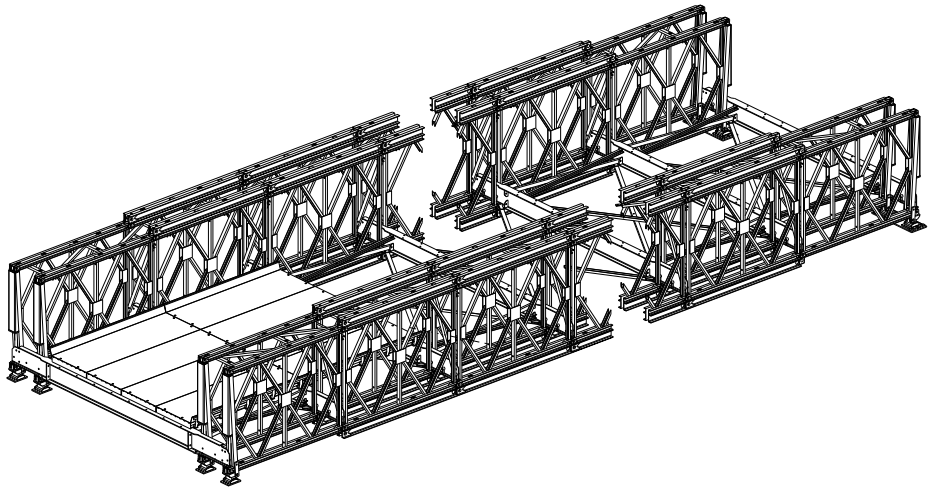
waagner biro
bridge systems

PANEL BRIDGE



Power Panel 30

DESIGN AND ERECTION MANUAL

Release: July 2024

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INTRODUCTION

The Waagner Biro Panel Bridge is the latest development of the original Bailey Bridge that has been used as semi-permanent, temporary and emergency bridges since the 1940s. The Waagner Biro Panel Bridge has been thoroughly researched to provide a versatile, easy-to-erect, modern unit construction bridge system with an optimum strength to weight ratio over a wide range of bridge spans.

The bridge is constructed using modular components, the fundamental component being the bridge panel. The panel, which forms the bay length of the bridge, has been designed using a modular length of 10 feet = 3.048 metres (Power Panel 30 or PP30). Using one transom per bay combined with a modular length of 3.5 metres a significant saving in weight and components per bridge may be achieved. As a major advantage the Waagner Biro Panel Bridge System uses one type of panel only. Therefore poor assembly and confusion of panels is not possible.

The major structural elements of the Waagner Biro Panel Bridge system are made of high strength steel with a minimum yield point of 460 N/mm^2. The system height is 2.15m. This system enables long spans up to 80m in double storey construction for the loading and width specified by the customer.

All major components are supplied with a durable hot dip galvanised finish. As standard the surface of the roadway decking is provided with a raised pattern. Optionally an anti skid finish may be utilized. The Waagner Biro Panel Bridge may be used as a single lane, double lane or special width structure to suit the customer's roadway requirements.

As very fast assembly and easy erection are mayor design criteria, the system shows very light individual components and allows for easy transport. It may be erected using unskilled labour and standard tools. Therefore all major information is stated in this design and erection manual. As the system allows for maximum versatility, it is suitable for stock holding for emergency situations. The standard method of bridge installation is the cantilever launch method. Alternatively the bridges may be lifted into position using suitable cranes.

In order to provide a wide variety of applications for the Waagner-Biro Panel Bridge System, an experienced team of technicians is always available for advice. Although Waagner-Biro Bridge Systems GmbH tries very hard to ensure that all the data in this manual is accurate and up to date, Waagner-Biro Bridge Systems GmbH cannot accept any liability of any kind whatsoever in this regard.

SECTION 1

GENERAL

TERMINOLOGY AND ABBREVIATIONS

PANEL .....Primary truss element

REINFORCING CHORD .....Twin channel member used to increase the bending capacity of the panels

SWAY BRACING .....Horizontal plane bracing between transoms

TRANSOM .....Main cross member supporting the deck

TRANSOM BRACING .....Vertical bracing between transoms

STRINGER.....Longitudinal beam for load distribution from the timber deck to the transom

LAUNCHING NOSE .....Lightweight assembly fitted to the front of the bridge to assist with a cantilever launch

TAIL.....Lightweight assembly fitted to the rear of the bridge to prevent the bridge from running off the rollers during a cantilever launch

LAUNCH PLAIN .....Level area on which to construct the bridge prior to launch

HOME BANK.....The side of the obstacle to be bridged that is nearest to the construction area

FAR BANK .....The side of the obstacle to be bridged that is furthest from the construction area

STD .....Standard deck width

EW .....Extra wide deck width

DW .....Double wide or two lane deck width

SS.., DS.., TS..etc. .....Truss construction designations (see Fig. 1.3 for variations)

EOB.....End of bridge

FW.....Footwalk

BASIC BRIDGE COMPONENTS

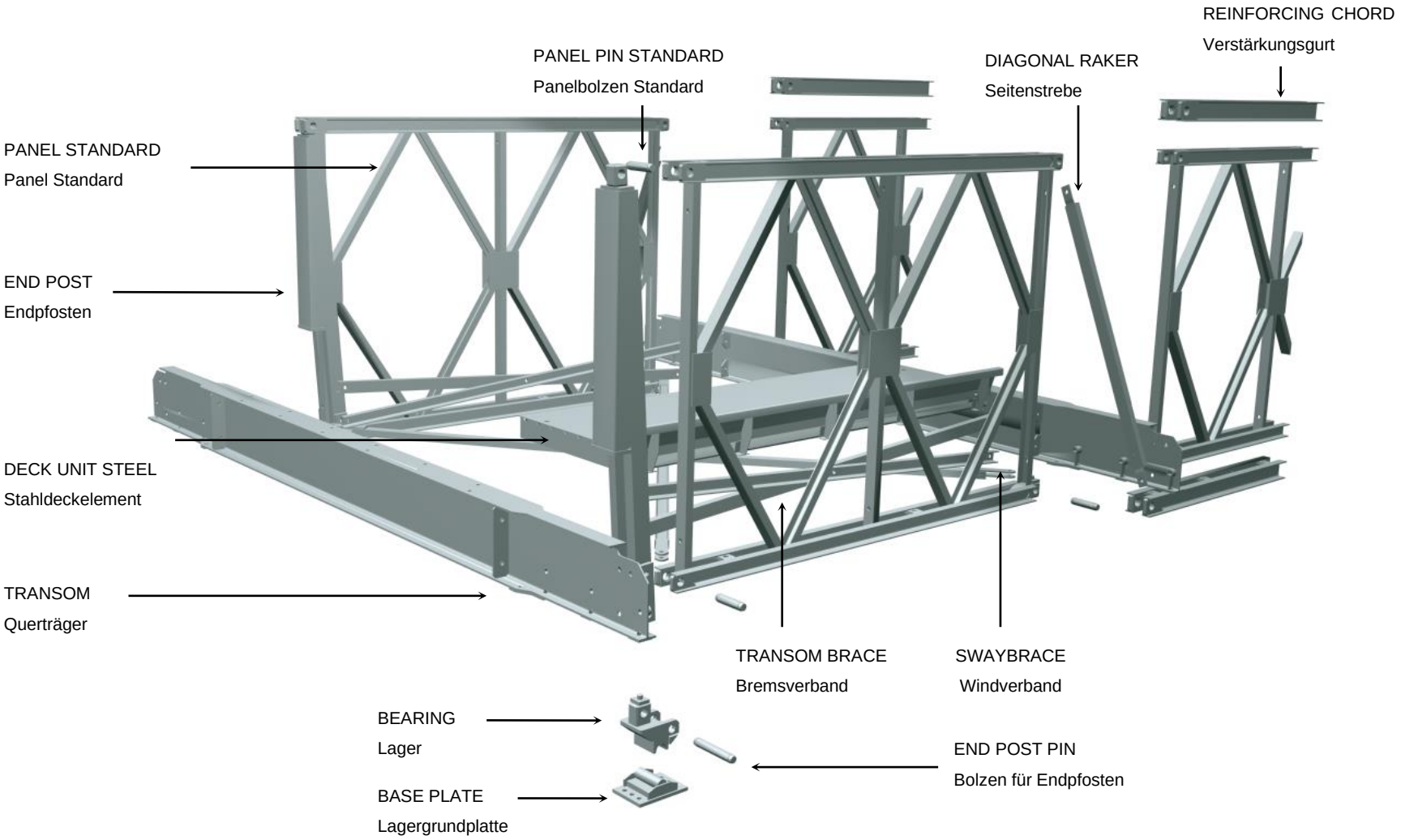


Figure 1.1 – BASIC BRIDGE COMPONENTS

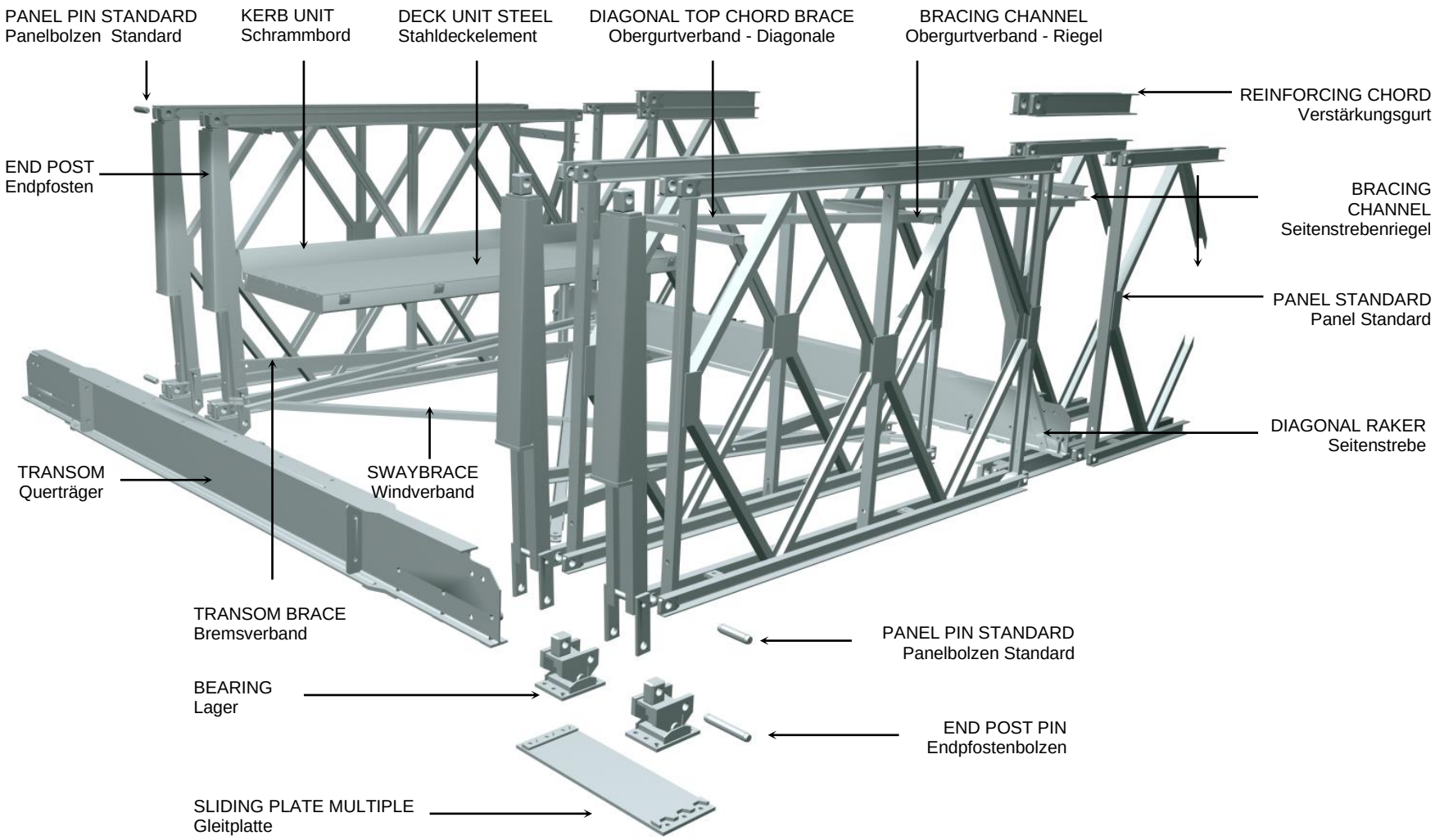
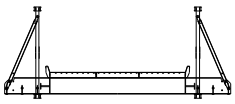


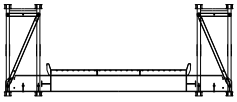
Figure 1.2 – BASIC BRIDGE COMPONENTS

BRIDGE TRUSS CONFIGURATIONS

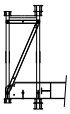


SS = SINGLE SINGLE

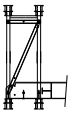
SSR(L) = Single Single Reinforced (Light)
SSR(M) = Single Single Reinforced (Medium)
SSR(H) = Single Single Reinforced (Heavy)



DS = DOUBLE SINGLE



DSR1(L)
DSR1(M)
DSR1(H)



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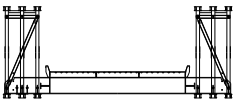
DSR2(M)
DSR2(H)



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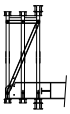

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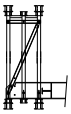
TSR1(H)



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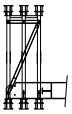
TSR2(M)
TSR2(H)



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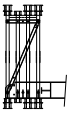
TSR3(H)

QS = QUADRUPLE SINGLE



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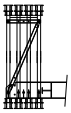
QSR3(H)



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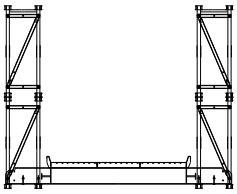
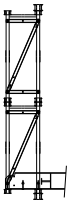
QSR4(H)



DD = DOUBLE DOUBLE



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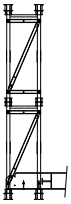
DDR1(H)



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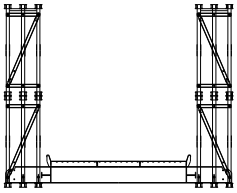
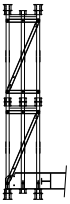
DDR2(M)
DDR2(H)



TD = TRIPLE DOUBLE



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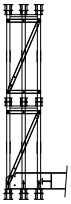
TDR2(H)



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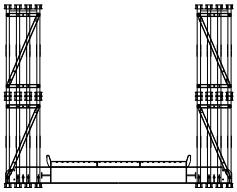
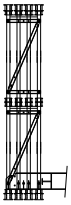
TDR3(M)
TDR3(H)



QD = QUADRUPLE DOUBLE

QDR3(L)
QDR3(M)
QDR3(H)



QDR4(L)
QDR4(M)
QDR4(H)

NOTE: QUADRUPLE TRUSSES (QS.. AND QD..) ARE NON STANDARD CONFIGURATIONS

Figure 1.3 – BRIDGE TRUSS CONFIGURATIONS

SECTION 2

BRIDGE DIMENSIONS

CROSS SECTION DIMENSIONS

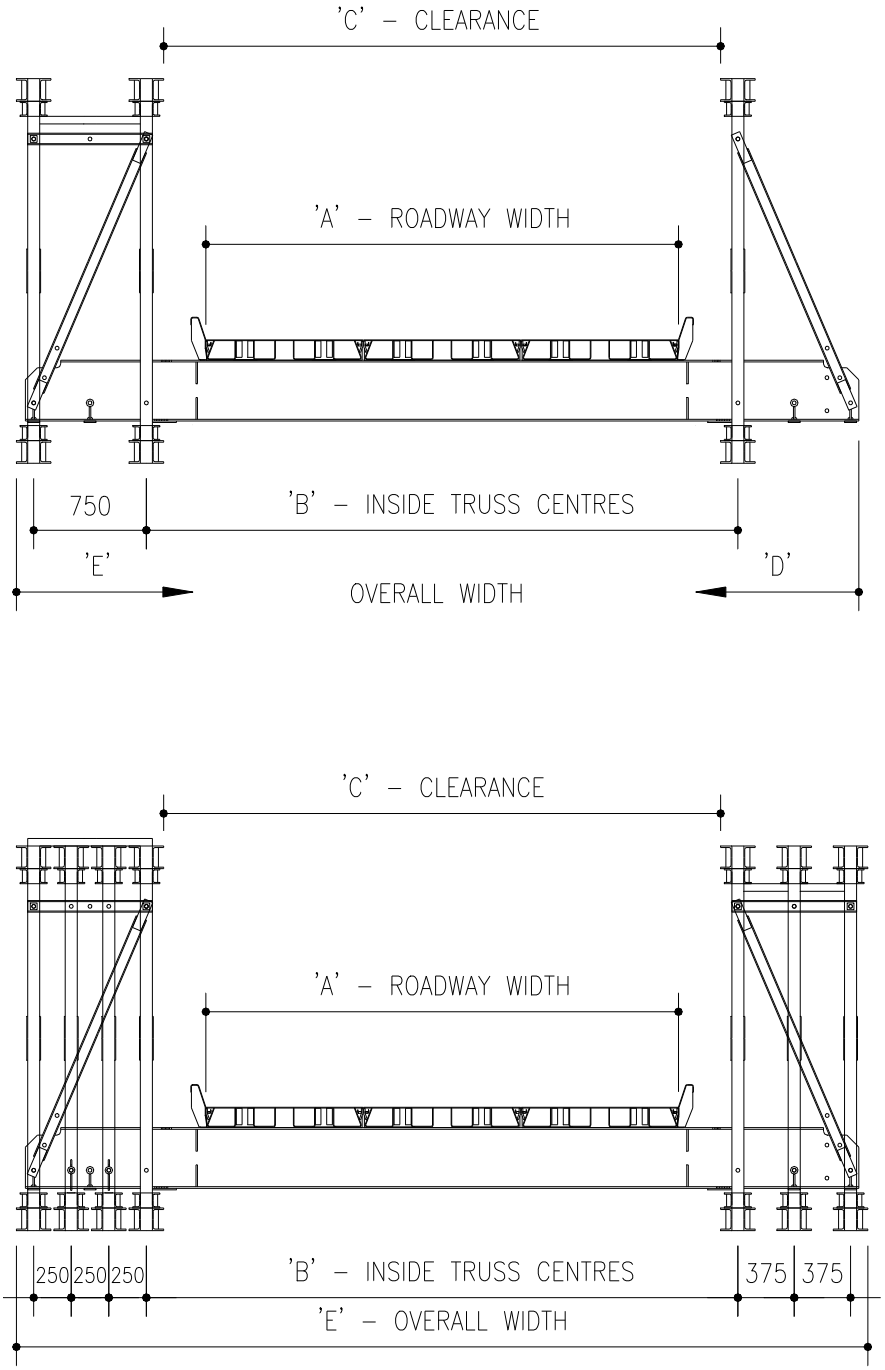


Figure 2.1 - TYPICAL CROSS SECTIONS OF SINGLE STOREY BRIDGES

CROSS SECTION **DIMENSIONS**

	A_1	A_2	B	C	D	E
	Steel Deck Standard	**Timber Deck**				
STANDARD	3150	3230	3937		5547	
UNREINFORCED				3744		5630
LIGHT CHORDS				3744		5630
MEDIUM CHORDS				3727		5647
HEAVY CHORDS				3717		5657
EXTRA WIDE	4200	4250	4953		6563	
UNREINFORCED				4760		6646
LIGHT CHORDS				4760		6646
MEDIUM CHORDS				4743		6663
HEAVY CHORDS				4733		6673
DOUBLE WIDE	7350	7115	7820		9430	
UNREINFORCED				7627		9513
LIGHT CHORDS				7627		9513
MEDIUM CHORDS				7610		9530
HEAVY CHORDS				7600		9540

Table 2.1 – Cross Sectional Dimensions (mm)

Dimensions ‘A’, ‘B’, ‘C’, ‘D’, ‘E’ are typical for all standard load cases

Dimension ‘A_1’ for Deck Unit Steel Standard

Dimension ‘A_2’ for Timber Deck

LONGITUDINAL DIMENSIONS

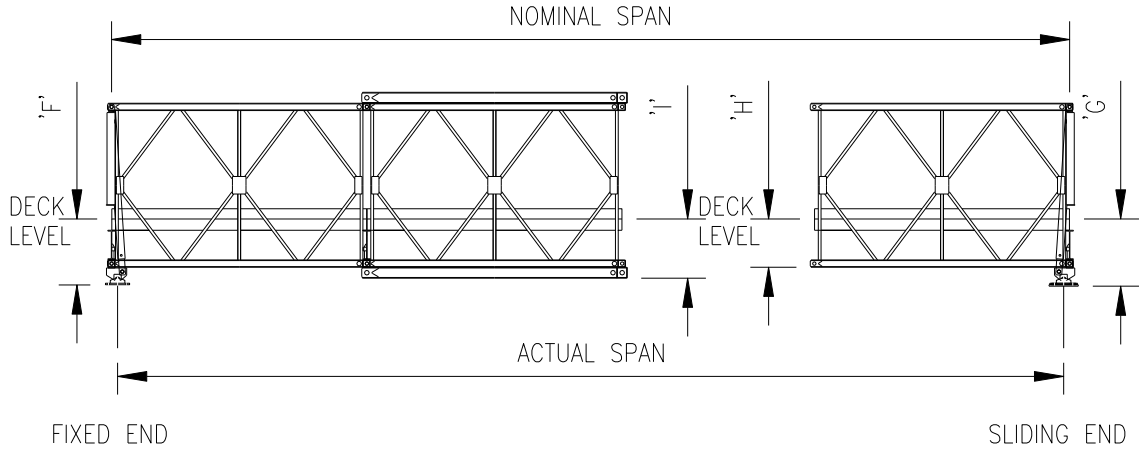


Figure 2.2 – TYPICAL LONGITUDINAL AND VERTICAL DIMENSIONS

NOMINAL SPAN PP30	= Number of bays	* 3.048 metres
ACTUAL SPAN	= Nominal span	- 0.164 metres
LENGTH OVER DECK	= Nominal span	+ 0.200 metres (STD, EW) + 0.240 metres (DW)

NOTES:

DIMENSION ‘F’: Dimension from deck level to bottom level of bearing

DIMENSION ‘G’: Dimension from deck level to bottom level of sliding bearing plate

DIMENSION ‘F’, ‘G’, ‘H’, ‘I’ all depend on the transom depth and deck thickness which themselves depend upon the loading applied to the deck. In the following figures standard deck WBDE150A is considered.

TYPICAL VERTICAL DIMENSIONS

	F	G	H	I
	Standard Deck	Standard Deck	Standard Deck	Standard Deck
STANDARD	895	915		
UNREINFORCED			658	
LIGHT CHORDS				758
MEDIUM CHORDS				798
HEAVY CHORDS				818
EXTRA WIDE	900	920		
UNREINFORCED			660	
LIGHT CHORDS				760
MEDIUM CHORDS				800
HEAVY CHORDS				820
DOUBLE WIDE	1105	1125		
UNREINFORCED			857	
LIGHT CHORDS				967
MEDIUM CHORDS				1007
HEAVY CHORDS				1027

Note: Using timber deck HS25-44 all dimensions above have to be increased by 187 mm.

Table 2.2 – Typical Vertical Dimensions (mm)

ABUTMENT AND BEARING PLATE DIMENSIONS

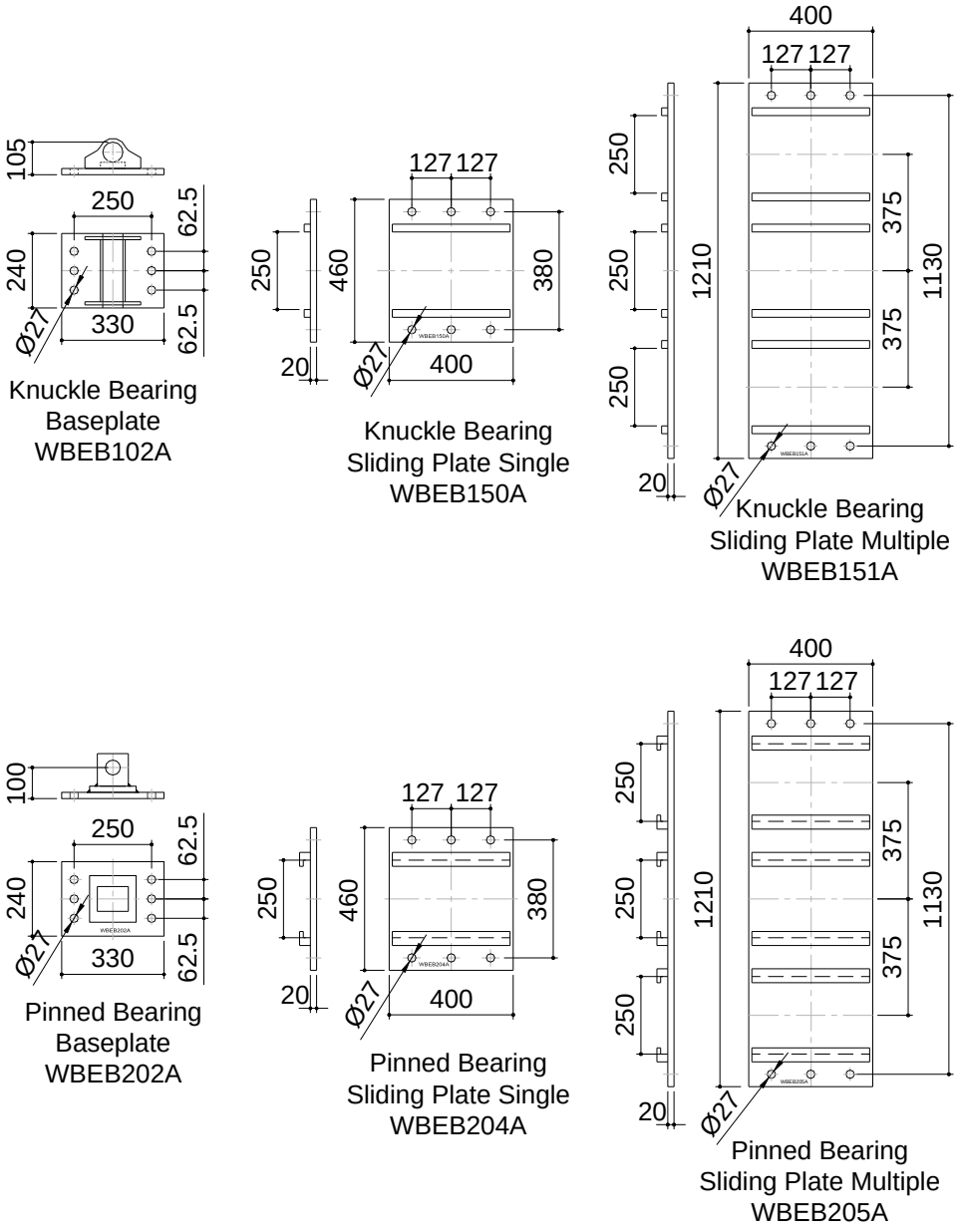


Figure 2.3 – BEARING PLATES DIMENSIONS

NOTES for Figures 2.4 and 2.5 – Abutment and bearing layout:

- '*' Denotes a minimum dimension – exact dimensions are to be determined by the customer to suit the expected ground conditions.
- 'F' and 'G' are dimensions from road level to bottom level of bearing or sliding plate. If required the customer may increase these dimensions by 25mm to allow for a layer of high strength grout to be used below the bearings.
- 'M' is required distance between the bearing axis and back wall. For Standard Width and Extra Wide bridges 200mm, for Double wide bridges 220mm

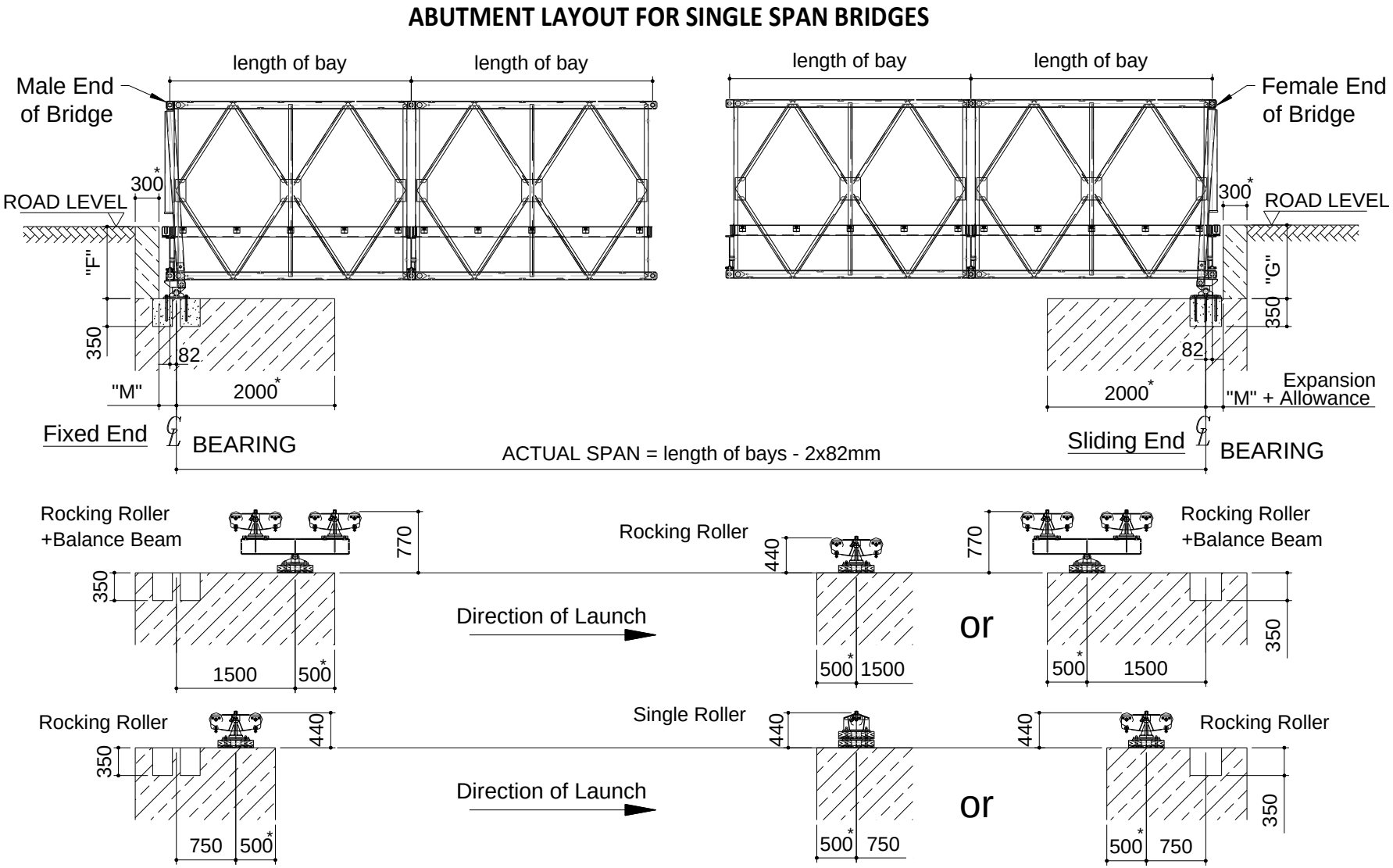


Figure 2.4 – ABUTMENT, BEARING PLATES AND ROLLER LAYOUT FOR SINGLE SPAN BRIDGES – SIDE VIEW

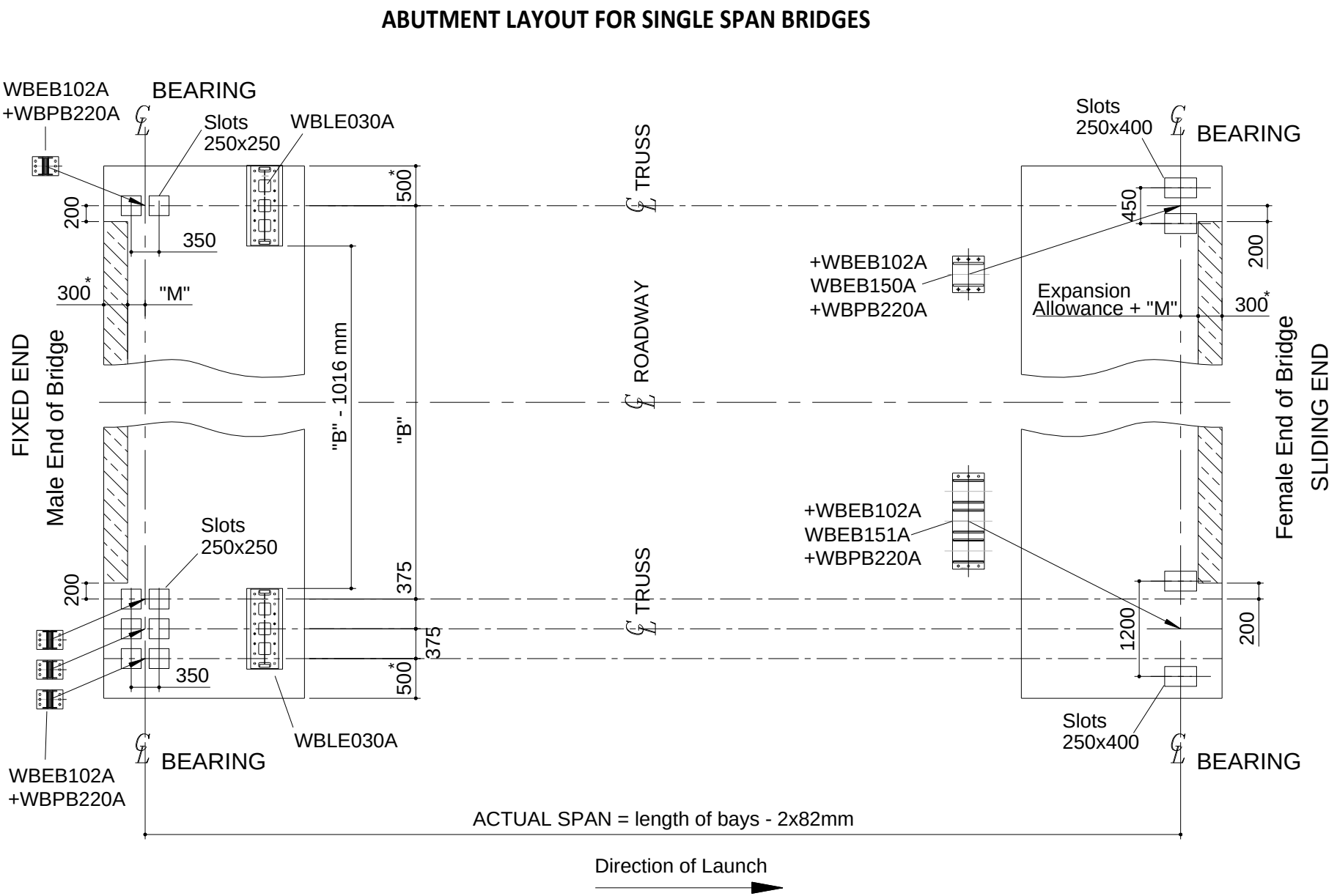


Figure 2.5 – ABUTMENT, BEARING PLATES And Roller Layout for Single span Bridges – Top View

SECTION 3
BRIDGE & LAUNCH DESIGN

BRIDGE DESIGN

GENERAL

The Waagner-Biro Panel Bridge uses, for its main longitudinal members, modular panels connected to form trusses. These trusses are designed as simple beam members with the properties given in the accompanying tables. The transverse members between the trusses (transoms) are specific members supplied to suit the required carriageway width and traffic loading. Standardised widths and loadings are shown in this manual but non-standard transoms can be manufactured to suit customers' requirements.

The decking elements are specified to suit the traffic loading on the bridge and may be supplied either in steel or in timber.

The load tables in this section are intended for specifying the truss constructions for simply supported bridges carrying the specified loading. Additional loads such as footwalks and services or the use of traffic loading not covered by the tables will require that the bridge trusses are designed manually using the dead weights and component properties given in the tables.

DESIGN CONSIDERATIONS

1. Side Trusses are designed as simple beams using normal analytical procedures.
2. The strength of the truss as a whole assumes that all the necessary bracing members are installed in order that the truss is fully stabilised.
3. Deflection of the truss comprises two elements that are additive:
    a) Elastic Deflection
    b) Pin Hole Deflection.
4. The span of the simply supported bridge between bearings is different from the nominal span (see Section 2 for details).

PIN HOLE DEFLECTION

This deflection is due to the difference between the outside diameter of the panel connecting pins and the diameter of the pin holes in the panels themselves. When the panels are pinned together to form a truss the result of these tolerances is to allow the truss to deflect in the form of a vertical curve. The allowance for this deflection may be calculated from the following formula:

For a Simply Supported Bridge:

$$\text{Pin Hole Deflection} = R - \left(R^2 - (\text{SPAN}/2)^2 \right)^{1/2} \text{ mm}$$

all dimensions in mm

R =	for 10ft Panel PP30	Single Storey	R = 4 100 000 mm
		Double Storey	R = 8 400 000 mm

LOAD SPECIFICATIONS
AS APPLICABLE TO SIMPLY SUPPORTED BRIDGE TRUSSES

1. H.A. LOADING (B.S. 5400, Part 2) – NORMAL TRAFFIC

H.A. Loading comprises a Knife Edge Load combined with a co-existent Uniformly Distributed Load, which varies in intensity with the span.

Design lane loading

1. KNIFE EDGE LOAD: for all spans K.E.L. = 120 kN
2. UNIFORMLY DISTRIBUTED LOAD:
   a) for span "L" up to 30 metres, U.D.L. = 30 kN
   b) for span "L" above 30 metres, U.D.L. = 151 $(1/L)^{0.475}$ kN/m

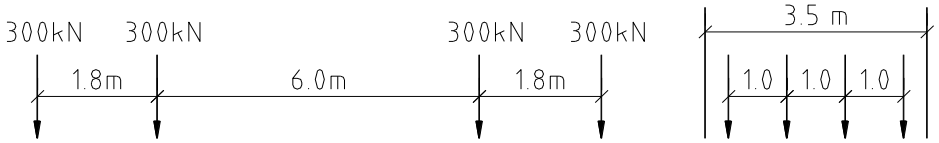
For Single Lane Bridges where carriageway width "W" exceeds 3 metres the Design Lane Loading (K.E.L. & U.D.L.) is to be increased by W/3.

For Multi-Lane Bridges multiply Design Lane Load x Number of Lanes.

Note: The H.A. single nominal wheel loading of 10.19 tons is to be uniformly distributed over a contact patch 500 mm wide by 200 mm long.

2. H.B. LOADING (B.S. 5400, Part 2) – ABNORMAL VEHICLE

H.B. Vehicle (30 units) – Axle loads (kilo Newton) and spacings (metres).



The H.B. Vehicle is to be positioned in one lane, and combined with the H.A. U.D.L. load, appropriate for the span, as shown below:

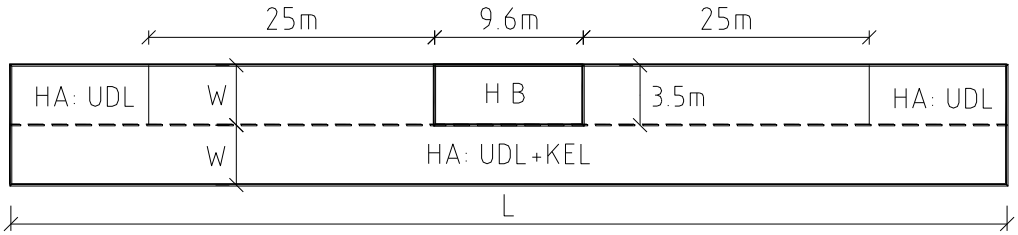


Figure 3.1 – H.B. Vehicle

Single Lane Bridges are to be loaded according to the above diagram.

Two Lane Bridges are to have one lane loaded as per the above diagram whilst the adjacent lane is fully loaded with H.A. (K.E.L. & U.D.L.)

Note: It is usual to allow an overstress of 15% when considering the effects of an infrequent Abnormal Vehicle upon the structure.

LOAD SPECIFICATION A.A.S.H.T.O. FOR SIMPLY SUPPORTED TRUSSES

The HS loadings consist of a tractor truck with semi trailer or the corresponding lane load as illustrated below. Both alternative loadings should be analysed for the span under consideration and the worst effects of either applied to the bridge structure.

Truck loading

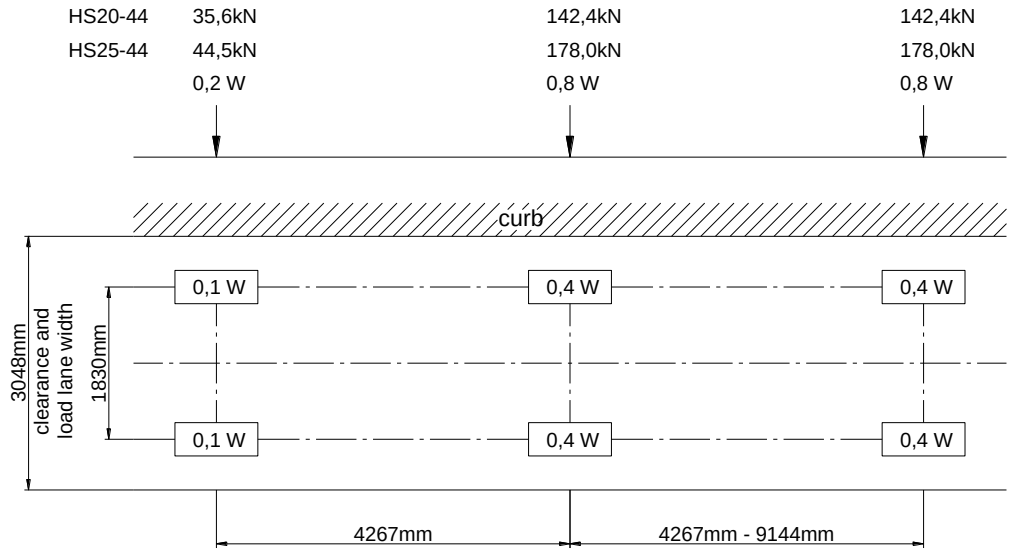


Figure 3.1 – A.A.S.H.T.O. HS TRUCK LOADING

W = Combined weight on the first two axles

Lane loading

The lane load shall consist of a uniform load of the traffic lane combined with a single concentrated load.

	HS20-44	HS25-44
- Uniform load	9.34 kN/m	11.68 kN/m
- Single concentrated load for shear	115.7 kN	144.6 kN
- Single concentrated load for moment	80.1 kN	100.1 kN

Truck loading and lane loading shall be assumed to occupy a load lane of 3.048m width. For single lane bridges, the load lane is placed eccentrically within the available roadway to produce the maximum effect upon the bridge structure. For two lane bridges the load lane is placed eccentrically within each half of the available roadway to produce the maximum effect upon the bridge structure.

Truck loading and lane loading shall be increased according the following formula, to allow for dynamic, vibratory and impact effects.

$$I = 1 + \frac{15.24}{L + 38.1}$$

I = impact factor, maximum 1.3
L = span of the bridge

LOAD TABLES FOR TRUSS CONSTRUCTIONS

SERIES: **PP30**

LOAD SPECIFICATION: **A.A.S.H.T.O.**

DECK TYPE: **STEEL STANDARD**

NOMINAL SPAN			LOAD TYPE – HS20-44 DECK WIDTH			LOAD TYPE – HS25-44 DECK WIDTH		
FEET	METRES	BAYS	STD	EW	DW	STD	EW	DW
30	9.144	3	SS	SS	SS	SS	SS	DS
40	12.192	4	SS	SS	SS	SS	SS	DS
50	15.240	5	SS	SS	SSRL	SS	SS	DS
60	18.288	6	SS	SS	DS	SS	SS	DS
70	21.336	7	SS	SS	DS	SSRL	SSRL	DSR1L
80	24.384	8	SSRL	SSRL	DS	SSRL	SSRL	DSR2L
90	27.432	9	SSRL	SSRL	DSR1L	SSRL	SSRL	DSR2L
100	30.480	10	SSRL	SSRL	DSR1L	SSRL	SSRM	DSR2L
110	33.528	11	SSRL	SSRL	DSR2L	SSRL	SSRM	DSR2L
120	36.576	12	SSRL	SSRM	DSR2L	SSRM	SSRH	DSR2M
130	39.624	13	SSRM	SSRH	DSR2L	SSRH	DSR1L	DSR2M
140	42.672	14	SSRM	DSR1L	DSR2M	DSR1L	DSR1M	DSR2H
150	45.720	15	SSRH	DSR1L	DSR2H	DSR1L	DSR1H	TSR2H
160	48.768	16	DSR1L	DSR1H	TSR2H	DSR1H	DSR2L	TSR3M
170	51.816	17	DSR1M	DSR2L	TSR3M	DSR2L	DSR2M	DDR2L
180	54.864	18	DSR2L	DSR2M	DDR2L	DSR2M	DSR2H	DDR2M
190	57.912	19	DSR2L	DSR2M	DDR2M	DSR2M	DSR2H	DDR2H
200	60.960	20	DSR2M	DSR2H	DDR2M	DSR2H	TSR3M	DDR2H
210	64.008	21	DSR2H	TSR2H	DDR2H	TSR2H	DDR2L	TDR3H
220	67.056	22	DDR2L	DDR2L	TDR3M	DDR2L	DDR2M	TDR3H
230	70.104	23	DDR2L	DDR2L	TDR3H	DDR2L	DDR2M	TDR3H

Table 3.1a – PP30 Truss Construction AASHTO Loading

Note:

Bending and shear capacities are based on a minimum safety factor of 1.7 to failure.
Above truss configuration allow for a minimum number of load cycles of 100,000 AASHTO fatigue load cycles.

LOAD TABLES FOR TRUSS CONSTRUCTIONS

SERIES: **PP30**

LOAD SPECIFICATION: **BRITISH STANDARD BS5400**

DECK TYPE: **STEEL STANDARD**

NOMINAL SPAN			LOAD TYPE – HA DECK WIDTH			LOAD TYPE – HA + 30 units HB DECK WIDTH		
FEET	METERS	BAYS	STD	EW	DW	STD	EW	DW
30	0.000	3	SS	SS	SS	SS	SS	DS
40	12.192	4	SS	SS	SSRL	SS	SS	DS
50	15.240	5	SS	SSRL	SSRL	SS	SS	DS
60	18.288	6	SS	SSRL	DS	SSRL	DS	DSR2L
70	21.336	7	SS	SSRL	DSR1L	DS	DS	DSR2L
80	24.384	8	SSRL	SSRM	DSR1L	DS	DSR1L	DSR2L
90	27.432	9	SSRL	DSR1L	DSR2L	DSR1L	DSR1L	TSR2L
100	30.480	10	SSRL	DSR1L	DSR2L	DSR1L	DSR2L	TSR2L
110	33.528	11	SSRM	DSR1M	DSR2M	DSR1L	DSR2L	TSR3L
120	36.576	12	DSR1L	DSR2L	DSR2H	DSR2L	DSR2L	TSR3M
130	39.624	13	DSR1L	DSR2L	TSR3L	DSR2L	DSR2M	TSR3M
140	42.672	14	DSR1L	DSR2H	TSR3M	DSR2L	DSR2M	TSR3H
150	45.720	15	DSR2L	DSR2H	TSR3H	DSR2M	DSR2H	TDR3L
160	48.768	16	DSR2L	TSR2H	DDR2M	DSR2H	TSR3M	TDR3L
170	51.816	17	DSR2M	TSR2H	DDR2M	DSR2H	TSR3M	TDR3L
180	54.864	18	DSR2M	TSR3H	DDR2H	TSR3M	TSR3H	TDR3M
190	57.912	19	DSR2H	DDR2L	TDR3M	TSR3M	DDR2M	TDR3M
200	60.960	20	TSR3L	DDR2M	TDR3M	TSR3H	DDR2M	TDR3H
210	64.008	21	TSR3M	DDR2M	TDR3H	TSR3H	DDR2M	TDR3H
220	67.056	22	DDR2L	DDR2H	TDR3H	DDR2M	DDR2H	
230	70.104	23	DDR2L	TDR3M		DDR2M	DDR2H	
240	73.152	24	DDR2M	TDR3M		DDR2H	TDR3M	
250	76.200	25	DDR2M	TDR3H		TDR3M	TDR3H	

Table 3.1b – PP30 Truss Construction BS5400 Loading

LOAD SPECIFICATION M.L.C. 60 (NATO – STANAG 1990)

The M.L.C. 60 loading consists of tracked vehicle, wheeled vehicle, single axle load and single wheel load as illustrated below. All alternative loadings shall be analysed for the span under consideration and the worst effects shall be applied to the bridge structure.

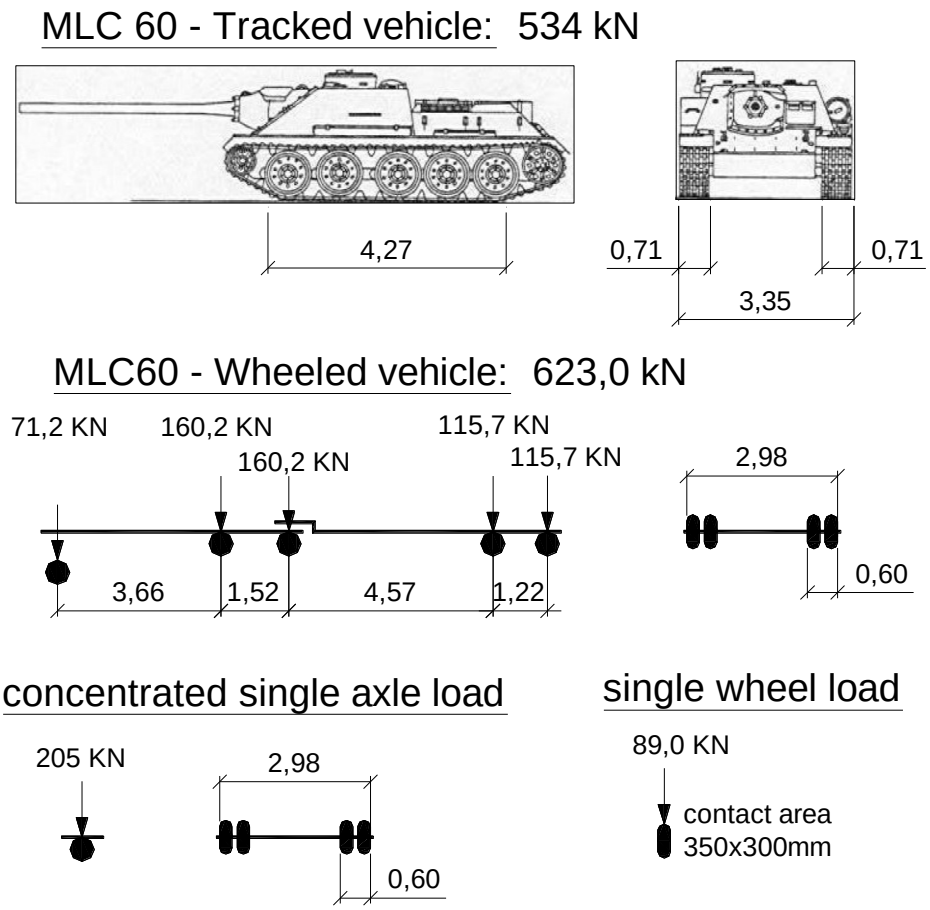


Figure 3.2 – M.L.C. 60 LOAD SPECIFICATIONS

The bridges shall be designed for tracked or wheeled vehicles in **convoys** with **30.5m** (100ft) **spacing** between ground contact points of vehicles.

For single lane bridges, the tracked and wheeled vehicle loading is placed eccentrically within the available roadway to produce the maximum effect upon the bridge structure. For two lane bridges the load is placed eccentrically within each half of the available roadway to produce the maximum effect upon the bridge structure.

Tracked and truck vehicle loading shall be increased to allow for dynamic, vibratory and impact effects.

LOAD SPECIFICATION M.L.C. 70 (NATO – STANAG 2021)

The M.L.C. 70 loading consists of tracked vehicle, wheeled vehicle, single axle load and single wheel load as illustrated below. All alternative loadings shall be analysed for the span under consideration and the worst effects shall be applied to the bridge structure.

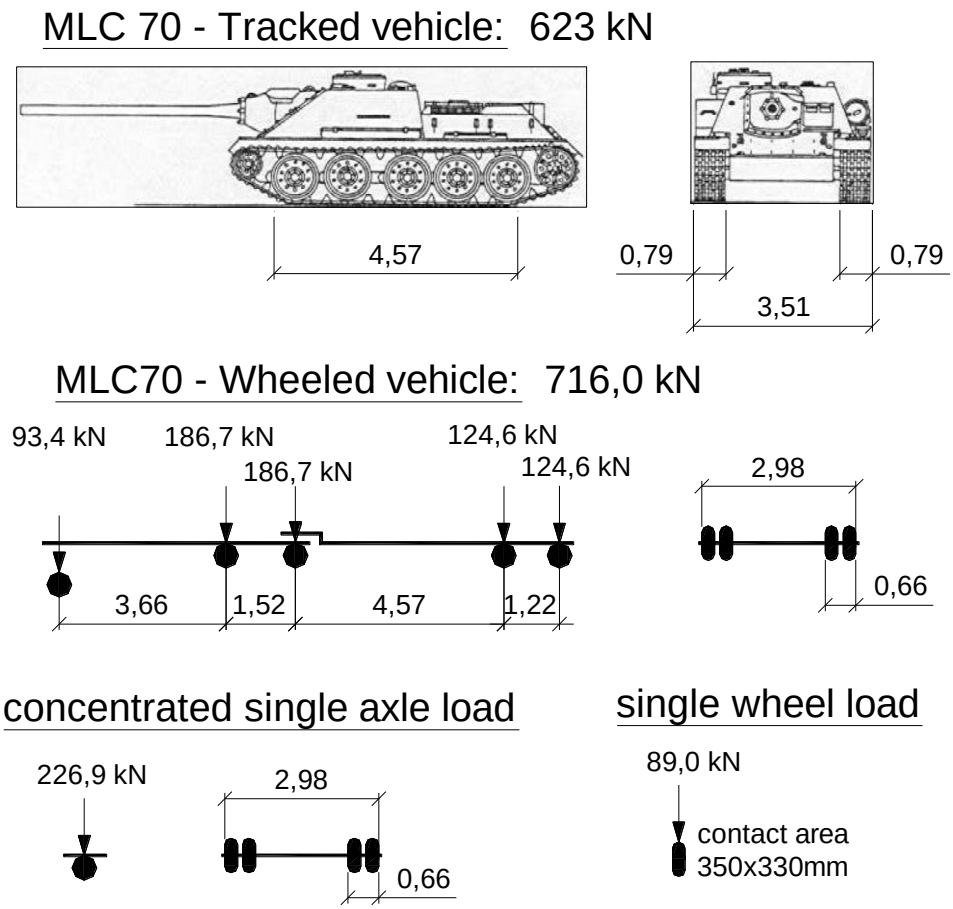


Figure 3.3 – M.L.C. 70 LOAD SPECIFICATIONS

The bridges shall be designed for tracked or wheeled vehicles in **convoys** with **30.5m** (100ft) **spacing** between ground contact points of vehicles.

For single lane bridges, the tracked and wheeled vehicle loading is placed eccentrically within the available roadway to produce the maximum effect upon the bridge structure. For two lane bridges the load is placed eccentrically within each half of the available roadway to produce the maximum effect upon the bridge structure.

Tracked and truck vehicle loading shall be increased to allow for dynamic, vibratory and impact effects.

LOAD TABLES FOR TRUSS CONSTRUCTIONS

SERIES: **PP30 - EXTRA WIDE**

LOAD SPECIFICATION: **MLC40, MLC 60 and MLC 70**

NOMINAL SPAN			M L C 40	M L C 60	M L C 70
FEET	METRES	BAYS	Factor of safety: 1.7 Mud 0,75kN/m	Factor of safety: 1.5 Mud 0,75kN/m²	Factor of safety: 1.5 Mud 0,75kN/m²
30	9.144	3	SS	SS	DS
40	12.192	4	SS	SS	DS
50	15.240	5	SS	SSRL	DS
60	18.288	6	SSRL	SSRL	DS
70	21.336	7	SSRL	SSRL	DS
80	24.384	8	SSRL	SSRL	DSR1L
90	27.432	9	SSRL	SSRM	DSR1L
100	30.480	10	SSRM	DSR1L	DSR1L
110	33.528	11	SSRH	DSR1L	DSR1M
120	36.576	12	DSR1L	DSR1M	DSR1H
130	39.624	13	DSR1M	DSR1H	DSR2L
140	42.672	14	DSR1H	DSR2L	DSR2M
150	45.720	15	DSR2L	DSR2M	DSR2M
160	48.768	16	DSR2M	DSR2M	DSR2H
170	51.816	17	DSR2M	DSR2H	DSR2H
180	54.864	18	DSR2H	TSR2M	TSR3M
190	57.912	19	TSR2H	TSR2H	TSR3M
200	60.960	20	TSR3M	TSR3M	TSR3H
210	64.008	21	TSR3H	TSR3H	DDR2M
220	67.056	22	DDR2M	DDR2M	DDR2M
230	70.104	23	DDR2M	DDR2M	DDR2H
240	73.152	24	DDR2H	DDR2H	TDR3M
250	76.200	25	TDR3M	TDR3M	TDR3M

Table 3.2 – PP30 Truss Constructions MLC40, MLC 60 and MLC 70 Loading

Note:

Bending and shear capacities are based on a minimum safety factor to failure as stated in above table. Above truss configurations allow for a minimum number of load cycles of 100,000 of the relevant loading. Impact and eccentricity effects are considered according to the Trilateral Design and Test Code for Military Bridges.

DEAD WEIGHTS OF TRUSSES

SERIES: **PP30**

TRUSS	WEIGHT / BAY [kN/bay]	WEIGHT / METRE [kN/m]
SS	7.08	2.32
SSRL	11.15	3.66
SSRM	12.59	4.13
SSRH	13.47	4.42
DS	14.79	4.85
DSR1L	18.86	6.19
DSR1M	20.30	6.66
DSR1H	21.18	6.95
DSR2L	22.93	7.52
DSR2M	25.81	8.47
DSR2H	27.57	9.05
TS	21.53	7.06
TSR2L	29.67	9.73
TSR2M	32.55	10.68
TSR2H	34.32	11.26
TSR3L	33.74	11.07
TSR3M	38.06	12.49
TSR3H	40.71	13.36
QS	28.27	9.28
QSR4L	44.55	14.62
QSR4M	50.31	16.51
QSR4H	53.85	17.67

TRUSS	WEIGHT / BAY [kN/bay]	WEIGHT / METRE [kN/m]
DD	28.89	9.48
DDR1L	32.96	10.81
DDR1M	34.40	11.28
DDR1H	35.28	11.57
DDR2L	37.03	12.15
DDR2M	39.91	13.09
DDR2H	41.67	13.67
TD	42.37	13.90
TDR2L	50.51	16.57
TDR2M	53.39	17.52
TDR2H	55.16	18.10
TDR3L	54.58	17.91
TDR3M	58.90	19.33
TDR3H	61.55	20.19

Table 3.3 – PP30 Dead Weights of Trusses

SERIES: **PP30**

DECK TYPE: **STEEL STANDARD**

ROADWAY WIDTH	LOADING	TRANSOMS & DECKS & BRACINGS		TRANSOMS & SWAY BRACE & TRAMSOM BRACE		TRANSOMS & SWAY BRACE (Launching Nose)	
		[kN/BAY]	[kN/m]	[kN/BAY]	[kN/m]	[kN/BAY]	[kN/m]
STANDARD	HS20	13.87	4.55	4.01	1.32	3.76	1.23
	HS25	13.87	4.55	4.01	1.32	3.76	1.23
EXTRA WIDE	HS20	17.65	5.79	4.73	1.55	4.48	1.47
	HS25	17.98	5.90	5.06	1.66	4.82	1.58
DOUBLE WIDE	HS20	33.52	11.00	11.41	3.74	11.17	3.66
	HS25	35.58	11.67	13.47	4.42	13.23	4.34
STANDARD	LAUNCHING TRANSOM					3.66	1.20
EXTRA WIDE	LAUNCHING TRANSOM					4.31	1.42
DOUBLE WIDE	LAUNCHING TRANSOM					6.62	2.17

Table 3.4 – PP30 Dead Weights of Transoms and Decking Steel Standard

SERIES: **PP30**

DECK TYPE: **TIMBER DECK AASHTO**

ROADWAY WIDTH	LOADING	TRANSOMS & STRINGERS & TIMBER & BRACINGS		TRANSOMS & SWAY BRACE & TRAMSOM BRACE		TRANSOMS & SWAY BRACE & (Launching Nose)	
		[kN/BAY]	[kN/m]	[kN/BAY]	[kN/m]	[kN/BAY]	[kN/m]
STANDARD	HS20	18.85	6.18	4.01	1.32	3.76	1.23
	HS25	18.85	6.18	4.01	1.32	3.76	1.23
EXTRA WIDE	HS20	24.31	7.98	4.73	1.55	4.48	1.47
	HS25	24.64	8.09	5.06	1.66	4.82	1.58
DOUBLE WIDE	HS20	41.44	13.60	11.41	3.74	11.17	3.66
	HS25	43.50	14.27	13.47	4.42	13.23	4.34
STANDARD	LAUNCHING TRANSOM					3.66	1.20
EXTRA WIDE	LAUNCHING TRANSOM					4.31	1.42
DOUBLE WIDE	LAUNCHING TRANSOM					6.62	2.17

Table 3.7 – PP30 Dead Weights of Transoms and Timber Decking HS25-44

Note: Above table covers a maximum timber density of 620 kg/m^3.

TRUSS	MOMENT OF INERTIA	BENDING CAPACITY		SHEAR CAPACITY		TOTAL END OF TRANSOM REACTION	
	[mm⁴]	[kNm]	[tonsfeet]	[kN]	[tons]	[kN]	[tons]
SS	13035 * 10⁶	2504	824	700	70	200	20
SSRL	28609 * 10⁶	4862	1600	700	70	200	20
SSRM	34056 * 10⁶	5732	1887	700	70	200	20
SSRH	38243 * 10⁶	6376	2099	700	70	200	20
DS	26071 * 10⁶	5321	1752	1400	140	400	40
DSR1L	41644 * 10⁶	8001	2634	1019	102	291	29
DSR1M	47091 * 10⁶	8860	2917	968	97	277	28
DSR1H	51278 * 10⁶	9517	3133	939	94	268	27
DSR2L	57218 * 10⁶	11040	3634	1400	140	400	40
DSR2M	68112 * 10⁶	13216	4350	1400	140	400	40
DSR2H	76485 * 10⁶	14857	4890	1400	140	400	40
TS	39106 * 10⁶	7768	2557	2100	211	600	60
TSR2L	70253 * 10⁶	13454	4429	1719	172	491	49
TSR2M	81147 * 10⁶	15660	5155	1668	167	477	48
TSR2H	89521 * 10⁶	17309	5698	1639	164	468	47
TSR3L	85827 * 10⁶	15976	5259	2100	211	600	60
TSR3M	102168 * 10⁶	19035	6266	2100	211	600	60
TSR3H	114728 * 10⁶	21349	7028	2100	211	600	60
DD	109190 * 10⁶	10598	3489	1940	195	400	40
DDR1L	168862 * 10⁶	15389	5066	1433	144	296	30
DDR1M	188419 * 10⁶	16768	5520	1366	137	282	28
DDR1H	203436 * 10⁶	18031	5935	1326	133	273	27
DDR2L	228533 * 10⁶	21210	6982	1940	195	400	40
DDR2M	267648 * 10⁶	25061	8249	1940	195	400	40
DDR2H	297682 * 10⁶	27894	9182	1940	195	400	40
TD	163786 * 10⁶	15152	4988	2910	292	600	60
TDR2L	283128 * 10⁶	25502	8395	2403	241	496	50
TDR2M	322243 * 10⁶	29326	9653	2336	234	482	48
TDR2H	352277 * 10⁶	32192	10597	2296	230	473	47
TDR3L	342799 * 10⁶	29575	9735	2910	292	600	60
TDR3M	401472 * 10⁶	34675	11414	2910	292	600	60
TDR3H	446523 * 10⁶	38498	12672	2910	292	600	60

Table 3.8 – Moments of Inertia, Bending-, Shear- and Transom Capacities

Bending and shear capacities are based on a minimum safety factor of 1.7 to failure. Bending and shear capacities are based on full bridge properties (all panel lines in both trusses).

LAUNCH DESIGN

GENERAL

The usual method of installation of the bridge is the ‘cantilever launch’. During the construction and launch of the bridge the supervising engineer must always know the location of the centre of gravity of the structure. This information is used to determine the location of packs on which the bridge is constructed and how far the structure may be safely moved during a launch operation.

During a launch operation it is imperative that the centre of gravity of the structure is kept at least 3 metres behind the centre of the home bank (launching) rollers until the tip of the nose is over the centre of the far bank (landing) rollers.

The following calculations must be carried out prior to constructing the bridge to ensure that sufficient equipment is on site and used to complete the structure safely and to facilitate a successful launch.

1. Launching Nose Design
2. Launching Link Location
3. Centre of Gravity Calculations
4. Counterweight Requirements
5. Roller Design
6. Jacking Loads

LAUNCHING NOSE DESIGN

The launching nose must be capable of supporting itself and the main bridge during all stages of the launch. The length and design of the nose depends on several factors, the main ones are listed below:

1. Distance centre to centre of the main launching and landing rollers
2. Whether the bridge must be launched fully or partially decked
3. The construction and length of the main bridge

It is usual to start the nose design procedure using a nose length equivalent to half the bridge length plus one bay.

For example the initial nose length to be checked for an 8 bay bridge would be (8/2)+1=5 bays long. For a 9 bay bridge it would be (9/2)+1=6 bays long – rounded up to the nearest full bay.

It is very important that the structure is checked for induced bending and shear at ALL stages of the launch using the weights of the components and the section properties of the trusses.

LAUNCHING LINK DETAILS AND LOCATION

Launching links are used to compensate for the vertical deflection of the nose. The launching links lift the tip of the nose sufficiently to allow it to land smoothly on the far bank (landing) rollers within the first bay of the nose.

The vertical deflection of the tip of the nose is made up of two distinct components:

- The elastic deformation of the nose due to its own dead weight which must be calculated using the section properties and weights given in this manual.
- The deflection due to the tolerances between the connecting pins and the pin holes in the panels.

The shear capacity at a launching link location is half the shear capacity of the related truss.

Typical allowances for tip deflections with launching links at various positions are given in Figure 3.5.

CENTRE OF GRAVITY CALCULATIONS

As stated previously it is vital that the supervising engineer knows, at all stages of the construction, where the centre of gravity of the structure is located. As the normal building procedure is to work from the tip of the nose back towards the bridge, it is logical to calculate the location of the centre of gravity from the tip of the nose. This calculation should be performed for each bay of nose/bridge constructed, taking note of all changes in construction, in addition to decking and counterweight.

COUNTERWEIGHT REQUIREMENTS

The need for counterweight will depend on several factors.

- Length of the nose
- Whether the bridge is launched fully decked, partially decked or undecked
- The distance between the main launching and landing rollers
- The actual construction site may dictate all these factors or the engineer may be able to specify them to suit the launch.

For the launch of a single span bridge the most efficient arrangement of the decking is to have the rear of the bridge decked up to the point of balance of the combined bridge and nose structure.

It is usual to use any spare decking for the counterweight and to position it evenly over the deck area of the end bay of the bridge where it will have most effect.

The supervising engineer should aim to use the minimum counterweight possible as unnecessary counterweight will add to the overall launch weight of the structure and have an influence on the number of rollers being used.

ROLLER DESIGN

CONSTRUCTION ROLLER

Construction Rollers are used on the launch plain area, they are single rollers mounted within a portable steel housing that can be placed directly onto temporary concrete pads or timber grillages. They are normally placed 9.25 metres apart along the launch plain.

Each roller is positioned in line with the truss that it supports and at the same level as the top of the main launch roller on the home abutment.

The rollers must be placed on firm foundations so that there is no tendency for them to move.

ROCKING ROLLER

Rocking Rollers are placed on the home bank abutment and the far bank abutment. These rollers pivot on their special bearings to allow for the deflection of the bridge and nose during the launch.

The main launching or home bank rollers will carry the full weight of the combined bridge and nose as the centre of gravity passes over these rollers.

Normally one rocking roller is used for each line of panels within the truss, but if the weight of the structure exceeds the combined capacity of the single line of rocking rollers, then it is possible to use balance beam assemblies to double the number of rocking rollers.

JACKING LOADS

Jacking down the bridge onto its bearings must be carried out with great care under strict supervision. It is important that the jacking load has been calculated before the work starts. This will ensure that the capacity of the jack is not exceeded or the bridge is not damaged.

CANTILEVER LAUNCH – DESIGN EXAMPLE

Bridge specification:

series:	PP30
nominal bridge length:	24.384 metres (8 Bays)
construction:	SSRL
footwalk:	not applicable
width:	Standard, steel decking
bearing centres:	24.220 metres
rocking roller centres:	22.720 metres
nose specification:	
length:	(8/2)+1= 5 Bays
construction:	Single Single

Bay weights (refer to Tables 3.5 and 3.6):

trusses – SS:	7.08 kN/bay
trusses – SSRL:	11.15 kN/bay
decking:	13.87 kN/bay (transoms and decking)
	4.01 kN/bay (transoms & braces only)

Referring to Figure 3.4:

bays 1 to 6 are SS (undecked), weight:	11.09 kN/bay
bays 7 to 9 are SSRL (undecked), weight:	15.16 kN/bay
bays 10 to 12 are SSRL (decked), weight:	25.02 kN/bay
bay 13 is SS (decked), weight:	20.95 kN/bay

For this example calculate the centre of gravity of the complete structure although the centre of gravity calculations for the part built structure (bay by bay) should be carried out to ensure the construction is carried out safely.

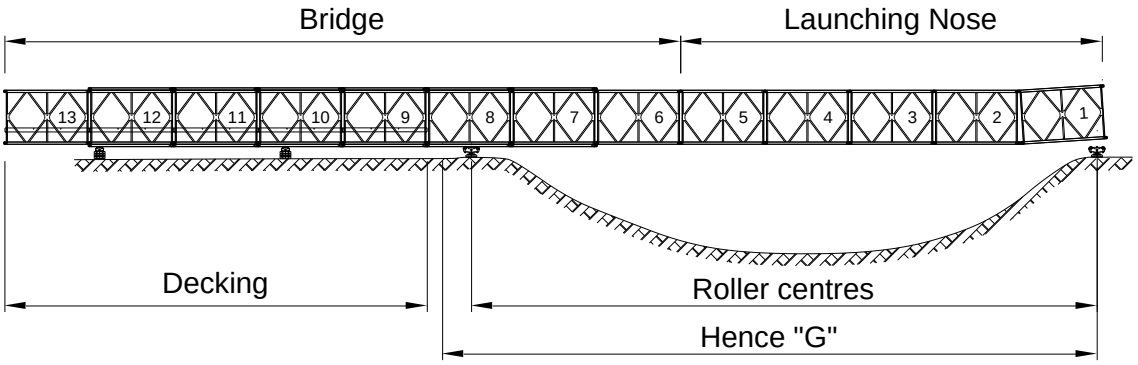


Figure 3.4 – LAUNCHING ARRANGEMENT - 28 METRES BRIDGE

Total weight of the structure:

(6 * 11.09) + (3 * 15.16) + (3 * 25.02) + 20.95 = 208.03 kN

Taking moments from the tip of the nose (in terms of kN and bays):

(6 * 11.09 * 3) + (3 * 15.16 * 7.5) + (3 * 25.02 * 10.5) + (20.95 * 12.5) = 1590.7 kNbay

Hence ‘G’ = 1590.7 / 208.03 = 7.646 bays from the tip of the nose.

For stability during the launch the distance ‘G’ must be at least 3 metres more than the roller centres. If this is not the case then counterweight must be added to bay 13 of the bridge where it will be most effective.

Note:

If the rollers had been placed on the bearing centre lines then the margin of safety would have been reduced and more counterweight would have been required.

CALCULATION TO DETERMINE THE SIZE OF THE COUNTERWEIGHT ‘C’

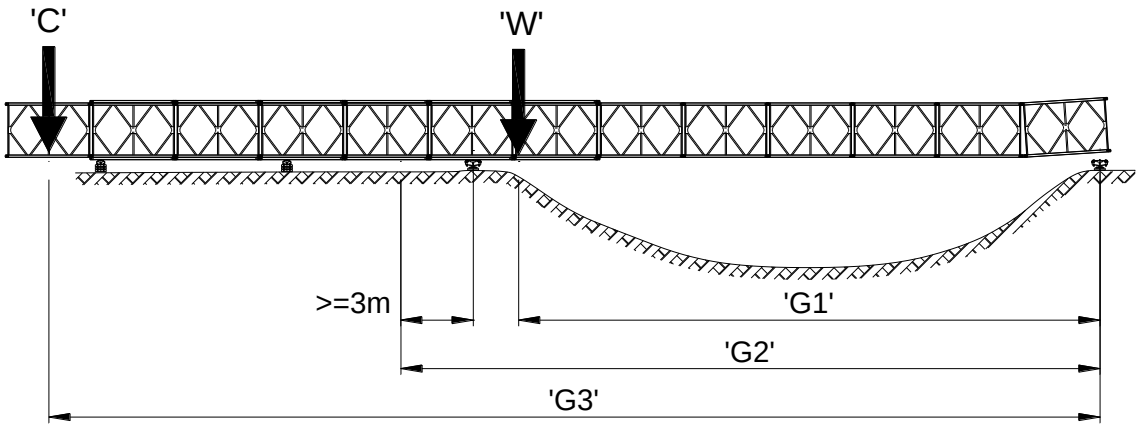


Figure 3.5 – LAUNCHING ARRANGEMENT – COUNTERWEIGHT CALCULATION

In the above figure ‘C’ = mass of the counterweight

‘W’ = mass of the combined bridge and nose

‘G_1’ = distance from tip of nose to the centre of gravity of the combined bridge and nose

‘G_2’ = distance from tip of nose to the new centre of gravity of the combined bridge, nose and counterweight which should be the distance between home roller centres and landing roller centres plus 3 metres

‘G_3’ = distance from tip of nose to the centre of gravity of the counterweight

From the above the mass of the counterweight may be calculated from the formula:

$$C = W \frac{G_2 - G_1}{G_3 - G_2}$$

Using the design example:

W = 208.03 kN

G_1 = 7.646*3.048 = 23.305 metres (bay=3.048 m)

G_2 = 22.720 + 3 = 25.720 metres

G_3 = 12.5bays = 38.10 metres

Hence C = 40.6 kN

The counterweight is usually made up using spare decks
(e.g. 13 x WBDE150A = 4060 kg / 312 kg).

ROLLER LOADING

The main launching rollers on the home bank abutment will carry the weight of the combined bridge, nose and counterweight. The load of the main launching rollers has to be lower than the allowed load.

LAUNCHING LINK POSITION

The launching link position is indicated by the number of panels from the tip of nose to the launching link position and shall not be positioned more than 4 bays from tip of nose.

The maximum shear force in the location of the launching link shall not exceed 175kN/panel.

Never place 2 launching links in one location.

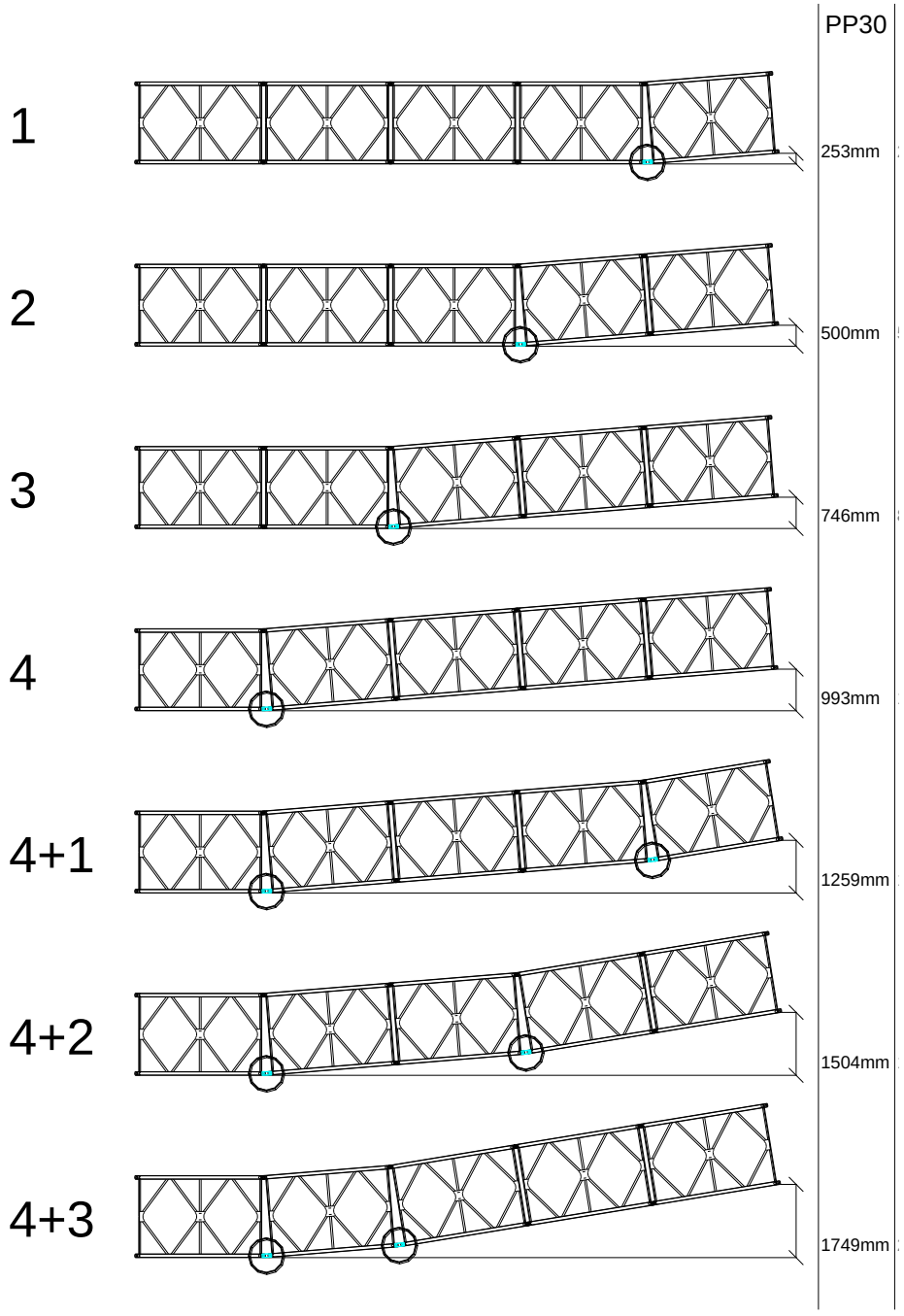


Figure 3.6 – EFFECT OF LAUNCHING LINK LOCATION

SECTION 4

ASSEMBLING DETAILS

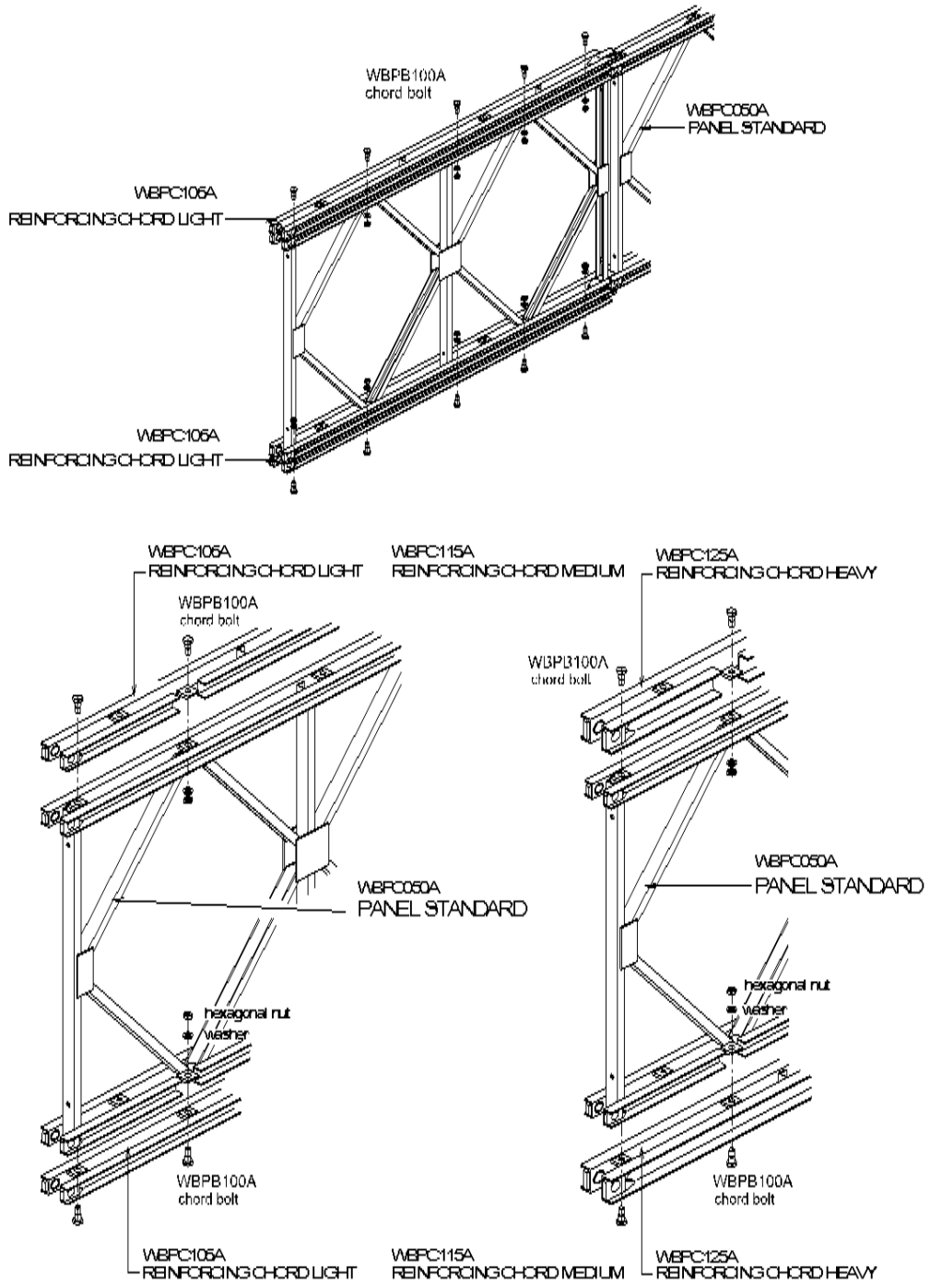


Figure 4.1 - CONNECTION OF THE REINFORCING CHORDS (LIGHT, MEDIUM AND HEAVY) TO THE PANEL

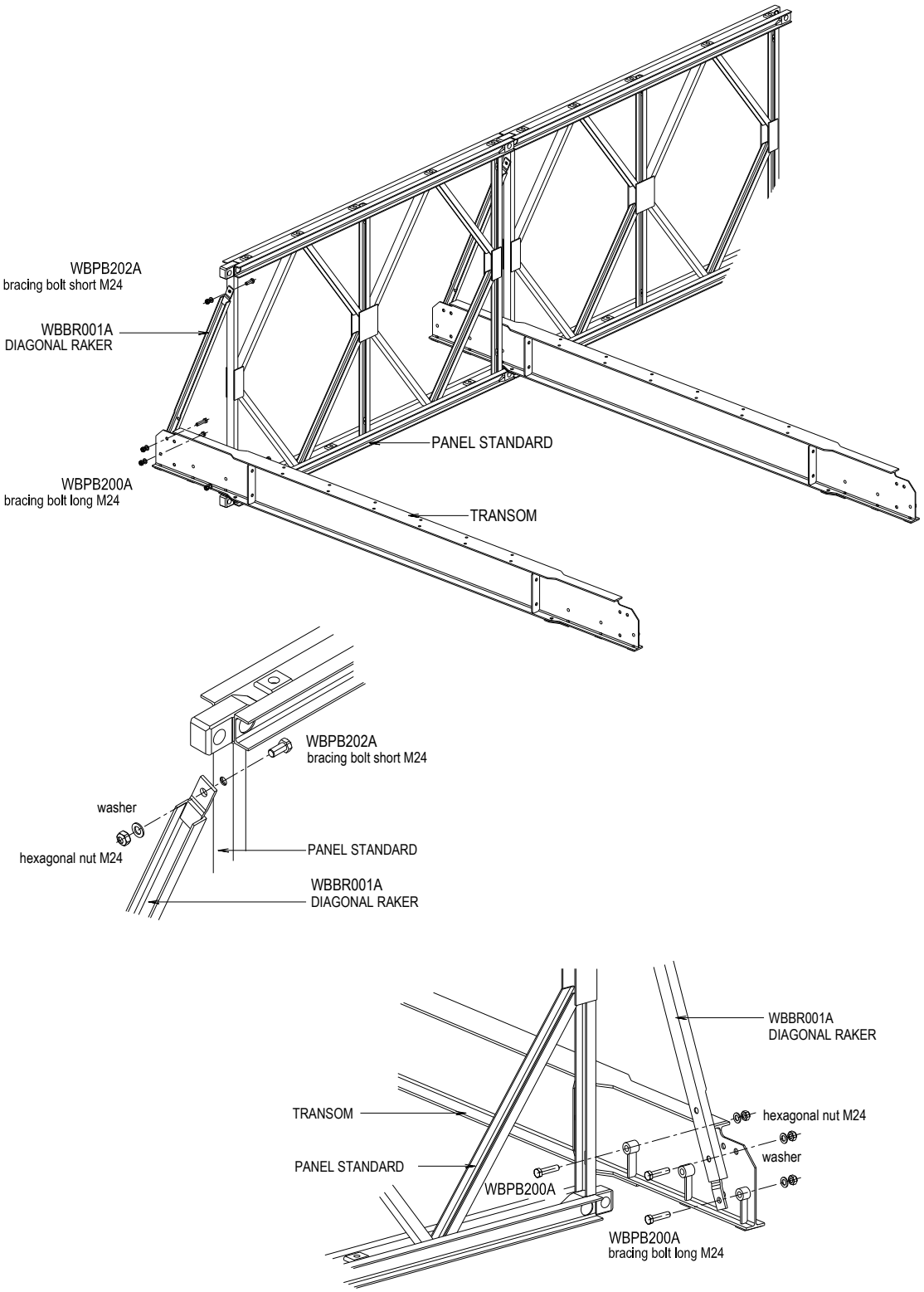


Figure 4.2 - CONNECTION OF THE DIAGONAL RAKER AND TRANSOM TO THE PANEL OF A SS-BRIDGE

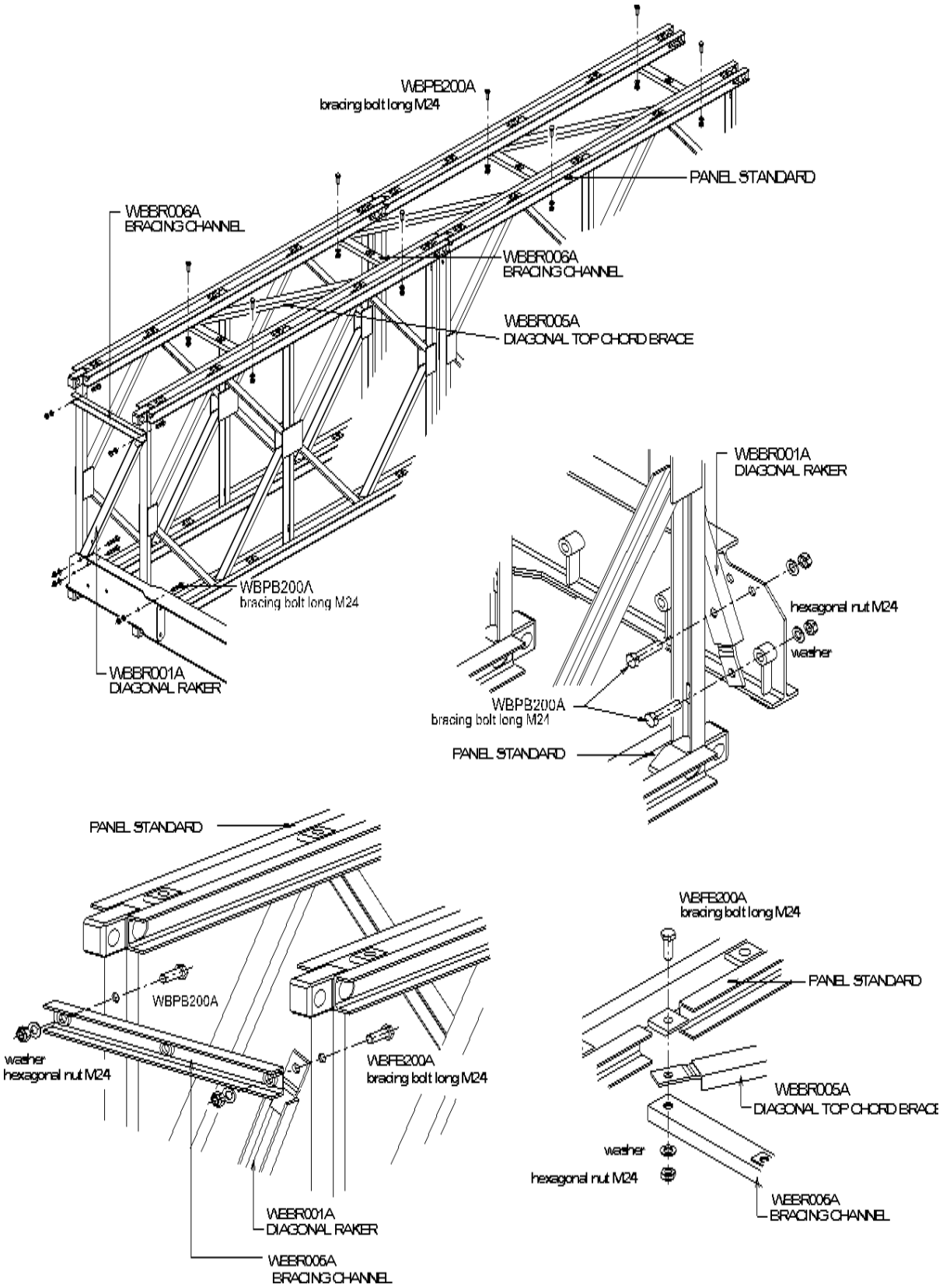


Figure 4.3 - CONNECTION OF PANEL BRACINGS AND THE TRANSOM TO THE PANELS OF A DS-BRIDGE

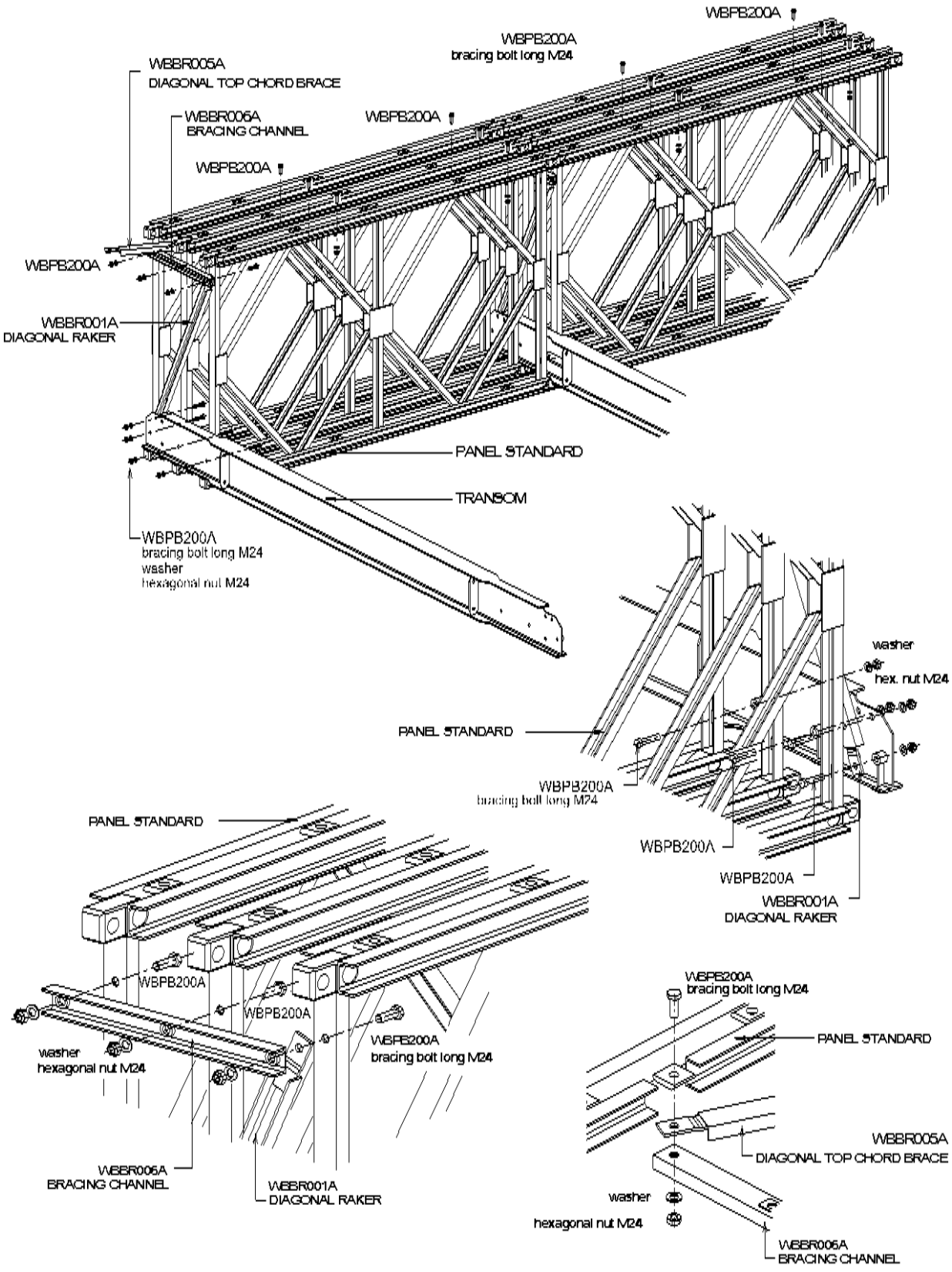


Figure 4.4 - CONNECTION OF PANEL BRACINGS AND THE TRANSOM TO THE PANELS OF A TS-BRIDGE

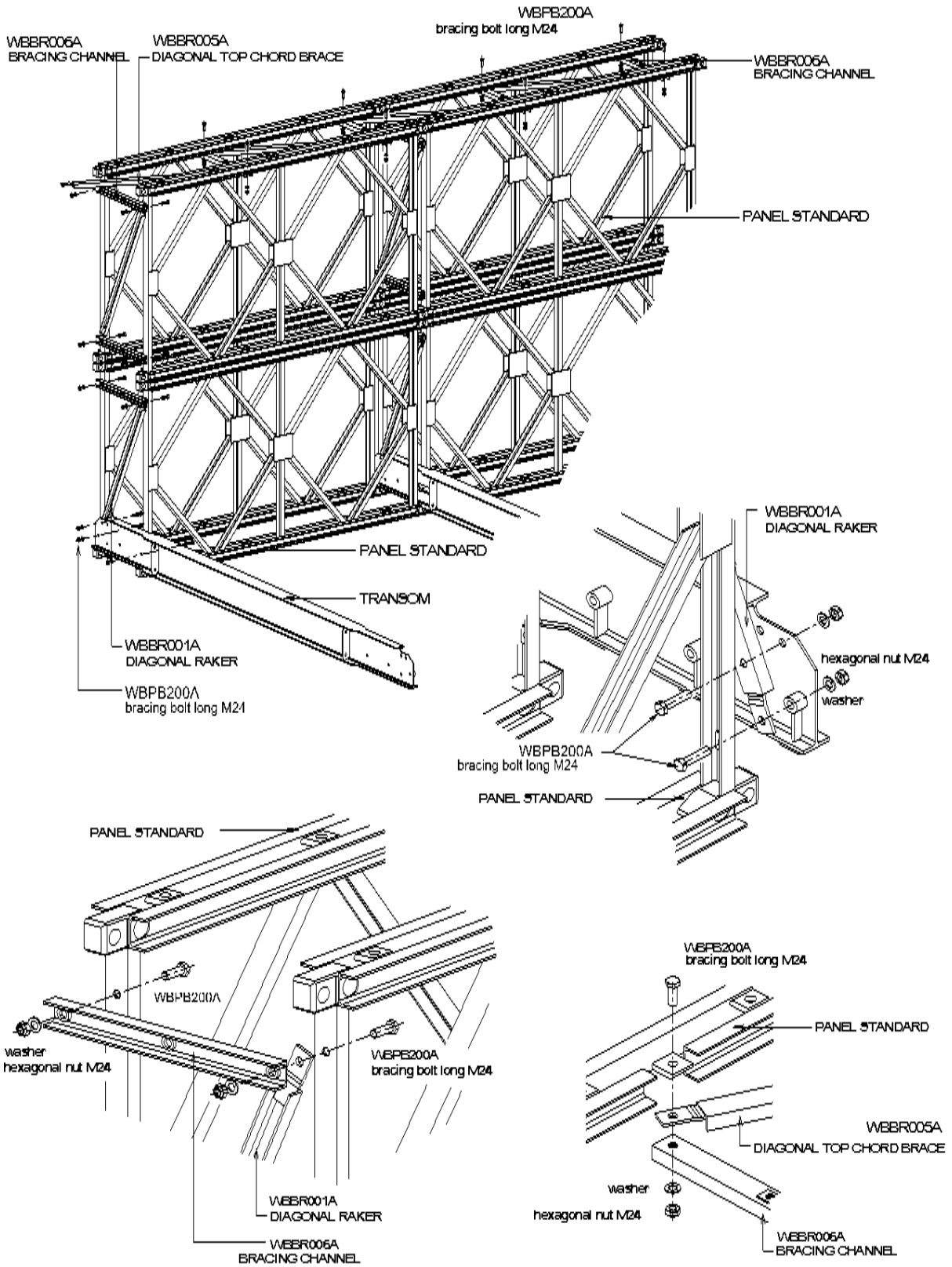


Figure 4.5 - CONNECTION OF PANEL BRACINGS AND THE TRANSOM TO THE PANELS OF A DD-BRIDGE

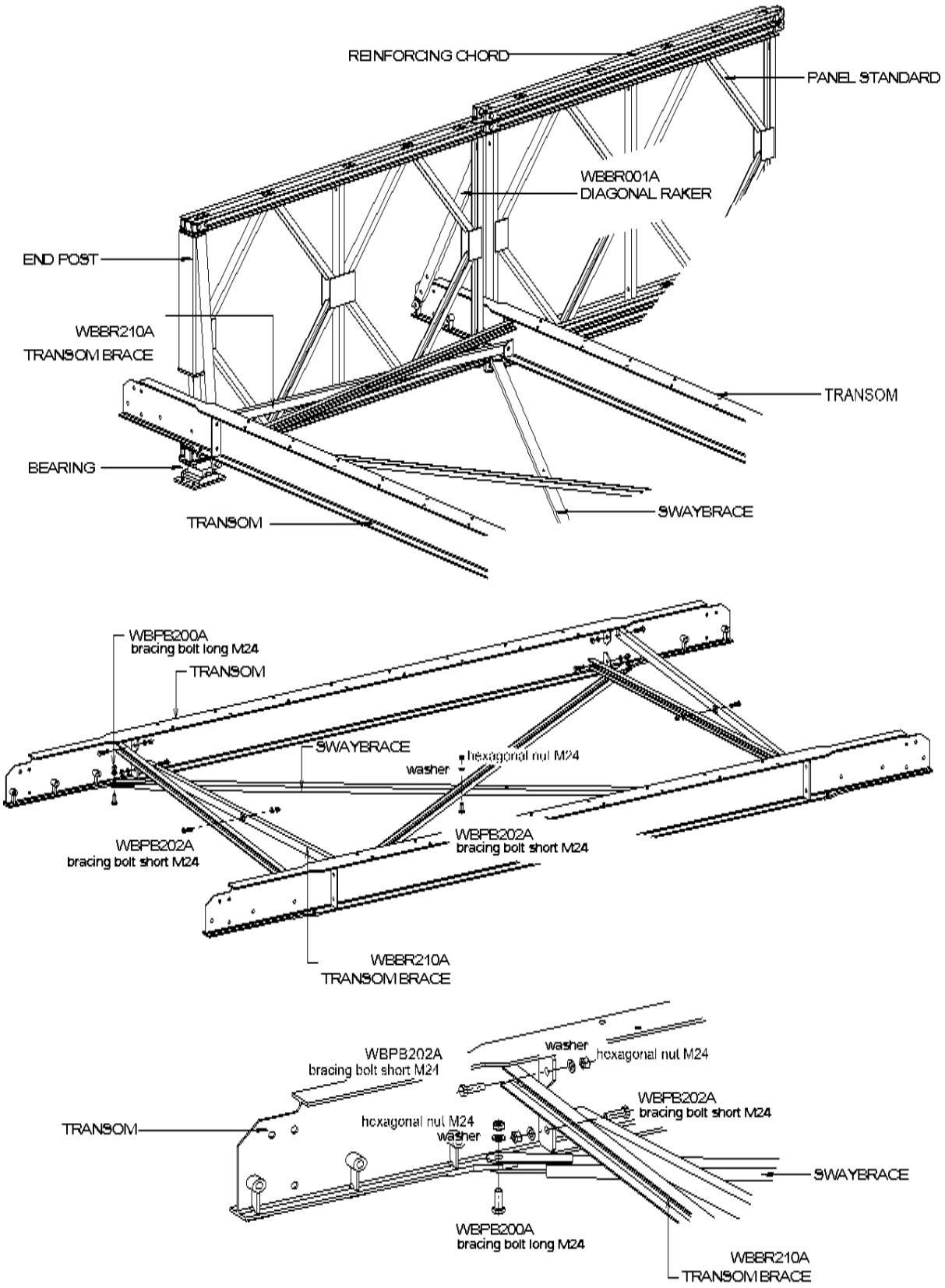


Figure 4.6 - CONNECTION OF THE TRANSOM BRACE AND THE SWAY BRACE TO THE TRANSOM

Deck Unit Steel Standard

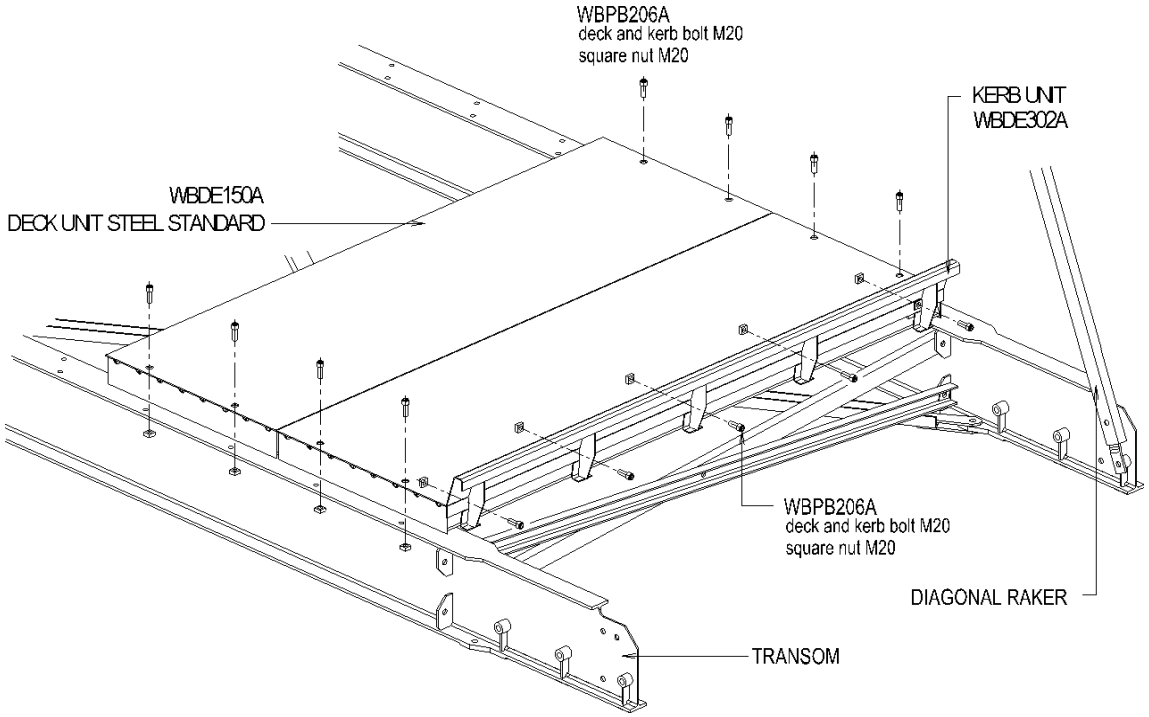


Figure 4.7 - CONNECTION OF THE DECK AND KERB UNIT

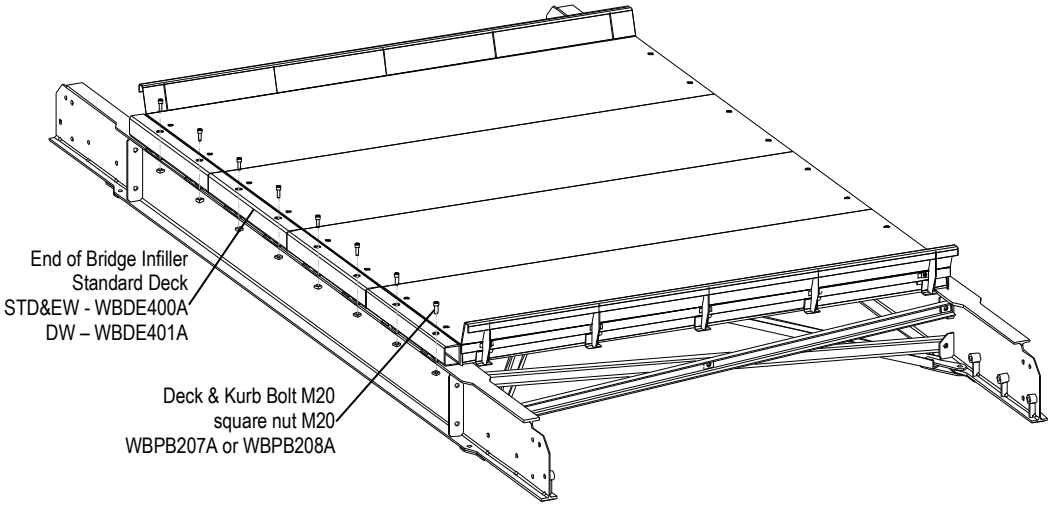


Figure 4.8 - CONNECTION OF THE End of bridge infiller

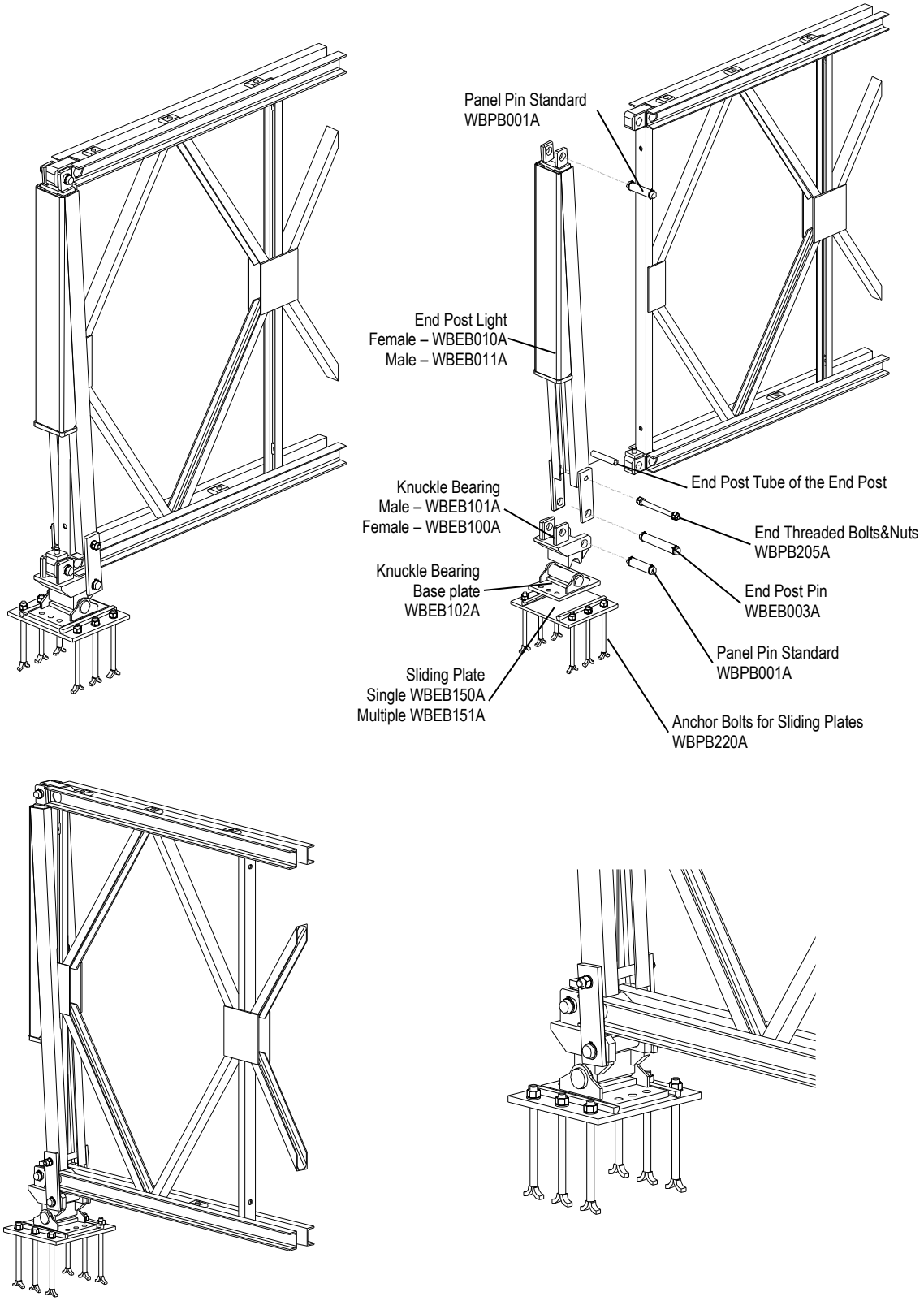


Figure 4.9 - ENDPOST AND BEARING ASSEMBLY

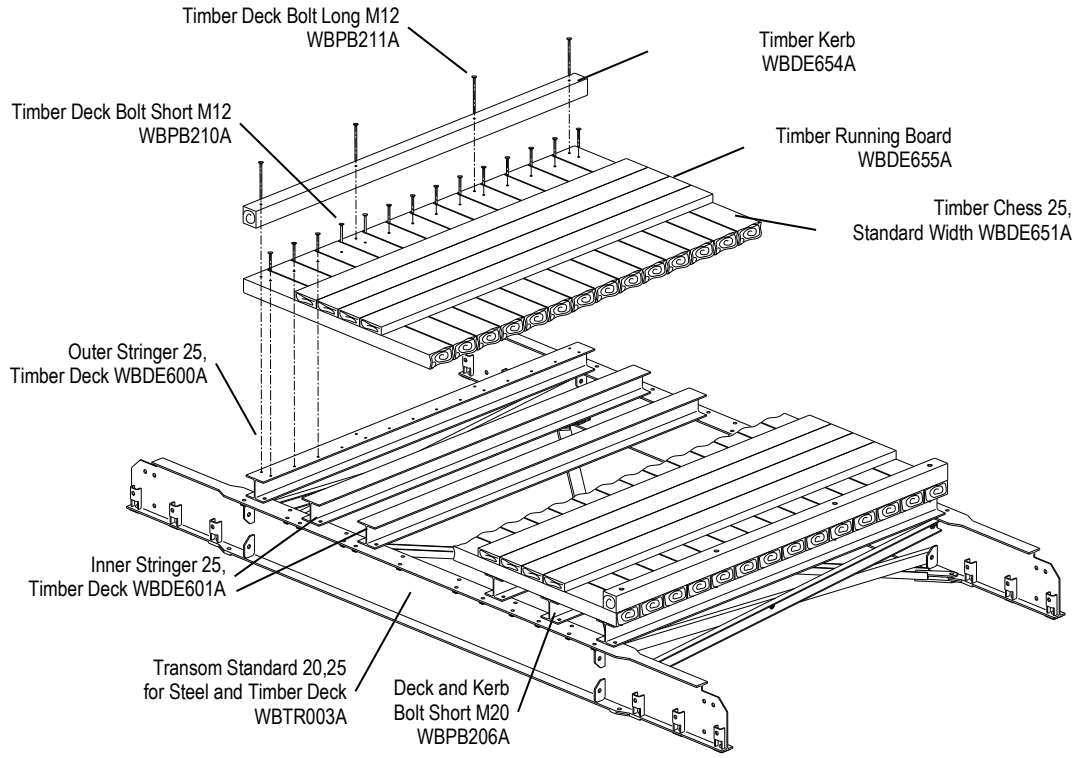


Figure 4.10 – TIMBER DECK ASSEMBLY

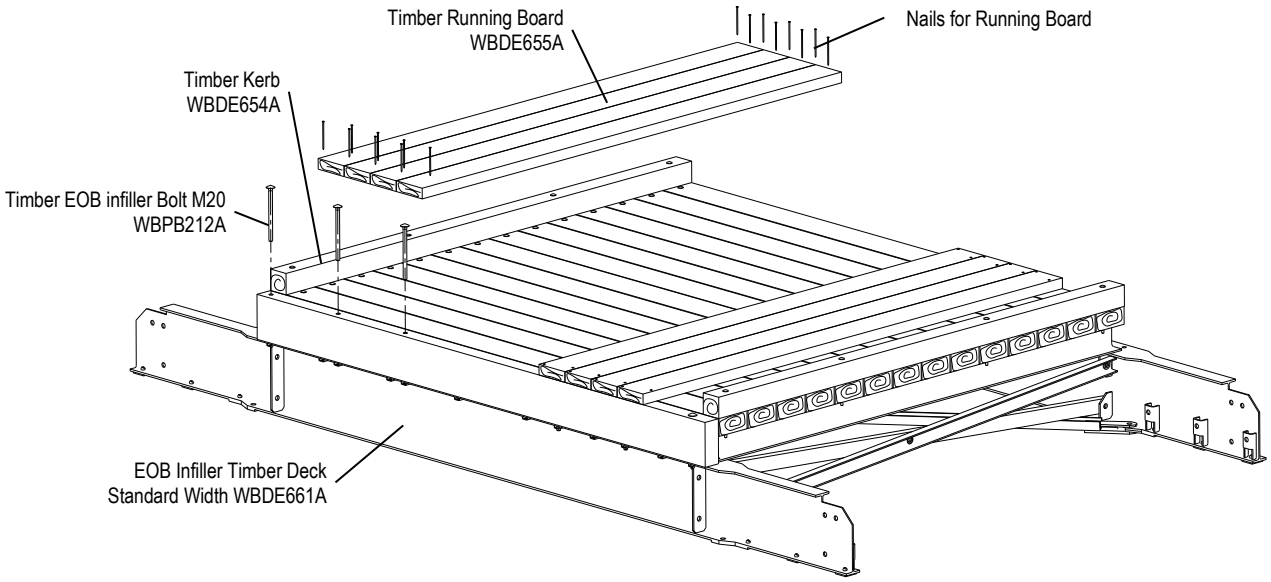
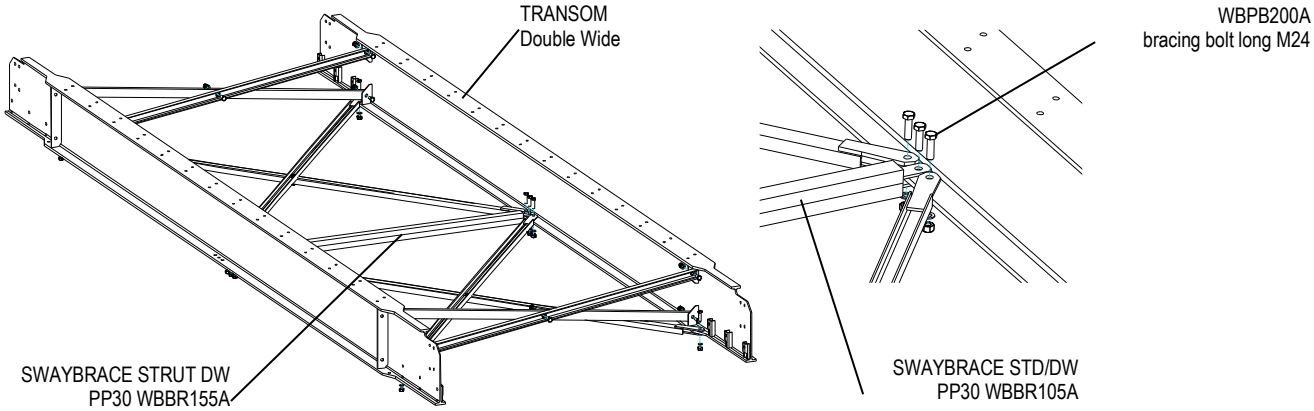


Figure 4.11 – TIMBER DECK ASSEMBLY WITH END OF BRIDGE INFILLER



Position of Sway Brace Strut DW

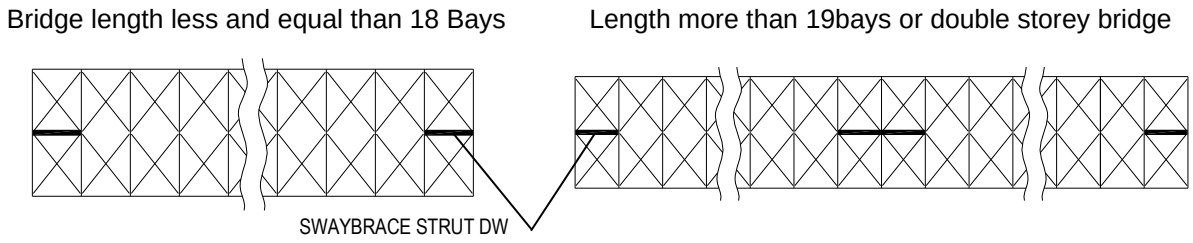


Figure 4.12 – POSITION AND CONNECTION OF THE SWAY BRACE STRUT

SECTION 5

PIER DESIGN

BRIDGE PIERS

GENERAL INFORMATION ABOUT PIERS AND TOWERS (PT)

The Waagner Biro Bridge Pier in its basic form utilises standard bridge panels that are braced with standard top chord bracing to form a full width ‘leaf’ pier. For special situations the bridge panels may be braced with special bracing members to vary the spacing of the panels.

As an alternative solution “square towers” are also possible. In this case four panels perpendicular to each other form a tower.

PIER ARRANGEMENT

The pier is made up from two rows of standard bridge panels placed vertically and spaced at 750mm centres (standard truss panel centres) and thus can utilise standard bracing for both vertical and plane bracing. The height of the pier is adjustable in modules of bridge panels.

Various bridge widths may be accommodated by installation of panels between the main load bearing sections of the pier (see Fig. 5.2).

When tall piers are to be designed it is possible to add further rows of panels at 750mm centre distance from the adjacent panel in front and behind the main pier to help with stability (see Fig. 5.3). These additional rows of panels may be curtailed below the crib as the design permits or extended up to the crib and used for supporting the roller or jacking support beams (see Fig. 5.4). The special plane and vertical bracing, the Pier Double Brace and / or the Pier Triple Brace will be required to tie these additional panels to the main pier.

CRIB TOP ASSEMBLIES

The pier is fitted with special crib top assemblies; the PT Edge Cross Beam(s) and / or the PT Centre Cross Beam are adjustable in position to suit either a single bearing location (from a broken span or span junction layout) on the PT Bearing Plate Single or a twin bearing layout (from two simple spans meeting at one pier) on the PT Bearing Plate Double.

The PT Bearing Plates, which are fitted to the top of the crib, may be bolted in various positions to suit the particular arrangement of truss construction and bridge width.

For bridge jacking it is possible to extend the Pier Side Beams with the Pier Side Extension Beams and incorporate the PT Transverse Jacking beam between the extensions for roller or jack support. The Pier Side Extension Beams must be supported on additional bridge panels positioned 750mm in front or behind the main pier panels (see Fig. 5.4).

PIER FOUNDATIONS

The base of the pier, depending on the loading, may be supported in one of two ways:

1. Where individual foundations or existing columns are to be utilised, the pier may be supported on the outer chords only.
2. Where a full width foundation is being used, the pier may be fitted with bearing plates on all chords.

If the pier is to be supported at its outer edge only, then it is important that the pier panels are fitted with Pier Soleplates Double Standard at the lower joints of the panels, which will resist the tensile forces present at that location (see Fig. 5.1).

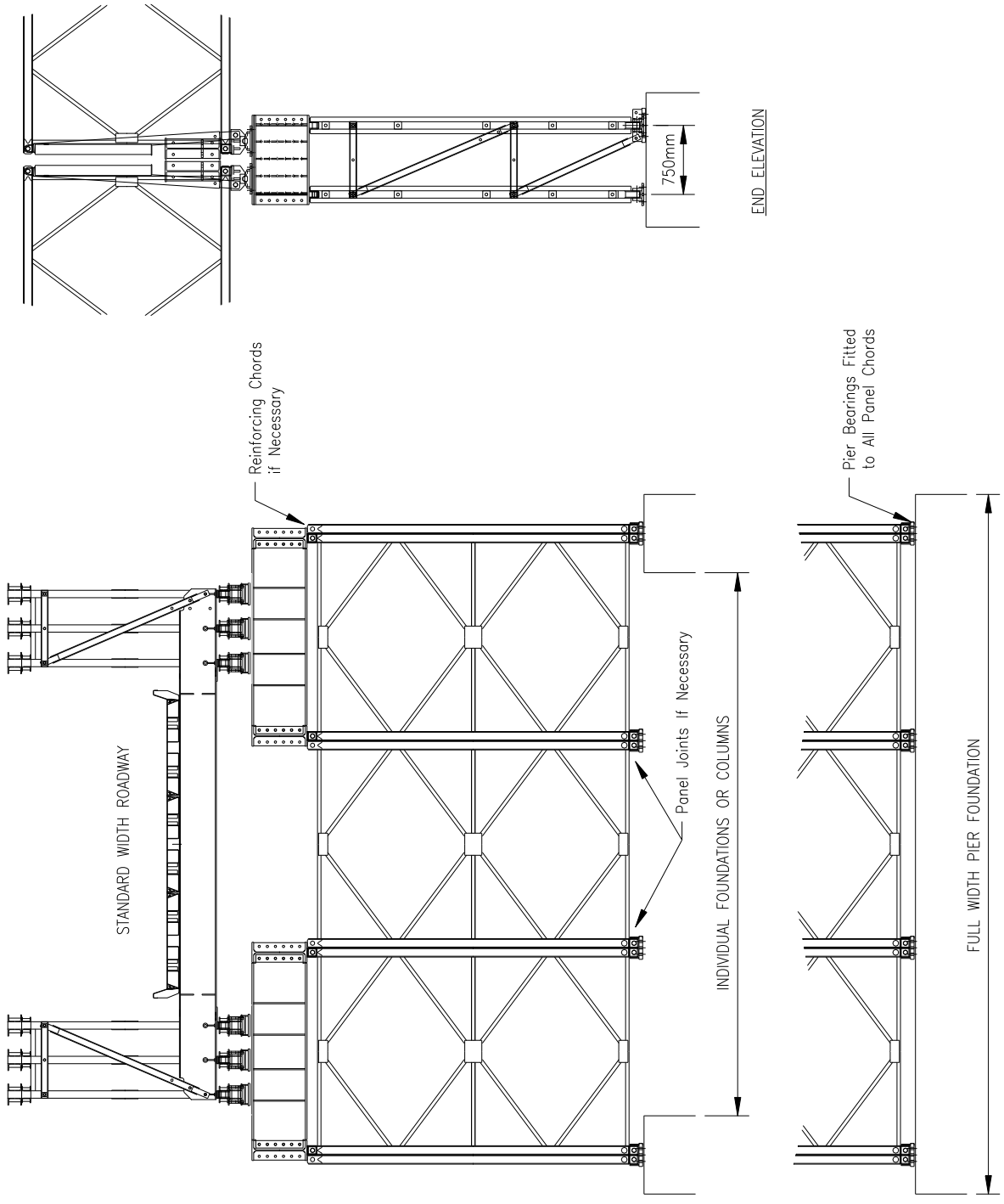


Figure 5.1 – TYPICAL 3.5 m HIGH PIER LAYOUT

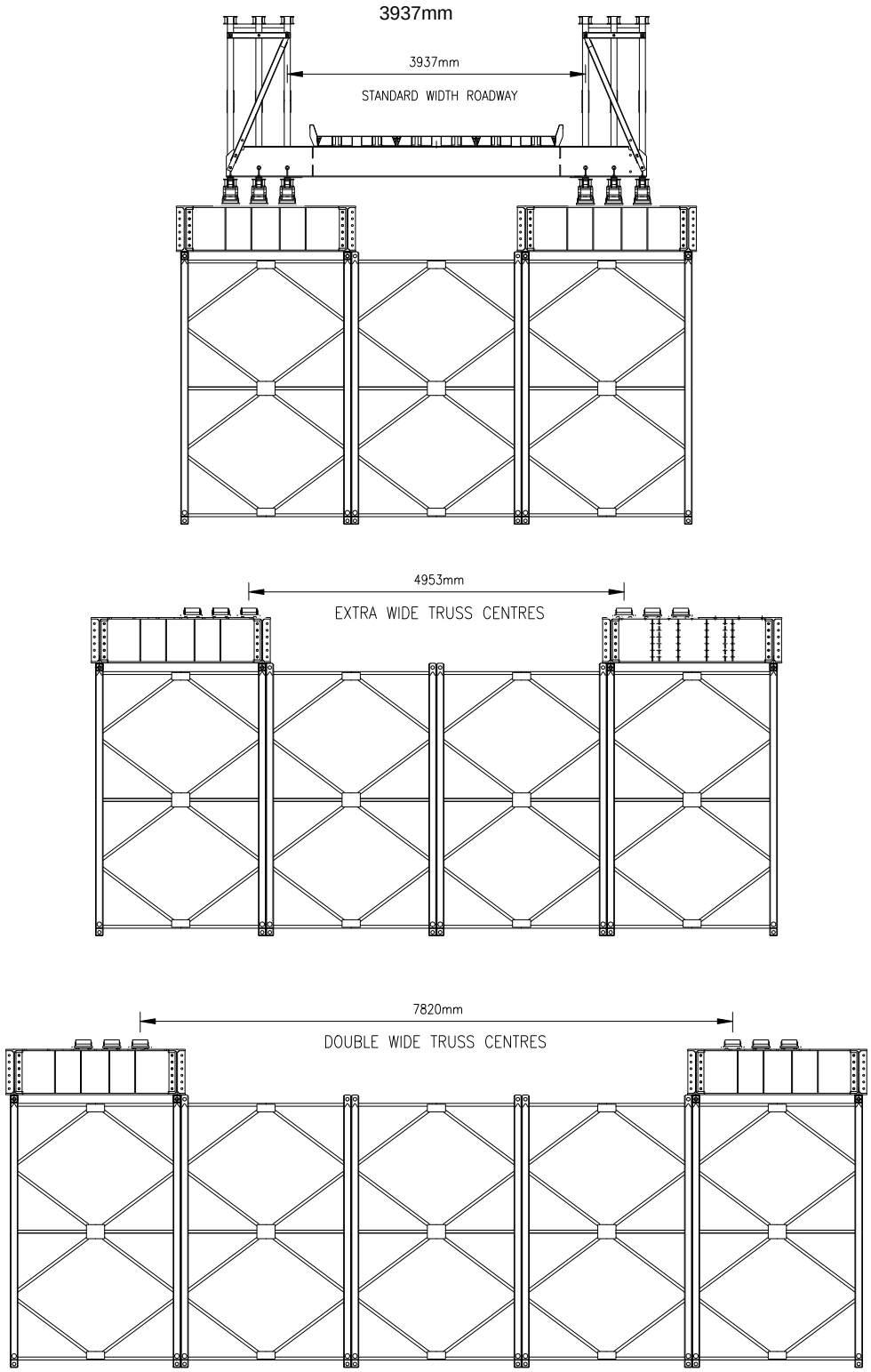


Figure 5.2 – PIER LAYOUTS FOR VARIOUS ROADWAY WIDTHS

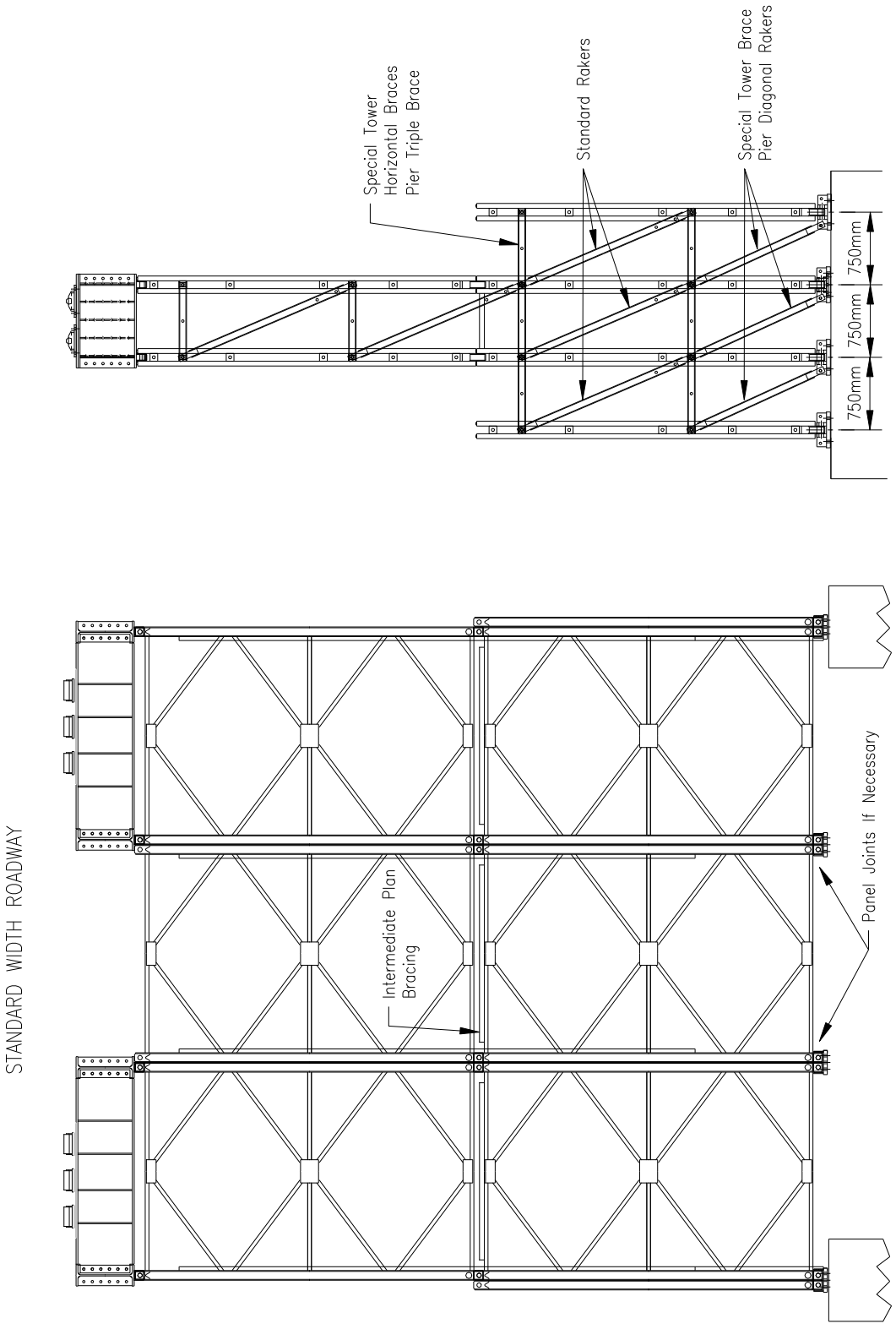


Figure 5.3 – TYPICAL PIER WITH OUTRIGGER PANELS

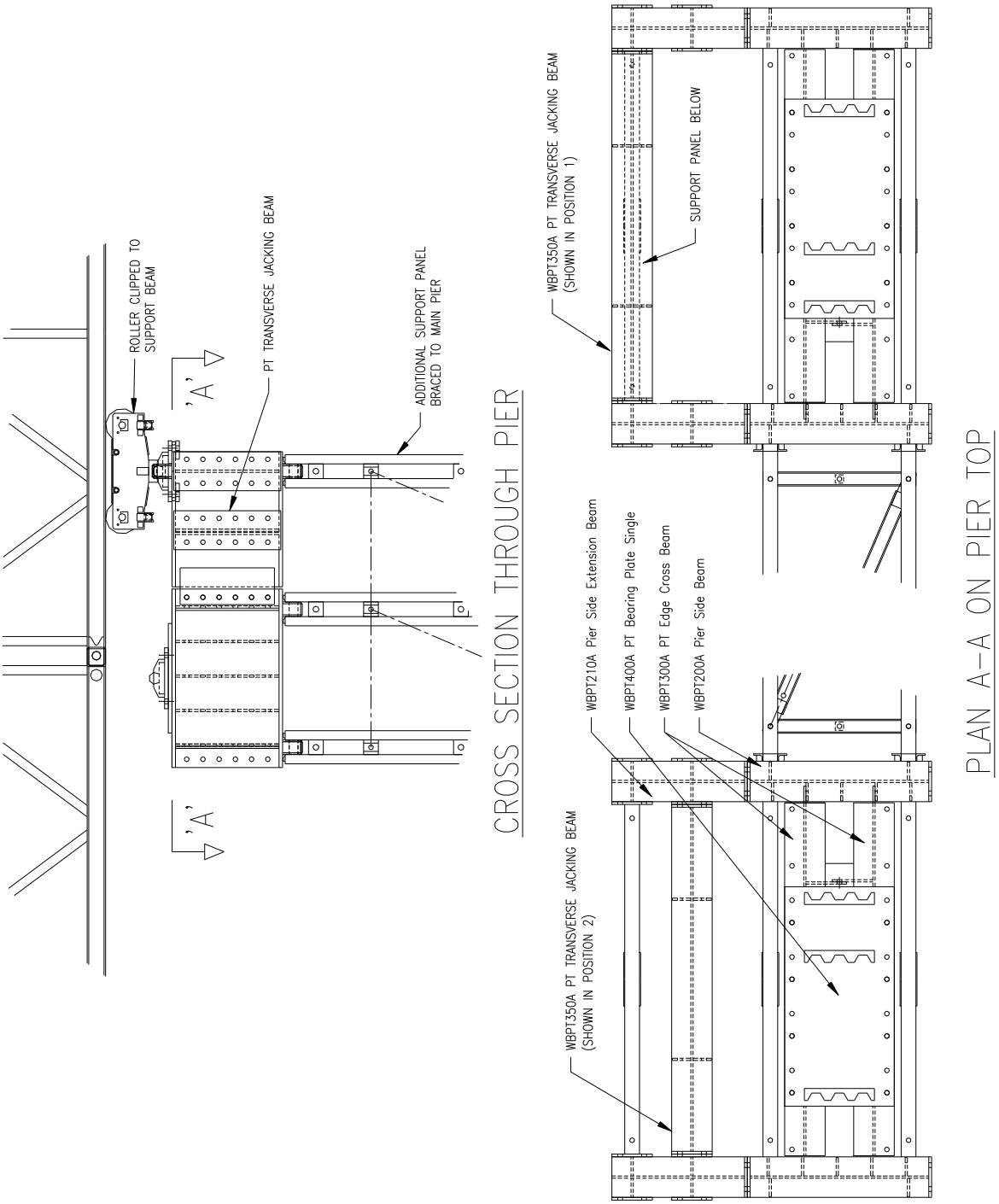


Figure 5.4 – TYPICAL PIER TOP DETAIL

(SHOWING OPTIONAL ROLLER SUPPORTBEAMS)

SECTION 6

MULTI SPAN BRIDGES

GENERAL

If the gap is too wide to cross it by a single span bridge or if it is more economic to erect piers to lower the costs of the bridge, multi span bridges should be installed.

Multi span bridges may utilise the following features:

1. **Continuous Bridge Construction**
2. **Discontinuous Bridge Construction**
   a) **Broken Span Equipment**
   b) **Span Junction Equipment**

The chosen method to install the multi span bridge will have an influence on the parts required for the bridge. Due to the many variations possible with this type of bridge please refer to Waagner-Biro for advice regarding design, parts requirements and construction of multi span bridges.

CONTINUOUS BRIDGE CONSTRUCTION

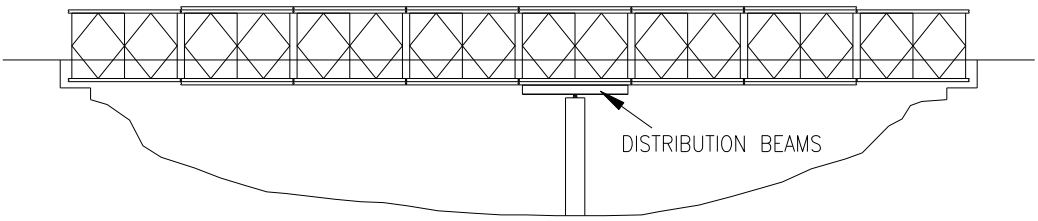


Figure 6.1 - CONTINUOUS BRIDGE CONSTRUCTION

The advantages of the continuous construction are the possible reduction of bending stresses in the trusses compared to simply supported spans and the flexibility of span length by positioning the Distribution Beams at the regular location along the length of the truss panels. The regular positions of the distribution beam are under the transom (Fig. 6.4) or halfway between the transoms (Fig. 6.5) to transfer horizontal bearing forces due to wind without additional bending in the panel to the pier. For other than regular positions please refer to Waagner Biro for advice.

The truss panels are pinned together throughout the whole length of the bridge, which may have one or more supports. The decking over the piers is erected as if the whole bridge is simply supported.

The two ends of the bridge are supported on normal abutments but at the intermediate supports the trusses are usually supported on Distribution Beams, which can rotate longitudinally on its bearing under live load.

The bridge is designed using normal analytical techniques, bending moments and shear forces must be checked at the supports and within the spans. Where the bridge requires reinforcement this can be made continuous over the supports.

Distribution Beam Assemblies are prepared to suit the particular bridge truss configuration being supported.

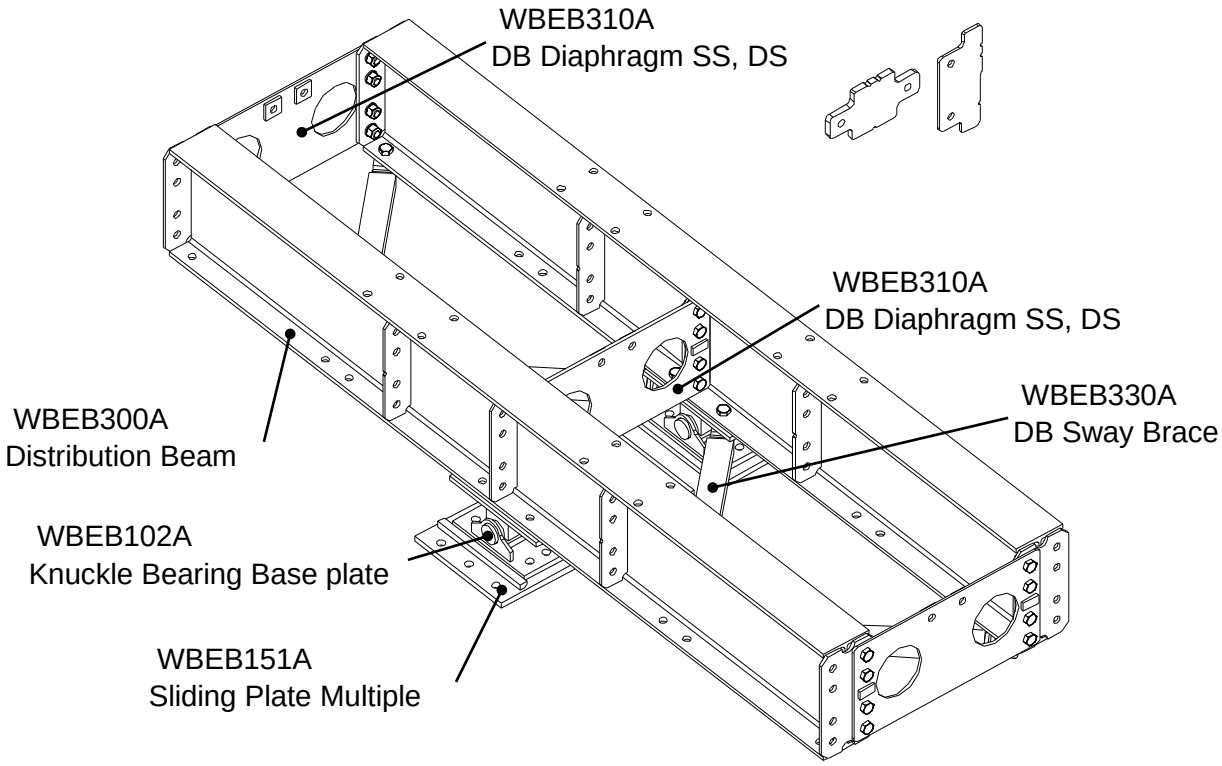


Figure 6.2 – DISTRIBUTION BEAM FOR SS- AND DS-CONSTRUCTION

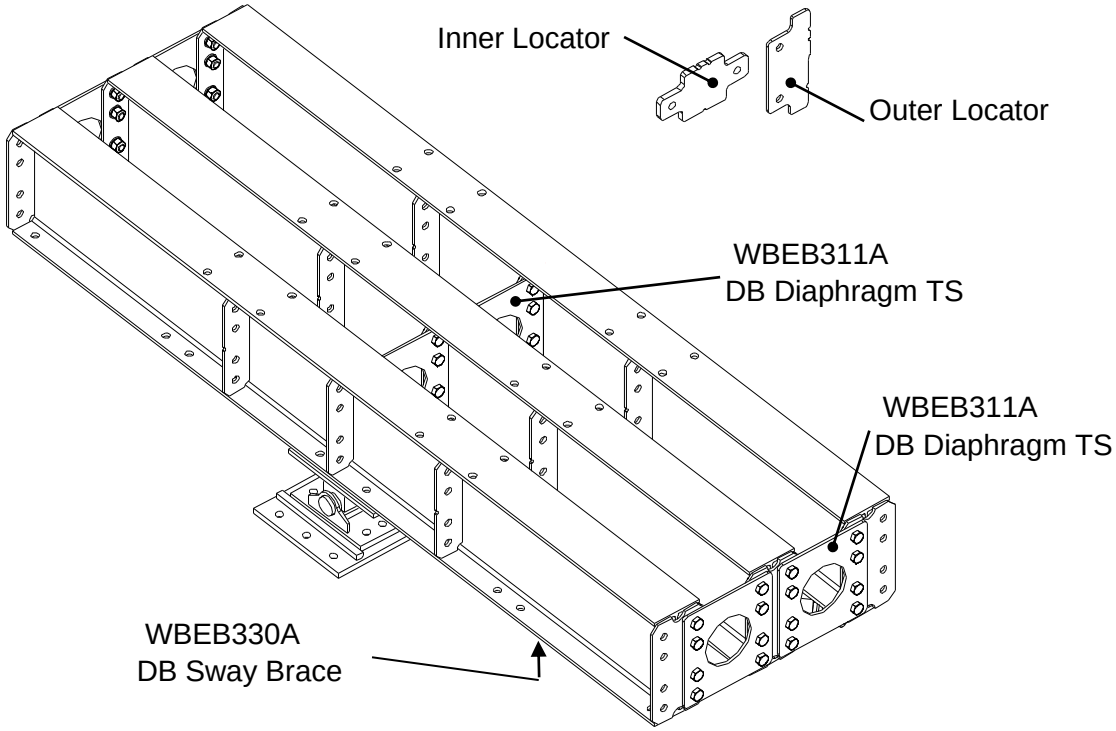


Figure 6.3 – DISTRIBUTION BEAM FOR TS-CONSTRUCTION

SINGLE TRUSS CONSTRUCTIONS

Short Spans

Single truss constructions require Stabilizing Wings additionally to the Distribution Beam. These Stabilizing Wings are connected by two bolts to the Distribution Beam to support each single truss construction on two Knuckle Bearing Base plates. A single Distribution Beam without the Stabilising Wing is unstable and must not be used.

Take care to use the Stabilising Wings on both sides, either inside or outside of the panel line, never on one side inside and on the other side outside of the panel line.

The Inner and Outer Locators, Light, Medium or Heavy type (depending on the installed Reinforcing Chords) have to be bolted onto both ends or in the middle of each Distribution Beam in order to transmit the horizontal, lateral loads (Fig. 6.6 – 6.8). Note the signing of the locators as per Fig. 6.9 for the correct choice of locators.

Long Spans

Single truss constructions require two Distribution Beams per truss spaced at 750mm (Fig. 6.2).

Take care that the second, stabilising Distribution Beams are on both sides, either inside or outside of the panel line, never on one side inside and on the other side outside of the panel line.

The diaphragms have to be bolted onto both ends and in the centre of each Distribution Beam to connect the Distribution Beams to each other and to enable the transmission of the horizontal, lateral loads to the bearing by the Distribution Beam Sway Brace and Locators (Fig 6.2 and 6.3).

The type of the inner and outer locators depends on the installed reinforcing chords. There are light, medium or heavy locators. Note the signing of the locators as per Fig. 6.9 for the correct side of locators. For the positioning of inner and outer locators to the diaphragms refer to Fig. 6.6 – 6.8. The clearance between locator profile and chord should be around 5mm on each side. These locators have to be bolted onto both ends or in the centre of each Distribution Beam (Fig. 6.4 – 6.5) in order to transmit the horizontal loads directly to the transom without additional local bending of the panel.

MULTIPLE TRUSS CONSTRUCTIONS

Multiple truss constructions require a Distribution Beam under each panel line.

At partially reinforced bridge truss configurations, i.e. DSR1H or TSR2H, Reinforcing Chords must be fitted to the bottom chord of the not reinforced panel line of each bay on either side of each Distribution beam.

The diaphragms have to be bolted onto both ends and in the centre of each Distribution Beam to connect the Distribution Beams to each other and to enable the transmission of the horizontal, lateral loads to the bearing by the Distribution Beam Sway Brace and Locators (Fig 6.2 and 6.3).

The type of the inner and outer locators depends on the installed reinforcing chords. There are light, medium or heavy locators. Note the signing of the locators as per Fig. 6.9 for the correct side of locators. For the positioning of inner and outer locators to the diaphragms refer to Fig. 6.6 – 6.8. The clearance between locator profile and chord should be around 5mm on each side. These locators have to be bolted onto both ends or in the centre of each Distribution Beam (Fig. 6.4 – 6.5) in order to transmit the horizontal loads directly to the transom without additional local bending of the panel.

Note:

- Should an end span be shorter than an adjacent intermediate span, the shorter span might lift off its end bearings, when a heavy load passes over the intermediate span. In this case, the correct solution is the discontinuous bridge construction.
- If any settlement of the foundations is expected, continuous bridge constructions must not be used. Due to settlement the bridge may be exposed to higher stress.

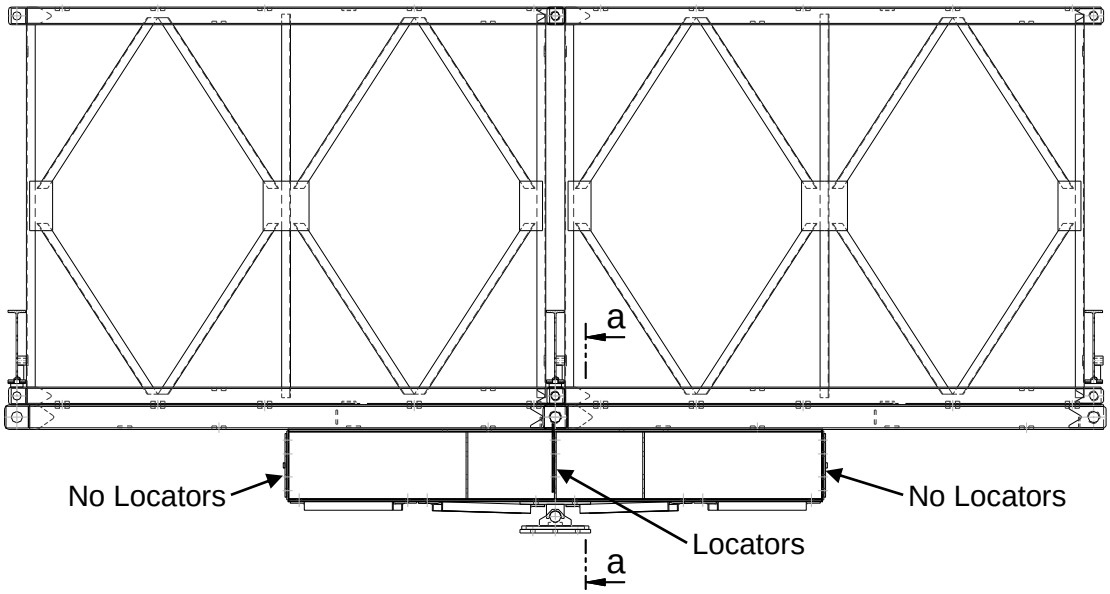


Figure 6.4 –DISTRIBUTION BEAM LOCATION UNDER THE TRANSOM

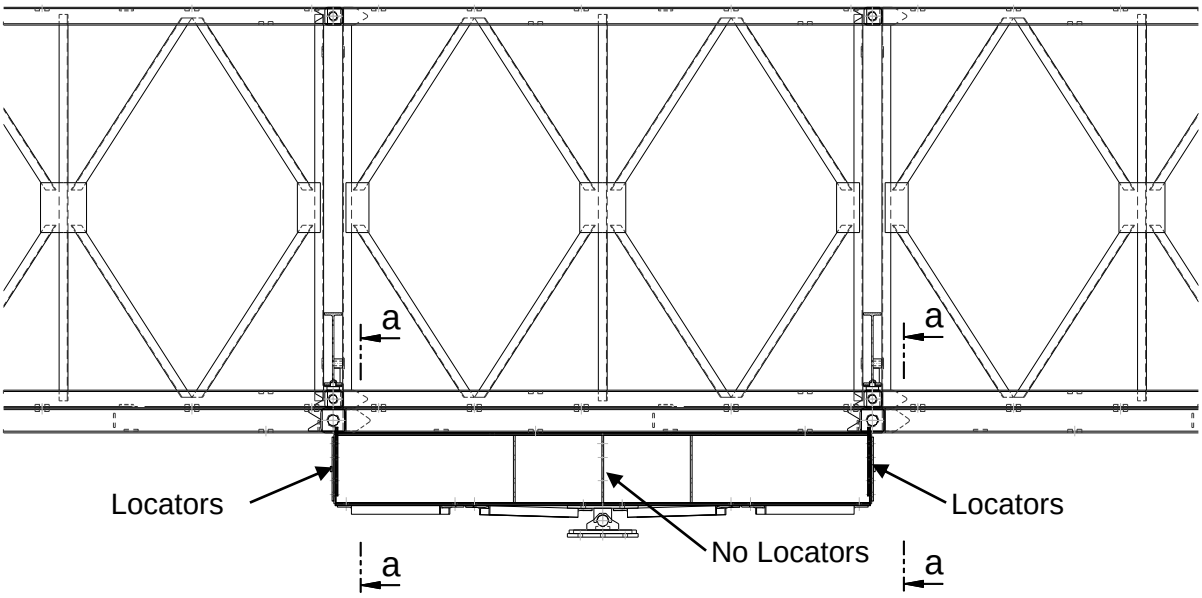


Figure 6.5 –DISTRIBUTION BEAM LOCATION HALFWAY BETWEEN TRANSOMS

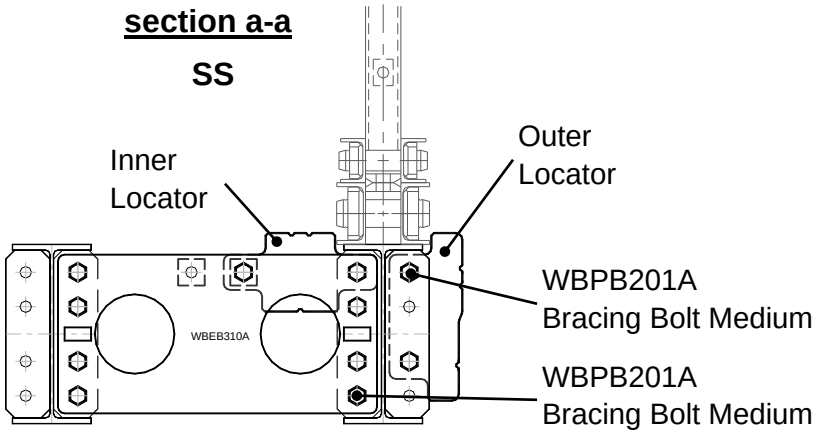


Figure 6.6 – LOCATION OF LOCATORS FOR SS-CONSTRUCTION

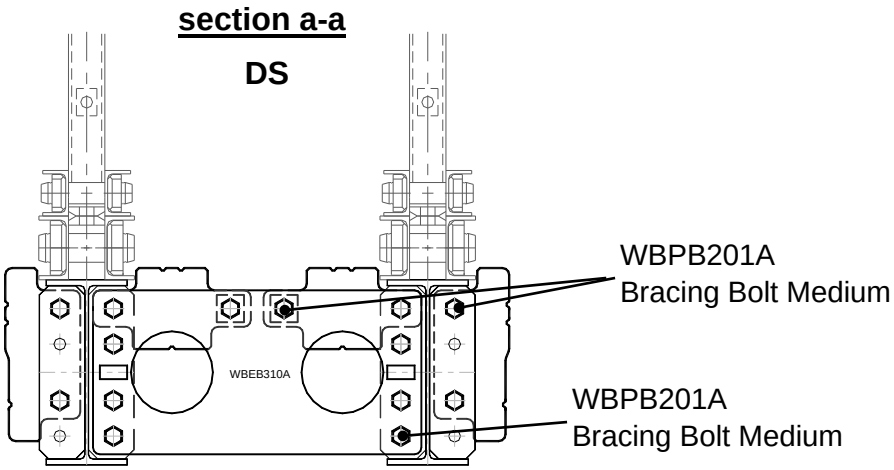


Figure 6.7 – LOCATION OF LOCATORS FOR DS-CONSTRUCTION

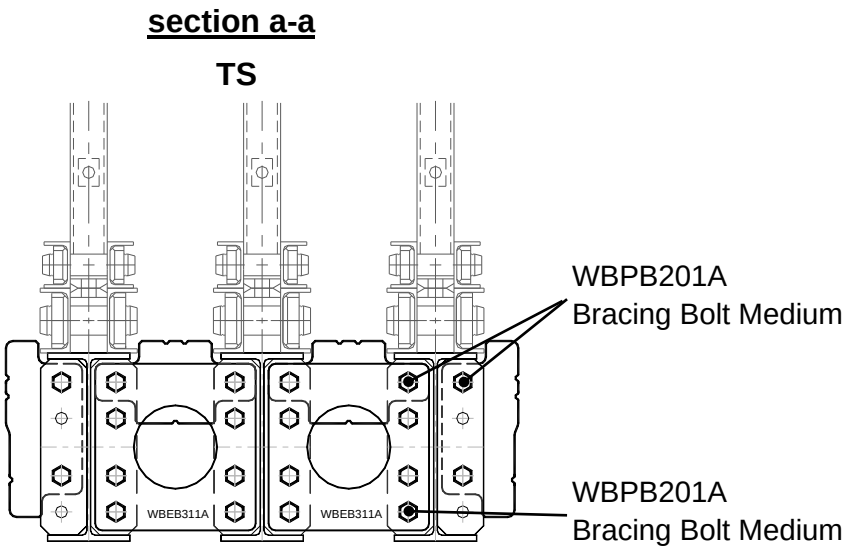


Figure 6.8 – LOCATION OF LOCATORS FOR TS-CONSTRUCTION

Signing of locators

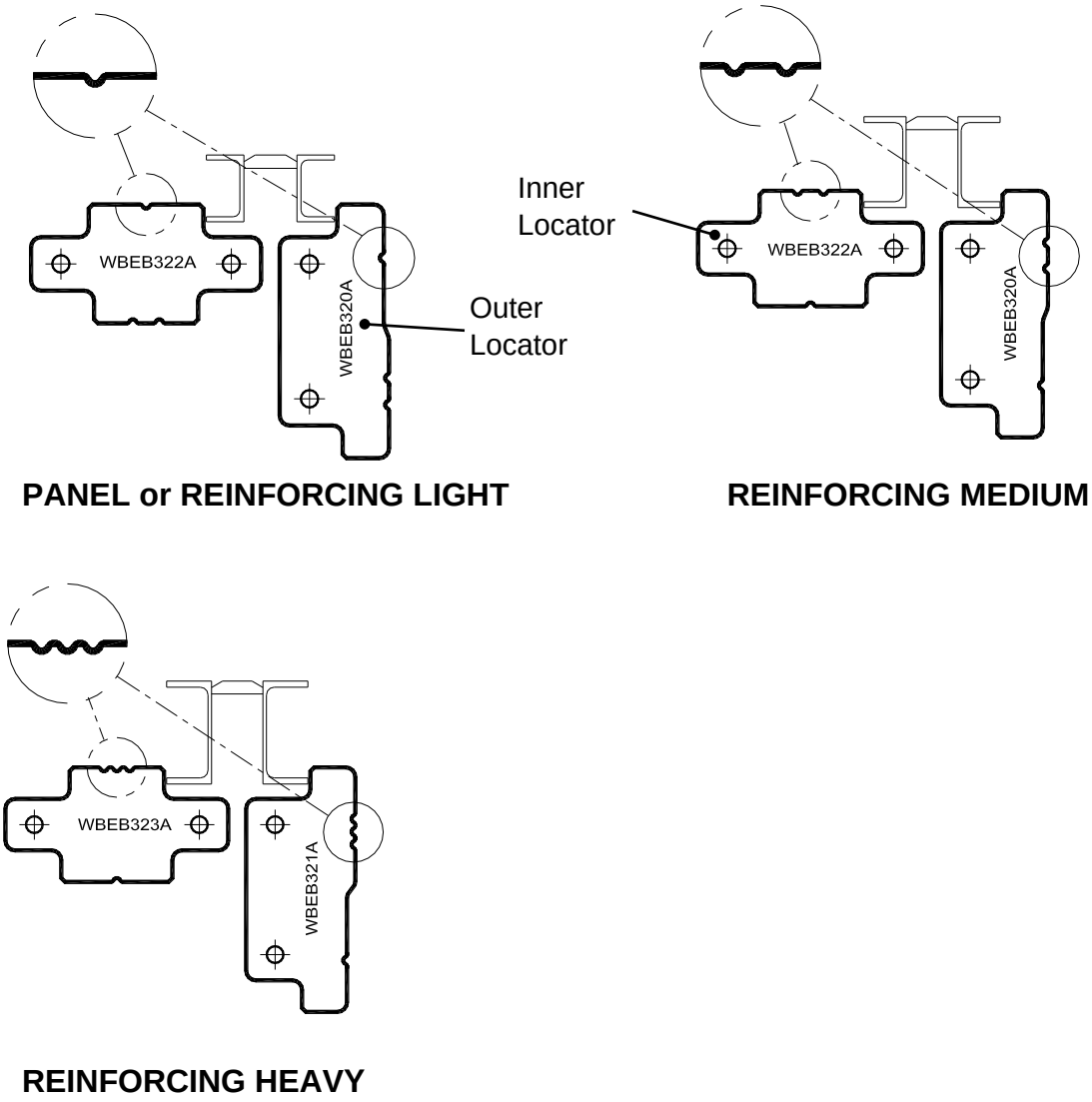


Figure 6.9 – SIGNING OF LOCATORS

ABUTMENT AND BEARING PLATE DIMENSIONS

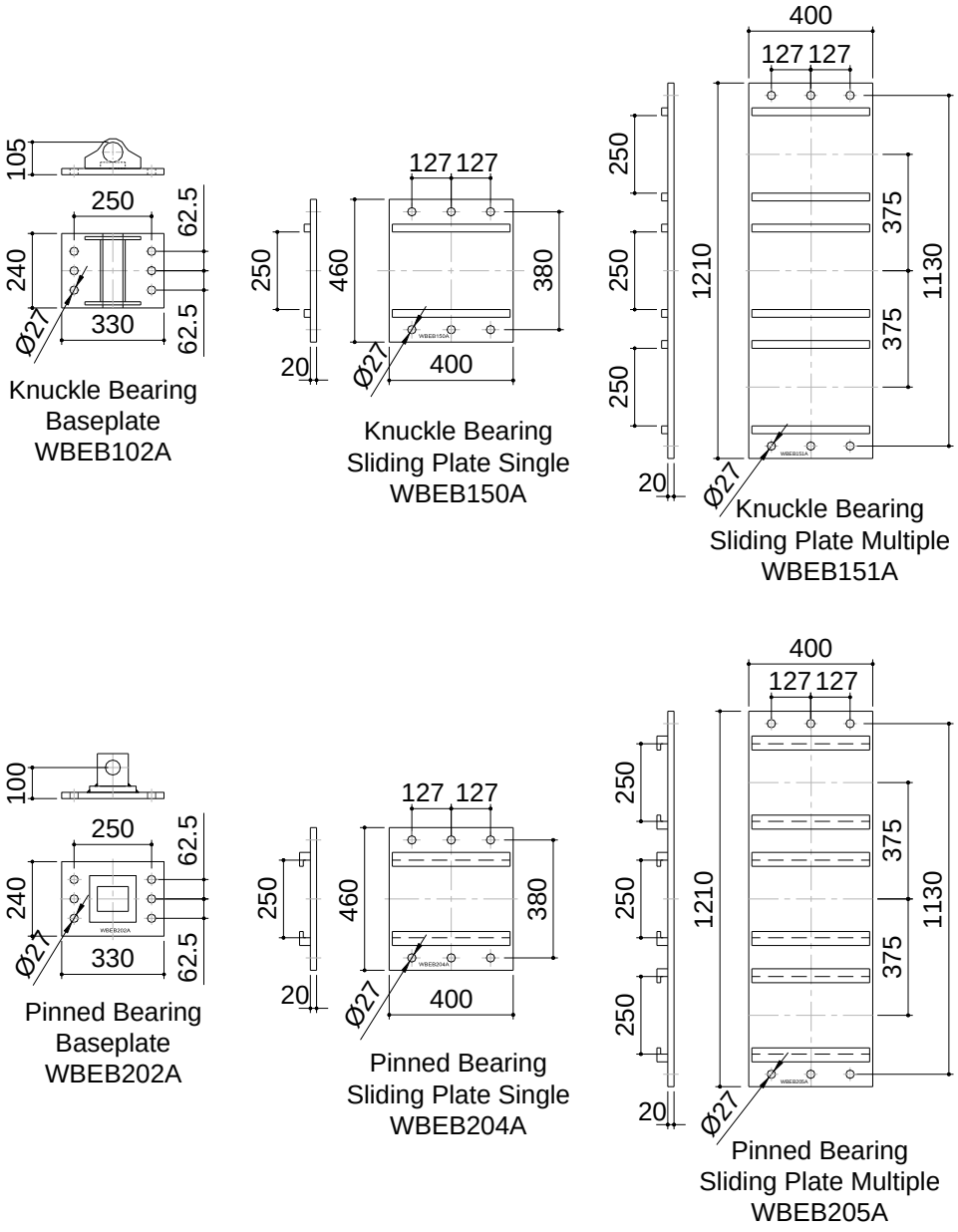


Figure 6.10 – BEARING PLATES DIMENSIONS

NOTES for Figures 6.11 and 6.12 – Abutment and bearing layout:

- '*' Denotes a minimum dimension – exact dimensions are to be determined by the customer to suit the expected ground conditions.
- 'F' and 'G' are dimensions from road level to bottom level of bearing or sliding plate. If required the customer may increase these dimensions by "#" = 25mm to allow for a layer of high strength grout to be used below the bearings.
- 'M' is required distance between the bearing axis and back wall. For Standard Width and Extra Wide bridges 200mm, for Double wide bridges 220mm

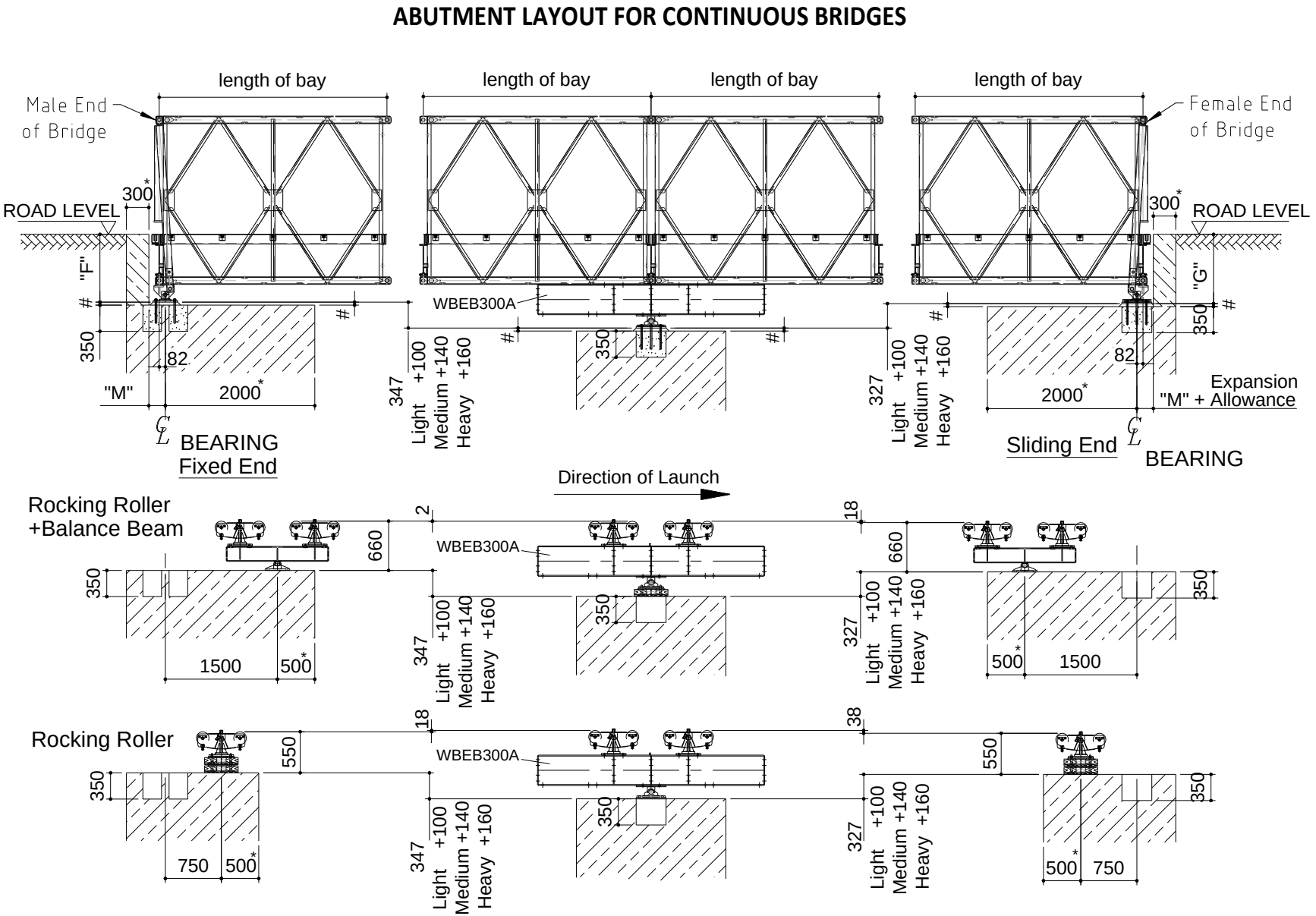


Figure 6.11 – ABUTMENT, BEARING PLATES AND ROLLER LAYOUT FOR SPAN JUNCTION BRIDGES – SIDE VIEW

ABUTMENT LAYOUT FOR CONTINUOUS BRIDGES

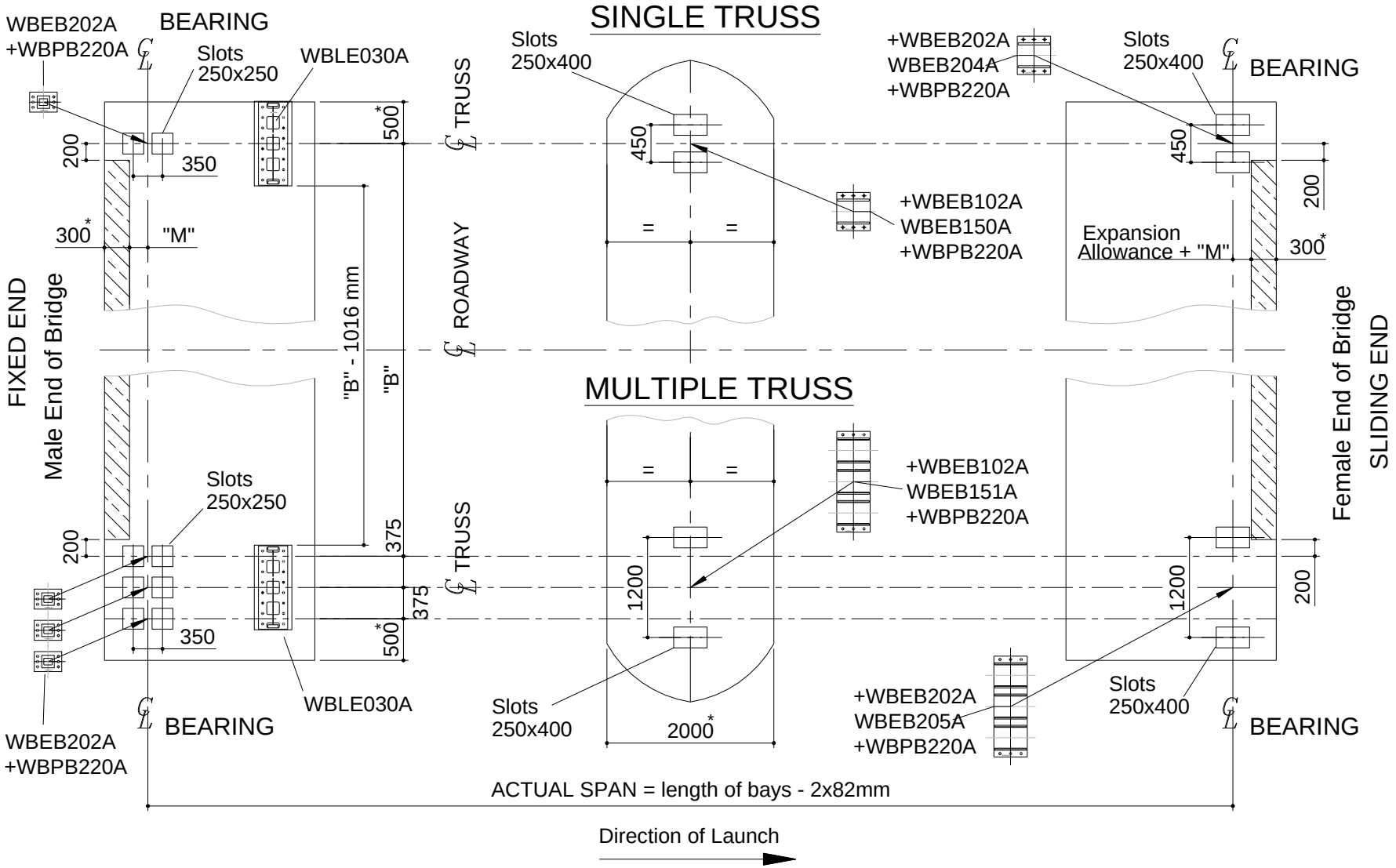


FIGURE 6 12– ABUTMENT, BEARING PLATES AND ROLLER LAYOUT FOR SPAN JUNCTION BRIDGES – TOP VIEW

ASSEMBLY OF THE DISTRIBUTION BEAM EQUIPMENT FOR LAUNCHING

1) The Diaphragms shall be temporarily placed under the Rocking Rollers during launching as per Fig. 6.13.
2) After the bridge has reached the end position the bridge has to be jacked up to remove the Rocking Rollers. It may be necessary to use the Jacking Transom Frame fitted with Jacking Transom Clamps to increase the jacking capacity. (Refer to the Section 7 – Jacking and Fig. 7.18)
3) The Diaphragms under the Rocking Rollers shall be moved from the temporary position under the Rocking Rollers to the end of the Distribution Beam (Fig. 6.2 and 6.3) in the stage where the bridge rests on the jacks.
4) Fit the Locators onto the Distribution Beams in order to transmit the horizontal loads to the bearing. For the correct procedure see above and Fig. 6.2-6.9.
5) Jack down. Take care that the clearance between locator profile and the chord should be around 5mm on each side.

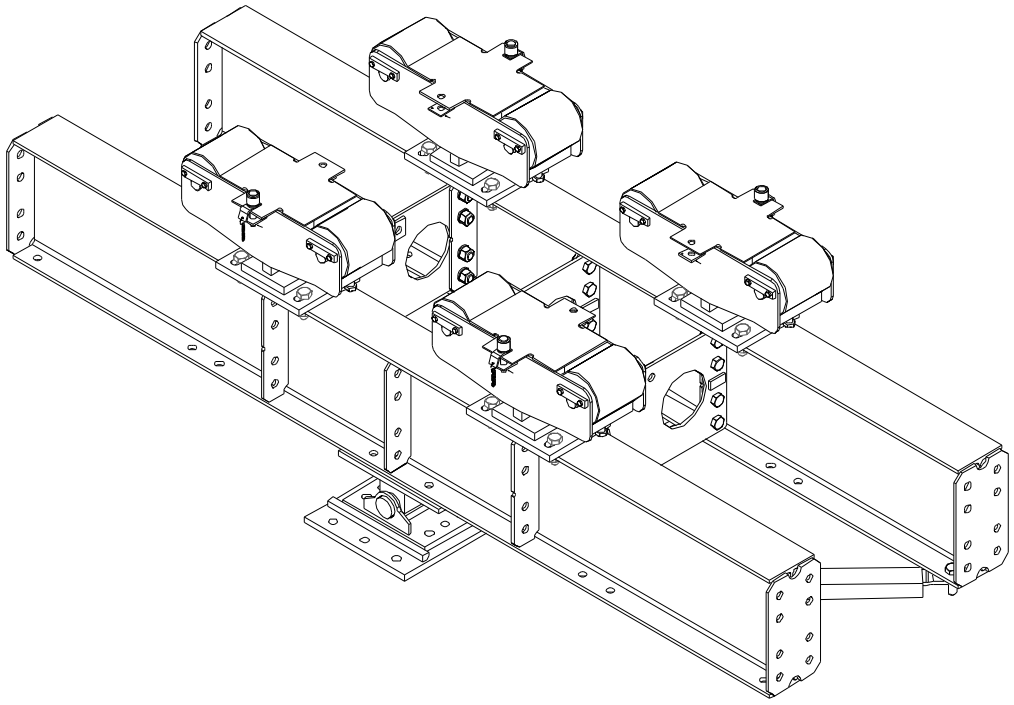


FIGURE 6.13– DISTRIBUTION BEAM ARANGEMENT DURING LAUNCHING

DISCONTINUOUS BRIDGE CONSTRUCTIONS

Discontinuous bridge constructions are used when it is desirable to create simply supported spans that are physically connected together. The following reasons may indicate the use of such a construction:

1. The span lengths are dissimilar and uplift may occur in the shorter span if they were to be made continuous.
2. Launching of two simply supported bridges to meet at a common support is made easier if they are launched as a continuous bridge and then split at the support.
3. If two separate bridges meet at a single support, that support would have to accommodate the two sets of bearings and consequently be of a large cross section.
4. Two dissimilar spans meeting at a single support will exert eccentric loading to the support which must be catered for in the design of the support. A broken span arrangement will ensure that the support can be loaded concentrically.

There are two possibilities of discontinuous bridge constructions:

- Broken Span Equipment
- Span Junction Equipment

BROKEN SPAN EQUIPMENT

This is the easiest way to create a discontinuity between the bridge spans.

Above the intermediate supports the separate spans are connected only by the bottom chord pins. The Broken Span Bearing Blocks are installed below the bottom chord pins.

Minimal rotation around the bottom panel chord pins is possible.

If the bridge is to be launched, the top chord panel pins get removed after positioning over the Broken Span Bearing Blocks. To aid the removal of the pins, it will be necessary to lift the end of the spans, using jacks or a suitable crane, to take the load off the pins at the broken span.

Take care that the maximum shear force of a single or double storey panel line is lower than 200kN to the left and to the right adjacent span of the broken span bearing.

Note:

- It is essential that the two spans meeting at the broken span maintain an equal grade, either horizontal or inclined.
- If any settlement of the foundations is expected, broken span equipment must not be used.
- During operation of the bridge the top chord panel junction (where the pins have been removed) must not disengage.

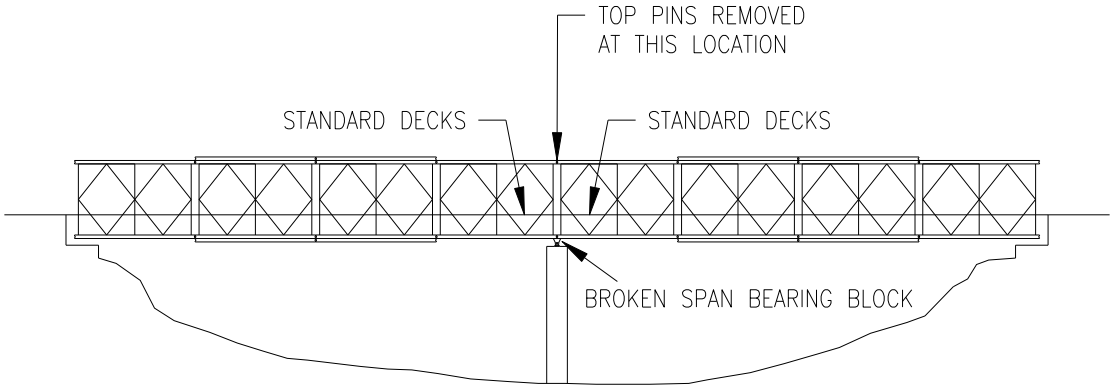


Figure 6.14 – STANDARD BROKEN SPAN CONSTRUCTION

SPAN JUNCTION

Span Junction equipment essentially pins one span to the end of another using special equipment at the junction.

The single pin connection between adjacent panels transfers the vertical shear while allowing free rotation of the bridge spans in the vertical plane.

The connection point and therefore rotation point is at the transom top flange level to allow for changes of slope resulting in minor changes of the gap between the Span Junction Infill Decks and the adjacent Deck Units.

Because of the different height of transoms, the Span Junction Post Female and the Span Junction Post Male are provided with two positions for the pinned connection, the lower hole being for standard and extra wide bridges (transom part no. WBTR002A, WBTR052A, WBTR053A) while the upper hole is used for double wide bridges (transom no. WBTR102A, WBTR103A).

To allow free rotation, note that it is not allowed to connect the upper and lower hole at one set of Span Junction Equipment; and all sets of Span Junction Equipment of one bridge cross section have to be connected in the same position, at the lower or upper hole according to the installed transom (Fig. 6.19).

Take care that the maximum end reaction of a single or double storey panel line is lower that 350kN.

Each Span Junction post has to be checked that:

- the shear forces, right-angled to the deck surface of the adjacent panel, which must be transmitted by the Span Junction Equipment through the span junction bolt, are lower than 350kN.
- the longitudinal force, parallel to the chords of the adjacent panels, which must be transmitted by the Span Junction Equipment through the span junction bolt and comprises the braking forces, the traction forces, the thermal forces and so on, is lower than 150kN per one panel line.

There are two forms of the span junction as follows:

1) Level Span Junction – This form of span junction is used, where the two adjacent spans are fixed on an equal grade, either horizontal or inclined. The two spans are pinned together using the Span Junction Posts and the fixed length Span Junction Infill Decks between the two end transoms (see Figure 6.15).

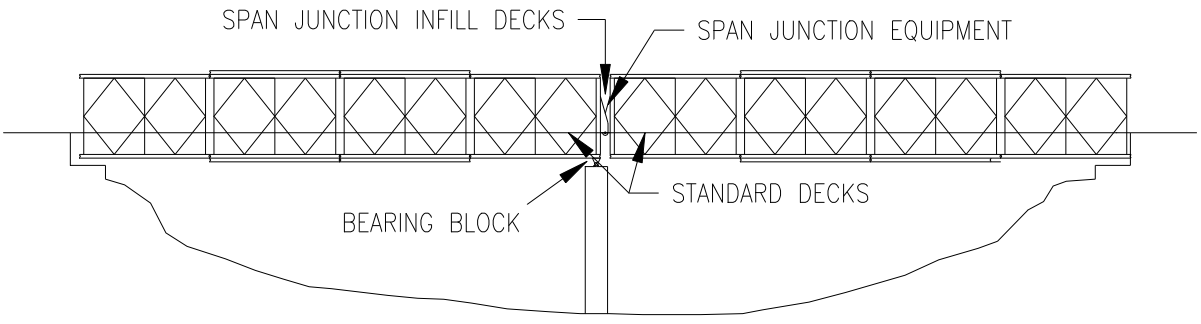


Figure 6.15 - LEVEL SPAN JUNCTION

2) Articulated Span Junction – has the added advantage of allowing full articulation, either in static or dynamic conditions, between adjacent spans within the following movement ranges:

   a) Single Storey Construction – 1 in 5 gradient up or down

   b) Double Storey Construction – 1 in 5 down, 1 in 10 up

   The articulating equipment may be used where inclined ramps are required to meet a horizontal span whilst minimising the support size (see Figures 6.16 and 6.17).

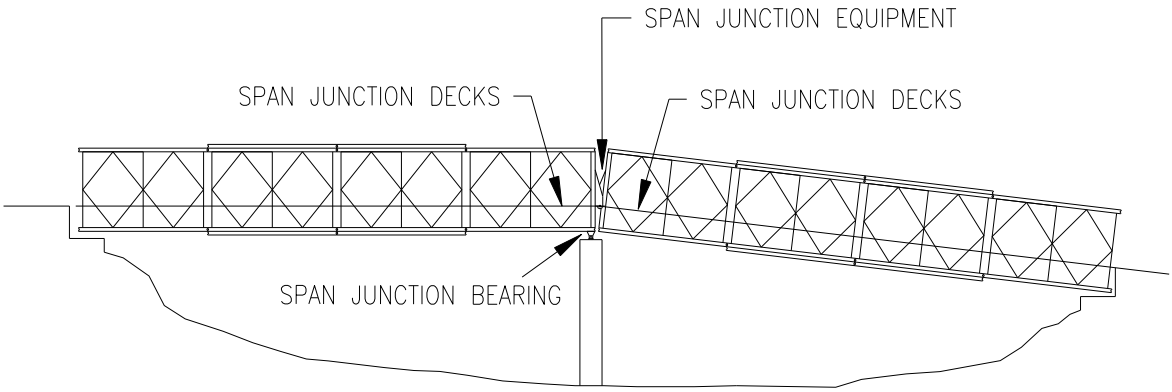


Figure 6.16 - ARTICULATED SPAN JUNCTION - STATIC

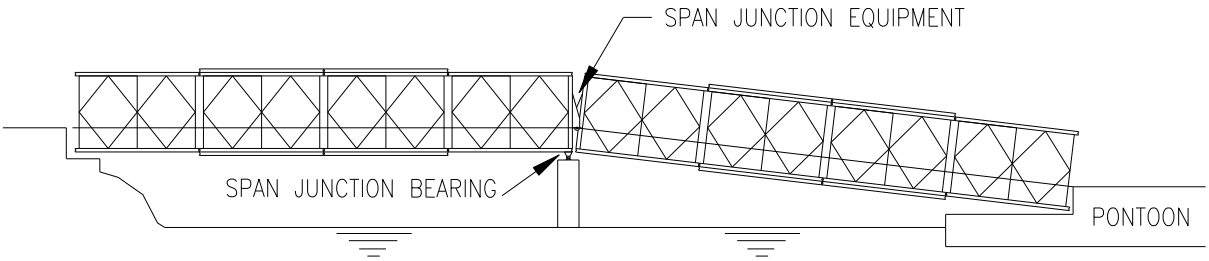


Figure 6.17 - ARTICULATED SPAN JUNCTION - DYNAMIC

Installation of these types of bridges may be carried out by either placing the individual spans using a large crane or by launching.

If the bridge is to be launched, it will be necessary to lock the Span Junction Equipment in a level position using the Span Junction Links for the Panels and the Reinforcing Chords. When the bridge is in its final position, the span junction would be unlocked by removal of all Span Junction Links and, if installed, the Reinforcing Chords of the adjacent panels. In order to remove the pins, it will be necessary to lift the end of the span, using jacks or a suitable crane to take the load off the pins at the span junction. Afterwards the articulated span is lowered onto its bearings.

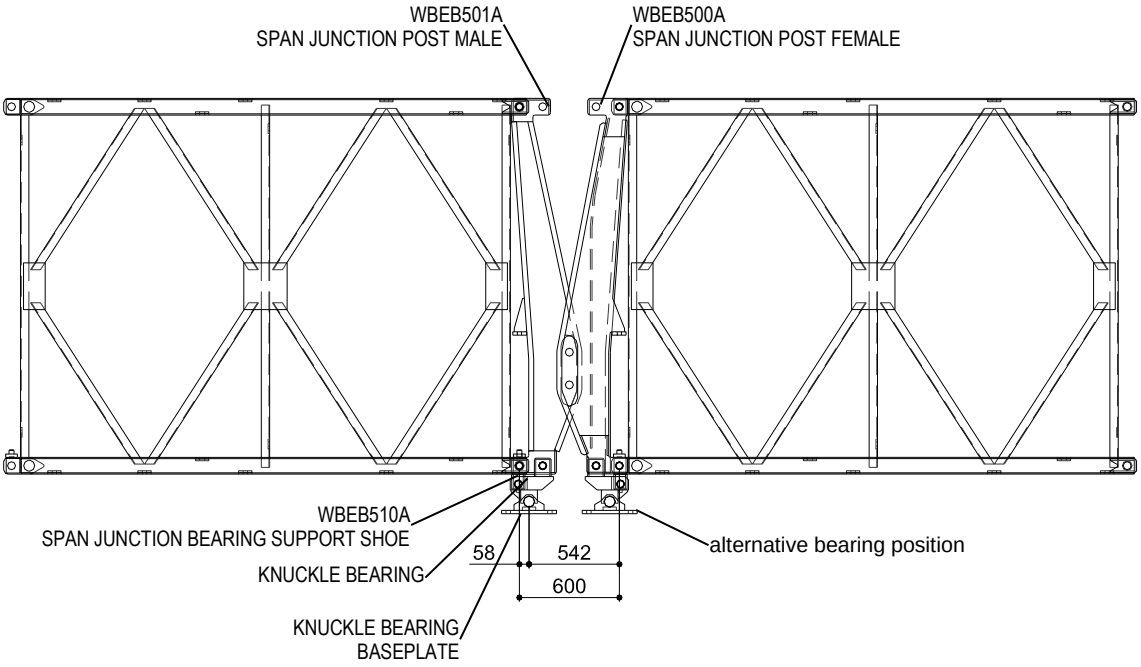


Figure 6.18 – SPAN JUNCTION ARANGEMENT ON BEARING

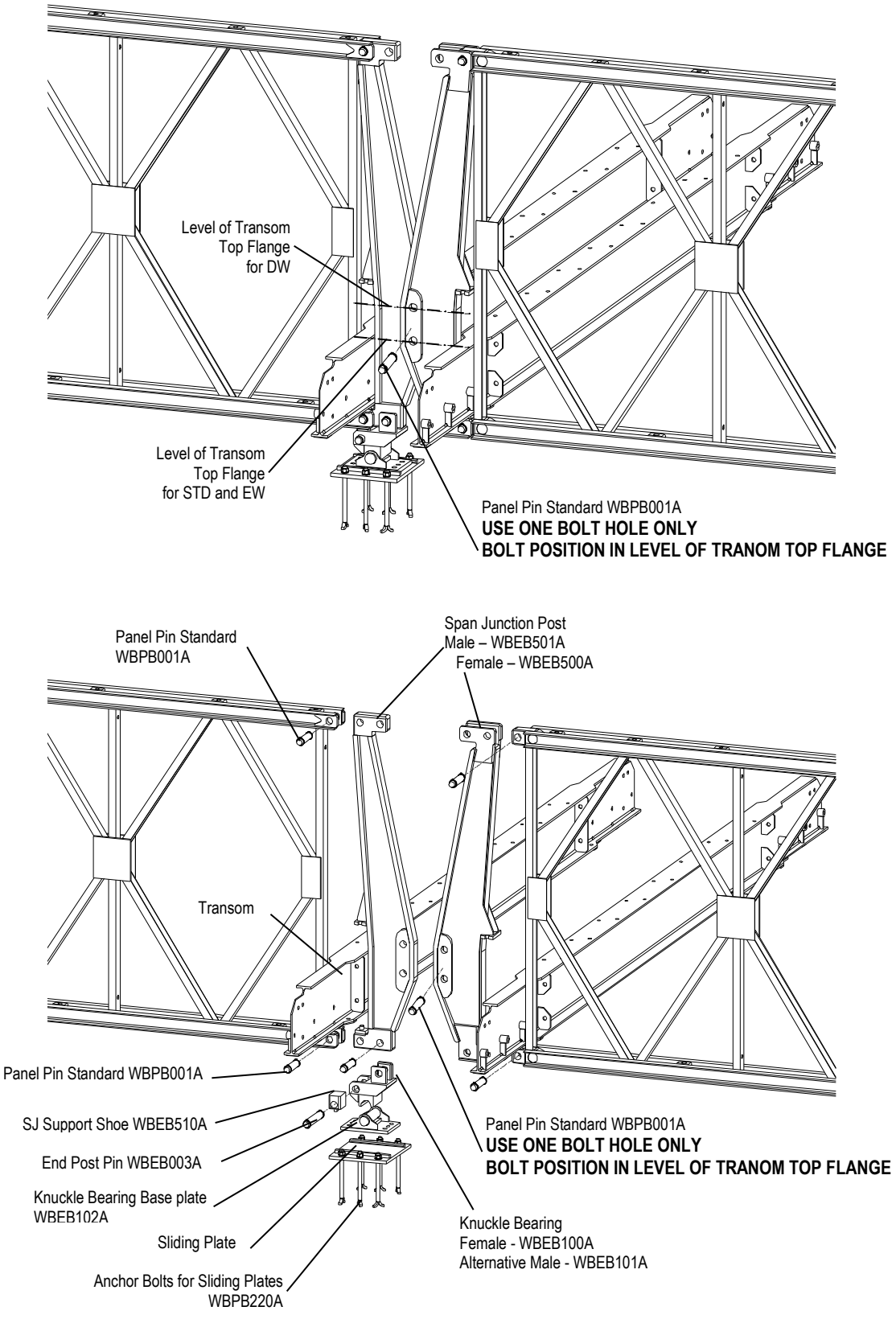


Figure 6.19 –SPAN JUNCTION AND BEARING ASSEMBLY

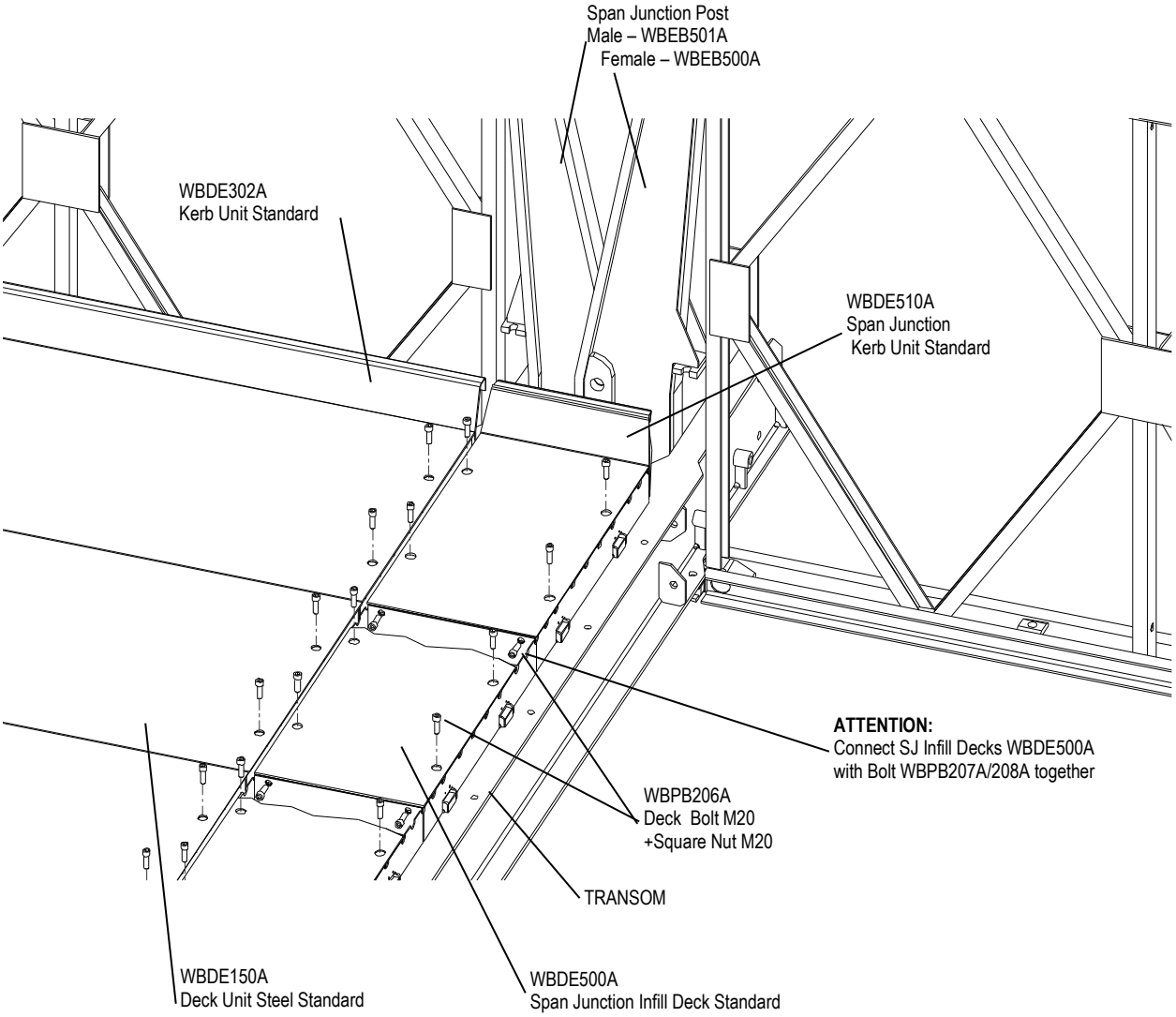


Figure 6.20 –SPAN JUNCTION DECK AND KERB ASSEMBLY

ASSEMBLY OF THE SPAN JUNCTION EQUIPMENT FOR LAUNCHING

1) Pin the Span Junction Post Female to the last panel of the first span.
2) Pin the Span Junction Post Male to the Span Junction Post Female (see notes above).
3) Pin the Span Junction Link Post to the pinned Span Junction Posts.
4) If reinforcing chords are required, install the reinforcing chords at the adjacent panels (last bay in the first span) and pin the Span Junction Reinforcing Link to the Reinforcing Chords of the last bay in the first span. (Fig. 6.21)
5) Place the next transom onto the Span Junction Post Male, transom bolt bosses are facing away from the gap.
6) Install the Span Junction Infill Decks, to take the lateral forces.
7) Pin the first panel of the second span to the Span Junction Post Male.
8) If reinforcing chords are required, install the reinforcing chords at the first panels of the second span.
9) For next assembling steps refer to the assembly of the bridge.

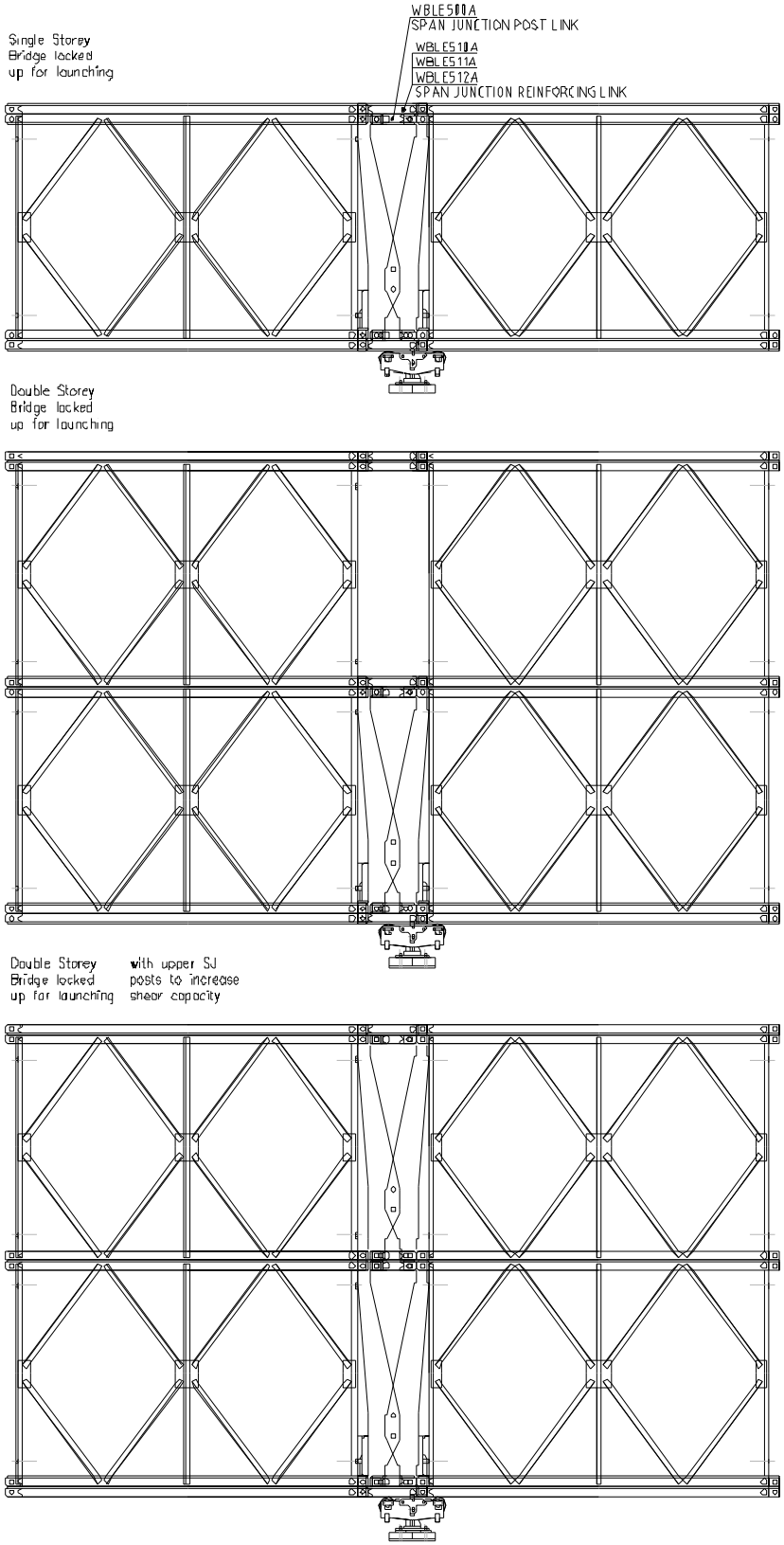


FIGURE 6.21 – SPAN JUNCTION ARANGEMENT DURING LAUNCHING

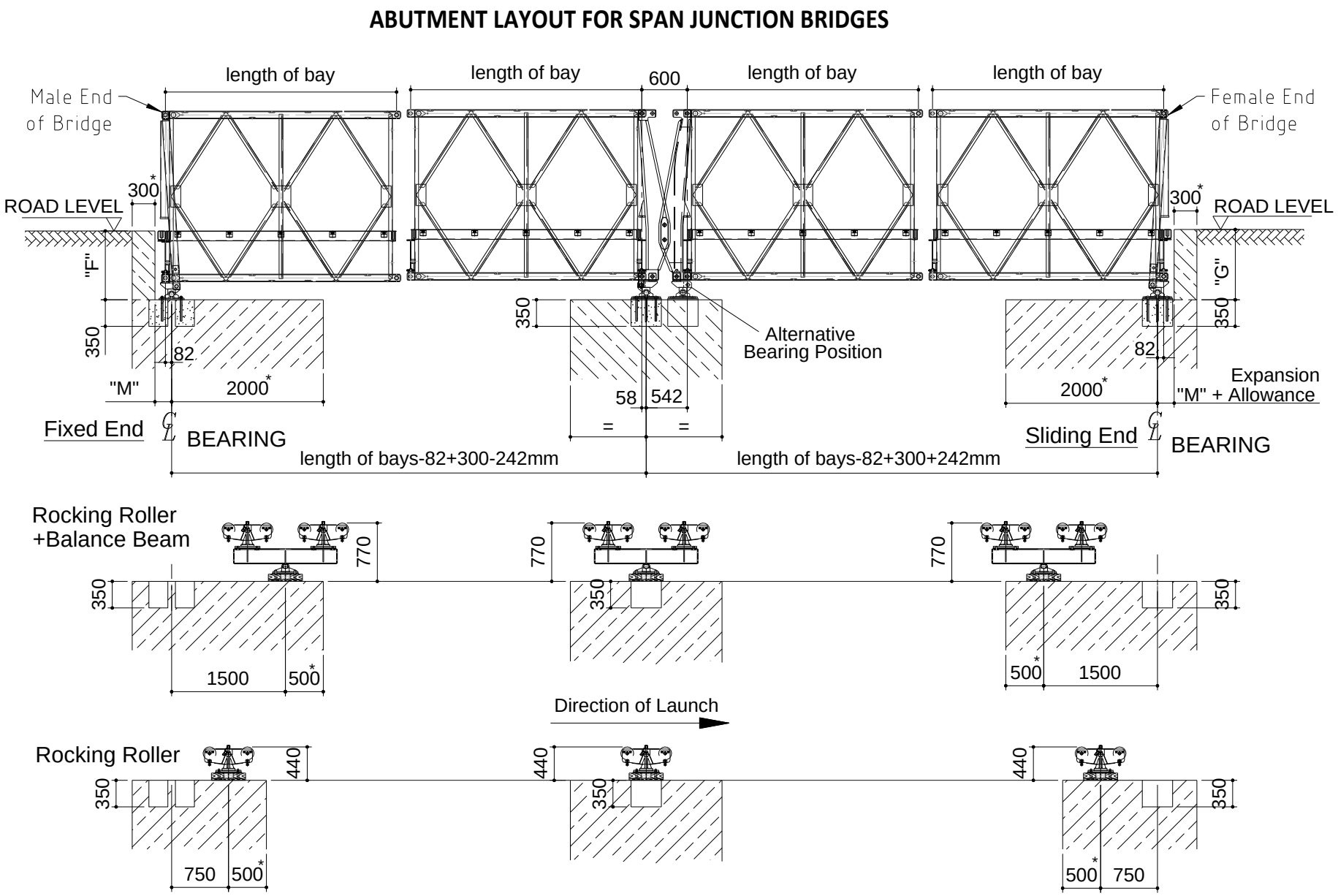


Figure 6.22 – ABUTMENT, BEARING PLATES AND ROLLER LAYOUT FOR SPAN JUNCTION BRIDGES – SIDE VIEW

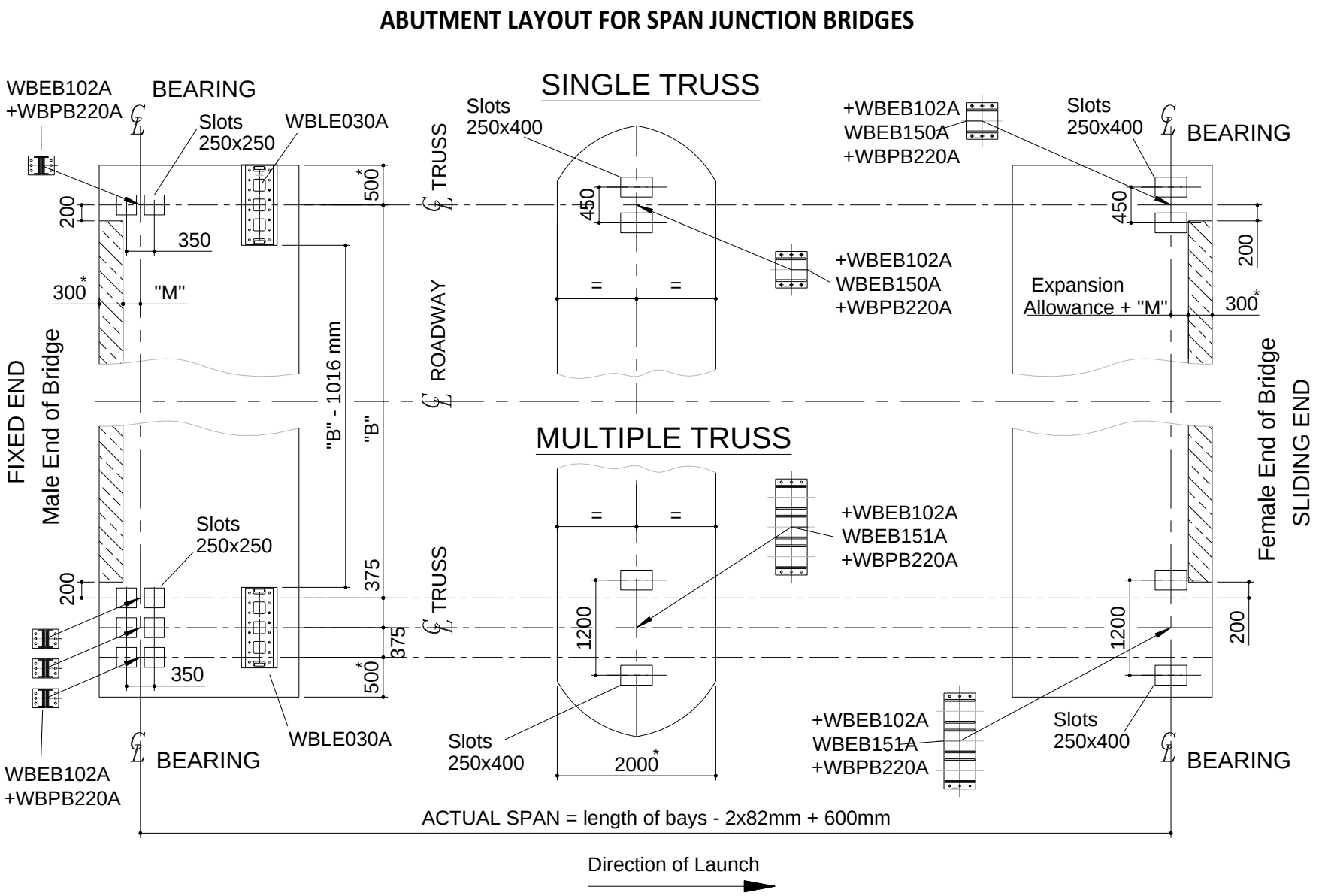


FIGURE 6.23 – ABUTMENT, BEARING PLATES AND ROLLER LAYOUT FOR SPAN JUNCTION BRIDGES – TOP VIEW

ABUTMENT AND BEARING PLATE DIMENSIONS

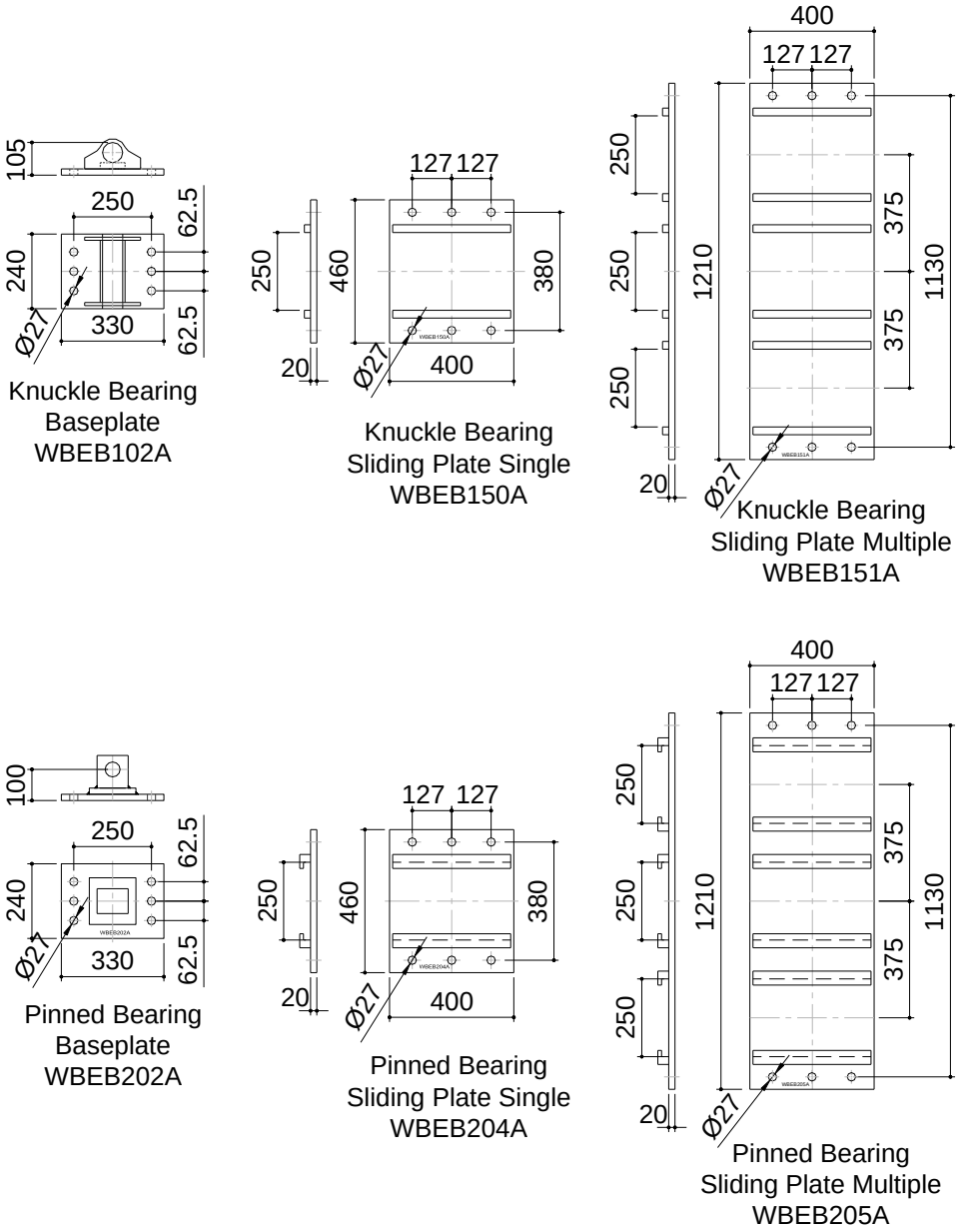


Figure 6.24 – BEARING PLATES DIMENSIONS

NOTES for Figures 6.22 and 6.23 – Abutment and bearing layout:

- '*' Denotes a minimum dimension – exact dimensions are to be determined by the customer to suit the expected ground conditions.
- 'F' and 'G' are dimensions from road level to bottom level of bearing or sliding plate. If required the customer may increase these dimensions by 25mm to allow for a layer of high strength grout to be used below the bearings.
- 'M' is required distance between the bearing axis and back wall. For Standard Width and Extra Wide bridges 200mm, for Double wide bridges 220mm

SECTION 7

BRIDGE CONSTRUCTION

INTRODUCTION

The aim of this section of the handbook is to identify the launching and construction requirements. Construction procedures may vary form site to site. Although this guidance is generally based on building a simply supported through bridge, the principles are similar to other types of construction.

Two methods of building are common:

- Lifting in
- Cantilever launch

The lifting in method is only possible, where sufficiently large cranes are available. Where possible, the bridge is constructed, usually without the deck units, alongside the gap or on one bank. Afterwards the whole structure is lifted into position. This method has the advantage that no launching equipment is required.

The majority of bridges are installed using the cantilever launch method. This procedure uses a lightweight launching nose added to the front of the bridge, special rollers placed below the trusses and the combined bridge/nose pushed over the gap to land on temporary rollers on the far bank.

The assembly procedure of the bridge most suited to this method of installation is described below even though it will be applicable to most other installation methods.

The construction sequence for a typical cantilever launch is usually as follows:

1. Launching Design
2. Construction of the Abutments
3. Preparation of the Launch Plain
4. Layout of the Rollers
5. Assembly of the Launching Nose
6. Assembly of the Bridge
7. Installation of Counterweight (if necessary)
8. Launching the Bridge
9. Launch Nose Removal
10. Jacking Down

Throughout the construction phase, the work must be supervised by a suitably experienced engineer.

SUPERVISING ENGINEERS DUTIES

1. Responsible for safety.
2. To ensure that he has all the relevant drawings and technical manuals for the bridge.
3. To check that the components delivered to site are sufficient for the bridge to be constructed.
4. To check that the bridge is the correct span for the gap.
5. To check that the launching method is suitable to the site.
6. To check the setting out of the bridge.
7. To ensure the correct layout and level of the launching rollers in accordance with this technical manual.
8. To ensure that the bridge is constructed safely and in accordance with this technical manual and any working drawings supplied by Waagner-Biro.
9. To check the centre of gravity of the structure, at all stages of construction, and ensure that there is no tendency for the structure to tip.
10. To ensure that the structure, at all stages of construction, is prevented from moving on the rollers and is only released during the launching operation.
11. To check that the bridge alignment is correct at all stages of construction and launch.
12. To decide at what stage the bridge may be partially launched to aid the construction operations.
13. To ensure that jacking operations are carried out safely.
14. To carry out a final inspection of the bridge to ensure that the bridge is complete according to the drawings/manual with all bolts and pins correctly installed.
15. To ensure that the gap between the End of Bridge Infiller and the concrete back wall is not more than 20 mm at fixed end and 20mm + expansion allowance (depending on the erection temperature) at sliding end of the bridge. See also measurement “M” in Figure 2.4. –Abutment layout.
    In case the End of Bridge Infiller with expansion plate is used, ensure that there is no vertical gap between the bottom edge of expansion plate and the top edge of the concrete back wall. Ensure also that there is free sliding way for the expansion plate. The Bolts of the End of Bridge Infiller shall be tightened as strong as possible.

LAUNCHING DESIGN

In Section 3 the launching design is described, including the following calculations, which must be carried out prior to constructing the bridge to ensure that sufficient equipment is on site and used to complete the structure safely and to facilitate a successful launch.

1. Launching Nose Design
2. Launching Link Location
3. Centre of Gravity Calculations
4. Counterweight Requirements
5. Roller Design
6. Jacking Loads

CONSTRUCTION OF THE ABUTMENTS

The abutments must be designed and detailed to suit the particular bridge construction and ground conditions at the site.

If possible they should be wide enough to accommodate the roller system in front of the bearings which eliminates the need to fit a tail on the bridge.

If the bridge is to be launched it is beneficial to leave the ballast wall off the abutment. This will allow for the bridge to be launched at a lower level and will reduce the amount of jacking that will otherwise be required. Even if the bridge is to be lifted into position there is always a tendency for the ballast walls to be misaligned with the end of the decks. Casting the walls after installation will produce a better match between approach road and deck.

PREPARATION OF THE LAUNCH PLAIN

The launch plain, ideally, should be the length of the bridge being installed, with its width equivalent to the overall width of the bridge plus 1.5 metre on either side for access to build the bridge (see Fig 7.1). The landing area should normally allow for the complete launching nose to pass to avoid unnecessary stopping of the launching.

The bridge stores area should be located within easy reach of the construction crane, as excessive handling of equipment will slow down construction considerably.

The launch plain should be level and horizontal for a horizontal bridge. If the final alignment of the bridge is to be inclined it is possible to grade the launch plain to the same inclination. Please note that for an inclined launch additional pushing power (uphill launch) or additional restraint forces (downhill launch) must be considered when specifying the method of propulsion.

LAYOUT OF THE ROLLERS

It is very important that the launching rollers are set up to the correct line and level and are placed on adequate foundations, either temporary or permanent. Great care must be taken at the setting up stage to ensure that the launch will be as trouble free as possible.

The number of rollers and their positions on the launch plain will be dictated by the ground conditions, launch weight and truss configuration of the entire structure. It is usual that the main launching and landing rollers are placed in front of the bridge bearing positions. This ensures that the minimum quantity of launching equipment is required. The specific distance at which the rollers are placed in front of the bearings depends on whether balance beams are used or not. Adequate room for positioning the rollers on the abutments must be provided during the design of the abutment as the entire launch weight of the bridge will be transferred to the main launching rollers during the launch.

If the rollers must be positioned at the bearing locations the bridge will have to be fitted with a tail bay so as to prevent the bridge running off the rollers.

The construction rollers are arranged on the launch plain, normally at a maximum spacing of 9.25m centre to centre; if the ground conditions are very poor then closer spacing may be required or concrete foundations provided. It is preferable to space the single rollers in 7.6m distance in case of short bridges with up to 5 bays.

Please refer to the Figures 7.2 to 7.8 for launching tools, possibilities in combining these tools to launch the different bridge truss configurations, the main dimensions and the use of bolts to connect the tools.

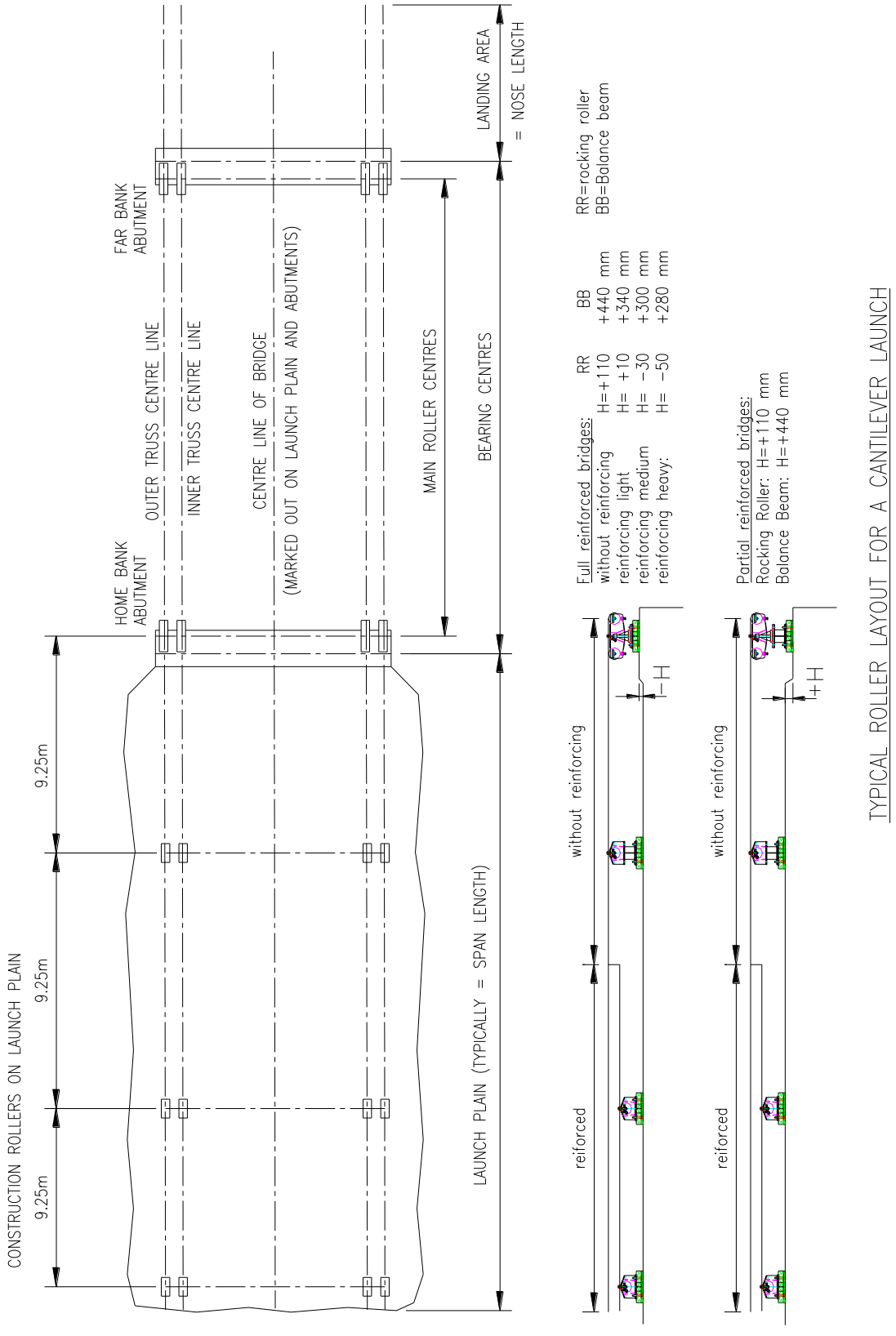


Figure 7.1 – TYPICAL ROLLER LAYOUT FOR A CANTILEVER LAUNCH

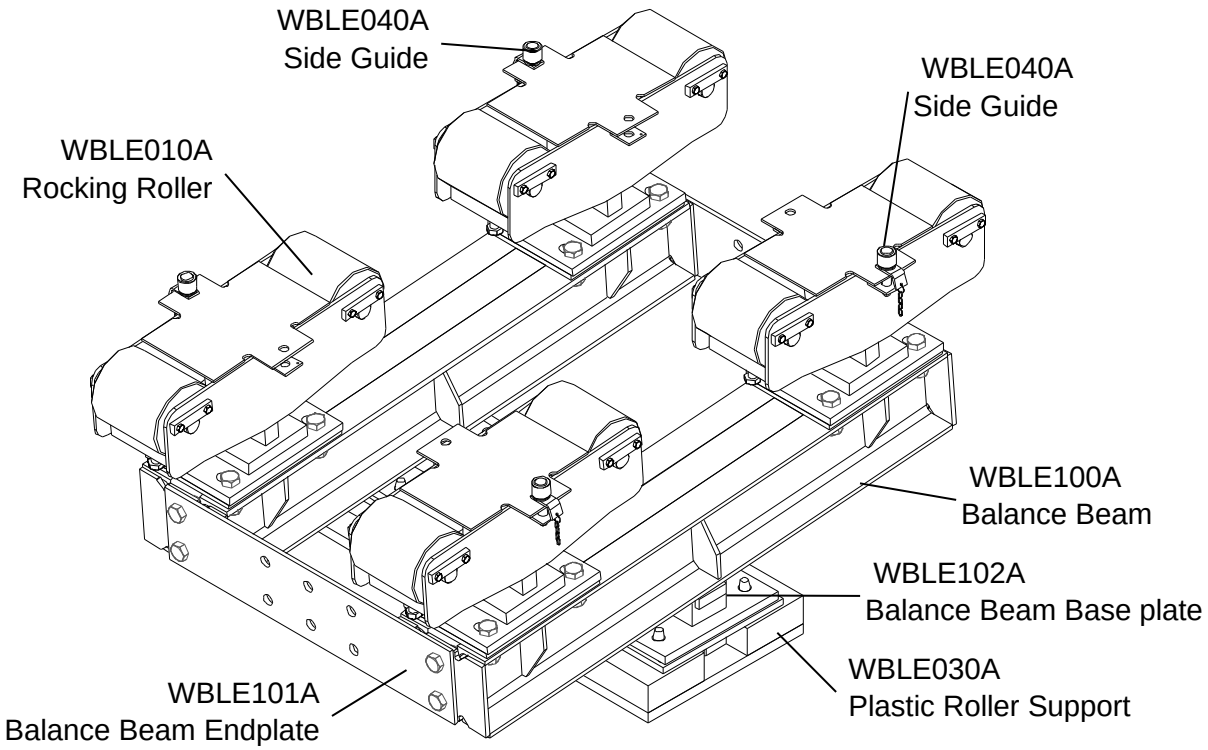
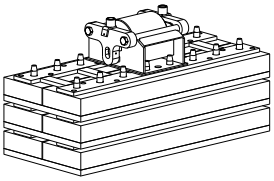
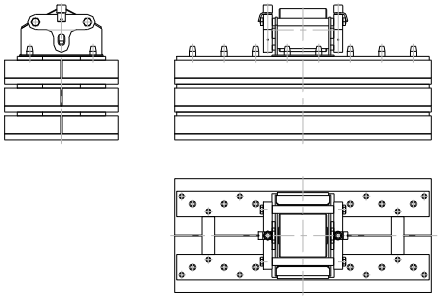


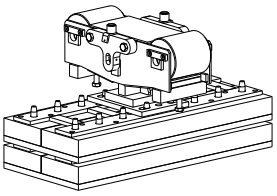
Figure 7.2 – ROCKING ROLLERS ON BALANCE BEAM

Views on construction rollers, set up on three stacked timber bases for single-type constructions





Views on rocking roller, set up on two stacked timber bases for single-type constructions



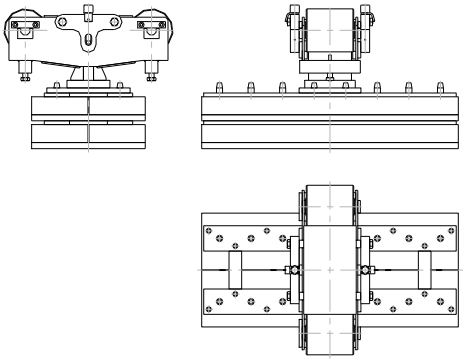
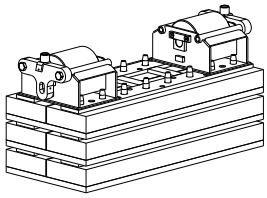
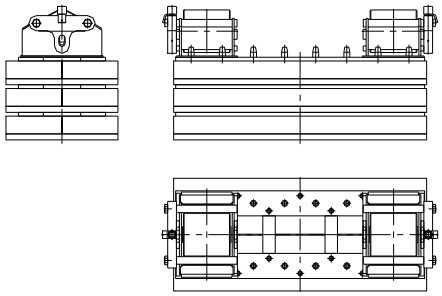


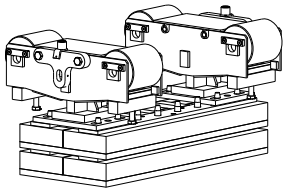
Figure 7.3 – LAUNCHING TOOLS FOR SS TRUSS CONFIGURATIONS

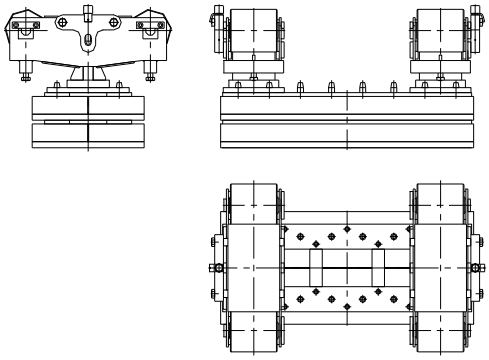
Views on construction rollers, set up on three stacked timber bases for double-single and double-double-type constructions



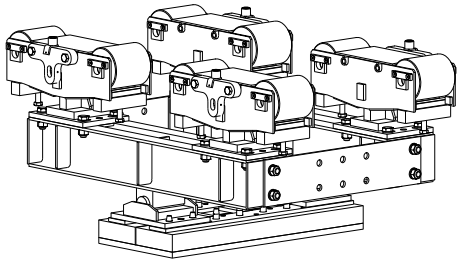


Views on rocking rollers, set up on two stacked timber bases for double-single and double-double-type constructions





Views on rocking rollers, set up on balance beam for double-single and double-double-type constructions



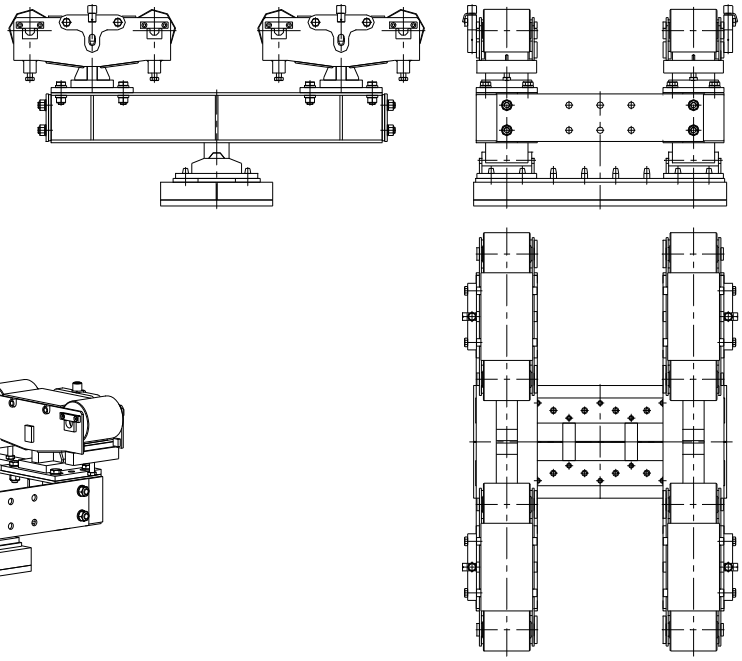
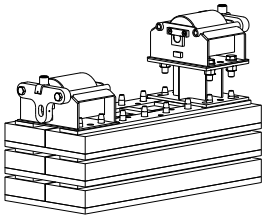
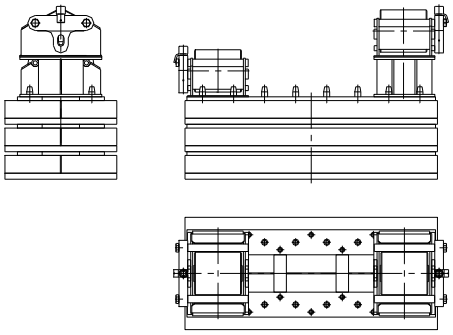


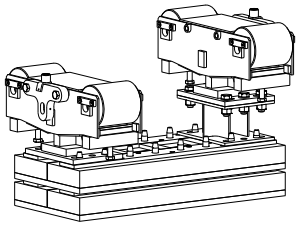
Figure 7.4 – LAUNCHING TOOLS FOR DS AND DD TRUSS CONFIGURATIONS

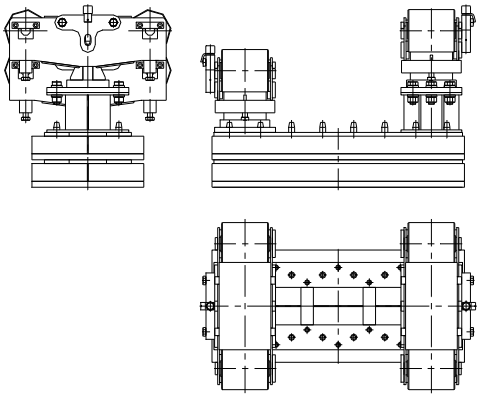
Views on construction rollers for partially reinforced trusses, set up on three stacked timber bases for double-single and double-double-type constructions



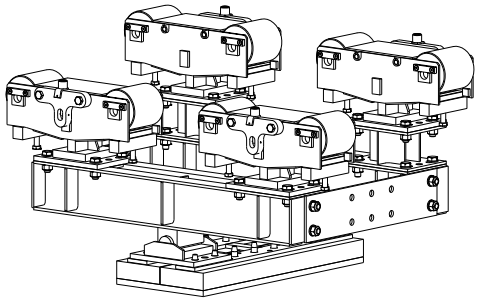


Views on rocking rollers for partially reinforced trusses, set up on two stacked timber bases for double-single and double-double-type constructions





Views on rocking rollers for partially reinforced trusses, set up on balance beam for double-single and double double-type constructions



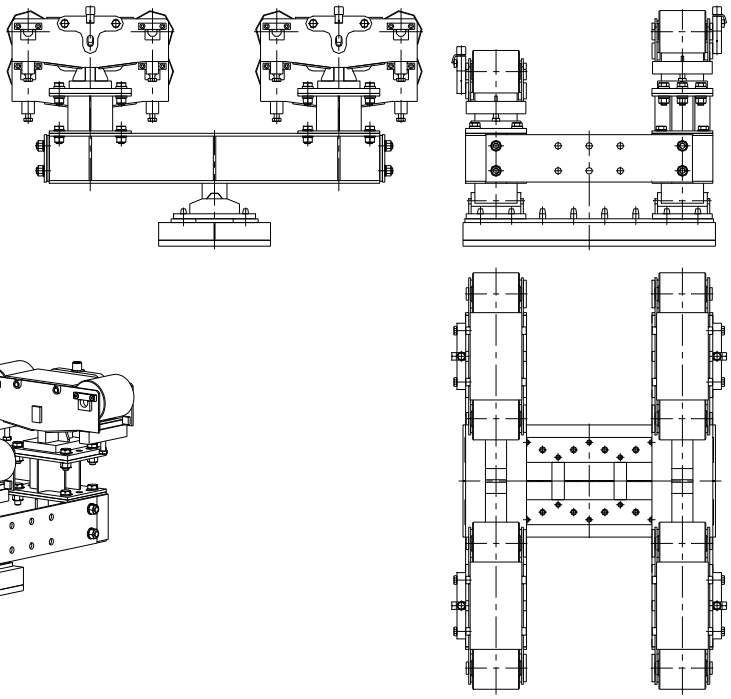
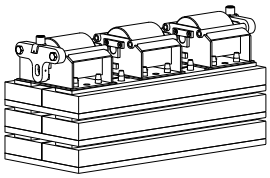
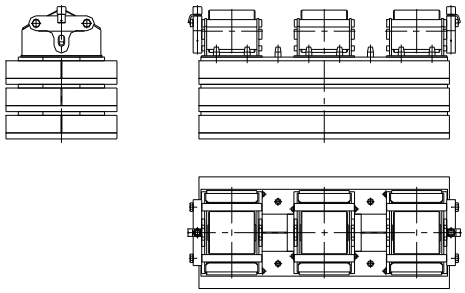


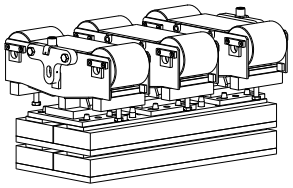
Figure 7.5 - LAUNCHING TOOLS FOR PARTIALLY REINFORCED DS AND DD TRUSS CONFIGURATIONS

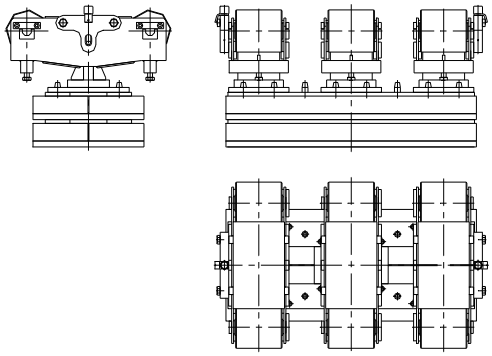
Views on construction rollers, set up on three stacked timber bases for triple-single and triple-double-type constructions



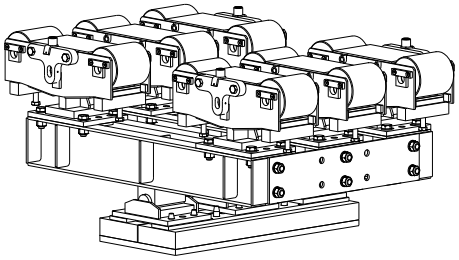


Views on rocking rollers, set up on two stacked timber bases for triple-single and triple-double-type constructions





Views on rocking rollers, set up on balance beam for triple-single and triple-double-type constructions



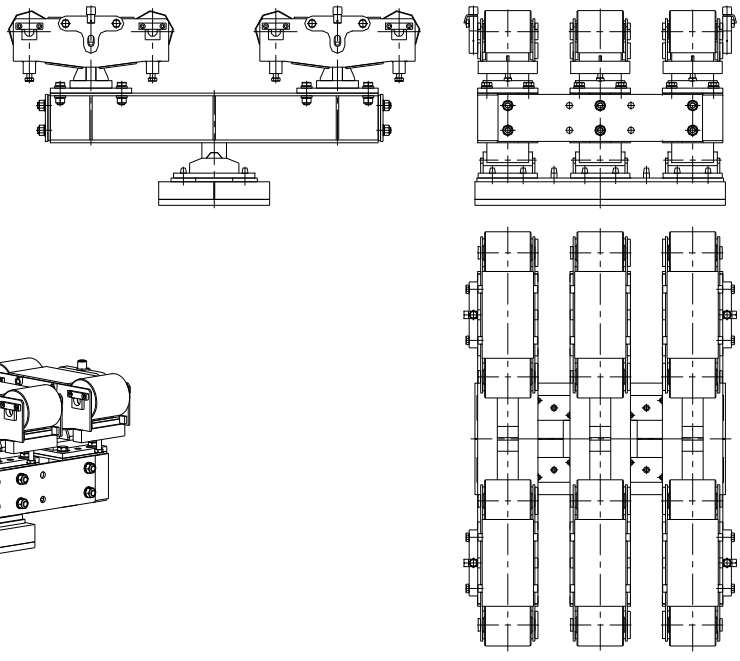
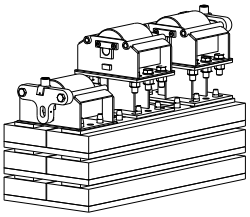
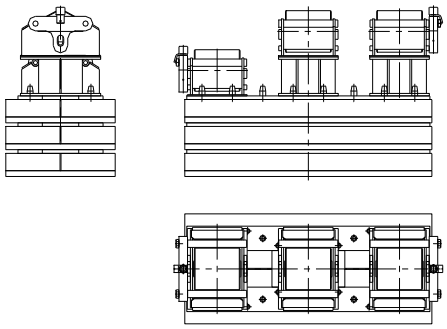


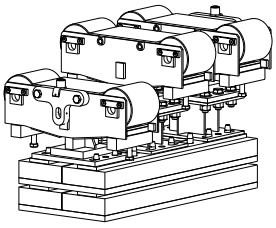
Figure 7.6 – LAUNCHING TOOLS FOR TS AND TD TRUSS CONFIGURATIONS

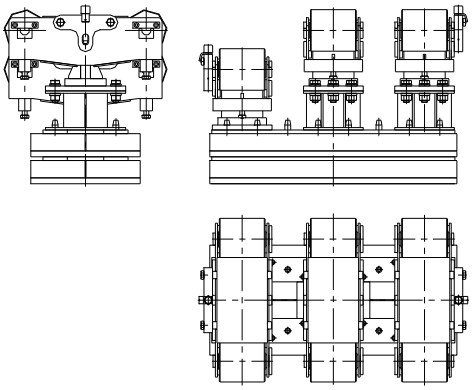
Views on construction rollers for partially reinforced trusses, set up on three stacked timber bases for triple-single and triple-double-type constructions



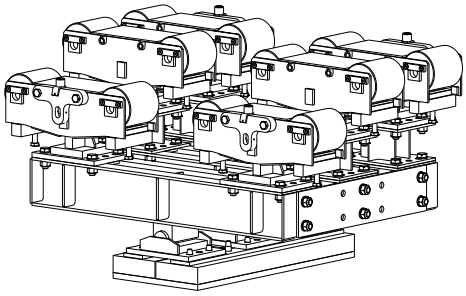


Views on rocking rollers for partially reinforced trusses, set up on two stacked timber bases for triple-single and triple-double-type constructions





Views on rocking rollers for partially reinforced trusses, set up on balance beam for triple-single and triple-double type constructions



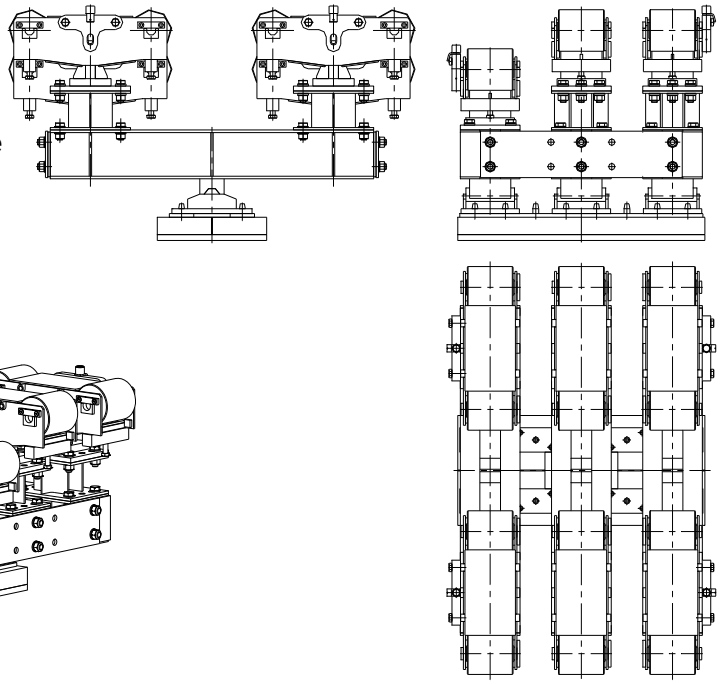


Figure 7.7 - LAUNCHING TOOLS FOR PARTIALLY REINFORCED TS AND TD TRUSS CONFIGURATIONS

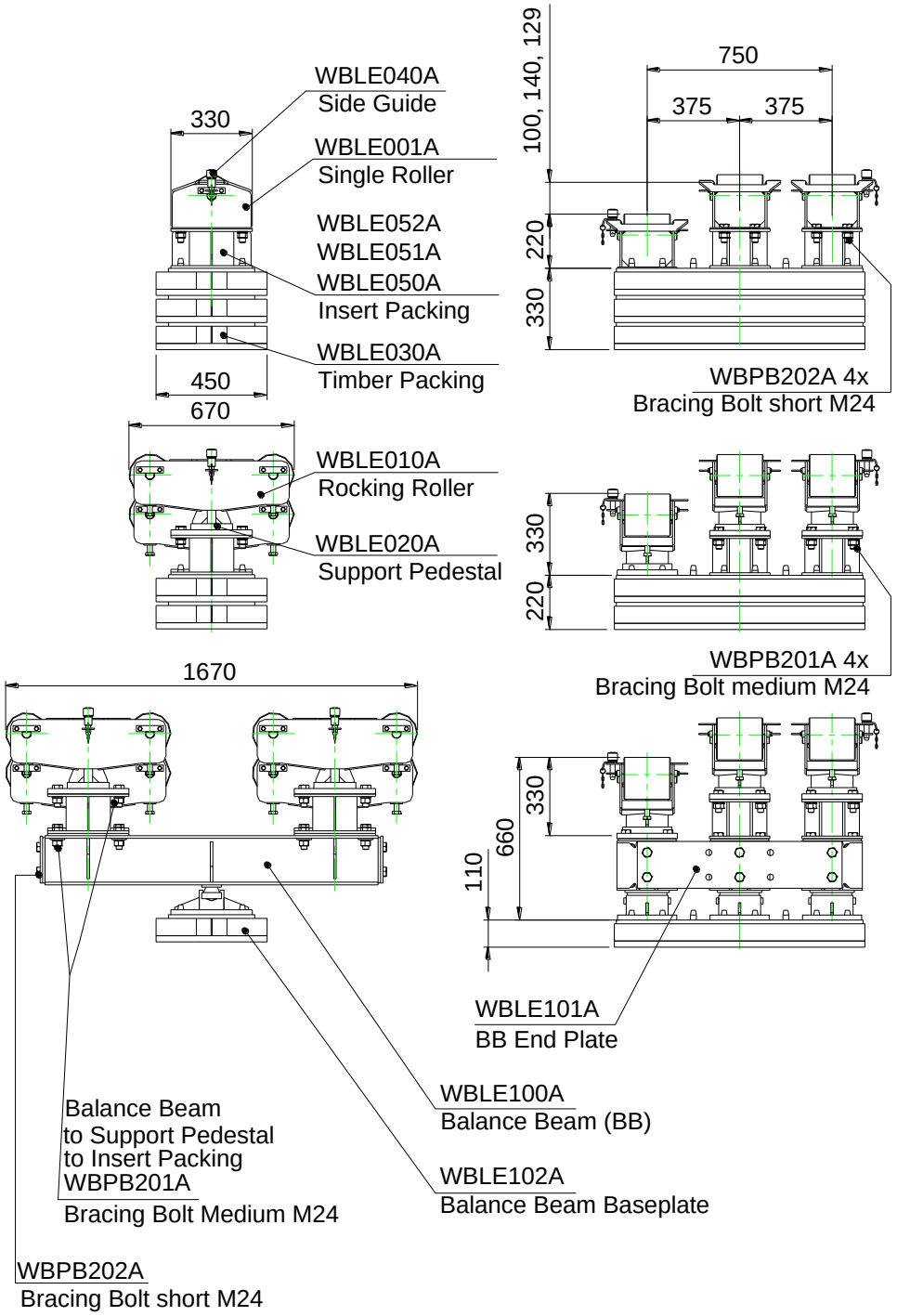


Figure 7.8 – LAUNCHING TOOLS; CONNECTIONS AND DIMENSIONS

ASSEMBLY OF THE LAUNCHING NOSE

GENERAL NOTES ON BRIDGE CONSTRUCTION

1) The bridge is assembled with the FEMALE end of the panel towards the gap to be bridged.
2) The transom seat location is always directly above the panel connecting pin of the bottom chord.
3) Transoms are typically bolted to the vertical panel member at the male end of the panel. Only at the female end of bridge, the tip of the nose and at certain modifications to the truss construction within the nose are the transoms bolted to the female end of the panel. In these special cases the transoms are turned around so that the transom bolt boss is aligned and positioned against the female panel upright. The transom bolt boss fulfils a carrying function between panel and transom.
4) Transom braces are only fitted into the bridge section, they are not used within the nose.
5) Double Storey construction – The upper storey panels are usually constructed one bay behind the lower storey construction.
6) Bolt Tightening – Bolts are initially tightened by hand; only when the bay that is being worked on is complete the previous bay can be fully tightened. All bolts are to be fully tightened using normal hand tools – there is no requirement for mechanical tightening. Make sure, that at any time no more than three bays of the partially built structure have un-tightened bolts.
7) Always check the stability of the partially built structure, adding and removing timber packing as necessary. During the construction of the bridge the supervising engineer must always know the location of the centre of gravity of the structure. This information is used to determine the location of packs on which the bridge is constructed and how far the structure may be safely moved during a launch operation.
8) Avoid overloading of the launching rollers.
9) Always prevent the bridge structure to move accidentally on the launching rollers.
10) During the launch, ensure that the rollers are not pushed forwards.
11) Check the alignment of the bridge structure after every movement.

NON STANDARD LAUNCHING NOSE EQUIPMENT

It has been assumed in this manual that the launching nose is constructed using standard Waagner-Biro bridge panels. It is possible to utilise the panels of other bridge systems (Bailey for instance) but special adapters are required in order to connect the two systems.

The transoms within the launching nose again are assumed to be standard road transoms. In order to make the launching nose lighter and therefore more efficient, it is possible to use special lightweight launching nose transoms.

Further information on these two special components may be obtained from Waagner-Biro upon request.

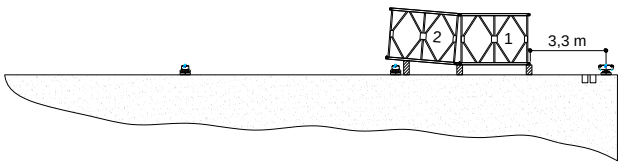
LAUNCHING LINKS

During a cantilever launch the tip of the launching nose will deflect downwards. To compensate for this effect, Launching Links are introduced into the nose. The number and location of the Launching Links will vary with the amount of 'kick up' as shown in Fig. 3.5. Wherever a Launching Link is incorporated into the nose, there will be a need to add Sway Brace Extension Plates. Note that Launching Links are never inserted more than four bays back from the tip of the nose. Never fit two sets of Launching Links at the same position.

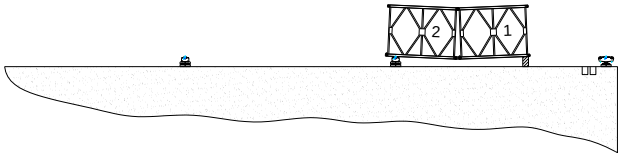
Depending on where the Launching Links are to be fitted will affect the assembly procedure for the nose and will make one of the two described methods more suitable:

- Fit the Launching Links during assembly of the nose
    1. Pin the Launching Links with the female side to the end of the previously completed bay.
    2. Pin the panels with the female side to the top chord end of the previously completed bay and to the male side of the Launching Link on the bottom chord.
    3. Due to the increased distance between the transoms of the adjacent bay to the previous one, Sway Brace Extension Plates are added.
- Introduce Launching Links within by raising the rear of the adjacent bay
    1. The previous bay(s) is (are) completed, and the adjacent bay is fitted in the same way it is done without using Launching Links. The panel pins in the bottom chords and the sway braces in the adjacent bay may be omitted; alternatively, you may dismount them again.
    2. Raise the rear of the adjacent bay, both trusses simultaneously.
    3. Insert the Launching Links and pin them to the bottom chords of the previous bay and the adjacent one.
    4. In addition, fit the Sway Brace Extension Plates to the adjacent bay.

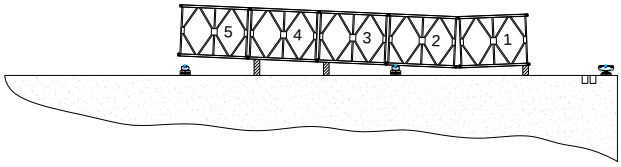
Figures 7.9 to 7.12 illustrate typical procedures for nose constructions with Launching Links. These procedures must be incorporated into the general construction sequences described further on in this section.



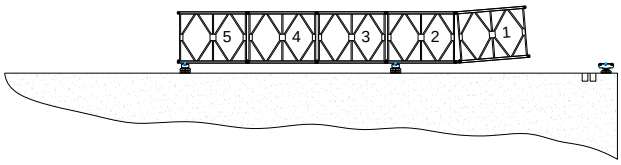
Build bay 1 on packing 3.3 m behind the axis of main launching rollers
Fit Launching Links to the bottom chord of bay 1
Add bay 2, ensure stability of combined unit using additional packing under bay 2



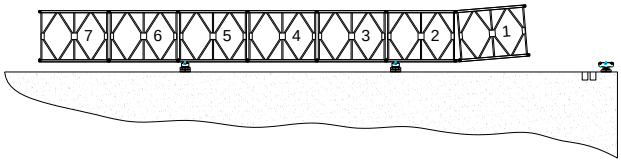
Lower combined unit onto construction rollers
Leave packing at front of bay 1



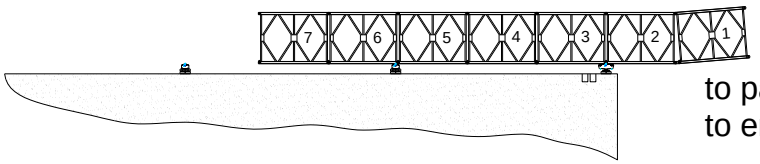
Add bays 3, 4 and 5
Ensure stability of bay 3 and 4 with packing



Lower combined unit onto second set of construction rollers to level the unit on construction rollers

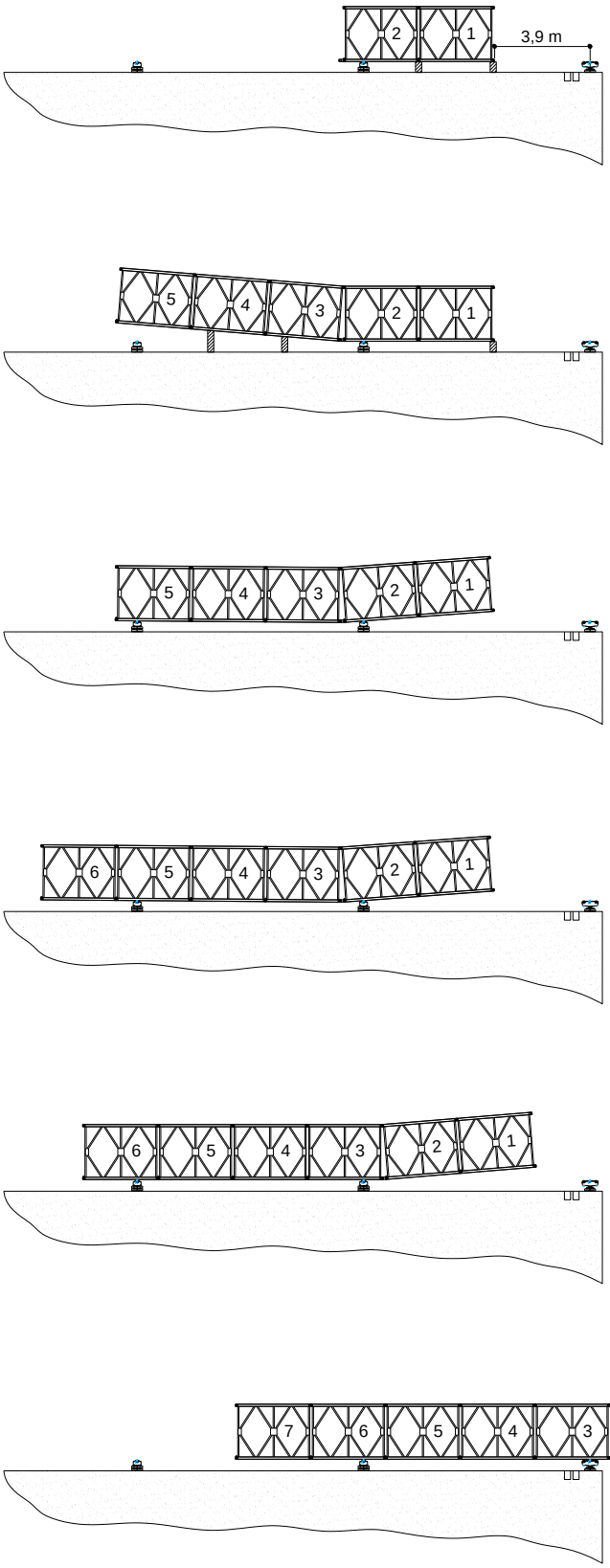


Add bays 6 and 7



At this stage it is possible to partially launch the unit forward to engage the main launch rollers

Figure 7.9 - LAUNCHING LINKS BETWEEN BAYS 1 AND 2



Build bay 1 on packing 3.9 m behind the axis of main launching rollers
Add bay 2, supporting the rear of bay 2 on the construction rollers
Fit Launching Links to the bottom chord of bay 2

Add bays 3, 4 and 5, supporting bays 3 and 4 on packing

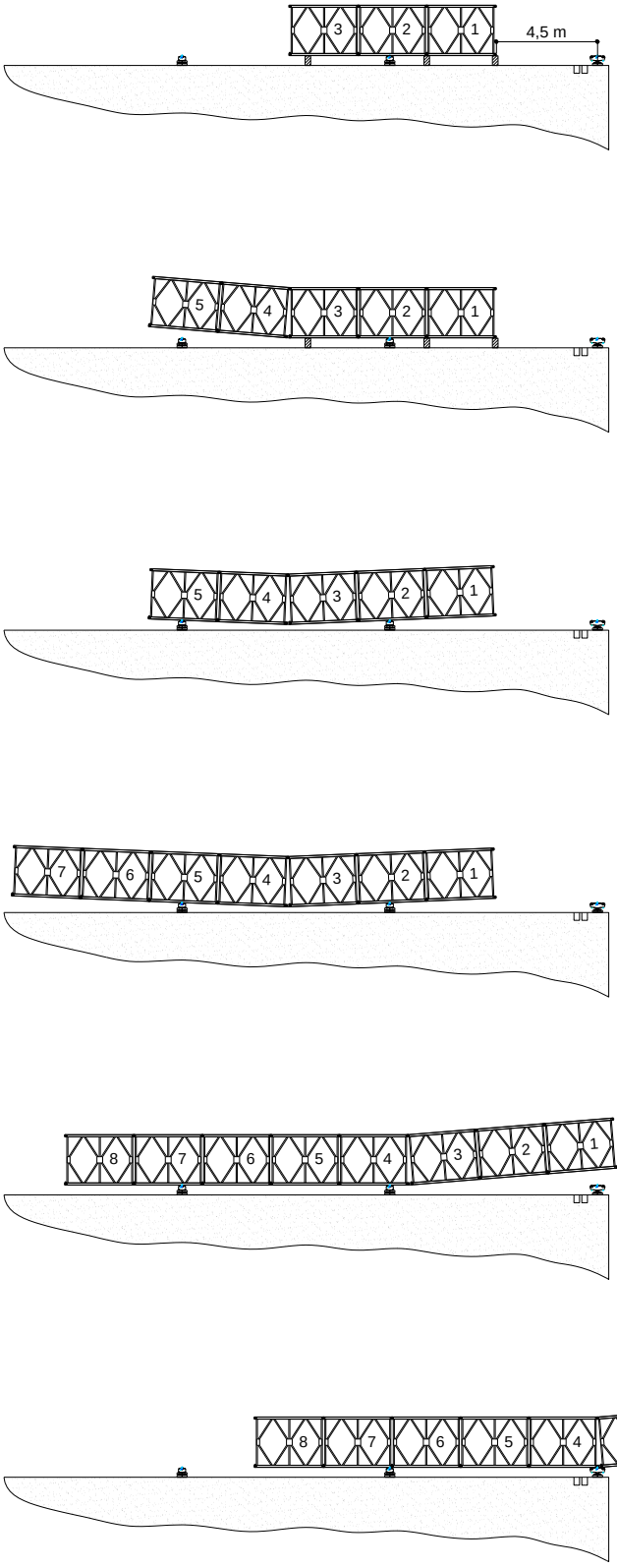
Lower combined unit onto second set of construction rollers to level the unit on construction rollers

Add bay 6

Partially launch the unit forward to level the structure on construction rollers

Add bay 7
Partially launch the unit forward to engage the main launch rollers and level the unit on construction rollers and main launching rollers

Figure 7.10 - LAUNCHING LINKS BETWEEN BAYS 2 AND 3



Build bay 1 on packing 4.5 m behind the axis of main launching rollers
Add bay 2 and 3, supporting the rear of bay 2 on the construction rollers and the rear of bay 3 on packing

Fit Launching Links to the bottom chord of bay 3
Add bays 4 and 5

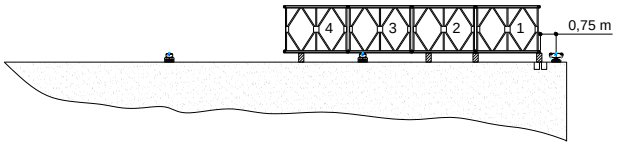
Lower combined unit onto second set of construction rollers

Add bays 6 and 7

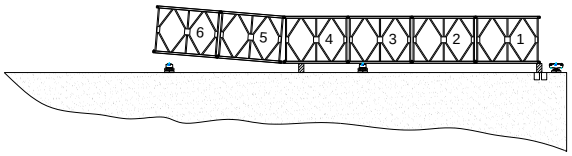
Partially launch the unit forward to level the structure on construction rollers
Add bay 8

At this stage it is possible to partially launch the unit forward to engage the main launch rollers and to level the unit on construction rollers and main launching rollers

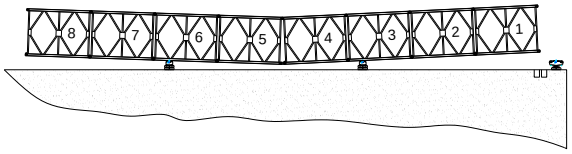
Figure 7.11 - LAUNCHING LINKS BETWEEN BAYS 3 AND 4



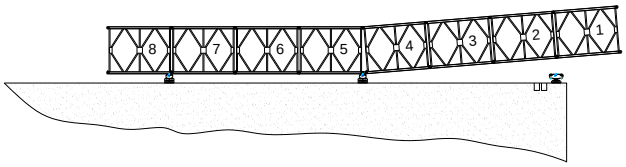
Build bay 1 and 2 on packing 0.75 m behind the axis of main launching rollers
Add bay 3, supporting the rear of bay 3 on the construction rollers
Add bay 4, supporting the rear of bay 4 on packing



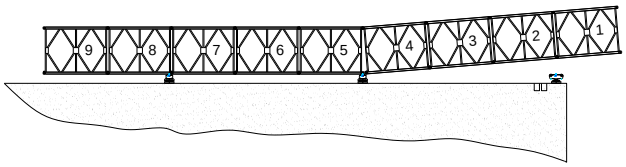
Fit Launching Links to the bottom chord of bay 4
Add bay 5 and 6



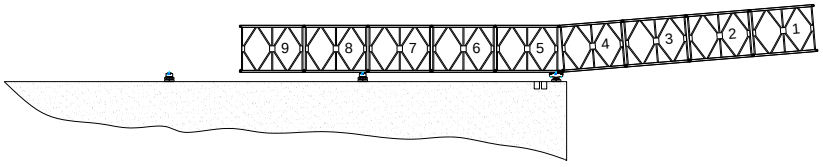
Lower combined unit onto second set of construction rollers
Add bays 7,8



Partially launch the unit forward to level the structure on construction rollers



Add bay 9



Partially launch and level the structure on construction rollers and main launching rollers

Figure 7.12 - LAUNCHING LINKS BETWEEN BAYS 4 AND 5

SINGLE SINGLE NOSE CONSTRUCTION

FIRST BAY OF SINGLE SINGLE NOSE CONSTRUCTION

1. The nose construction starts with the positioning of the first transom. This transom is located approximately 0.75m behind the main launch rollers in order that the work can be carried out safely from the ground. Place timber packs approximately 450mm inboard of each truss line. The top level of the packs should be 100mm above the launch roller level. The transom is turned so that the transom bolt bosses are facing away from the gap (see Figure 7.13) and then positioned carefully on these packs square to and centred over the bridge centre line.
2. The second transom is turned so that the transom bolt bosses are facing towards the gap (see Figure 7.13) and now positioned on a similar set of packs that are placed for the PP30 series 3.048m.
3. Sway bracing can now be fitted loosely between these two transoms which will assist in keeping the second transom square to the bridge.
4. The first truss panel is now slid between the ends of the two transoms (female end towards the gap) and secured with transom bolts.
5. Two Diagonal Rakers are now fitted between the ends of each transom and the panel.
6. The second truss panel is now fitted onto the other ends of the transoms.
7. Two Diagonal Rakers are now fitted to the second panel, which completes the first bay of nose.
8. Do not tighten any bolts at this stage.

INTERMEDIATE BAYS OF SINGLE SINGLE NOSE CONSTRUCTION

1. Pin the Launching Links where required.
2. Pin the first of the panels with the female side to the end of the previously completed bay and to the Launching Link, if this is required in this position.
3. Pin the second panel to the end of the previously completed bay and to the Launching Link, if this is required in this position.
4. Bolt the transom to the ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
5. Install the sway bracing, where required also the Sway Brace Extension Plates.
6. Fit the two Diagonal Rakers to the transom and the truss panels.

7. Check that the structure is properly aligned, adjust if necessary.
8. Tighten the bolts in the bay behind the one just completed.

FINAL BAY OF SINGLE SINGLE NOSE CONSTRUCTION

The sequence of construction is similar to that of an intermediate bay with the exception that the transom is reversed, so that the transom bolt bosses face away from the gap (see Figure 7.13), and it is held onto the panels using the sway braces only. This transom will be bolted to the next bay of nose or first bay of bridge.

DOUBLE SINGLE NOSE CONSTRUCTION

FIRST BAY OF DOUBLE SINGLE NOSE CONSTRUCTION

1. Pin the two inner panels to the ends of the previous single single trusses.
2. Place the next transom onto the male ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
3. Bolt this transom to the two inner panels.
4. Bolt the previous transom to the female end of the inner panels of this bay (see Figure 7.13).
5. Install the sway bracing.
6. Slide the first outer truss panel, female end towards the gap, between the ends of the transoms of this bay.
7. Insert the Diagonal Rakers and fix the transom bolts.
8. Fit the Bracing Channels to the top of the Diagonal Rakers and bolt the braces to both panels.
9. Fit the Bracing Channels and the Diagonal Top Chord Braces.
10. Repeat 6, 7, 8 and 9 for the other truss.
11. Tighten the bolts in the bay behind the one just completed.

INTERMEDIATE BAYS OF DOUBLE SINGLE NOSE CONSTRUCTION

1. Pin four panels to the ends of the previous double single trusses.
2. Place the next transom onto the male ends of these four panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
3. Bolt the transom to the two inner panels.
4. Install the sway bracing.
5. Insert the Diagonal Raker and fix the transom bolts at one of both trusses.
6. Fit the Bracing Channel to the top of the Diagonal Raker and bolt the brace to both panels.
7. Continue the top chord bracing.
8. Repeat 5, 6 and 7 for the other truss.
9. Tighten the bolts in the bay behind the one just completed.

FINAL BAY OF DOUBLE SINGLE NOSE CONSTRUCTION

1. Pin four panels to the ends of the previous double single trusses.
2. Place the next transom onto the male ends of these four panels, this time ensure that the transom bolt bosses are facing away from the gap as this transom will be bolted to the next bay of panels (see Figure 7.13).
3. Install the sway bracing.
4. Do not insert the Diagonal Rakers and the Bracing Channels at this time.
5. Continue the top chord bracing. If the next bay to be constructed is single storey then the top chord bracing can continue uninterrupted, but if the next bay is to be double storey then the top chord brace ends in the first bay of the double storey construction with a Bracing Channel.
6. Tighten the bolts in the bay behind the one just completed.

DOUBLE DOUBLE NOSE CONSTRUCTION

It is usual to build the upper storey of double height trusses one bay behind the lower storey.

Therefore the lower storey bays of double height noses are assembled as described above for double single construction with the exception that the top chord bracing is not installed.

Construction then continues for the next lower storey bay, and only when this is completed, the upper storey panels in the first bay are assembled.

The upper storey panels may be assembled using either method mentioned below:

Method 1

1. Bolt the chord bolt of panel two onto panel one.
2. Fit vertical ‘Z’ braces (one Diagonal Raker plus two Bracing Channels) to each end of the pair of panels.
3. Fit the top chord bracing.
4. Tighten the bolts in the bay behind the one just completed.

Method 2

In this method the upper storey panels and their vertical and top chord bracing members are assembled on the ground and then lifted as an assembly onto the top of the lower storey panels, where the pins and bolts are fitted. Afterwards tighten the bolts in the bay behind the one just completed.

ASSEMBLY OF THE BRIDGE

Note:

The general notes on bridge construction of the Chapter “Assembly of the Launching Nose”, which are valid also for this Chapter.

Construction of the bridge is assumed to continue from the appropriate nose construction as described above.

SINGLE SINGLE TRUSS CONSTRUCTION

FIRST BAY OF SINGLE SINGLE BRIDGE CONSTRUCTION

1. Pin the first of the bridge truss panels to the end of the previously completed nose bay.
2. Pin the second panel to the end of the previously completed bay.
3. Bolt the transom to the ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
4. Bolt the previous transom (i.e. first transom of the bridge) to the two panels of this bay (see Figure 7.13).
5. Install the transom bracing and the sway bracing; on double wide decks additionally install the Sway Brace Strut Double Wide.
6. Fit the four Diagonal Rakers to the two transoms and the truss panels.
7. Decking and kerbs may be placed at this stage, but only where designated on the launch scheme.
8. Tighten the bolts in the bay behind the one just completed.

SECOND AND SUBSEQUENT BAYS OF SINGLE SINGLE BRIDGE CONSTRUCTION

1. Pin the first of the panels to the end of the previously completed bay.
2. Pin the second panel to the end of the previously completed bay.
3. Bolt the transom to the ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
4. Install the sway bracing; also install the Sway Brace Strut Double Wide on the last bridge bay and on double wide decks.

5. Install the transom bracing on each odd number of bridge bays and on the last bridge bay, regardless of this being an odd or even number of bays.
6. Fit the two Diagonal Rakers to the transom and the truss panels, with the exception of the last transom, where the Diagonal Rakers are not required.
7. Fit decking and kerbs, but only where designated on the launch scheme.
8. Tighten the bolts in the bay behind the one just completed.

DOUBLE SINGLE TRUSS CONSTRUCTION

FIRST BAY OF DOUBLE SINGLE BRIDGE CONSTRUCTION

1. Pin the two inner panels to the ends of the nose trusses.
2. Place the next transom onto the male ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
3. Bolt this transom to the two inner panels.
4. Bolt the first bridge transom, previously installed on the end of the nose, to the female end of the inner panels of this bay (see Figure 7.13).
5. Install the transom bracing and the sway bracing and on double wide decks the Sway Brace Strut Double Wide.
6. Slide the first outer truss panel, female end towards the gap, between the ends of the transoms of this bay.
7. Insert the two Diagonal Rakers and fix the transom bolts at one of both trusses.
8. Fit the Bracing Channels to the top of the Diagonal Rakers and bolt the braces to both panels.
9. Fit the Bracing Channels and the Diagonal Top Chord Braces.
10. Repeat 6, 7, 8 and 9 for the other truss.
11. Tighten the bolts in the bay behind the one just completed.

SECOND AND SUBSEQUENT BAYS OF DOUBLE SINGLE BRIDGE CONSTRUCTION

1. Pin four panels to the ends of the previous double single trusses.
2. Place the next transom onto the male ends of these panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
3. Bolt the transom to the two inner panels.
4. Install the sway bracing and add the Sway Brace Strut Double Wide on the first and last bridge bay in case of double wide decks.
5. Install the transom bracing on each odd number of bridge bays and on the last bridge bay, irrespective of this being an odd or even number of bays.
6. Insert the Diagonal Raker and fix the transom bolt at one of both trusses.
7. Fit the Bracing Channel to the top of the Diagonal Raker and bolt the brace to both panels.
8. Continue the top chord bracing.
9. Repeat 6, 7 and 8 for the other truss.
10. Tighten the bolts in the bay behind the one just completed.

TRIPLE SINGLE TRUSS CONSTRUCTION

FIRST BAY OF TRIPLE SINGLE BRIDGE CONSTRUCTION

1. Pin the two inner panels to the ends of the nose trusses.
2. Place the next transom onto the male ends of these two panels; ensure that the transom bolt bosses are facing the gap (see Figure 7.13).
3. Bolt this transom to the two inner panels.
4. Bolt the first bridge transom, previously installed on the end of the nose, to the female end of the inner panels of this bay (see Figure 7.13).
5. Install the transom and sway bracing; on double wide decks additionally affix the Sway Brace Strut Double Wide.
6. Slide the first middle truss panel, female end towards the gap, between the ends of the transoms of this bay.
7. Bolt the panel to the transoms using the transom bolts.
8. Slide the first outer truss panel, female end towards the gap, between the ends of the transoms of this bay.
9. Insert the two Diagonal Rakers and fix the transom bolts.

10. Fit the Bracing Channels to the top of the Diagonal Rakers and bolt the braces to all three panels.
11. Fit the Bracing Channels and the Diagonal Top Chord Braces.
12. Repeat 6, 7, 8, 9, 10 and 11 for the other truss.
13. Tighten the bolts in the bay behind the one just completed.

SECOND AND SUBSEQUENT BAYS OF TRIPLE SINGLE BRIDGE CONSTRUCTION

1. Pin six panels to the ends of the previous triple single trusses.
2. Place the next transom onto the male ends of these panels; ensure that the transom bolt bosses are facing the gap.
3. Bolt the transom to the two inner panels.
4. Install the sway bracing and on the last bridge bay on double wide decks also the Sway Brace Strut Double Wide.
5. Install the transom bracing on each odd number of bridge bays and on the last bridge bay, regardless of this being an odd or even number of bays.
6. Insert the Diagonal Raker and fix the transom bolt at one of both trusses.
7. Fit the Bracing Channel to the top of the Diagonal Raker and bolt the brace to all three panels.
8. Continue the top chord bracing.
9. Repeat 6, 7 and 8 for the other truss.
10. Tighten the bolts in the bay behind the one just completed.

DOUBLE HEIGHT TRUSS CONSTRUCTION

The upper storey of double height bridge trusses, as with the nose, are usually built one bay behind the lower storey construction.

Therefore the lower storey bays of double height trusses are assembled as described above for double single or triple single construction with the exception that the top chord bracing is not installed.

Construction then continues for the next lower storey bay, and only when this is completed, the upper storey panels in the first bay are assembled.

The upper storey panels may be assembled using either of the methods described for double height nose construction.

REINFORCED CONSTRUCTION

The configuration of the truss construction gives the information as to whether a chord reinforcement is required and where and which type of Reinforcing Chords are required (see also Fig. 1.3).

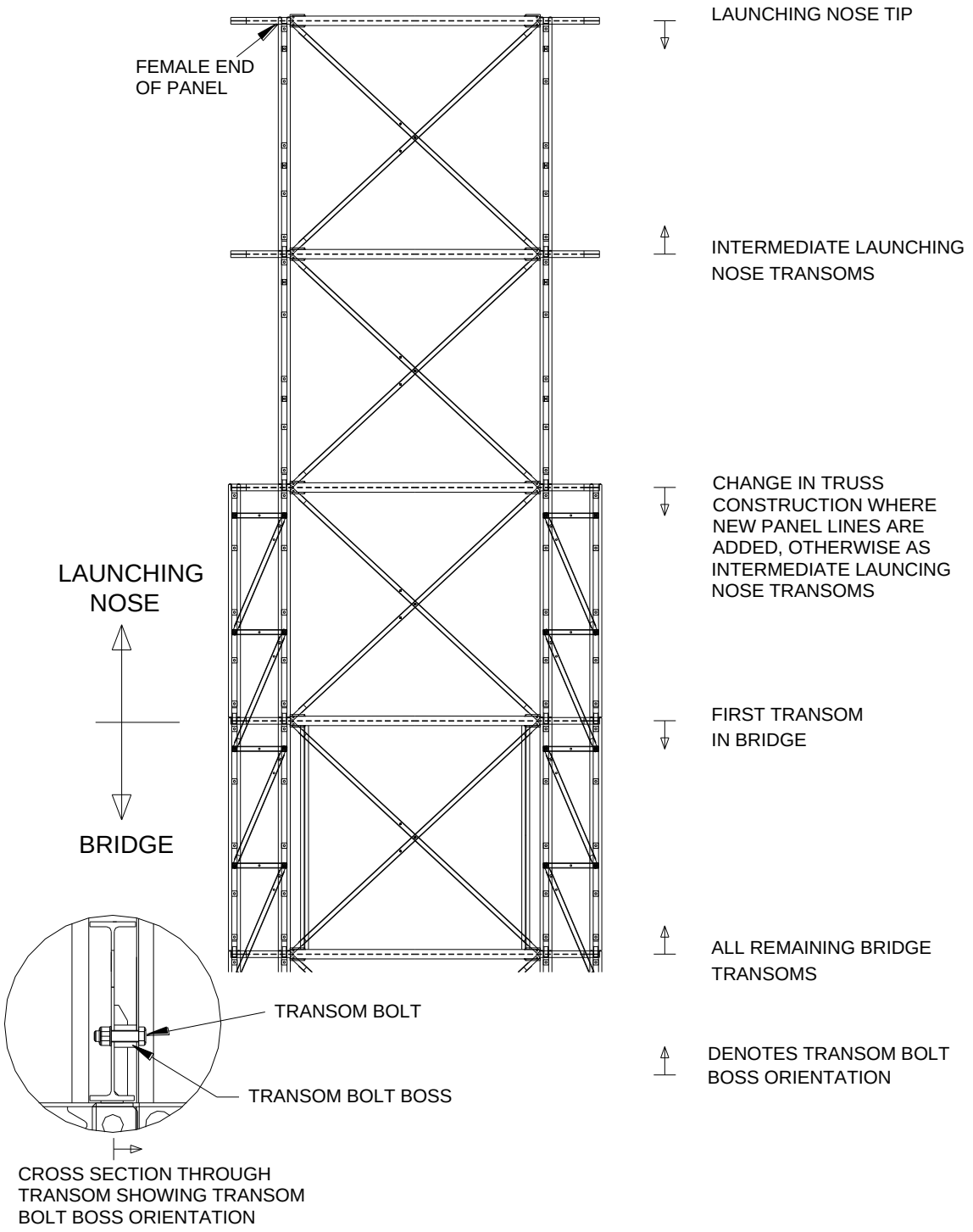
If the code assigned to the truss construction has only two letters, no chord reinforcement is required. The third letter “R” indicates that a chord reinforcement is essential. The fourth letter shows the number of Reinforcing Chords at one truss and the fifth letter refers to the type of Reinforcing Chords.

If chord reinforcement is required, Reinforcing Chords are to be fitted to the top and the bottom chords of the panels with the exception of the end bays. If the number of Reinforcing Chords is lower than the number of panels per truss, the Reinforcing Chords are to be fitted to the outer panel lines only, i.e. a TSR2H truss construction requires two Heavy Reinforcing Chords on the inner and outer panel line, the centre panel line is without chord reinforcement.

Where Reinforcing Chords are required only the bottom Reinforcing Chord or both the bottom and top Reinforcing Chords may be fitted to the bridge panels prior to the panels being installed onto the bridge. The Reinforcing Chords are bolted directly onto the top or bottom chords of the panels with the pin holes of the panels and the Reinforcing Chords lined up. The chord bolts should not get tightened at this stage; always check that all five chord bolts are installed in each Reinforcing Chord. The partly or fully reinforced panel assembly may then be pinned to the bridge as described above. Connect the panel before connecting the Chord Reinforcement.

If the top Reinforcing Chord has not been pre-assembled, fix the top Reinforcing Chord after the panels have been connected to the main structure ensuring that all five chord bolts are installed in each Reinforcing Chord.

Tighten also the chord bolts in the bay behind the one just completed.



TRANSOM LAYOUT

Figure 7.13 – TRANSOM ARRANGEMENT

INSTALLATION OF COUNTERWEIGHT

The requirement of a counterweight is the result of the launching design and the counterweight calculation. Please refer to Section 3 for a description of the launch design.

It is usual to use any spare decking for the counterweight and to position it evenly over the deck area of the end bay of the bridge, where it will have the greatest effect.

LAUNCHING THE BRIDGE

Launching or partial launching of the bridge may be carried out using either manpower in case of a lightweight structure or equipment/machines.

The usual method of launching is to push the bridge from the rear but, if a suitable winch is available, it may also be pulled from the front.

MANUAL LAUNCHING

Manual launching is normally restricted to partially launching an incomplete bridge section and only then if there are sufficient men for the task.

LAUNCHING WITH A PUSHING VEHICLE

Launching using a pushing vehicle is the normal method of launch adopted for most bridges. The size of the launch vehicle depends on the total weight of the structure being launched and may change during construction. For instance the incomplete bridge may be pushed forward during construction using a construction vehicle but the final launch may require a much heavier bulldozer.

The normal rule to determine the size of the launch vehicle to effect a horizontal launch is as follows:

$$\text{launching} - \text{vehicle} - \text{pushing} - \text{capacity} = \frac{\text{bridge} - \text{launching} - \text{weight}}{10}$$

Having determined the size of the launch vehicle it must then be secured to the rear of the bridge. It is vital that the vehicle is fixed to the bridge such that the vehicle can act as a brake in case that the bridge ‘runs on’ after the vehicle has stopped; it may

also be necessary to pull the bridge back. Heavy chains or wire ropes may be used to tie the vehicle to the bridge.

Always insert suitable timbers between the vehicle and the pusher vehicle to prevent damage to either one.

For small bridges the launch vehicle may be fit with rubber tyres; large heavy bridges, however, are best launched using a tracked machine. There is a tendency for rubber tired vehicles to push in ‘jerks’ whereas a tracked machine is more smooth and controllable.

It is very important that the launch vehicle is placed square to the last transom and that it pushes in line with the centre line of the bridge.

Launching using a winch has the great advantage that, provided the winch is correctly aligned with the bridge, it will maintain the alignment far better than using the pushing vehicle.

Note:

- The winch must be securely anchored down to prevent it from moving.
- The winch must be positioned so as not to interfere with the nose during the final stages of the launch.
- The winch rope attachment to the bridge must be made via a ‘bridle’ ideally secured to the female pin holes at the end of the nose panels (see Figure 7.14). Suitable shackles and wire ropes may need to be provided.
- Some form of brake or preventer equipment should be attached to the rear of the bridge to prevent it from running further than intended. This preventer equipment may be either of the following:
  - Another winch pulling at the rear which is let out at the same time as the pulling winch is hauling the bridge forward.
  - A suitable vehicle lashed to the rear of the bridge, which is pulled along until it is required to act as a brake.

Whichever method of propulsion is used for the bridge it is very important that the operation is carried out under the supervision of an experienced engineer, who will monitor the rollers and the alignment of the bridge. The personnel should be placed at each roller location to act as observers together with the leading supervisor directing the launch.

Great care should be exercised as the bridge approaches the point of balance, at which time the bridge may rotate vertically about the home bank (main launching) rollers as the tip of the nose meets the far bank (landing) rollers.

At the point of balance the bridge becomes very light particularly with regard to side loads such as wind; therefore, the launching of the bridges is not allowed at more than 30km/h wind speed.

If there are any problems during the launch, operations should be halted immediately enabling an appraisal of the situation to be made.

The following is a list of the common problems encountered during a launch:

a) Disturbed rollers – the structure will need to be locally jacked up to the level of the roller assembly and the rollers need to be realigned

b) Bridge moving off line – this may be due to one of the following causes:

- Pushing machine not square to the end of the bridge, or not driving in a straight line
- Rollers not level or square to the bridge truss
- Additional weight on one side of the bridge i.e. footwalk on one truss
- Rollers seized up

Occasionally it may be necessary to pull the bridge back, rectify the problem and start again.

The launch will continue in a very controlled manner until the nose is over the landing rollers and the centre of gravity is 3m behind the centre of the main launching roller group. At this stage the launch is stopped to execute checks on the alignment of the bridge and the height of the nose above the landing rollers.
Assuming everything is correct, the bridge may be slowly pushed / pulled forward to engage the landing rollers.
If the contact between the nose and landing rollers cannot be reached before the centre of gravity is 3m behind the centre of the main launching roller group, add additional Plastic Roller Supports WBLE030 under the landing rollers.
If the nose is lower than the landing rollers remove the Plastic Roller Supports under the landing rollers.

Continue pushing / pulling until the bridge reaches its final position.

The roller brakes are now applied.

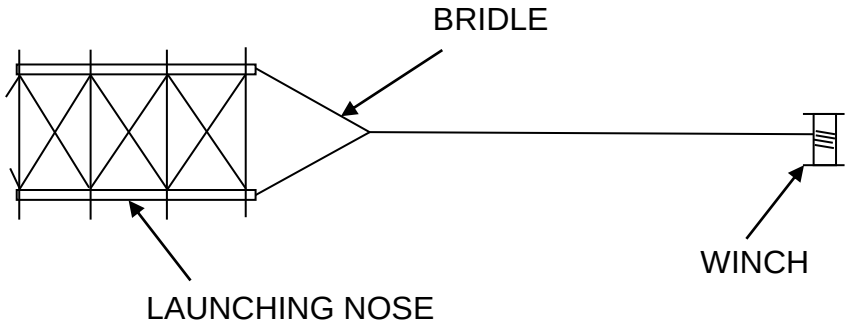


Figure 7.14 – WINCH BRIDLE LAYOUT

LIFTING THE BRIDGE USING A CRANE

Lifting the bridge using a crane may be carried out provided the operation is thoroughly planned by a competent person. If this method of installation is being considered kindly refer to Waagner-Biro for more information.

The following points are for guidance only:

1) Where possible make the structure as light as possible without compromising the structural integrity of the bridge. This is most easily done by leaving off the Deck Units.
2) The weight of the lift must be calculated accurately; this weight should include:
   a) the weight of the bridge structure
   b) the weight of the lifting gear, including chains, ropes, shackles, spreader beams, crane hook
3) Care must be taken in lifting points selection. Where possible secure the lifting ropes to the panel bottom chord adjacent to a transom, if this is not possible secure to the top chord at a pin location, but horizontal forces induced by the inclined lifting ropes will have to be accounted for using struts or spreader beams.
4) Never lift the bridge using the transoms.

LAUNCH NOSE REMOVAL

GENERAL

Removal of the nose and tail depends on the location of the rollers. If the main launching and landing rollers have been positioned in front of the bridge bearings and the rollers are not below the nose or tail panels then the nose and tail may be removed immediately the bridge has been securely positioned on the rollers.

Note:
Do not carry out any dismantling operations if the bridge is supported on any jacks.

If the main launching and landing rollers have been positioned at the bridge bearing locations with the result that the rollers are beneath the tail panel and the first panel of the nose, it will only be possible to remove the nose as far as the first panel. Further dismantling will only be possible after the rollers have been removed and the bridge supported on packing below either the end panels of the bridge span or the end transoms.

Note:
Jacking under the transom without the End Post can only take place, if the jack load does not exceed the shear capacity of the transom bolts (see also Chapter “Jacking Down”).

For a sped-up process it is possible, provided adequate crane equipment is available, to remove the nose in large pieces by unpinning at the panel joints.

TYPICAL SEQUENCE OF OPERATIONS:

ROLLERS IN FRONT OF BEARINGS

a) Launch bridge into position.
b) Lock rollers to secure the bridge.
c) Dismantle nose and tail (if fitted).
d) Pin End Posts and Bearings onto end panels. Do not forget to install the Threaded Bolt M24 and the Tube, delivered together with the End Post.
e) Fit Jacking Transom Clamps and if required the Jacking Transom Flange Extension if jacking is to take place under the transom.
f) Jack up each corner of the bridge and remove the rollers.
g) Jack structure down onto bearings.

ROLLERS ON CENTRE LINE OF BEARINGS

a) Launch bridge into position.
b) Lock rollers to secure the bridge.
c) If it is necessary to dismantle the nose partially to reduce the jacking loads, remove the nose but only as far as the first panel (supported panel).
d) Jack up each corner of the bridge (see important notes on jacking above and below) and remove the rollers.
e) Temporarily support the bridge either below the end panels of the bridge or the end transoms.
f) Dismantle nose and tail (if fitted).
g) Pin End Posts and Bearings onto the end panels. Do not forget to install the Threaded Bolt M24 and the Tube, delivered together with the End Post.
h) Fit Jacking Transom Clamps and if required the Jacking Transom Flange Extension if jacking is to take place under the transom.
h) Jack structure down onto bearings.

PARTIAL REMOVAL OF THE NOSE DURING THE LAUNCH

On very restricted sites it may be possible to partially remove the nose as the launch proceeds. This can be carried out when the partially launched structure is secure on the main launching and landing rollers and complete bays of the nose are cantilevering beyond the landing rollers.

Note:

The effect of removing the nose will be to increase the bending moment in the partially launched bridge span. This is due to the relieving effect from the weight of the cantilever nose. Therefore when partial removal of the nose is planned, structural checks must be carried out for each stage of the launch, taking into account the removal of the nose, to ensure that there is adequate strength in the remaining trusses.

JACKING DOWN

GENERAL

When the bridge has been fully launched and located over the bearing position, the nose and if needed the tail has been removed, the End Posts are installed and the bearings are placed the bridge is ready for jacking down.

Before jacking down, raise the bridge like described below to remove the launching rollers.

Raising or lowering a bridge from its bearings by means of jacking may be carried out safely provided the following guidelines are adhered to:

1. Always estimate the load that is to be carried by the jacks, this is paramount prior to making the decisions on where it is safe to position the jacks.
2. Do not exceed the rated capacity of the jacks. Note that certain types of jacks have different load carrying capacities depending on their mode of use – in particular ‘toe jacks’ have a reduced capacity on the toe than on their head.
3. Always ensure that the jack is placed on a solid footing.
4. Wherever possible jack under the transom or the panel chords. Specific jacking capacities have been given in Figure 7.18.
5. When jacking below a panel chord or a Reinforcing Chord always use a Jacking Head Plate to protect the chords from damage from the jack (see Fig. 7.15).

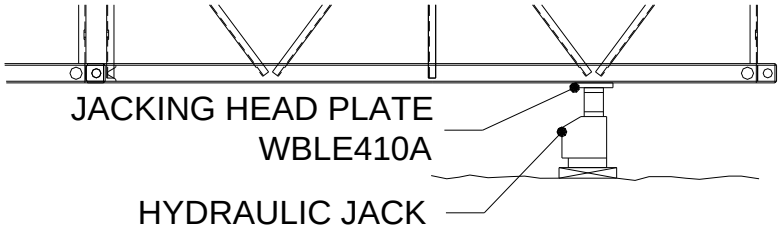


Figure 7.15 – JACKING UNDER A PANEL OR REINFORCING CHORD

6. When it comes to jacking beneath the transom, the jacking capacity of the transom can be increased by installation of the Jacking Transom Clamps between the top flange of the transom and the End Posts or Span Junction Post (see Figures 7.16 and 7.17). Using the Jacking Transom Clamp Packs, the Jacking Transom Clamping Bolts have to be tightened to make sure that the jacking force is going directly to the End Posts or Span Junction Post and not through the transom bolts and the Diagonal Rakers. Please also refer to the Chapter “Erection of the Jacking Transom Clamp Packs” below.

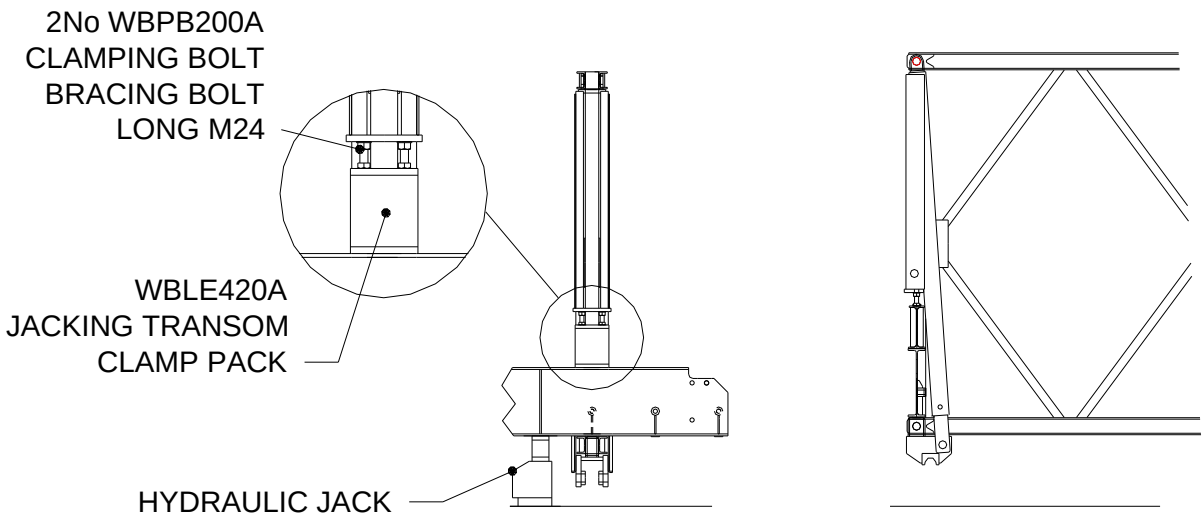


Figure 7.16 – JACKING TRANSOM CLAMP PACK (INNER AND MIDDLE PANEL)

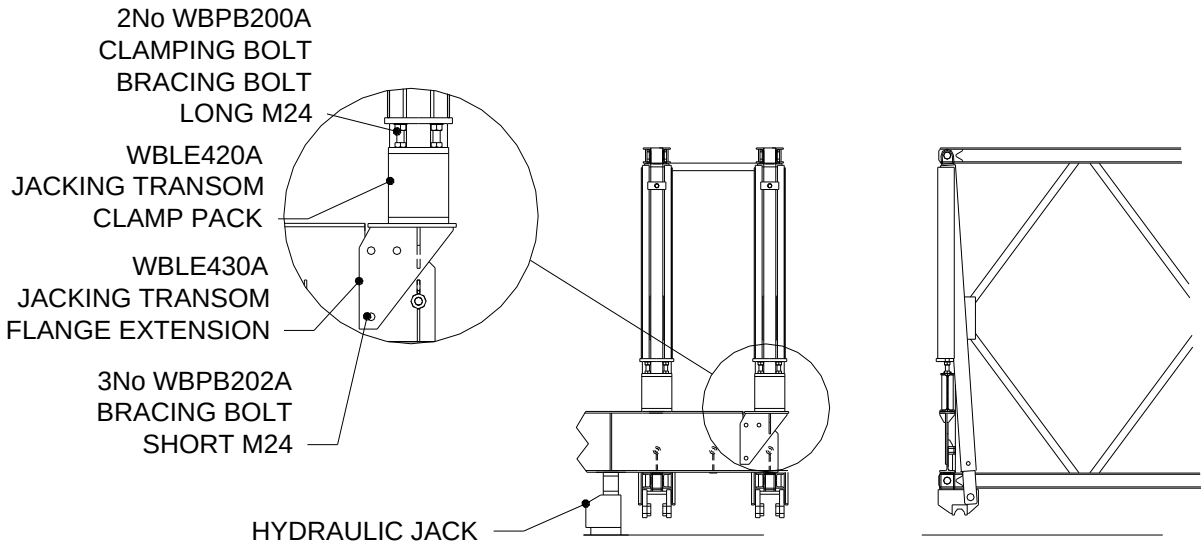


Figure 7.17 – JACKING TRANSOM CLAMP PACK (OUTER PANEL)

7. When jacking below an intermediate transom without the possibility of utilising the end post (i.e. jacking near launching roller), the jacking capacity of the transom can be increased by installation of the jacking transom frame and jacking transom clamp pack between the transom and the panel (see Figure 7.18). Utilizing the Jacking Transom Clamp Packs, the Jacking Transom Clamping Bolts have to be tightened to make sure that the jacking force is going directly to the jacking transom frame and not through the transom bolts and the Diagonal Rakers. Please also refer to the Chapter “Erection of the Jacking Transom Clamp Packs” below. For jacking capacity kindly refer to Figure 7.18.
8. Always keep the jack vertical beneath the member to be raised or lowered. If the jack is used out of plumb, there is likely to be a tendency for the jack to ‘fly out’ and cause injury to those operating the equipment.
9. During the jacking operation it is recommended to use ‘catch packs’ positioned under the bridge maintaining a 10mm gap between the pack and the bridge. In the event of a failure or defect of the jack the bridge will fall by 10mm only.
10. Jack at one end of the bridge at a time. Ensure that the other end of the bridge is unable to move. Never have both ends of the bridge supported on jacks at the same time.
11. If only one corner of the bridge is being jacked at a time, make sure that the cross fall in the bridge does not exceed 50mm for a single lane bridge or 100mm on a double wide bridge.
12. Do not work below the bridge when it is only supported on jacks.
13. When the bridge is to be placed on temporary timber packing make sure that:
    a) the timbers are in good condition and capable of carrying the load,
    b) if necessary arrange the timbers in the form of a stable ‘grillage’,
    c) the timbers are placed under the bridge in a location that will not damage the steelwork.
14. If more than one jack is used at one location it is easy to have more load on one of the jacks. Therefore, during lifting of the structure, the jacks should be pressurised stroke for stroke and during lowering the pressure must be released slowly and equally from each jack. If possible use multiple cylinders running from a single pump which will guarantee that the cylinders are equally loaded.

ERECTION OF THE JACKING TRANSOM CLAMPS

See Figures 7.16 and 7.17.

The transom bolts and the Diagonal Rakers are not in the condition to allow high jacking forces acting below the transom. Therefore connections between the top flange of the transom and the End Posts can increase the jacking capacity of the transom.

Note:

To allow increased jacking forces, the Jacking Transom Clamping Bolts have to be tightened to make sure that there is no gap between the top flange of the transom and the End Posts or Span Junction Post and that the jacking force is able to go directly to the End Posts or Span Junction Post.

Depending on the height of the transom the use of the Jacking Transom Clamp Packs may be necessary or not.

STANDARD AND EXTRA WIDE BRIDGES
TRANSOM TYPES WBTR002A, WBTR003A, WBTR052A, WBTR053A

For truss constructions with more than one panel line per truss install the Jacking Transom Flange Extension with three Bracing Bolts Short on each side of the end Transoms.

Place the Jacking Transom Clamping Bolts, which are the same as the Bracing Bolts Long (WBPB200A), together with the nuts beneath the noses of the End Post such that the heads of the bolts face the transom.

Insert the Jacking Transom Clamp Packs between the transom and the heads of the Jacking Transom Clamping Bolts. Pay attention that the centres of the webs of the transom, the Jacking Transom Clamp Packs and the Jacking Transom Clamping Bolts are in line.

Tighten the Jacking Transom Clamping Bolts, such that there is no gap between transom and End Posts.

DOUPLE WIDE BRIDGES
TRANSOM TYPES WBTR102A, WBTR103A

For truss constructions with more than one panel line per truss install the Jacking Transom Flange Extension with three Bracing Bolts Short on each side of the end Transoms.

Before erection of the End Posts place the Jacking Transom Clamping Bolts, which are the same as the Bracing Bolts Long (WBPB200A), together with the nuts beneath the noses of the End Posts such that the heads of the bolts face the transom.

Pay attention that the centres of the web of the transom and the Jacking Transom Clamping Bolts are in line.

Tighten the Jacking Transom Clamping Bolts, so that there is no gap between transom and End Posts.

After jacking loosen the nuts of the Jacking Transom Clamping Bolts to make sure that the vertical bridge forces of the End Posts do not run through the Jacking Transom Clamping Bolts.

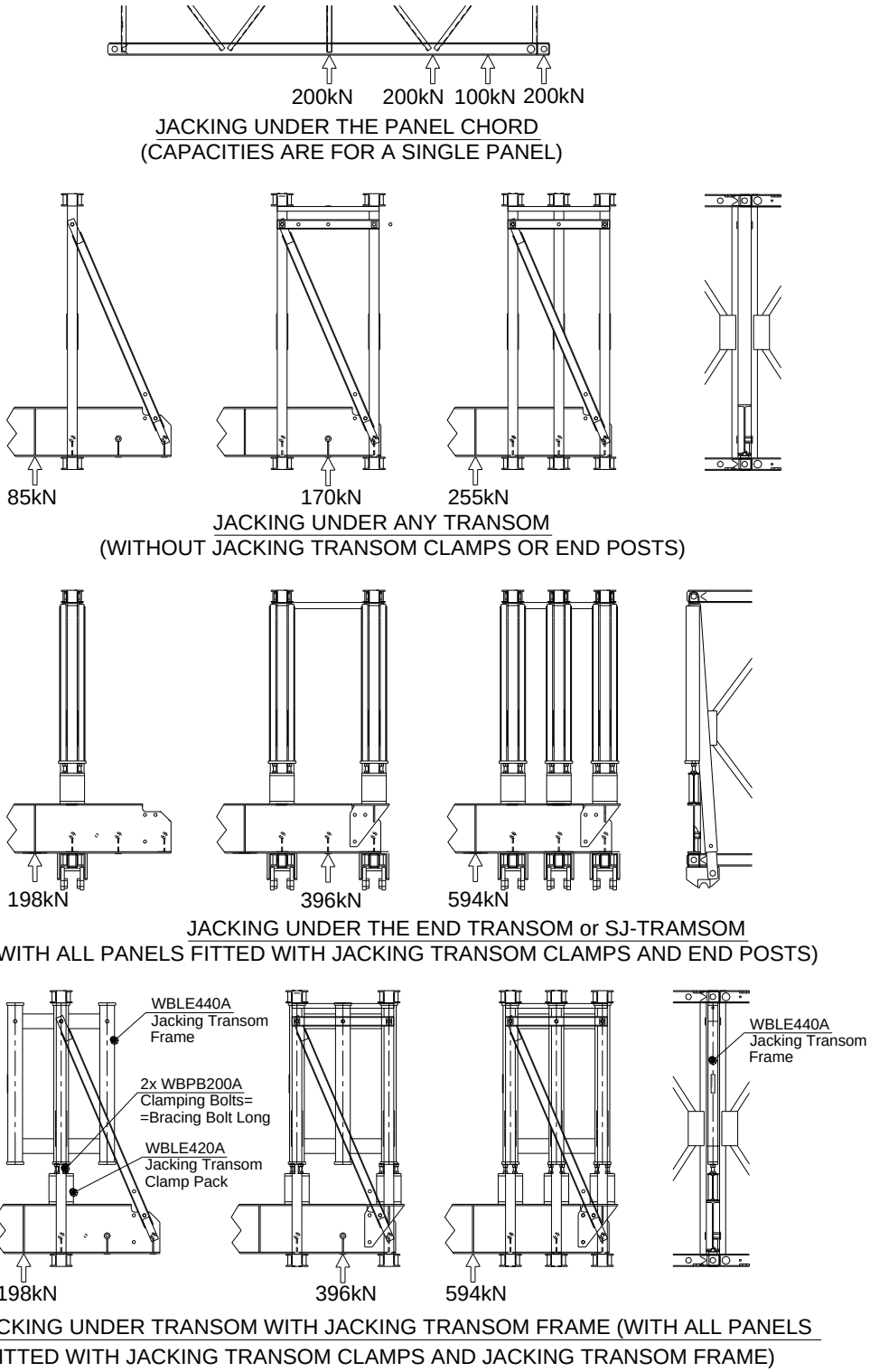


Figure 7.18 – ALLOWABLE JACKING CAPACITY

LAUNCHING DATA TABLES

GENERAL

The Launching Data tables on the following pages show the required launching equipment and roller layout for common panel bridge configurations and lengths. The tables should be used for preliminary assessment purposes only.

Explanation of Abbreviations:

SR	–	Single Roller (WBLE001A)
RR	–	Rocking Roller (WBLE010A)
BB	–	Balance Beam assembly (refer to the fig. 7.2 - 7.8, page 98-104)
+(IP)	–	Roller with Insert Pack Light, Medium or Heavy depending on the reinforcing chords in the bridge
C of G	–	Centre of gravity
CW	–	Counterweight

Assumptions:

The main launching roller and the landing rollers are placed between the bearings at the distance as per fig. 2.4 (page 23).

The launching nose may not be removed before the bridge reaches the end position. The construction rollers on the landing base may be spared in case of long bridges, if the nose will be removed upon reaching maximum 7 bays in cantilever behind the centre of landing rollers.

If there is a requirement for two Single Rollers under DS-configuration, the Single Rollers are to be placed beneath the inner panel line whereas the outer panel lines are not supported by the Single Rollers. If there are two Single Rollers under TS-configuration required, the Single Rollers are placed under inner and outer panel line, with the middle panel lines not being supported by the Single Rollers. For the typical roller layout, longitudinal and lateral distances refer to the Figure 7.1 (page 97).

The row “Launching Link Position” refers to the number of bays from the tip of nose up to the bay where the Launching Link is fitted. (Fig. 3.6, page 47)

The term “Bays of Bridge Decked” refers to the number of bays decked from the end of bridge (where the counterweight is placed)

The term “Last Bay Counterweight” refers to the number of steel deck standard units placed symmetrically between the kerbs in the last bay of the bridge. The cantilever of bridge with counterweight behind the last construction roller must not be more than 2 bays for SS configurations and 1 bay for DS configurations. Do not place the counterweight before the centre of gravity of the complete bridge and nose less than 3 m before the main launching rollers to avoid overload of the last construction rollers.

As the launching proceeds the Insert Packs (IP) under the construction rollers shall be dismantled shortly before the taper chord reaches them to avoid reel-up of the taper chord on the construction rollers and cause overloading of the construction rollers. To remove the Insert Packs, take out the bolts between the Insert Pack and Single Roller, take out the Side Guides (WBLE040A) and jack up by not more than 10 mm under the transom nearby the Insert Pack to be removed. Take care of the maximum jacking capacity in each case (Figure 7.18). Remove the Insert Pack and lower the Single Roller onto the Plastic Roller Support (WBLE030A). Install again the Side Guides to the Single Roller.

Single Truss reinforced and fully reinforced bridges will be launched using taper chords on either bridge end. The home bank main launching rollers do not have insert packs. The construction rollers under the launching nose are fitted with insert packs. The construction rollers under the reinforced portion of the bridge are fitted without insert packs (Fig. 7.1). After assembly of the launching nose and the first bay of bridge, this construction is ready to be launched as far across the gap as possible (note that the centre of gravity is not closer than 3m to the axis of the main launching rollers). As this launching proceeds, some construction rollers are cleared so that the Insert Packs can be easily removed without jacks. After the taper chords reach the home bank main rollers, the erection team keeps launching the bridge very carefully, until the bridge structure has been driven up across the taper chords onto the reinforcing chords. Note that the total weight of the bridge with the launching nose rests on the home bank main launching rollers and the last construction rollers in each launching stage after the driving up procedure.

If partially reinforced panel bridges are launched, all main launching rollers on the home bank are fitted with insert packs, as are the construction rollers under the unreinforced portion of the bridge. Launching is effected without taper chords on the front end of the bridge but with taper chord on the rear end of the bridge.
Launch the bridge until the reinforcing chord is firmly positioned just short of the home bank main launching roller. Now the construction is to be jacked up slightly under the transom close to the main launching rollers to be able to remove the insert pack from below the row of reinforced panels. In the gap created between the main launching rollers and the bridge temporarily installed reinforcing chords shall be connected with chord block bolts only. The pin doesn’t need to be installed for easier dismantling at a later stage. The construction can be jacked down subsequently. After passing the main launching rollers, the temporary reinforcing chords are to be dismantled and fixed as regular reinforcing chords at the rear of the structure.

Table 7.1 - Launching Data Table: PP30 – EW, Steel Deck Standard – Part 1a

BRIDGE SPAN	Bays	3	4	5	6	7	7	8	9	10	10	11	11	12	12	13	13	14	14	15	15
	Feet	30	40	50	60	70	70	80	90	100	100	110	110	120	120	130	130	140	140	150	150
	Metres	9,144	12,192	15,240	18,288	21,336	21,336	24,384	27,432	30,480	30,480	33,528	33,528	36,576	36,576	39,624	39,624	42,672	42,672	45,720	45,720
	Construction	SS	SS	SS	SS	SS	SSRL	SSRL	SSRL	SSRL	SSRM	SSRL	SSRM	SSRM	SSRH	SSRH	DSR1L	DSR1L	DSR1M	DSR1L	DSR1H
NOSE CONSTRUCTION	SS	2	3	3	4	5	5	5	6	6	6	7	7	7	7	8	7	8	7	7	7
	DS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	2
	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Light special launching transom		no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
C of G from Nose end [bay]		1,16	1,66	1,66	2,16	2,65	2,66	2,66	3,16	3,15	3,16	3,65	3,66	3,65	3,66	4,15	3,89	4,15	3,89	4,18	4,20
LAUNCHING LINK POSITION [bay]		1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	3	3	3	2	3
BAYS OF BRIDGE DECKED		1	2	2	3	4	4	5	5	6	6	6	6	7	7	7	7	8	8	8	8
C of G without CW from end of bridge [bay]		2,15	2,92	3,37	4,15	4,92	4,81	5,20	6,00	6,36	6,34	7,16	7,14	7,49	7,49	8,24	8,09	8,38	8,46	9,31	9,25
Last Bay COUNTERWEIGHT [kN]		67,34	21,43	52,03	33,67	18,36	15,30	39,79	24,49	48,97	52,03	33,67	33,67	42,85	42,85	24,49	39,79	42,85	73,46	36,73	55,09
Nr.of deck units WBDE150A		22	7	17	11	6	5	13	8	16	17	11	11	14	14	8	13	14	24	12	18
C of G with CW from end of bridge [bay]		1,38	2,54	2,53	3,53	4,54	4,53	4,55	5,56	5,54	5,52	6,55	6,55	6,77	6,80	7,80	7,53	7,78	7,53	8,78	8,53
HOME BASE																					
	MAIN LAUNCHING ROLLERS	SR	SR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	BB	BB	BB	RR+(IP)	RR+(IP)	RR+(IP)	RR+(IP)	RR+(IP)
Position 1	No. Required	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4
	CONSTRUCTION ROLLERS	SR	SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 2	No. Required	2	2	2	2	2	2-J	2-J	2-J	2-J	2	2	2	2	2	2	2	2	2	2	2
	CONSTRUCTION ROLLERS	SR	SR	SR	SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 3	No. Required	2	2	2	2	2	2	2	2	2	2-J	2-J	2-J	2-J	2-J	2-J	2	4	4	4	4

Table 7.1 - Launching Data Table: PP30 – EW, Steel Deck Standard – Part 1b

BRIDGE SPAN	Bays	3	4	5	6	7	7	8	9	10	10	11	11	12	12	13	13	14	14	15	15
	Feet	30	40	50	60	70	70	80	90	100	100	110	110	120	120	130	130	140	140	150	150
	Metres	9,144	12,192	15,240	18,288	21,336	21,336	24,384	27,432	30,480	30,480	33,528	33,528	36,576	36,576	39,624	39,624	42,672	42,672	45,720	45,720
	Construction	SS	SS	SS	SS	SS	SSRL	SSRL	SSRL	SSRL	SSRM	SSRL	SSRM	SSRM	SSRH	SSRH	DSR1L	DSR1L	DSR1M	DSR1L	DSR1H
	CONSTRUCTION ROLLERS													SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 4	No. Required	SR distance 5m	SR distance 7.6m	SR distance 7.6m	SR distance 9.25m	⇨								2	2	2	2	2	2	2	2
	CONSTRUCTION ROLLERS																				
Position 5	No. Required																				
	CONSTRUCTION ROLLERS																				
Position 6	No. Required																				
	CONSTRUCTION ROLLERS																				
Position 7	No. Required																				
LANDING BASE																					
	LANDING ROLLERS	SR	SR	SR	SR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR	RR
Position 1	No. Required	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	4	4	4	4
Additional plastic support for landing rollers		-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* letter "J" behind the number of construction rollers means that jacking and inserting of inset pack is required to reach the touch down (to equalize the slope from reel up on the home base taper chord)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Table 7.1 - Launching Data Table: PP30 – EW, Steel Deck Standard – Part 2a

BRIDGE SPAN	Bays	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25
	Feet	160	160	170	170	180	180	190	190	200	200	210	210	220	220	230	230	240	240	250	250
	Metres	48,768	48,768	51,816	51,816	54,864	54,864	57,912	57,912	60,960	60,960	64,008	64,008	67,056	67,056	70,104	70,104	73,152	73,152	76,200	76,200
	Construction	DSR1H	DSR2L	DSR2L	DSR2M	DSR2M	DSR2H	DSR2M	DSR2H	DSR2H	TSR3M	TSR2H	DDR2L	DDR2L	DDR2M	DDR2L	DDR2M	DDR2M	DDR2H	DDR2H	TDR3M
NOSE CONSTRUCTION	SS	7	7	7	7	9	8	9	9	8	8	8	8	8	8	8	8	8	8	7	7
	DS	2	2	3	3	1	2	2	2	3	3	4	4	4	4	4	4	4	4	5	5
	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	2
	light special launching transom	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
	C of G from Nose end [bay]	4,18	4,20	4,54	4,57	4,86	4,68	5,15	5,17	5,01	5,04	5,40	5,42	5,40	5,42	5,44	5,47	5,44	5,47	5,63	5,67
	LAUNCHING LINK POSITION [bay]	3	1	2	1	3	3	4	4	4	4	4 and 3	3	3	2	4	3	4	3	4	3
	BAYS OF BRIDGE DECKED	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13
	C of G without CW from end of bridge [bay]	9,64	9,61	10,39	10,32	10,52	10,59	11,31	11,29	11,76	11,48	12,29	12,23	12,63	12,60	13,48	13,43	13,84	13,83	14,70	14,27
	Last Bay COUNTERWEIGHT [kN]	64,28	67,34	45,91	42,85	39,79	48,97	21,43	21,43	64,28	48,97	24,49	18,36	64,28	61,21	45,91	42,85	88,76	91,82	76,52	33,67
	Nr.of deck units WBDE150A	21	22	15	14	13	16	7	7	21	16	8	6	21	20	15	14	29	30	25	11
	C of G with CW from end of bridge [bay]	8,80	8,79	9,79	9,80	10,04	10,03	11,04	11,03	11,03	11,03	12,03	12,05	12,03	12,05	13,04	13,04	13,05	13,05	14,04	14,04
HOME BASE																					
	MAIN LAUNCHING ROLLERS	BB+(IP)	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
Position 1	No. Required	4	4	4	4	4	4	4	4	4	6	6	4	4	4	4	4	4	4	4	6
	CONSTRUCTION ROLLERS	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 2	No. Required	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	CONSTRUCTION ROLLERS	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 3	No. Required	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Table 7.1 - Launching Data Table: PP30 – EW, Steel Deck Standard – Part 2b

BRIDGE SPAN	Bays	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25
	Feet	160	160	170	170	180	180	190	190	200	200	210	210	220	220	230	230	240	240	250	250
	Metres	48,768	48,768	51,816	51,816	54,864	54,864	57,912	57,912	60,960	60,960	64,008	64,008	67,056	67,056	70,104	70,104	73,152	73,152	76,200	76,200
	Construction	DSR1H	DSR2L	DSR2L	DSR2M	DSR2M	DSR2H	DSR2M	DSR2H	DSR2H	TSR3M	TSR2H	DDR2L	DDR2L	DDR2M	DDR2L	DDR2M	DDR2M	DDR2H	DDR2H	TDR3M
	CONSTRUCTION ROLLERS	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 4	No. Required	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	CONSTRUCTION ROLLERS	SR	SR	SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR	SR	SR+(IP)	SR+(IP)	RR	RR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 5	No. Required	2	2	2	2	4	4	4	4	4	6	4	4	4	4	4	4	4	4	4	6
	CONSTRUCTION ROLLERS							SR	SR	SR	SR	SR	RR	RR	RR	RR	RR	RR	RR	RR	RR
Position 6	No. Required							4	4	4	6	6	4	4	4	4	4	4	4	4	4
	CONSTRUCTION ROLLERS																	RR	RR	RR	RR
Position 7	No. Required																	4	4	4	4

LANDING BASE

	LANDING ROLLERS	RR	RR	RR	RR	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB
Position 1	No. Required	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Additional plastic support for landing rollers		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* letter "J" behind the number of construction rollers means that jacking and inserting of inset pack is required to reach the touch down (to equalize the slope from reel up on the home base taper chord)

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	

Table 7.2 - Launching Data Table: PP30 – DW, Steel Deck Standard – Part 1

BRIDGE SPAN	Bays	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Feet	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
	Metres	9,144	12,192	15,240	18,288	21,336	24,384	27,432	30,480	33,528	36,576	39,624	42,672	45,720	48,768	51,816	54,864	57,912	60,960	64,008	67,056	70,104
	Construction (HS25-44 only)	DS	DS	DS	DS	DSR1L	DSR2L	DSR2L	DSR2L	DSR2L	DSR2M	DSR2M	DSR2H	TSR2H	TSR3M	DDR2L	DDR2M	DDR2H	DDR2H	TDR3H	TDR3H	TDR3H
NOSE CONSTRUCTION	SS	2	3	3	4	5	5	6	6	6	6	6	5	7	7	7	7	8	8	8	8	8
	DS									1	1	2	3	2	2	3	3	3	3	2	2	3
	DD																			2	2	2
Light special launching transom		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
C of G from Nose end [bay]		1,18	1,68	1,68	2,18	2,68	2,68	3,18	3,18	3,44	3,44	3,79	3,71	4,27	4,27	4,65	4,65	5,12	5,12	4,95	4,95	5,37
LAUNCHING LINK POSITION [bay]		1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	2
BAYS OF BRIDGE DECKED		1	2	2	3	4	5	5	5	5	6	6	7	7	8	8	8	5	6	5	7	5
C of G without CW from end of bridge [bay]		1,6	2,5	2,9	3,6	4,2	4,6	5,3	5,7	6,5	6,8	7,6	8,0	8,5	8,9	9,6	10,0	10,8	11,2	11,9	12,2	13,0
Last Bay COUNTERWEIGHT [kN]		12,2	0,0	45,9	6,1	0,0	9,2	0,0	18,4	0,0	33,7	3,1	27,5	0,0	0,0	0,0	0,0	0,0	24,5	0,0	27,5	0,0
No. of deck units WBDE150A		4	0	15	2	0	3	0	6	0	11	1	9	0	0	0	0	0	8	0	9	0
Weight of Bridge + Nose + CW [kN]		186,8	210,4	284,6	309,0	387,4	475,5	516,6	571,4	611,0	732,0	762,2	877,1	998	1.120	1.192	1.289	1.320	1.422	1.885	2.032	2.057
C of G with CW from end of bridge [bay]		1,56	2,51	2,55	3,55	4,25	4,55	5,29	5,55	6,47	6,54	7,55	7,8	8,52	8,89	9,6	10,01	10,84	11,03	11,86	12,04	13,02
HOME BASE																						
MAIN LAUNCHING ROLLERS		RR	RR	RR	RR	RR+(IP)	RR	RR	RR	RR	RR	RR	BB	BB+(IP)	BB	BB	BB	BB	BB	BB	BB	BB
Position 1	No. Required	4	4	4	4	4	4	4	4	4	4	4	4	6	6	4	4	4	4	6	6	6
CONSTRUCTION ROLLERS		SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 2	No. Required	2	2	4	4	4 – J	4 – J	4 – J	4 – J	2	2	2	2	2	2	2	2	2	2	2	2	2
CONSTRUCTION ROLLERS		SR	SR	SR	SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 3	No. Required	2	2	2	4	4	4	4	4	4 – J	4 – J	4 – J	4 – J	4	4	4	4	4	4	4	4	4

Table 7.2 - Launching Data Table: PP30 – DW, Steel Deck Standard – Part 2

BRIDGE SPAN	Bays	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Feet	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230
	Metres	9,144	12,192	15,240	18,288	21,336	24,384	27,432	30,480	33,528	36,576	39,624	42,672	45,720	48,768	51,816	54,864	57,912	60,960	64,008	67,056	70,104
	Construction (HS25-44 only)	DS	DS	DS	DS	DSR1L	DSR2L	DSR2L	DSR2L	DSR2L	DSR2M	DSR2M	DSR2H	TSR2H	TSR3M	DDR2L	DDR2M	DDR2H	DDR2H	TDR3H	TDR3H	TDR3H
	CONSTRUCTION ROLLERS	SR distance									SR	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	RR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)	SR+(IP)
Position 4	No. Required	5,0 m	7,6 m								4	4	4	4	6	4	4	4	4	4	4	4
	CONSTRUCTION ROLLERS															SR	RR	RR+(IP)	RR	SR+(IP)	SR+(IP)	SR+(IP)
Position 5	No. Required															4	4	4	4	6	6	6
	CONSTRUCTION ROLLERS																	RR	RR	SR	SR	SR
Position 6	No. Required																	4	4	6	6	6
LANDING BASE																						
	LANDING ROLLERS	SR	SR	SR	SR	RR	RR	RR	RR	RR	RR	RR	RR	BB	BB	BB	BB	BB	BB	BB	BB	BB
Position 1	No. Required	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Additional plastic support for landing rollers	1	1	1	1	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
	PARTIAL NOSE DISASSEMBLY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	YES	YES	YES	YES	YES
	No. disassembled bays required	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6 bays	6 bays	5 bays	5 bays	5 bays

* letter "J" behind the number of construction rollers means that jacking and inserting of inset pack is required to reach the touch down (to equalize the slope from reel up on the home base taper chord)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

SECTION 8

RAMPS

RAMPS

GENERAL

Ramps provide the possibility to connect the lower street level with the higher positioned roadway level.

The design of the ramps allows a sliding of the total ramp due to temperature expansion.

Two constructions of ramps are possible depending on the circumstances on site:

- Ramp with concrete foundation
- Emergency Ramp

RAMP WITH CONCRETE FOUNDATION

If it is possible to provide concrete foundations, this construction type is the cheaper solution (see Figure 8.1).

Erection

Place the End of Bridge Plate embedded in concrete. For double wide bridge constructions use the combination of an End of Bridge Plate for Standard and an End of Bridge Plate for Extra Wide.

Bolt the Sliding Plates Single to the concrete. At a Standard width bridge construction use four Sliding Plates per Ramp Girder, at an Extra Wide bridge construction five and at a Double Wide bridge construction eight Sliding Plates per Ramp Girder. The lateral distance of the Sliding Plates is 1050mm. Take care that the free sliding way is given in both directions, depending on the temperature during erection.

Bolt the Ramp Plates between the bridge and transoms and the Steel Decks.

Put the Ramp Girders onto the Sliding Plates.

Bolt the Angle for SJ Infill Deck and Ramp to the lower Ramp Girder.
For standard wide bridge constructions use 3, for extra wide 4 and for double wide 7 pieces of angles. Erect the angle, so that the 6 holes are on the vertical leg and that the 2 holes, farther to the corner of the angle, get bolted to the Ramp Girder.

Before tightening the bolts, check the lateral position of the angles to make sure that the angles fit together with the End of Bridge Plates. Control of the position and correct tightening of the bolts may easily be effected by fitting the End of Bridge Plates, turned 180 degrees along the vertical axis.

Fit the End of Bridge Plate to the Angles for SJ Infill Deck and Ramp, so that all pins of the End of Bridge Plate(s) are in the holes of the angles. For double wide bridge construction use the combination of an End of Bridge Plate for Standard Width and an End of Bridge Plate for Extra Width. Make sure that the lower end of the End of Bridge Plate can have contact with the End of Bridge Plate embedded in concrete at all sliding positions.

Bolt the Decks to the Ramp Girders and to the bridge end transoms.

Bolt the Kerbs to the Decks.

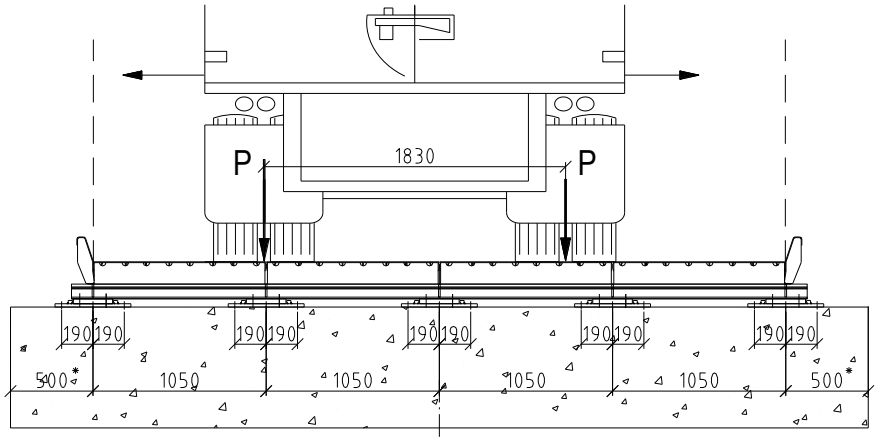


Figure 8.1 – RAMP WITH CONCRETE FOUNDATION - CROSS SECTION

NOTES for Figures 8.1:

- '*' Denotes a minimum dimension – exact dimensions of the concrete foundation are to be determined by the customer to suit the expected ground conditions.

SUPPORT FORCES

The concrete foundation for the ramp shall be designed for a wheel load P under each sliding plate. An impact factor of 1.3 is included in the forces. The values show the working load, no safety factors are included.

For Standard and Extra Wide bridges the loading consists of one lorry with two wheel loads P at a distance of 1830mm (see fig. 3.1). For Double Wide bridges two lorries need to be considered.

Load standard:	HS20-44	HS25-44
	P [kN]	P [kN]
Wheel Load P	93	116

Table 8.1 – Support forces - ramp with concrete foundation

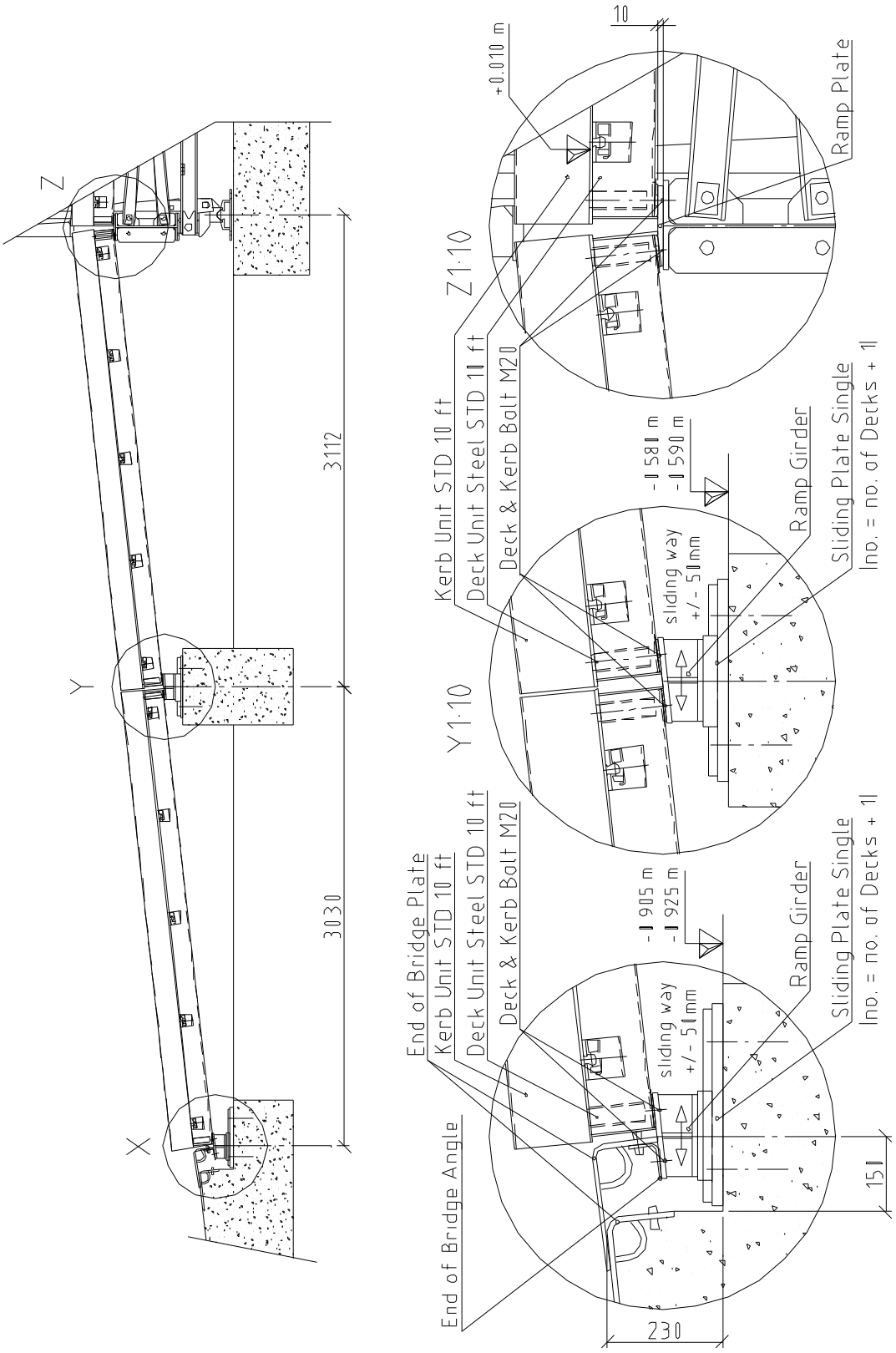


Figure 8.2 – RAMP WITH CONCRETE FOUNDATION

EMERGENCY RAMP

This construction is the better solution, if there is no time or no possibility to erect concrete foundations to support the ramps. A paved ground beyond the End of Ramp Deck Unit is required to allow a sliding of the “End of Ramp Deck Unit”. See Figure 8.2.

ERECTION

Bolt the Sliding Plates Single to the foundation. At a Standard width bridge construction use four Sliding Plates per Ramp Girder, at an Extra Wide bridge construction five and at a Double Wide bridge construction eight Sliding Plates per Ramp Girder. The lateral distance of the Sliding Plates is 1050mm. Pay attention that the free sliding way is given in both directions, depending on the temperature during erection.

Bolt the Ramp Plates between the bridge end transoms and the Steel Decks.

Bolt the Ramp Pedestals (for a Standard width bridge construction four pieces, for an Extra Wide bridge construction five pieces and for a double wide bridge construction eight pieces per Ramp Girder) to the Ramp Girders and put the Ramp Girders, with or without the Ramp Pedestals depending on the location, onto the Sliding Plates.

Bolt the Ramp Braces as longitudinal connection of the lower Ramp Girder to each Ramp Pedestal of the higher Ramp Girder.

Bolt the Decks to the Ramp Girders and to the bridge end transoms.

Bolt the End of Ramp Deck Units to the Ramp Girders and connect the End of Ramp Deck Units together, side to side, using Deck and Kerb Bolt M20.

Bolt the Kerbs to the Decks.

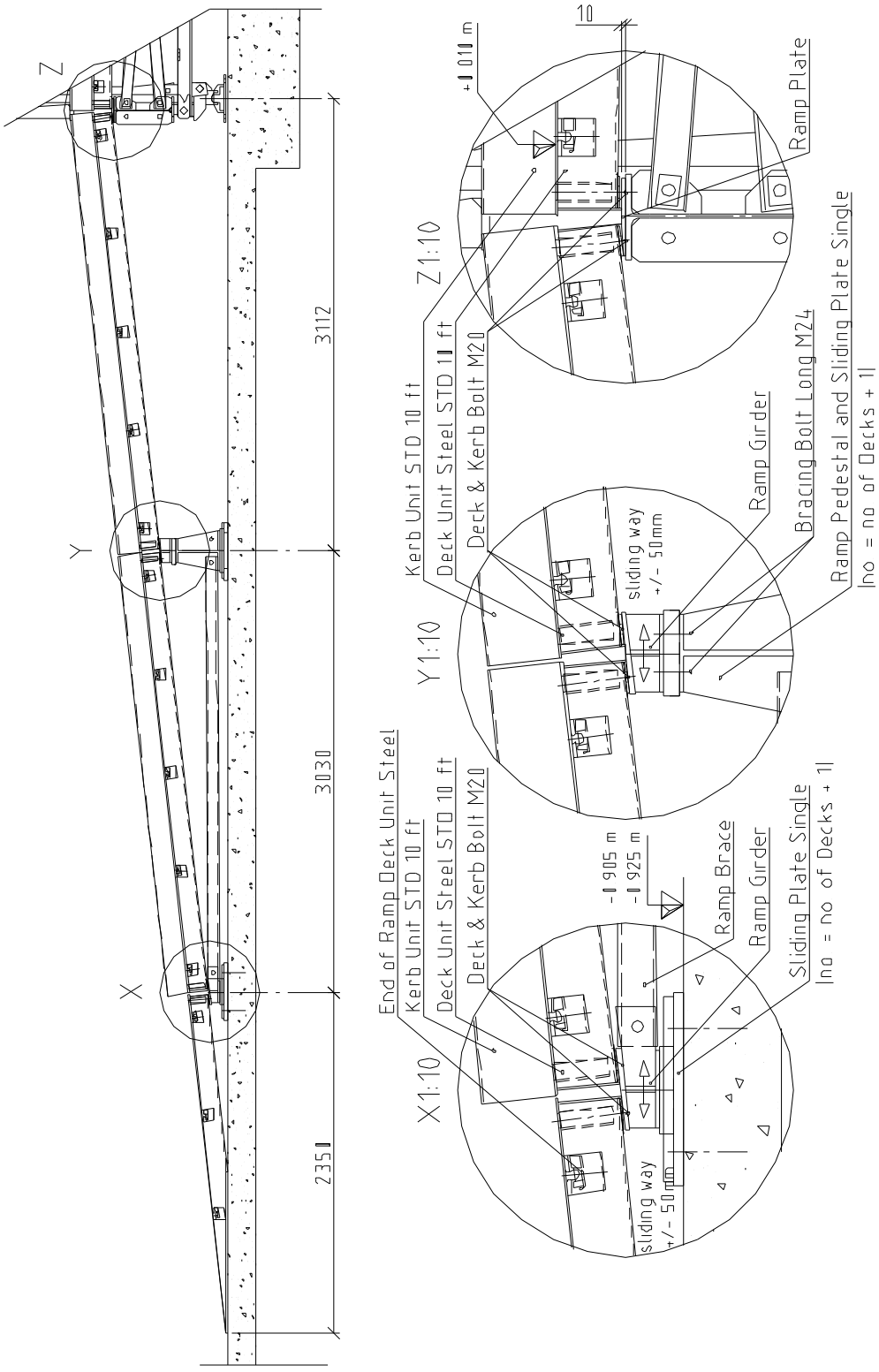


Figure 8.3 – EMERGENCY RAMP

SECTION 9

FOOTWALK

GENERAL

The footwalk allows pedestrians to cross the bridge safely separate from roadway traffic.

The footwalk can be positioned on the left-hand or right-hand or either side of the truss by a bolted connection to the transom. This allows to fit the footwalk easily after launching or during service.

LOAD

The footwalk parts are designed to carry a nominal pedestrian working load of up to 500 kg/m² (104lb/ft²). In case that the footwalk shall be mounted to an existing bridge the loading bridge capacity of the bridge has to be evaluated carefully. An experienced team of Waagner Biro engineers is always available for advice.

DEAD WEIGHT OF FOOTWALK

SERIES: **PP30**

FOOTWALK WIDTH	Complete Footwalk		Footwalk without Footwalk Tray	
	[kN/bay]	[kN/m]	[kN/bay]	[kN/m]
1.0 m	3.04	1.00	0.42	0.14
1.5 m	3.85	1.26	0.47	0.15

Table 9.1 – Dead weight of footwalk

DESIGN

The footwalk can be delivered with a width of 1.0m or 1.5m and is provided with a rigid steel hand and knee railing. The hand/knee rail is positioned 1.0/0.5m above the footwalk deck level. In the footwalk tray kerbs and holes for dewatering are integrated (see Figure 9.2 and 9.3).

The footwalk deck is made of steel checkered plates.

All footwalk parts are provided with high life time corrosion protection by means of hot dip galvanizing.

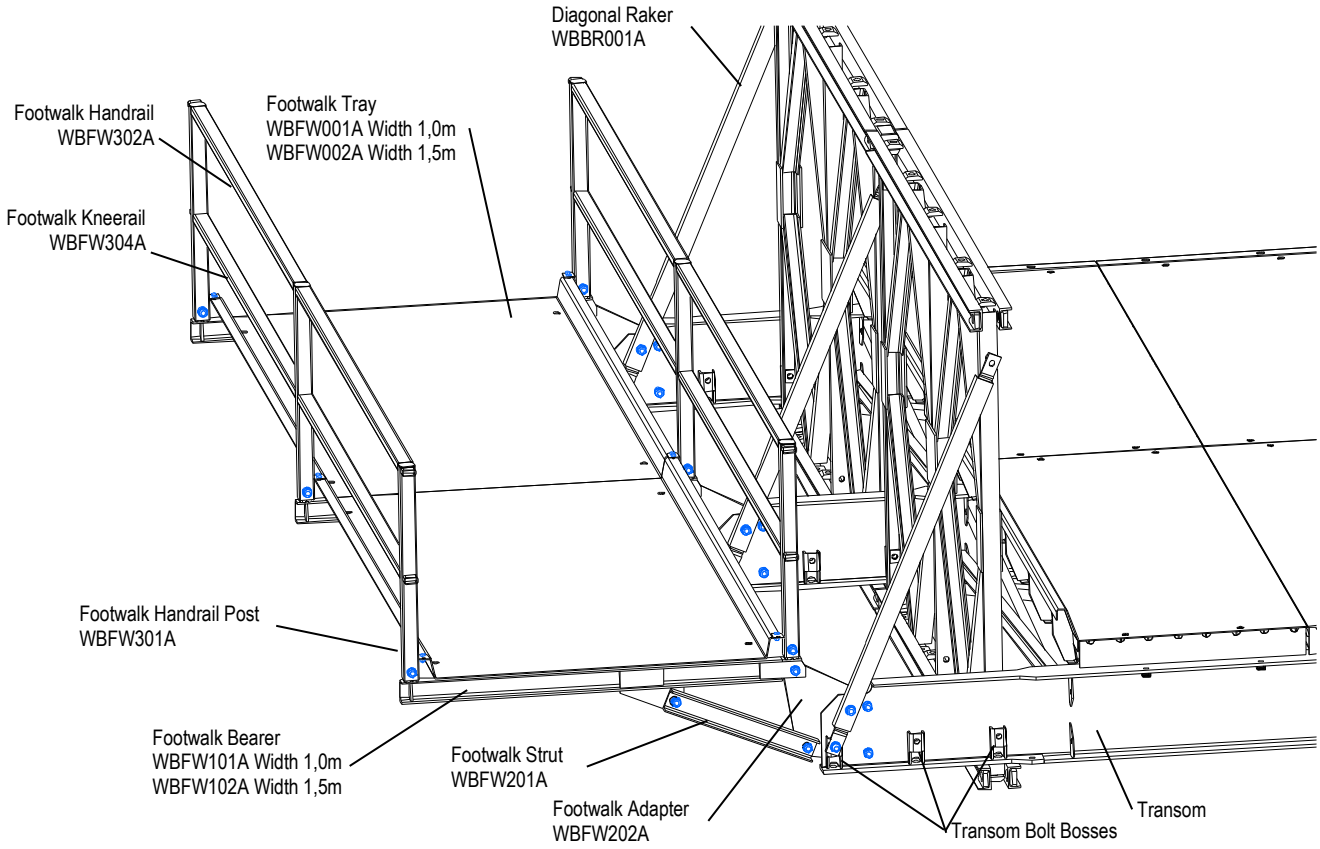


Figure 9.1 – FOOTWALK ASSEMBLY IN FIELD

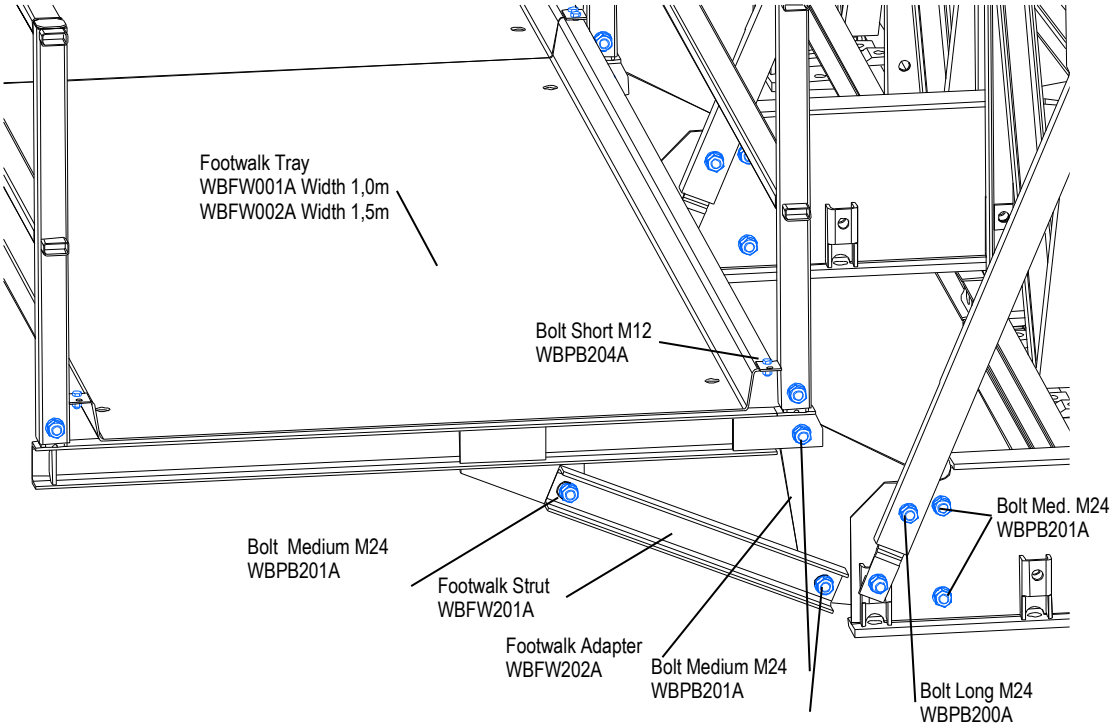


Figure 9.2 – FOOTWALK DETAIL EXTRA WIDE TRANSOM

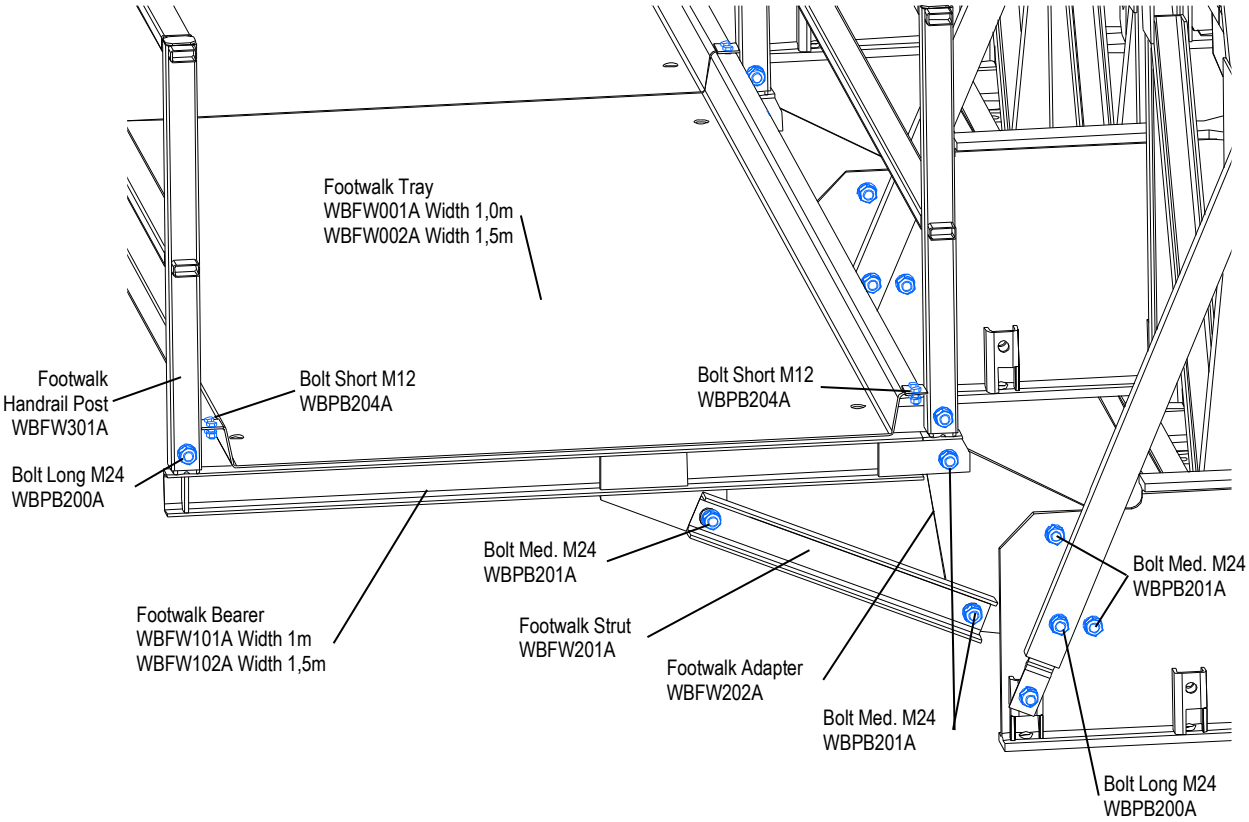


Figure 9.3 – FOOTWALK DETAIL DOUBLE WIDE TRANSOM

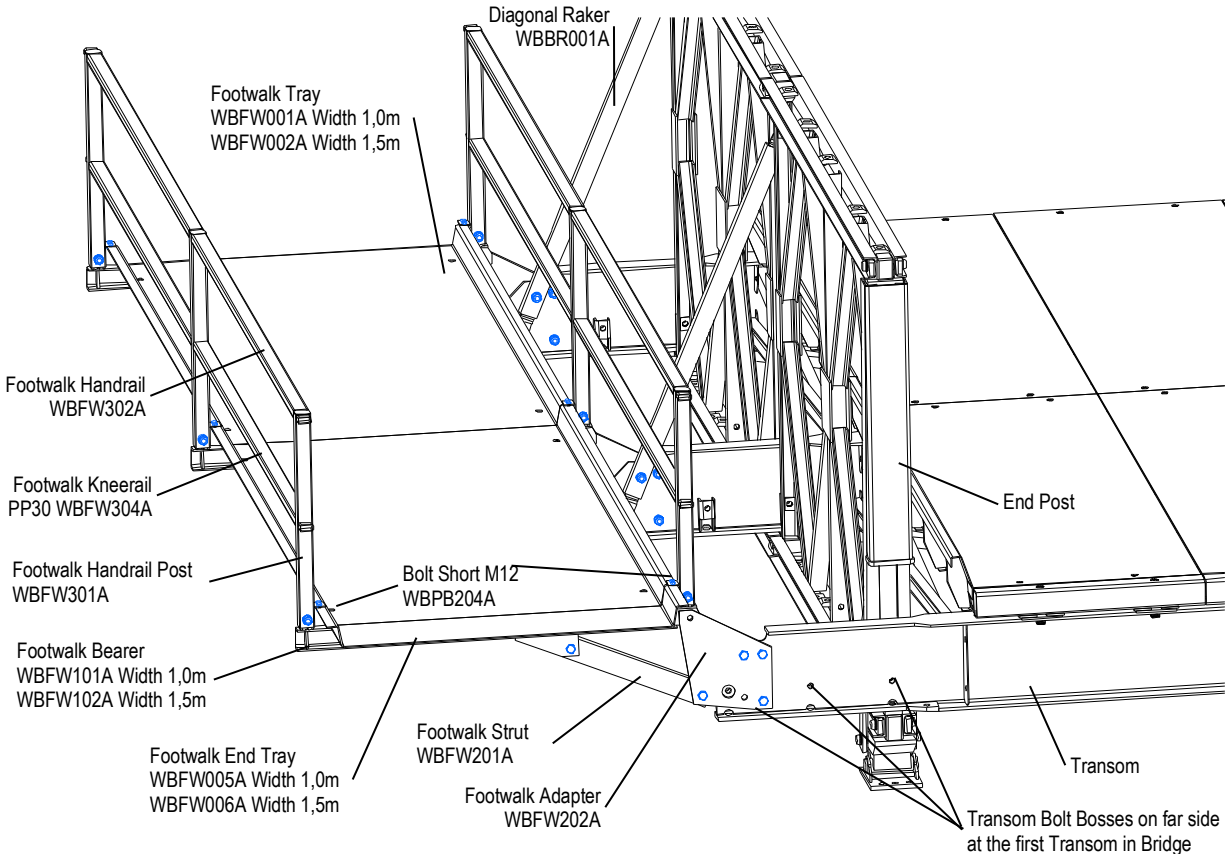


Figure 9.4 – FOOTWALK ASSEMBLY AT THE END

CROSS SECTION DIMENSIONS

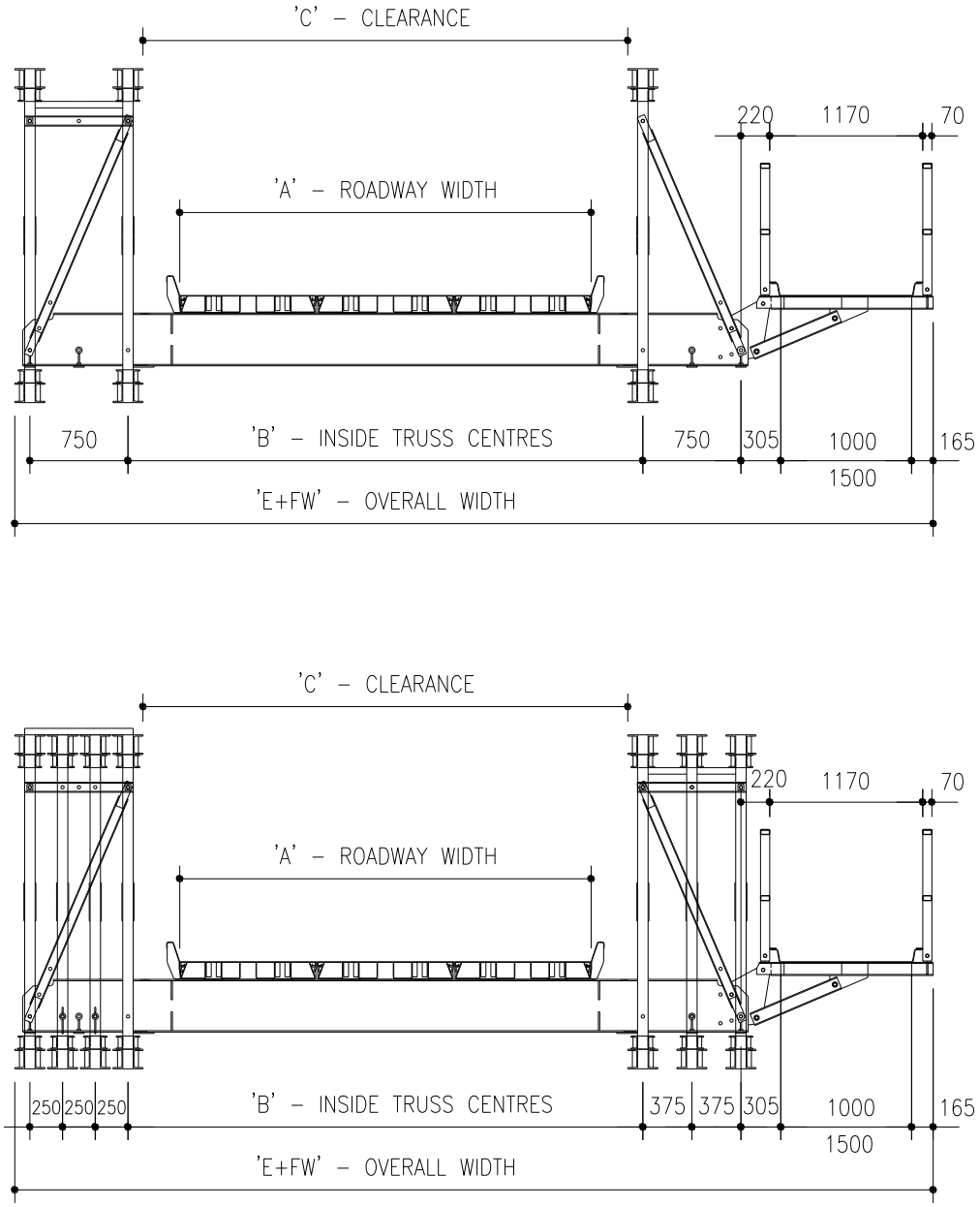


Figure 9.5 - TYPICAL CROSS SECTIONS OF SINGLE STOREY BRIDGES WITH FOOTWALK

TYPICAL **DIMENSIONS**

	A	B	C	E+FW	E+FW	F	G
	Deck Standard			**Width 1,0 m**	**Width 1,5 m**		
STANDARD	3150	3937				895	915
UNREINFORCED			3744	7004	7504		
LIGHT CHORDS			3744	7004	7504		
MEDIUM CHORDS			3727	7012	7512		
HEAVY CHORDS			3717	7012	7512		
EXTRA WIDE	4200	4953				900	920
UNREINFORCED			4760	8020	8520		
LIGHT CHORDS			4760	8020	8520		
MEDIUM CHORDS			4743	8028	8528		
HEAVY CHORDS			4733	8033	8533		
DOUBLE WIDE	7350	7820				1105	1125
UNREINFORCED			7627	10887	11387		
LIGHT CHORDS			7627	10887	11387		
MEDIUM CHORDS			7610	10895	11395		
HEAVY CHORDS			7600	10900	11400		

Table 9.2 – Typical Dimensions with footwalk (mm)

Dimensions ‘A’, ‘B’, ‘C’, ‘D’, ‘E+FW’ are typical for all standard load cases

Dimension ‘A’ for Deck Unit Steel Standard

Dimension ‘F’: Dimension from deck level to bottom level of bearing

Dimension ‘G’: Dimension from deck level to bottom level of sliding bearing plate

ABUTMENT LAYOUT FOR SINGLE SPAN BRIDGES WITH FOOTWALK

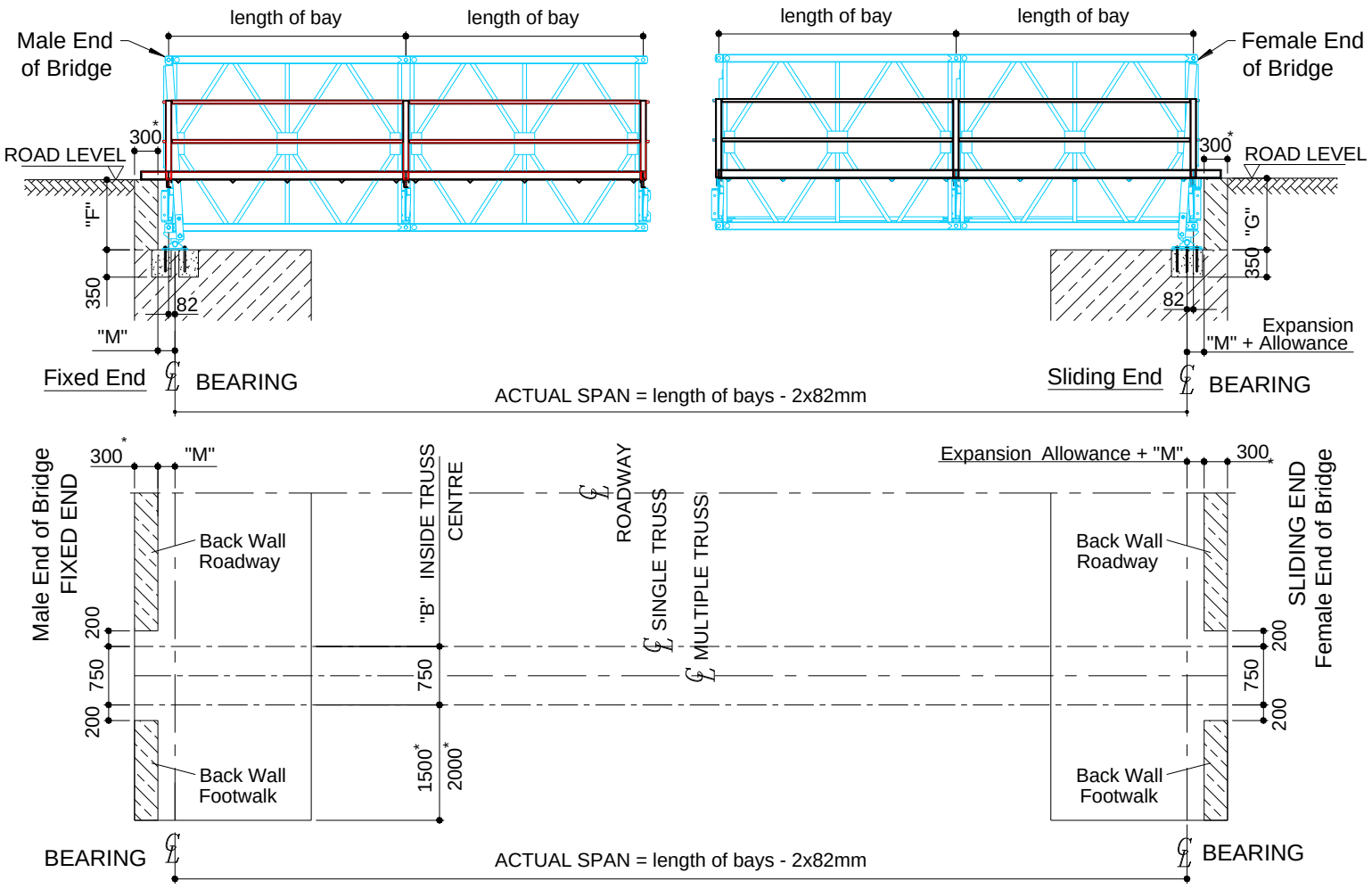


Figure 9.6 –ABUTMENT LAYOUT FOR SINGLE SPAN BRIDGES WITH FOOTWALK

NOTES for Figure 9.6 – Abutment layout:

- '*' Denotes a minimum dimension – exact dimensions are to be determined by the customer to suit the expected ground conditions.
- 'F' and 'G' are dimensions from road level to bottom level of bearing or sliding plate. If required the customer may increase these dimensions by 25mm to allow for a layer of high strength grout to be used below the bearings.
- 'M' is required distance between the bearing axis and back wall. For Standard Width and Extra Width bridges 200mm, for Double Width bridges 220mm.

Erection

The Waagner Biro launching tables do not include any weight for footwalks. Should the bridge be launched with complete or partly assembled footwalk the launching process has to be evaluated carefully. An experienced team of Waagner Biro engineers is always available for advice.

Step 1:

First connect the footwalk Adapter Plate (WBFW202A) to the end of transom using 3 bolts (2x bolt M24 medium WBPB201A and 1x bolt M24 long WBPB200A). The Bolt M24 Long (WBPB200A) through the Diagonal Raker has to be removed first and reassembled together with the Adapter Plate. See Figures 9.2 and 9.3.

The position of the Adapter Plate is always on the far side from the Transom Bolt Bosses. See Figures 9.1 and 9.4.

Afterwards bolt the Footwalk Bearer to the Adapter Plate by using one Bolt M24 medium (WBPB201A) and spread the Footwalk Strut (WBFW201A) with two Bolts M24 Short (WBPB201A) against Footwalk Bearer and Adapter Plate. See Figures 9.2 and 9.3.

Step 2:

The first Footwalk Tray has to be laid down on the first and second Footwalk Bearer of the bridge. Fix the first footwalk Tray with the Footwalk Post connected to the Footwalk Bearer by Bolt M24 Long (WBPB200A) and to the Footwalk Tray by Bolt M12 (WBPB204A).

Step 3:

Place the second Footwalk Tray between the Footwalk Bearers.

For hand assembly without cranes it will be helpful to place timber stringers between the Footwalk Bearers.

Step 4:

Fix the Footwalk Handrails and Knee rails to the first Footwalk Post at the first bay.

Fix the first and second Tray with a further Footwalk Post, connected to the Bearer by means of Bolt M24 Long (WBPB200A) and to the Footwalk Tray by Bolt M12 (WBPB204A), subsequently install the Footwalk Hand- and Knee rail.

Step 5:

Place a further Footwalk Tray between the Bearers.

Step 6:

Fix the Footwalk Handrails and Knee rails at the previous Footwalk Post.

Fix the Footwalk Trays to the next Footwalk Post, connected to the Bearer by Bolt M24 Long (WBPB200A) and to the Footwalk Tray by Bolt M12 (WBPB204A); also mount the Footwalk Handrails and Knee rails.

Repeat the steps 5 and 6 along the entire length of the bridge.

Last Step:

After completion of the bridge and the concrete back wall, the Footwalk End Tray has to be laid down on the back wall and to be fixed with the last Footwalk Post by means of Bolts M12 (WBPB204A).

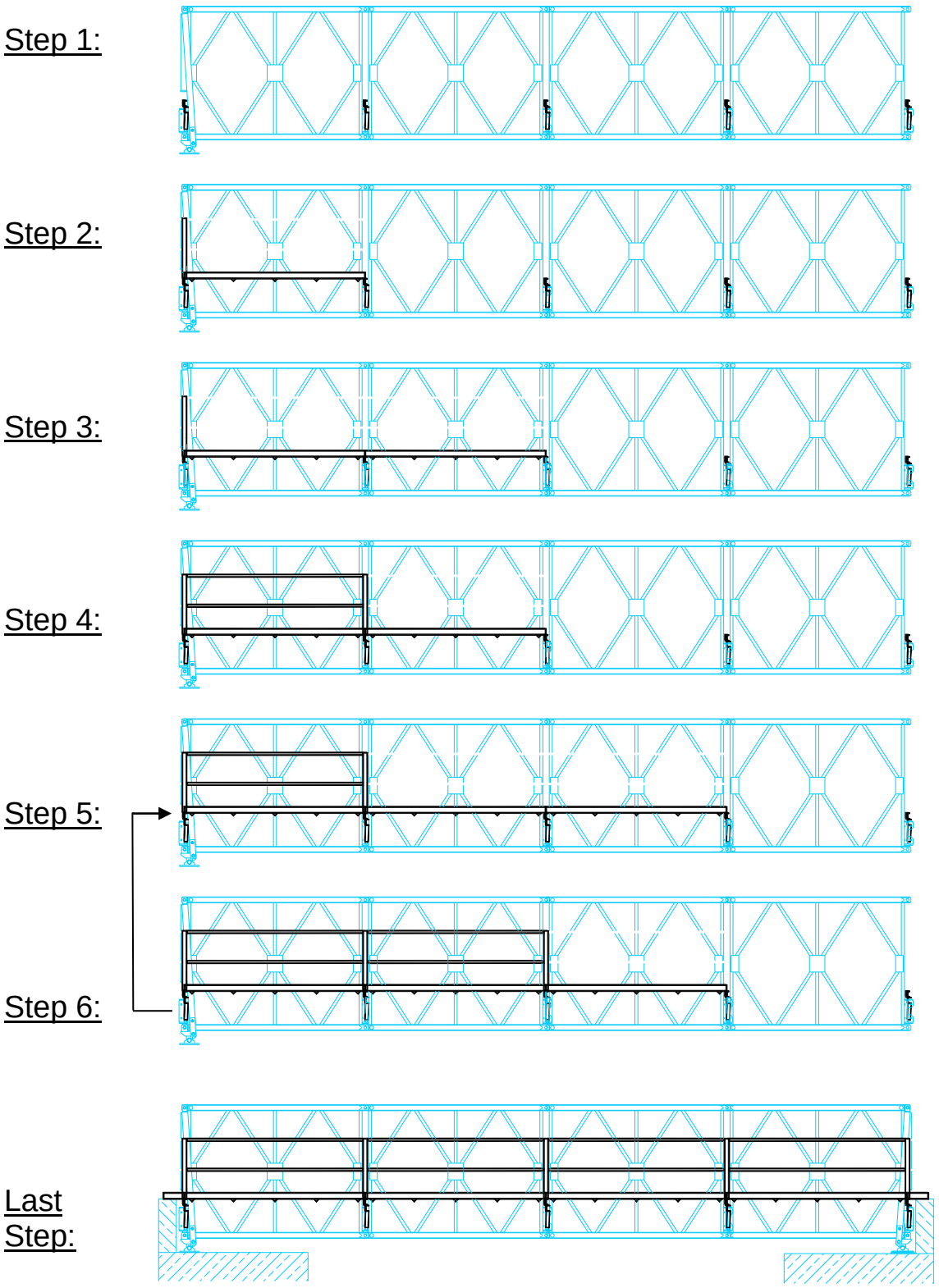


Figure 9.7 – FOOTWALK ERECTION STEPS

Footwalk with Span Junction

Using Span Junction construction it is possible to install the footwalk construction by means of four special span junction parts (SJ).

The Footwalk SJ Infill Tray is designed with long holes allowing movements of a 1:5 gradient up or down. In these long holes the bolts M12 (WBPB204A) are sliding against the connected angle and the angle is fixed to the SJ Handrail Post by a Bolt M12 (WBPB204A). See Figure 9.8.

Also the SJ Infill Handrail (WBFW306A) and Kneerail (WBFW307A) are produced with long holes for above movements. See Figure 9.10.

The SJ Handrail Post (WBFW311A) is necessary for a one sided connection of the Handrail and Kneerail.

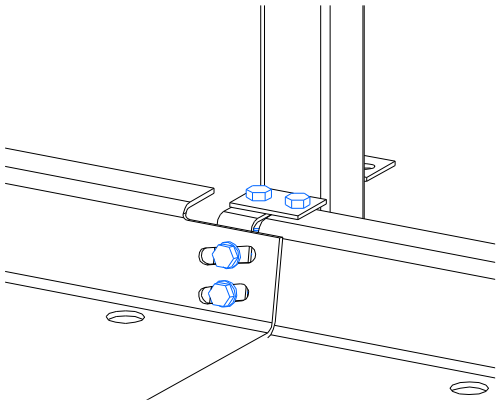


Figure 9.8 – SJ-Infill tray detail

ERECTION

The Footwalk SJ Infill Tray has to be laid down after the assembly of the adjacent Footwalk Trays. The SJ Infill Tray overlaps a short distance on the adjacent Trays.

Afterwards fix the SJ Infill Tray and the adjacent Trays by means of the SJ Handrail Post (WBFW311A), connected to the Bearer by one Bolt M24 Long (WBPB200A) and to the Trays by Bolts M12 (WBPB204A). Also fix the adjacent Handrail and Kneerail on the SJ Handrail Post.

Finally connect the SJ Infill Handrail (WBFW306A) and Kneerail (WBFW307A) to the SJ Handrail Post (WBFW311A) by using one Bolt M24 Long (WBPB200A) per post. See Figure 9.10.

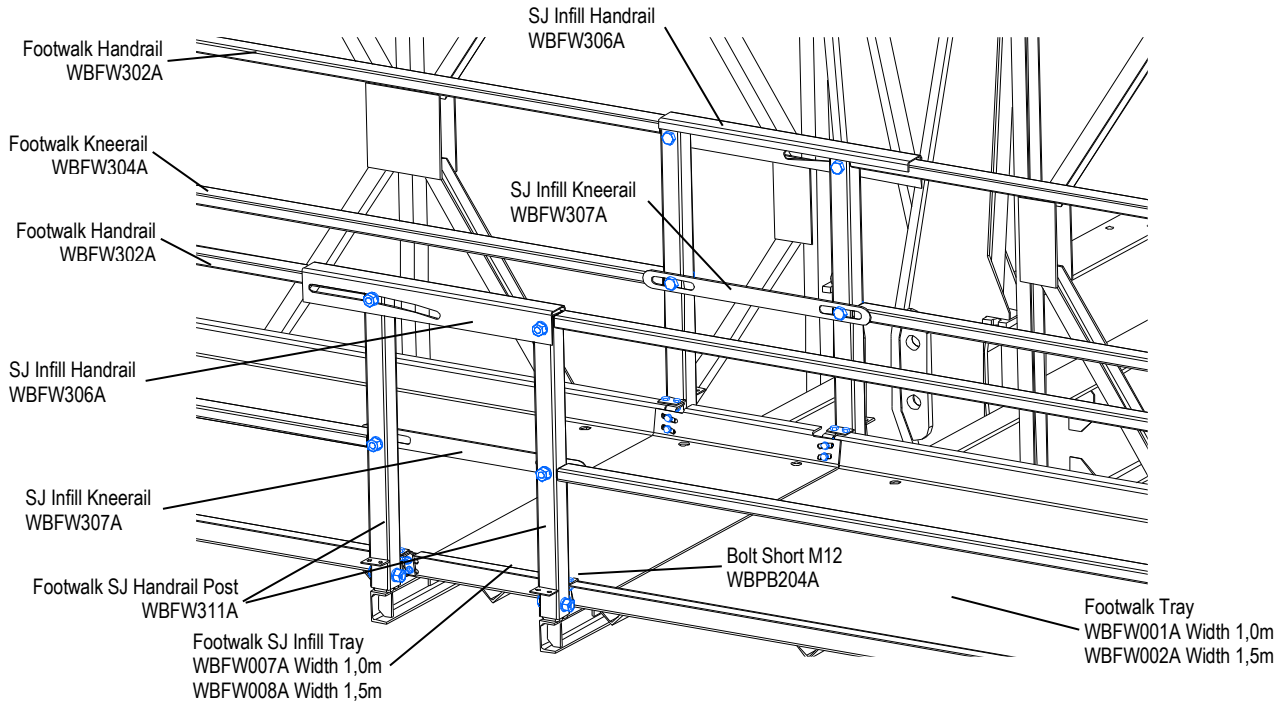


Figure 9.9 –SPAN JUNCTION FOOTWALK ASSEMBLY

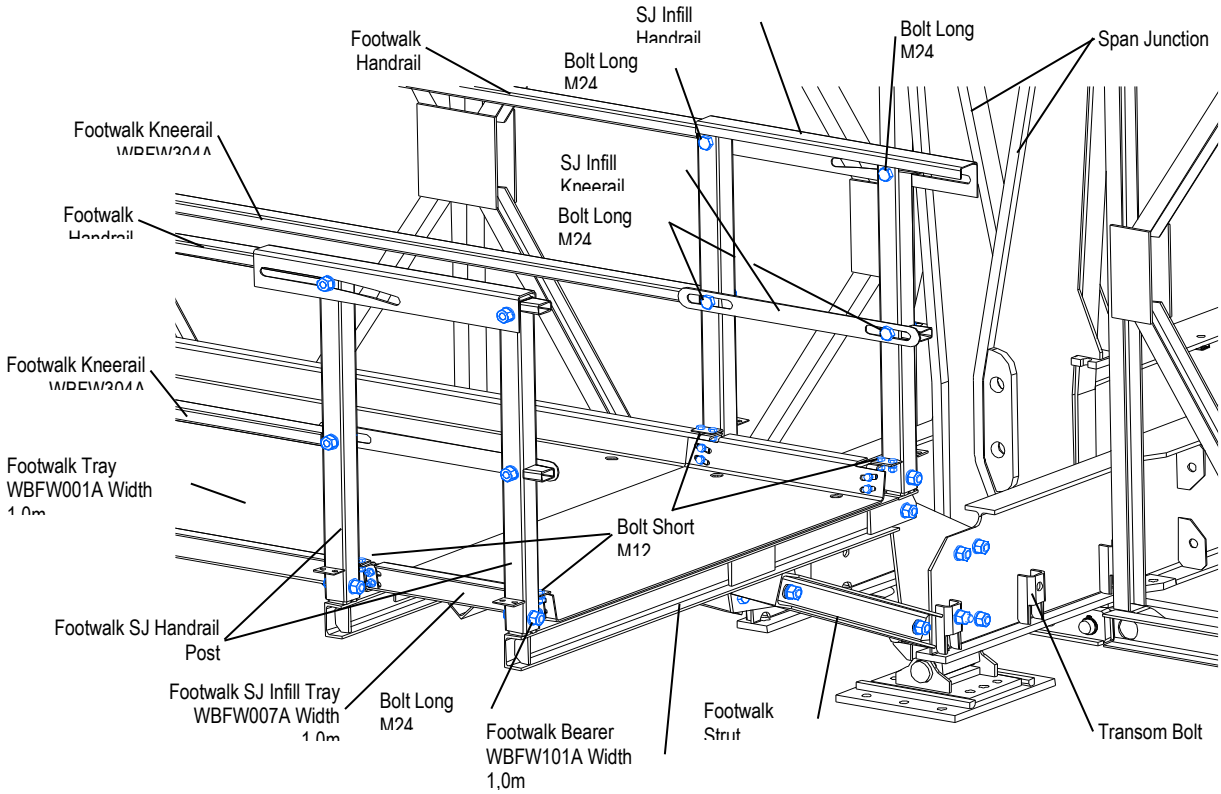


Figure 9.10 –SPAN JUNCTION FOOTWALK DETAIL ASSEMBLY

SECTION 10

BRIDGE PARTS LIST

PARTS LIST

GENERAL

The following tables are to be used to provide parts lists for simply supported road bridges.

Tables 10.1 to 10.3 list the quantities per bay for the superstructure (trusses and decking). Each table lists all the unreinforced truss constructions; additional quantities for reinforced bridges are given separately in Table 10.4.

The quantities required are produced by multiplying the number of parts per bay (column “a”) by the total number of bays in the bridge. Where necessary, an adjustment to the total number of parts must be made by adding or subtracting the figure given in *column “b”.*

For Reinforced Bridges it is necessary to add the quantities given in Table 10.4 by multiplying the number of parts per bay (column “a”) by the number of reinforced bays. Where necessary, an adjustment to the total number of parts must be made by adding or subtracting the figure given in *column “b”.*

Additional parts for End of Bridge equipment are given in Table 10.5.

Notes:

- The numbers given in the Tables do not include an allowance for spare parts.
- The numbers of Transom Braces and their fixing bolts depend on whether the complete bridge is made up of an ODD or EVEN number of bays.

PART NUMBER	DESCRIPTION	bays	SS		DS		TS		QS		DD		TD	
		o / e	a	*b*	a	*b*	a	b	a	b	a	b	a	b
WBPC050A	PANEL STANDARD		2		4		6		8		8		12	
WBBR001A	DIAGONAL RAKER		2	*-2*	2	*-2*	2	*-2*	2	*-2*	4		4	
WBBR006A	BRACING CHANNEL TO RAKER				2	*-2*	2	*-2*	2	*-2*	6	*2*	6	*2*
WBBR005A	DIAGONAL TOP CHORD BRACE				4	*-2*	4	*-2*	4	*-2*	4	*-2*	4	*-2*
WBBR006A	BRACING CHANNEL				4		4		4		4		4	
WBTR002A	TRANSOM STANDARD		1	*1*	1	*1*	1	*1*	1	*1*	1	*1*	1	*1*
WBBR105A	SWAY BRACE STANDARD/DW LIGHT		2		2		2		2		2		2	
WBBR210A	TRANSOM BRACE	odd	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*
		even	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*
WBDE150A	DECK UNIT STEEL STANDARD		3		3		3		3		3		3	
WBDE302A	KERB UNIT		2		2		2		2		2		2	
WBPB001A	PANEL PIN STANDARD		4	*4*	8	*8*	12	*12*	16	*16*	16		24	
WBPB002A	SAFETY CLIP STANDARD		8	*8*	16	*16*	24	*24*	32	*32*	32		48	
WBPB200A	BRACING BOLT LONG M24		6	*-2*	6	*2*	8	*4*	10	*6*	10	*2*	16	*4*
WBPB200A	BRACING BOLT LONG M24		4		16	*-4*	22	*-6*	28	*-8*	20	*4*	30	*6*
WBPB201A	BRACING BOLT MEDIUM M24	odd	8	*3*	6	*5*	6	*5*	6	*5*	6	*5*	6	*5*
		even	8	*8*	6	*10*	6	*10*	6	*10*	6	*10*	6	*10*
WBPB206A	DECK AND KERB BOLT M20		22		22		22		22		22		22	

Table 10.1 – Parts List - Standard Width

a . . . . . parts per bay *b . . . . . adjustments per bridge*

To get the correct number of parts choose the type of the bridge (SS, DS, ..), multiply the total number of bays by the number in column “a” and add the number in *column “b”*.

Example: Bracing Channel to raker for DS, bridge 8 bays long: a = 2, b = -2 ➔ Number of Bracing Channel to rakers = (8 x 2) – 2 = 14

PART NUMBER	DESCRIPTION	bays	SS		DS		TS		QS		DD		TD	
		o / e	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*
WBPC050A	PANEL STANDARD		2		4		6		8		8		12	
WBBR001A	DIAGONAL RAKER		2	*-2*	2	*-2*	2	*-2*	2	*-2*	4		4	
WBBR006A	BRACING CHANNEL TO RAKER				2	*-2*	2	*-2*	2	*-2*	6	*2*	6	*2*
WBBR005A	DIAGONAL TOP CHORD BRACE				4	*-2*	4	*-2*	4	*-2*	4	*-2*	4	*-2*
WBBR006A	BRACING CHANNEL				4		4		4		4		4	
WBTR052A or	TRANSOM EXTRA WIDE 20		1	*1*	1	*1*	1	*1*	1	*1*	1	*1*	1	*1*
WBTR053A	TRANSOM EXTRA WIDE 25													
WBBR115A	SWAY BRACE EXTRA WIDE LIGHT		2		2		2		2		2		2	
WBBR210A	TRANSOM BRACE	odd	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*
		even	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*
WBDE150A	DECK UNIT STEEL STANDARD		4		4		4		4		4		4	
WBDE302A	KERB UNIT		2		2		2		2		2		2	
WBPB001A	PANEL PIN STANDARD		4	*4*	8	*8*	12	*12*	16	*16*	16		24	
WBPB002A	SAFETY CLIP STANDARD		8	*8*	16	*16*	24	*24*	32	*32*	32		48	
WBPB200A	BRACING BOLT LONG M24		6	*-2*	6	*2*	8	*4*	10	*6*	10	*2*	16	*4*
WBPB200A	BRACING BOLT LONG M24		4		16	*-4*	22	*-6*	28	*-8*	20	*4*	30	*6*
WBPB201A	BRACING BOLT MEDIUM M24	odd	8	*3*	6	*5*	6	*5*	6	*5*	6	*5*	6	*5*
		even	8	*8*	6	*10*	6	*10*	6	*10*	6	*10*	6	*10*
WBPB206A	DECK AND KERB BOLT M20		26		26		26		26		26		26	

Table 10.2 – Parts List - Extra Wide

a . . . . . parts per bay *b . . . . . adjustments per bridge*

To get the correct number of parts choose the type of the bridge (SS, DS, ..), multiply the total number of bays by the number in column “a” and add the number in *column “b”*.

Example: Bracing Channel to raker for DS, bridge 8 bays long: a = 2, b = -2 ➔ Number of Bracing Channel to rakers = (8 x 2) – 2 = 14

PART NUMBER	DESCRIPTION	bays	SS		DS		TS		QS		DD		TD	
		o / e	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*
WBPC050A	PANEL STANDARD		2		4		6		8		8		12	
WBBR001A	DIAGONAL RAKER		2	*-2*	2	*-2*	2	*-2*	2	*-2*	4		4	
WBBR006A	BRACING CHANNEL TO RAKER				2	*-2*	2	*-2*	2	*-2*	6	*2*	6	*2*
WBBR005A	DIAGONAL TOP CHORD BRACE				4	*-2*	4	*-2*	4	*-2*	4	*-2*	4	*-2*
WBBR006A	BRACING CHANNEL				4		4		4		4		4	
WBTR102A or	TRANSOM DOUBLE WIDE 20		1	*1*	1	*1*	1	*1*	1	*1*	1	*1*	1	*1*
WBTR103A	TRANSOM DOUBLE WIDE 25													
WBBR105A	SWAY BRACE STANDARD/DW LIGHT		4		4		4		4		4		4	
WBBR155A	SWAY BRACE STRUT DOUBLE WIDE			*2*		*2*		*2*		*2*		*2*		*2*
WBBR210A	TRANSOM BRACE	odd	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*	2	*2*
		even	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*	2	*4*
WBDE150A	DECK UNIT STEEL STANDARD		7		7		7		7		7		7	
WBDE302A	KERB UNIT		2		2		2		2		2		2	
WBBP001A	PANEL PIN STANDARD		4	*4*	8	*8*	12	*12*	16	*16*	16		24	
WBPB002A	SAFETY CLIP STANDARD		8	*8*	16	*16*	24	*24*	32	*32*	32		48	
WBPB200A	BRACING BOLT LONG M24		6	*-2*	6	*2*	8	*4*	10	*6*	10	*2*	16	*4*
WBPB200A	BRACING BOLT LONG M24		8		20	*-4*	26	*-6*	32	*-8*	20	*4*	30	*6*
WBPB201A	BRACING BOLT MEDIUM M24	odd	9	*11*	7	*13*	7	*13*	7	*13*	7	*13*	7	*13*
		even	9	*16*	7	*18*	7	*18*	7	*18*	7	*18*	7	*18*
WBPB206A	DECK AND KERB BOLT M20		38		38		38		38		38		38	

Table 10.3 – Parts List - Double Wide

a . . . . . parts per bay *b . . . . . adjustments per bridge*

To get the correct number of parts choose the type of the bridge (SS, DS, ..), multiply the total number of bays by the number in column “a” and add the number in *column “b”*.

Example: Bracing Channel to raker for DS, bridge 8 bays long: a = 2, b = -2 ➔ Number of Bracing Channel to rakers = (8 x 2) – 2 = 14

PART NUMBER	DESCRIPTION	SSRL		DSR1L DDR1L		DSR2L DDR2L		TSR2L TDR2L		TSR3L TDR3L		QSR4L	
		a	*b*	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*
WBPC106A	REINFORCING CHORD LIGHT	4		4		8		8		12		16	
WBPB100A	CHORD BOLT	20		20		40		40		60		80	
WBPB001A	PANEL PIN STANDARD	4	*-4*	4	*-4*	8	*-8*	8	*-8*	12	*-12*	16	*-16*
WBPB002A	SAFETY CLIP STANDARD	8	-8	8	-8	16	-16	16	-16	24	-24	32	-32

PART NUMBER	DESCRIPTION	SSRM		DSR1M DDR1M		DSR2M DDR2M		TSR2M TDR2M		TSR3M TDR3M		QSR4M	
		a	*b*	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*
WBPC115A	REINFORCING CHORD MEDIUM	4		4		8		8		12		16	
WBPB100A	CHORD BOLT	20		20		40		40		60		80	
WBPB010A	PANEL PIN HEAVY	4	*-4*	4	*-4*	8	*-8*	8	*-8*	12	*-12*	16	*-16*
WBPB011A	CLIP HEAVY	8	-8	8	-8	16	-16	16	-16	24	-24	32	-32

PART NUMBER	DESCRIPTION	SSRH		DSR1H DDR1H		DSR2H DDR2H		TSR2H TDR2H		TSR3H TDR3H		QSR4H	
		a	*b*	a	*b*	a	*b*	a	*b*	a	*b*	a	*b*
WBPC125A	REINFORCING CHORD HEAVY	4		4		8		8		12		16	
WBPB100A	CHORD BOLT	20		20		40		40		60		80	
WBPB010A	PANEL PIN HEAVY	4	*-4*	4	*-4*	8	*-8*	8	*-8*	12	*-12*	16	*-16*
WBPB011A	CLIP HEAVY	8	-8	8	-8	16	-16	16	-16	24	-24	32	-32

Table 10.4 – Parts List - Reinforcement

a . . . . . parts per reinforced bay b . . . . . adjustments per bridge

To get the correct number of parts choose the type of the bridge (SS, DS, ..), multiply the total number of reinforced bays by the number in column “a” and add the number in *column “b”.*

Example: Panel Pin Heavy for DSR1M, 5 reinforced bays: a = 4, b = -4 ➔ Number of panel pins heavy = (5 x 4) – 4 = 16

PART NUMBER	DESCRIPTION	SS	DS	TS	QS	DD	TD
WBEB010A	END POST FEMALE LIGHT	2	4	6	8	4	6
WBEB011A	END POST MALE LIGHT	2	4	6	8	4	6
WBPB205A	END POST THREADED BOLTS&NUTS	4	8	12	16	8	12
WBEB100A	KNUCKLE BEARING FEMALE	2	4	6	8	4	6
WBEB101A	KNUCKLE BEARING MALE	2	4	6	8	4	6
WBEB102A	KNUCKLE BEARING BASEPLATE	4	8	12	16	8	12
WBEB150A	SLIDING PLATE SINGLE	2	0	0	0	0	0
WBEB151A	SLIDING PLATE MULTIPLE	0	2	2	2	2	2
WBPB220A	ANCHOR BOLTS FOR SLIDING PLATES	24	36	48	60	36	48
WBEB001A	PANEL PIN STANDARD	4	8	12	16	8	12
WBEB003A	END POST PIN	4	8	12	16	8	12
WBPB002A	SAFETY CLIP STANDARD	16	32	48	64	32	48

PART NUMBER	DESCRIPTION	Standard Width (STD)	Extra Wide (EW)	Double Wide (DW)
WBDE400A	END OF BRIDGE INFILLER STANDARD DECK STD+EW	6	8	0
WBDE401A	END OF BRIDGE STANDARD DECK INFILLER DW	0	0	14
WBPB206A	DECK AND KERB BOLT M20	12	16	28

Table 10.5 – Parts List - End of Bridge per Bridge

PART NUMBER	DESCRIPTION	SS	DS	TS	QS	DD	TD
WBEB500A	SPAN JUNCTION POST FEMALE	2	4	6	8	4	6
WBPB501A	SPAN JUNCTION POST MALE	2	4	6	8	4	6
WBEB100A	KNUCKLE BEARING FEMALE **OR**	2	4	6	8	4	6
WBEB101A	KNUCKLE BEARING MALE	2	4	6	8	4	6
WBEB102A	KNUCKLE BEARING BASEPLATE	2	4	6	8	4	6
WBEB510A	SJ SUPPORT SHOE	2	4	6	8	4	6
WBEB150A	SLIDING PLATE SINGLE	2	0	0	0	0	0
WBEB151A	SLIDING PLATE MULTIPLE	0	2	2	2	2	2
WBPB220A	ANCHOR BOLTS FOR SLIDING PLATES	24	36	48	60	36	48
WBEB001A	PANEL PIN STANDARD	4	8	12	16	8	12
WBEB003A	END POST PIN	2	4	6	8	4	6
WBPB002A	SAFETY CLIP STANDARD	12	24	36	48	24	36

PART NUMBER	DESCRIPTION	Standard Width (STD)	Extra Wide (EW)	Double Wide (DW)
WBDE500A	SPAN JUNCTION INFILL DECK STANDARD	3	4	7
WBDE510A	SPAN JUNCTION KERB UNIT STANDARD	2	2	2
WBPB206A	DECK AND KERB BOLT M20	16	20	32

Table 10.6 – Parts List – Span Junction Equipment per Pier

PART NUMBER	DESCRIPTION	Standard Width (STD)	Extra Wide (EW)	Double Wide (DW)
		Parts per Bay		
WBDE600A, WBDE602A	OUTER STRINGER 25, TIMBER DECK	2	2	2
WBDE601A, WBDE603A	INNER STRINGER 25, TIMBER DECK	4	7	12
WBPB206A	DECK AND KERB BOLT M20	14	18	28
WBDE651A, WBDE671A	TIMBER CHESS 25	14	14	14
WBDE654A	TIMBER KERB	2	2	2
WBDE655A	TIMBER RUNNING BOARD	8	8	8
WBPB210A	TIMBER DECK BOLT SHORT M12	28	28	28
WBPB211A	TIMBER DECK BOLT LONG M12	8	8	8

PART NUMBER	DESCRIPTION	Standard Width (STD)	Extra Wide (EW)	Double Wide (DW)
		Parts per Bridge		
WBDE661A	END OF BRIDGE INFILLER 25	2	2	2
WBPB212A	TIMBER EOB INFILLER BOLT M20	14	18	28

Remark: The Tables 10.1. – 10.5. shall be used to determine the parts for bridges with timber deck except the following parts:
"Deck Unit Steel Standard", "Kerb Unit" and "Deck and Kerb Bolt M20" from tables 10.1-10.3 are not used.
"End of Bridge Infiller" and "Deck and Kerb Bolt M20" from table 10.5 are not used.

Table 10.7 – Parts List –Additional Parts for Timber Deck

EXAMPLE OF THE USE OF PARTS LIST TABLES

Simply supported, series PP30, 7 bay extra wide bridge DSR2L construction for HS25-44

Main bridge components from Table 10.2

PART NUMBER	DESCRIPTION	7 bays	DS		TOTAL
		o / e	a	*b*	
WBPC050A	PANEL STANDARD		4		28
WBBR001A	DIAGONAL RAKER		2	*-2*	12
WBBR002A	RAKER BRACE		2	*-2*	12
WBBR005A	DIAGONAL TOP CHORD BRACE		4	*-2*	26
WBBR004A	TOP CHORD BRACE		4		28
WBTR053A	TRANSOM EXTRA WIDE		1	1	8
WBBR115A	SWAY BRACE EXTRA WIDE, LIGHT		2		14
WBBR210A	TRANSOM BRACE	odd	2	2	16
WBDE150A	DECK UNIT STEEL STANDARD		4		28
WBDE302A	KERB UNIT		2		14
WBPB001A	PANEL PIN STANDARD		8	8	64
WBPB002A	SAFETY CLIP STANDARD		16	*16*	128
WBPB200A	BRACING BOLT LONG M24		6	*2*	44
WBPB201A	BRACING BOLT MEDIUM M24		16	*-4*	108
WBPB201A	BRACING BOLT MEDIUM M24	odd	6	*5*	47
WBPB206A	DECK AND KERB BOLT M20		26		182

Reinforcement from Table 10.4

PART NUMBER	DESCRIPTION	5 bays	DSR2L		TOTAL
			a	*b*	
WBPC105A	REINFORCING CHORD LIGHT		8		40
WBPB100A	CHORD BOLT		40		200
WBPB001A	PANEL PIN STANDARD		8	*-8*	32
WBPB002A	SAFETY CLIP STANDARD		16	-16	64

End of Bridge components from Table 10.5 (continued on next page)

PART NUMBER	DESCRIPTION	DS	TOTAL
WBEB010A	END POST FEMALE LIGHT	4	4
WBEB011A	END POST MALE LIGHT	4	4
WBPB205A	END POST THREADED BOLTS&NUTS	4	4
WBEB100A	KNUCKLE BEARING FEMALE	4	4
WBEB101A	KNUCKLE BEARING MALE	4	4
WBEB102A	KNUCKLE BEARING BASEPLATE	8	8
WBEB150A	SLIDING PLATE SINGLE	0	0
WBEB151A	SLIDING PLATE MULTIPLE	2	2
WBPB220A	ANCHOR BOLTS FOR SLIDING PLATES	36	36

End of Bridge components from Table 10.5 (continuation)

PART NUMBER	DESCRIPTION	DS	TOTAL
WBEB003A	END POST PIN	8	8
WBPB002A	SAFETY CLIP STANDARD	16	16
WBDE400A	END OF BRIDGE INFILLER STD+EW	8	8
WBDE401A	END OF BRIDGE INFILLER DW	0	0
WBPB206A	DECK AND KERB BOLT M20	16	16

SECTION 11

COMPONENT DRAWINGS

STANDARD BRIDGE PARTS

GROUP	PART NUMBER	DESCRIPTION	WEIGHT	PAGE
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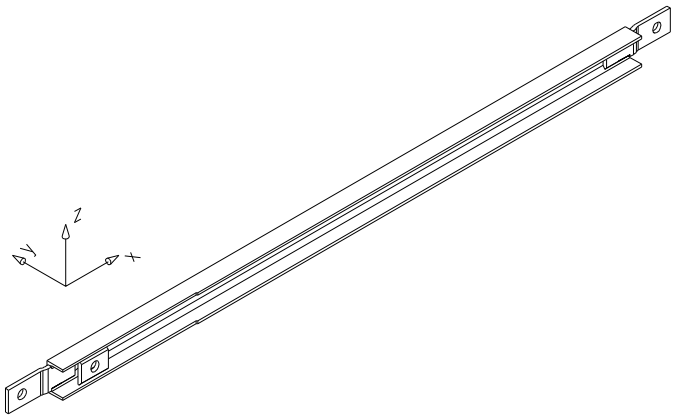
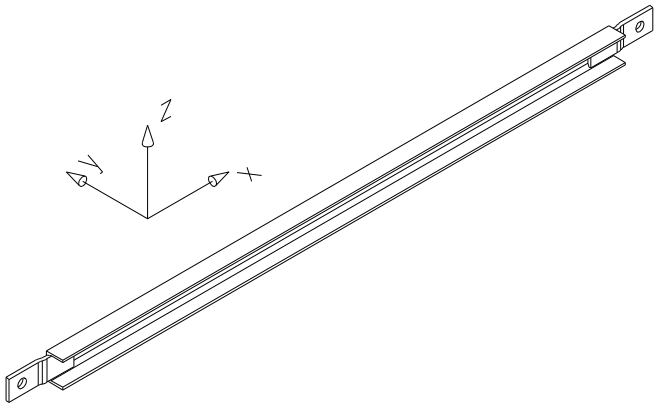


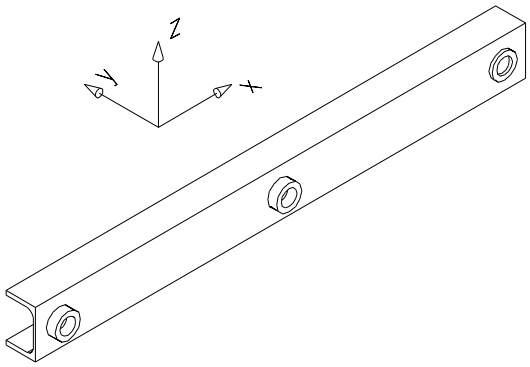
WBBR001A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR001A	**Diagonal Raker**	**1984 – 80 - 50**	**16**



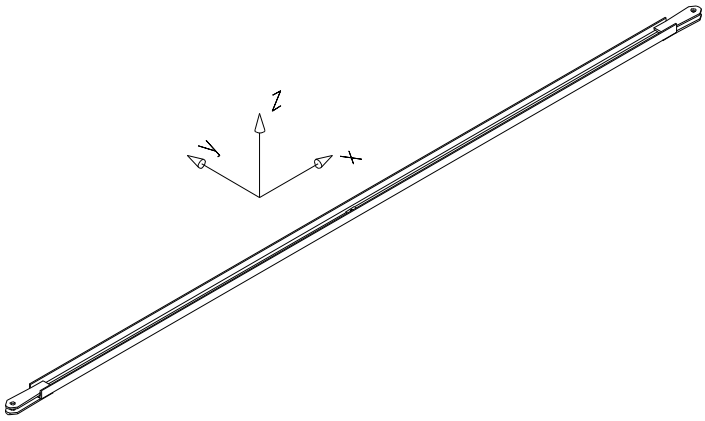
WBBR005A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR005A	**Diagonal Top Chord Brace**	**1779 – 80 - 50**	**14**



WBBR006A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR006A	**Bracing Channel**	**830 – 80 - 65**	**7**

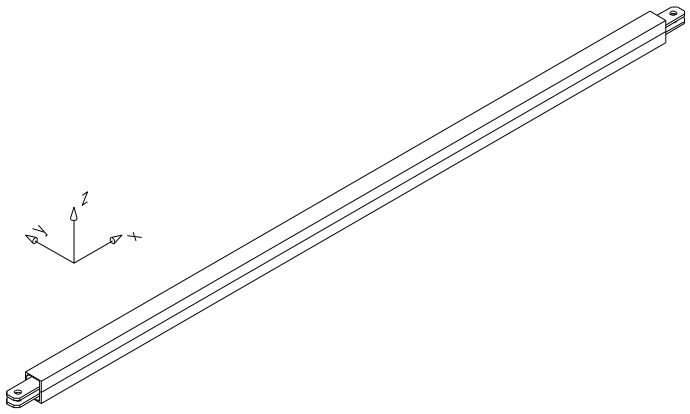


WBBR105A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR105A	**Sway Brace STD/DW**	**4762 - 80 - 60**	**46**

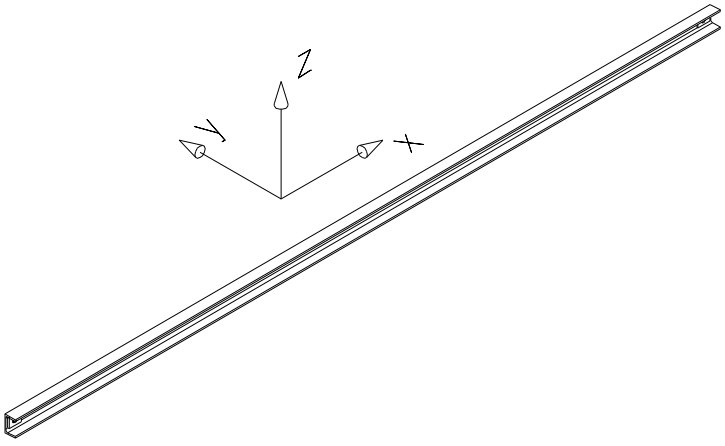
WBBR115A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR115A	**Sway Brace EW**	**5588 - 80 - 60**	**53**



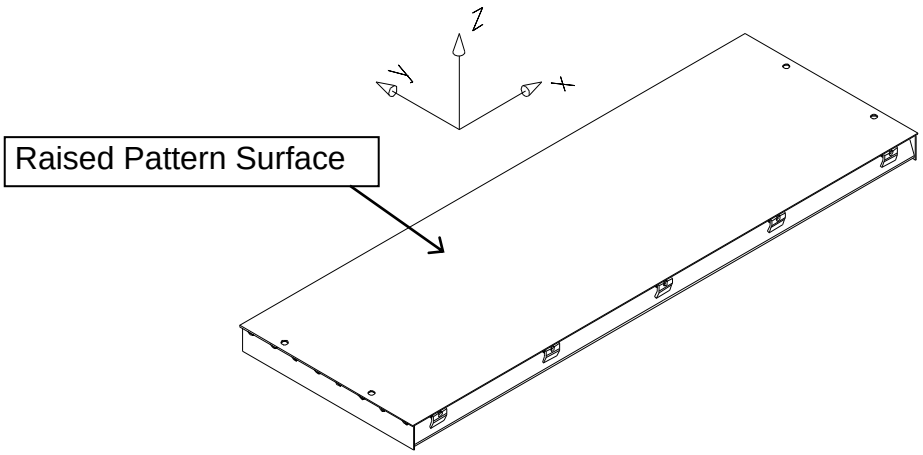
WBBR155A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR155A	**Sway Brace Strut DW**	**3180 – 80 - 100**	**50**



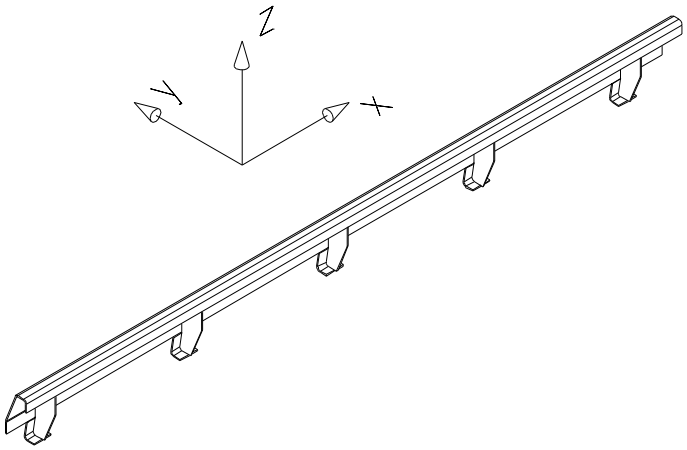
WBBR210A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBBR210A	**Transom Brace**	**3030 - 55 - 80**	**26**



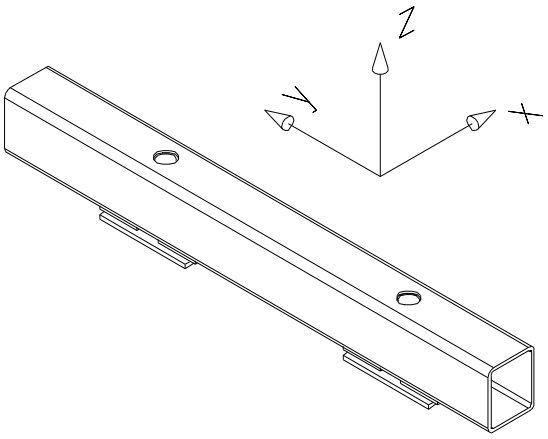
WBDE150A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE150A	**Deck Unit Steel Standard**	**3042 - 1045 - 135**	**305**



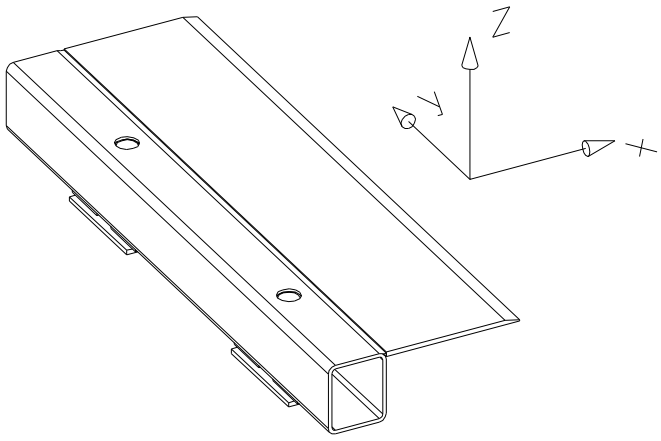
WBDE302A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE302A	**Kerb Unit Standard**	**3042 - 110 - 260**	**42**



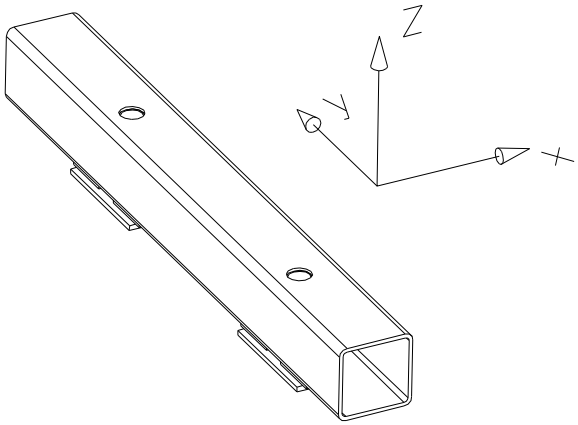
WBDE400A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE400A	**End of Bridge Infiller Standard Deck – STD+EW**	**100 - 1045 - 136**	**25**



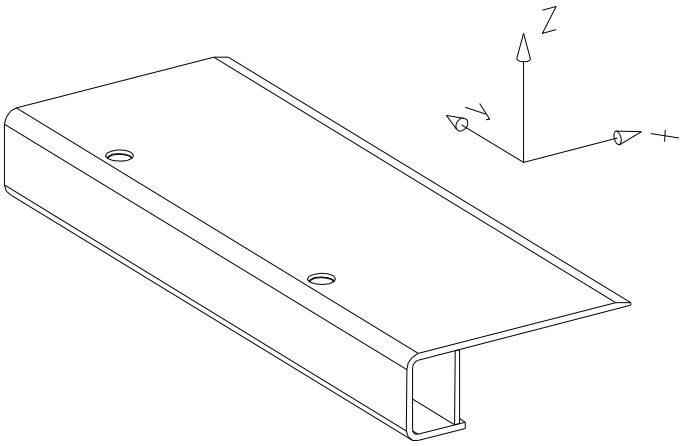
WBDE410A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE410A	**EOB Standard Deck – STD+EW - expansion plate**	**330 - 1045 - 136**	**40**



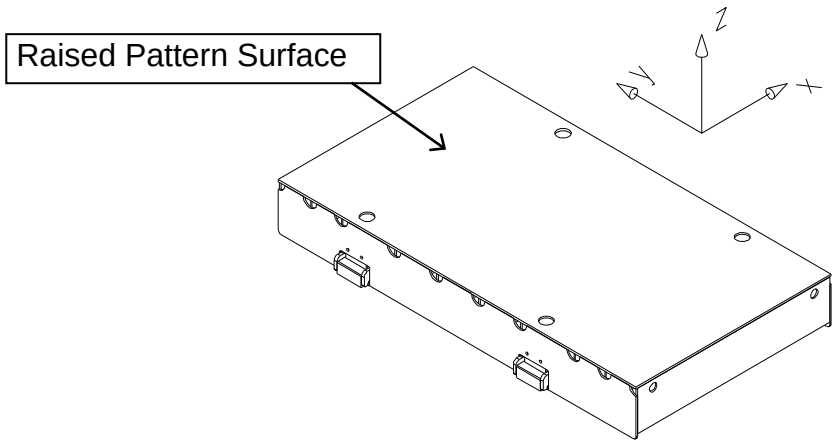
WBDE401A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE401	**EOB Infiller Standard Deck, DW**	**120 - 1045 - 136**	**27**



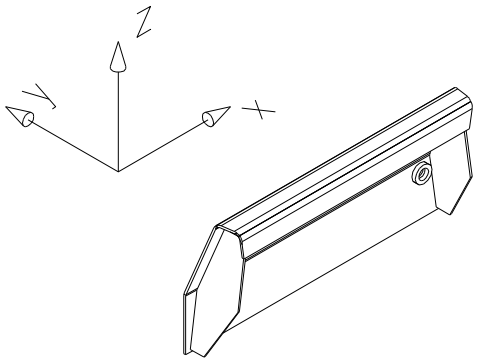
WBBDE411A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE411A	**EOB Infiller Standard Deck DW - expansion**	**380 - 1045 - 135**	**55**



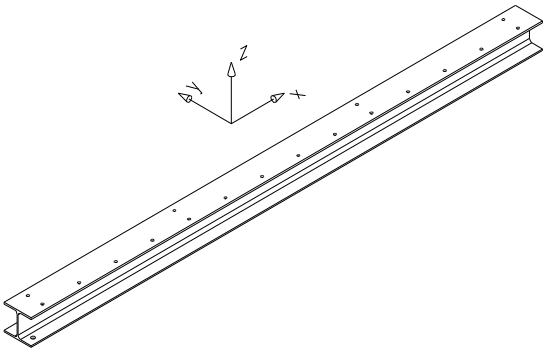
WBDE500A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE500A	**Span Junction Infill Deck Standard**	**1050 - 560 - 135**	**63**



WBDE510A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE510A	**Span Junction Kerb Unit Standard**	**575 - 100 - 265**	**8**

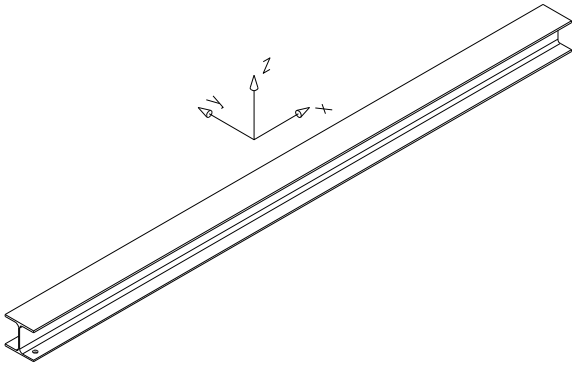


WBDE600A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE600A	**Outer Stringer 25, Timber Deck**	**3042 - 160 - 152**	**93**

WBDE602A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE602A	**Outer Stringer H=157mm 25, Timber Deck**	**3042 - 160 - 157**	**92**

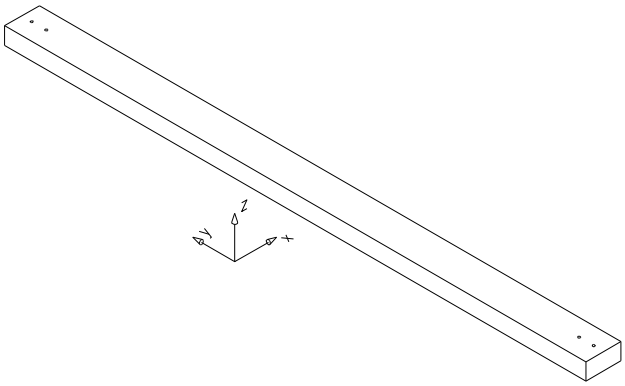


WBDE601A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE601A	**Inner Stringer 25, Timber Deck**	**3042 - 160 - 152**	**93**

WBDE603A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE603A	**Inner Stringer H=157mm, 25, Timber Deck**	**3042 - 160 - 157**	**92**

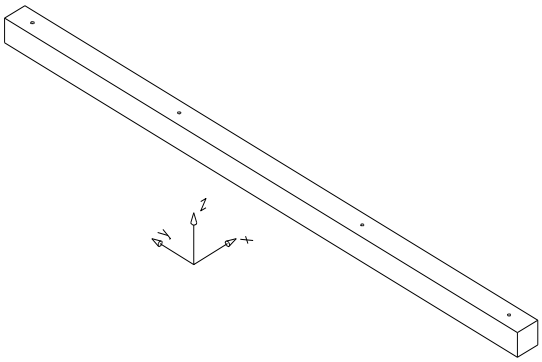


WBDE651A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE651A	**Timber Chess 25, STD**	**3470 - 210 – 100**	**51**

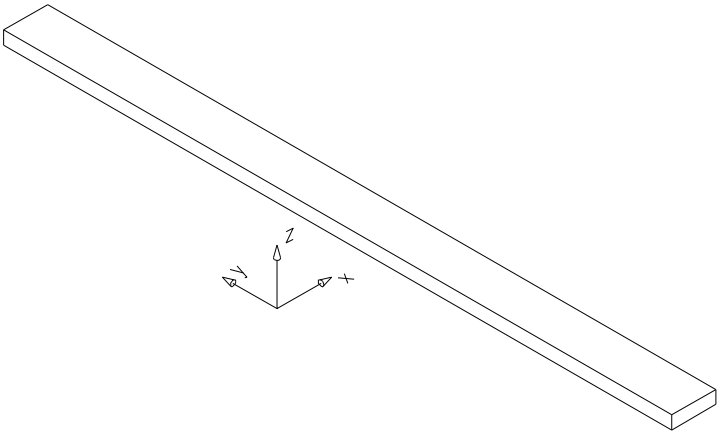
WBDE671A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE671A	**End Timber Chess 25, STD**	**3470 - 104 – 100**	**25**



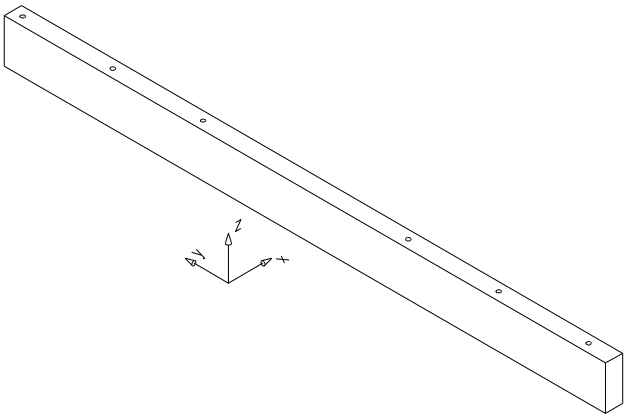
WBDE654A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE654A	**Timber Kerb**	**3042 - 120 – 120**	**31**



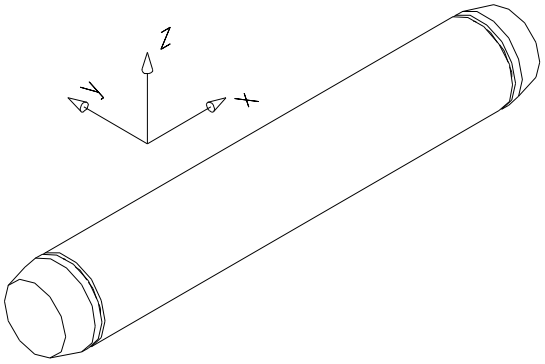
WBDE655A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE655A	**Timber Running Board**	**variable - 200 - 60**	**9 kg/m**



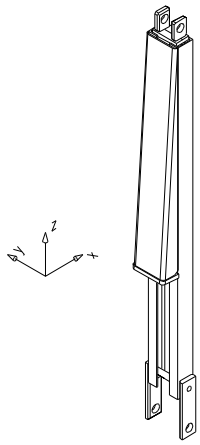
WBDE661A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBDE661A	**EOB Infiller Timber Deck,STD**	**3470 - 100 - 252**	**61 kg**



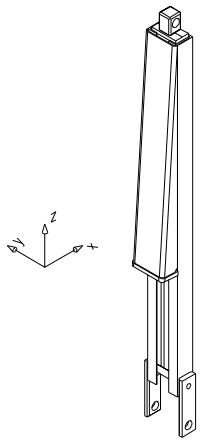
WBEB003A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBEB003A	**End Post Pin**	**290 – 46.8**	**4**



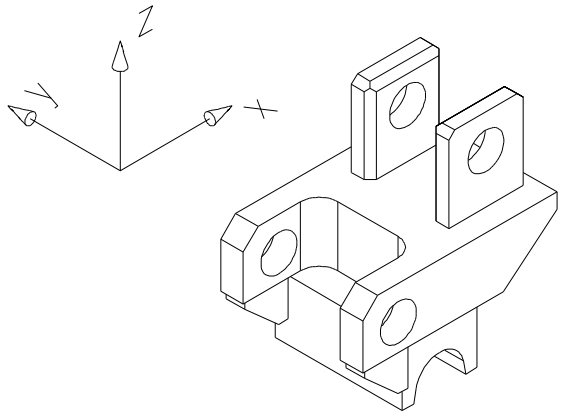
WBEB010A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB010A	**End Post Female Light**	**211 - 244 - 2356**	**81**



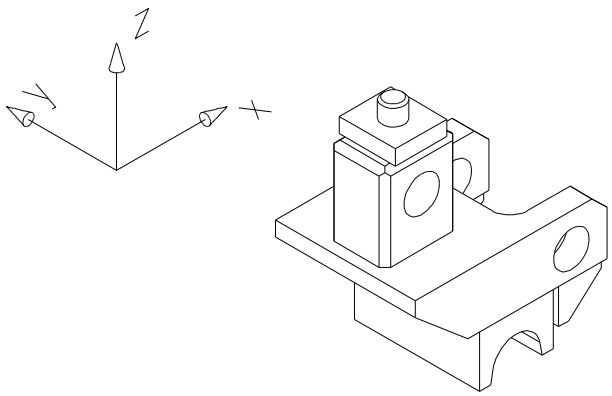
WBEB011A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB011A	**End Post Male Light**	**211 - 244 - 2356**	**83**



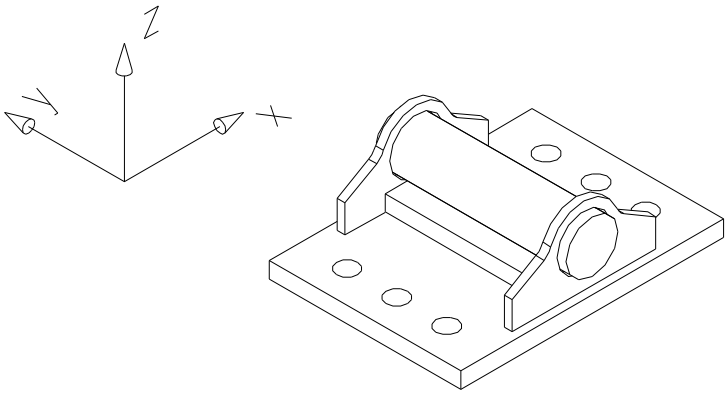
WBEB100A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB100A	**Knuckle Bearing Female**	**260 - 190 - 270**	**47**



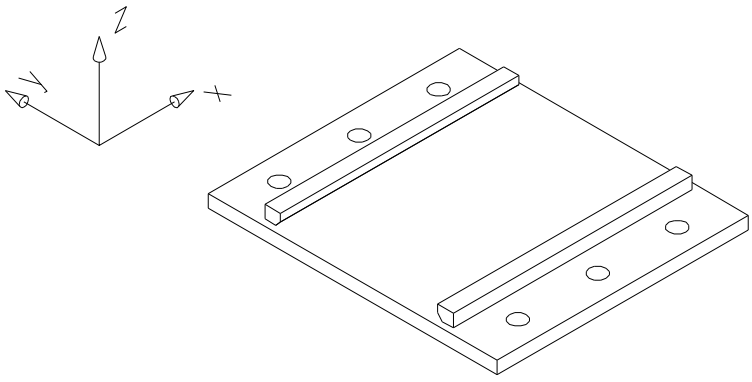
WBEB101A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB101A	**Knuckle Bearing Male**	**260 - 190 - 270**	**51**



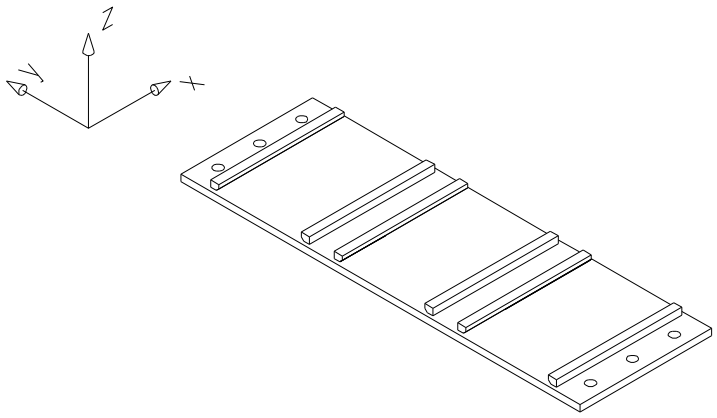
WBEB102A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB102A	**Knuckle Bearing Baseplate**	**330 - 240 - 105**	**24**



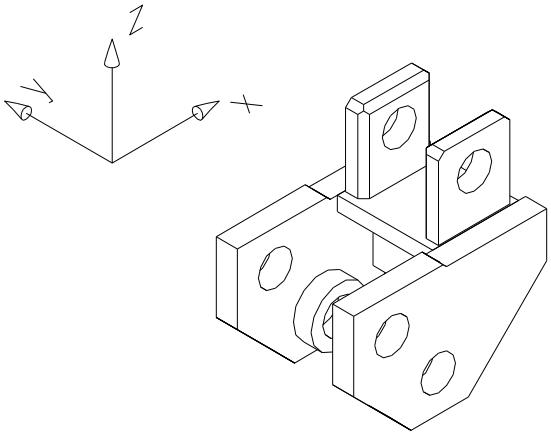
WBEB150A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB150A	**Sliding Plate Single**	**400 - 460 - 40**	**32**



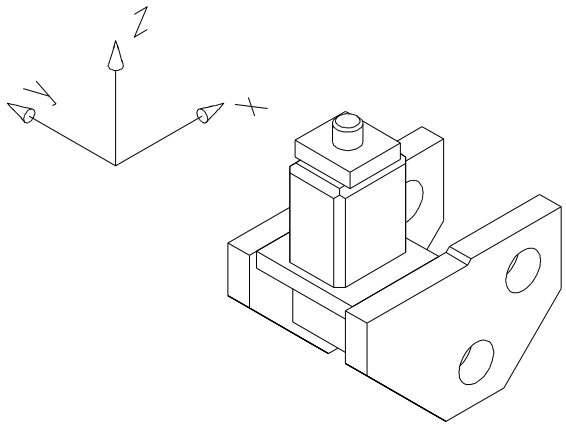
WBEB151A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB151A	**Sliding Plate Multiple**	**400 - 1210 - 40**	**85**



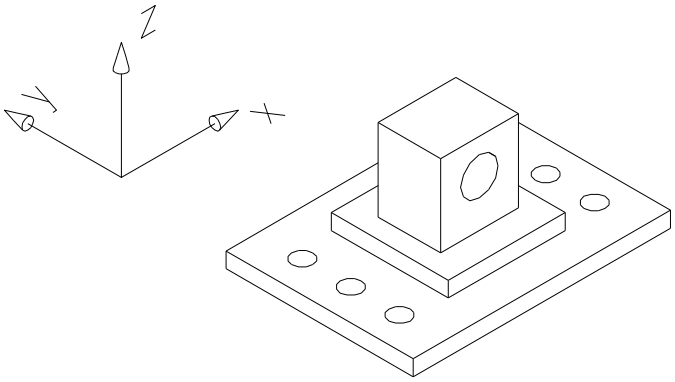
WBEB200A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB200A	**Pinned Bearing Female**	**277 - 190 - 290**	**34**



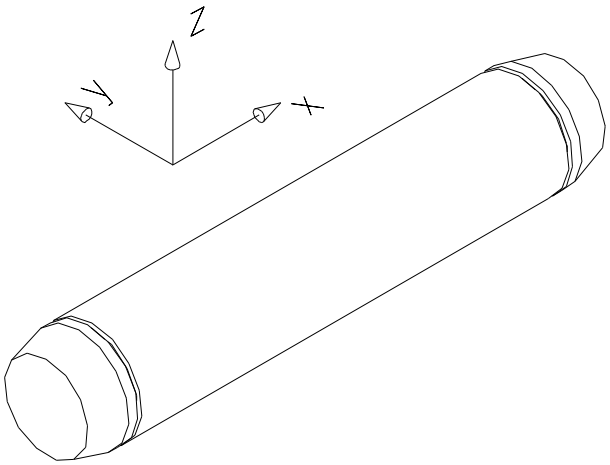
WBEB201A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB201A	**Pinned Bearing Male**	**277 - 190 - 290**	**38**



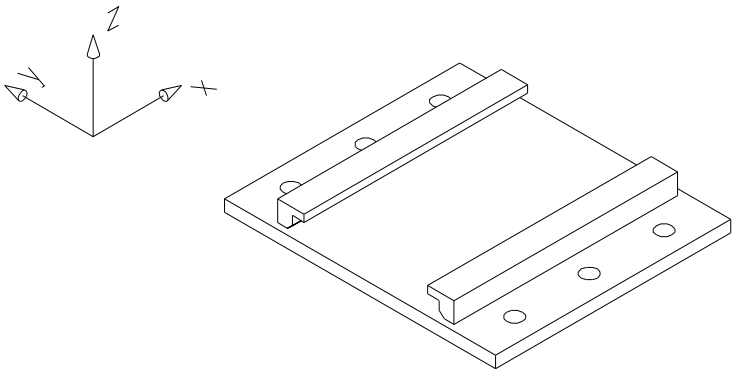
WBEB202A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB202A	**Pinned Bearing Baseplate**	**330 - 240 - 145**	**24**



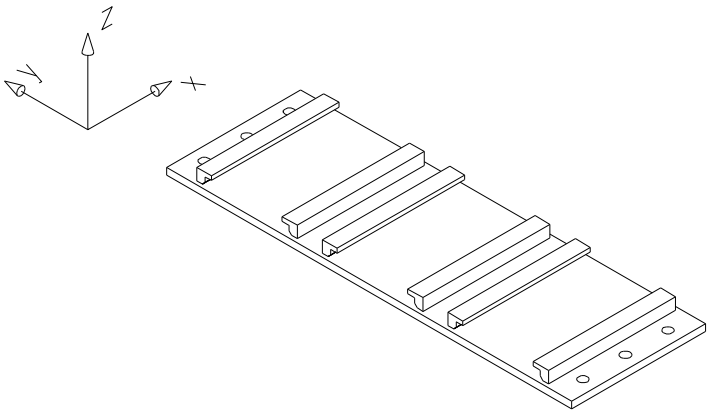
WBEB203A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBEB203A	**Pinned Bearing Pin**	**240 – 46.8**	**3**



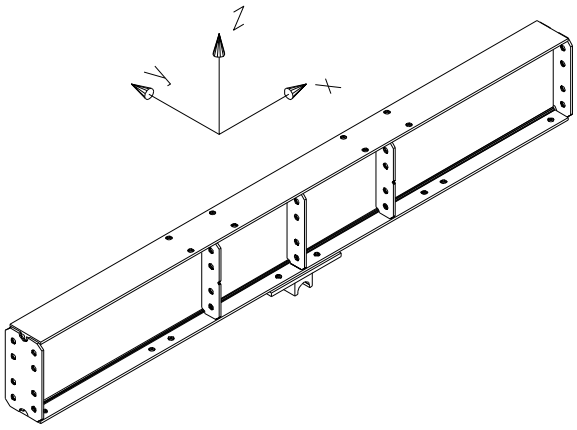
WBEB204A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBEB204A	**Pinned Bearing Sliding Plate Single**	**400 - 460 - 55**	**38**



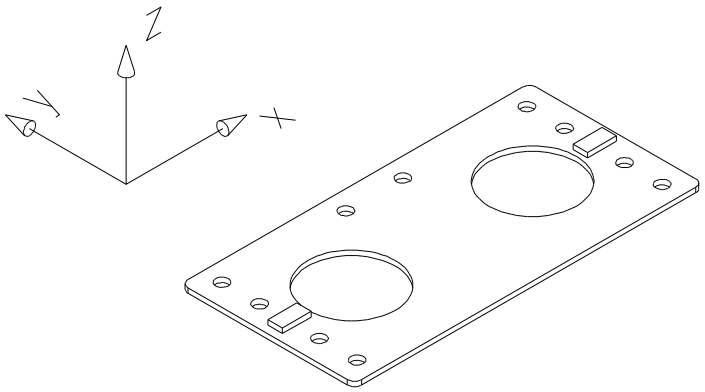
WBEB205A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBEB205A	**Pinned Bearing Sliding Plate Multiple**	**400 - 1210 - 55**	**104**



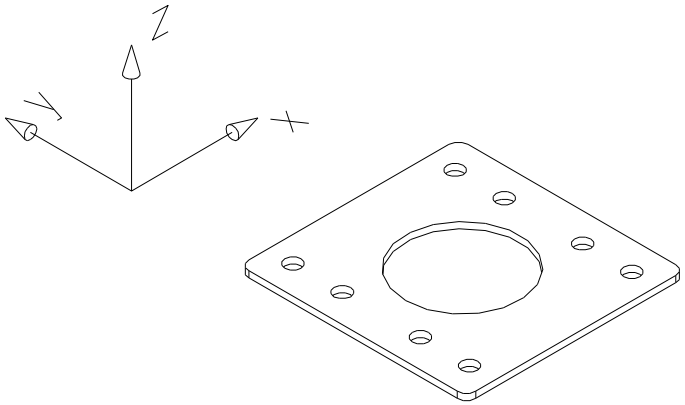
WBEB300A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB300A	**Distribution Beam**	**3020 – 178 - 487**	**236**



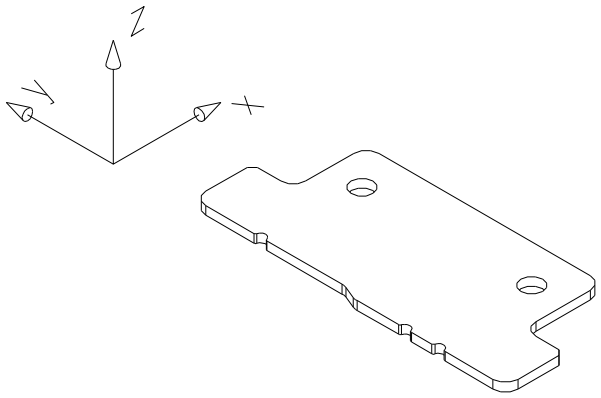
WBEB310A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB310A	**Distribution Beam Diaphragm SS, DS construction**	**722 - 360 - 10**	**17**



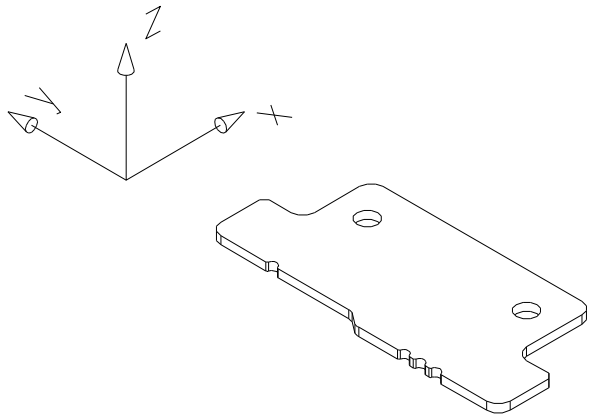
WBEB311A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB311A	**Distribution Beam Diaphragm TS construction**	**347 - 360 - 10**	**7**



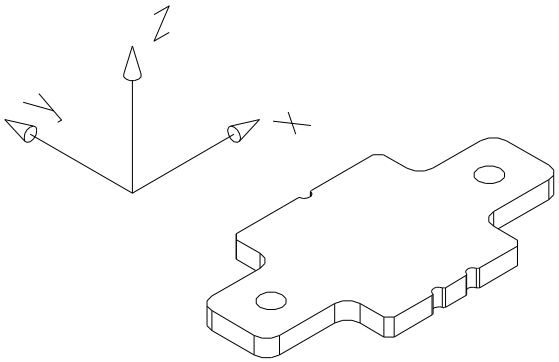
WBEB320A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB320A	**Outer DB Locator for Reinforcing Chord Light & Medium**	**300 - 10 - 120**	**5**



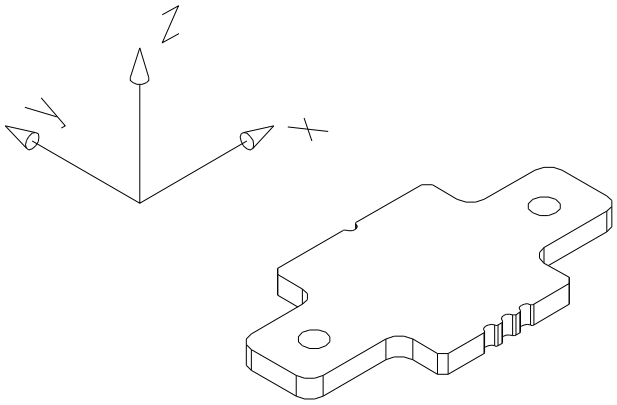
WBEB321A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB321A	**Outer DB Locator for Reinforcing Chord Light & Heavy**	**320 - 10 - 120**	**6**



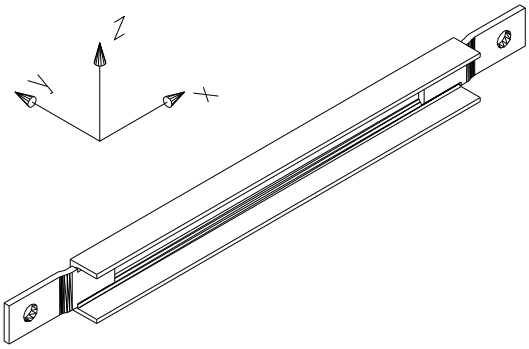
WBEB322A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB322A	**Inner Distribution Beam Locator for Reinforcing Chord Light + Medium**	**330 - 10 - 120**	**10**



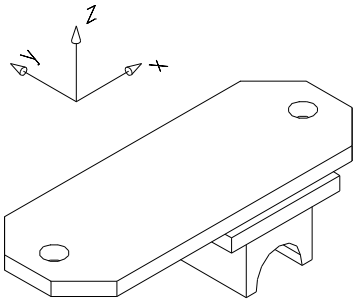
WBEB323A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB323A	**Inner Distribution Beam Locator for Reinforcing Chord Light + Heavy**	**330 - 10 - 120**	**10**



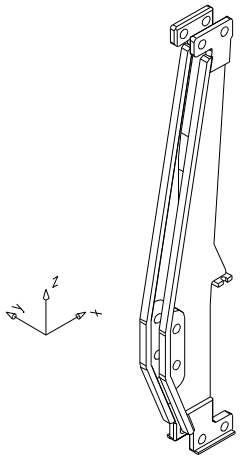
WBEB330A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB330A	**Distribution Beam Sway Brace**	**975 - 50 - 80**	**8**



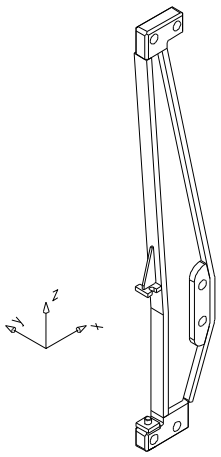
WBEB400A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB400A	**Broken Span Bearing Block**	**458 - 190 - 120**	**25**



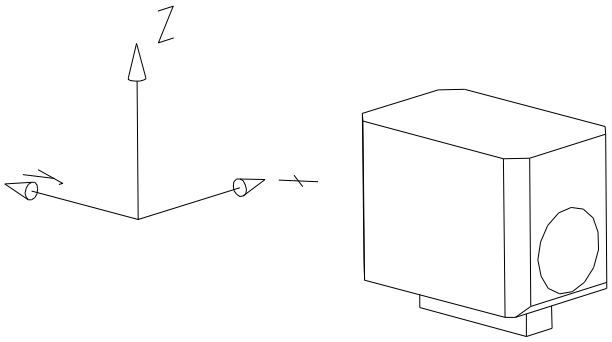
WBEB500A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB500A	**Span Junction Post Female**	**425 - 160 - 2250**	**284**



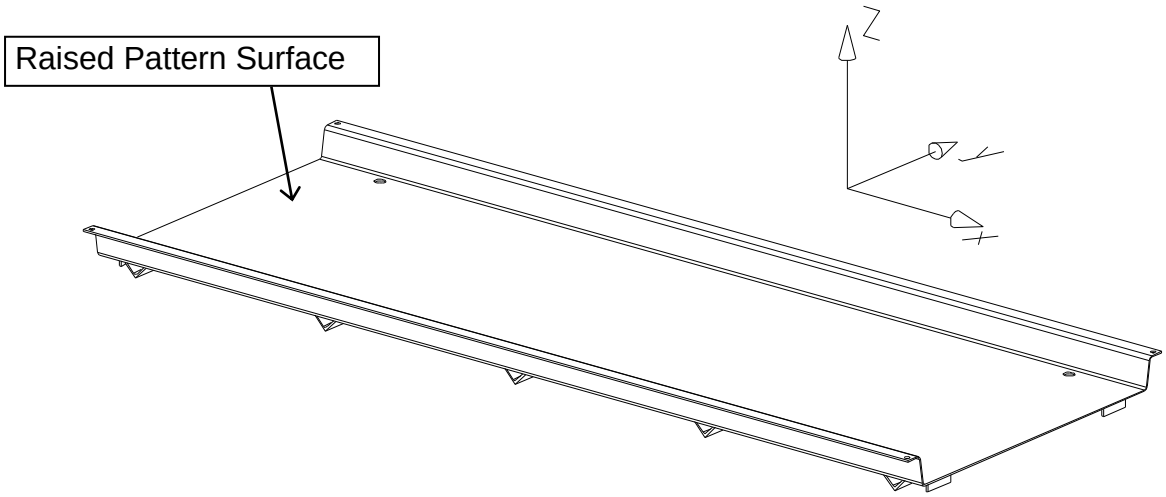
WBEB501A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB501A	**Span Junction Post Male**	**425 - 77 - 2250**	**194**



WBEB510A

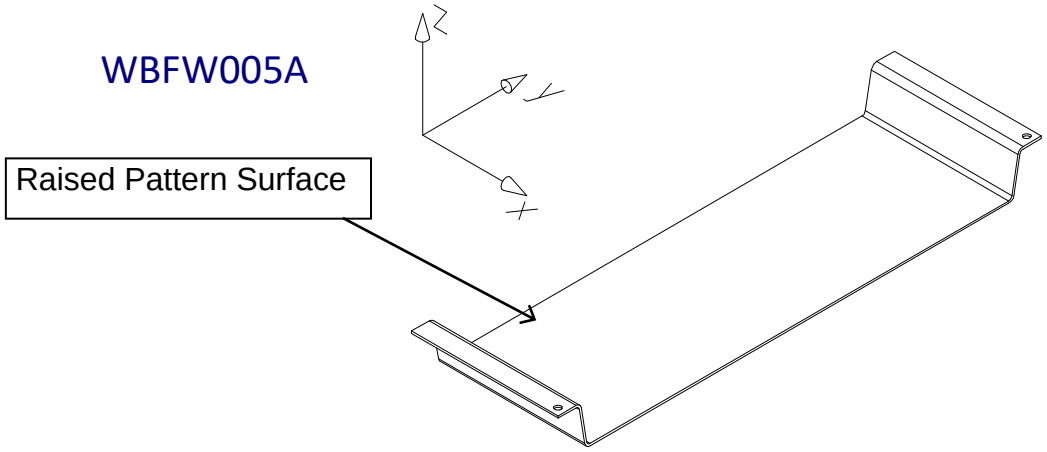
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBEB510A	**Span Junction Bearing Support Shoe**	**80 – 125 – 112**	**8**

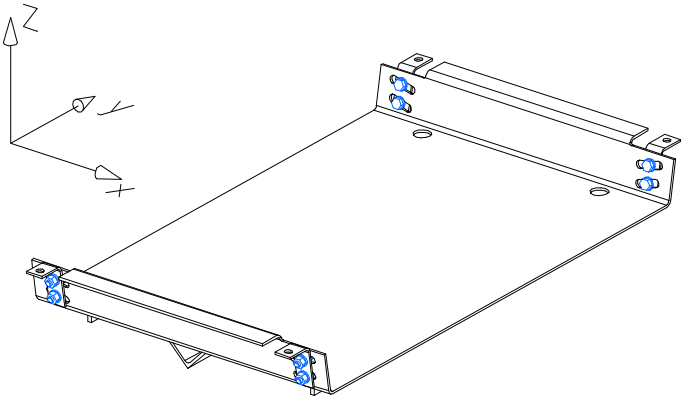


WBFW001A

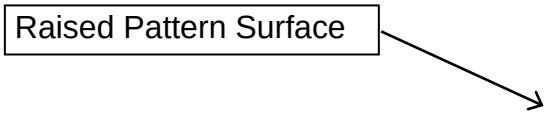
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW001A	**Footwalk Tray Width 1,0m**	**3040 - 1142 - 150**	**226**

WBFW005A



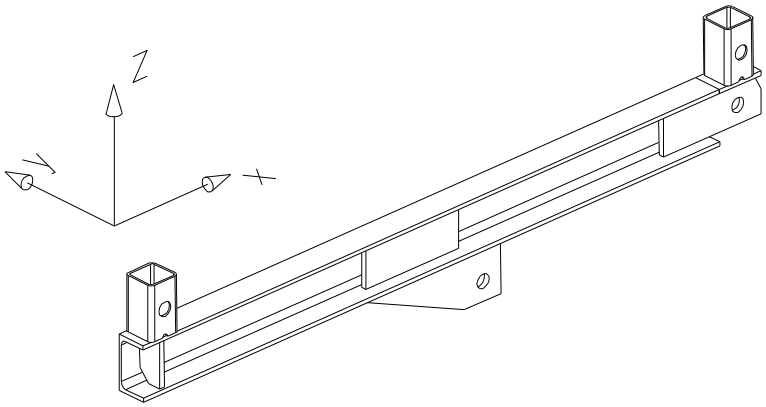


PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW005A	**Footwalk end Tray Width 1,0m**	**350 - 1142 - 150**	**28**



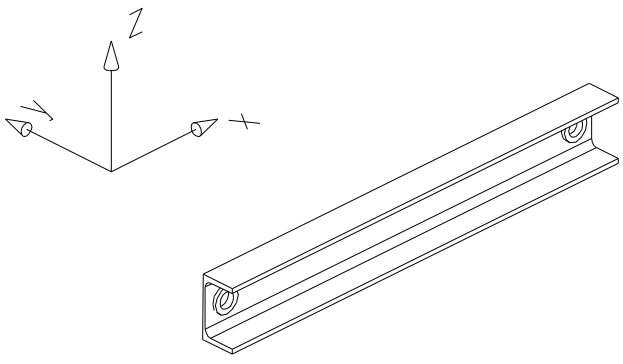
WBFW007A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW007A	**SJ Footwalk Infiller tray – Width 1,0m**	**588 - 1142 - 150**	**40**



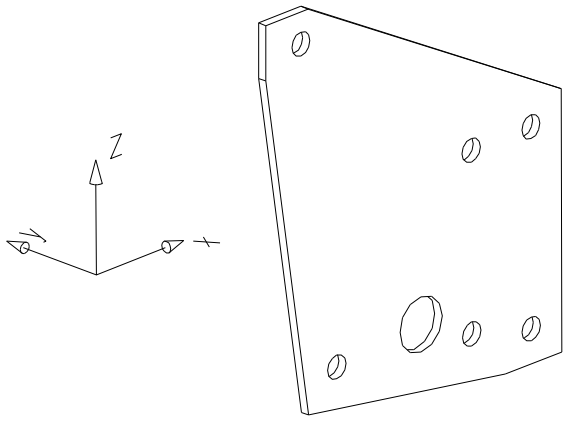
WBFW101A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW101A	**Footwalk Bearer Width 1,0m**	**1850 - 55 - 313**	**23**



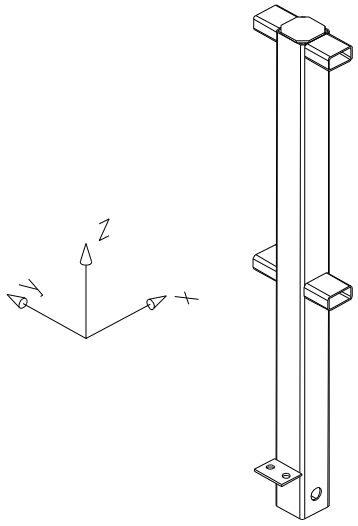
WBFW201A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW201A	**Footwalk Strut**	**690 - 50 - 80**	**6**



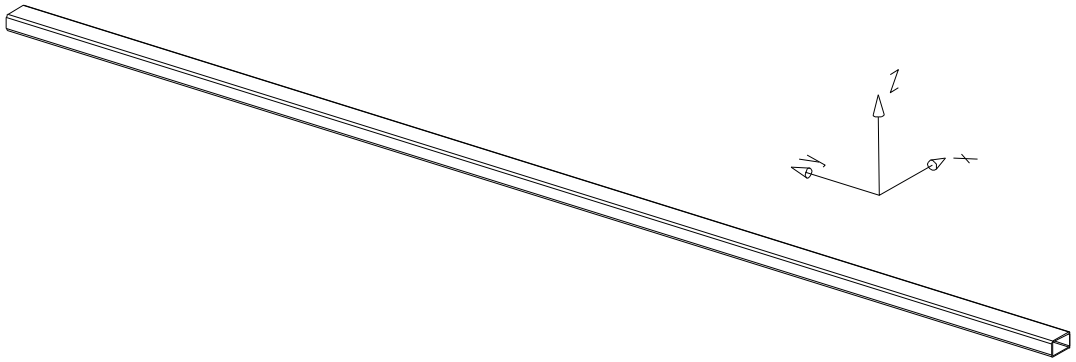
WBFW202A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW202A	**Footwalk Adapter**	**355 - 476 - 10**	**14**



WBFW301A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW301A	**Handrail Post**	**120 - 190 - 1000**	**7**

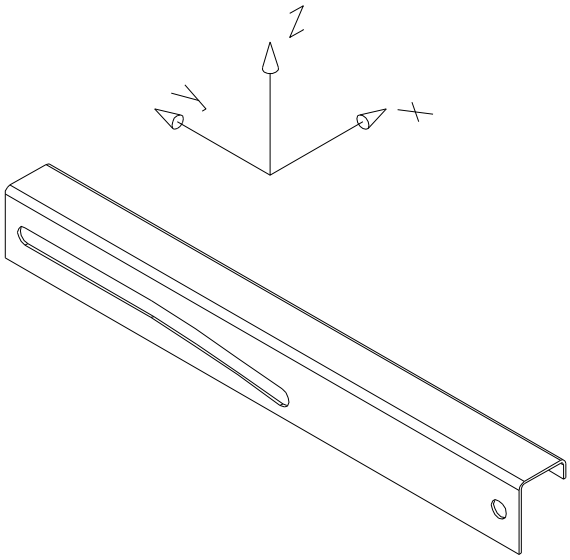


WBFW302A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW302A	**Handrail**	**3000 - 70 - 40**	**15**

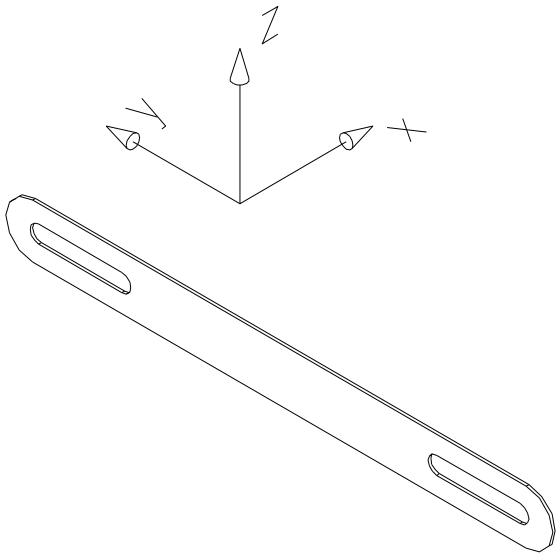
WBFW304A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW304A	**Kneerail**	**3000 - 70 - 40**	**15**



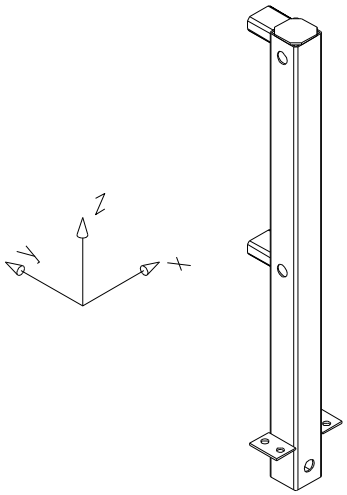
WBFW306A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW306A	**SJ Infill Handrail**	**80 - 888 - 105**	**6**



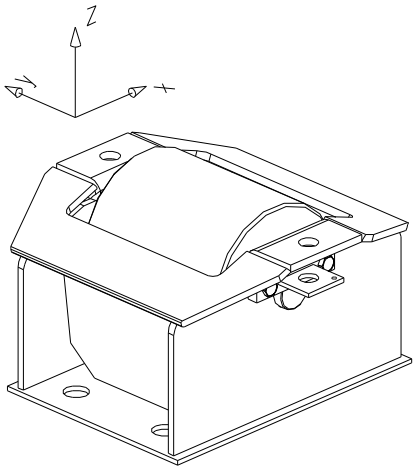
WBFW307A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW307A	**SJ Infill Kneerail**	**4 - 820 - 80**	**2**



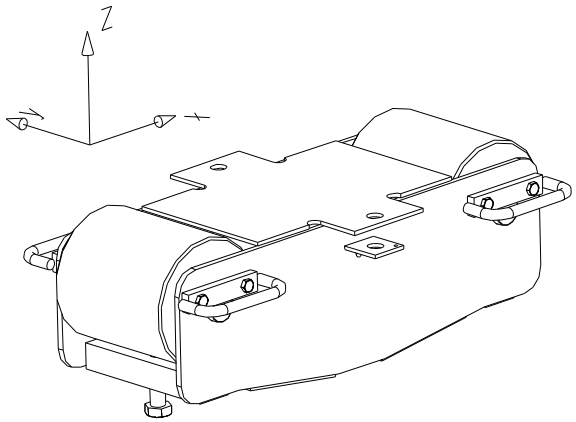
WBFW311A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBFW311A	**SJ Handrail Post**	**170 - 130 - 1000**	**7**



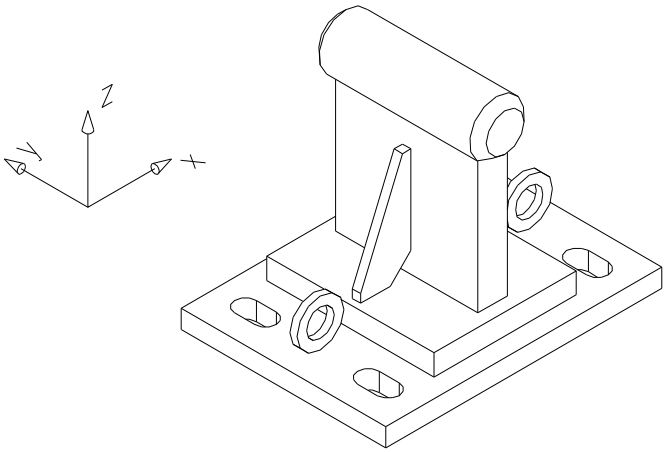
WBLE001A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE001A	**Single Roller**	**330 - 246 - 221**	**58**



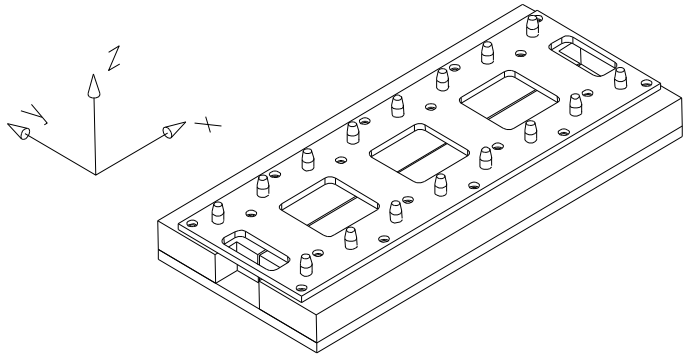
WBLE010A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE010A	**Rocking Roller**	**670 - 243 - 287**	**117**



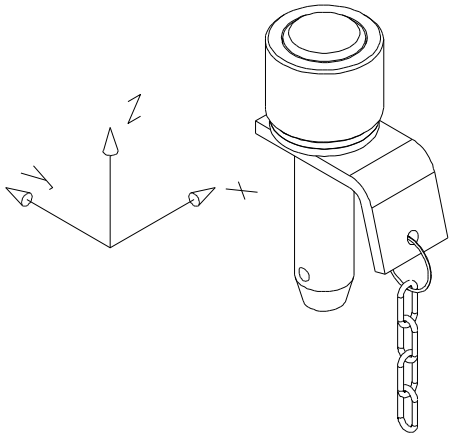
WBLE020A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE020A	**Support Pedestal**	**330 - 245 - 280**	**35**



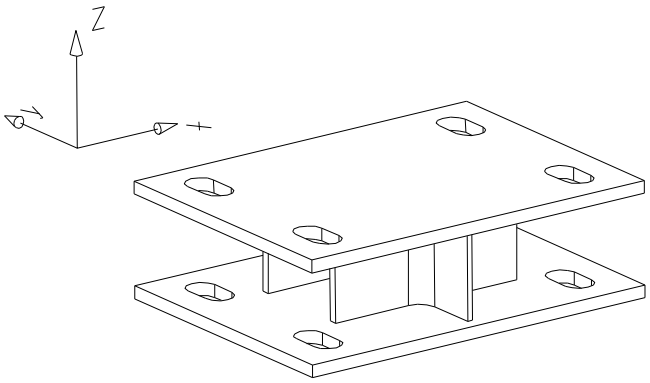
WBLE030A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE030A	**Plastic Roller Support**	**1000 - 500 - 150**	**82**



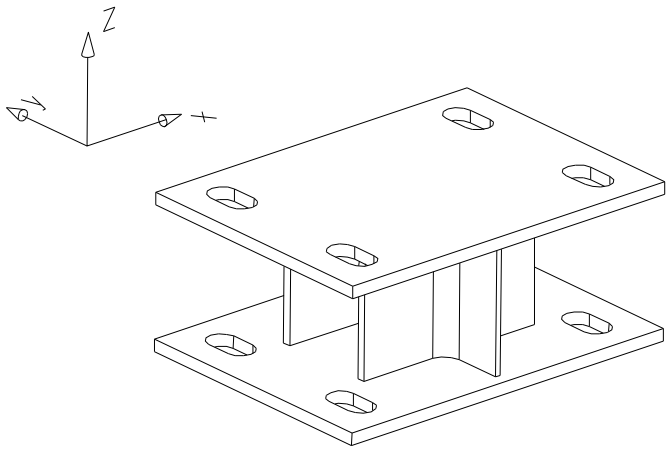
WBLE040A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE040A	**Side Guide**	**50 - 60 – 120**	**1**



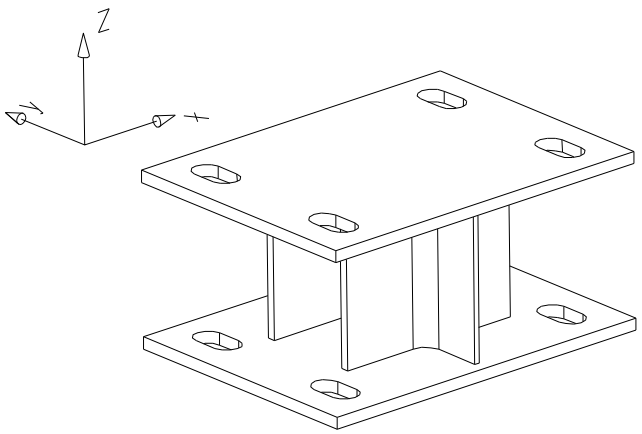
WBLE050A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE050A	**Insert Pack Light**	**330 - 245 - 100**	**18**



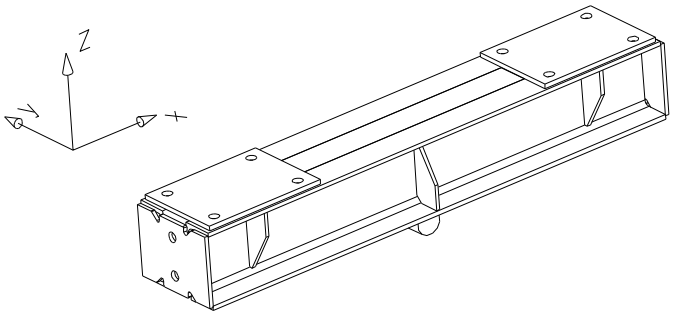
WBLE051A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE051A	**Insert Pack Medium**	**330 - 245 - 140**	**18**



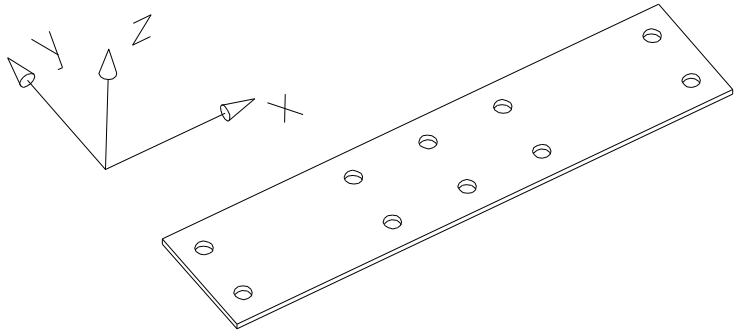
WBLE052A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE052A	**Insert Pack Heavy**	**330 - 245 – 160**	**19**



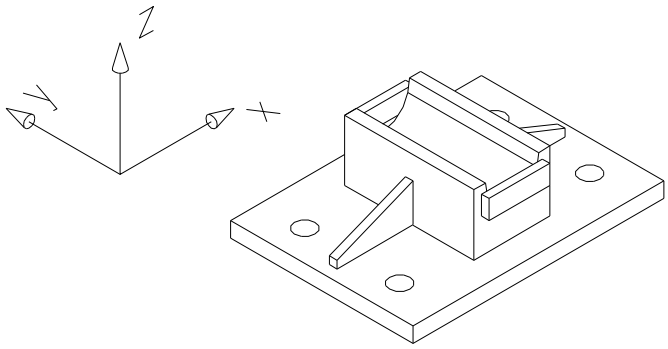
WBLE100A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE100A	**Balance Beam**	**1350 - 245 – 268**	**100**



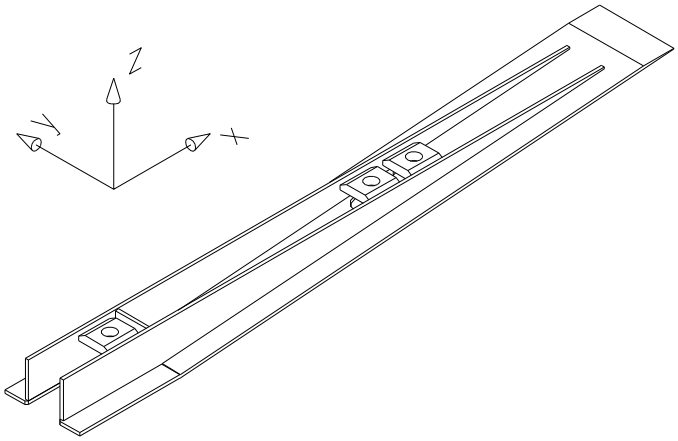
WBLE101A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE101A	**Balance Beam End Plate**	**10 - 830 - 190**	**12**



WBLE102A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE102A	**Balance Beam Baseplate**	**330 - 240 - 100**	**24**



WBLE200A

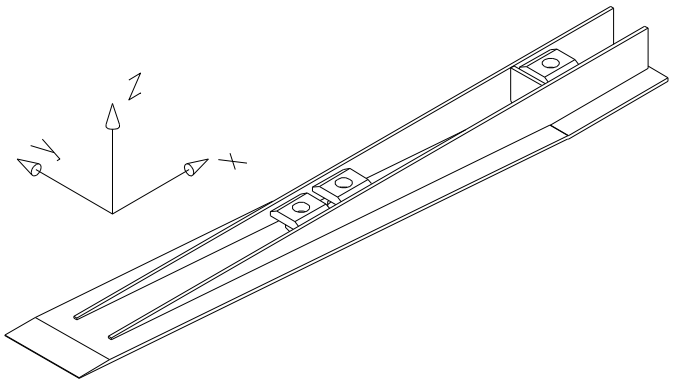
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE200A	**Taper Chord Female Light**	**1560 - 193 - 100**	**36**

WBLE210A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE210A	**Taper Chord Female Medium**	**2065 - 220 – 140**	**61**

WBLE220A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE220A	**Taper Chord Female Heavy**	**2325 - 230 - 160**	**78**



WBLE201A

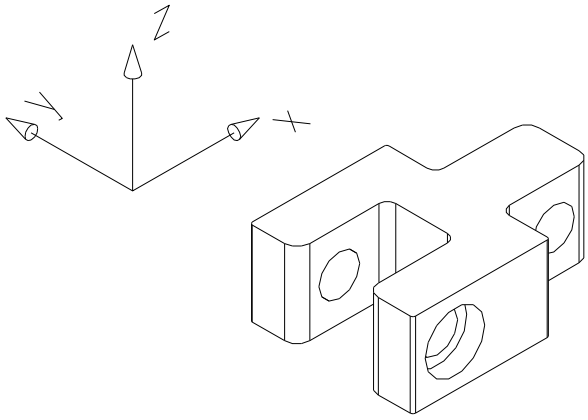
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE201A	**Taper Chord Male Light**	**1650 - 193 - 100**	**37**

WBLE211A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE211A	**Taper Chord Male Medium**	**2195 - 220 - 140**	**63**

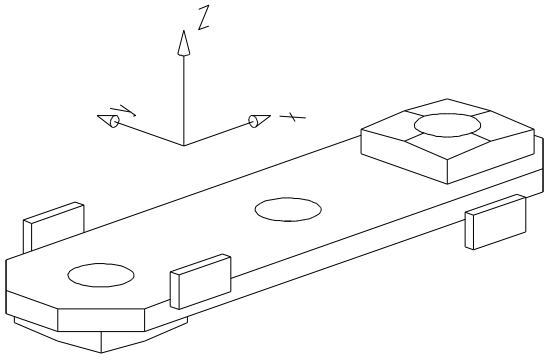
WBLE221A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE221A	**Taper Chord Male Heavy**	**2455 - 230 - 160**	**80**



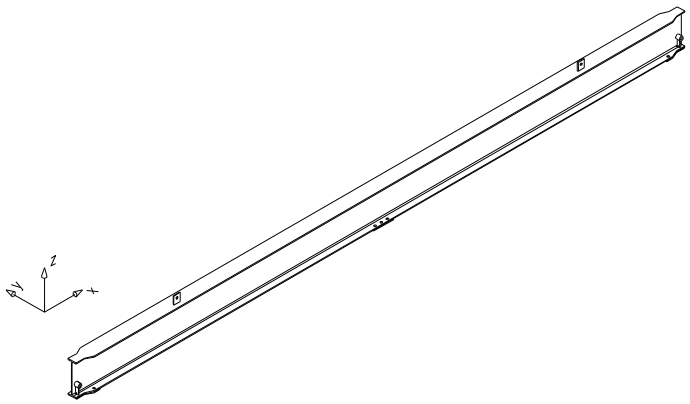
WBLE300A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE300A	**Launching Link**	**270 - 193 - 100**	**30**



WBLE311A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE311A	**Sway Brace Extension Plate**	**280 - 90 - 35**	**3**



WBLE351A

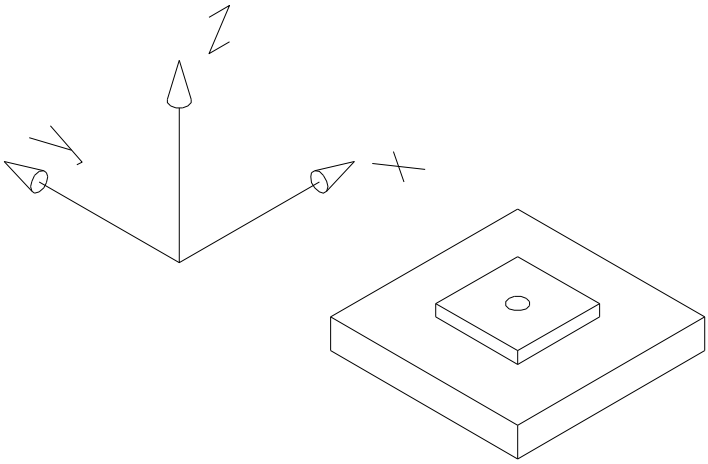
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE351	**Launching Transom STD**	**4042 - 178 - 413**	**263**

WBLE352A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE352	**Launching Transom EW**	**5058 - 178 - 413**	**309**

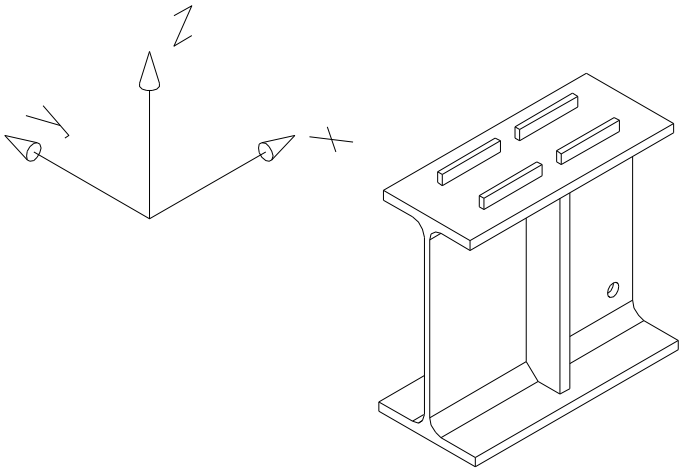
WBLE353A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE353A	**Launching Transom DW**	**7925 - 178 - 413**	**438**



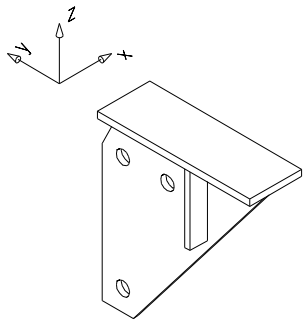
WBLE410A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE410A	**Jack Head Plate**	**160 – 60 - 35**	**4**



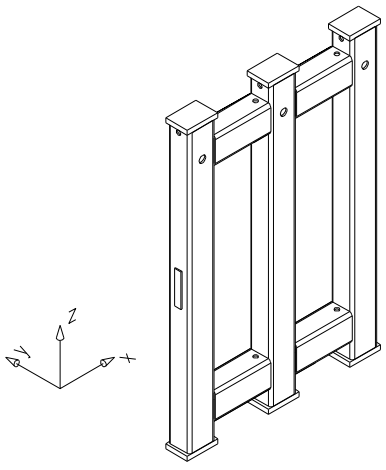
WBLE420A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE420A	**Jacking Transom Clamp Pack**	**210 - 100 - 210**	**6**



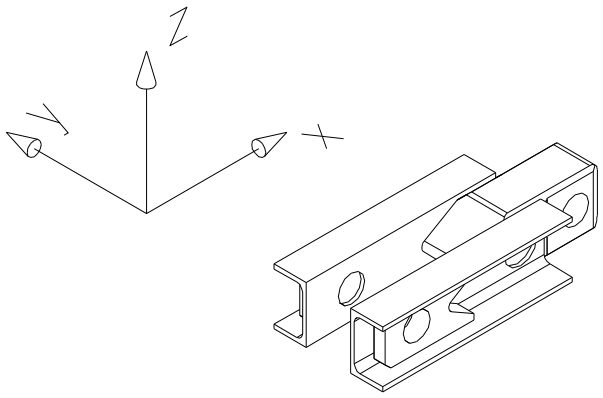
WBLE430A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE430A	**Jacking Transom Flange Extention**	**322 - 100 - 349**	**11**



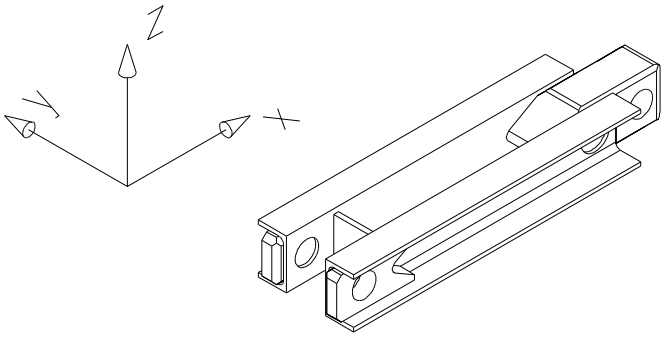
WBLE440A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE440A	**Jacking Transom Frame**	**890 - 100 - 1318**	**105**



WBLE500A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE500A	**Span Junction Post Link**	**425 - 193 – 100**	**29**



WBLE510A

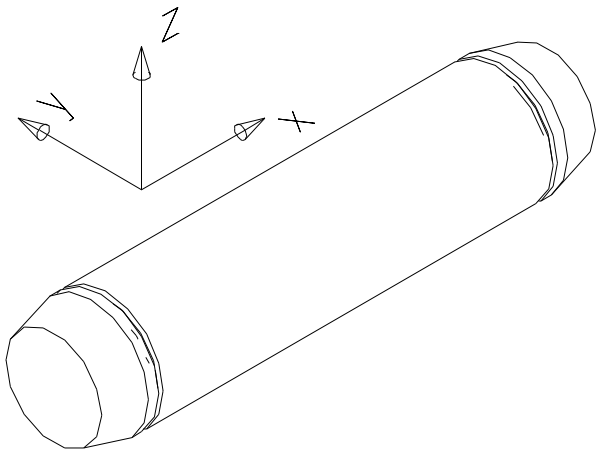
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE510A	**Span Junction Reinforcing Light Link**	**703 - 193 - 100**	**33**

WBLE511A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE511A	**Span Junction Reinforcing Medium Link**	**740 - 210 - 140**	**56**

WBLE512A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBLE512A	**Span Junction Reinforcing Heavy Link**	**740 - 220 - 160**	**60**

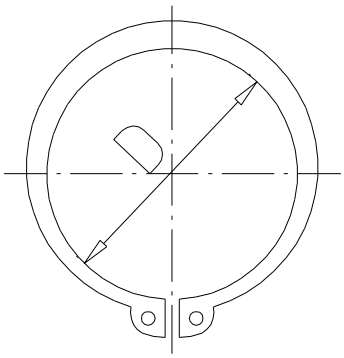


WBPB001A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBPB001A	**Panel Pin Standard**	**200 – 46.8**	**3**

WBPB010A

PART NUMBER	DESCRIPTION	DIMENSIONS X - ϕ (Y, Z)	WEIGHT in kg per piece
WBPB010A	**Panel Pin Medium & Heavy**	**210 – 63**	**5**

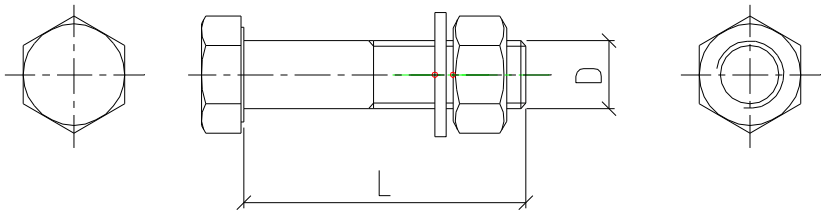


WBPB002A

PART NUMBER	DESCRIPTION	DIMENSIONS D	WEIGHT in kg per piece
WBPB002A	**Safety Clip Standard**	**47**	

WBPB011A

PART NUMBER	DESCRIPTION	DIMENSIONS D	WEIGHT in kg per piece
WBPB011A	**Safety Clip Medium & Heavy**	**60**	



WBPB100A

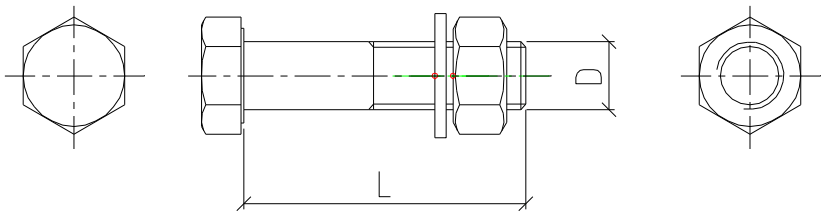
PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB100A	**Chord Bolt**	**M30 - 85**	

WBPB200A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB200A	**Bracing Bolt Long M24**	**M24 – 100**	

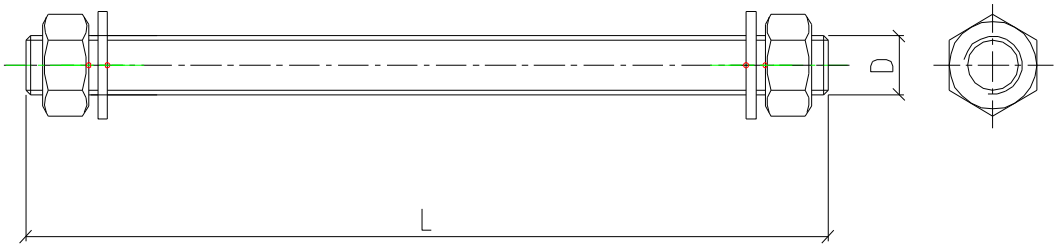
WBPB201A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB201A	**Bracing Bolt Medium M24**	**M24 – 75**	



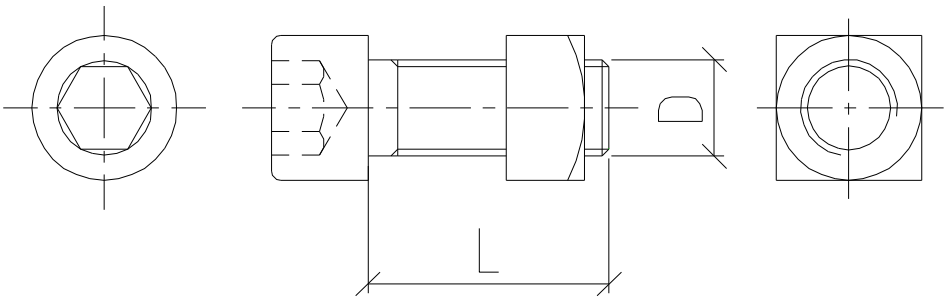
WBPB204A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB204A	**Footwalk Tray Bolt M12**	**M12 - 30**	**0,05**



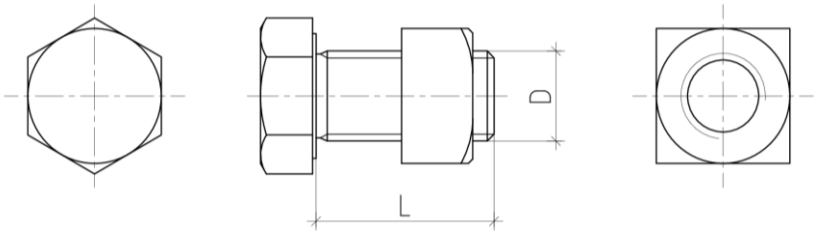
WBPB205A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB205A	**Endpost threaded Bolts & Nuts**	**M24 - 330**	



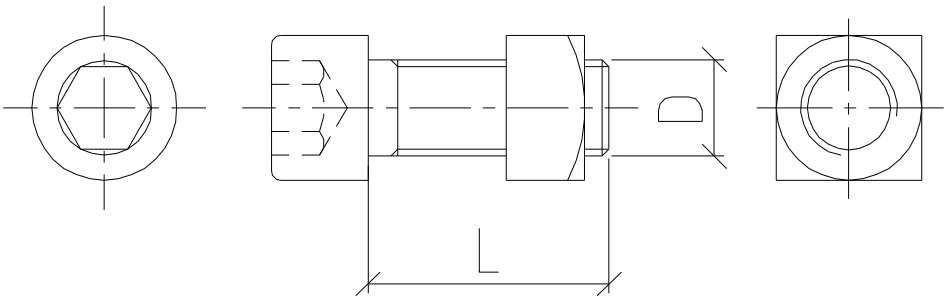
WBPB206A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB206A	**Kerb & Infiller Bolt M20x50**	**M20 - 50**	**0,2**



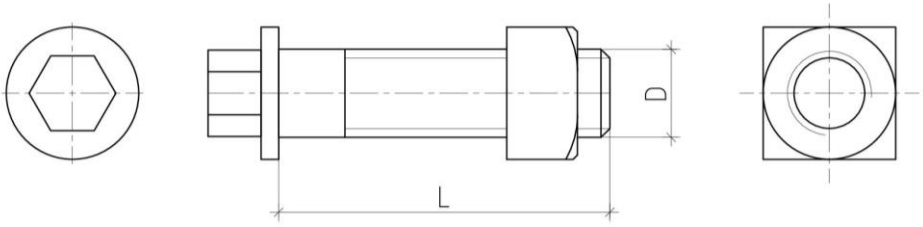
WBPB206B

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB206B	**Kerb Bolt M20x40**	**M20 - 40**	**0,2**



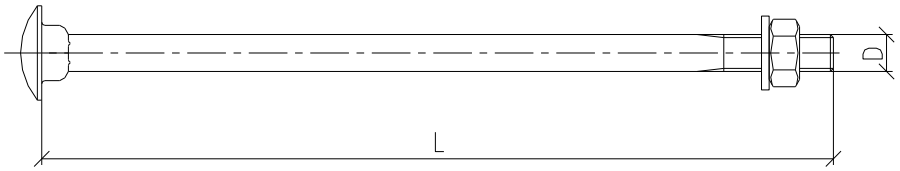
WBPB207A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB207A	**Deck Bolt M20x60 for Deck and for Ramp Plate**	**M20 - 60**	**0,2**



WBPB208A

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB208A	**Deck Bolt M20x75 for Deck and for Infiller**	**M20 - 75**	**0,25**

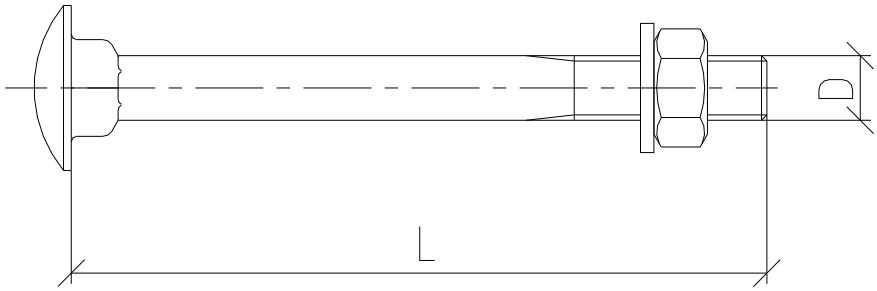


WBPB210A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB210A	**Timber Deck Bolt Short M12**	**M12 – 130**	

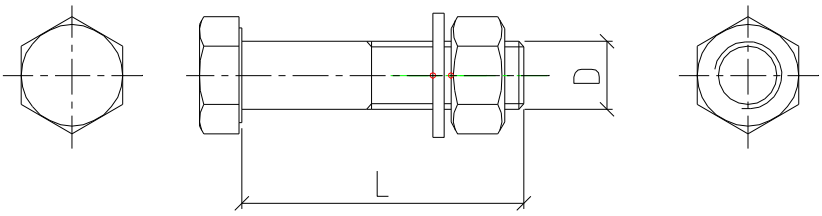
WBPB211A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB211A	**Timber Deck Bolt Long M12**	**M12 - 260**	



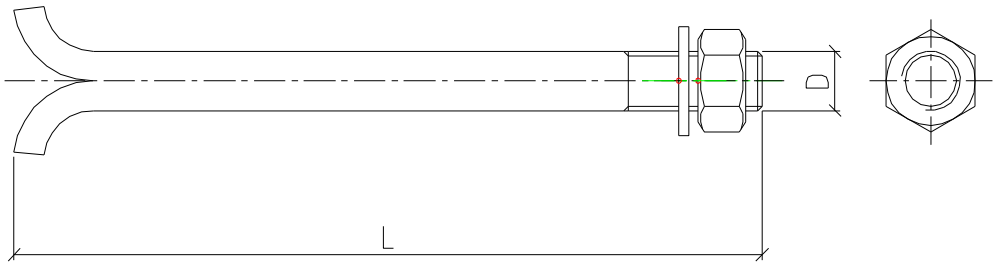
WBPB212A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPB212A	**Timber EOB Infiller Bolt M20**	**M20 – 300**	



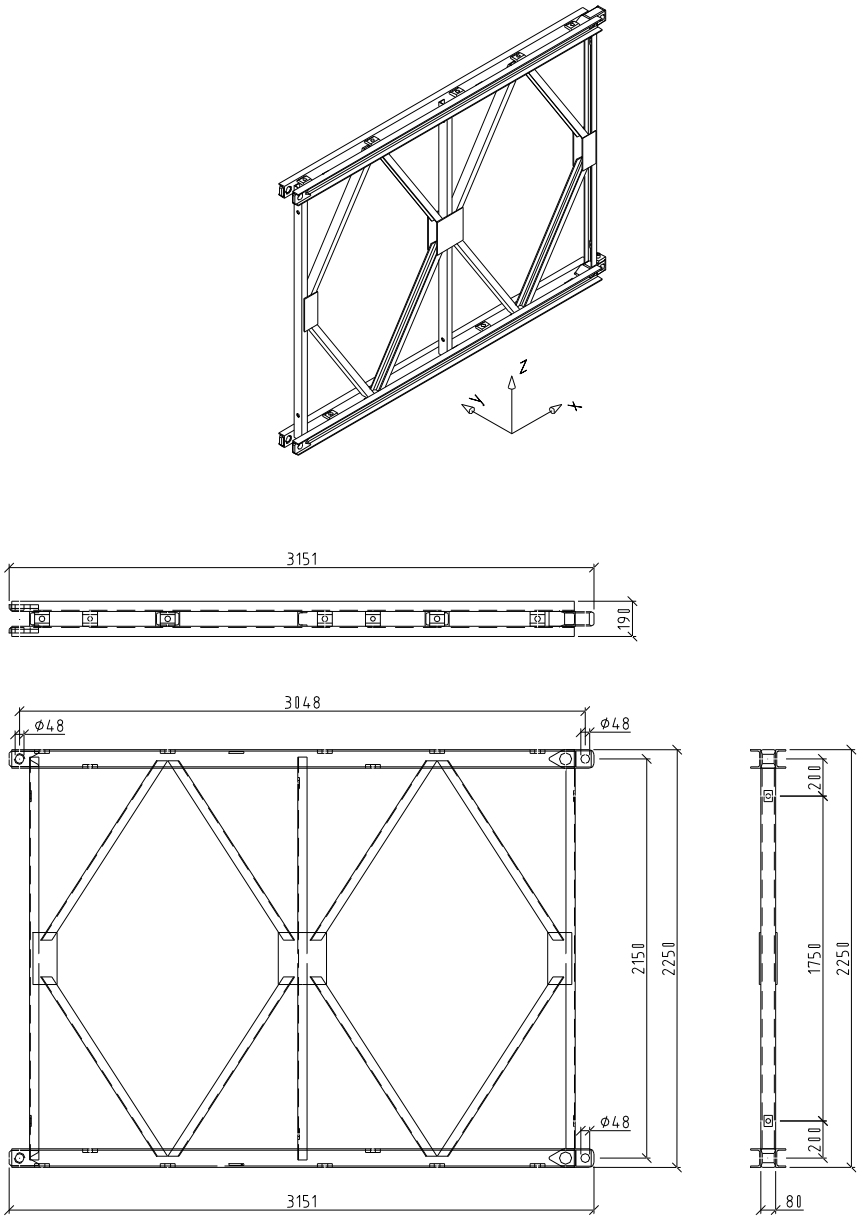
WBPB213A (Excluded)

PART NUMBER	DESCRIPTION	DIMENSIONS D - L	WEIGHT in kg per piece
WBPB213A	**Alternative Timber Deck Bolt Short M12**	**M12 - 90**	**0,05**



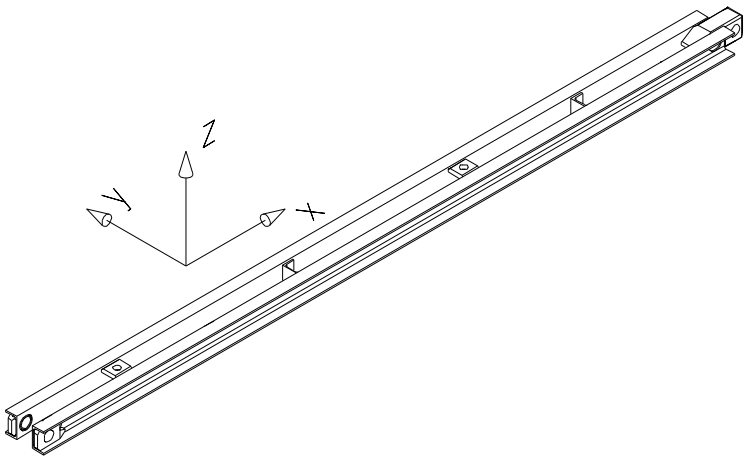
WBPB220A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPB220A	**Anchor Bolts & Nuts for Sliding Plates**	**M24 - 320**	



WBPC050A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBPC050A	**Panel Standard**	**3151 - 193 - 2250**	**335**



WBPC106A

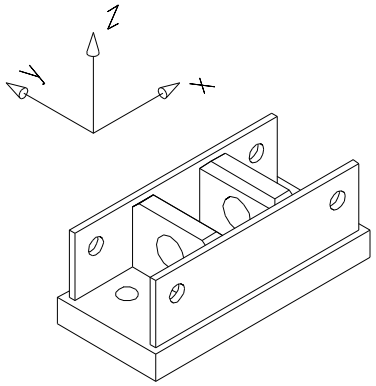
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBPC106A	**Reinforcing Chord Light**	**3151 – 193 - 100**	**98**

WBPC115A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBPC115A	**Reinforcing Chord Medium**	**3188 – 210 - 140**	**139**

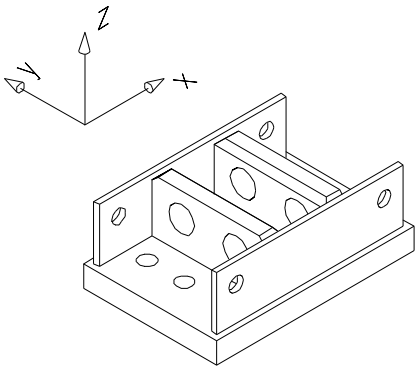
WBPC125A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBPC125A	**Reinforcing Chord Heavy**	**3188 – 220 - 160**	**160**



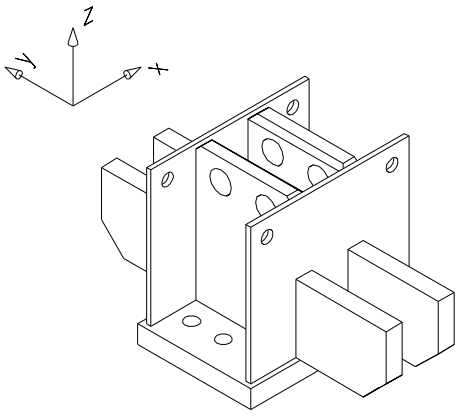
WBPT001A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT001A	**Pier Soleplate Single**	**380 – 290 – 150**	**50**



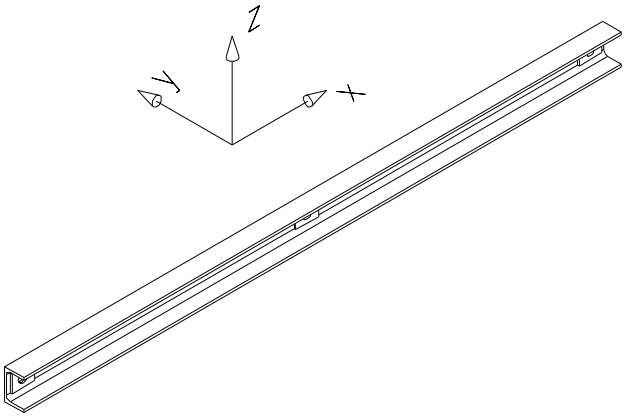
WBPT002A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT002A	**Pier Soleplate Double Std.**	**480 – 265 – 150**	**63**



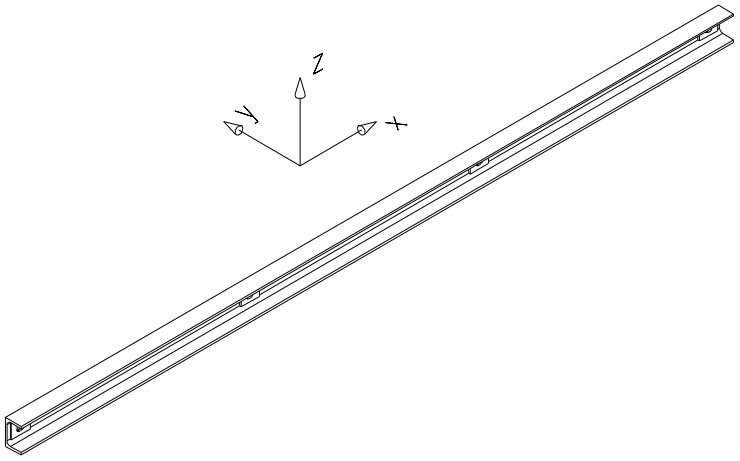
WBPT003A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT003A	**Pier Soleplate Double HT (High Tension)**	**480 – 645 - 340**	**139**



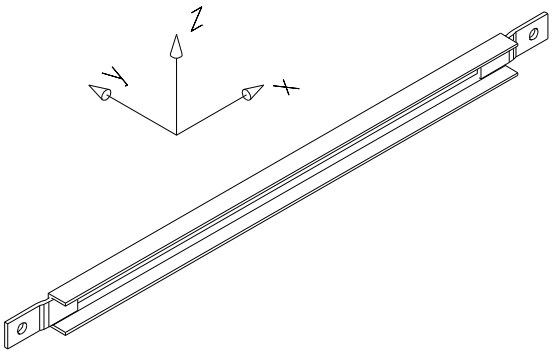
WBPT100A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT100A	**Pier Double Brace**	**1580 – 50 – 80**	**13**



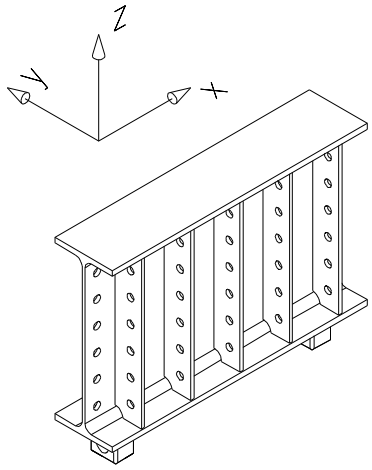
WBPT101A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT101A	**Pier Triple Brace**	**2330 – 60 – 80**	**19**



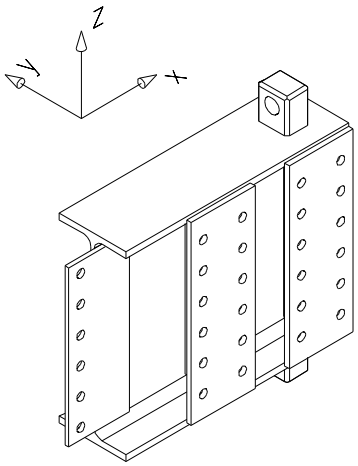
WBPT102A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT102A	**Pier Diagonal Raker**	**1541 – 50 - 80**	**12**



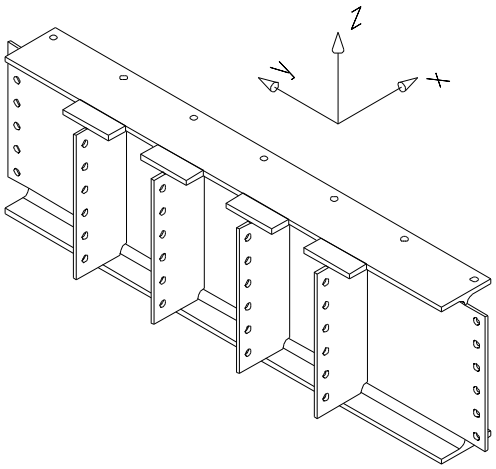
WBPT200A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT200A	**Pier Side Beam**	**970 – 220 – 710**	**163**



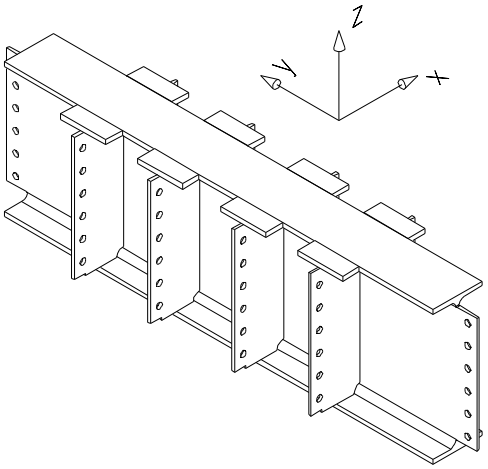
WBPT210A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT210A	**Pier Side Extension Beam**	**835 – 235 – 820**	**159**



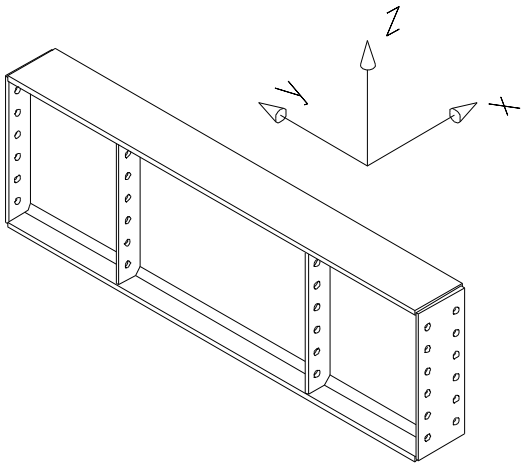
WBPT300A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT300A	**PT Edge Cross Beam**	**353 – 2100 – 600**	**323**



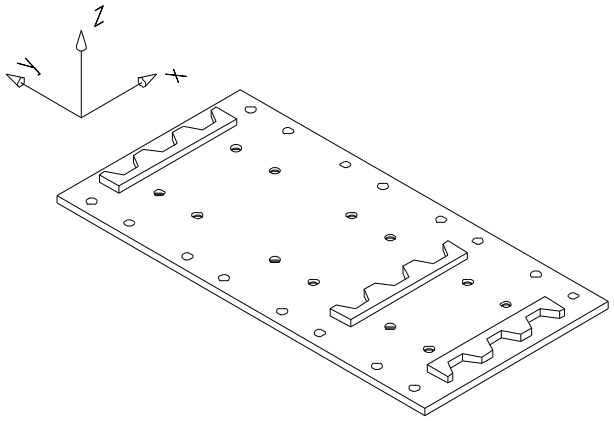
WBPT310A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT310A	**PT Centre Cross Beam**	**485 – 2100 – 600**	**370**



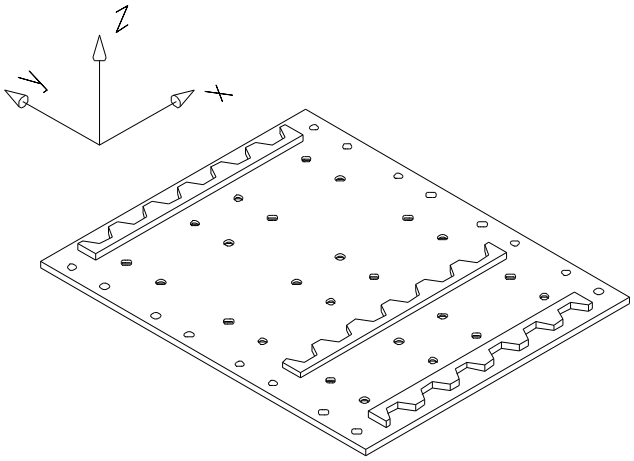
WBPT350A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT350A	**PT Transverse Jacking Beam**	**220 – 1900 - 600**	**281**



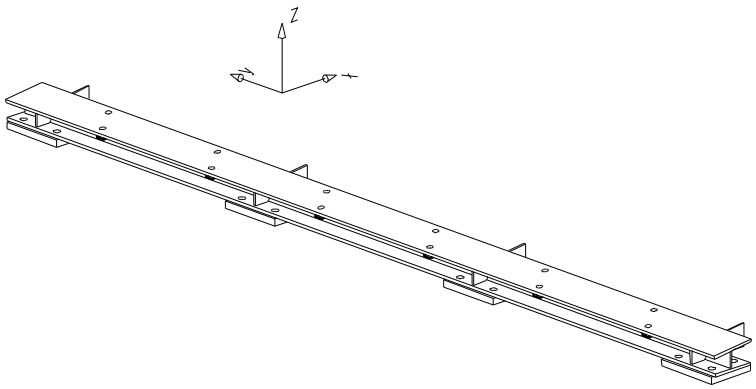
WBPT400A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT400A	**PT Bearing Plate Single**	**595 – 1195 - 40**	**117**



WBPT410A

PART NUMBER	DESCRIPTION	DIMENSIONS	WEIGHT in kg per piece
WBPT410A	**PT Bearing Plate Multiple**	**970 – 1195 – 40**	**193**



WBRA100A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA100A	**Ramp Girder STD, Standard Deck**	**260 – 3410 - 181**	**165**

WBRA101A

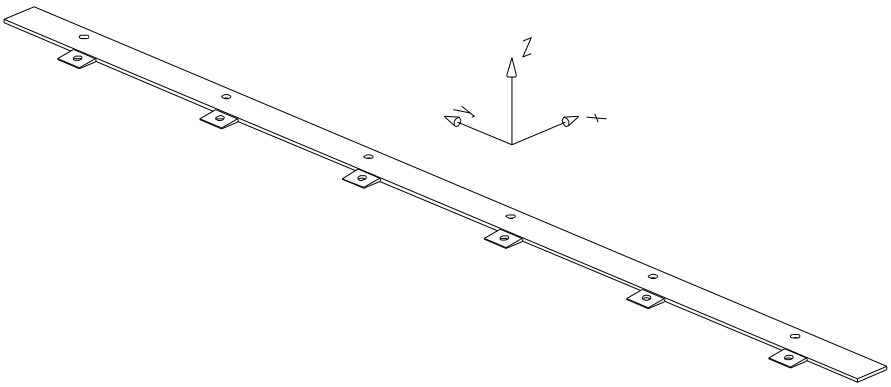
PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA101A	**Ramp Girder EW, Standard Deck**	**260 - 4460 – 181**	**210**

WBRA102A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA102A	**Ramp Edge Girder DW Standard Deck**	**260 - 7610 - 239**	**400**

WBRA103A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA103A	**Ramp Centre Girder DW, Standard Deck**	**180 - 7610 - 307**	**435**

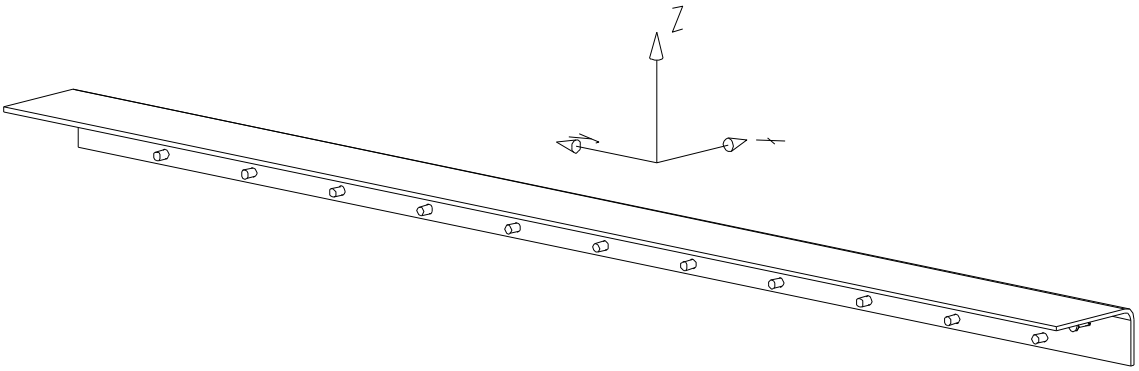


WBRA200A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA200A	**Ramp Plate STD/DW, Standard Deck**	**172 - 3149 - 15**	**43**

WBRA201A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA201A	**Ramp Plate EW/DW, Standard Deck**	**172 - 4199 - 15**	**58**

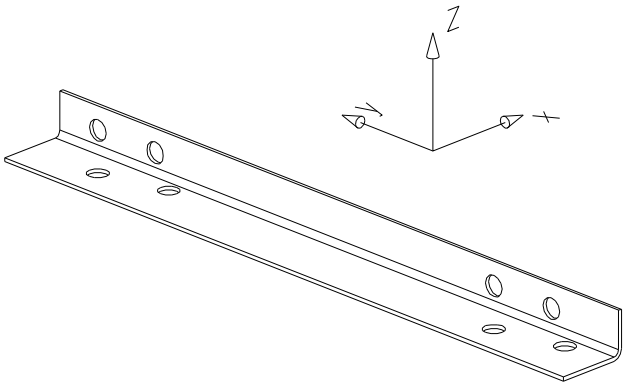


WBRA250A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA250A	**End of Bridge Plate STD/DW Standard Deck**	**268 - 3145 - 135**	**95**

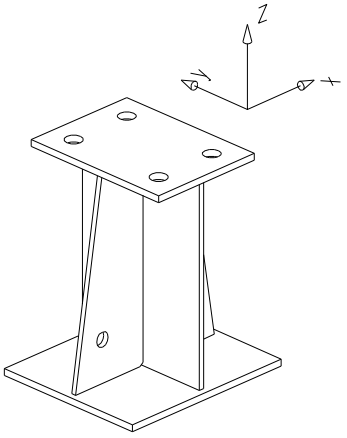
WBRA251A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA251A	**End of Bridge Plate EW/DW Standard Deck**	**268 - 4195 - 135**	**126**



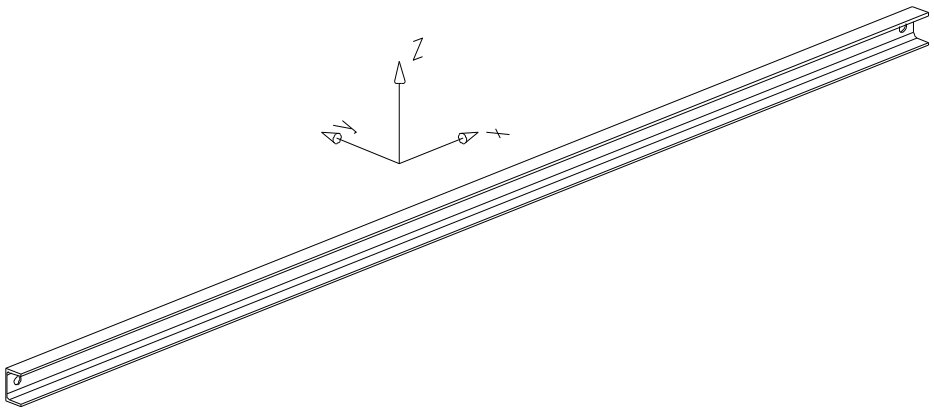
WBRA255A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA255A	**Angle for Span Junction Infill Deck and Ramp**	**77 - 740 - 50**	**3**



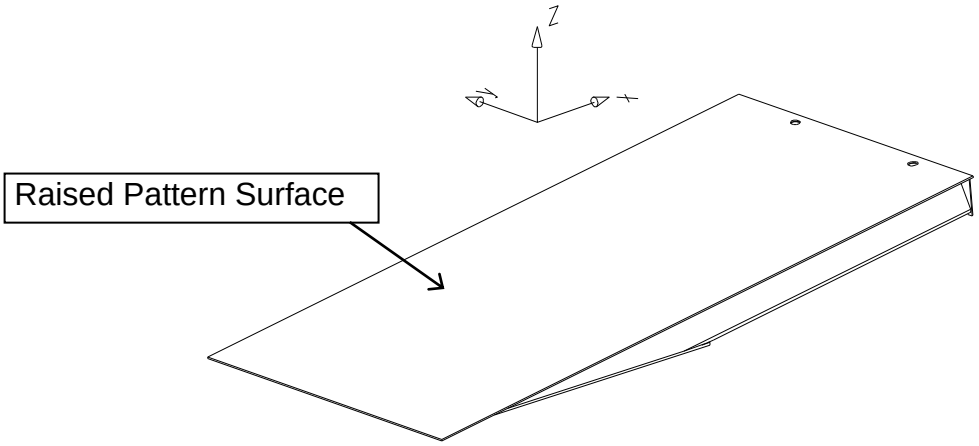
WBRA260A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA260A	**Ramp Pedestal**	**280 - 240 - 303**	**18**



WBRA270A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA270A	**Ramp Brace**	**2890 - 50 - 80**	**25**

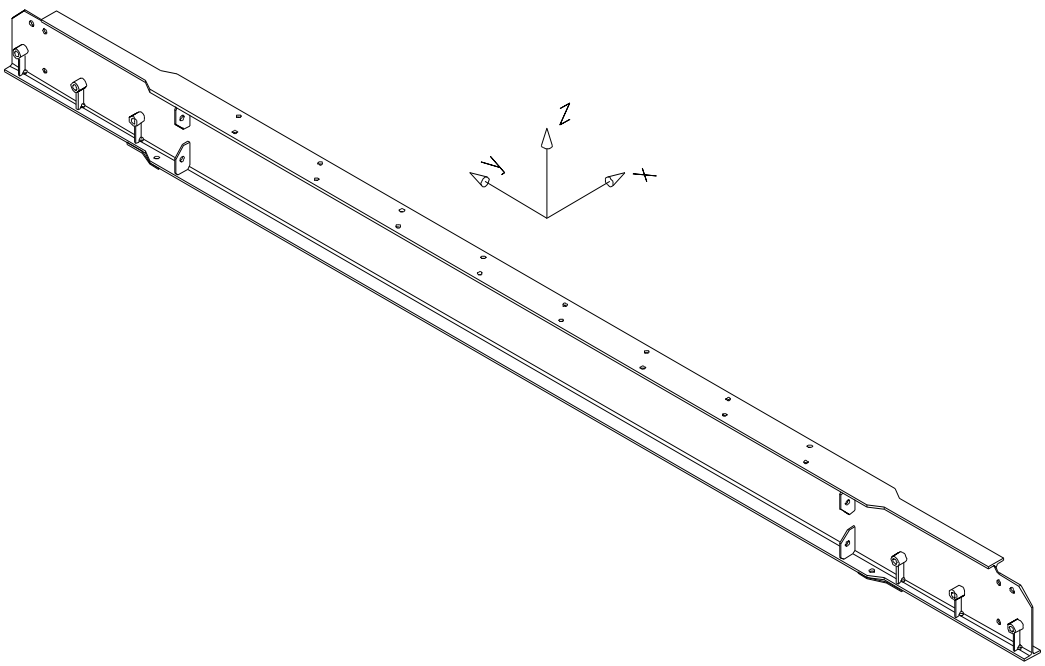


WBRA300A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA300A	**End of Ramp Deck Unit STD/EW Standard Deck**	**3177 - 1045 - 135**	**361**

WBRA301A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBRA301A	**End of Ramp Deck Unit DW, Standard Deck**	**3058 - 1045 - 135**	**341**



WBTR002A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR002A	**Transom 20/25, STD**	**5547 - 188 – 413**	**322**

WBTR003A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR003A	**Transom 20/25, STD Steel + Timber Deck**	**5547 - 188 – 413**	**322**

WBBTR052A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR052A	**Transom 20, EW**	**6563 - 188 – 413**	**388**

WBTR053A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR053A	**Transom 25, EW**	**6563 - 188 – 414**	**400**

WBTR054A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR054A	**Transom EW-LRFD**	**6563 - 188 – 414**	**430**

WBTR102A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR102A	**Transom 20, DW**	**9430 - 228 – 608**	**995**

WBTR103A

PART NUMBER	DESCRIPTION	DIMENSIONS X - Y - Z	WEIGHT in kg per piece
WBTR103A	**Transom 25, DW**	**9430 - 229 – 612**	**1222**

SECTION 12

TOOLS

PART NUMBER	DESCRIPTION[1)]	PCS	SET[1)]
WBTO001	Tool box	1	EXT
WBTO002	Padlock	1	EXT
WBTO003	Hammer 1 kg	2	STD
WBTO004	Bench hammer 3 kg	2	STD
WBTO005	Flat-chisel	1	EXT
WBTO006	Cross-chisel	1	EXT
WBTO008	Ring spanner 36, 41, mm	2	STD
WBTO009	Ring spanner 41, 46 mm	2	STD
WBTO012	Open spanner 36, 41 mm	2	STD
WBTO013	Open spanner 46 mm	2	STD
WBTO014	Plumb 0.5 kp with 5 m cord	1	STD
WBTO015	Tape 5 m	3	STD
WBTO016	Measuring tape 50 m	1	STD
WBTO017	Pliers for outside rings dm 40-100 mm	2	STD
WBTO018	Smooth file half-round 300 mm	1	EXT
WBTO019	Smooth file round 300 mm	1	EXT
WBTO020	Ratchet ¾ inch	2	STD
WBTO020-1	T-Handle ¾ inch	2	STD
WBTO021	Extension ¾ inch 150mm	2	STD
WBTO021-1	Extension ½ inch 250mm	2	STD
WBTO022	Hexagon socket screw, 17 mm	2	STD[6)]
WBTO023	Socket ½ inch, 17 mm	2	STD
WBTO024	Socket ¾ inch, 30 mm	2	STD
WBTO025	Socket ¾ inch, 30 mm	2	STD[3)]
WBTO026	Socket ¾ inch, 46 mm	2	STD
WBTO028	Spirit-level with magnet	2	STD
WBTO029	Adjustable spanner	2	EXT
WBTO030	Pair of gloves	10	STD
WBTO031	Bar 800 mm	2	STD
WBTO032	Synthetic rope 20 m, dm 16 mm	1	EXT
WBTO033	Hemp ropes 3 m	5	EXT
WBTO034	Chain block 2 to	2	EXT
WBTO035	Cable pull Tierfore 3,2 to, 3 parts,	3	EXT
WBTO036	50 m of rope dm 16 mm	3	EXT
WBTO037	Pulley	2	EXT
WBTO038	Instep set round loop 1 to, 1,5 m	4	EXT
WBTO039	Instep set round loop 1 to, 3 m	4	EXT
WBTO040	Wire-cable loop 3 m, dm 12 mm	6	EXT
WBTO041	Wire-cable loop 3 m, dm 16 mm	6	EXT
WBTO042	Shackle 1 inch	6	EXT
WBTO043	Rack Jack 3 to	2	EXT
WBTO044	Clamp 500 mm	4	EXT
WBTO048	Transport plateau car 1 to, 1 x 2 m	1	EXT
WBTO049	Stepladder 2 x 8	2	EXT
WBTO050	Pair of metal shears	1	EXT
WBTO051	Neal bear	1	EXT
WBTO052	Hydraulic jack 30to, hand pump and hose	2	STD[4)]
WBTO053	Hydraulic jack 50to, hand pump and hose	2	STD[4)]
WBTO054	Long socket head spanner 17 mm	2	STD[6)]
WBTO055	Long spanner 17 mm	2	STD
WBTO056	Ring spanner 19, 22 mm	2	STD[5)]
WBTO057	Open spanner 19, 22 mm	2	STD[5)]

Notes:
1) pictures are only symbolical
2) STD: standard tool set, minimal requirement to fit the bridge components, EXT: extended tool set, recommended for easier erection
3) tool to fit special tapered chord bolts, only supplied within the tool-set, if this position is within our supply
4) either WBTO052A or WBTO053A are within the tool set, depending to the type of our supplied bridge components
5) for footwalk delivery only
6) for socket head screws only

WBTO001A

DESCRIPTION	PCS
Tool box	**1**

WBTO002A

DESCRIPTION	PCS
Padlock	**1**

WBTO003A

DESCRIPTION	PCS
Hammer 1 kg	**2**

WBTO004A

DESCRIPTION	PCS
Bench hammer 3 kg	**2**

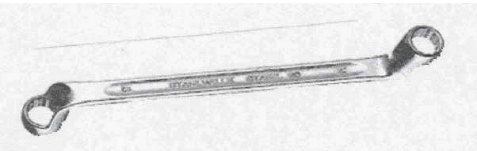
WBTO005A

DESCRIPTION	PCS
Flat chisel	**1**

WBTO006A

DESCRIPTION	PCS
Cross chisel	**1**

WBTO008A



DESCRIPTION	PCS
Ring spanner 30, 36 mm	**2**

WBTO009A

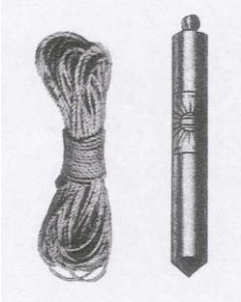
DESCRIPCTION	PCS
Ring spanner & pipe 46 mm	**2**

WBTO012A

DESCRIPTION	PCS
Open spanner 30, 36 mm	**2**

WBTO013A

DESCRIPTION	PCS
Open spanner 46 mm	**2**



WBTO014A

DESCRIPTION	PCS
Plumb 0.5 kp with 5 m cord	**1**

WBTO015A

DESCRIPTION	PCS
Tape 5 m	**3**

WBTO017A

DESCRIPTION	PCS
Pliers for outside rings dm 40-100 mm	**2**

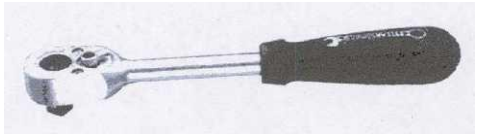
WBTO018A

DESCRIPTION	PCS
Smooth file half round 300 mm	**1**

WBTO019A

DESCRIPTION	PCS
Smooth file round 300 mm	**1**

WBTO020A

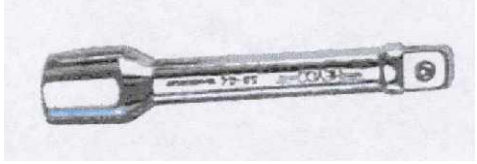


DESCRIPTION	PCS
Ratchet ¾ inch	**2**

WBTO020-1A

DESCRIPTION	PCS
T-handle ¾	**2**

WBTO021A



DESCRIPTION	PCS
Extension ¾ inch	**2**

WBTO021-1A

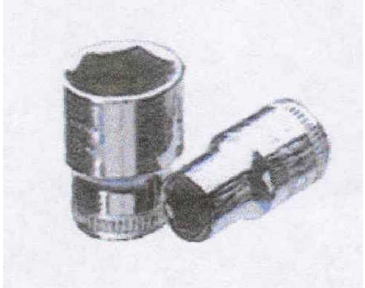
DESCRIPTION	PCS
Extension 1/2 inch 250mm	**4**

WBTO022A

DESCRIPTION	PCS
Hexagon socket screw, 17 mm	**2**

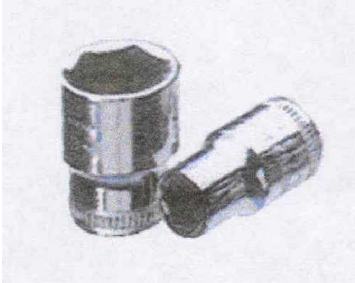
WBTO023A

DESCRIPTION	PCS
Socket ½ inch, 17 mm	**2**



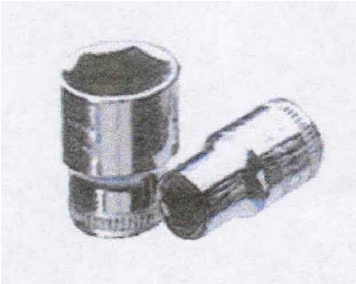
WBTO024A

DESCRIPTION	PCS
Socket ¾ inch, 30 mm	**2**



WBTO025A

DESCRIPTION	PCS
Socket ¾ inch, 36 mm	**2**



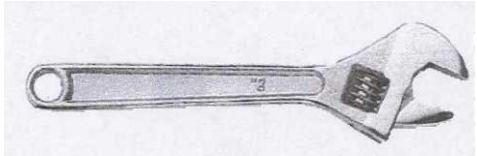
WBTO026A

DESCRIPTION	PCS
Socket ¾ inch, 46 mm	**2**

WBTO028A

DESCRIPTION	PCS
Spirit-level with magnet	**2**

WBTO029A



DESCRIPTION	PCS
Adjustable spanner	**2**

WBTO030A

DESCRIPTION	PCS
Pair of gloves	**10**

WBTO031A

DESCRIPTION	PCS
Bar 800 mm	**2**

WBTO038A

DESCRIPTION	PCS
Instep set round loop 1 to, 1,5 m	**4**

WBTO039A

DESCRIPTION	PCS
Instep set round loop 1 to, 3 m	**4**

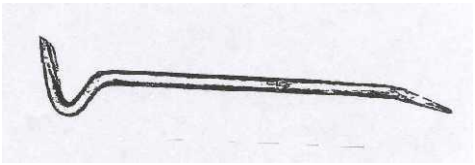
WBTO042A

DESCRIPTION	PCS
Shackle 1 inch	**6**

WBTO044A

DESCRIPTION	PCS
Clamps 500 mm	**4**

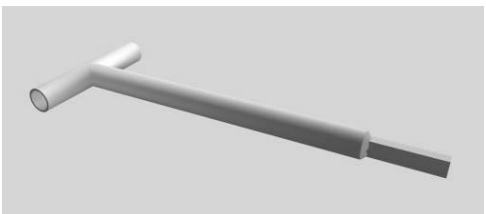
WBTO051A



DESCRIPTION	PCS
Neal Bear	**1**

WBTO052A or 053A

DESCRIPTION	PCS
Hydraulic jack 30to or 50to	**2**



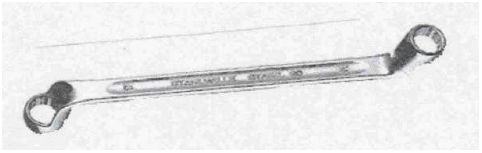
WBTO054A

DESCRIPTION	PCS
Long socket head spanner 17 mm	**2**

WBTO055A

DESCRITION	PCS
Long spanner 17 mm	**2**

WBTO056A



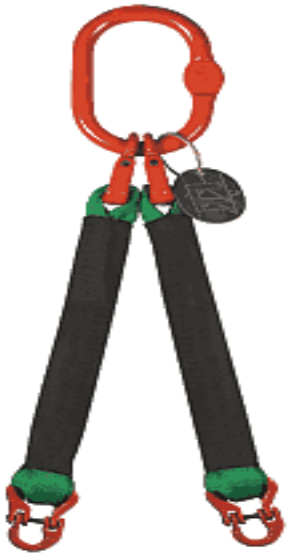
DESCRIPTION	PCS
Ring spanner 19, 22 mm	**2**

WBTO057A

DESCRIPTION	PCS
Open spanner 19, 22 mm	**2**

WBTO060A

DESCRIPTION	PCS
Punch 35 mm	**2**



WBTO082A

DESCRITION	PCS
Lifting hanger Steel Deck	**1**