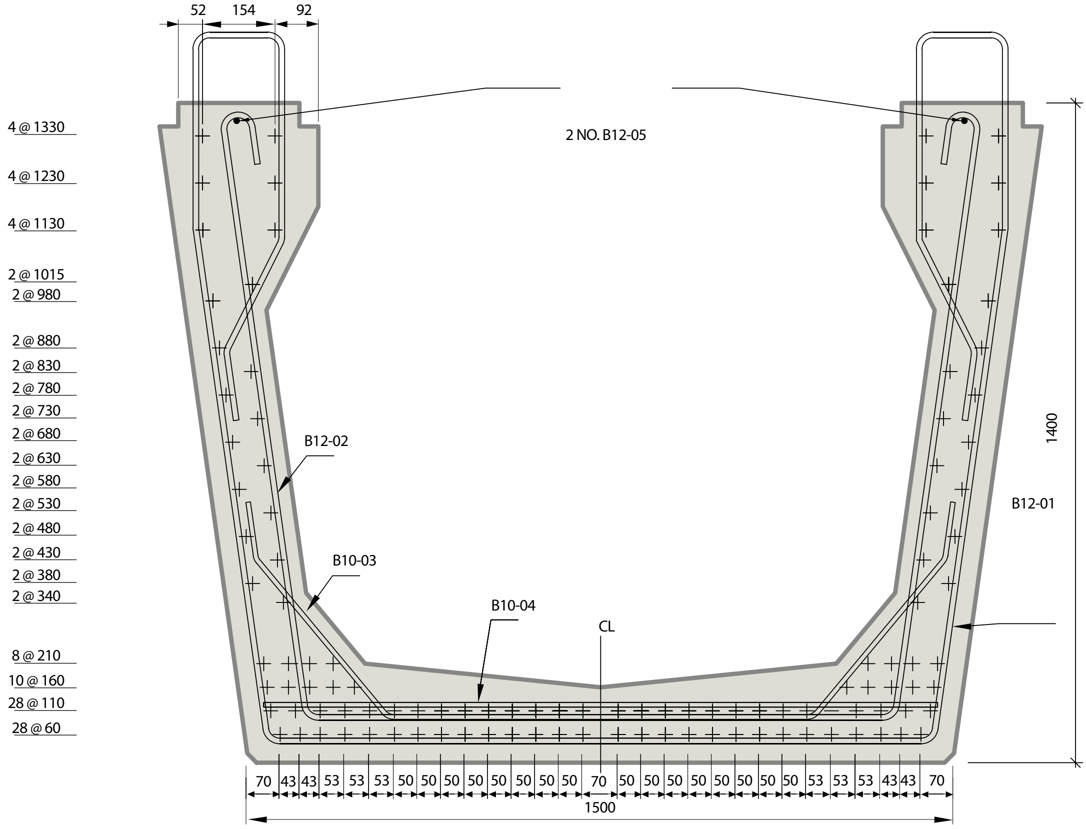


Section Through W9 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range

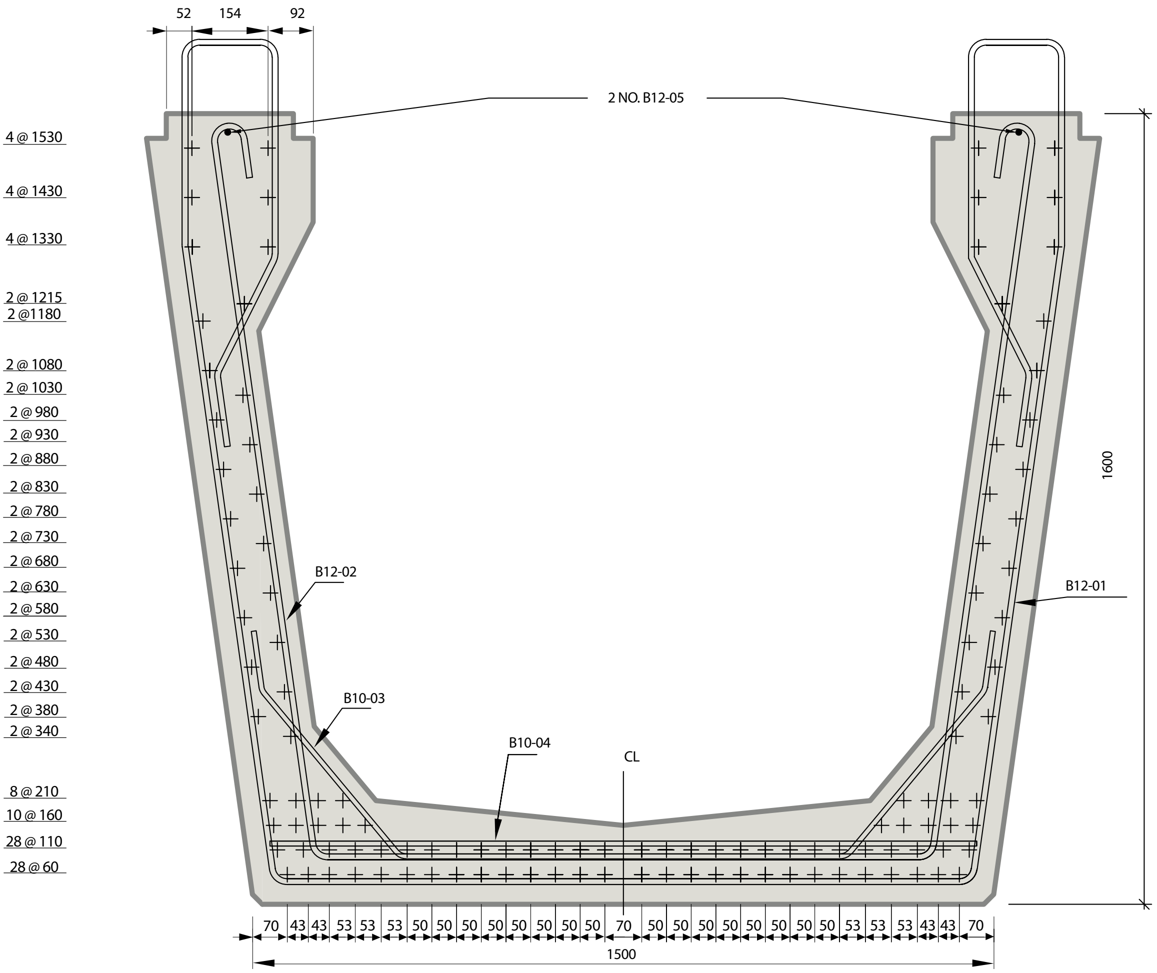


Section Through W13 Beam showing all possible Strand Locations

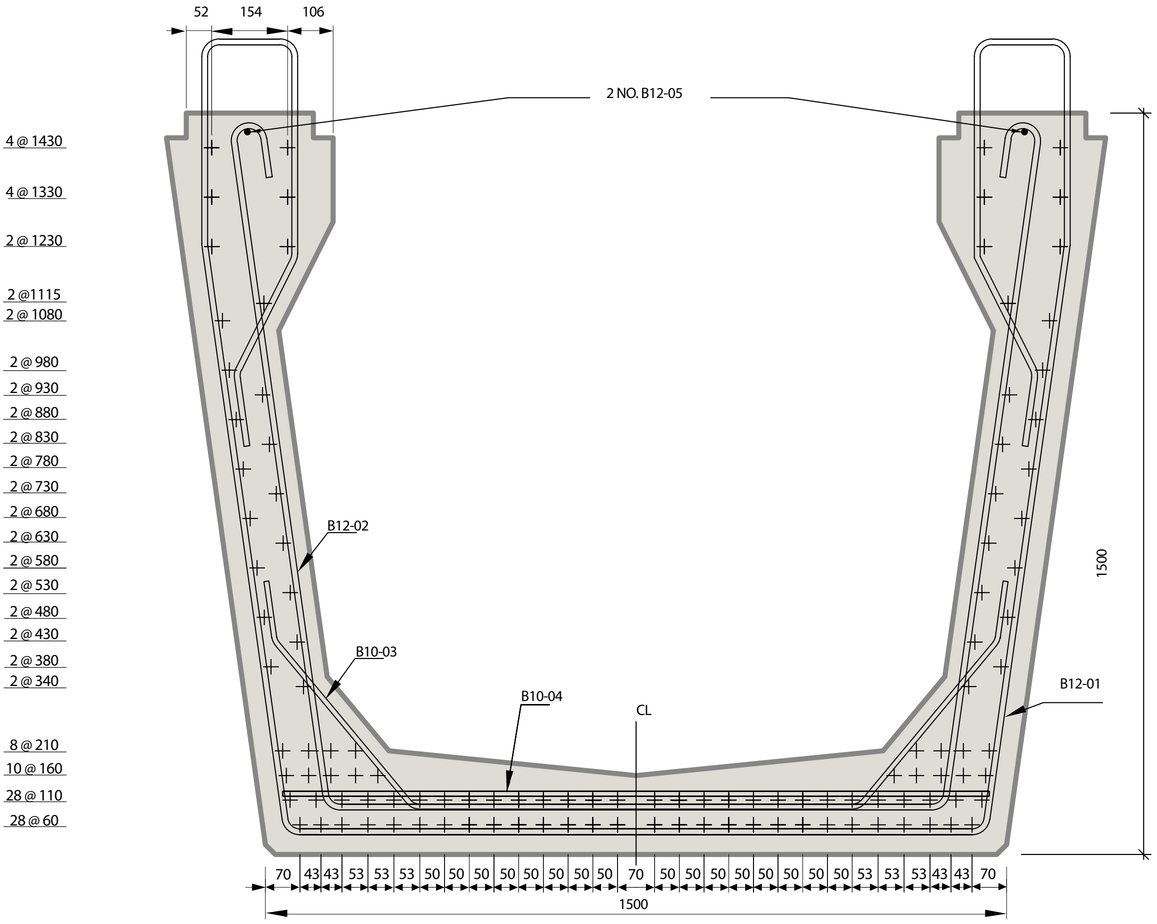


Section Through W10 Beam showing all possible Strand Locations

Appendix C - Full W Beam Range



Section Through W12 Beam showing all possible Strand Locations



Section Through W11 Beam showing all possible Strand Locations

1.0 Construction Details

1.1 Transverse Holes in Diaphragms

The number of transverse holes in the diaphragms will be at the discretion of the permanent works designer and the precast manufacturer. However, it is strongly recommended that a series of transverse holes are located at various depths at an appropriate distance from the front face of the diaphragm (maximum centres approx. 500mm). This will enable sufficient anchorage of the precast beam and will also allow the end diaphragms to act as a torsional beam.

1.2 Scabbling of the Beam Ends

Scabbling the beam-ends can be done on request but is not standard practice.

1.3 Embedment Depth

It is recommended that the embedment length of the precast beams should have a minimum range of 0.5d to 0.75d (where d is the effective depth of the beam). In our opinion the minimum embedment should be 500mm.

1.4 Projecting Strand

Un-tensioned projecting strands can be left protruding from the beam ends if required for an integral bridge. These will be at a height of 160mm over the soffit of the beam. Leaving projecting rebar is not standard practice.

1.5 Beam Centres

Beam centres are based on the maximum span of the FRC shutter. Advancements are being made continuously on FRC and alternative formwork therefore beam centres are to be used as a guide not a limit.

1.6 Debonding

Banagher Precast Concrete have established from many years of experience that where appropriate, debonding of tendons provides both a sound engineering and economic solution in beam design, and for this reason it is regarded as good practice.

1.7 Beam Weight

The calculated beam weight should be increased by 10-15% by the contractor on site when ordering his crane to allow for additional reinforcement and manufacturing tolerances etc. Lifting should be in accordance with the Banagher Precast Concrete Bridge Beam Manual.

1.8 Skews

Skewed ends are expensive and should be avoided where possible. In order to re-use end shutters and thereby keep additional cost of skew ended beams to a minimum skews should be in the order of 5 degrees and specified as per Figure 1. Where skews in excess of that shown in Figure 1 are specified, damage to beam ends may result.

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

1.9 Surface Finish

The top surface of the beam is cast and finished (see Figure 2)with a strong application of 8-10mm dry coarse aggregate to give a finish in accordance with EN1992-1-1:2004 Cl.6.2.5 – "ROUGH". The remaining surfaces of the beam are all cast with a steel shutter and will result in a very smooth finish but will have mould joint lines present in elevation only. This finish can only be obtained by the use of high quality concrete and formwork. The concrete should be thoroughly compacted and all surfaces should be true, with clean arises. Only very minor surface blemishes should occur, with no staining or discoloration from the release agent.

NOTE: Designers should appreciate that it is virtually impossible to achieve dense, flat, smooth, even-coloured, blemish-free concrete surfaces directly from the formwork. Some degree of making good is inevitable, even with precast work.

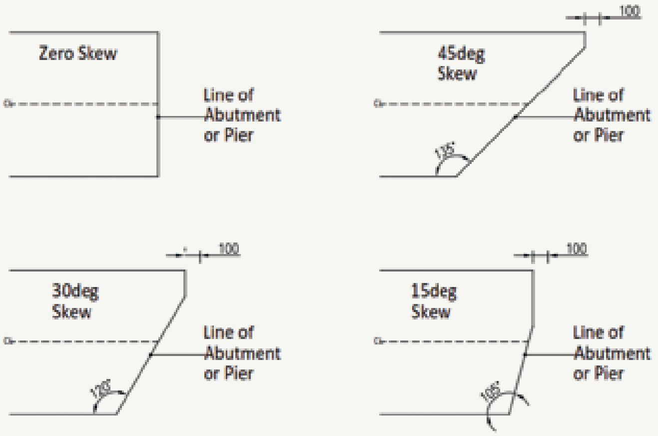


Figure 1 Skew Ends Available for the BPS beam

Figure 2 Top Surface Finish

1.10 Camber

Most prestressed concrete bridge beams will have an upward camber due to the prestress. This should be taken into account when detailing the bridge structure especially the reinforcement and insitu concrete in the deck allowing for the additional height at the ends when compared to the middle of the beam. If the screed can maintain the curve of the beam camber, then there will not be an issue. The tie in with the precast parapets also needs careful consideration to allow for the upward curve as you move towards the middle of the beam.

For all other technical or construction queries please contact the Banagher Precast Concrete technical team on

designteam@banagherprecast.com

Notes

Notes

For a copy of the

Bridge Beam Design Manual

please contact our technical department.

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