Modelling Timber Bridges

of the

Queensland Railways

by

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INTRODUCTION

It has been stated that the PB15 steam locomotive was the ubiquitous workhorse of the Queenslands Railways. It is then a fair analogy to say that the timber bridge is the ubiquitous structure of the Queensland Railways.

About 110 kilometres of timber bridges existed in the Queensland Railways system. This figure has been substantially reduced with the mainline upgrading program. This program was touted in the press as eliminating all timber bridges on the North Coast Line. This is incorrect as significant numbers still exist with the remaining structures having been modified and in some cases substantially rebuilt to accommodate the heavier axle loadings.

Timber was a popular structural material for bridges because of its ready availability and low cost. The motivation to eliminate timber was not because of structural inadequacy but to reduce the inherent inspection and maintenance costs.

The timber bridge provided a more economical method of spanning gaps than constructing earth embankments in the early days of construction.

The purpose of this paper is to provide the modeller with sufficient information to build a good representation of a Queensland Railways timber bridge.

BRIDGE COMPONENTS

There are various names and terms which are specific to bridge components and structures. The following list is sufficient for discussing the basics of timbers bridges and is not intended to be exhaustive.

Glossary Of Terms

Abutment	:	The foundation structure at the end of the bridge.
Brace	:	A diagonal member which connects the piles of a pier to provide lateral stability
Corbel	:	A corbel is a length of timber located under and parallel to the girder that transfers the load gradually to the pier.
Escape platform	:	The platform built off the edge of the top of a bridge to provide a refuge for personnel during the passage of a train.
Foot planks	:	Two planks fixed to the transoms, located centrally between and parallel to the rails and used for personnel access on the bridge top.
Girder	:	A horizontal component of long length which spans across the piers and supports the transoms.
Headstock	:	The horizontal member at the top of the pier on which the corbels rest.
Pier	:	A braced framework supporting the bridge. It has one or more vertical members, flanked by a pair of sloping members and connected by a combination of headstocks, braces and wales.
Pile	:	The vertical or sloping members which provides the elevation for the bridge above the ground and supports the load of the headstocks.
Sill	:	A horizontal member on which the bottoms of the piles in a silled pier rests.
Slab bank end	:	Reinforced concrete backing slabs which prevent the spill through of the earth embankment to the end of the bridge.
Span	:	Distance from on support to the next in line.
Substructure	:	All the structural elements that support the bridge; piers footings, abutments.
Superstructure	:	The part of the structure in direct contact with the loads.
Transom	:	A sleeper which supports the running rail on an open top bridge.
Wale	:	A horizontal member which connects the piles of a pier to prevent spreading of the piles above ground of silled piers and high driven piers.

ASSEMBLING THE COMPONENTS TO BUILD A BRIDGE

A careful study of how the components fit together is necessary so the finished model is authentic. Checking against an accurate plan or prototype photos is the best method. The area which requires the closest attention is the relative positions of the girders, corbels and headstocks.

BRIDGE STANDARDS

QR has a set of standard drawings so that bridges can be constructed and maintained to the required structural adequacy for the designed operating conditions. These standard drawings are listed in the following table. These drawings are for bridges originally designed for B16 loadings (12 ton load with steam impact) and were checked and found to be adequate for "A" class lines. Therefore the standards have remained unchanged from the steam era until the mainline upgrading program.

DRAWING NUMBER	DRAWING NAME
1932	Standard Timber Bridges General Arrangement
1933	Standard Timber Bridges Pier Details
1934	Standard Timber Bridges Details at Pier Tops
1935	Standard Timber Bridges Details of Sills, Concrete Bases and Cant on Curves
1936	Standard Timber Bridges Details at Bridge Ends
1937	Standard Timber Bridges Material List

These drawings supersede the previous standard drawings numbers 1210, 1211, 1212, 1213 and 1450.

TIMBER COMPONENT SIZES

Piles are 440mm in diameter. Braces and wales are 230x130mm sawn timber. Part worn 30kg rails may be substituted. Headstocks are 250x150mm sawn timber. Headstocks for 3 pile piers are 3000mm long and for 4 and 5 pile piers are 4000mm long.

Corbels are 435mm in diameter and 1800mm long. Girders are of two standard diameters, 435 and 460mm but oversize girders up to 620mm diameter are found in the system. The length of the girders is dependent on the span length, whether the span is single, end or intermediate and the number of girders in adjacent spans. Girders are not intended to be milled to a regular sized section, however octagonal section girders can been observed in bridges. The tops of 435mm diameter girders have 15mm removed and 460mm diameter girders have 20mm removed to provide a bearing surface for the transoms. Girders and corbels have to be dressed to size. Details for the many variations can be obtained from drawing number 1934.

The maximum permissible span length for the number and diameter girders is listed in the following table.

Number & Diameter of Girders	Maximum Permissible Span Length
2 single 435mm	4400mm
3 single 435mm	5600mm
3 single 460mm	6250mm
2 double 435mm	6700mm
3 double 435mm	8200mm

LENGTH OF SPANS AND NUMBER OF GIRDERS PER SPAN

The standard lengths of timber bridge spans are 4000mm, 5000mm, 6000mm, 7000mm and 8000mm. All spans have three girders positioned horizontally adjacent to each other per span except for 4000mm spans for which two girders are structurally adequate. For spans of 7000mm and 8000mm, double girders positioned vertically one on the other are required for structural adequacy. These girders are placed vertically one on top the other and bolted together with M30x825 bolts at 1000mm centres. Double girders are spaced at 1700mm centres and triple girders at 850mm centres. The distance between the centres of the two outside girders of a triple girder span is therefore 1700. This means that the girders in a double girder span will be aligned with the outside girders of a triple girder span.

HEIGHT OF PIERS AND NUMBER OF PILES PER PIER

As the height of the piers increase, the requirements for structural adequacy necessitates the addition of diagonal braces, wales and extra piles. The height of a pier is defined as the vertical distance from ground or stream bed level to the top of the headstocks.

The following tables detail the combination of components for various heights of both driven and silled piers.

Driven Piers

MAXIMUM HEIGHT (mm)	PILES	BRACE	WALE
1500	3	0	
3000	3	1 diagonal	
4500	3	1 pair diagonal cross	
6000	3	2 pair diagonal cross	
7500	4	2 pair diagonal cross	
7500	5	2 pair diagonal cross	
9000	5	2 pair diagonal cross	double

Siled Piers

MAXIMUM HEIGHT (mm)	PILES	BRACE	WALE
1500	3	0	
2500	3	1 diagonal	
3500	3	1 pair diagonal cross	single
5000	3	2 pair diagonal cross	double
6500	3	2 pair diagonal cross	double
8000	4	2 pair diagonal cross	double
9000	5	2 pair diagonal cross	double

OTHER MODELLING NOTES

The butt end of the pile is placed upper most. The reason for this is that the narrow end of a driven pile wedges into the ground for a solid footing. Escape platforms are usually located on the down stream side of the bridge particularly on structures subject to flooding. The slope of the single braces on 2500mm high silled piers and 3000mm high driven piers are such that the low end of the brace is towards the stream flow.

Timber, steel and concrete are used in combination for bridge structures. Short steel spans on timber piers is prototypical. It this instance it is common for one central span to be steel and of slightly greater length than the adjacent timber spans. Timber spans are commonly used for the approaches to steel truss spans on concrete piers. Timber on concrete is unusual but can be found where a pier has been replaced in a timber bridge.

SUGGESTIONS FOR DETAILING

Having gotten the basic timber bridge structure correct, the logical extension is consider further detailing. The unusual and different which can be found around bridges involve supporting structures for maintenance activities particularly for the replacement of piles. A below ground inspection requires the excavation around piles. Pig stying is a common method of supporting bridges during emergencies such as flooding or fires. Visible variations to the bridge structure include piers on concrete bases, silled piers on ground surface rock.

OTHER TIMBER BRIDGES AND ASSOCIATED STRUCTURES

Variations To The Standard

An inspection of bridge drawings dated 1912 and 1915 indicate that the standards from that time to date have changed little. The current standard drawings will suffice for modelling periods from the late steam era to the present day. However, timber bridges other than those of the standard drawings were and can be found of the Queensland Railways. Old photographs reveal a pellitory of designs and careful research will be need for early days modelling. Some interesting structures incorporating features such as lattice girders were constructed during the major expansion of the railways. More mundane features such as a single headstock instead of a double headstock on a pier was used in the early years. Variations to the standards observed in today's QR are only minor and generally not visually significant.

Amened designs for the mainline upgrading program are evident from observed works. Specific details for these works has not been obtainable for inclusion in this paper. It is understood that the bending moment to the transoms by the increased axle load was excessive. The solution to this problem involved the insertion of additional transoms between the existing ones so that the top is almost fully decked.

Strengthening For Flooding

For bridges that are regularly over topped or the risk of flood damage is high, raking piles are often added. These piles sloped at about 45° and suitably strengthened by bracing. There are several examples on the Maryborough Monto branch.

Rail Overbridges

Rail overbridges (road over rail bridge) are maintained by railway personnel. The structures have a distinctly Queensland Railways flavour and would make a satisfying model. The same principles of construction as for the rail underbridges apply to these structures.

Water Tanks

The supporting timber structure for the water tanks of the steam era were maintained by bridge gangs and therefore are appropriate for mention.

CONCLUSION

Timber bridges have endured the passage of time and have only seen significant replacement with concrete structures recently. While possibly not as spectacular as a steel or concrete bridge, they are distinctive. To capture the prototype of the mainline of Queensland Railways is it is essential that a timber bridge be represented.

Coal stages similar but sawn timber.

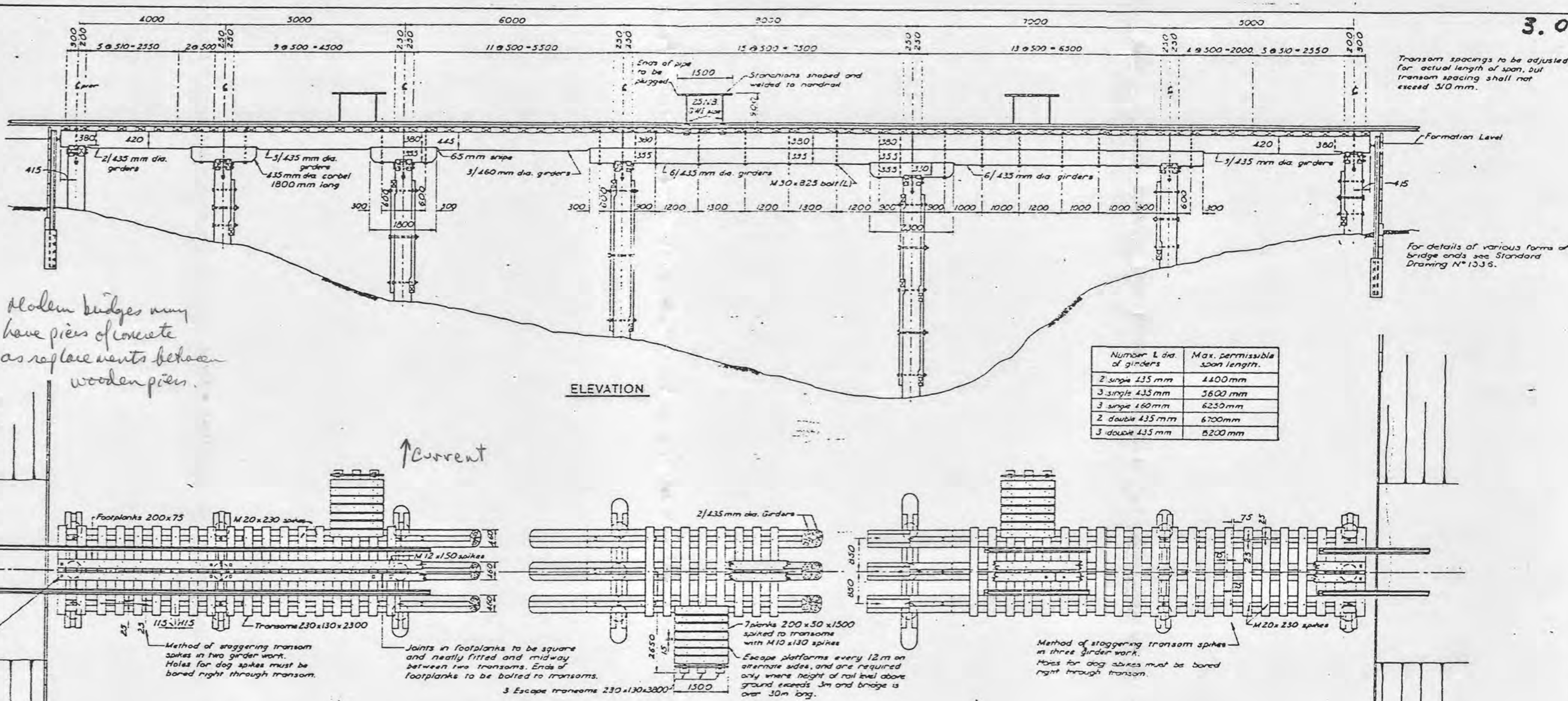
Originally a solid head stock but hard to replace.

Leave centre girders out for Branch lines - Note not ties on bridge - deeper.

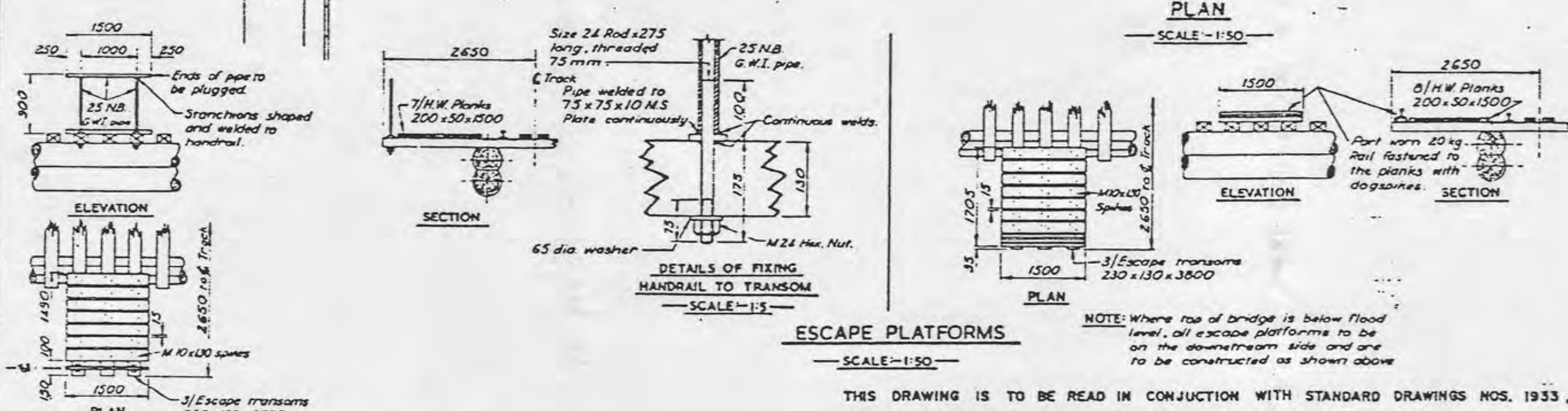
Modern bridges may have piers of concrete as replacements between wooden piers.

3.01

Transom spacings to be adjusted for actual length of span, but transom spacing shall not exceed 510 mm.



Number & dia. of girders	Max. permissible span length.
2 single 435 mm	4400 mm
3 single 435 mm	5600 mm
3 single 460 mm	6250 mm
2 double 435 mm	6700 mm
3 double 435 mm	8200 mm



NOTE: Where top of bridge is below flood level, all escape platforms to be on the downstream side and are to be constructed as shown above

NOTES:

1. The depths between faces of girders, and the depth to the pile shoulder must not depart from those shown on standard drawing No 1334.
2. Headstocks of intermediate piers must be kept not less than 150 mm above ground.
3. All new girders, corbels and transoms shall be bored 150mm from the ends to accommodate anti-split bolts if required at a later date.
4. Heart sides of headstocks, wales and braces to be placed inwards. All other squared timbers generally to be placed heart downwards.
5. Certain species of timber, when used for girders and headstocks, are required to be 25 mm larger than shown on the drawings. See relevant timber specification.
6. The top face of girders for a width of 150 mm, the upper surface of footplanks, escape planks and handrails to be given 3 coats of an approved white lead-free paint.
7. Refer to Standard Practice Directive No 4301 for limits on the number and arrangement of various types of piers in a bridge.
8. The ends of all sawn, hewn and round timber (except transoms), and the tops of piles shall be treated with a special mixture of petroleum jelly in accordance with the relevant instructions.
9. All beds and joins to receive a thick coat of an approved white lead-free paint.
10. All sapped, dressed, hewn or sawn timber below ground to receive 2 coats of an approved tar mixture.
11. No other timber shall be painted or tarred except in tropical high rainfall areas, where the tops of girders for one half the circumference and the top face of headstocks shall receive 3 coats of an approved white lead-free paint.
12. Galvanised bolts shall be used in lieu of black bolts over tidal waters, and in other areas where considered necessary by the Maintenance Engineer.
13. 'Loctite' shall be applied to all bolts in accordance with the relevant instructions.
14. These structures were originally designed for B16 (12 ton axle load with steam impact) but have been checked and found adequate for all "A" Class line loadings.

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1933, 1934, 1935, 1936, 1937

THIS DRAWING SUPERSEDES STANDARD DRAWING NO. 1210

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE

C.E.S. FILE: 1920-1 | SCALE: 1:50 1:5 | DRAWING NUMBER: 1932 | ISSUE | LOADING: SEE NOTE 14 (ADEQUATE FOR ALL "A" CLASS LINE LOADINGS)

1:50 — 0.5 0 1 2 3 4m

1:5 — 100 50 0 100 200 300 400 mm

ALTERATIONS

CALCS.	METRICATED FROM DRAWING NO. 1210	
CHECKED		
DRAWN	B.A.H.	28.8.79
CHECKED		8/79
PASSED		8/79
SUBMITTED		

RECOMMENDED — BRIDGE ENGINEER — DATE

ENGINEER FOR WORKS — DATE

APPROVED — CHIEF ENGINEER — DATE 31-7-80

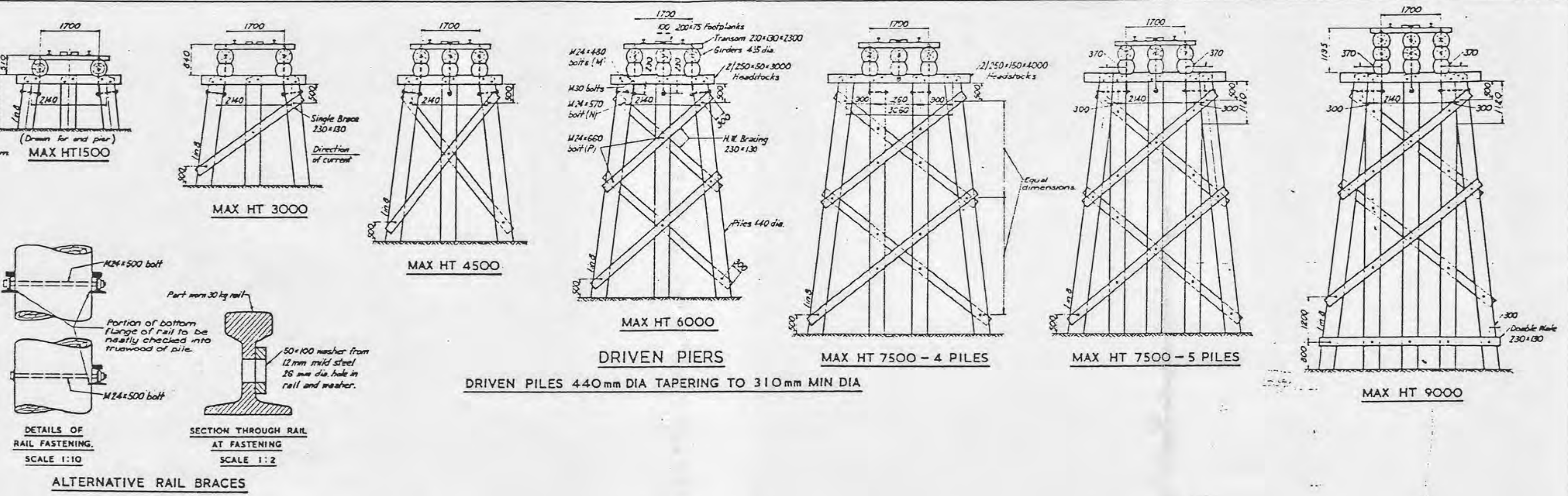
QUEENSLAND RAILWAYS.

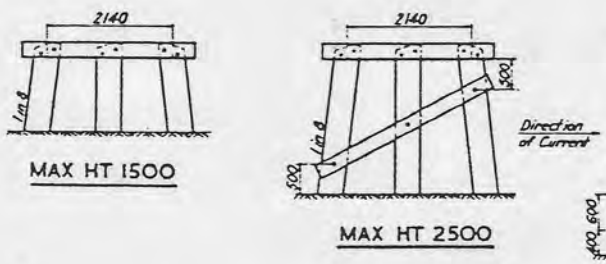
CHIEF ENGINEER'S BRANCH

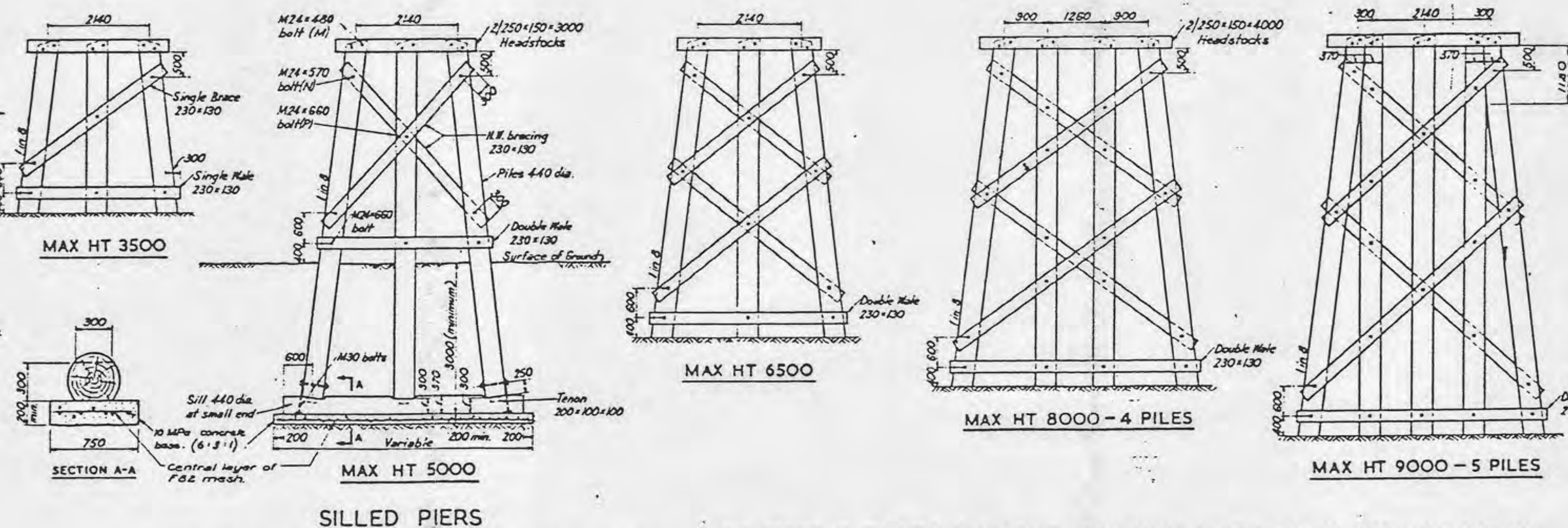
STANDARD TIMBER BRIDGES GENERAL ARRANGEMENT

DRAWING NUMBER 1932

ISSUE







Notes:

1. *All piers constructed in accordance with this drawing, both driven and silled, shall have the piles placed with the butt end up.*
2. *For bridges on curves, or subjected to floods, wale and brace bolts may be increased to M30 at the discretion of the Maintenance Engineer.*
3. *All wales and braces shall be checked 40 mm into truewood of piles.*
4. *All new piles in silled piers shall be sapped and tarred from 300 mm above surface of ground to bottom of pile.*
5. *In driven piers the ground shall be excavated after piles are driven to allow piles to be sapped and tarred from 300 mm above to 1000 mm below surface of ground or further if necessary.*
6. *Round sills shall be sapped completely.*
7. *All sills shall be tarred on all surfaces.*
8. *All beds and joints shall be well tarred.*
9. *For sizes of headstocks for different species of timber see relevant timber specifications.*
10. *Heart sides of headstocks wales and braces to be placed inwards.*
11. *Part-worn 30 kg rails may be used for wales and braces. Arrangement of rails should be as for timber wales and braces.*
12. *All dimensions are clear of sapwood.*

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1932, 1934, 1935, 1936, 1937

THIS DRAWING SUPERSEDES STANDARD DRAWING NO. 1211

ALL DIMENSIONS ARE IN MILLIMETRES

C.E.'S FILE 1920·1	SCALE: 1:50 UNLESS SHOWN OTHERWISE	1:2 / 1:10 / 1:50	ALTERATIONS
DRAWING NUMBER 1933	LOADING: SEE NOTE 14 ON DRG. Nº 1932 ADEQUATE FOR ALL "A" CLASS LINE LOADINGS		
ISSUE			

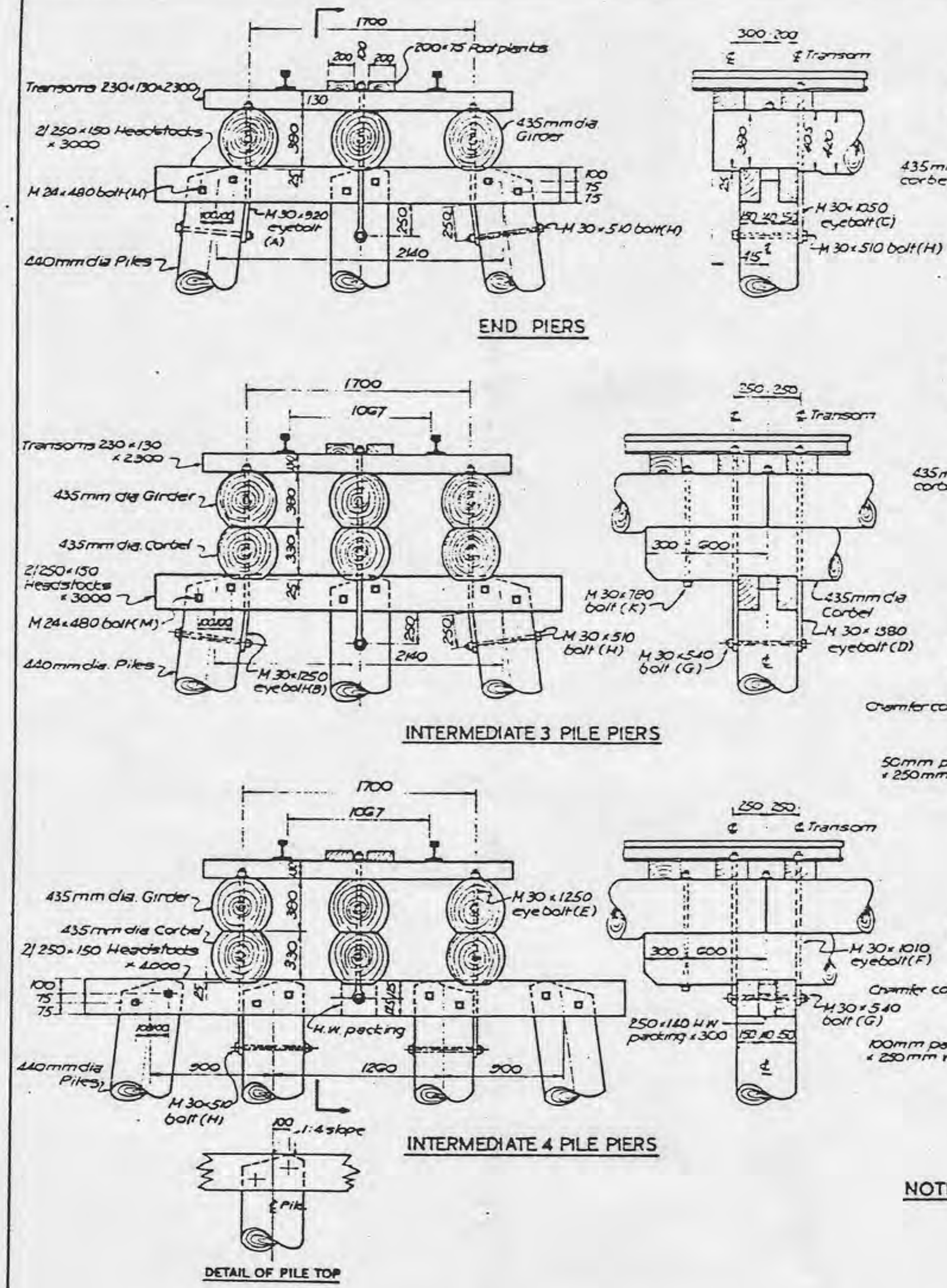
CALCS.	METRICATED FROM DRAWING NO. 1211	RECOMMENDED
CHECKED		BRIDGE ENGINEER DATE
DRAWN	C.M. 12.3.79	ENGINEER FOR WORKS DATE 19.5.80
CHECKED	SRL 5.79	APPROVED
PASSED	SRL 5.79	
SUBMITTED		CHIEF ENGINEER DATE 31-7-80

QUEENSLAND RAILWAYS. CHIEF ENGINEER'S BRANCH

STANDARD TIMBER BRIDGES
PIER DETAILS

DRAWING NUMBER 1933

ISSUE

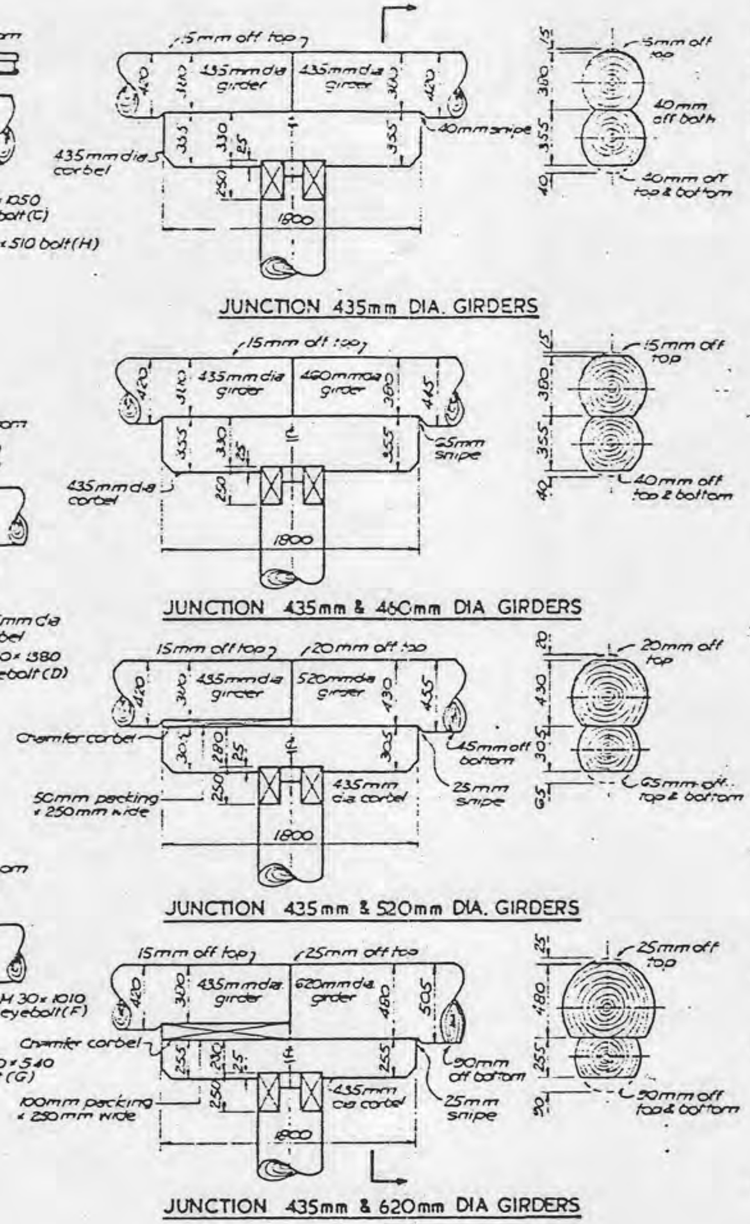


END PIERS

INTERMEDIATE 3 PILE PIERS

INTERMEDIATE 4 PILE PIERS

DETAIL OF PILE TOP



JUNCTION 435mm DIA. GIRDERS

JUNCTION 435mm & 460mm DIA GIRDERS

JUNCTION 435mm & 520mm DIA. GIRDERS

JUNCTION 435mm & 620mm DIA GIRDERS

NOTES:

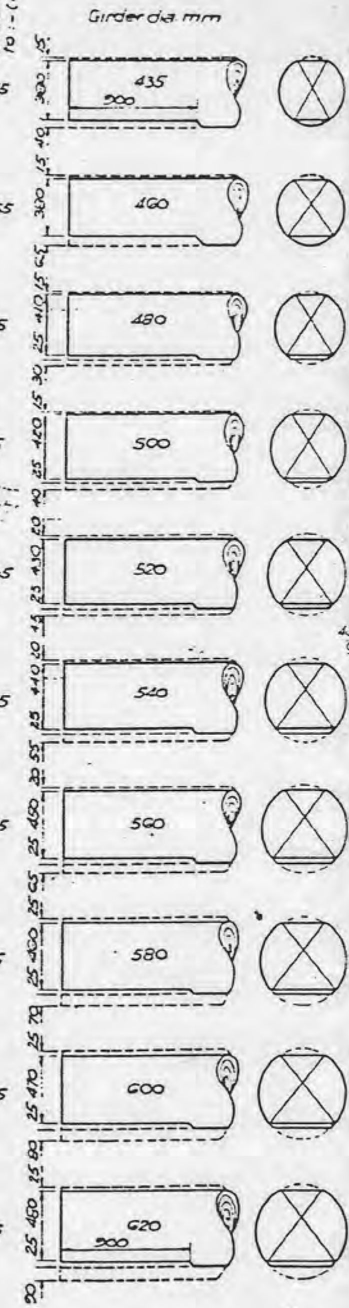
All corbel and eye bolts to be placed with nut up.

Tops of all pile tongues to be sloped at 1 : 4 as shown and treated with a special mixture of petroleum jelly in accordance with the relevant instructions.

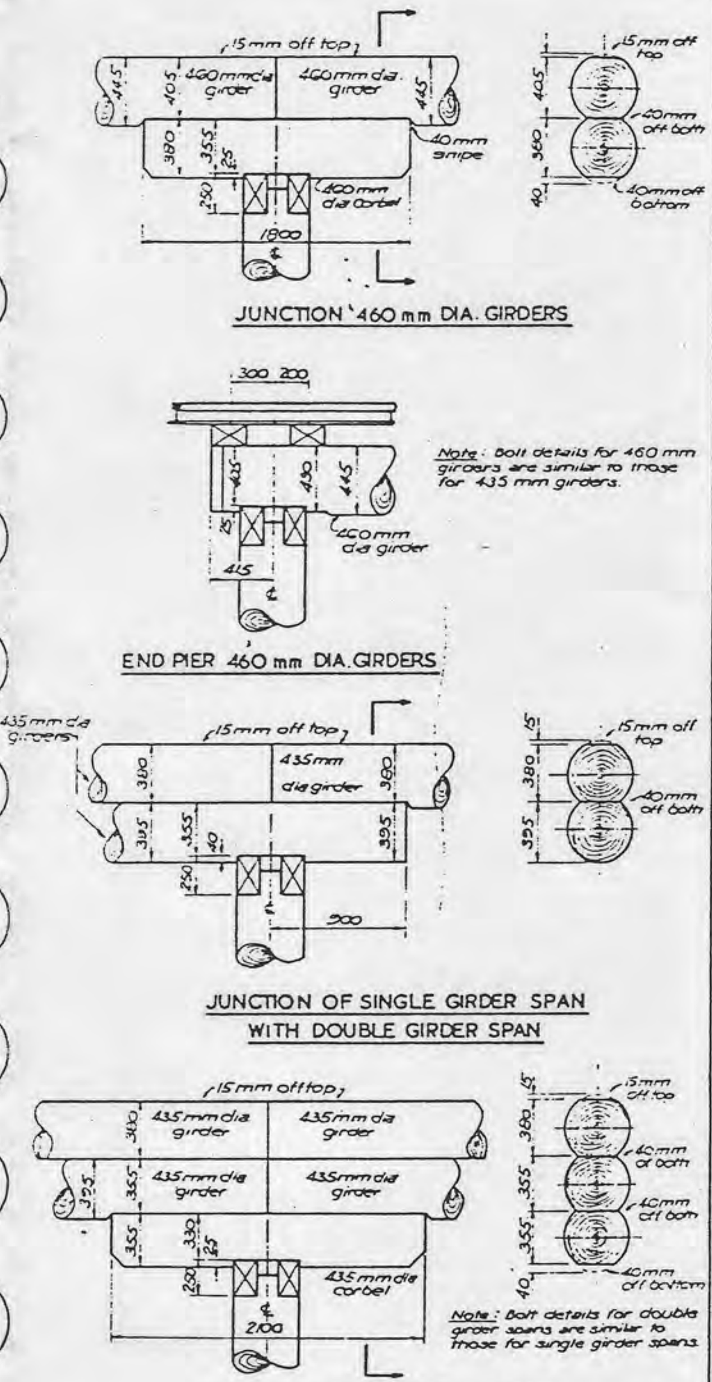
Where packing 15mm or more in thickness has to be used, this must be in one length for the whole distance required.

Packing thinner than 15mm may be inserted as cross packing, but the whole of the bed must be filled and the packing nailed in place.

Thickness of Packing under 435 mm dia Girder (mm)	435 mm dia Corbel faced to - (mm)	Girder dia mm
nil	355	435
nil	355	460
30	325	480
40	315	500
50	305	520
60	295	540
70	285	560
80	275	580
90	265	600
100	255	620



DRESSING OF OVERSIZE GIRDERS FOR JUNCTION WITH 435mm DIA. GIRDERS



JUNCTION 460 mm DIA. GIRDERS

END PIER 460 mm DIA. GIRDERS

JUNCTION OF SINGLE GIRDER SPAN WITH DOUBLE GIRDER SPAN

JUNCTION DOUBLE GIRDER SPANS

METHOD OF FIXING GIRDERS ON PILES

(DRAWN FOR 435 mm DIA. GIRDERS)

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1932, 1933, 1935, 1936, 1937

THIS DRAWING SUPERSEDES STANDARD DRAWING NO. 1210

ALL DIMENSIONS ARE IN MILLIMETRES

C.E'S. FILE	1920-1
SCALE:	1 : 20
DRAWING NUMBER	1934
LOADING:	SEE NOTE 14 ON DRG Nº 1932 ADEQUATE FOR ALL "A" CLASS LINE LOADINGS
ISSUE	

1:20 — 400 200 0 400 800 1200 1600mm

ALTERATIONS

CALCS.	METRICATED FROM DRAWING NO. 1210		RECOMMENDED
CHECKED			BRIDGE ENGINEER DATE
DRAWN	L. J.	27.8.73	ENGINEER FOR WORKS DATE
CHECKED	SRB	8/79	APPROVED
PASSED	SRB	8/79	
SUBMITTED			CHIEF ENGINEER DATE

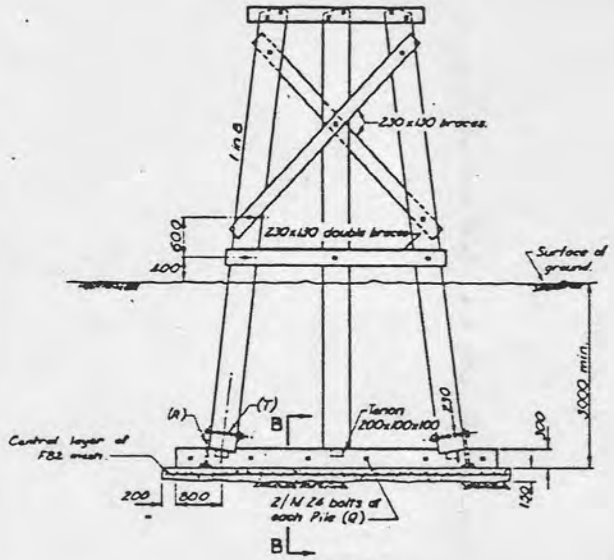
QUEENSLAND RAILWAYS. CHIEF ENGINEER'S BRANCH

STANDARD TIMBER BRIDGES
DETAILS AT PIER TOPS

DRAWING NUMBER 1934

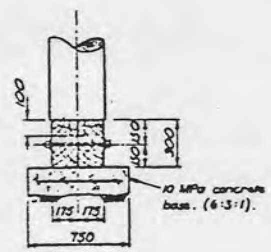
ISSUE

SILLED FOUNDATION DETAILS



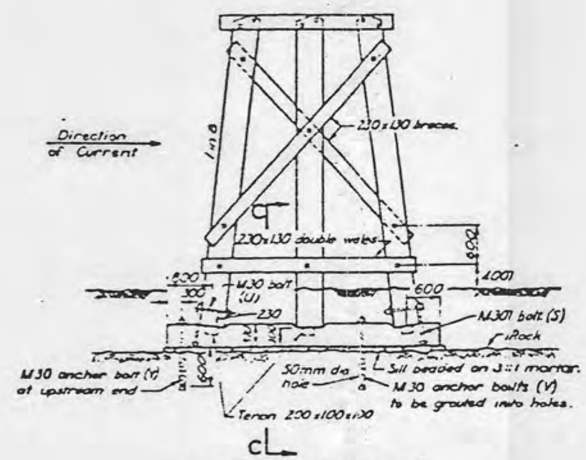
SPLIT SILLS

SCALE: 1:50



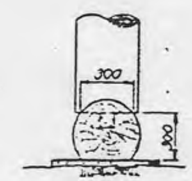
SECTION BB

SCALE 1:20



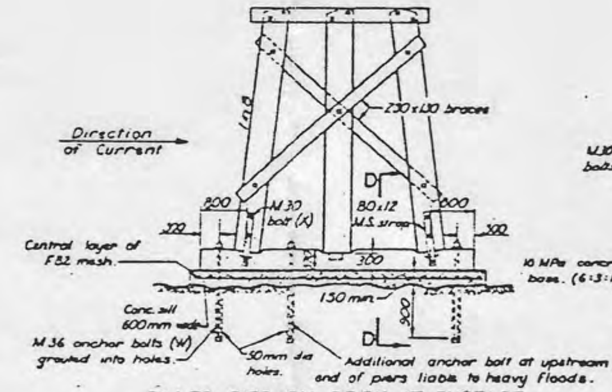
SILLED PIER ON ROCK

SCALE. 1:50



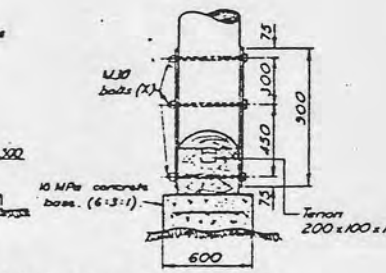
SECTION CC

SCALE 1:20



SILLED PIER ON ROCK AT SURFACE

SCALE 1:50



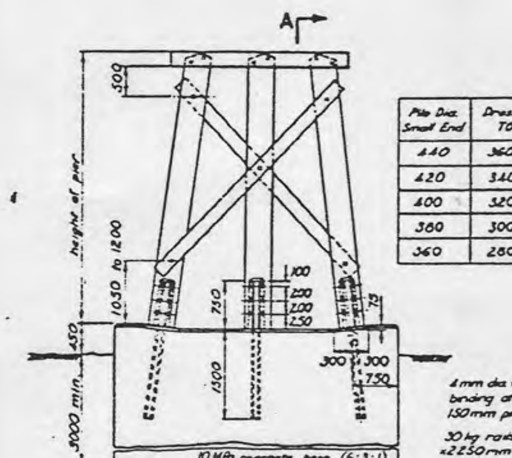
SECTION DD

SCALE 1:20

NOTES:

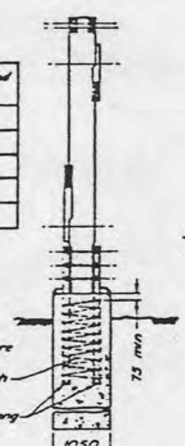
1. Round sills to be not less than 440 diameter at small end and sapped completely.
2. Split sills 300 x 175 may be used in lieu.
3. Anchor bolts are to be used where rock is less than 3000 below ground.
4. All new piles in silled piers shall be sapped and tarred from 300 mm above surface of ground to bottom of pile.
5. All sills shall be tarred on all surfaces.
6. All dimensions are clear of sapwood.

PIERS ON CONCRETE BASES



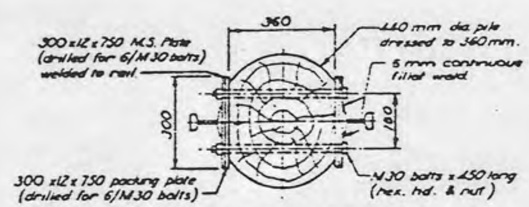
ELEVATION

Pile Dia. Small End	Dressed TO
440	360
420	340
400	320
380	300
360	280



SECTION AA

SCALE 1:50



DETAIL OF CONNECTIONS

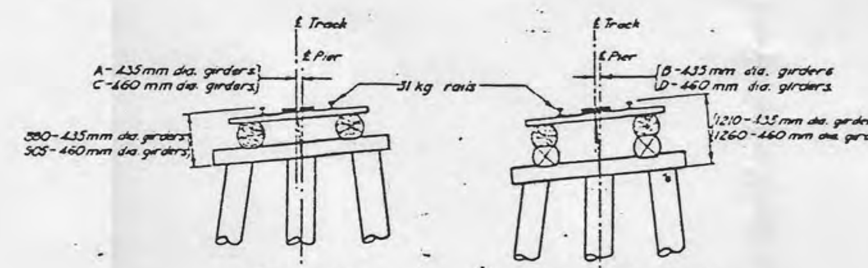
SCALE: 1:10.

NOTES:

1. Surface of concrete under piles to be finished with 1:1 cement mortar.
2. Piles to be sapped for bottom 1 metre and well tarred. Ends of piles and concrete seats also to be tarred.
3. Width of base to be increased where considered necessary by the Maintenance Engineer.
4. Bracing may be from part worn 30 kg rails as shown on Standard Drawing No. 1933.
5. Where height of pier is less than 3000 mm, a full concrete pier should be constructed.

No. of piles in pier.	Maximum height of pier.
3	6000
4	7500
5	9000

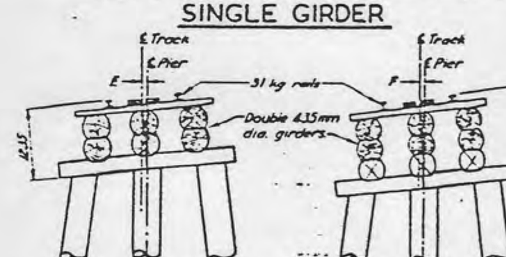
METHOD OF PROVIDING CANT ON TIMBER BRIDGES ON CURVES



END PIERS

INTERMEDIATE PIERS

SINGLE GIRDER



END PIERS

INTERMEDIATE PIERS

DOUBLE GIRDER

SCALE. 1: 50.

CANT	A	B	C	D	E	F
5	4	6	4	6	6	7
10	8	11	8	12	12	15
15	12	17	13	18	17	22
20	16	23	17	24	23	29
25	21	28	21	30	29	37
30	25	34	25	35	35	44
35	29	40	30	41	41	51
40	33	45	34	47	46	59
45	37	51	38	53	52	66
50	41	57	42	59	58	73
60	49	68	51	71	69	88
70	58	79	59	83	81	103
80	66	.91	68	94	93	117
90	74	102	76	106	104	132
100	82	113	85	118	116	147

Corrections for cant have been based on the use of 31 kg rail.

Cant to be provided for any radius curve may be determined from the Standard Cant Table. The actual cant shall be fixed by the Maintenance Engineer to suit local conditions.

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1932, 1933, 1934, 1936, 1937

THIS DRAWING SUPERSEDES STANDARD DRAWINGS NOS. 1211, 1212, 1450

ALL DIMENSIONS ARE IN MILLIMETRES

C.E'S FILE 1920-1	SCALE: 1:50 Unless Otherwise Shown	1:50 — 1000 500 0 1000 2000 3000 4000mm	ALTERATIONS
DRAWING NUMBER 1935	LOADING: SEE NOTE 14 ON DRG. Nº 1932 ADEQUATE FOR ALL "A" CLASS LINE LOADINGS	1:20 — 400 200 0 400 800 1200 1600mm	

CALCS.	METRICATED FROM DRAWINGS NOS. 1211, 1212, 1450	RECOMMENDED	
CHECKED		BRIDGE ENGINEER DATE	
DRAWN	B.R.H.	6.2.78	ENGINEER FOR WORKS DATE
CHECKED	I.R.S.	7/2/78	APPROVED
PASSED		8/78	CHIEF ENGINEER
SUBMITTED			DATE 31-7-80

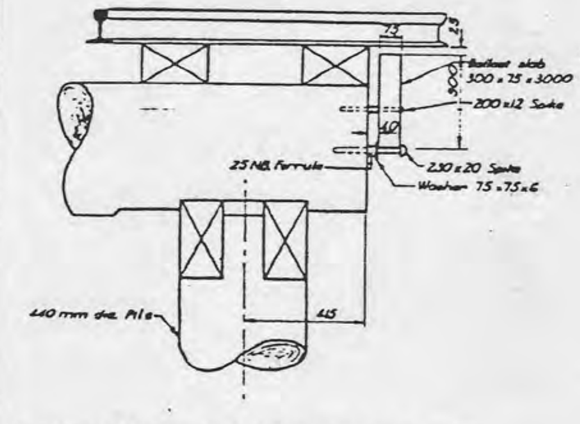
QUEENSLAND RAILWAYS.

CHIEF ENGINEER'S BRANCH

STANDARD TIMBER BRIDGES
DETAILS OF SILLS, CONCRETE BASES
& CANT ON CURVES

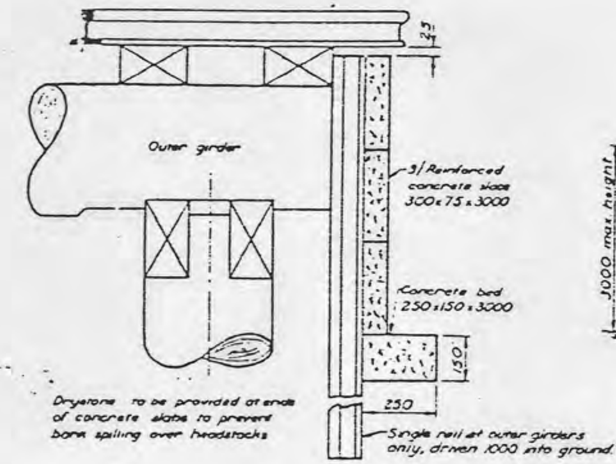
DRAWING NUMBER 1935

ISSUE



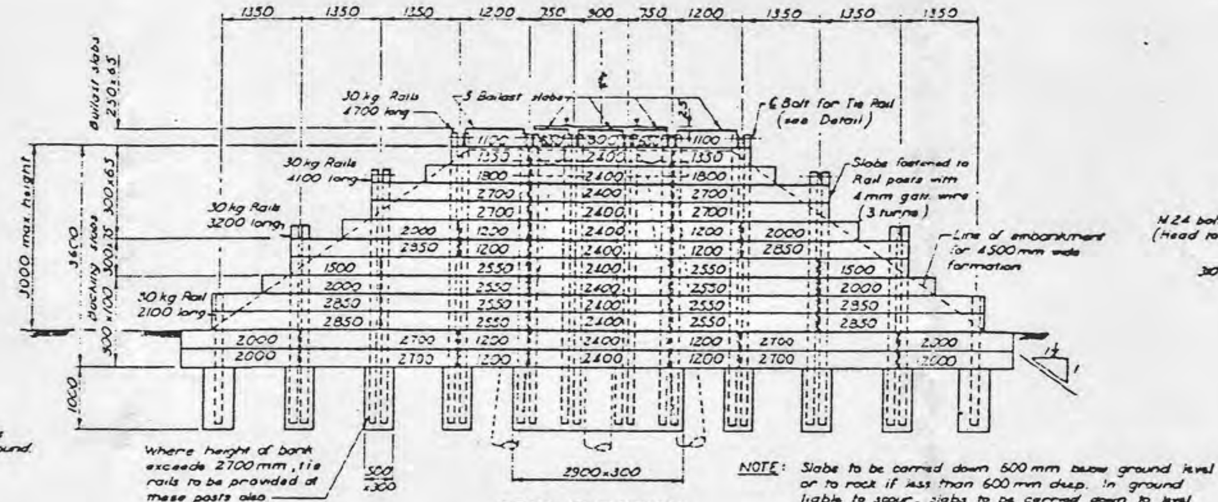
REINFORCED CONCRETE BALLAST SLAB

SCALE 1:10

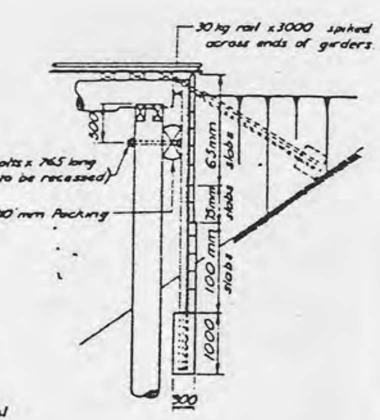


REINFORCED CONCRETE SLAB FACE WALL

SCALE 1:10



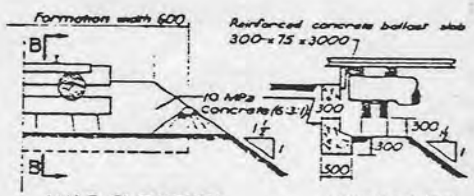
REAR ELEVATION



END ELEVATION

REINFORCED CONCRETE BACKING SLABS UP TO 3 m BANK

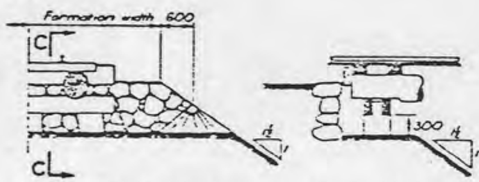
SCALE 1:50



HALF ELEVATION — SECTION BB

CONCRETE FACE WALL

SCALE 1:50

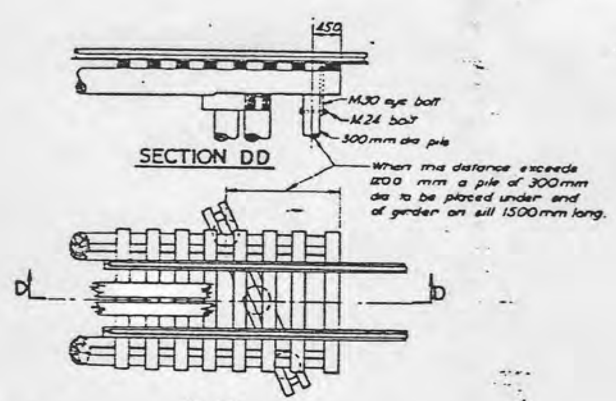


HALF ELEVATION — SECTION CC

RUBBLE FACE WALL

SCALE 1:50

BRIDGE ENDS AT SPILL BANKS

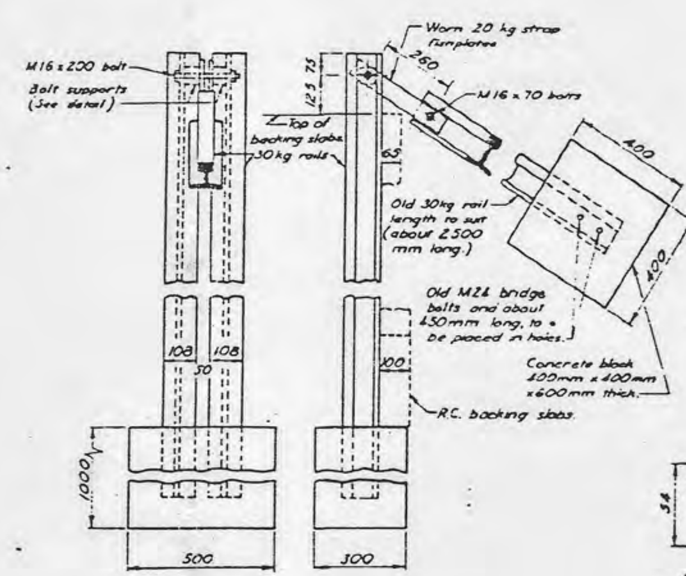


SECTION DD

PLAN

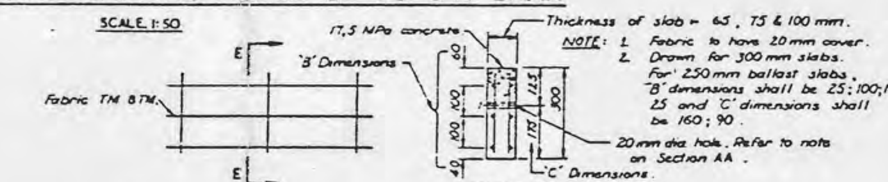
END OF BRIDGE ON SKEW PIER

SCALE 1:50



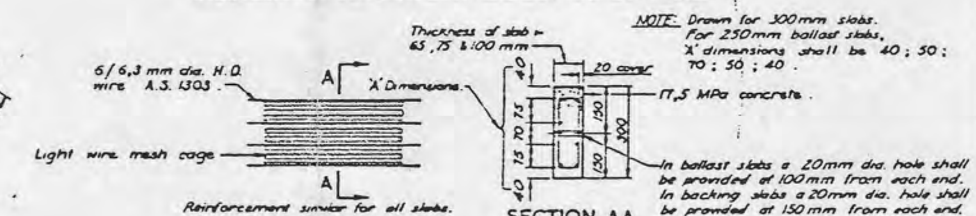
DETAILS OF POSTS

SCALE 1:10



SECTION EE

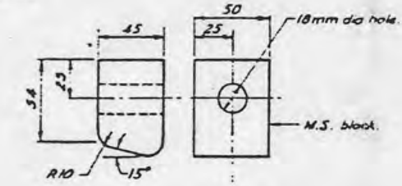
ALTERNATIVE USING MESH REINFORCEMENT



SECTION AA

DETAILS OF REINFORCEMENT FOR BACKING SLABS AND BALLAST SLABS

SCALE 1:10



DETAILS OF BOLT SUPPORTS

SCALE 1:2

CONCRETE SLAB BANK END

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1932, 1933, 1934, 1935, 1937

THIS DRAWING SUPERSEDES STANDARD DRAWING NO. 1212

ALL DIMENSIONS ARE IN MILLIMETRES

C.E.'S FILE	1920-1
SCALE	AS SHOWN
DRAWING NUMBER	1936
LOADING	SEE NOTE 14 ON DRG No 1932 ADEQUATE FOR ALL "A" CLASS LINE LOADINGS
ALTERATIONS	
METRICATED FROM DRAWING NO.	1212
DRAWN	B.R.H. 28.8.79
CHECKED	8/79
PASSED	8/79
RECOMMENDED	BRIDGE ENGINEER; ENGINEER FOR WORKS
APPROVED	CHIEF ENGINEER 21-1-80

QUEENSLAND RAILWAYS. CHIEF ENGINEER'S BRANCH

STANDARD TIMBER BRIDGES — DETAILS AT BRIDGE ENDS

DRAWING NUMBER 1936

SUPERSTRUCTURE

Length of span	Type of span	No. dia. & length of girders	Transoms	Foot planks (length)	Bolts (No) L	Bolts (No) Z	Transom spikes	Foot plank spikes
4000	Single	2/435 dia × 4830	10	9660		4	20	32
	End	2/435 dia × 4415	9	8830		4	18	28
	Intermediate	2/435 dia × 4000	8	8000		4	16	24
5000	Single	3/435 dia × 5830	12	11 660		4	36	40
	End	3/435 dia × 5415	11	10 830		4	33	36
	Intermediate	3/435 dia × 5000	10	10 000		4	30	32
6000	Single	3/460 dia × 6830	14	13 660		4	42	48
	End	3/460 dia × 6415	13	12 830		4	39	44
	Intermediate	3/460 dia × 6000	12	12 000		4	36	40
7000	Single	6/435 dia × 7830	16	15 660	18	8	48	48
	End	6/435 dia × 7415	15	14 830	15	8	45	44
	Intermediate	6/435 dia × 7000	14	14 000	12	8	42	40
8000	Single	6/435 dia × 8830	18	17 660	18	8	54	56
	End	6/435 dia × 8415	17	16 830	15	8	51	52
	Intermediate	6/435 dia × 8000	16	16 000	12	8	48	48

CONNECTIONS — SUPERSTRUCTURE TO PIERS

Type of pier	No. & dia. of girders in adjacent spans		No. dia. & length of corbels	Bolts (No) A	B	C	D	G	H	K	L	Remarks
END PIERS		2/435 dia		2A					2H			
		3/435 dia		2A		1C			3H			
		3/460 dia	–	2A1		1C1			3H			
		3/double 435 dia		2A2		1C2			3H			
INTERMEDIATE PIERS 3 PILE PIERS	2/435 dia	2/435 dia	2/435 dia × 1800		2B				2H	4K		
	2/435 dia	3/435 dia	3/435 dia × 1800		2B		2D	1G	2H	6K		Centre girder of 3 girder span to be 300 mm longer than outer girders.
	2/435 dia	3/460 dia	3/435 dia × 1800		2B		2D	1G	2H	6K		
	3/435 dia	3/435 dia	3/435 dia × 1800		2B		2D	1G	2H	6K		
	3/435 dia	3/460 dia	3/435 dia × 1800		2B		2D	1G	2H	6K		
	3/460 dia	3/460 dia	3/460 dia × 1800		2B1		2D1	1G	2H	6K1		
	3/435 dia	3/double 435 dia			2B3		2D3	1G	2H		6L	Bottom girders of double girder spans
	3/460 dia	3/double 435 dia			2B3		2D3	1G	2H		6L	to be 300 mm longer than top girders.
	3/double 435 dia	3/double 435 dia	3/435 dia × 2100		2B2		2D2	1G	2H	6K2		
4 PILE PIERS	On four pile piers bolts B are replaced by bolts E, and bolts D are replaced by bolts F.											
5 PILE PIERS	On five pile piers bolts B are replaced by bolts E, and bolts H are replaced by bolts J.											

DRIVEN PIERS

Height of pier	No. of piles	H'stocks	Braces	Wales	Bolts M	N	P
1500	3	2/3000			6		
1800	"	"	1/3000		"	3	
2100	"	"	1/3200		"	"	
2400	"	"	1/3300		"	"	
2700	"	"	1/3500		"	"	
3000	"	"	1/3700		"	"	
3300	"	"	2/3500		"	4	1
3600	"	"	2/4100		"	"	"
3900	"	"	2/4400		"	"	"
4200	"	"	2/4600		"	"	"
4500	"	"	2/4300		"	"	"
4800	"	"	2/3700 2/4100		"	"	4
5100	"	"	2/3800 2/4200		"	"	"
5400	"	"	2/3300 2/4300		"	"	"
5700	"	"	2/4000 2/4500		"	"	"
6000	"	"	2/4200 2/4600		"	"	"
6300	4	2/4000	2/5000 2/5500		8	12	2
6600	"	"	2/5100 2/5600		"	"	"
6900	"	"	2/5200 2/5700		"	"	"
7200	"	"	2/5300 2/5300		"	"	"
7500	"	"	2/5400 2/6000		"	"	"
6300	5	"	2/4700 2/5200		10	"	4
6600	"	"	2/4800 2/5400		"	"	"
6900	"	"	2/4500 2/5500		"	"	"
7200	"	"	2/5100 2/5600		"	"	"
7500	"	"	2/5200 2/5800		"	"	"
7800	"	"	2/4700 2/5200	2/5100	"	"	3
8100	"	"	2/4800 2/5400	2/5200	"	"	"
8400	"	"	2/4300 2/5500	2/5200	"	"	"
8700	"	"	2/5100 2/5600	2/5300	"	"	"
9000	"	"	2/5200 2/5800	2/5400	"	"	"

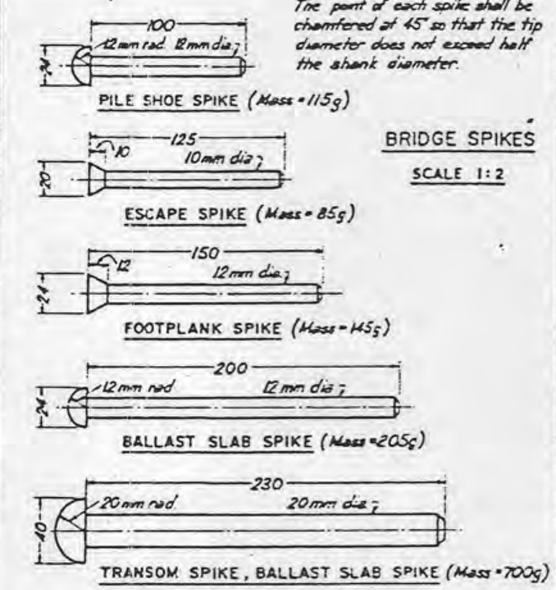
SILLED PIERS

Height of pier	No. of piles	H'stocks	Braces	Wales	Bolts M	N	P	Round S	Round U	Split R	Split T	Sill on rock S	Sill on rock U	Sill on rock V
1500	3	2/3000			6			2	2	2	2	2	2	2
1800	"	"	1/3000		"	3		"	"	"	"	"	"	"
2100	"	"	1/3200		"	"		"	"	"	"	"	"	"
2400	"	"	1/3300		"	"		"	"	"	"	"	"	"
2700	"	"	1/3200	1/3300	"	6		"	"	"	"	"	"	"
3000	"	"	1/3400	1/3400	"	"		"	"	"	"	"	"	"
3300	"	"	1/3600	1/3500	"	"		"	"	"	"	"	"	"
3600	"	"	2/3800	2/3500	"	4	4	"	"	"	"	"	"	"
3900	"	"	2/4000	2/3600	"	"	"	"	"	"	"	"	"	"
4200	"	"	2/4200	2/3700	"	"	"	"	"	"	"	"	"	"
4500	"	"	2/4400	2/3800	"	"	"	"	"	"	"	"	"	"
4800	"	"	2/4700	2/3800	"	"	"	"	"	"	"	"	"	"
5100	"	"	2/3600 2/4000	2/3900	"	"	7	"	"	"	"	"	"	"
5400	"	"	2/3700 2/4100	2/4000	"	"	"	"	"	"	"	"	"	"
5700	"	"	2/3900 2/4300	2/4100	"	"	"	"	"	"	"	"	"	"
6000	"	"	2/4000 2/4400	2/4100	"	"	"	"	"	"	"	"	"	"
6300	"	"	2/4100 2/4500	2/4200	"	"	"	"	"	"	"	"	"	"
6600	4	2/4000	2/4300 2/5400	2/5200	8	12	6	4	4	4	4	4	4	3
6900	"	"	2/5000 2/5500	2/5300	"	"	"	"	"	"	"	"	"	"
7200	"	"	2/5100 2/5700	2/5300	"	"	"	"	"	"	"	"	"	"
7500	"	"	2/5200 2/5800	2/5400	"	"	"	"	"	"	"	"	"	"
7600	"	"	2/5300 2/5300	2/5500	"	"	"	"	"	"	"	"	"	"
6600	5	"	2/4600 2/5100	2/4300	10	"	3	"	"	"	"	"	"	"
6900	"	"	2/4800 2/5300	2/5000	"	"	"	"	"	"	"	"	"	"
7200	"	"	2/4300 2/5400	2/5000	"	"	"	"	"	"	"	"	"	"
7500	"	"	2/5000 2/5500	2/5100	"	"	"	"	"	"	"	"	"	"
7800	"	"	2/5100 2/5700	2/5200	"	"	"	"	"	"	"	"	"	"
8100	"	"	2/5200 2/5800	2/5300	"	"	"	"	"	"	"	"	"	"
8400	"	"	2/5300 2/5300	2/5300	"	"	"	"	"	"	"	"	"	"
8700	"	"	2/5500 2/6100	2/5400	"	"	"	"	"	"	"	"	"	"
9000	"	"	2/5600 2/6200	2/5500	"	"	"	"	"	"	"	"	"	"

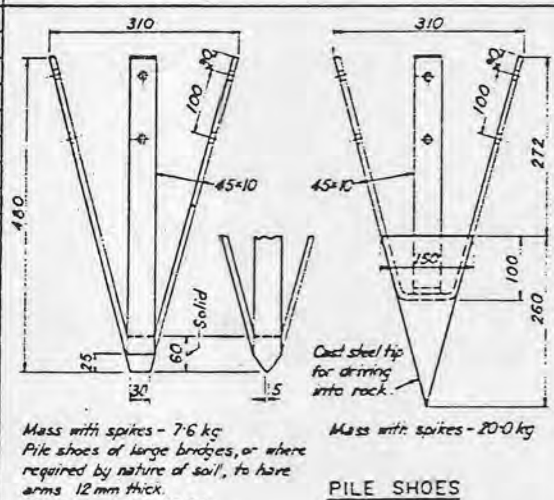
BRIDGE SPIKES

SCALE 1:2

Note: The point of each spike shall be chamfered at 45° so that the tip diameter does not exceed half the shank diameter.



PILE SHOES



PILE SHOES

SCALE 1:5

BOLT LIST

Bolt No	Dia	'X' length	Total length	Position	Remarks
A	30	690	320	Outer girders to piles. End piers.	435 mm dia. girder.
A1		720	350		460 mm dia girder.
A2		1020	1250		Double 435 mm dia. girders.
B	30	1020	1250	Outer girders to piles. Intermediate piers. Three pile piers.	435 mm dia. girder.
B1		1070	1300		460 mm dia girder.
B2		1375	1605		Junction of 435 mm double girders
B3		1045	1275		Junction of 435 mm double girders with single girders.
C	30		1050	Centre girders to piles. End piers.	435 mm dia. girder.
C1			1075		460 mm dia. girder.
C2			1380		Double 435 mm dia. girder.
D	30		1380	Centre girders to piles. Intermediate piers. Three and five pile piers.	435 mm dia. girder.
D1			1430		460 mm dia. girder.
D2			1735		Junction of 435 mm dia. double girders.
D3			1405		Junction of 435 mm dia. double girders with single girders.
E	30		1250	Outer girders to piles. Four & five pile piers.	435 mm dia. girder.
E1			1300		460 mm dia girder.
E2			1605		Junction of 435 mm dia. double girders.
E3			1275		Junction of 435 mm dia. double girders with single girders.
F	30		1010	Centre girders to piles. Four pile piers.	435 mm dia. girder.
F1			1060		460 mm dia. girder.
F2			1370		Junction of 435 mm dia. double girders
F3			1040		Junction of 435 mm dia. double girders with single girders.
G	30		540	Centre girders to piles. Intermediate piers.	Connects eyebolts D & F to piles.
H	30		610	Outer girders to piles. Centre girders, end piers.	Connects eyebolts A, B, C & E to piles.
J			870	Outer girders to piles.	Eyebolt E – Five pile piers.
K	30		780	Girder to corbel.	435 mm dia. girders.
K1			830		460 mm dia. girders.
K2			1130		Double 435 mm dia. girders.
L			835	Girder to girder.	Double 435 mm dia. girders.
M	24		480	Headstocks to piles.	
N	24		570	Wales or braces to piles.	Single
P			660		Double
Q	24		440	Split sills.	Connects split sills.
R	30		570	Sill to pile.	Split sills.
S			620		Round sills.
T	30		510	Sill to pile.	Eyebolt R to piles.
U			510		Eyebolt S to piles.
V	30		1000	Sill to rock.	Sill on rock below ground.
W	36		1500	Sill to rock.	Sill on rock at surface.
X	30			Sill on rock at surface.	M.S. Strap to sill.
Y				Piers with concrete base.	M.S. Plate to pile.
Z	12		230	Ends of footplanks.	Footplank to transom.

Notes.
1. Heads and washers of bolts to be square unless otherwise shown. Nuts to be hexagonal.
2. Washers must be used between heads or nuts and timber.
3. Threads for all M30 bolts to be not less than 60 mm long. Threads for all M24 bolts to be not less than 50 mm long.
4. For bridges on curves or subjected to floods, wale and brace bolts may be increased to M30 at discretion of Maintenance Engineer.
5. Bolt lengths shall be varied to suit the actual dimensions of bridge timbers.

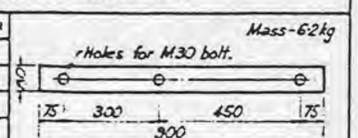
ONE STANDARD ESCAPE

Description	Length	No	Remarks
Transoms 230 × 130 H.W.	3800	3	In lieu of 2300 mm transoms.
Planks 200 × 50 H.W.	1500	7	
Escape spikes M10	130	42	
Handrail (complete)		1	
Nuts M24		2	For handrail.
Washers 65 mm dia × 4 mm		2	For M24 nuts.

SILLED PIER ON ROCK AT SURFACE

Description	3 pile pier	4 or 5 pile pier
Additional Ironwork:–		
M.S. Strap 80 × 12 × 900	4	8
M30 bolts × 510 (X)	6	12
M30 Lewis bolts × 1500 (W)	3	4

Note: Omit wales and corresponding attachment bolts N or P.



M.S. SILL STRAP

SCALE - 1:10

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN

THIS DRAWING IS TO BE READ IN CONJUCTION WITH STANDARD DRAWINGS NOS. 1932, 1933, 1934, 1935, 1936

THIS DRAWING SUPERSEDES STANDARD DRAWING NO. 1213

C.E.'S FILE 1920-1 | SCALE 1:2, 1:5, 1:10

DRAWING NUMBER 1937 | ISSUE A

1:2 | 1:5 | 1:10

ALTERATIONS

A | Thickness of 75 × 75 washer increased from 6 mm to 10 mm

CALCS	METRICATED FROM DRAWING NO. 1213	
CHECKED		
DRAWN	CM	8/75
CHECKED	SKI	8/79
PASSED	SKI	8/79
SUBMITTED		

RECOMMENDED: BRIDGE ENGINEER, DATE; ENGINEER FOR WORKS, DATE; APPROVED: CHIEF ENGINEER 31-7-80 DATE

QUEENSLAND RAILWAYS. CHIEF ENGINEER'S BRANCH

STANDARD TIMBER BRIDGES
MATERIAL LIST

DRAWING NUMBER 1937 | ISSUE A