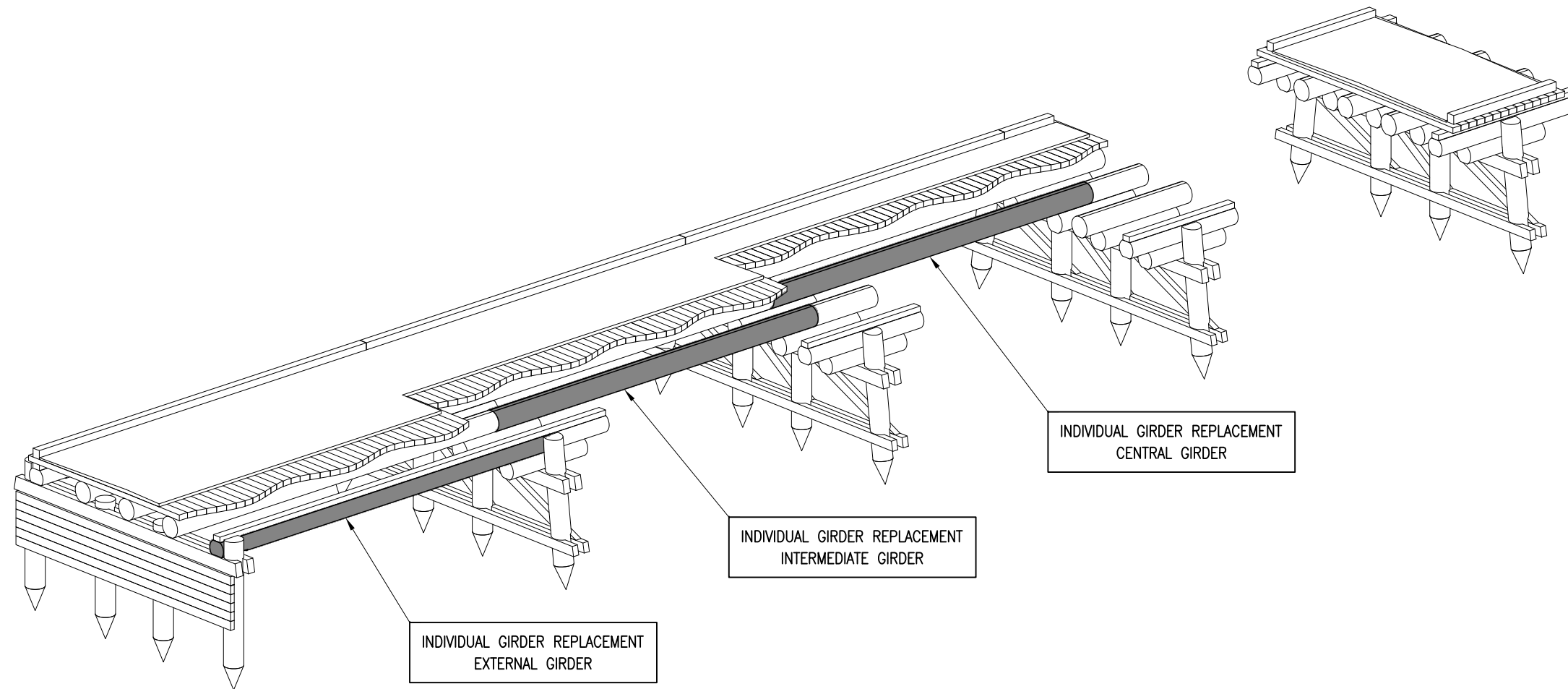


FIBRE REINFORCED POLYMER (FRP) COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION



TYPICAL ARRANGEMENT "A" CLASS TIMBER BRIDGE (1939)

DRAWING INDEX

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Steel Fabrication Details – 2 of 2	Sheet 17 of 17

ACRONYMS

TPA	Top Plate Assembly
CW	Channel Washer
DF	Deck Flat bar
B1 TO B4	Bolts for external girder replacement
B5 TO B8	Bolts for intermediate girder replacement
B9 TO B12	Bolts for central girder replacement
RBA	Restraint Bracket Assembly
RBU	Restraint Bracket Upper assembly
RBM	Restraint Bracket Middle assembly
RBL	Restraint Bracket Lower assembly
FRP	Fibre Reinforced Polymer
FRPC	Fibre Reinforced Polymer Composite
PFR	Particulate Filled Resin
SW	Saddle Washer
HWP	Hardwood Packer

Australian Standards:

AS 1101.3	Graphical symbols for general engineering – Welding and non-destructive examination
AS 1111.1	ISO metric hexagon bolts and screws – Product grade C – Bolts
AS 1112.1	ISO metric hexagon nuts – Style 1 – Product Grade A and B
AS 1112.4	ISO metric hexagon nuts – Chamfered thin nuts – Product grades and B
AS 1163	Cold-formed structural steel hollow sections
AS 1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS 1237.1	Plain washers for metric bolts, screws and nuts for general purposes – General plan
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS/NZS 1554.1	Structural steel welding – Welding of steel structures
AS/NZS 3678	Structural steel – Hot-rolled plates, floorplates and slabs
AS/NZS 3679.1	Structural steel – Hot-rolled bars and sections
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS ISO 14341	Welding consumables – Wire electrode and weld deposits for gas shielded metal arc welding of non alloy and fine grain steels – Classification
AS/NZS ISO 17632	Welding consumables – Tubular cored electrodes for gas shielded and on-gas shielded metal arc-welding of non-alloy and fine grain steels – Classification

GENERAL NOTES:

- G1. This drawing was previously standard drawing No. 2605.
- G2. The details shown on this standard drawing are for individual girder replacement only using FRPC girders designed and manufactured by LOC Composites (LOC Composite Girders) for the "Bridging the Gap" project. This standard drawing is not applicable for any other use.
- G3. Refer Standard drawing 2281 for installation procedure
- G4. This Standard Drawing is applicable for the following cases:
 - Single girder requiring replacement in one span
 - Bridges with a timber sub-structure
 - 30' spans
 - 'A', 'Am' or 'B' Class Timber bridges
 - Bridges with no traffic barriers attached directly to edge girder
- G5. Maximum one FRPC girder replacement per span using LOC Composite Girders denoted as LOC 400 or LOC 420 in this drawing.
- G6. The scope of the FRPC girder replacement for timber bridges standard drawings is to define situations where approved FRPC girders may be used as timber girder replacements in the rehabilitation of existing timber bridges.
- G7. Consideration needs to be given to lateral and longitudinal restraint and some samples of typical restraint systems are detailed on these drawings. When timber girders are replaced, props may be required to provide stability to adjacent span. In each case, calculations need to be performed to assess the design for each project.
- G8. All dimensions listed in these drawings are to be confirmed on site prior to construction.

STEELWORK NOTES:

- S1. STEELWORK to be fabricated to the requirements of MRTS78
 - SHS to be Grade C350L0 to AS/NZS 1163.
 - Steel plate to be Grade 350 to AS/NZS 3678.
 - Flat bar to be Grade 300 to AS/NZS 3679.1.
 - Bolts Class 4.6 to AS 1111.1, nuts Class 5 to AS 1112.1 and washers for Class 4.6 bolts to AS 1237.1.
 - Bolts Class 8.8, nuts Class 8 and washers for Class 8.8 bolts to AS/NZS 1252, thin nuts Class 5 to AS 1112.4.
 - All bolts and nuts to be hot dip galvanized to AS 1214. All other steelwork to be hot dip galvanized to AS/NZS 4680 unless shown otherwise. Prior to galvanizing all weld splatter and welding slag is to be removed.
- S2. WELDING symbols conform to AS 1101.3.
 - All welding to AS/NZS 1554.1.
 - All welds, except location tack welds, to be SP category.
 - Welding consumables to be controlled hydrogen type G493 to AS/NZS ISO 14341-B or T493 to AS/NZS ISO 17632-B, unless shown otherwise.
- S3. DIMENSIONS are in millimetres unless shown otherwise.

TIMBER NOTES:



- T1. All Timber Packers to be:
 - Seasoned Hardwood
 - Stress Grade F27
 - Joint Group JD1
 - Minimum Strength Group SD2

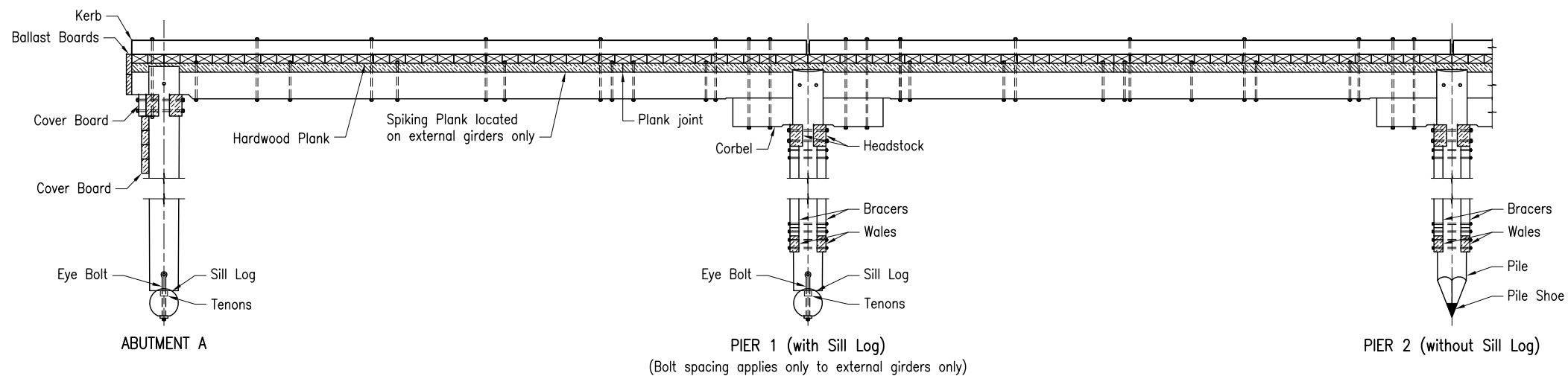
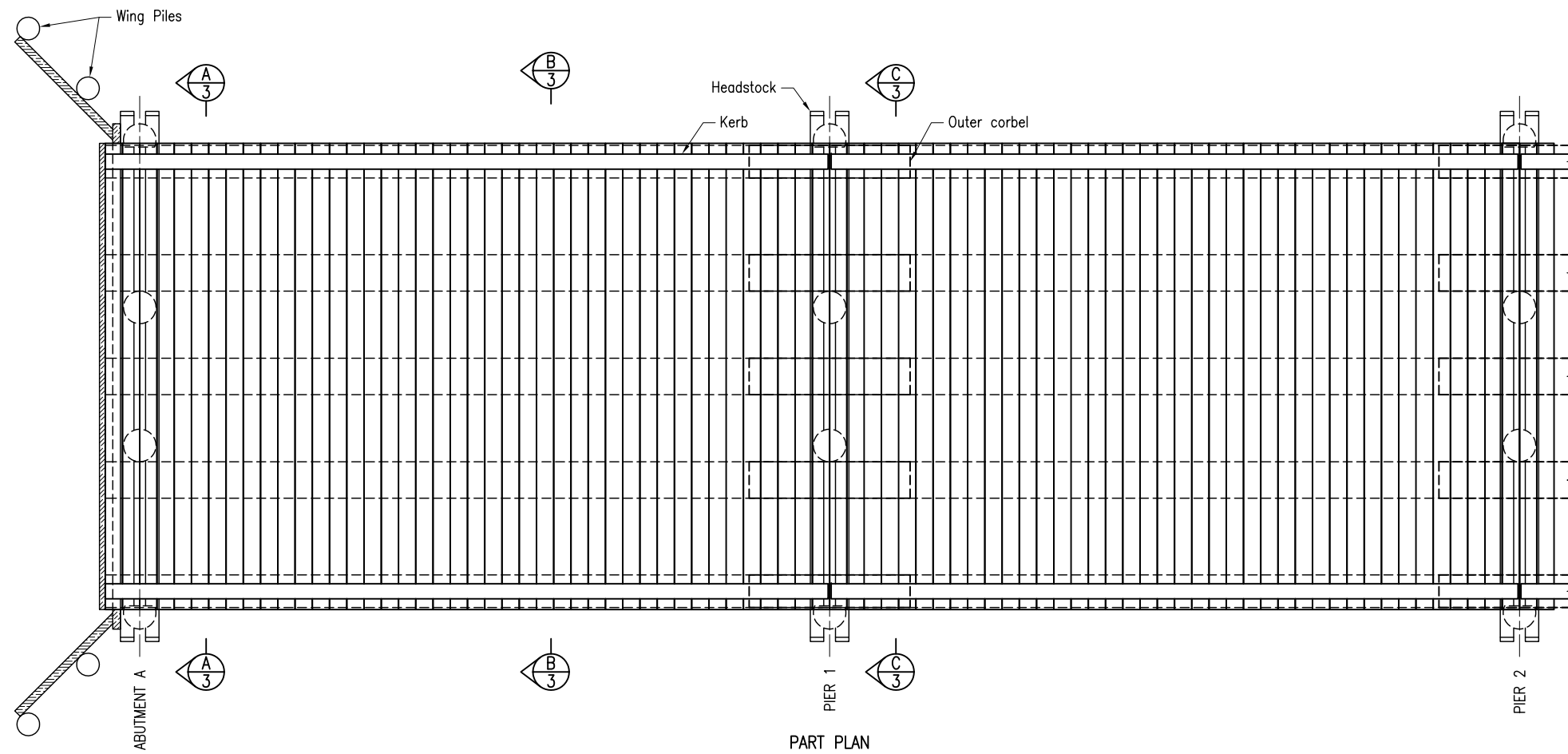
ASSOCIATED DEPARTMENTAL DOCUMENTS:

Standard Drawings
Specifications
Timber Bridge Maintenance Manual

REFERENCED DOCUMENTS:

Departmental Standard Drawings:
2281 FRP Composite Girders for Timber Bridge Rehabilitation – LOC 400 & LOC 420 Installation Procedure
Departmental Specifications:
MRTS78 Fabrication of Structural Steelwork
MRTS60 Installation of Fibre Reinforced Polymer (FRP) Composite Girders

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 1 of 17		A3 Not to Scale	Standard Drawing No 2280 Date 7/15

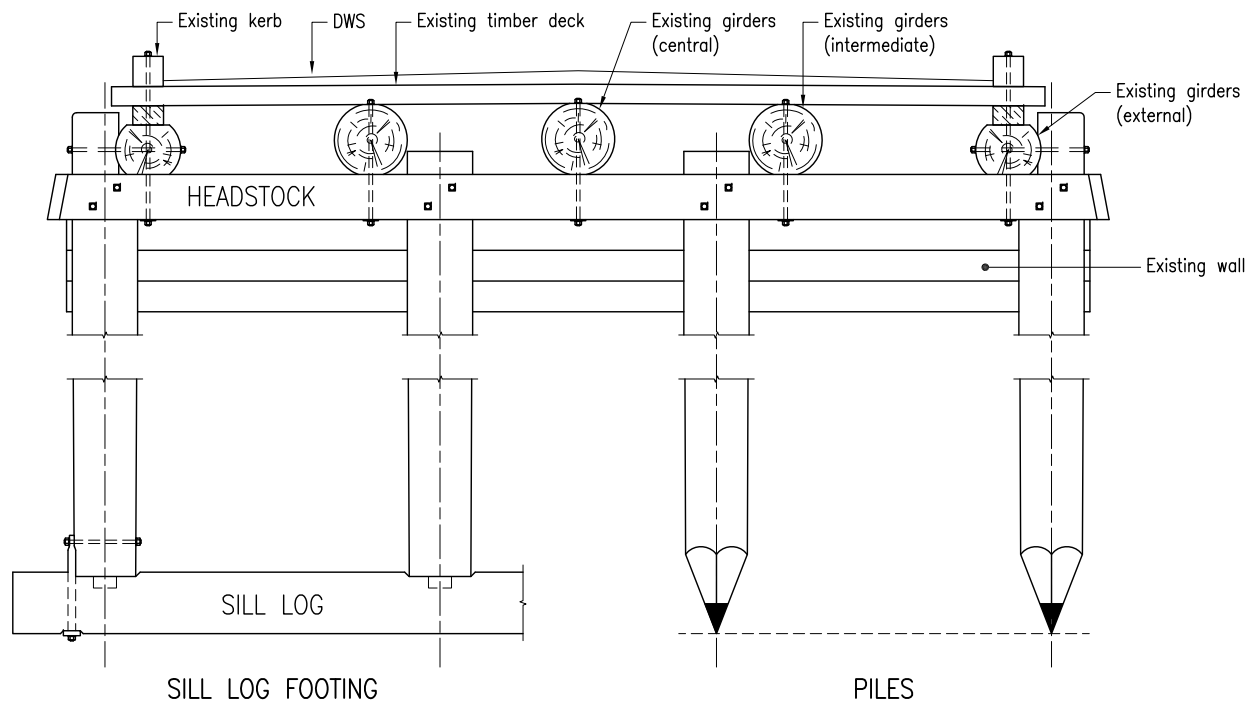


PART ELEVATION
 TYPICAL DETAILS – EXISTING 30'x18' WIDE TIMBER SUBSTRUCTURE & SUPERSTRUCTURE*

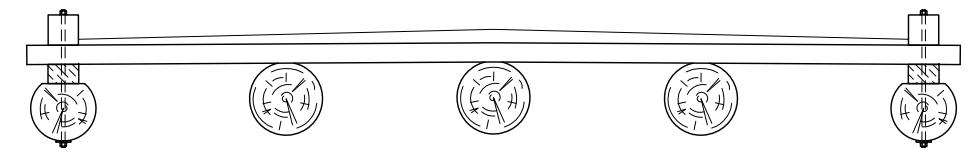
*Dimensions to be confirmed on site

- NOTES:
1. General Arrangement for a five girder timber bridge.
 2. Bituminous DWS on top of wood deck (not shown on PLAN view for clarity)

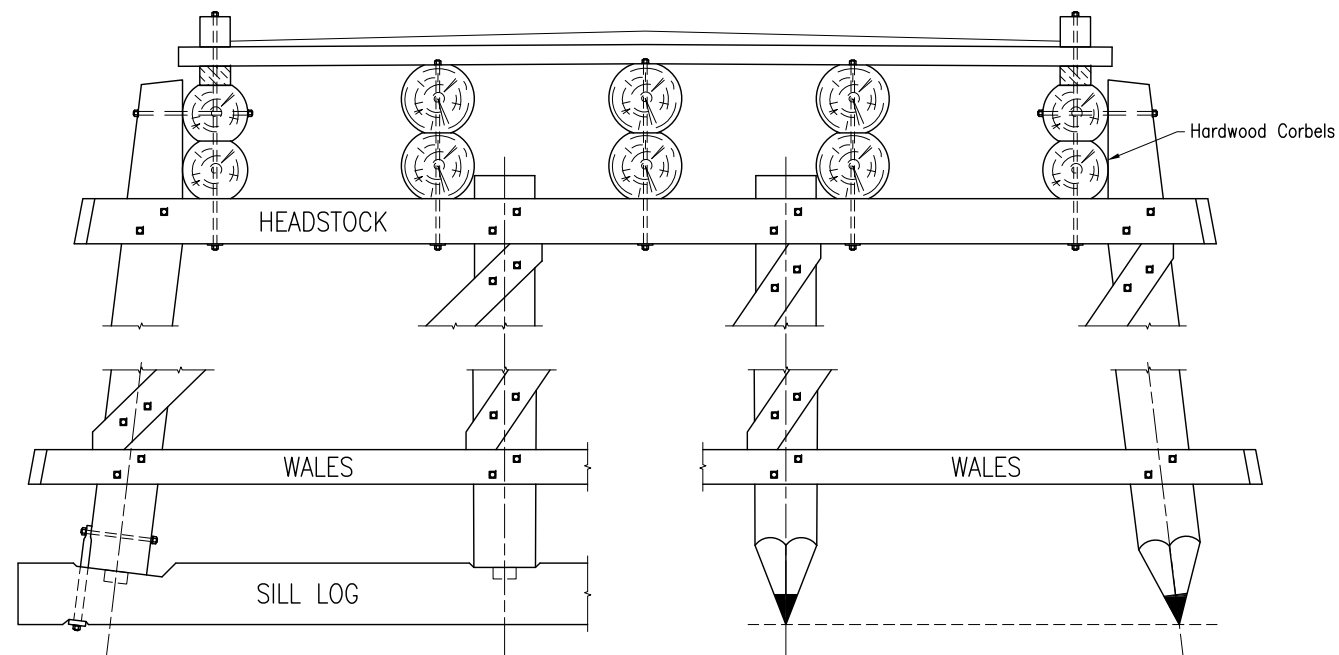
Department of Transport and Main Roads		 <small>© The State of Queensland (Department of Transport and Main Roads) 2015 http://creativecommons.org/licenses/by/3.0/au</small>	
FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 2 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15



SECTION $\frac{A}{2}$ ABUTMENT DETAIL





SECTION $\frac{B}{2}$ MID SPAN DETAIL



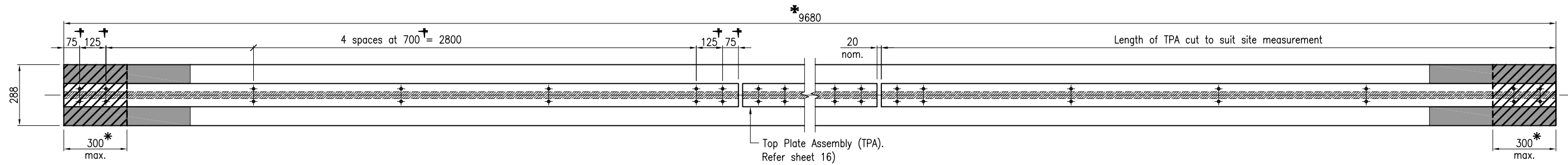
SECTION $\frac{C}{2}$ PIER DETAIL

NOTES:

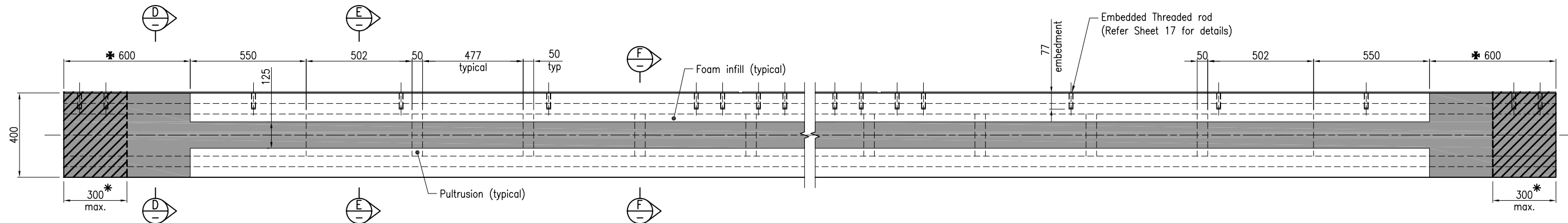
1. General Arrangement for a five girder timber bridge.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 3 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15

* Required length to be confirmed on site. FRPC girder may be cut to fit prior to installation.
 * When trimming is required, equal length to be cut at both ends. Trimming to be in accordance with manufacturer handling/installation and maintenance guidelines. Exposed cut or cored surface to be painted with TMR approved 2 pack epoxy paint.
 † Anchor locations indicative only. TPA to be cut based on required girder length.



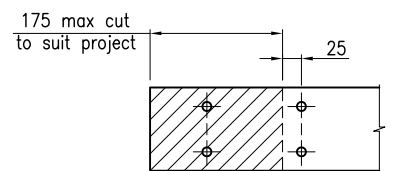
PLAN - GENERAL ARRANGEMENT OF LOC 400



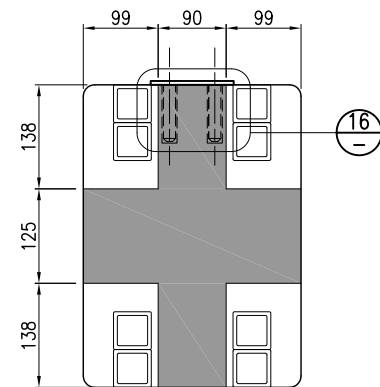
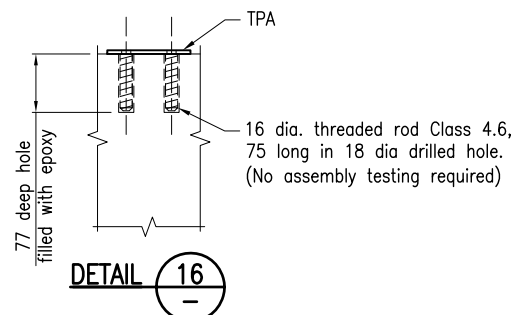
ELEVATION - GENERAL ARRANGEMENT OF LOC 400

LEGENDS:

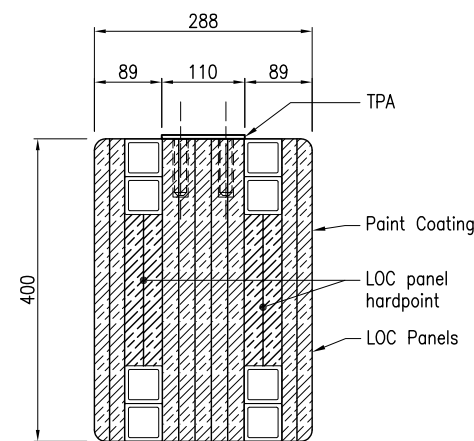
- - Drillable area (painted white on girders)
- ▨ - Cut length (maximum 300 at both ends)



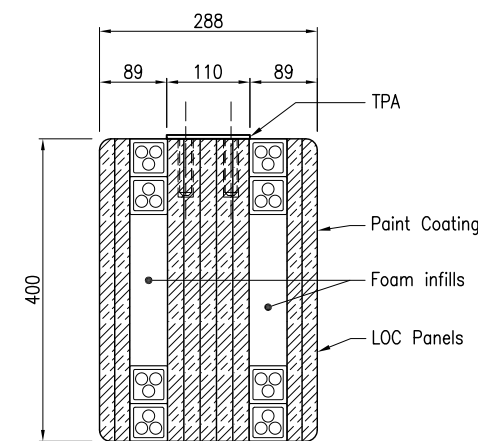
PLAN - TPA END CUT DETAIL



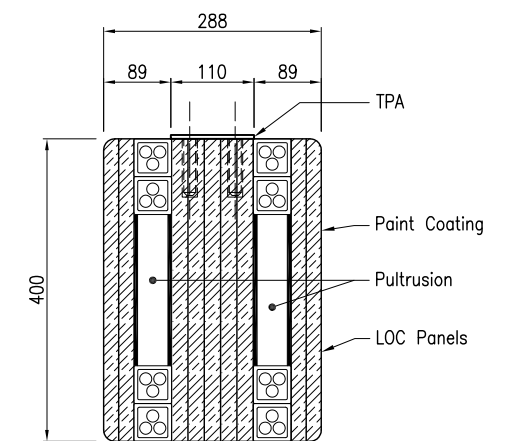
TYPICAL SECTION





SECTION D



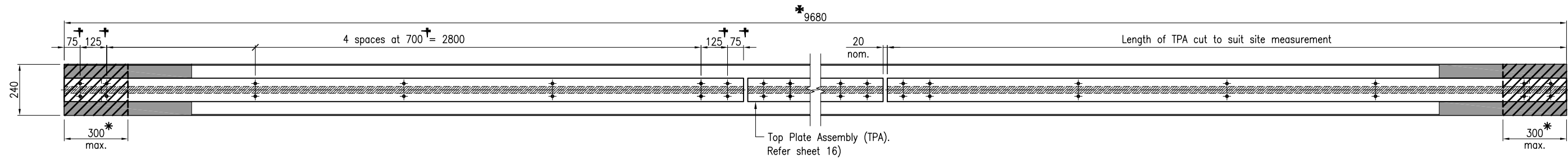
SECTION E



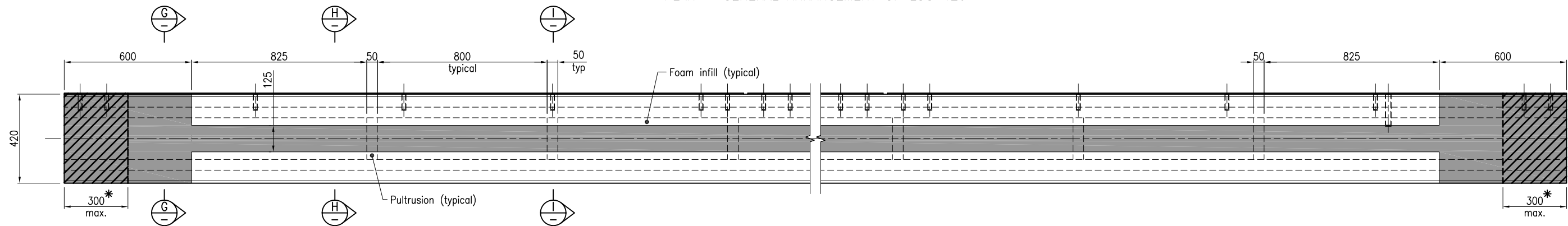
SECTION F

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 4 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15

* Required length to be confirmed on site. FRPC girder may be cut to fit prior to installation.
 * When trimming is required, equal length to be cut at both ends. Trimming to be in accordance with manufacturer handling/installation and maintenance guidelines. Exposed cut or cored surface to be painted with TMR approved 2 pack epoxy paint.
 † Anchor locations indicative only. TPA to be cut based on required girder length.



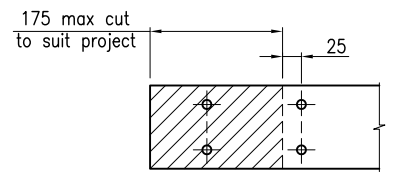
PLAN - GENERAL ARRANGEMENT OF LOC 420



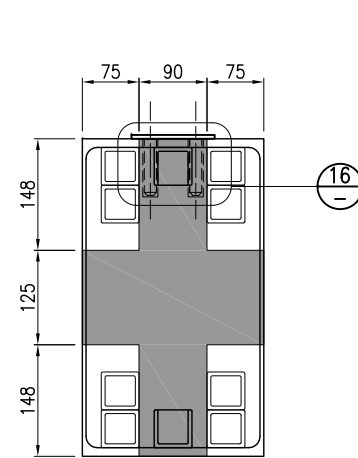
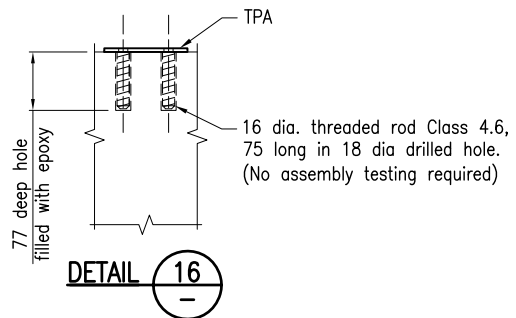
ELEVATION - GENERAL ARRANGEMENT OF LOC 420

LEGENDS:

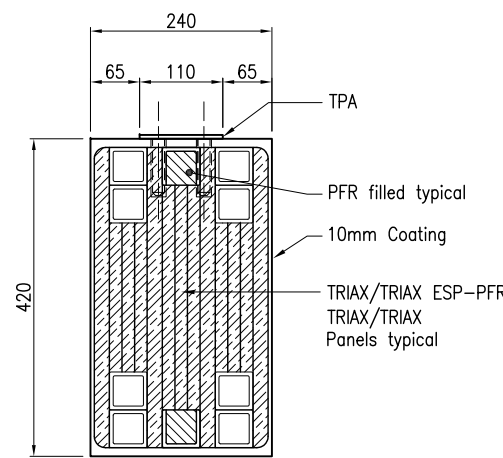
- - Drillable area (painted white on girders)
- ▨ - Cut length (maximum 300 at both ends)



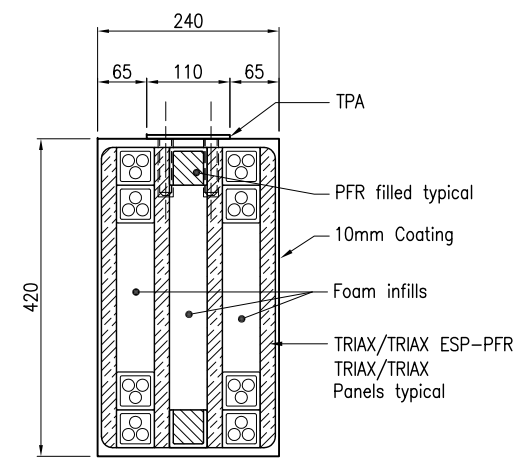
PLAN - TPA END CUT DETAIL



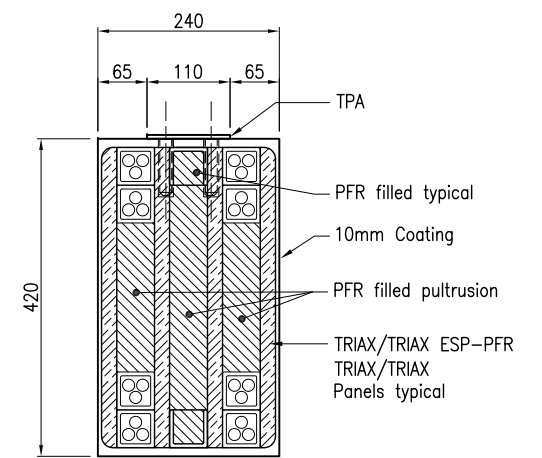
TYPICAL SECTION



SECTION G

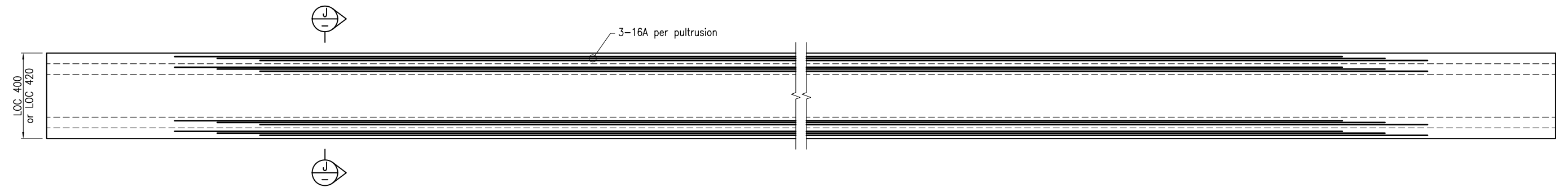


SECTION H

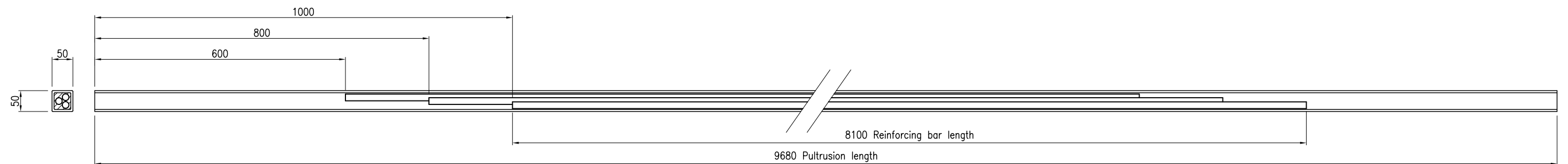


SECTION I

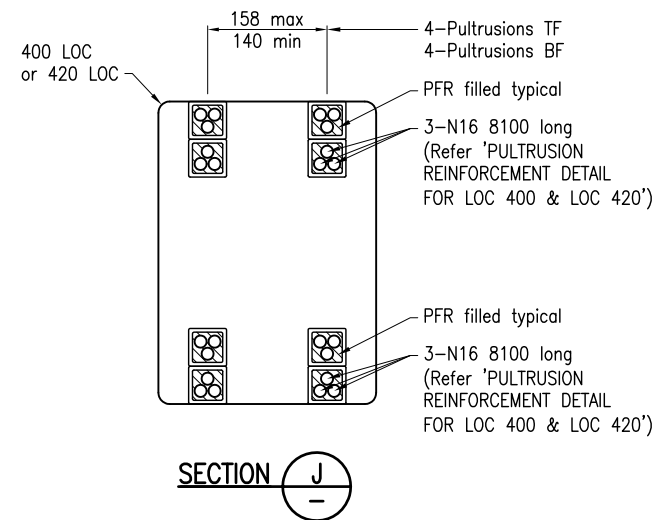
Department of Transport and Main Roads			
FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 5 of 17		A3 Not to Scale	Standard Drawing No 2280 Date 7/15



ELEVATION – TYPICAL REINFORCEMENT FOR LOC 400 & LOC 420



PULTRUSION REINFORCEMENT DETAIL FOR LOC 400 & LOC 420



PERFORMANCE CRITERIA



CRITERIA	VALUE	UNITS
Maximum Width	350	mm
Maximum Depth	425	mm
M_{min} at failure (Test to destruction)	660	kNm
-ve M capacity	30% +ve BM	kNm
V_{min} at failure	350	kN
δ_{max} deflection at failure	170	mm
El girder	2.96e13	Nmm ²
Fatigue Load Testing (1 x 10 ⁶ cycles, spike load every 2x10 ⁵ cycles)	60	kN cycle load
	210	kN spike load

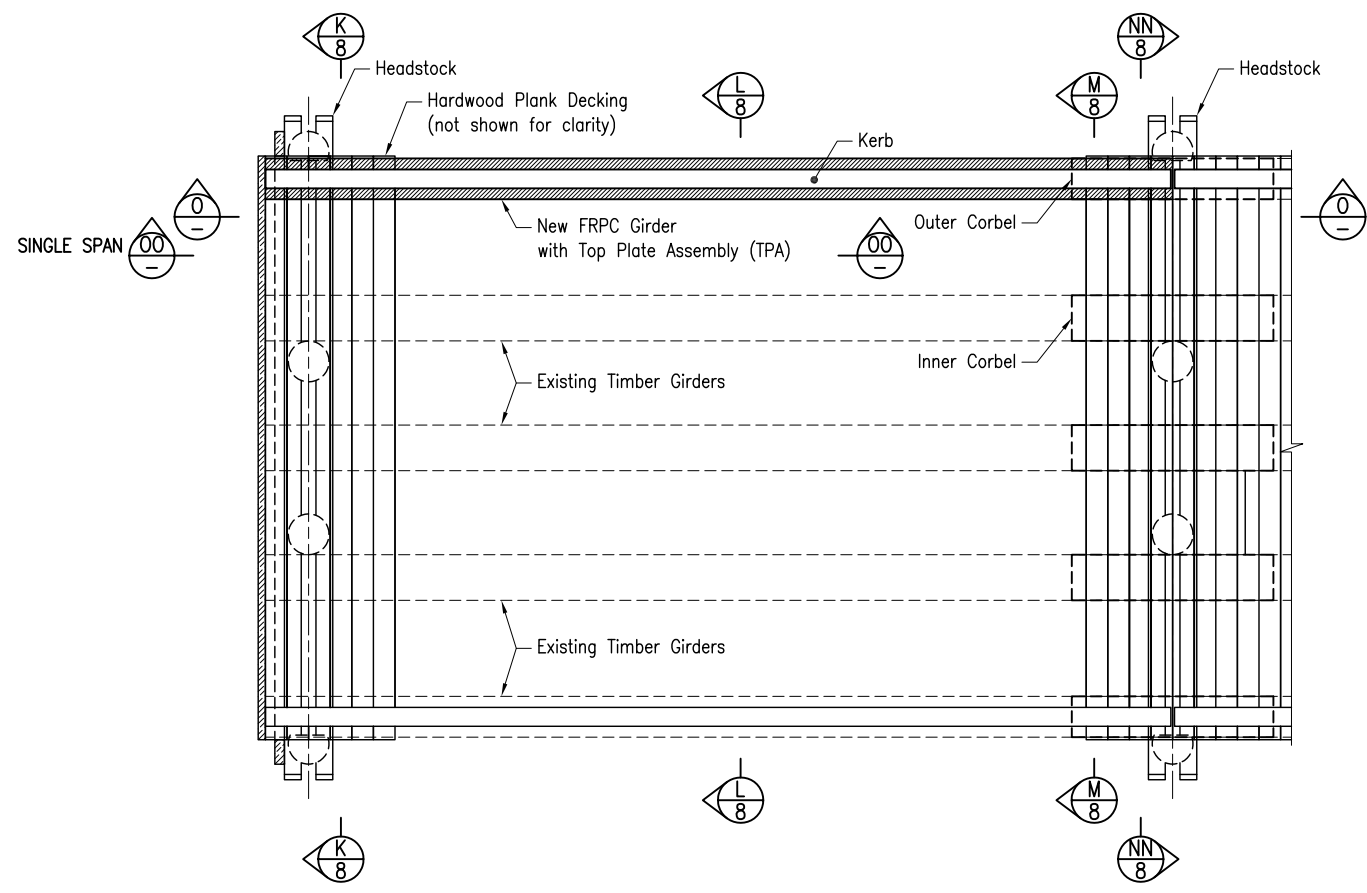
NOTES

1. These drawings shall be read in conjunction with all other consultants drawings and specifications.
2. During construction the structure shall be maintained in a stable condition. Construction loads must not exceed the capacity of the structure at the time of loading.

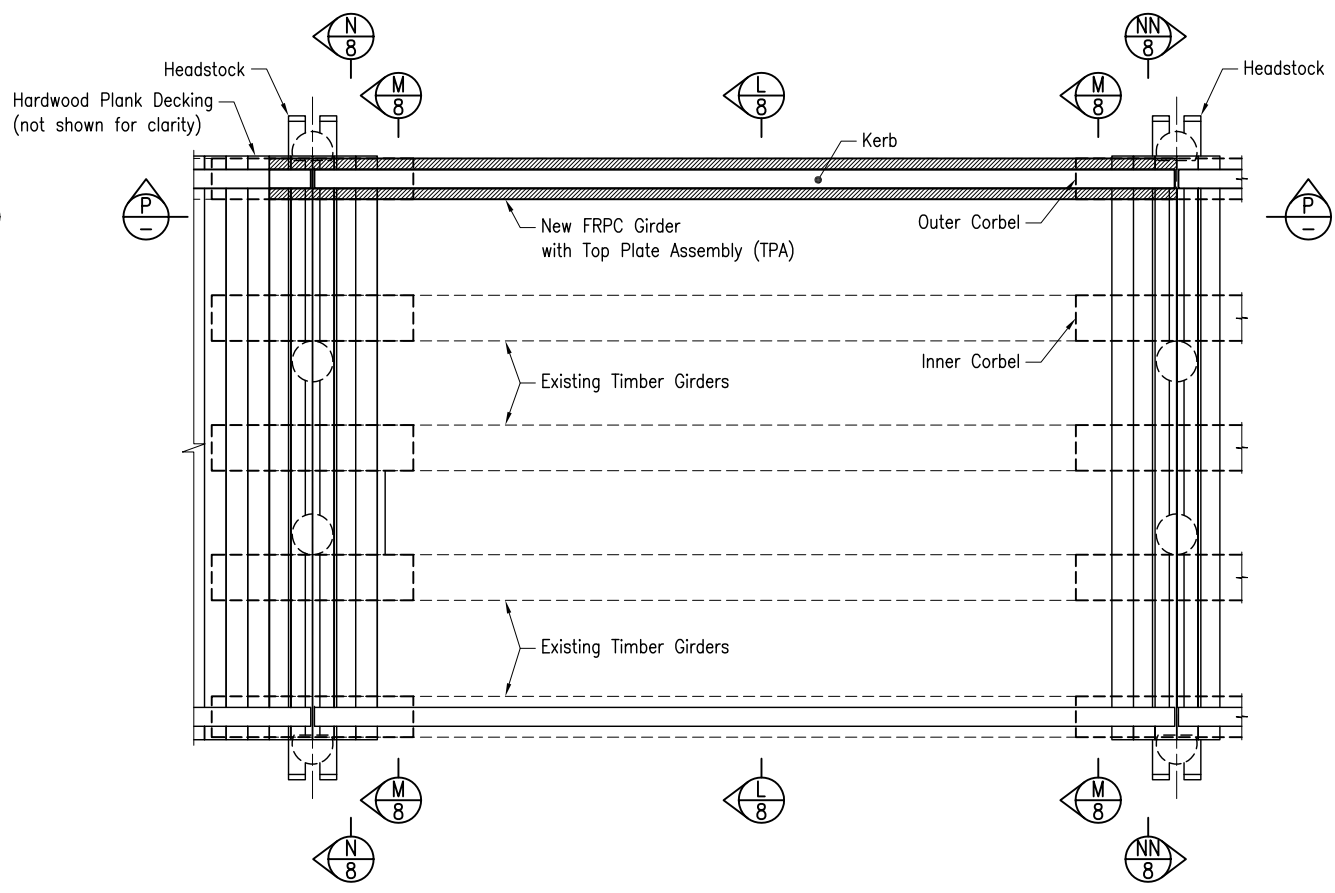
COMPOSITE FIBRE MATERIALS

1. All members shall be in sound condition free from pitting, de-laminations and other defects which are likely to impair the structural capacity of the members.
2. Use of a waterproofing compound to seal any end cut fibres, as a result of drilling or cutting the composite fibre profiles, is highly recommended.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 6 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15

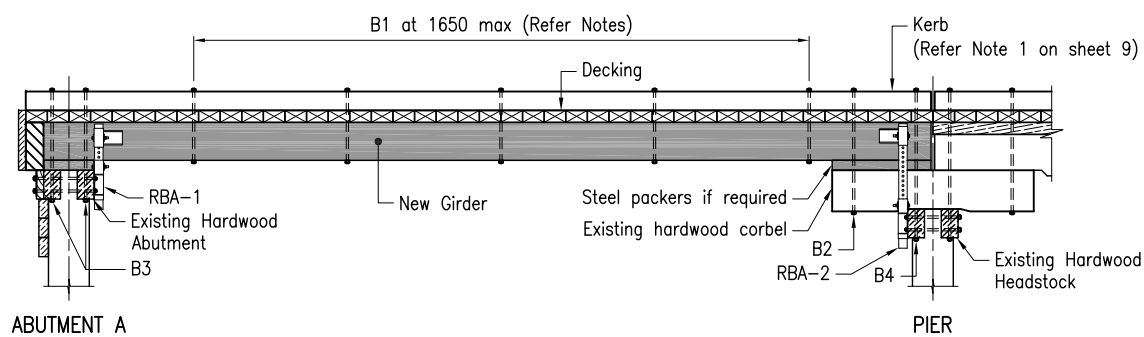


END SPAN ARRANGEMENT SHOWN, SINGLE SPAN SIMILAR

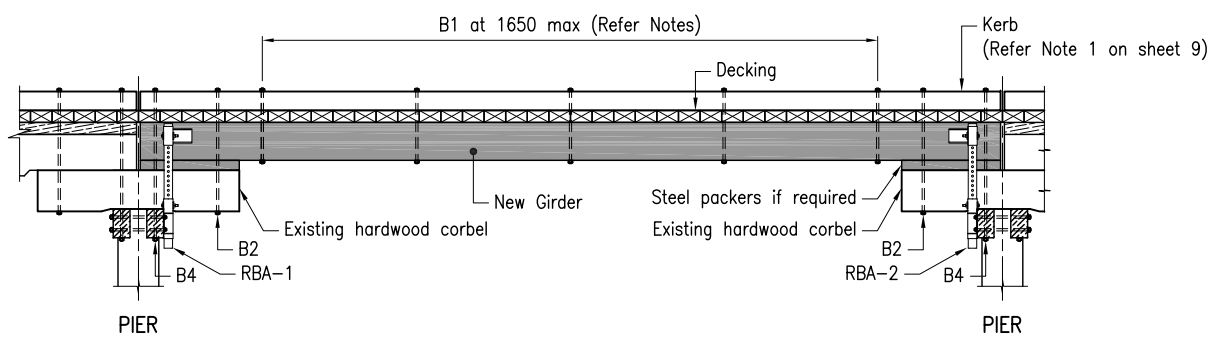


PIER TO PIER SPAN ARRANGEMENT

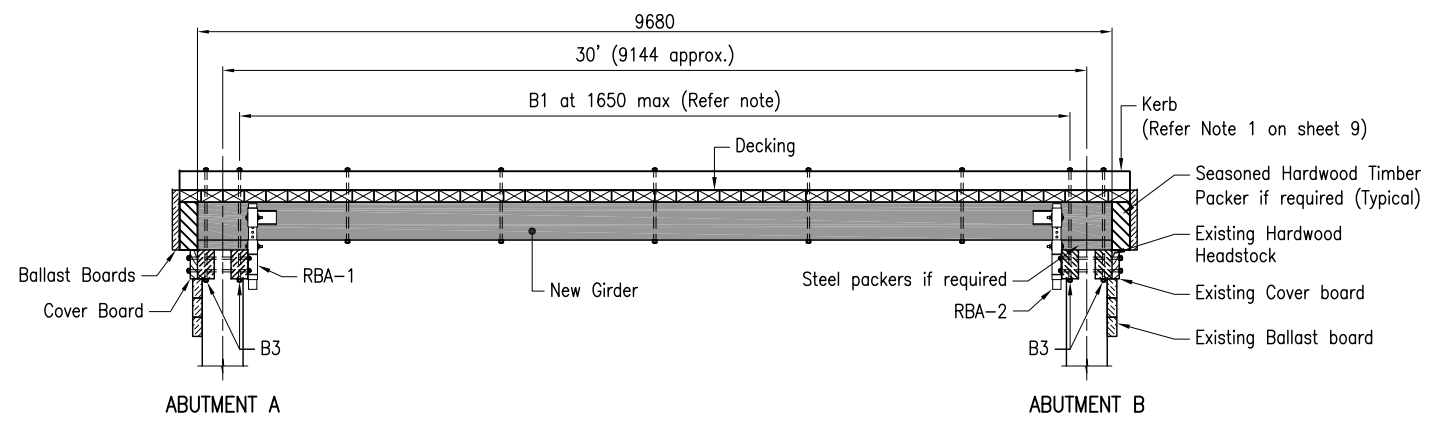
PLAN - GENERAL ARRANGEMENT EXTERNAL GIRDER REPLACEMENT



PART ELEVATION
SECTION O END SPAN
(MULTISPAN BRIDGE)



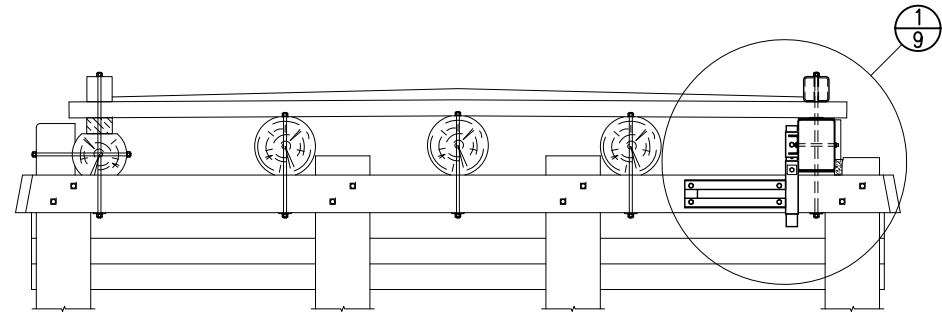
PART ELEVATION
SECTION P INTERIOR SPAN
(MULTISPAN BRIDGE)



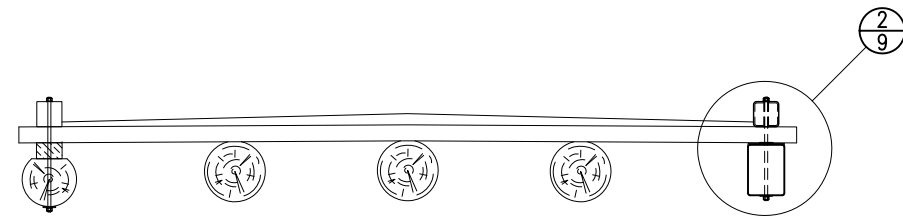
PART ELEVATION
SECTION OO SINGLE SPAN

- NOTES:
1. Bolt spacing and locations to match existing spacing in kerb where applicable.
 2. The top of all bolt holes to be sealed with approved sealant. Refer Detail 14 on sheet 9.

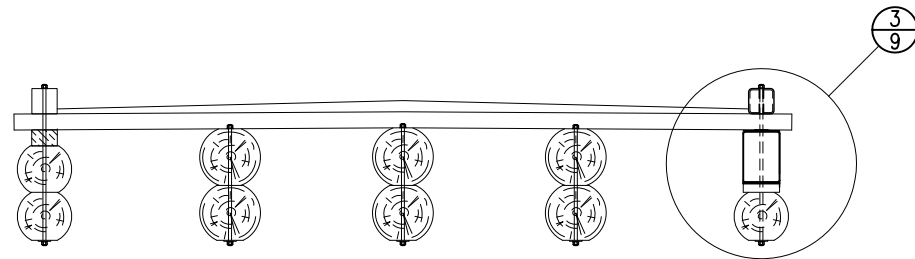
Department of Transport and Main Roads			
FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 7 of 17		A3	Standard Drawing No 2280
		Not to Scale	Date 7/15
		A	



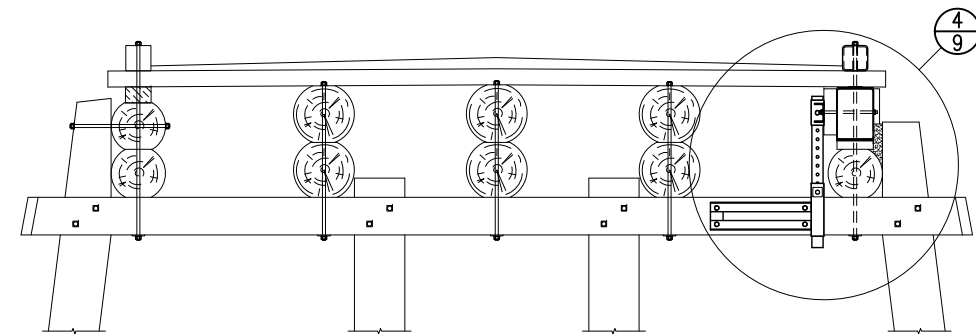
SECTION **K**
7



SECTION **L**
7



SECTION **M**
7





SECTION **N**
7

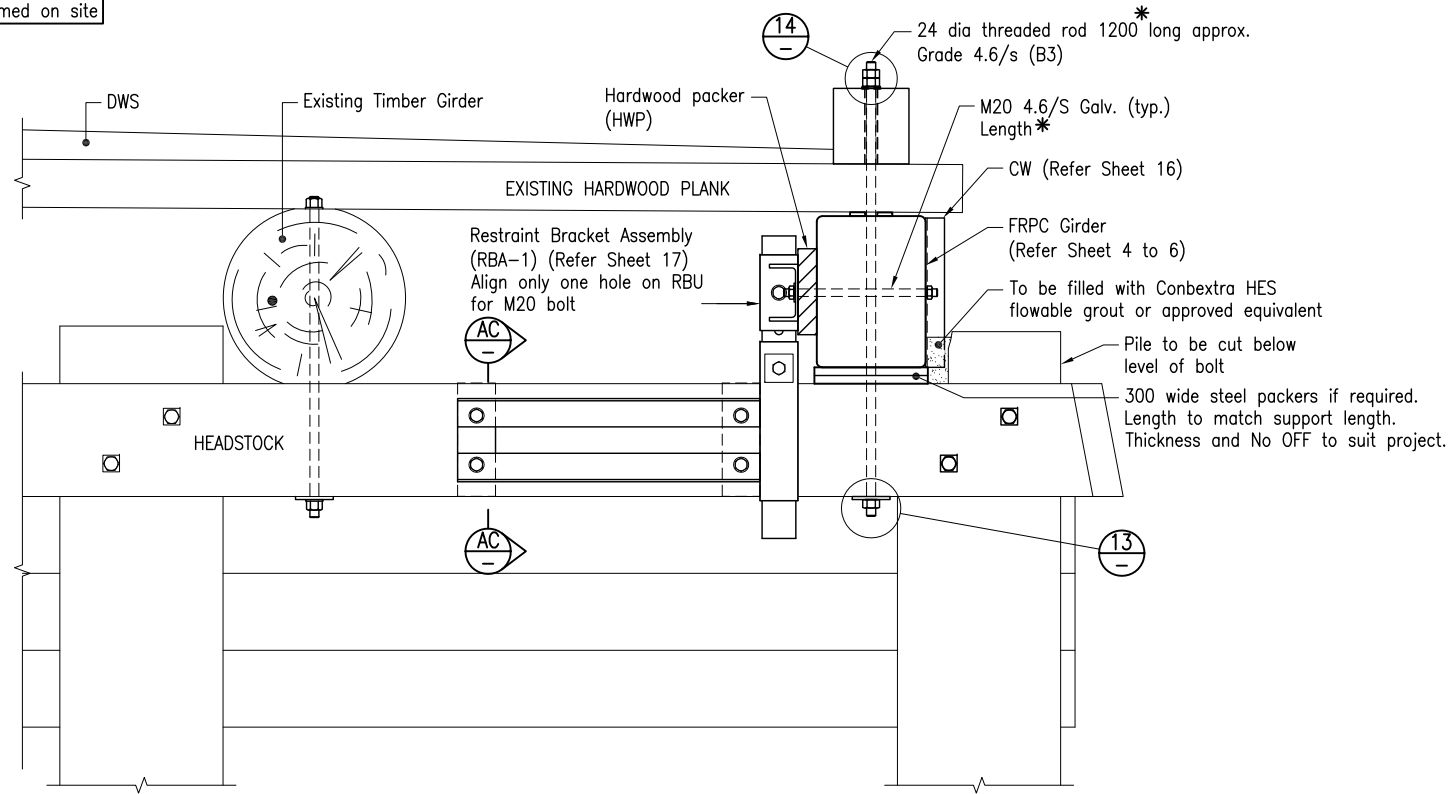
SECTION **NN** SIMILAR
7 (OPPOSITE HAND)

NOTES:

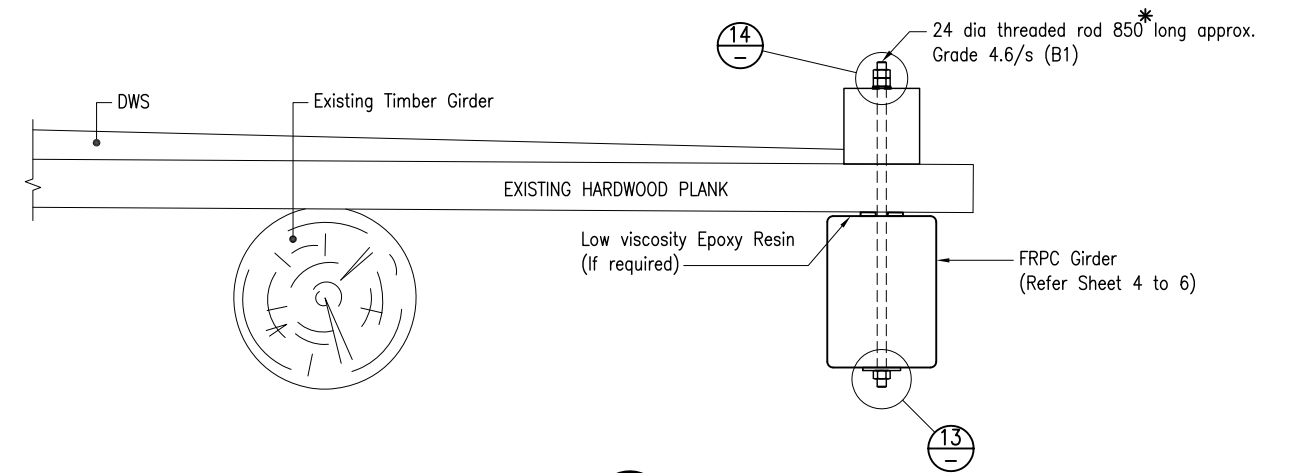
1. Refer sheet 7 for indicative bolt layout.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 8 of 17		A3 Not to Scale	Standard Drawing No 2280 Date 7/15
A			

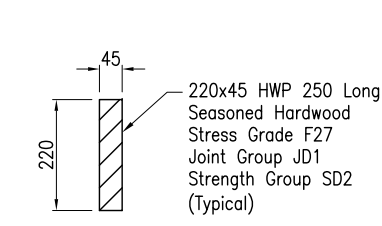
*Dimensions to be confirmed on site



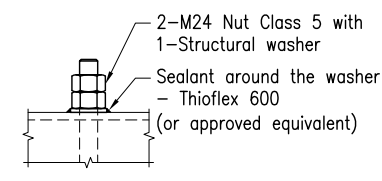
DETAIL 1 AT ABUTMENT



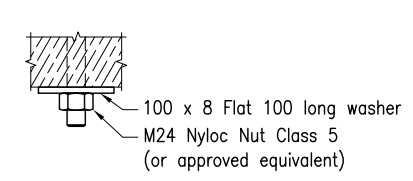
DETAIL 2 AT MID SPAN



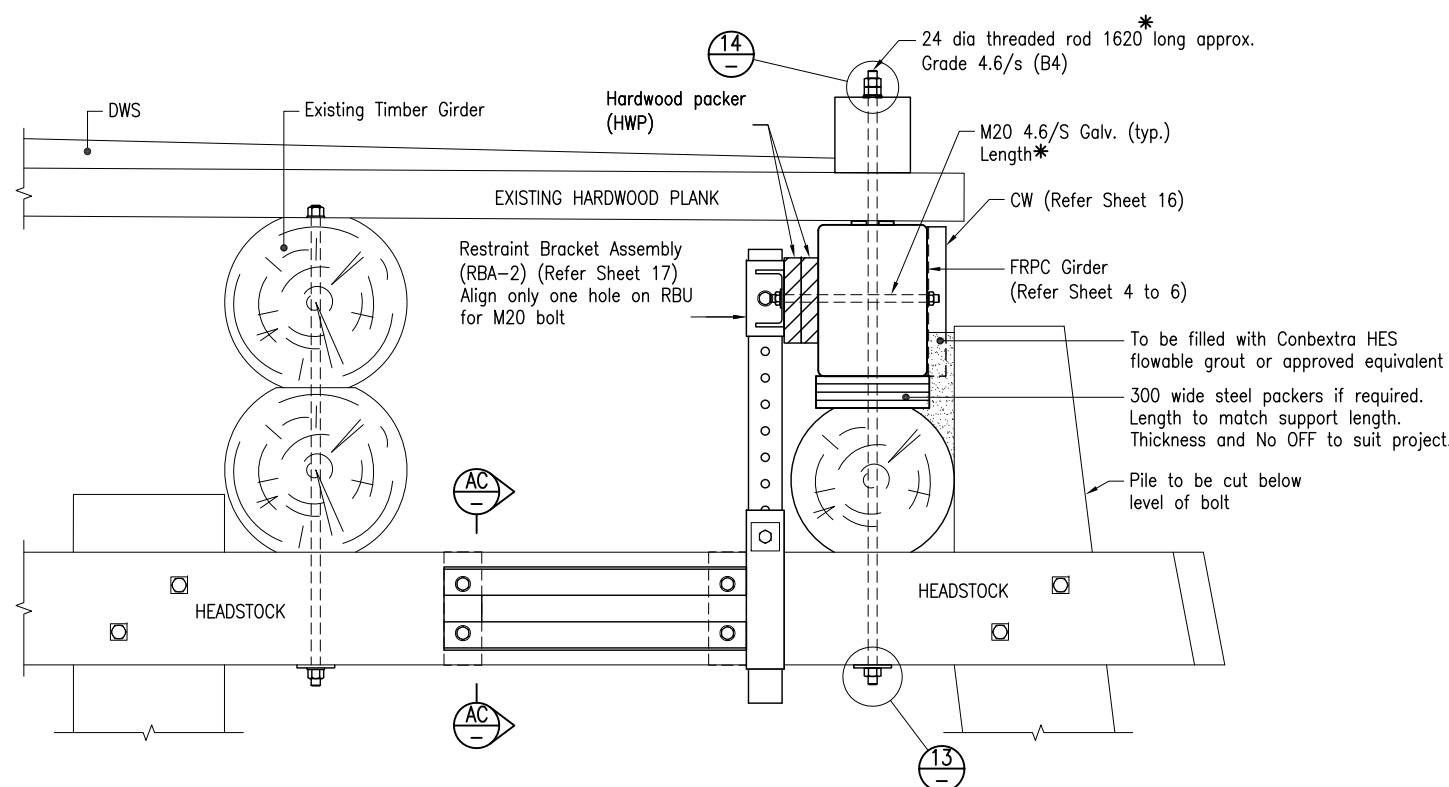
TIMBER PACKER SIDE DETAIL



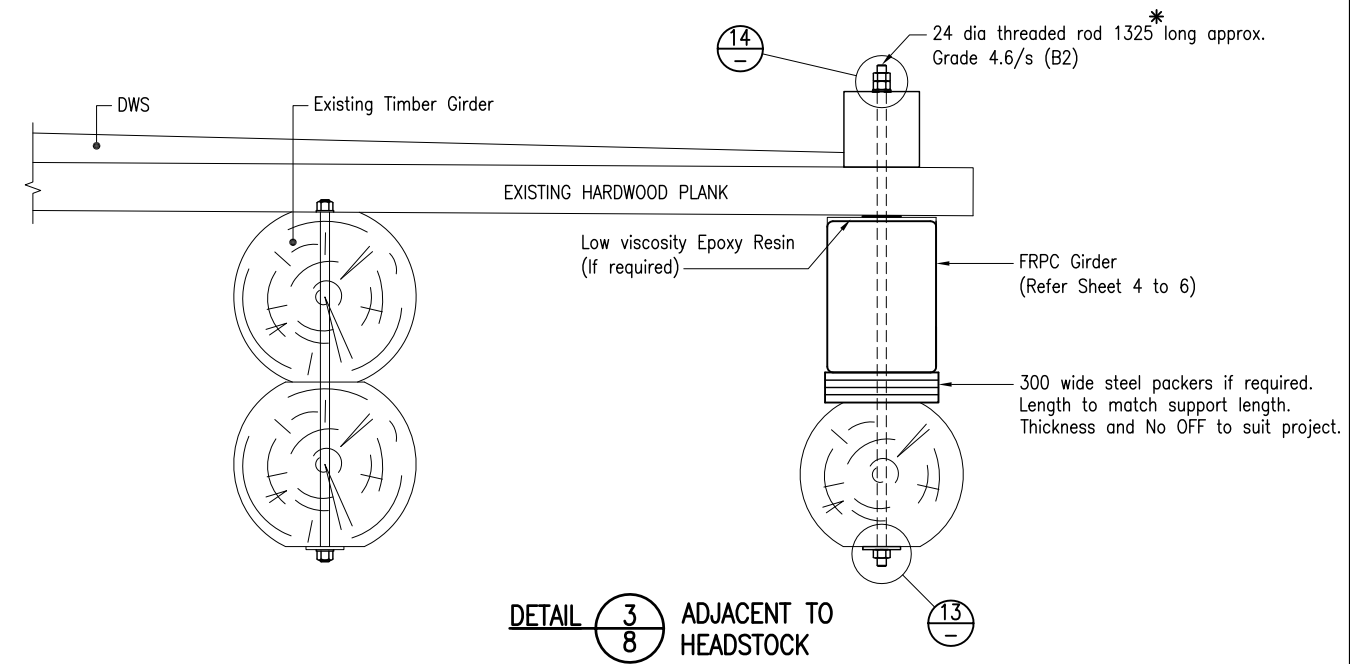
DETAIL 14



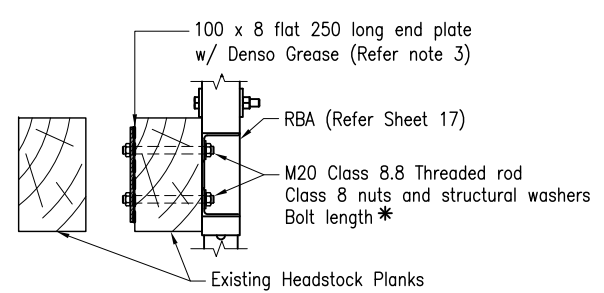
DETAIL 13



DETAIL 4 AT PIER



DETAIL 3 ADJACENT TO HEADSTOCK

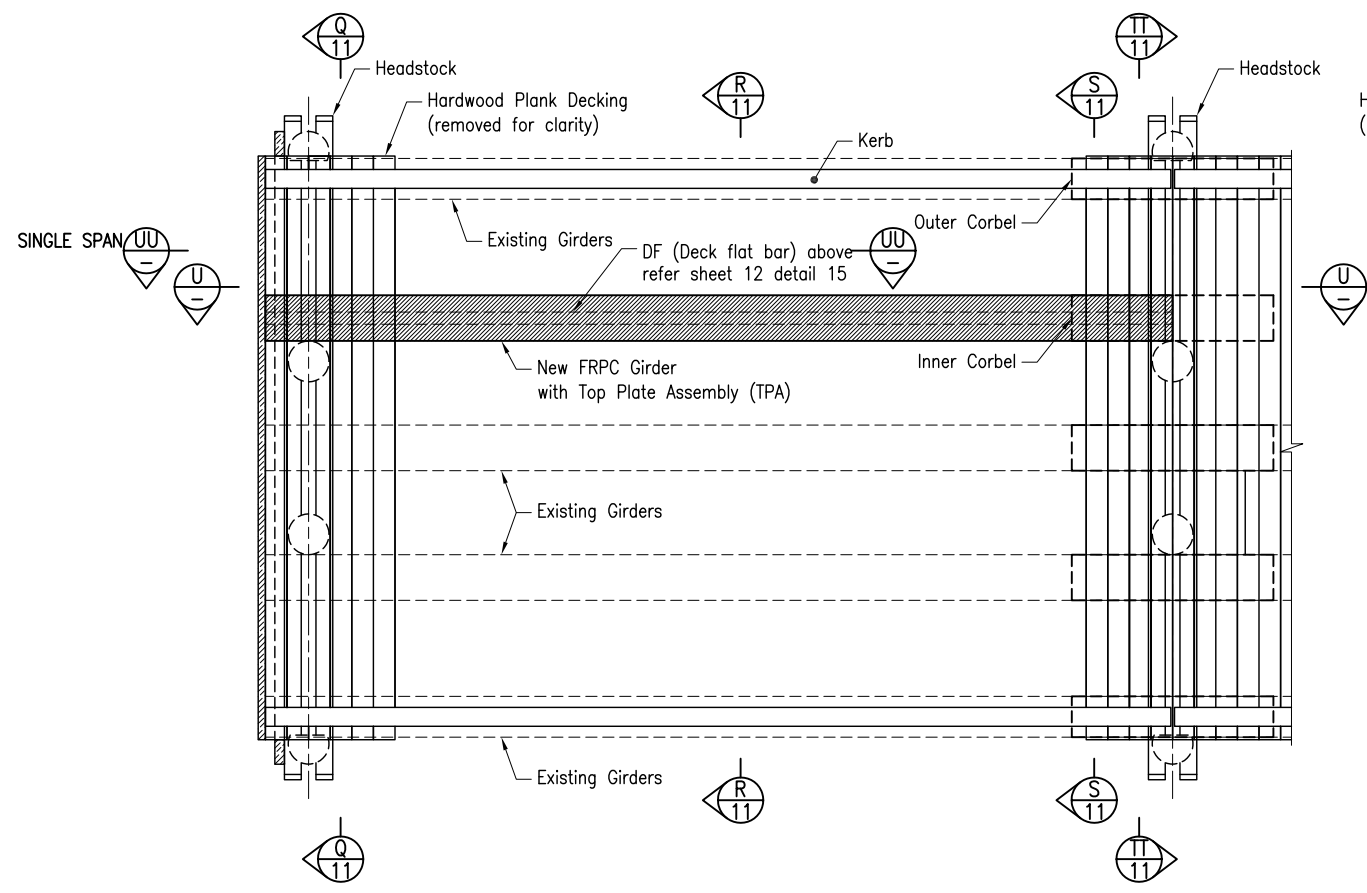


SECTION AC

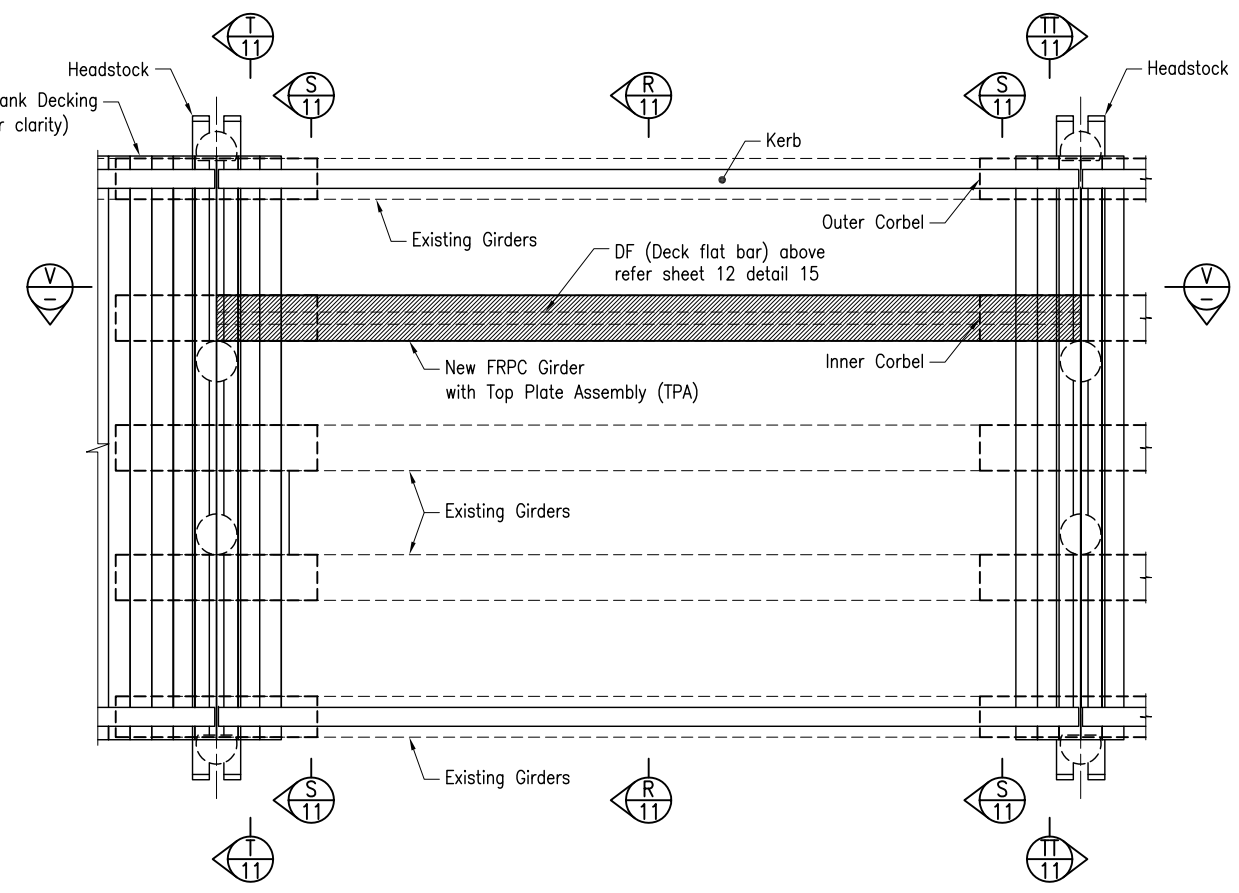
NOTES:

- Existing kerb conditions must be inspected during any girder replacement procedure to determine if existing kerb may be reused or replaced.
- All Structural Steelwork to be Hot Dip Galvanised.
- Denso Grease or equivalent to be applied to headstock area which will be in contact with remaining bracket.
- Hardwood to be treated in accordance with Timber Bridge Maintenance Manual.
- Grade 8.8 threaded rod may be used in lieu of grade 4.6.
- Bolts conforming with MRTS78 may be used in lieu of threaded rod.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 9 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15

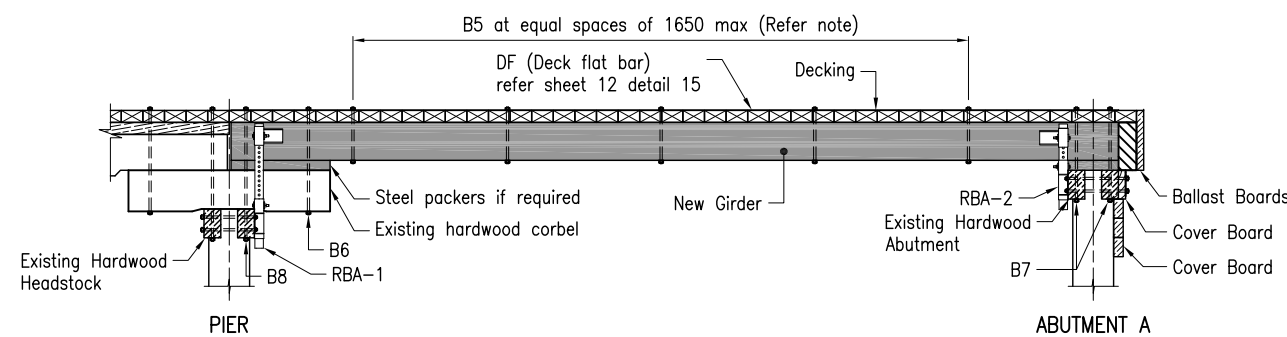


END SPAN ARRANGEMENT SHOWN, SINGLE SPAN SIMILAR

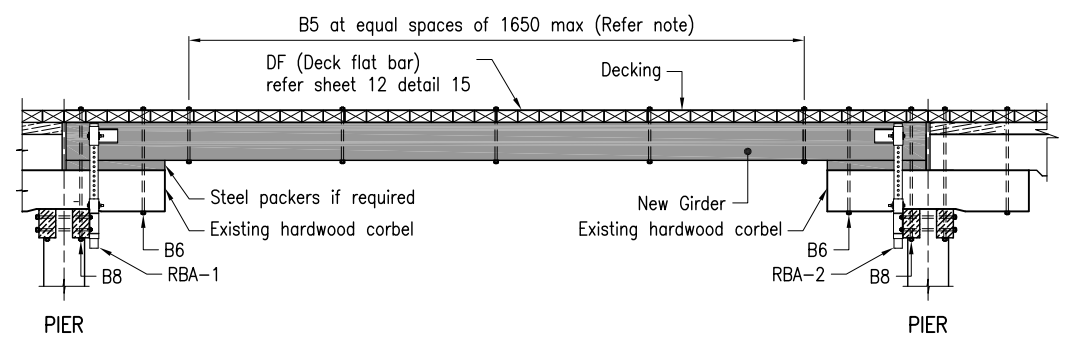


PIER TO PIER SPAN ARRANGEMENT

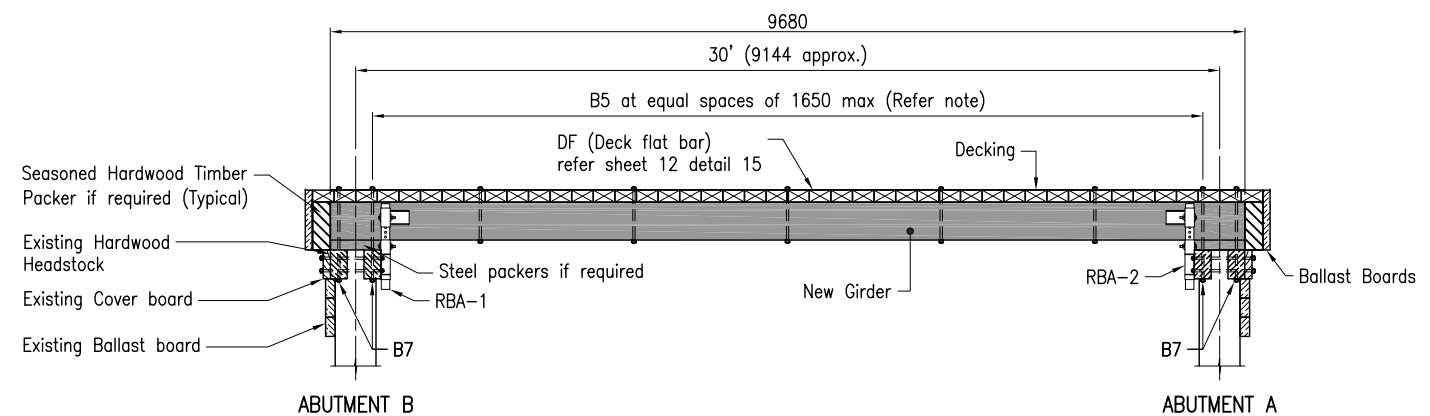
PLAN - GENERAL ARRANGEMENT INTERMEDIATE GIRDER REPLACEMENT



PART ELEVATION
SECTION U-11 END SPAN
(MULTISPAN BRIDGE)



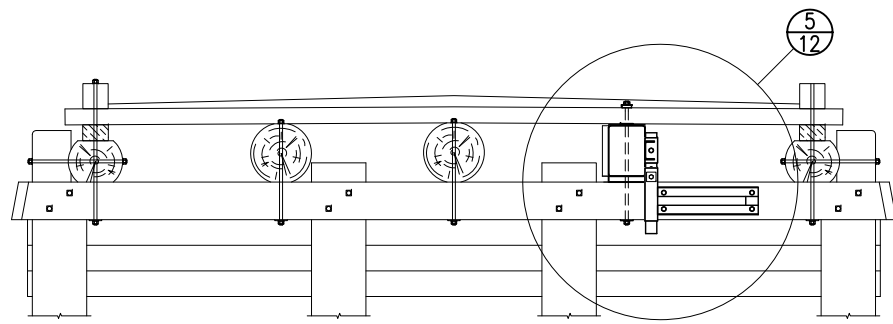
PART ELEVATION
SECTION V-11 INTERIOR SPAN
(MULTISPAN BRIDGE)



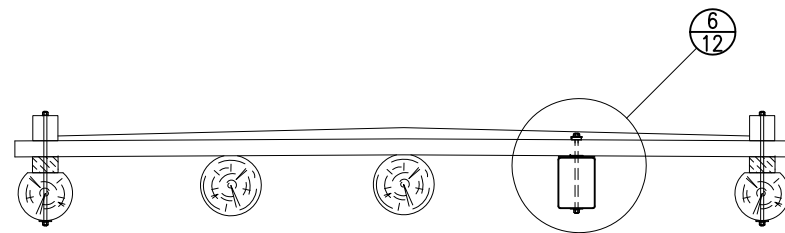
PART ELEVATION
SECTION UU-11 SINGLE SPAN

- NOTES:
1. Bolt spacing and locations to match existing spacing in kerb where applicable.
 2. The top of all bolt holes to be sealed with approved sealant. Refer Detail 14 on sheet 9.

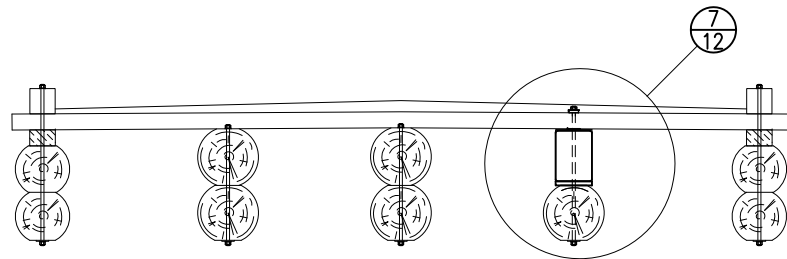
Department of Transport and Main Roads			
FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 10 of 17		A3	Standard Drawing No 2280
		Not to Scale	Date 7/15
		A	



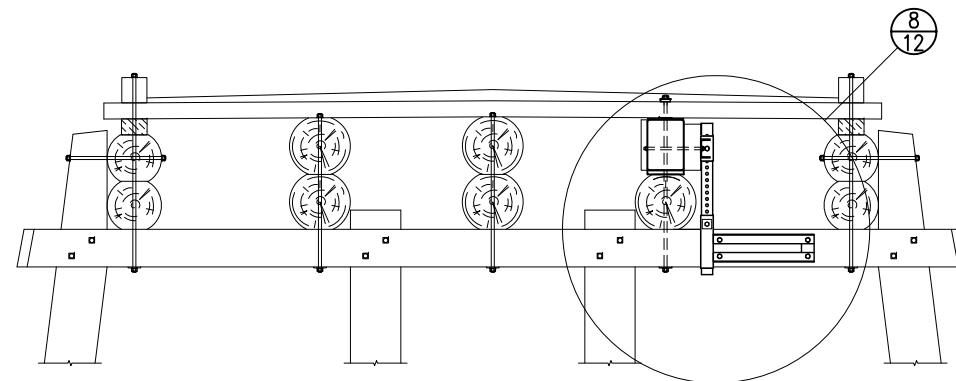
SECTION Q
10



SECTION R
10





SECTION S
10

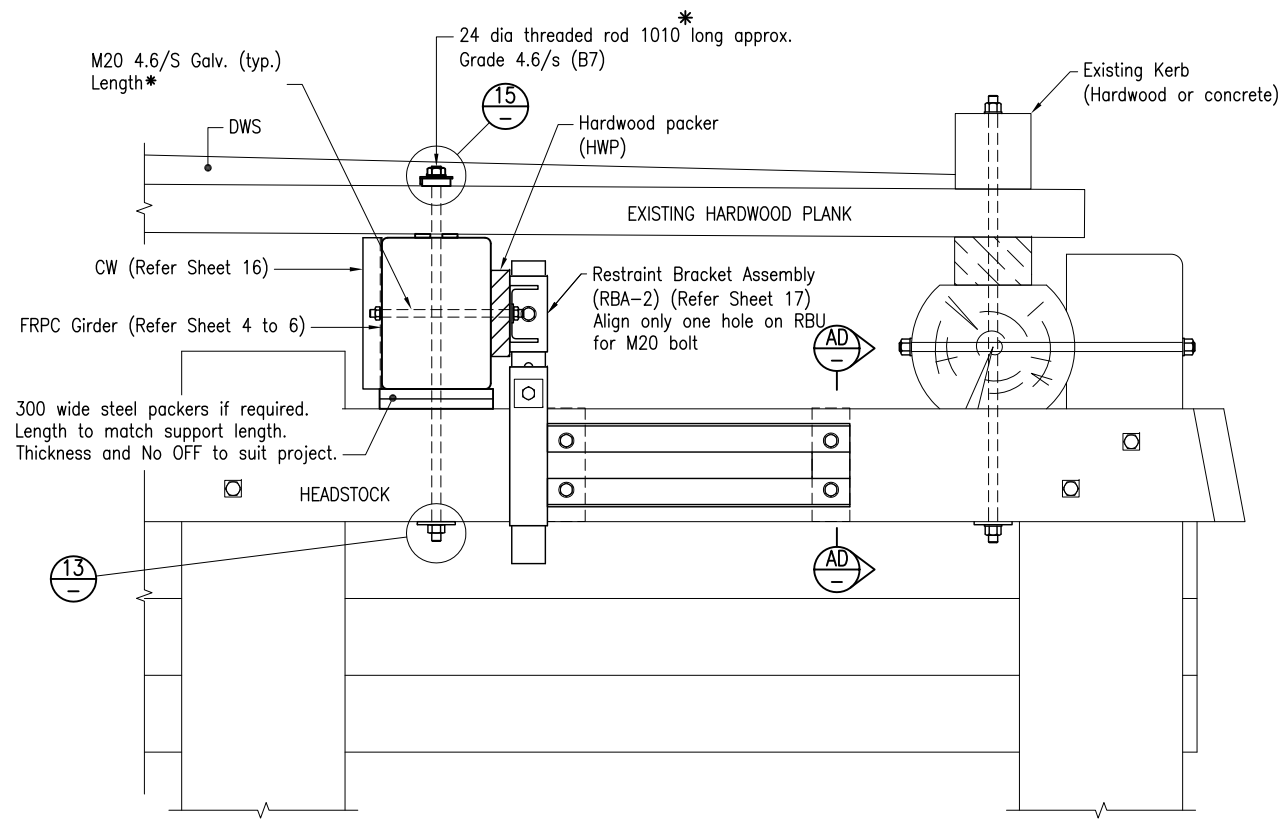


SECTION T
10

SECTION TT
10 SIMILAR
(OPPOSITE HAND)

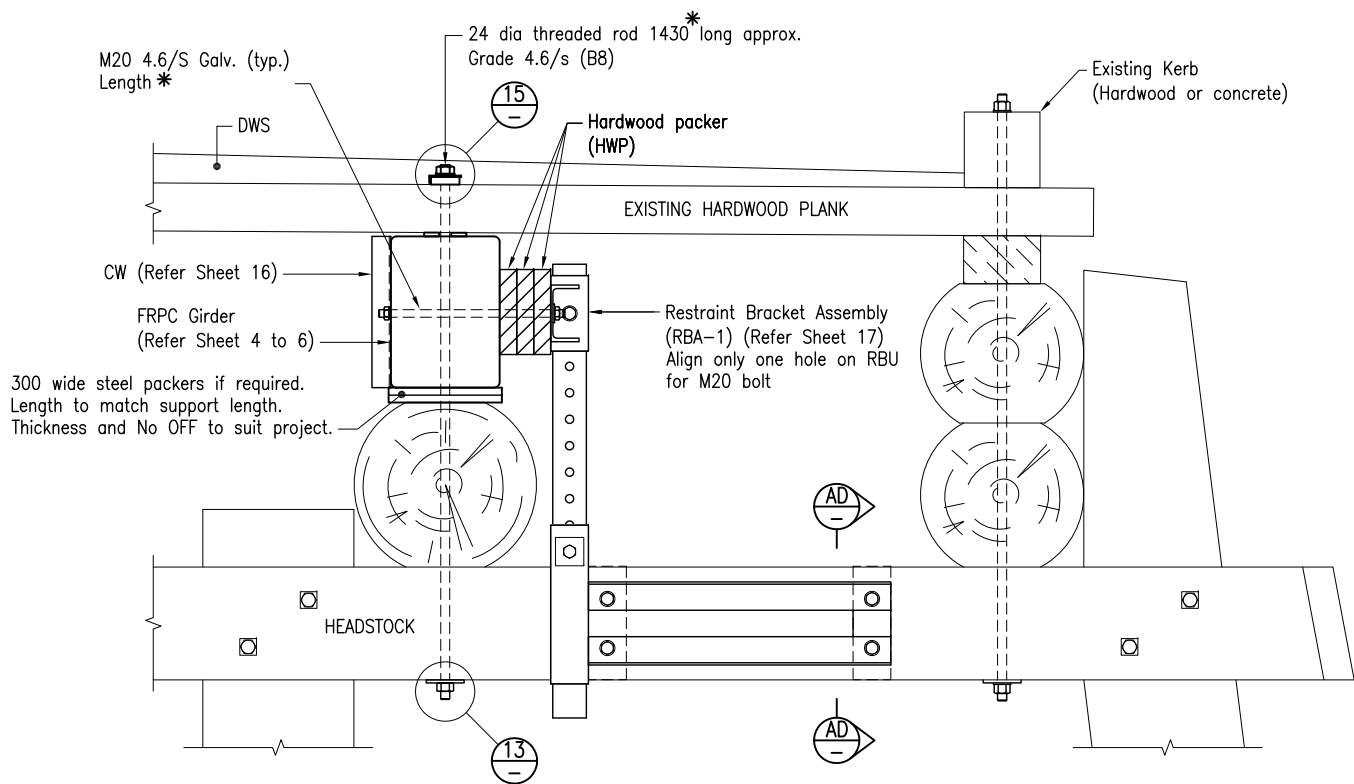
- NOTES:
1. Bolt spacing to match existing spacing in kerb where applicable.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 11 of 17		A3 Not to Scale A	Standard Drawing No 2280 Date 7/15

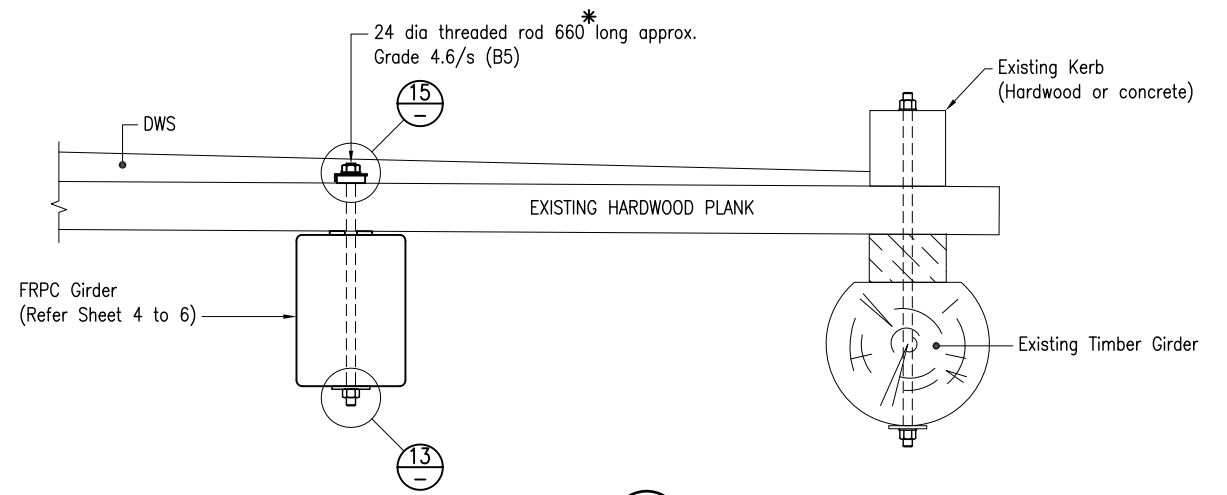


DETAIL 5 AT ABUTMENT

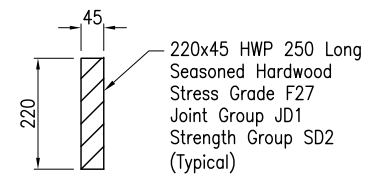
*Dimensions to be confirmed on site



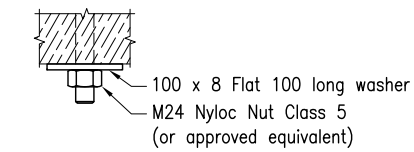
DETAIL 8 AT PIER



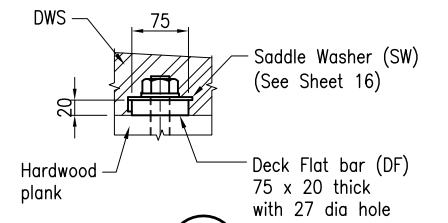
DETAIL 6 AT MID SPAN



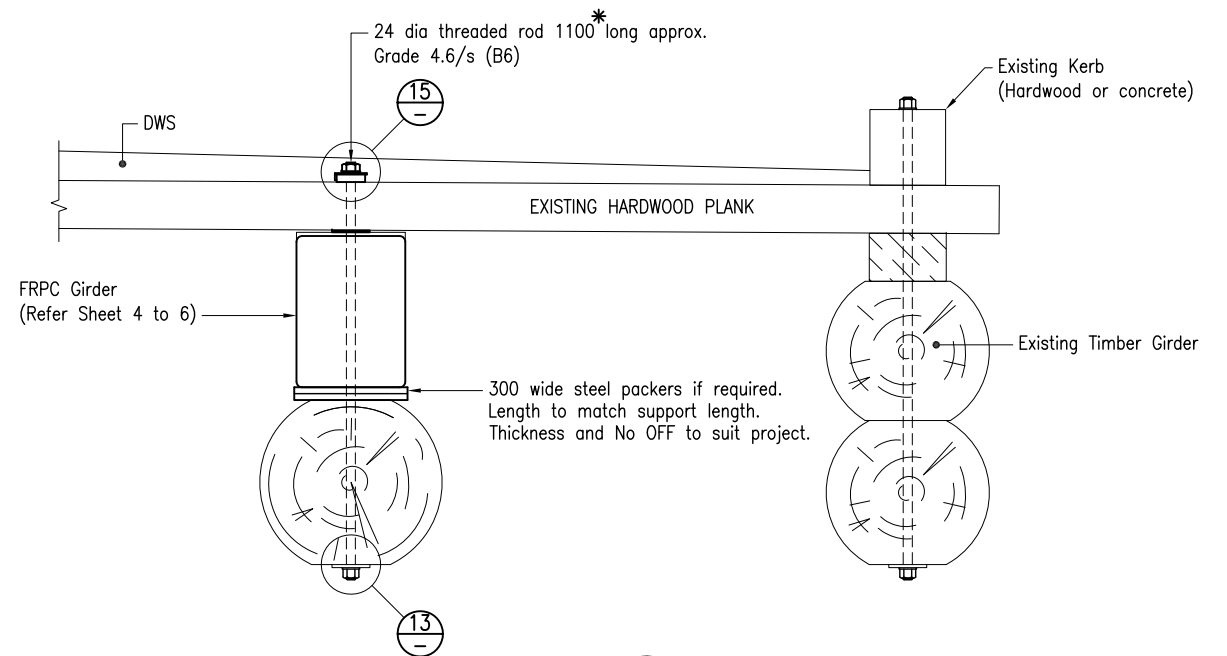
TIMBER PACKER SIDE DETAIL



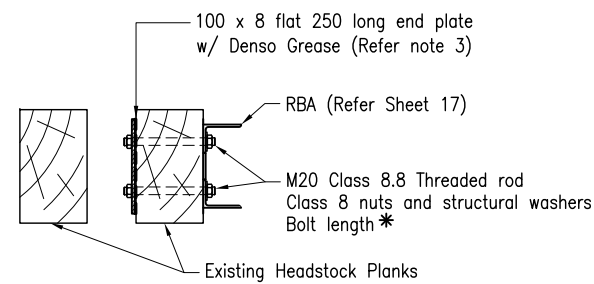
DETAIL 13



DETAIL 15



DETAIL 7 AT MID SPAN

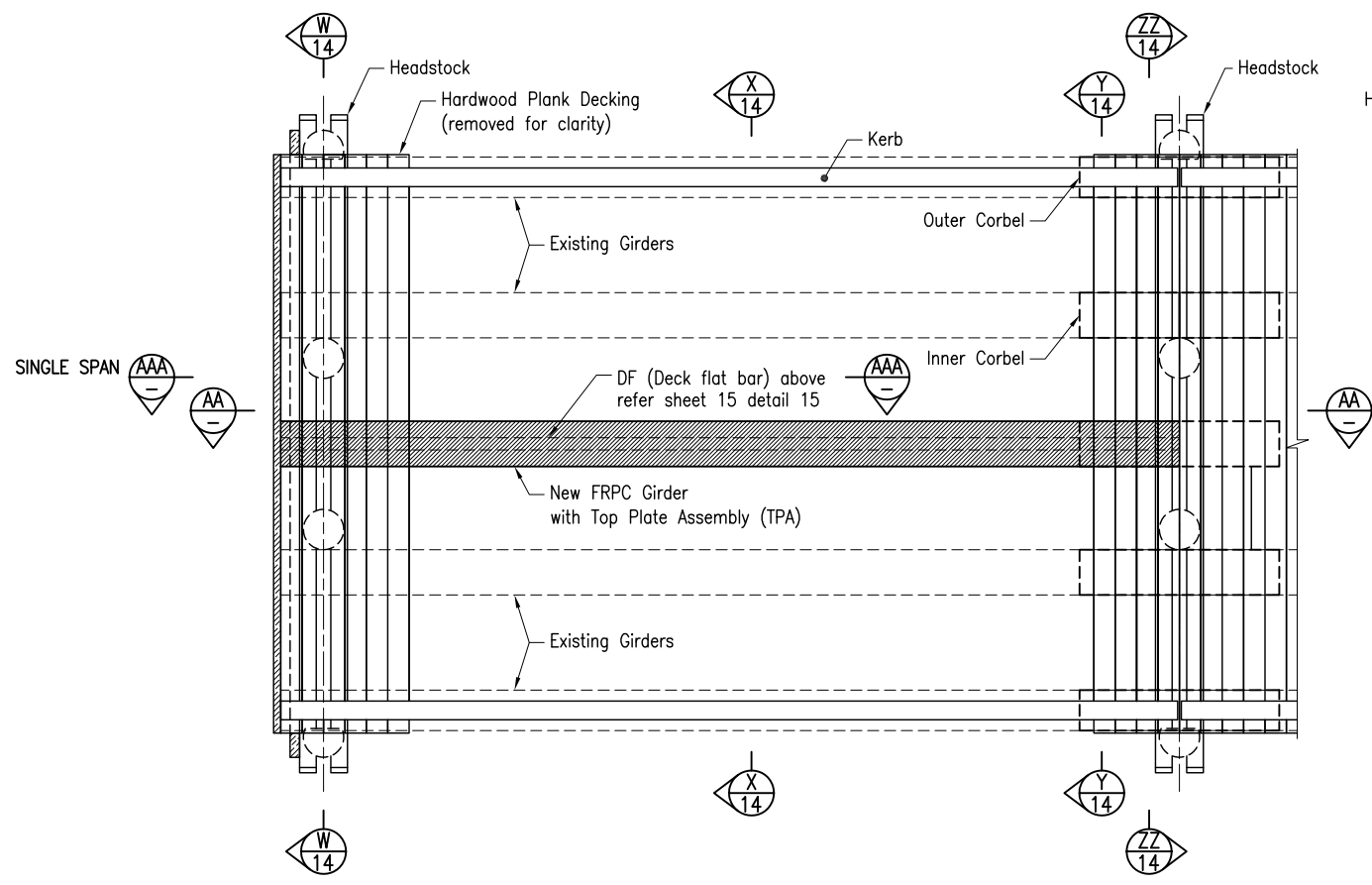


SECTION AD

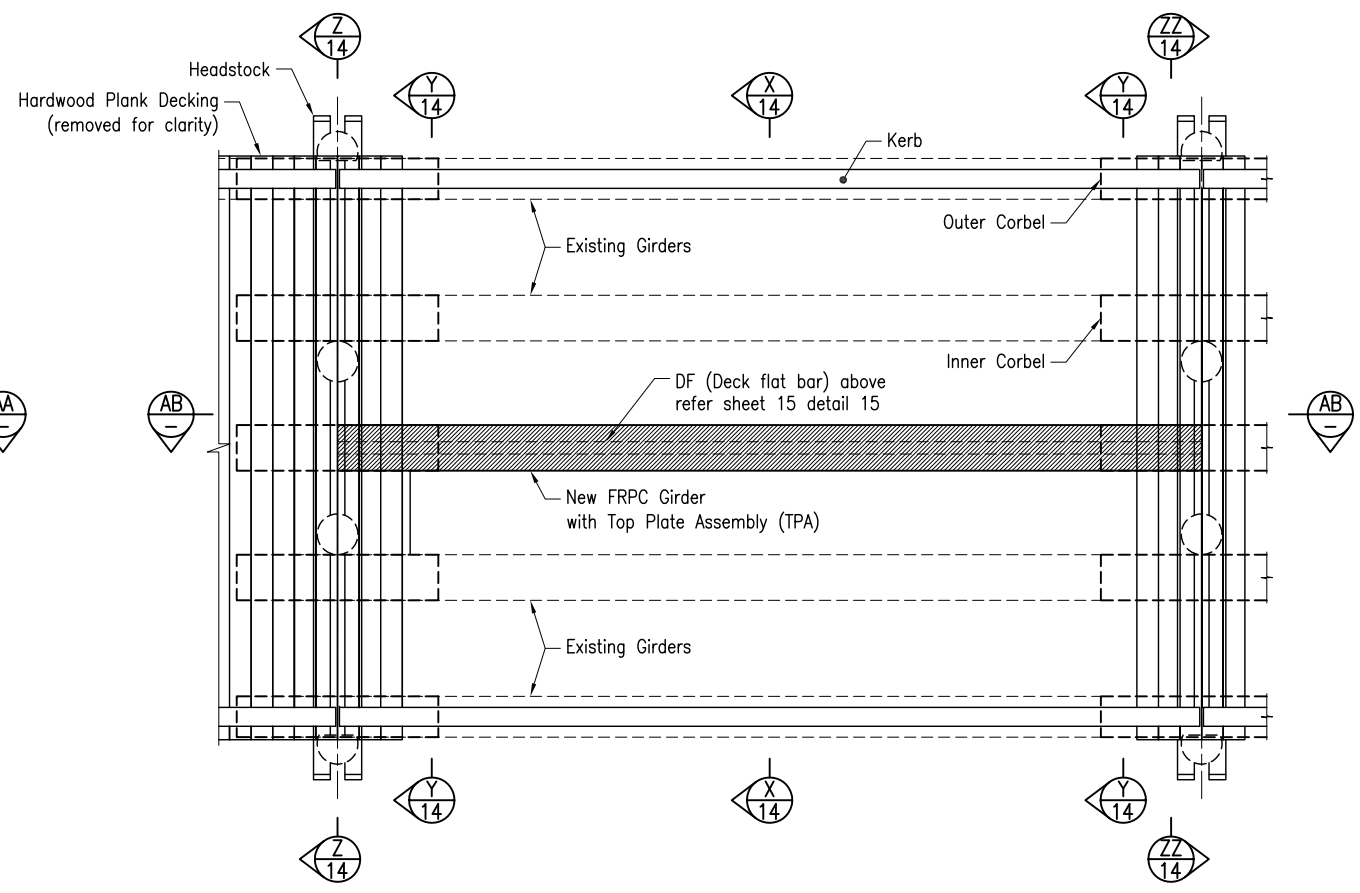
NOTES:

1. All Structural Steelwork to be Hot Dip Galvanised.
2. Denso Grease or equivalent to be applied to headstock area which will be in contact with remaining bracket.
3. Hardwood to be treated in accordance with Timber Bridge Maintenance Manual.
4. Grade 8.8 threaded rod may be used in lieu of grade 4.6.
5. Bolts conforming with MRTS78 may be used in lieu in of threaded rod.

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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 12 of 17		A3	Standard Drawing No
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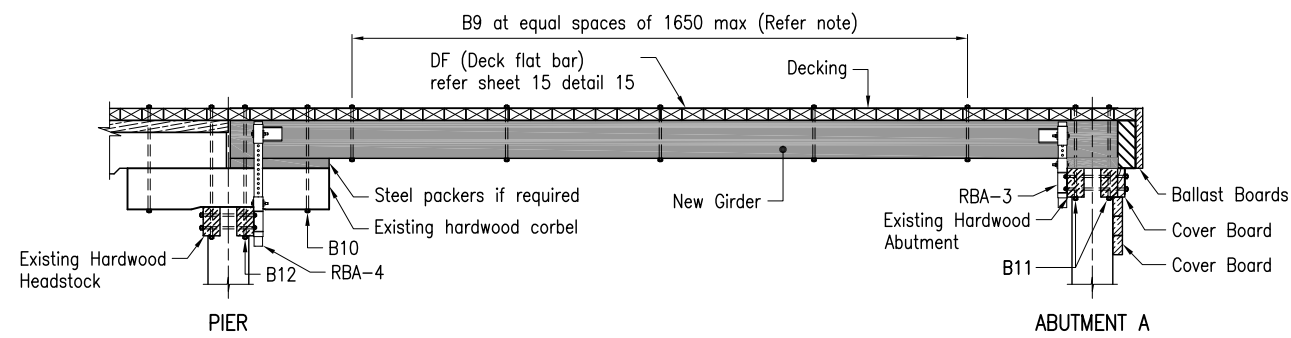


END SPAN ARRANGEMENT SHOWN, SINGLE SPAN SIMILAR

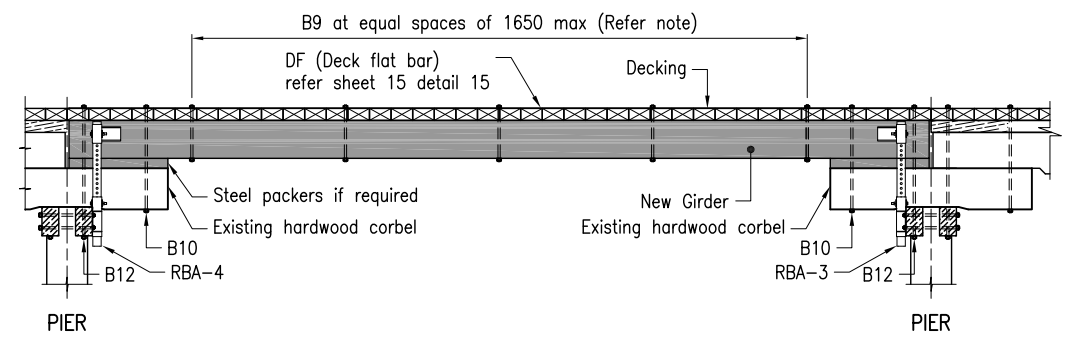


PIER TO PIER SPAN ARRANGEMENT

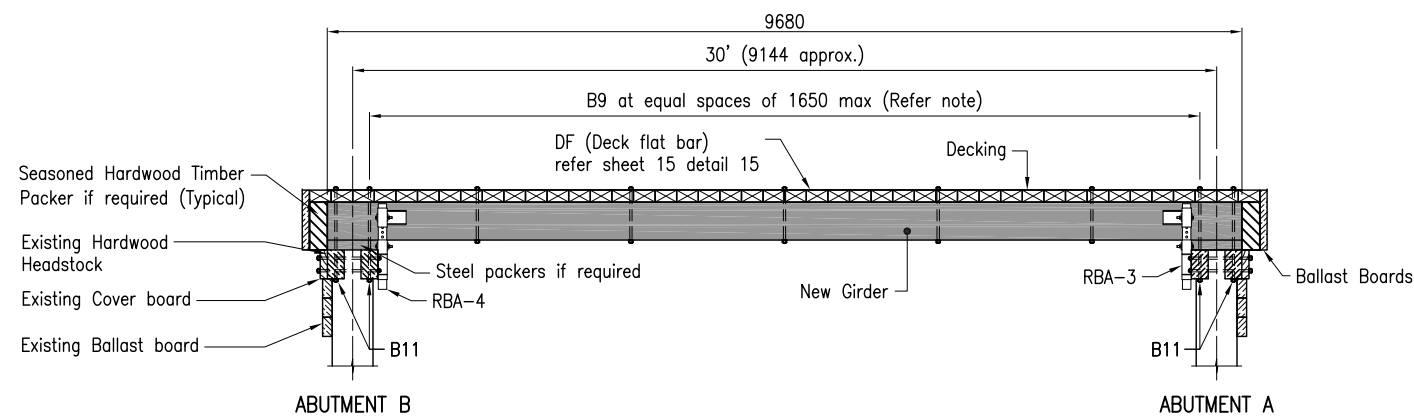
PLAN - GENERAL ARRANGEMENT INTERMEDIATE GIRDER REPLACEMENT



PART ELEVATION
SECTION AA END SPAN
(MULTISPAN BRIDGE)





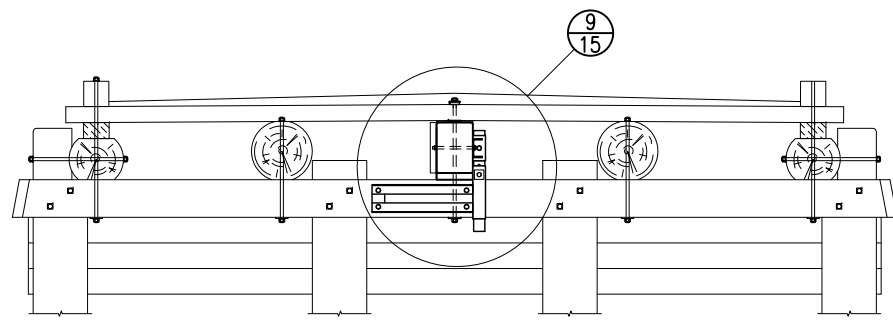
PART ELEVATION
SECTION AB INTERIOR SPAN
(MULTISPAN BRIDGE)



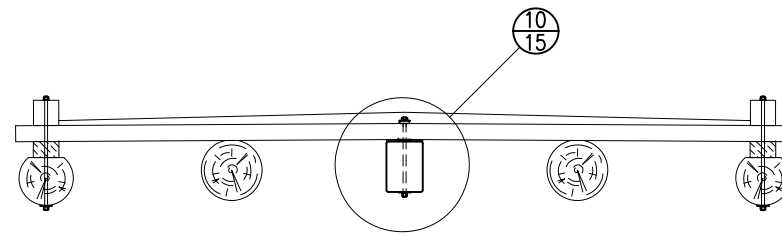
PART ELEVATION
SECTION AAA SINGLE SPAN

- NOTES:
1. Bolt spacing and locations to match existing spacing in kerb where applicable.
 2. The top of all bolt holes to be sealed with approved sealant. Refer Detail 14 on sheet 9.

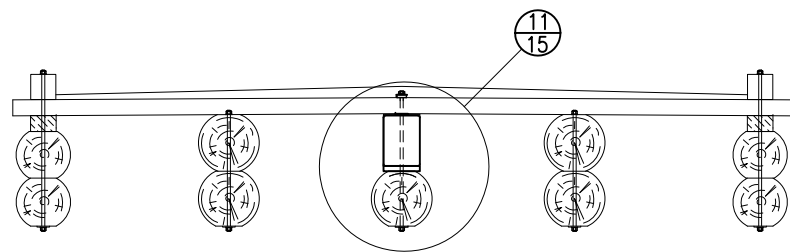
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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 13 of 17		A3	Standard Drawing No
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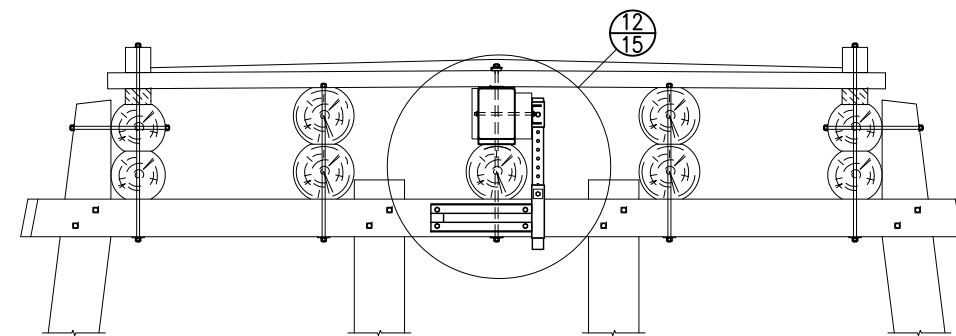
SECTION $\frac{W}{13}$



SECTION $\frac{X}{13}$



SECTION $\frac{Y}{13}$





SECTION $\frac{Z}{13}$

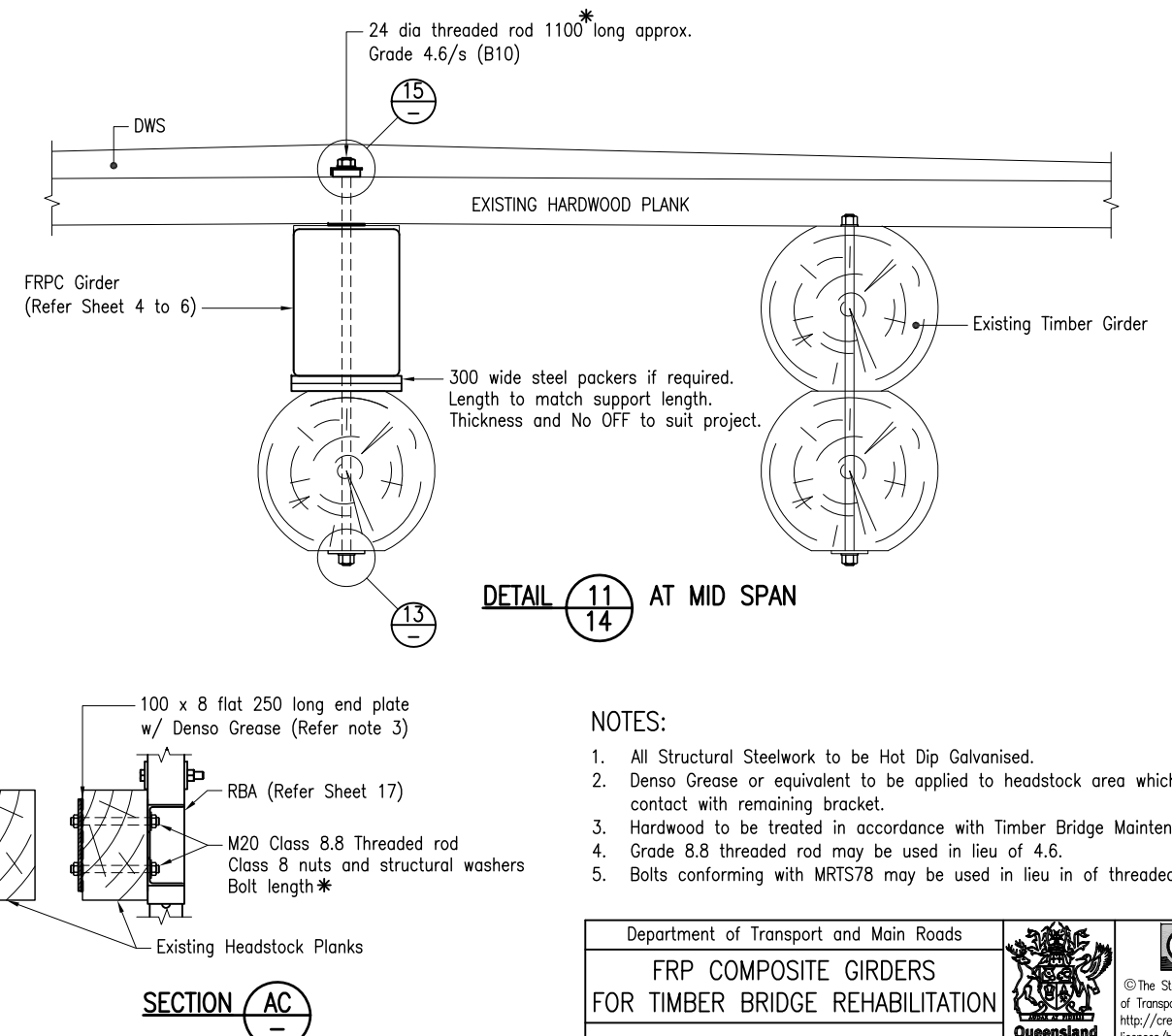
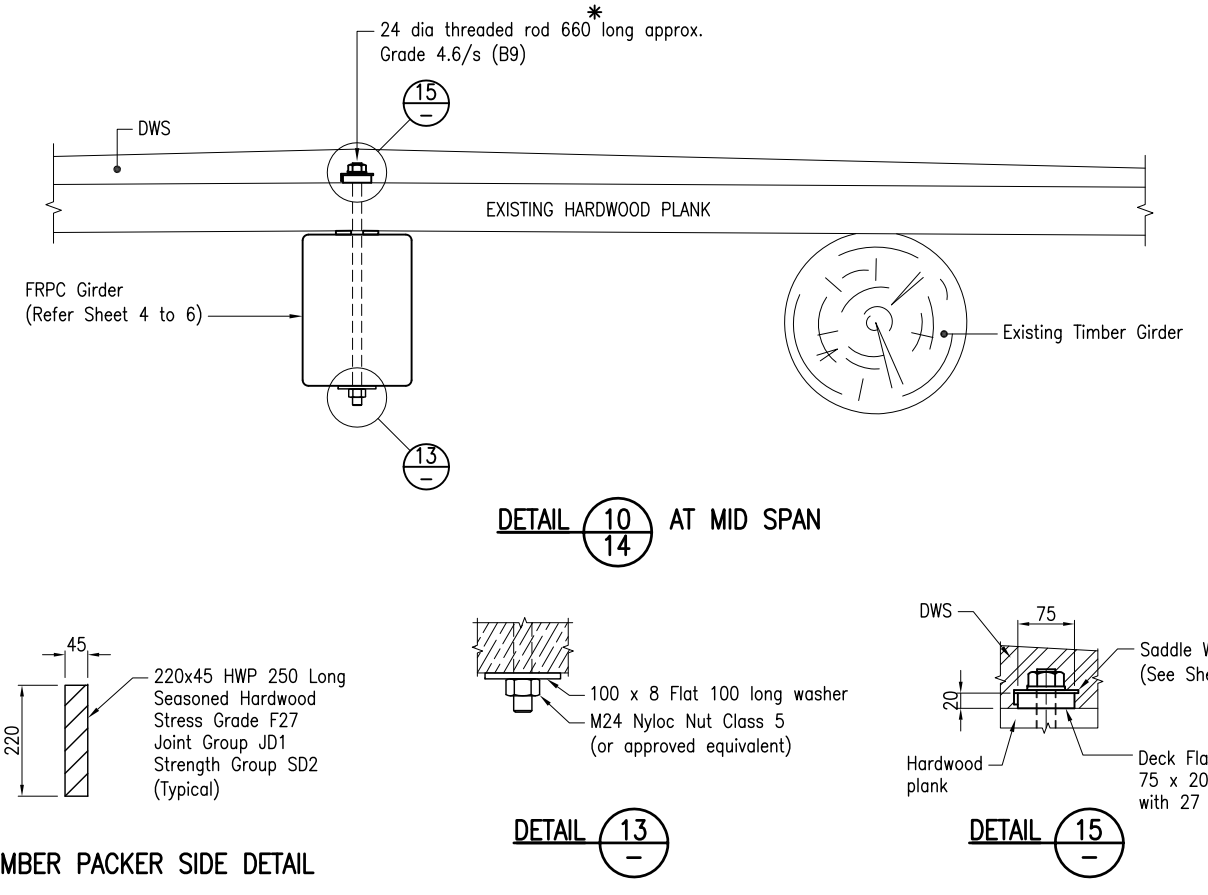
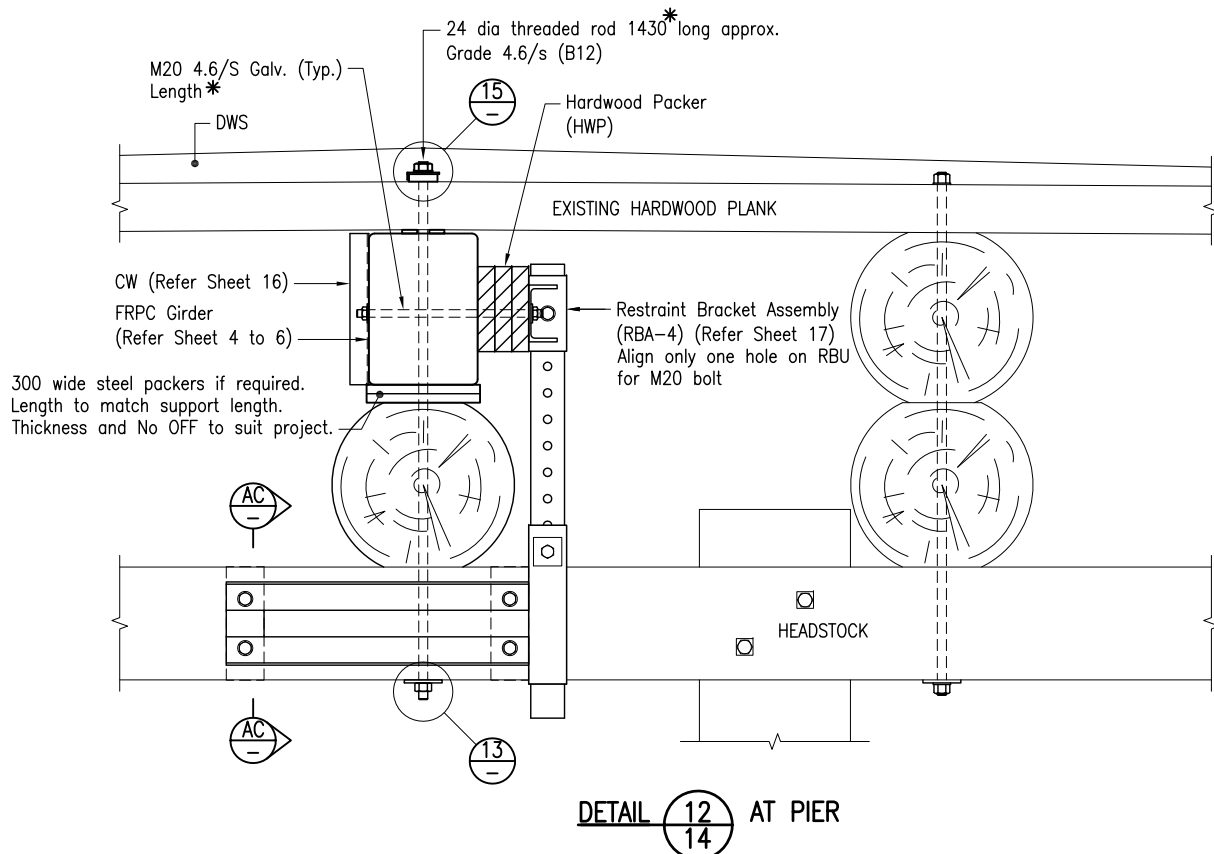
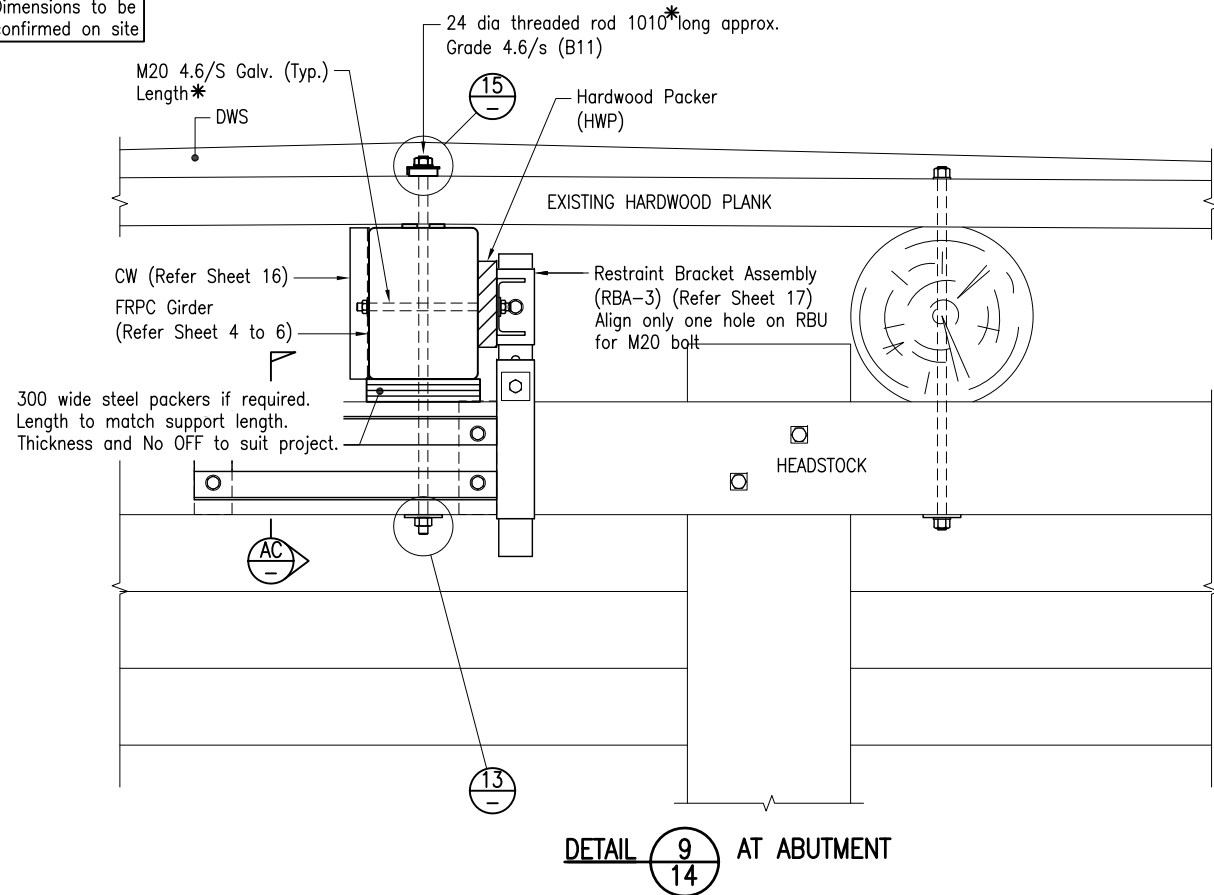
SECTION $\frac{ZZ}{13}$ SIMILAR (OPPOSITE HAND)

NOTES:

1. Bolt spacing to match existing spacing in kerb where applicable.

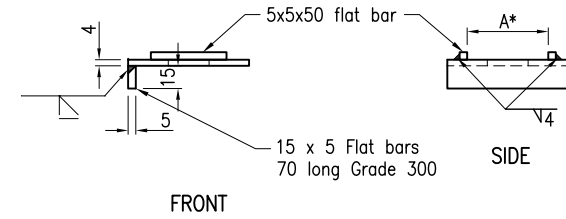
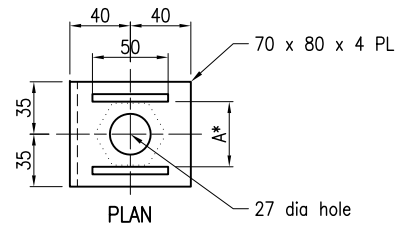
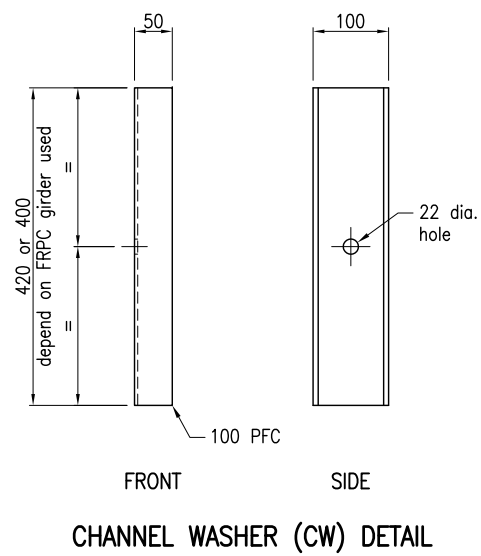
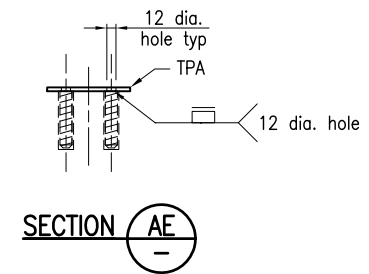
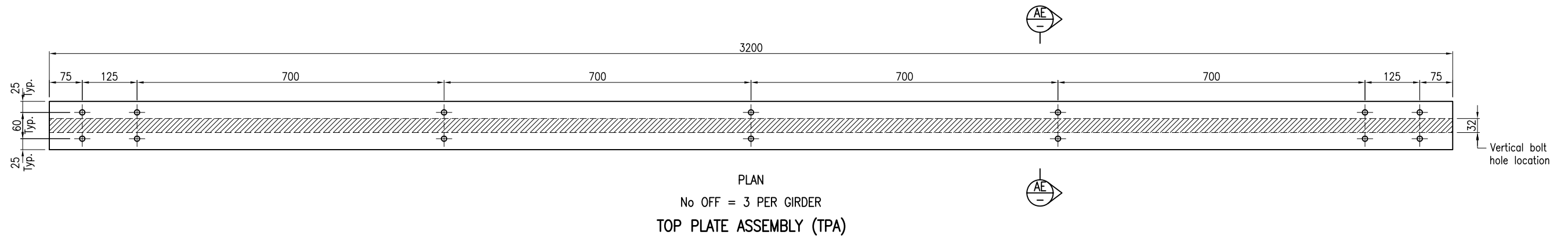
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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 14 of 17		A3	Standard Drawing No
		Not to Scale	2280
		A	Date 7/15

*Dimensions to be confirmed on site



- NOTES:
1. All Structural Steelwork to be Hot Dip Galvanised.
 2. Denso Grease or equivalent to be applied to headstock area which will be in contact with remaining bracket.
 3. Hardwood to be treated in accordance with Timber Bridge Maintenance Manual.
 4. Grade 8.8 threaded rod may be used in lieu of 4.6.
 5. Bolts conforming with MRTS78 may be used in lieu in of threaded rod.

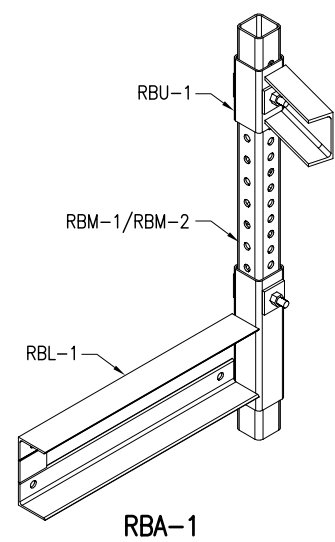
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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 15 of 17		A3	Standard Drawing No 2280
		Not to Scale	Date 7/15
		A	



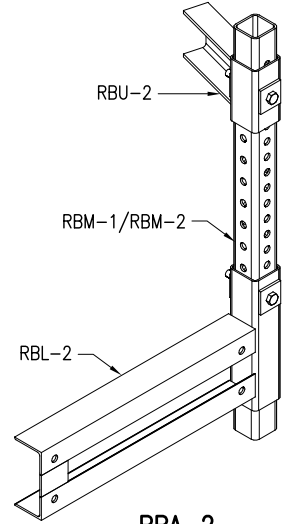
A* = 43mm FOR GRADE 8.8 BOLT
A* = 40mm FOR GRADE 4.6 BOLT

SADDLE WASHER (SW) DETAIL

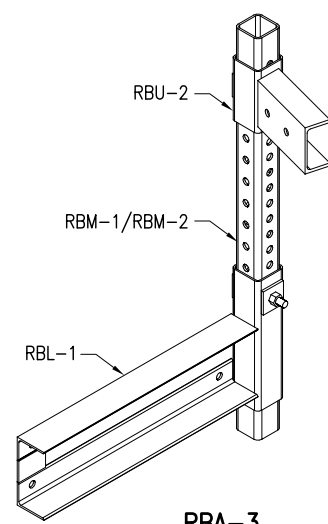
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FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 16 of 17		A3	Standard Drawing No
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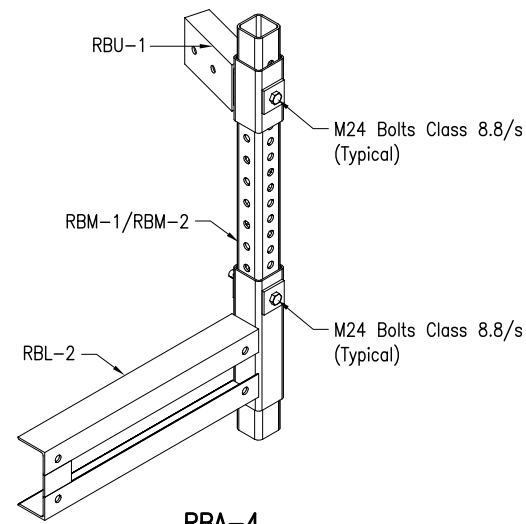
RBA-1



RBA-2



RBA-3

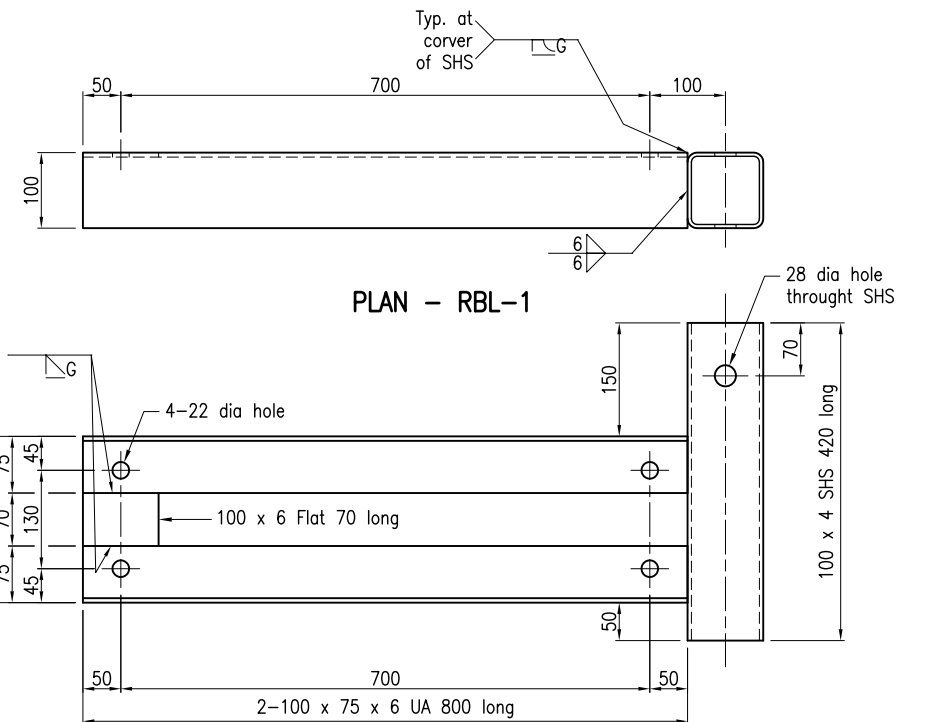


RBA-4

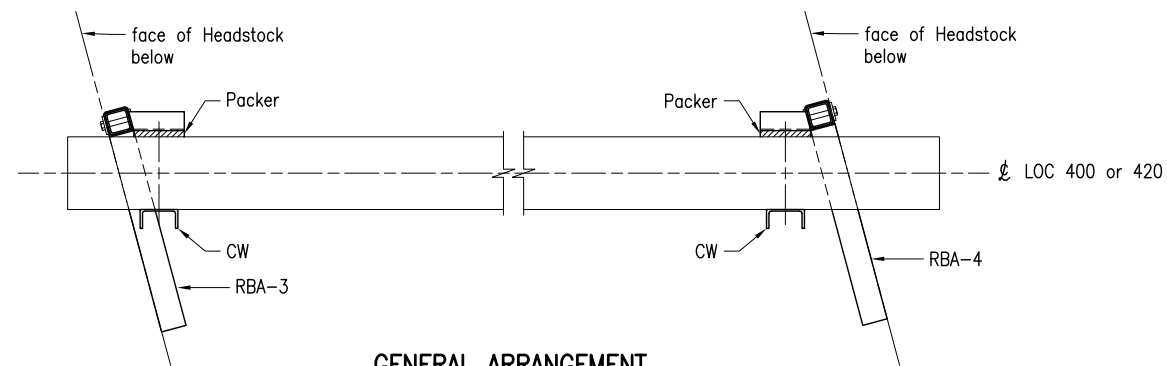
EXTERNAL/INTERMEDIATE GIRDER REPLACEMENT

CENTRAL GIRDER REPLACEMENT

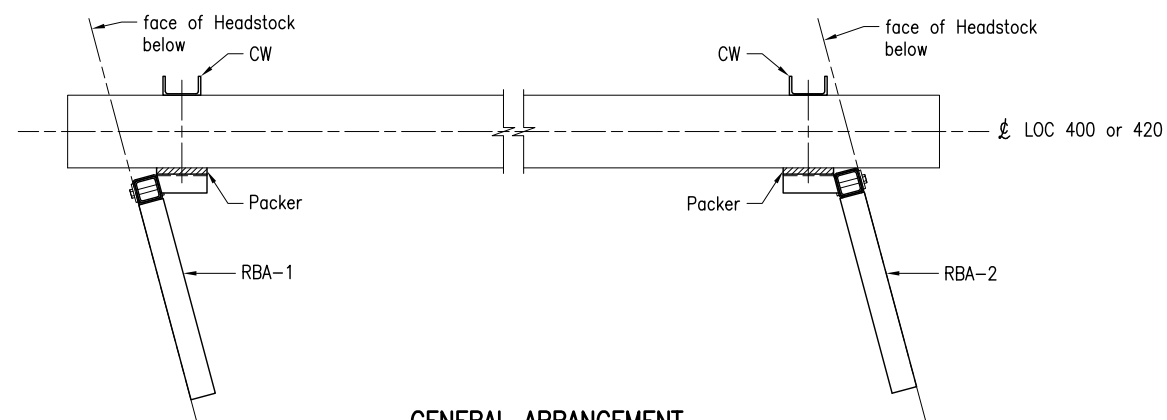
RESTRAINT BRACKET ASSEMBLY DETAIL
(REFER GENERAL ARRANGEMENT SHEET 16)



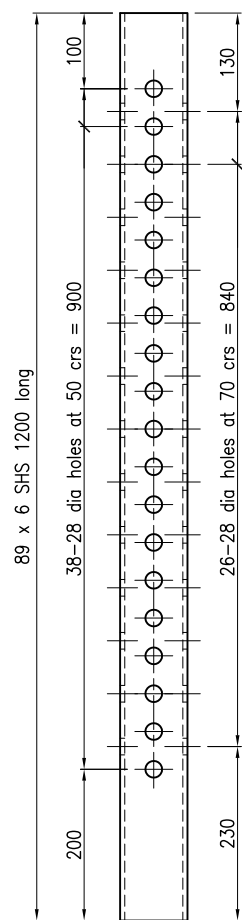
ELEVATION - RBL-1
RBL-2 SIMILAR OPPOSITE HAND



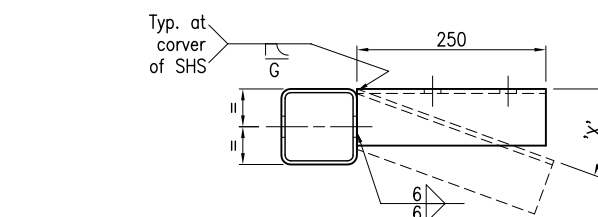
GENERAL ARRANGEMENT
CENTRAL GIRDER RESTRAINTS



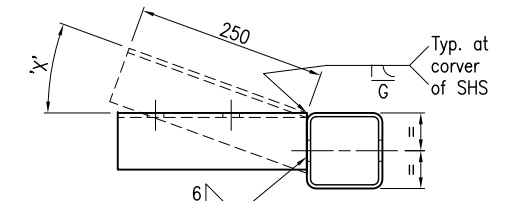
GENERAL ARRANGEMENT
EXTERNAL/INTERMEDIATE GIRDER RESTRAINTS



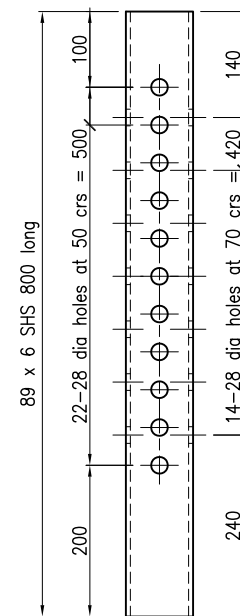
ELEVATION - RBM-1
(FOR USE AT PIER)



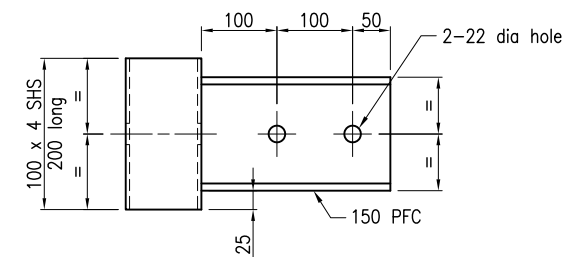
PLAN - RBU-1



PLAN - RBU-2



ELEVATION - RBM-2
(FOR USE AT ABUTMENT)



ELEVATION - RBU-1
RBU-2 SIMILAR OPPOSITE HAND

Department of Transport and Main Roads			
FRP COMPOSITE GIRDERS FOR TIMBER BRIDGE REHABILITATION			
LOC 400 & LOC 420 INSTALLATION DETAILS SHEET 17 of 17		A3 Not to Scale A	Standard Drawing No 2280 Date 7/15