タイ王国

タイ国鉄道橋梁改良計画

調査報告書

付録Ⅱ　改良対象橋の重力度調査及び現地調査結果一覧表

〃Ⅲ　補修、補強工事のための標準設計図

〃Ⅳ　架換え橋の標準設計図及び施工計画

昭和52年1月

国際協力事業団

Volume 4/4
(APPENDIX)

タイ王国

タイ国鉄道橋梁改良計画

調査報告書

付録Ⅵ　改良対象梁の応力度照査及び現場調査結果一覧表

〃Ⅶ　補修、補強工事のための標準設計図

〃Ⅷ　架換え橋の標準設計図及び施工計画

昭和52年1月

国際協力事業団

付　録　Ⅵ

橋梁の応力度及び現場調査結果一覧表

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調査を実施した２１４スパンの中から代表的な１２橋について部材応力度、現橋調査結果等を一覧図にして示す。

LIST OF 214 SPANS OF STEEL RAILWAY

BRIDGES UNDER INVESTIGATION

List of 214 Steel Railway Bridges

Northern Line:

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawings	Remarks
1.	1	Bangkok	1 + 643	1 x 33.52	TT	Dayde'	1923	Originals	Drawing No. Unknown
2.	2	Bangkok	4 + 216	1 x 30.00	TT	De Vries Robbe		2620, A-1	
3.	3.4	Bangkok	7 + 000	2 x 30.00	TT	De Vries Robbe		2620, A-1	
4.	5.6	Bangkok	70 + 866	2 x 31.70	TT	P & W McLellan	1894	4466	
5	7	Nakhon Sawan	133 + 962	1 x 35.00	TT	Dayde'	1929	Field Drawing	
6.	8	Nakhon Sawan	134 + 724	1 x 35.00	TT	Dayde'	1929	Field Drawing	
7.	9	Nakhon Sawan	162 + 125	1 x 40.00	TT	Dayde'	1928	Originals	Drawing No. Unknown
8.	10	Nakhon Sawan	249 + 181	1 x 30.00	TT	Dayde'	1927	4498, 1-6, 4541	
9.	11	Nakhon Sawan	263 + 335	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
10.	12	Nakhon Sawan	265 + 206	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
11.	13	Nakhon Sawan	271 + 298	1 x 45.00	TT	De Vries Robbe		2661, A-1	
12.	14	Nakhon Sawan	280 + 791	1 x 35.00	TT	Dayde'	1929	Field Drawing	
13.	15	Nakhon Sawan	311 + 599	1 x 40.00	TT	Dayde'	1928	Originals	Drawing No. Unknown
14.	16	Nakhon Sawan	327 + 833	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
15.	17	Nakhon Sawan	359 + 321	1 x 40.00	TT	Dayde'	1928	Originals	Drawing No. Unknown
16.	18	Sila At	361 + 851	1 x 30.00	TT	Dayde'	1928	4498, 1-6, 4541	
17.	19	Sila At	366 + 053	1 x 50.00	TT	De Vries Robbe		Originals	Drawing No. Unknown
18.	20	Sila At	510 + 309	1 x 17.50	DP			Originals	Drawing No. Unknown
19.	21	(Sawankhalok)	465 + 609	1 x 40.00	TT			Originals	Drawing No. Unknown
20.	22	Lampang	577 + 622	1 x 30.00	DT			Field Drawing	

Total No. of Span = 22 Total Length = 744.42 m

	Unit	Price ₦
- repeater post (₦.....)	Unit	.....
- regenerating post (₦.....)	Unit	.....

North Eastern Line:

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Remarks
1.	1.2.3	Kaeng Khoi	284 + 079	3 x 30.00	TT	Cleveland	1924	Originals	Drawing No. Unknown
	4			1 x 60.00	TT	Cleveland	1924	"	" "
2.	5	Lam Chi	298 + 979	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
3.	6	Lam Chi	299 + 354	1 x 50.00	TT	Dayde'	1923	5837, 1-16	
4.	7	Lam Chi	311 + 725	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
5.	8	Lam Chi	313 + 217	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
6.	9	Lam Chi	320 + 058	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
7.	10	Lam Chi	323 + 816	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
8.	11	Lam Chi	335 + 380	1 x 25.00	TP			Field Drawing	
9.	12.13	Lam Chi	343 + 930	2 x 25.00	TT	Dayde'	1923	4540, 4544	
10	14	Lam Chi	409 + 030	1 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	
11.	15	Lam Chi	409 + 503	1 x 80.00	TT	Dayde'	1928	4548	
12.	16	Lam Chi	409 + 970	1 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	
13.	17	Lam Chi	415 + 060	1 x 50.00	TT	De Vries Robbe		2670, 1-10	
14	18	Lam Chi	421 + 326	1 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	
15.	19	Lam Chi	436 + 449	1 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	
16.	20	Lam Chi	451 + 406	1 x 30.00	TT	Dayde'	1927	4498, 1-6, 4541	
17.	21	Lam Chi	472 + 750	1 x 30.00	TT	Dayde'	1927	4498, 1-6, 4541	
18.	22	Lam Chi	479 + 741	1 x 80.00	TT	Dayde'	1925	4548	
	23			1 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	
19.	24.25	Lam Chi	480 + 160	2 x 30.00	TT	Dayde'	1925	4498, 1-6, 4541	

TELECOMMUNICATIONS

	Unit	Price ₦
1. Telephone cable (1)		
Main cable (₦.....)		.....
Terminal cable box (₦.....)		.....
Loading box (₦.....)		.....
2. Dialling telephone system (1)		
Automatic Exchange, with branching capacity		
- up to 50 subscriber (₦.....)	"	.....
- up to 100 subscriber (₦.....)	"	.....
- up to 200 subscriber (₦.....)	"	.....
- up to 300 subscriber (₦.....)	"	.....
- up to 500 subscriber (₦.....)	"	.....
Subscriber telephone set (₦.....)	"	.....

(1) The prices are to be intended for equipments and plants in operation (supply, installation, tests etc. included).

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawings	Remarks
20.	26	Lam Chi	511 + 040	1 x 30.00	TT	Dayde'	1927	4498, 1-6, 4541	
21.	27	Lam Chi	514 + 123	1 x 50.00	TT	Dayde'	1923	5837, 1-16	
	28			1 x 80.00	TT	Dayde'	1927	4548	
22.	29	Lam Chi	519 + 442	1 x 50.00	TT	Dayde'	1927	5837, 1-16	
23.	30	Lam Chi	531 + 103	1 x 40.00	TT	Dayde'	1927	4543	
24.	31	Lam Chi	553 + 214	1 x 80.00	TT	Dayde'	1927	4548	
25.	32	Lam Chi	560 + 392	1 x 40.00	TT	Dayde'	1927	4543	
26.	33	Lam Chi	572 + 430	1 x 20.00	TP	Dayde'	1927	5742	
27.	34.35	Khon Kaen	296 + 407	2 x 30.00	TT	Dayde'	1928	4498, 4541	
28.	36	Khon Kaen	312 + 728	1 x 30.00	TT	Dayde'	1928	4498, 1-6, 4541	
29.	37	Khon Kaen	314 + 888	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
30.	38	Khon Kaen	343 + 320	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
31	39	Khon Kaen	356 + 316	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
32.	40	Khon Kaen	426 + 697	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
33.	41	Khon Kaen	441 + 438	1 x 50.00	TT	Dayde'	1929	5837, 1-16	
34.	42	Khon Kaen	441 + 611	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	
35.	43	Khon Kaen	441 + 667	1 x 80.00	TT	Dayde'	1929	4548	
36.	44	Khon Kaen	443 + 442	1 x 50.00	TT	Dayde'	1929	5837, 1-16	
37.	45	Khon Kaen	536 + 969	1 x 25.00	TT	P & W McLellan	1895	Field Drawing	

Total No. of Span = 45 Total Length = 1,740.5 m

Southern Line:

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Note
1.	1	Hua Hin	77 + 844	1 x 25.00	TT	P & W McLellan	1895	Field Drawing	
2.	2.3.4 5.6.7 8.9	Hua Hin (Kanchanaburi)	120 + 195	8 x 20.75	TT			"	ExJava
3.	10	Hua Hin	153 + 788	1 x 16.00	TP			"	
4.	11	Hua Hin	234 + 954	1 x 40.00	TT	Cleveland	1920	Field Drawing	
5.	12	Hua Hin	284 + 096	1 x 35.00	TT	Cleveland	1920	5983, 1-3	
6.	13	Hua Hin	293 + 926	1 x 30.00	TT	Cleveland	1911		
7.	14	Hua Hin	297 + 063	1 x 70.00	TT	Cleveland	1911		
8.	15	Chumphon	326 + 367	1 x 20.00	TP	Cleveland	1914		
9.	16	Chumphon	334 + 415	1 x 25.00	TT	Cleveland	1914		
10.	17	Chumphon	347 + 690	1 x 30.00	TT	Cleveland	1914	Originals	Drawing No. Unknown
11.	18.19 20	Chumphon	373 + 273	3 x 30.00	TT	Cleveland	1914	"	Drawing No. Unknown
12.	21	Chumphon	377 + 210	1 x 70.00	TT	Cleveland	1914	5815, 1-4	
13.	22	Chumphon	377 + 354	1 x 50.00	TT	Cleveland	1914		Cleveland 190 A-C
14.	23	Chumphon	386 + 462	1 x 30.00	TT	Cleveland	1914	Originals	Drawing No. Unknown
15.	24	Chumphon	392 + 471	1 x 30.00	TT	Cleveland	1914	"	Drawing No. Unknown
16.	25	Chumphon	397 + 192	1 x 60.00	TT	Cleveland	1914	Field Drawing	
17.	26	Chumphon	402 + 077	1 x 30.00	TT	Cleveland	1914	Originals	Drawing No. Unknown
18.	27	Chumphon	403 + 257	1 x 35.00	TT	Cleveland	1915	5983	
19.	28	Chumphon	440 + 290	1 x 25.00	TT	Cleveland	1914	Field Drawing	

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Notes
20.	29	Chumphon	442 + 187	1 x 30.00	TT	Cleveland	1914	Originals	Drawing No. Unknown
21.	30	Chumphon	469 + 428	1 x 25.00	TT	P & M McLellan	1895	Field Drawing	
22	31	Chumphon	471 + 865	1 x 45.00	TT	Cleveland	1914	"	
23.	32	Chumphon	497 + 613	1 x 35.00	TT	Cleveland	1915	5983	
24.	33	Chumphon	499 + 659	1 x 80.00	TT	Cleveland	1914	Field Drawing	
25.	34	Chumphon	532 + 659	1 x 65.00	TT	Cleveland	1914	"	
26.	35	Chumphon	544 + 072	1 x 25.00	TT	Cleveland	1914	"	
27.	36.37	Chumphon	551 + 793	2 x 50.00	TT	Cleveland	1914	"	
28.	38	Chumphon	568 + 610	1 x 45.00	TT	Cleveland	1914	"	
29.	39	Chumphon	576 + 330	1 x 65.00	TT	Cleveland	1914	"	
30.	40	Chumphon	595 + 040	1 x 30.00	TT	Cleveland	1914	1077	
31.	41	Chumphon	597 + 357	1 x 25.00	TT	Dayde'	1928	4540, 1-4	
32.	42	Chumphon	598 + 376	1 x 25.00	TT	Cleveland	1914	Field Drawing	
33	43	Thung Song	661 + 692	1 x 45.00	TT	Cleveland	1920	"	
34.	44	Thung Song	672 + 874	1 x 45.00	TT	Cleveland	1920	"	
35.	45	Thung Song	689 + 434	1 x 25.00	TT	Cleveland	1920	"	
36.	46	Thung Song	706 + 437	1 x 30.00	TT	Cleveland	1920	Originals	Drawing No. Unknown
37.	47	Thung Song	706 + 740	1 x 30.00	TT	Cleveland	1920	"	Drawing No. Unknown
38.	48	Thung Song	724 + 404	1 x 70.00	TT	Cleveland	1914	Field Drawing	
39.	49.50	Thung Song	728 + 272	2 x 50.00	TT	Cleveland	1920	Originals	Drawing No. Unknown
40.	51	Thung Song	734 + 042	1 x 30.00	TT	Cleveland	1920	1077-1,-2,-3	
41	52	Thung Song	743 + 388	1 x 25.00	TT	Cleveland	1913	Field Drawing	

Bridge No.	Span No.	Directs	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Notes
42.	53	Thung Song (Kantang)	775 + 549	1 x 45.00	TT	Cleveland	1920	Field Drawing	
43.	54	Thung Song (Kantang)	828 + 560	1 x 30.00	TT	Cleveland	1920	Field Drawing	
44.	55	Thung Song (Nakhon Si Thammarat)	801 + 412	1 x 35.00	TT	Cleveland	1920	5983, 1-3	
45.	56	Thung Song (Nakhon Si Thammarat)	807 + 786	1 x 30.00	TT	Cleveland	1920	1077-1,-2,-3	
46.	57	Hat Yai	897 + 174	1 x 25.00	TT	Cleveland	1920	Field Drawing	Cleveland 959 Incomplete
47.	58	Hat Yai	907 + 721	1 x 48.00	TT	Cleveland	1920	Field Drawing	Cleveland 146 Incomplete
48.	59	Hat Yai	908 + 031	1 x 25.00	TT	Dayde'	1928	4540, 1-3	
49.	60	Hat Yai	910 + 652	1 x 40.00	TT	Cleveland	1920	5743	
50.	61	Hat Yai	925 + 165	1 x 80.00	TT	Cleveland	1920	Field Drawing	
51.	62	Hat Yai	929 + 903	1 x 30.00	TT	Cleveland	1920	Originals	Drawing No. Unknown
52.	63	Hat Yai	930 + 931	1 x 60.00	TT	Cleveland	1920	"	Drawing No. Unknown
53.	64	Hat Yai	931 + 066	1 x 25.00	TT	Cleveland	1920	Field Drawing	
54.	65	Hat Yai	938 + 403	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
55.	66	Hat Yai	940 + 191	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
56.	67	Hat Yai	942 + 759	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
57.	68	Hat Yai	944 + 409	1 x 30.00	TT	Cleveland	1920	Field Drawing	
58.	69	Hat Yai	945 + 481	1 x 50.00	TT	Cleveland	1920		
59.	70	Hat Yai	950 + 863	1 x 25.00	TT	Cleveland	1920	Field Drawing	Cleveland 148 Incomplete
60.	71	Hat Yai	953 + 491	1 x 30.00	TT	Cleveland	1920	"	Cleveland 293 Incomplete
61.	72	Hat Yai	954 + 320	1 x 60.00	TT	Cleveland	1920	Originals	Drawing No. Unknown

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Note
62.	73	(Songkhla)	932 + 781	1 x 48.00	TT	Cleveland	1920	Field Drawing	
63.	74	(Songkhla)	947 + 958	1 x 20.00	TP	Cleveland	1920	5742	
64.	75	(Songkhla)	952 + 443	1 x 20.00	TP	Cleveland	1920	5742	
65.	76	(Songkhla)	954 + 178	1 x 20.00	TP	Cleveland	1920	5742	
66.	77.78	Yala	948 + 293	2 x 25.00	DP	Cleveland	1920	Field Drawing	
67.	79	Yala	953 + 193	1 x 35.00	TT	Cleveland	1920	5983, 1-3	
68.	80	Yala	963 + 401	1 x 35.00	TT	Cleveland	1920	5983, 1-3	
69.	81.82	Yala	992 + 673	2 x 30.00	TT	Cleveland	1920	Originals	Drawing No. Unknown
	83			1 x 80.00	TT	Cleveland	1920	Field Drawing	
70.	84	Yala	993 + 501	1 x 30.00	TT	Dayde'	1920	4498, 1-6, 4541	
71.	85	Yala	1,032 + 426	1 x 50.00	TT	Cleveland	1920		
72.	86.87 88	Yala	1,035 + 353	3 x 30.00	TT	Cleveland	1920	1077-1,-2,-3	
73.	89	Yala	1,038 + 001	1 x 35.00	TT	Cleveland	1920	5983, 1-3	
	90.91			2 x 50.00	TT	Cleveland	1920	Field Drawing	
74.	92	Yala	1,038 + 001	1 x 60.00	TT	Cleveland	1920	Originals	Drawing No. Unknown
75.	93.94	Yala	1,063 + 810	2 x 50.00	TT	Cleveland	1920	"	Drawing No. Unknown
76.	95.96 97.98	Yala	1,065 + 064	4 x 50.00	TT	Cleveland	1920	Field Drawing	
	99			1 x 30.00	TT	Cleveland	1920		
77.	100 101	Yala	1,070 + 158	2 x 45.00	TT	Cleveland	1920	5981, 1-4	
78	102	Yala	1,101 + 404	1 x 30.00	TT	Dayde'	1929	4498, 1-6, 4541	

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawing No.	Note
79.	103	Yala	1,102 + 144	1 x 30.00	TT	Cleveland	1920		
80.	104	Yala	1,102 + 661	1 x 70.00	TT	Cleveland	1920	5815, 1-4	No Drawings
81.	105	Yala	1,103 + 999	1 x 35.00	TT	Japanese	1933	3916, 1-2	
82.	106 107 108	Yala	1,122 + 255	3 x 20.00	TP	Cleveland	1920	5742	
83.	109 110	Yala	1,144 + 293	2 x 31.40	TT			Field Drawing	

Total No. of Span = 110 Total Length = 4,056.3 m

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawings	Remarks
1.	1	Prachin Buri	41 + 767	1 x 35.00	TT	Cleveland	1920	Field Drawing	
2.	2	Prachin Buri	65 + 960	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
3.	3	Prachin Buri	67 + 959	1 x 30.00	TT	Cleveland	1920	1077-1,-2,-3	
4.	4	Prachin Buri	80 + 024	1 x 45.00	TT	Cleveland	1920	5981, 1-4	
5.	5	Prachin Buri	81 + 475	1 x 25.00	TT	Cleveland	1920	Field Drawing	Cleveland 148 Incomplete
6.	6	Prachin Buri	81 + 985	1 x 25.00	TT	Cleveland	1920	Field Drawing	Cleveland 148 Incomplete
7.	7	Prachin Buri	84 + 393	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
8.	8	Prachin Buri	87 + 097	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
9.	9	Prachin Buri	89 + 847	1 x 25.00	TT	Cleveland	1920	"	Cleveland 148 Incomplete
10.	10.11	Prachin Buri	92 + 668	2 x 35.00	TT	Cleveland	1920	5983, 1-3	
	12.13			2 x 35.00	TT	Dayde'	1923	29935, 30272 -73,75,76	
	14			1 x 70.00	TT	Cleveland	1920	5815, 1-4	
11.	15	Prachin Buri	110 + 762	1 x 35.00	TT	Dayde'	1923	29935, 30272 -73, 75, 76	
12.	16	Prachin Buri	112 + 795	1 x 50.00	TT	Dayde'	1923	5837, 1-16	
13.	17	Prachin Buri	116 + 012	1 x 35.00	TT	Dayde'	1923	29935, 30272 -73, 75, 76	
14.	18	Prachin Buri	119 + 830	1 x 35.00	TT	Dayde'	1923	29935, 30272, -73, 75, 76	
15.	19	Prachin Buri	128 + 203	1 x 50.00	TT	Dayde'	1923	5837, 1-16	
16.	20	Prachin Buri	132 + 634	1 x 50.00	TT	Dayde'	1923	5837, 1-16	
17.	21	Prachin Buri	134 + 137	1 x 35.00	TT	Dayde'	1923	4498, 1-6, 4541	
18.	22	Prachin Buri	134 + 563	1 x 35.00	TT	Dayde'	1923	4498, 1-6, 4541	

Bridge No.	Span No.	District	Km	Size (m)	Type	Manufacturer	Year	Drawings	Remarks
19.	23	Prachin Buri	135 + 105	1 x 35.00	TT	Dayde'	1923	4498, 1-6, 4541	
20.	24.25	Prachin Buri	138 + 560	2 x 35.00	TT	De Vries Robbe	1920	2525, A-G	
21.	26	Prachin Buri	147 + 645	1 x 35.00	TT	Dayde'	1923	4498, 1-6, 4541	
22.	27	Prachin Buri	152 + 384	1 x 25.00	TT	Cleveland	1920		
23.	28	Prachin Bur	155 + 924	1 x 30.00	TT	Dayde'	1923	4498, 1-6, 4541	
24.	29	Prachin Buri	162 + 432	1 x 35.00	TT	De Vries'Robbe	1920	2525, A-G	
25.	30.31	Prachin Buri	187 + 240	2 x 30.00	TT	De Vries Robbe	1920	Field Drawing	
	32			1 x 50.00	TT	De Vries Robbe	1920		
26.	33	Prachin Buri	192 + 329	1 x 40.00	TT	Dayde'	1923	2670, 1-10	
27.	34	Prachin Buri	208 + 601	1 x 30.00	TT	De Vries Robbe	1920	Field Drawing	
28.	35	Prachin Buri	218 + 823	1 x 30.00	TT	De Vries Robbe	1920	Field Drawing	
29.	36	Prachin Buri	252 + 068	1 x 35.00	TT	De Vries Robbe	1920	2525, A-G	
30.	37	Prachin Buri	260 + 449	1 x 31.70	TT	P & W McLellan	1894	4466	

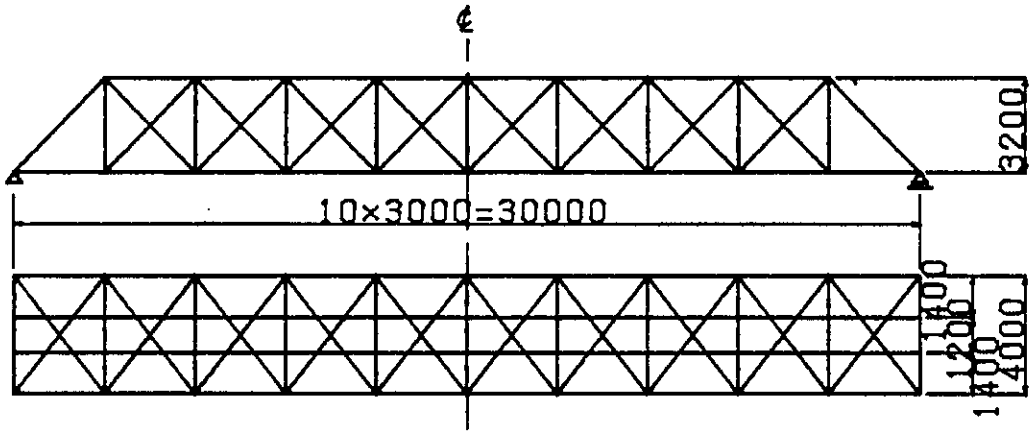
Total No. of Span = 37 Total Length = 1,301.7 m

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. N - 11

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N -Line	9	263+335	Nakhon Sawan	30.0m	TT	Dayde'	1929	4498.1-6.4541	Original Drawing

Outline:



Scale 1 in 250
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Main truss is supported by two sleeper stagings.	* Lower flanges of intermediate floor beams are partially corroded.	* Several rivets connecting stringer with floor beam are loose.	* Fixed shoes are in displacement. * Concrete under the shoe is not in good condition. * Shoes have no anchor bolts.

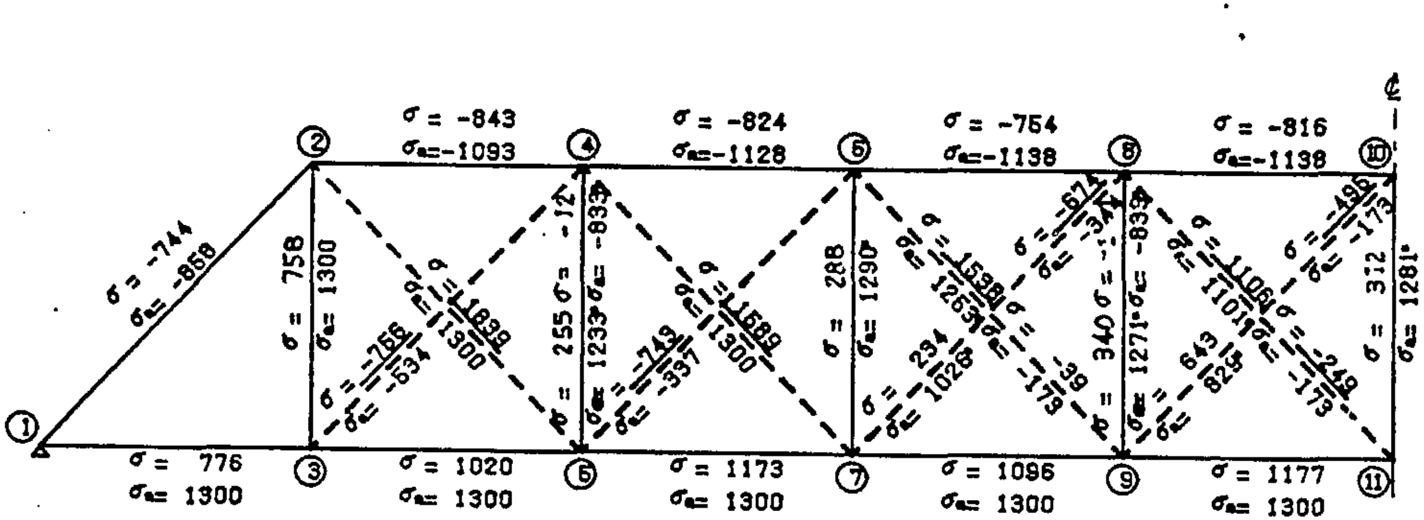
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. N - 11

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N - Line	9	263+335	Nakhon Sawan	30.0m	TT	Dayde'	1929	4498.1-6.4541	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ Shear	σ Bear	σa Shear	σa Bear
L	1- 3	475	1491	800	1760
L	3- 5	624	1960	800	1760
L	5- 7	673	2123	800	1760
L	7- 9	637	2000	800	1760
L	9-11	684	2148	800	1760
U	2- 4	671	2108	800	1760
U	4- 6	656	2061	800	1760
U	6- 8	600	1885	800	1760
U	8-10	400	1255	800	1760
U	1- 2	641	1495	800	1760
D	3- 4	633	1454	800	1760
D	2- 5	642	1239	800	1760
D	4- 7	573	1350	800	1760
D	5- 6	545	1284	800	1760
D	6- 9	542	1582	791*	1706*
D	7- 8	540	1574	721*	1556*
D	9-10	455	919	542*	1170*
D	8-11	563	1138	635*	1370*
V	2- 3	496	1560	800	1760
V	4- 5	292	459	781*	1685*
V	6- 7	391	615	800	1760
V	8- 9	389	611	800	1753*
V	10-11	357	561	800	1760

Reaction per one Shoe = 62 ton

Lateral Bracings

Member		Flanges σ	Flanges σa	Rivets σ	Rivets σa
L	1- 3	1496	1300	544	800
L	3- 5	1501	1300	661	800
L	5- 7	1238	1300	764	800
L	7- 9	997	1300	1025	800
L	9-11	777	1300	799	800

Floor Systems

Member	Flanges σ_t	Flanges σ_{ta}	Flanges σ_c	Flanges σ_{ca}	Rivets σ	Rivets σ_a
Stringer	778	1300	778	980	1742	1800
End Floor Beam	813	1300	679	1188	1052	1800
Int. Floor Beam	899	1300	751	1188	1162	1800

Over stressed members are underlined

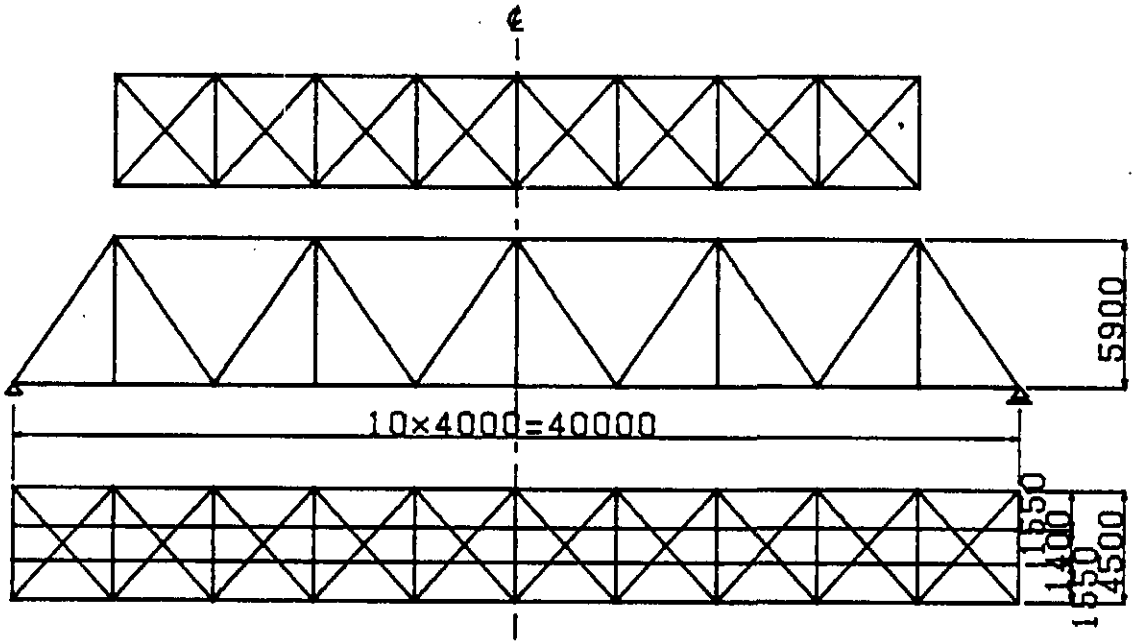
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. N - 15

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N -Line	13	311+599	Nakhon Sawan	40.0m	TT	Dayde'	1928		Field Drawing

Outline:



Scale 1 in 300
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Main truss is supported by two sleeper stagings.	* Cover plate of flange and web plate are partially corroded.	* Loose rivets were replaced two years ago but some of them have been loosened again.	* Lower lateral members have a large slenderness ratio. * Knee bracings are not provided.

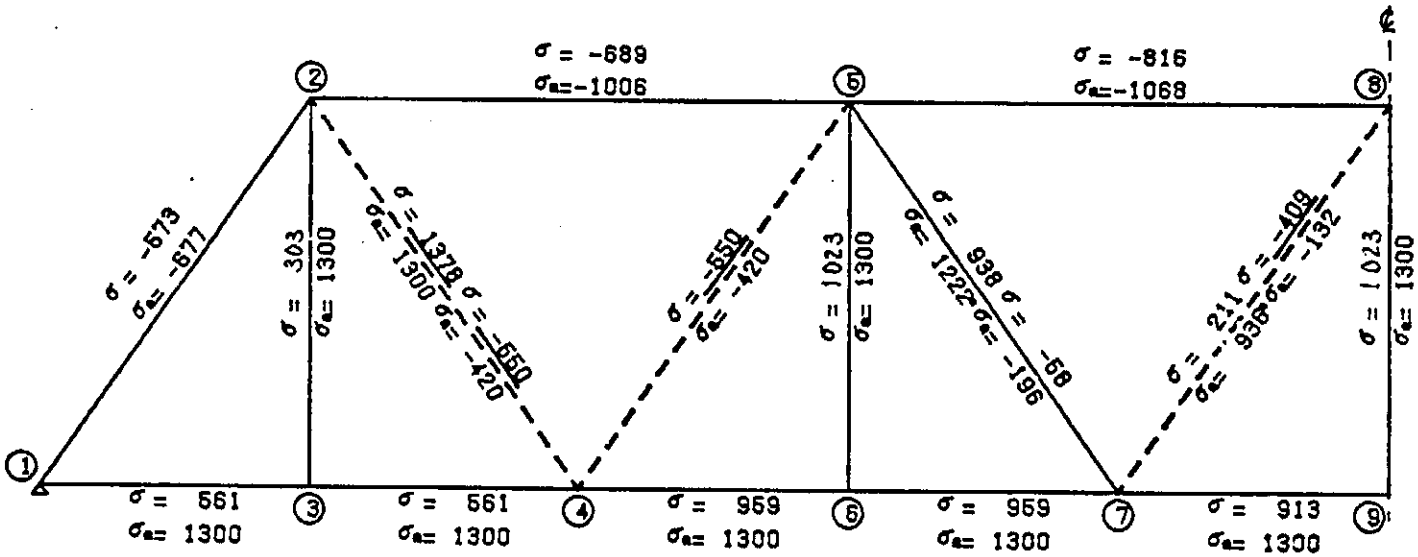
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. N - 15

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N -Line	13	311+599	Nakhon Sawan	40.0m	TT	Dayde'	1928		Field Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	273	945	800	1760
L	3- 4	374	1292	800	1760
L	4- 6	0	0	0	0
L	6- 7	470	1624	800	1760
L	7- 9	544	1879	800	1760
U	2- 5	530	1666	800	1760
U	5- 8	602	1890	800*	1760
U	1- 2	538	1861	800	1760
D	2- 4	559	1933	800	1760
D	4- 5	514	1775	800	1760
D	5- 7	396	1245	776*	1673*
D	7- 8	380	1194	599*	1292*
V	2- 3	435	1368	800	1760
V	5- 6	781	1349	800	1760
V	8- 9	781	1349	800	1760

Reaction per one Shoe = 101 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1312	1300	403	800
L	3- 4	1435	1300	564	800
L	4- 6	1340	1300	778	800
U	2- 5	636	1300	583	800
U	5- 8	551	1300	505	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σo	σoa	σ	σa
Stringer	777	1300	777	953	856	800
End Floor Beam	1150	1300	839	1166	1623	1800
Int. Floor Beam	894	1300	759	1166	1767	1800

Over stressed members are underlined

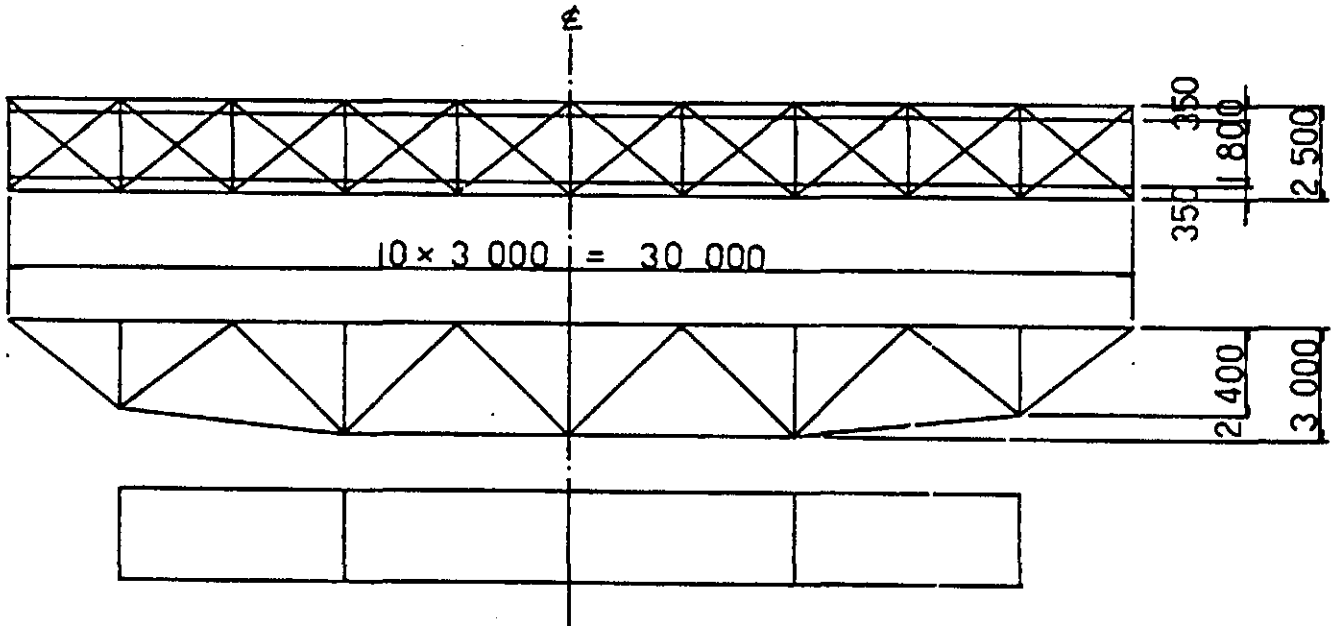
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. N - 22

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N -Line	20	577+622	Lampang	30.0m	DT				Field Drawing

Outline:



Scale 1 in 200
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Ends of lower chord are in contact with parapet walls. * Lacing bars of upper chord are corroded and deformed severely. * Cover plates of upper chord are corroded severely.	* Some of rivets for connection between floor beam and upper chord are loose.	* Flange plates under sleepers are corroded.	* Abutments are in displacement.

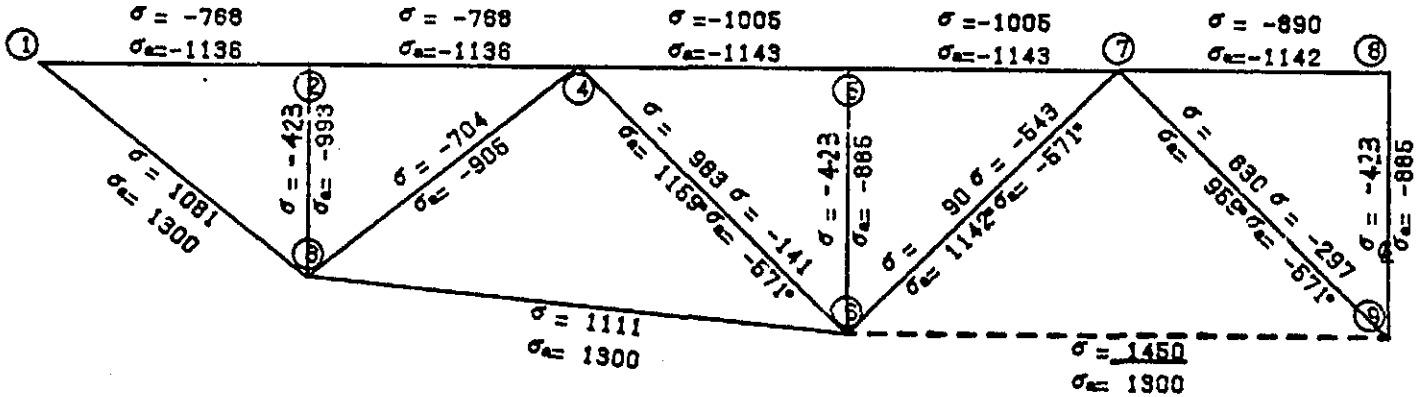
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. N - 22

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
N -Line	20	577+622	Lampang	30.0m	DT				Field Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses - Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	1062	2032	800	1760
L	3- 6	678	1062	800	1760
L	6- 9	602	1450	800	1760
U	1- 2	0	0	0	0
U	2- 4	0	0	0	0
U	4- 5	509	1520	800	1760
U	5- 7	0	0	0	0
U	7- 8	731	1756	800	1760
D	3- 4	1035	1545	800	1760
D	4- 6	936	1239	726*	1565*
D	6- 7	946	1412	731*	1577*
D	7- 9	852	1060	579*	1249*
V	2- 3	709	882	800	1760
V	5- 6	709	882	800	1760
V	8- 9	709	882	800	1760

Reaction per one Shoe = 77 ton

△

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
U	1- 2	1325	1300	813	800
U	2- 4	1698	1300	820	800
U	4- 6	1678	1300	846	800
U	5- 7	1270	1300	908	800
U	7- 8	990	1300	708	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σc	σca	σ	σa
Stringer	1736	1300	1736	1200	2	800
End Floor Beam	1517	1300	1517	1200	1824	1800
Int. Floor Beam	1678	1300	1678	1200	2017	1800

Over stressed members are underlined

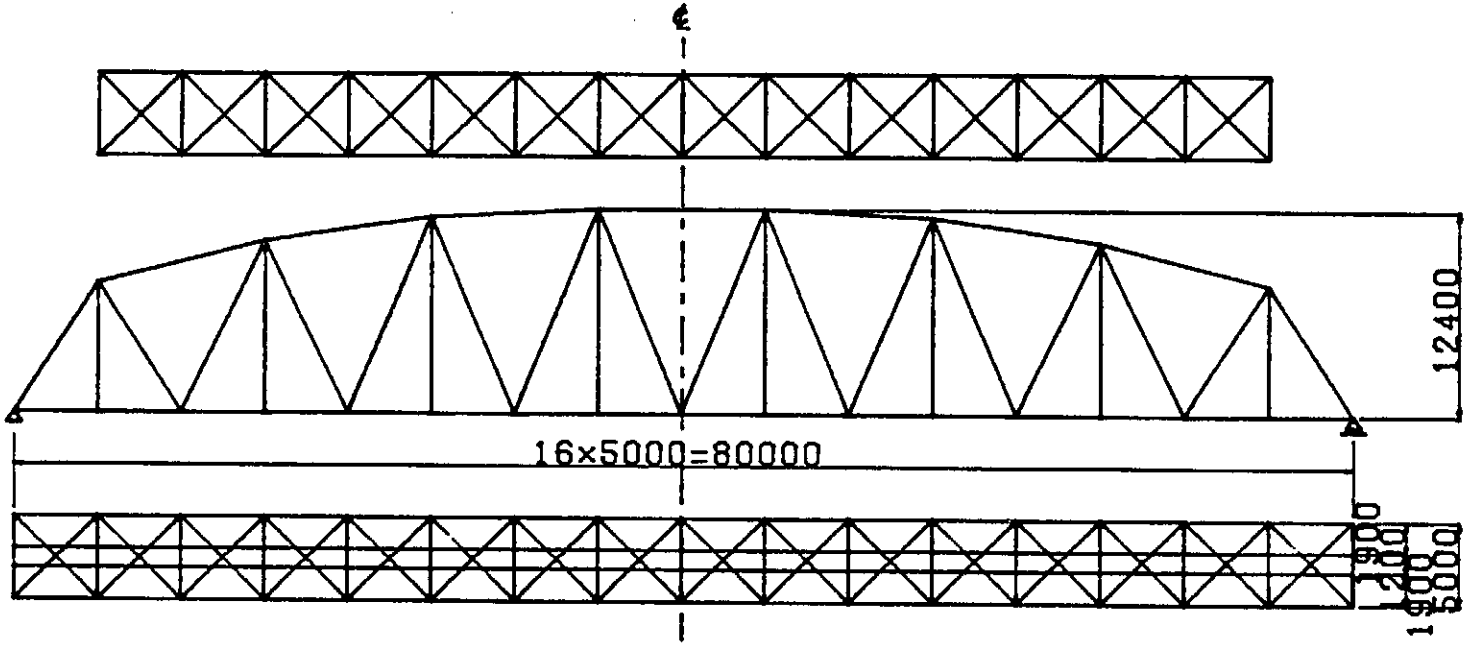
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. NE- 22

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
NE-Line	18	479+741	Lam Chi	80.0m	TT	Dayde'	1925	4548.	Original Drawing

Outline:



Scale 1 in 450
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Diagonal members, lacing bars of diagonals, and web plates of lower chords are deformed. * Tie plates are not sufficient. * Some rivets have been already replaced.	* Web plates are partially corroded. * Corroded portions are covered by asphalt mortar with bitumen. * Some lower flanges are deformed.	* Many rivets for connection are loose.	* Shoes have no anchor bolts.

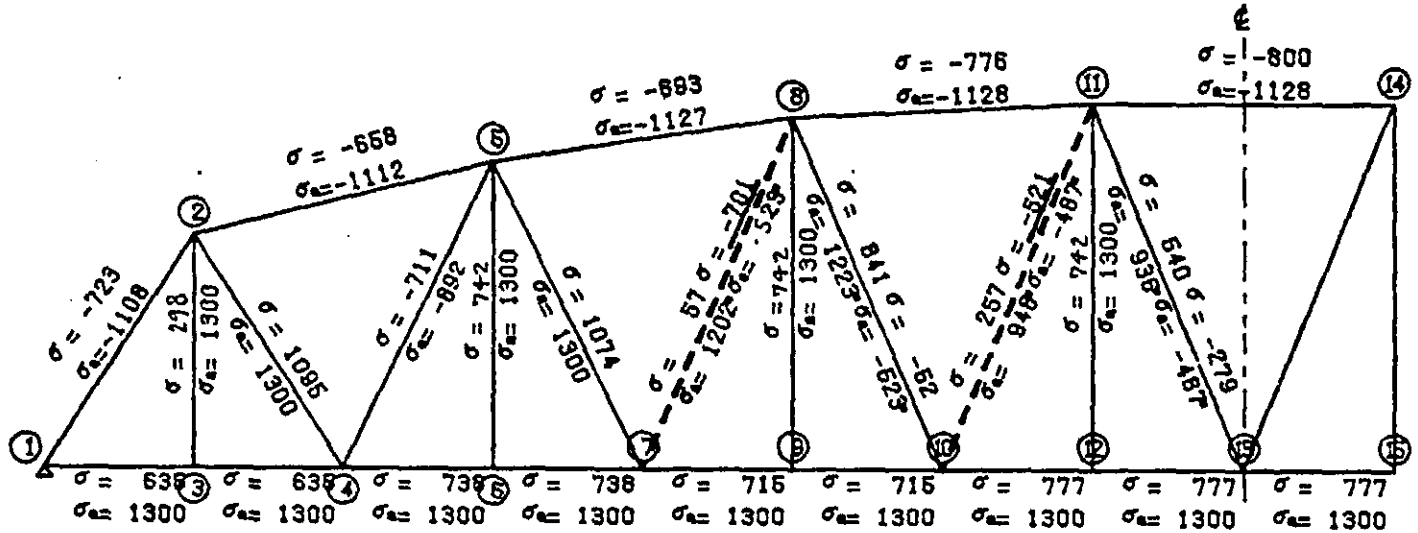
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. NE- 22

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
NE-Line	18	479+741	Lam Chi	80.0m	TT	Dayde'	1925	4548.	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses - Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	259	897	800	1760
L	3- 4	0	0	0	0
L	4- 6	214	549	800	1760
L	6- 7	0	0	0	0
L	7- 9	811	2079	800	1760
L	9-10	0	0	0	0
L	10-12	882	2259	800	1760
L	12-13	0	0	0	0
L	13-15	882	2259	800	1760
U	1- 2	456	1049	800	1760
U	2- 5	67	1726	800	1760
U	5- 8	919	2381	800	1760
U	8-11	1029	2667	800	1760
U	11-14	1061	2751	800	1760
D	2- 4	439	949	800	1760
D	4- 5	494	854	800	1760
D	5- 7	510	882	800	1760
D	7- 8	397	686	775*	1674*
D	8-10	400	691	776*	1674*
D	10-11	295	510	633*	1365*
D	11-13	256	443	570*	1230*
V	2- 3	383	663	800	1760
V	5- 6	575	994	800	1760
V	8- 9	575	994	800	1760
V	11-12	575	994	800	1760

Reaction per one Shoe = 192 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	817	1300	444	800
L	3- 4	1078	1300	553	800
L	4- 6	951	1300	488	800
U	2- 5	874	1300	483	800
U	5- 8	785	1300	661	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σc	σca	σ	σa
Stringer	937	1300	806	767	2129	1800
End Floor Beam	753	1300	646	1185	1053	1800
Int. Floor Beam	825	1300	707	1185	1152	1800

Over stressed members are underlined

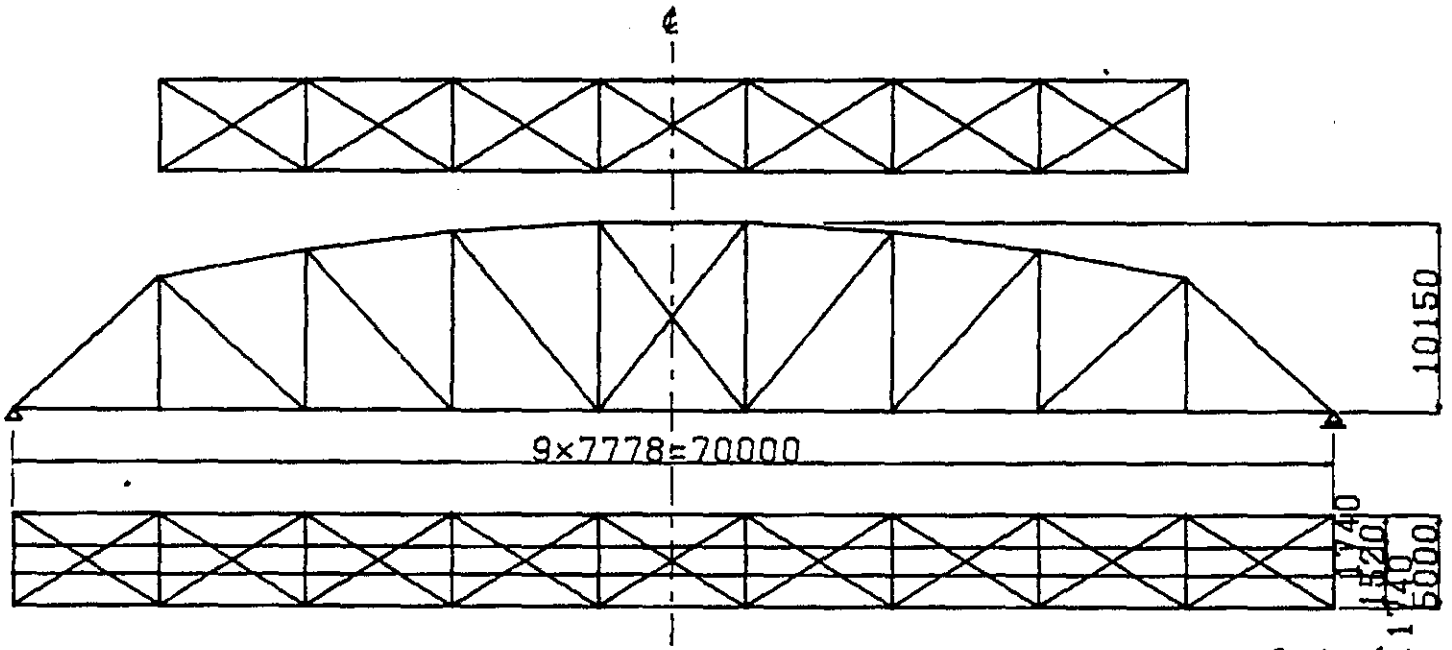
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 14

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	7	297+ 63	Hua Hin	70.0m	TT	Cleveland	1911	5815.1-4	Original Drawing

Outline:



Scale 1 in 400
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Member L7-L8 is locally deformed.	* Floor beams are locally corroded. * Web plates have been already repaired.		* Guide plates of shoes are missing.

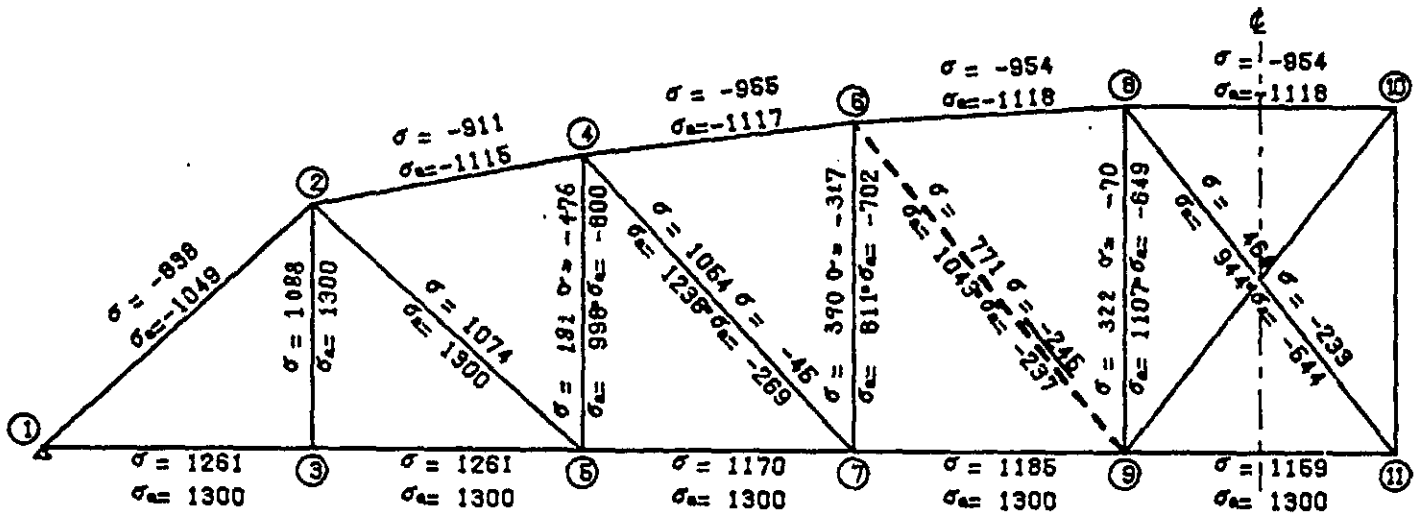
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 14

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	7	297+ 63	Hua Hin	70.0m	TT	Cleveland	1911	5815.1-4	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	443	1611	800	1760
L	3- 5	487	1772	800*	1760
L	5- 7	565	1372	800	1760
L	7- 8	394	876	800	1760
L	9-11	394	865	800	1760
U	2- 4	374	1246	800	1760
U	4- 6	420	1393	800	1760
U	6- 8	424	1411	800	1760
U	8-10	414	1350	800	1760
U	1- 2	363	1146	800	1760
D	2- 5	503	1097	800	1760
D	4- 7	501	911	786*	1696*
D	6- 9	412	749	634*	1367*
D	8-11	274	499	544*	1174*
D	9-10	274	499	544*	1174*
V	2- 3	627	1140	800	1760
V	4- 5	467	849	667*	1439*
V	6- 7	311	565	483*	1042*
V	8- 9	254	462	686*	1480*

Reaction per one Shoe = 160 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1141	1300	702	800
L	3- 5	1057	1300	936	800
L	5- 7	992	1300	726	800
U	2- 4	623	1300	391	800
U	4- 6	532	1300	334	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σo	σoa	σ	σa
Stringer	868	1300	768	769	1486	1800
End Floor Beam	840	1300	743	1178	1061	1800
Int. Floor Beam	1077	1300	952	1178	1473	1800

Over stressed members are underlined

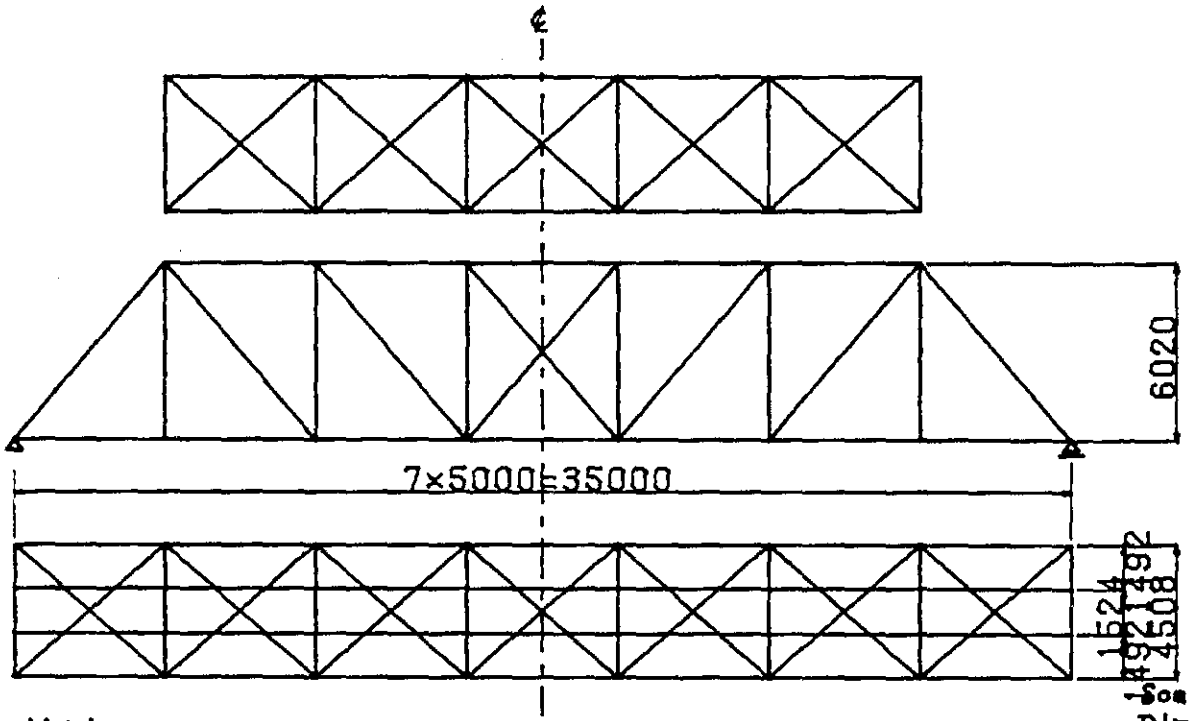
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 27

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	18	403+257	Chumphon	35.0m	TT	Cleveland	1915	CLEVELAND 963 INCOMP	Original Drawing

Outline:



Scale 1 in 250
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Main truss is supported by old rail stagings.	* Floor beams are locally corroded.	* Rivets for connection stringer and floor beam are loose. * All connection rivets of struts are loose. * Flange plates are corroded under sleepers. * Excessive stress due to corrosion exists in upper flanges.	* Shoe rollers are misaligned by about 60mm.

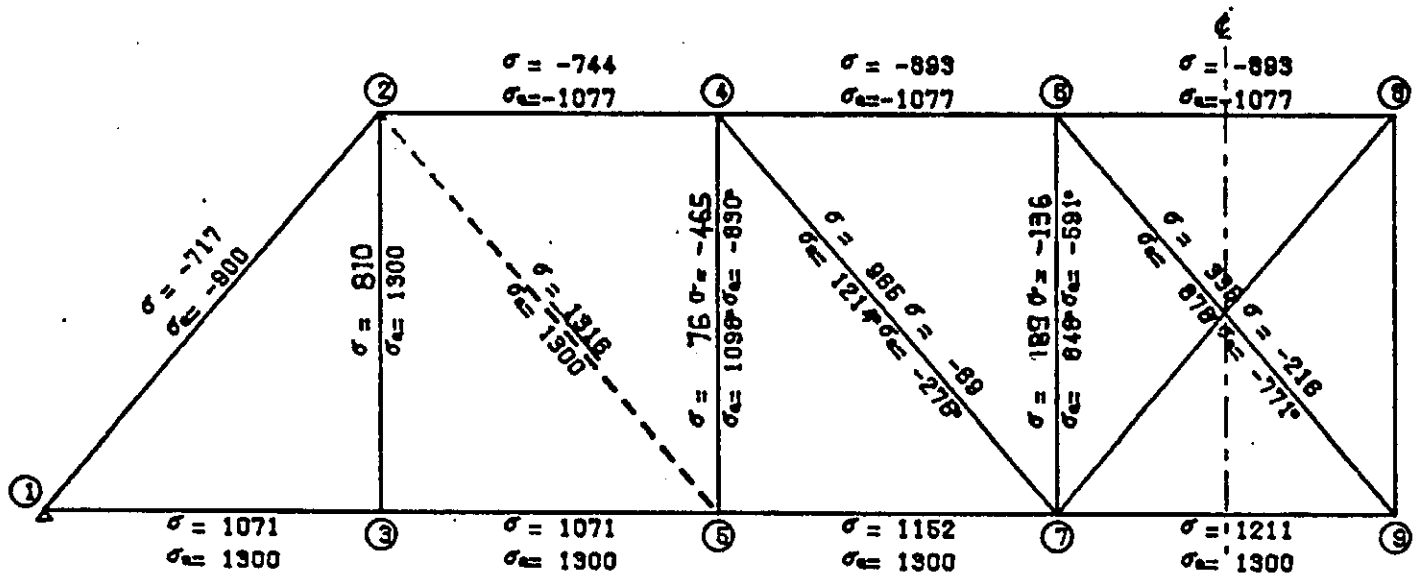
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 27

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	18	403+257	Chumphon	35.0m	TT	Cleveland	1915	CLEVELAND 963 INCOMP	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses - Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	350	813	800	1760
L	3- 5	322	875	800	1760
L	5- 7	466	1110	800	1760
L	7- 9	0	0	0	0
U	2- 4	390	878	800	1760
U	4- 6	0	0	0	0
U	6- 8	448	1500	800	1760
U	1- 2	303	727	800	1760
D	2- 5	619	1125	800	1760
D	4- 7	439	799	762*	1643*
D	6- 9	233	423	486*	1045*
V	2- 3	666	1212	800	1760
V	4- 5	376	684	728*	1572*
V	6- 7	302	548	484*	1045*

Reaction per one Shoe = 89 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1362	1300	717	800
L	3- 5	1177	1300	681	800
L	5- 7	913	1300	657	800
U	2- 4	608	1300	365	800
U	4- 6	470	1300	338	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σo	σca	σ	σa
Stringer	934	1300	934	857	720	800
End Floor Beam	1118	1300	1002	1183	1892	1800
Int. Floor Beam	1097	1300	997	1183	1813	1800

Over stressed members are underlined

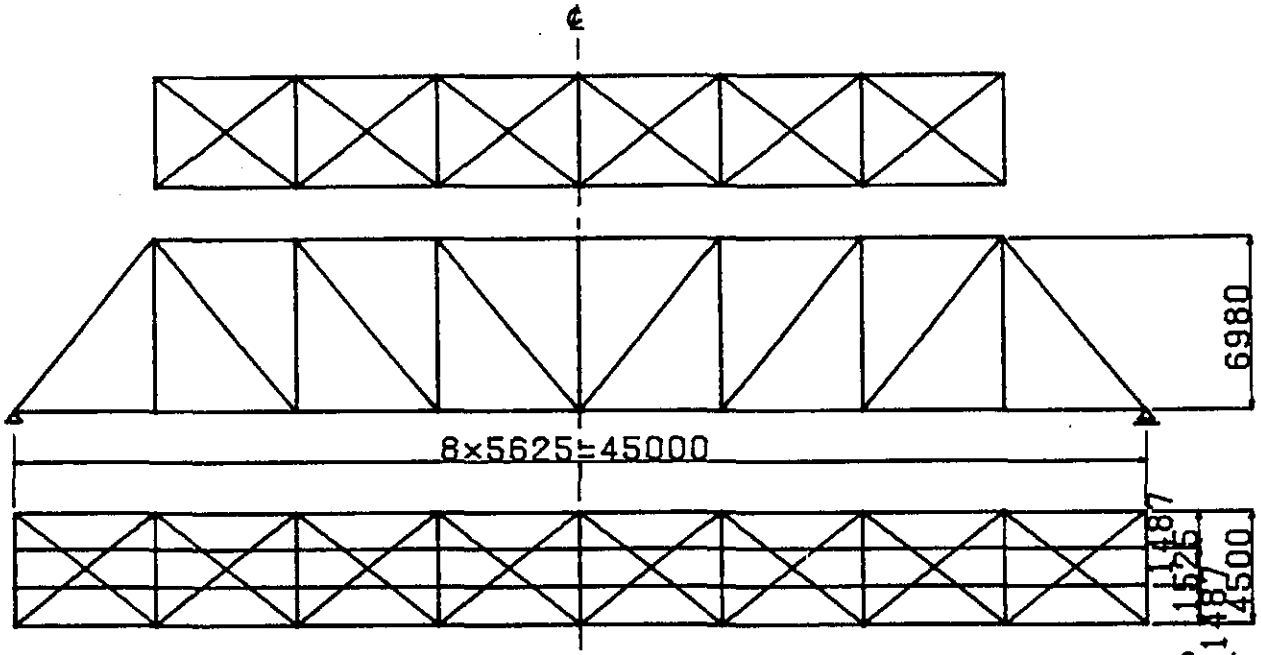
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 44

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	34	672+874	Thung Song	45.0m	TT	Cleveland	1920	138 INCOMPLETE	Original Drawing

Outline:



Scale 1 in 300
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
	* Web plates are provided with protective cover plates. * Lower flanges are excessively corroded. * Excessive stress exists due to corrosion in end floor beams.		* Sidewalk is provided * Sway bracings are already replaced.

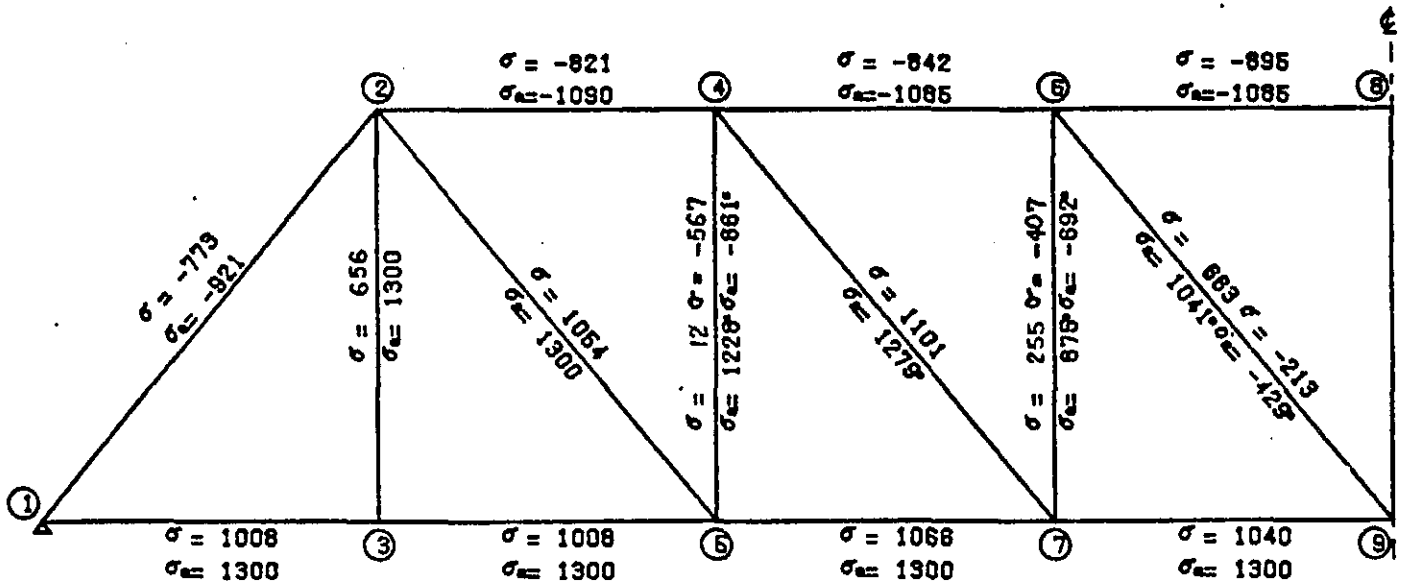
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 44

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	34	672+874	Thung Song	45.0m	TT	Cleveland	1920	138 INCOMPLETE	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses - Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	392	712	800	1760
L	3- 5	294	1005	800	1760
L	5- 7	482	951	800	1760
L	7- 9	443	743	800	1760
U	2- 4	257	827	800	1760
U	4- 6	332	860	800	1760
U	6- 8	403	1002	800	1760
U	1- 2	275	851	800	1760
D	2- 5	523	952	800	1760
D	4- 7	496	902	800	1760
D	6- 9	341	621	626*	1351*
V	2- 3	700	1273	800	1760
V	4- 5	519	944	791*	1706*
V	6- 7	358	651	609*	1314
V	8- 9	0	0	800	1760

Reaction per one Shoe = 106 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1504	1300	501	800
L	3- 5	1320	1300	506	800
L	5- 7	1072	1300	670	800
U	2- 4	509	1300	509	800
U	4- 6	491	1300	491	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σo	σoa	σ	σa
Stringer	1143	1300	1017	975	2350	1800
End Floor Beam	1203	1300	1086	1184	1682	1800
Int. Floor Beam	904	1300	817	1184	1323	1800

Over stressed members are underlined

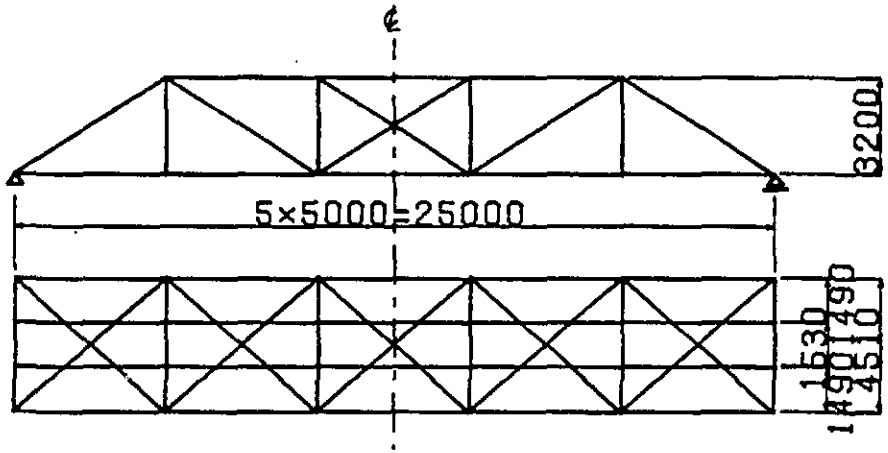
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 57

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	46	897+174	Hat Yai	25.0m	TT	Cleveland	1920	959 INCOMPLETE	Original Drawing

Outline:



Scale 1 in 250
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Rivets of some diagonal members are loose. * Tie plates of end posts are locally deformed. * Lower chords are locally corroded in the neighborhood of gusset plates.	* Lower flanges are locally corroded near gusset plates. * Corroded portions of web plate were patched, but corrosion is in progress again there.	* Connection rivets of struts are loose.	* Most of rivets for connection with hangers are loose. * Wedge-shaped steel plates remain under the shoes.

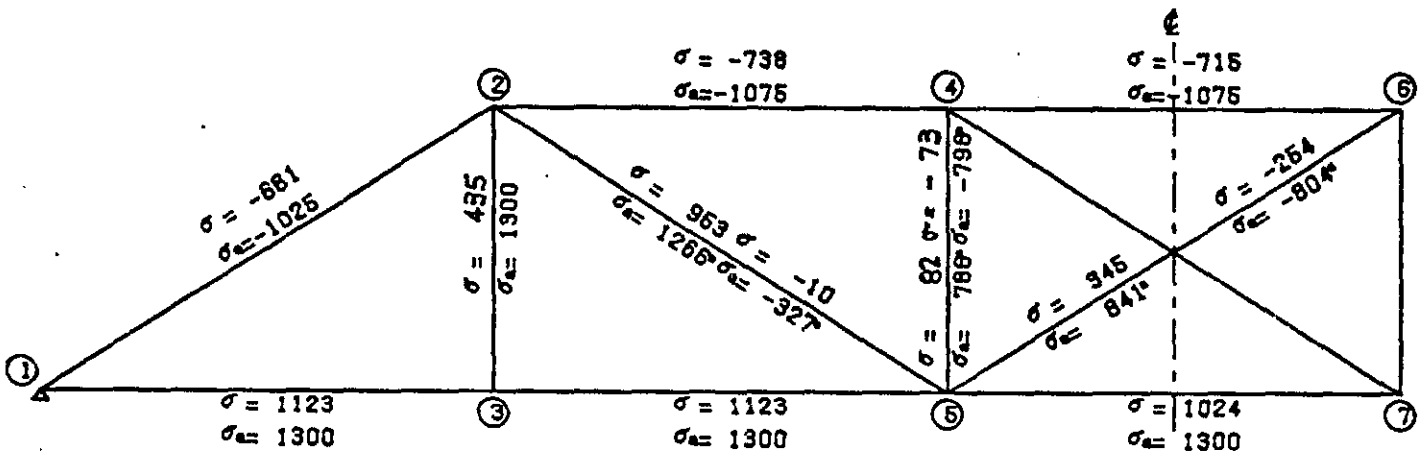
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 57

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	46	897+174	Hat Yai	25.0m	TT	Cleveland	1920	959 INCOMPLETE	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	235	582	800	1760
L	3- 5	0	0	0	0
L	5- 7	597	1017	800	1760
U	2- 4	439	976	800	1760
U	4- 6	419	1141	800	1760
U	1- 2	727	989	800	1760
D	2- 5	468	850	800	1742*
D	5- 6	179	279	481*	1037*
D	4- 7	179	279	481*	1037*
V	2- 3	395	718	800	1760
V	4- 5	199	362	481*	1037*

Reaction per one Shoe = 72 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1421	1300	947	800
L	3- 5	948	1300	632	800
L	5- 7	553	1300	369	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σc	σca	σ	σa
Stringer	1049	1300	1049	712	863	800
End Floor Beam	1262	1300	1147	1184	515	800
Int. Floor Beam	1102	1300	1012	1188	2033	1800

Over stressed members are underlined

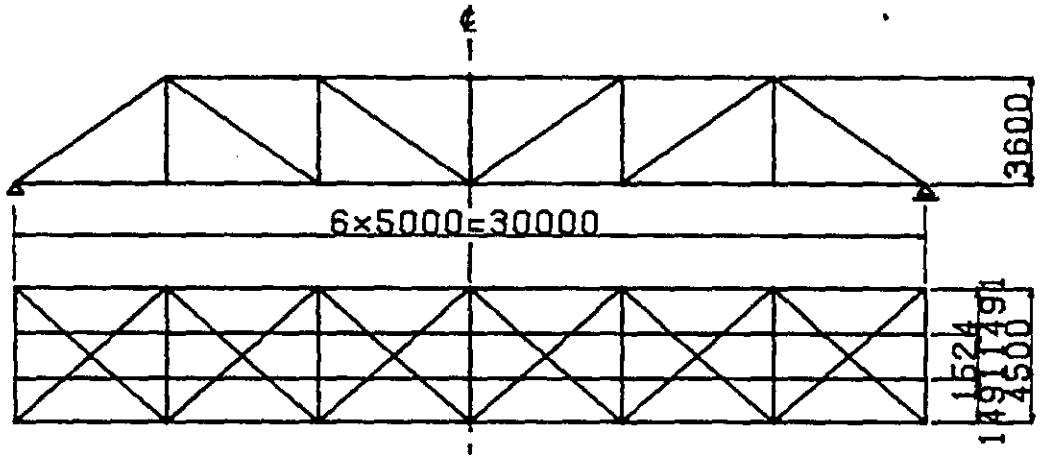
a = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 62

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	51	929+903	Hat Yai	30.0m	TT	Cleveland	1920	178 A.B.C INCOMPLETE	Original Drawing

Outline:



Scale 1 in 250
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
	* Web plates of floor beams were already repaired, but the patch plates have been corroded again. * Repair for the corroded portions is desired.	* Most of connection rivets are loose. * Excessive stress due to corrosion exists in upper flanges.	* Lateral bracings are locally corroded. * Floor system should be repaired urgently.

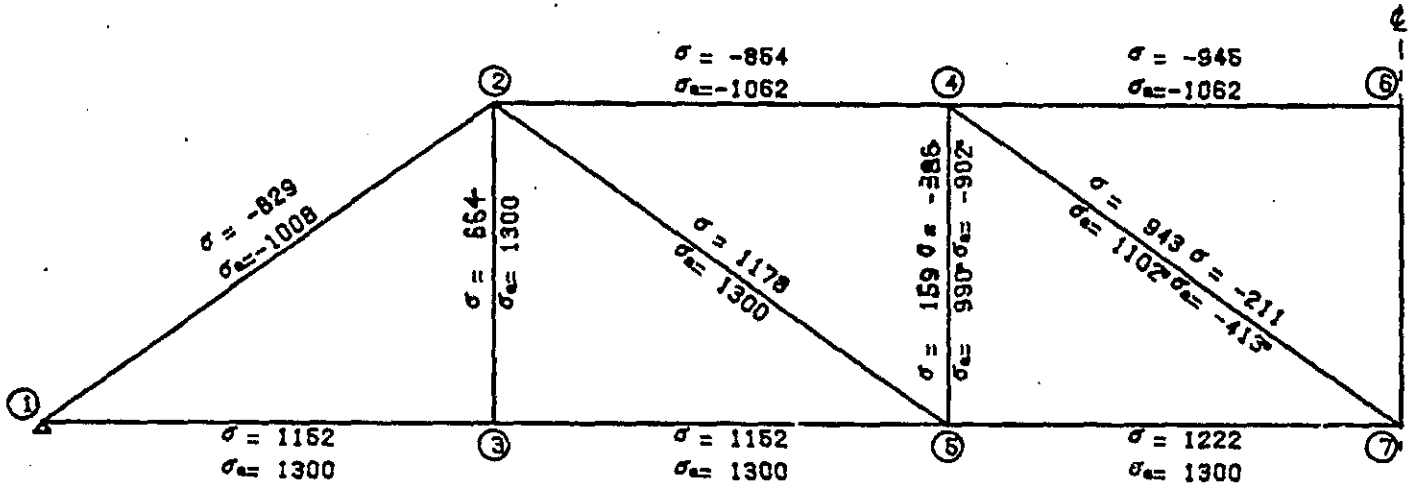
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 62

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	51	929+903	Hat Yai	30.0m	TT	Cleveland	1920	178 A.B.C INCOMPLETE	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	692	942	800	1760
L	3- 5	560	1602	800	1760
L	5- 7	0	0	0	0
U	2- 4	431	993	800	1760
U	4- 6	555	1566	800	1760
U	1- 2	617	1171	800	1760
D	2- 5	611	951	800	1760
D	4- 7	416	757	664*	1431*
V	2- 3	446	811	800	1760
V	4- 5	250	454	668*	1419*
V	6- 7	0	0	800	1760

Reaction per one Shoe = 80 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1226	1300	806	800
L	3- 5	1055	1300	776	800
L	5- 7	672	1300	519	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σc	σca	σ	σa
Stringer	1127	1300	1010	1020	2612	1800
End Floor Beam	999	1300	908	1183	1888	1800
Int. Floor Beam	1219	1300	1093	1183	1807	1800

Over stressed members are underlined

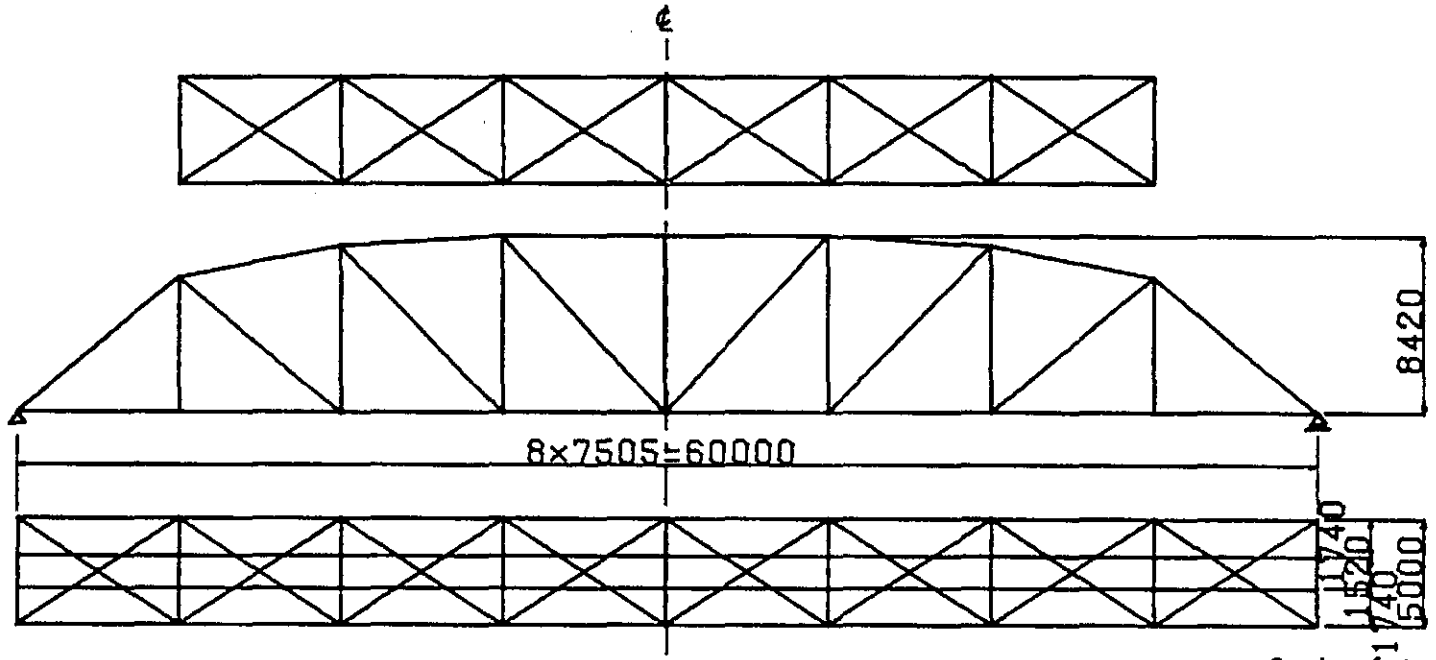
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 63

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	52	930+931	Hat Yai	60.0m	TT	Cleveland	1920		Field Drawing

Outline:



Scale 1 in 350
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
	* Web plates and lower flanges have perforated corrosion. * Excessive stress due to corrosion exists in flange and web plates.	* Many rivets in struts of stringer are loose. * Flange plates under sleepers are corroded. * Excessive stress due to corrosion exists in upper flanges.	* Rivets at many intersection points between lower laterals are loose.

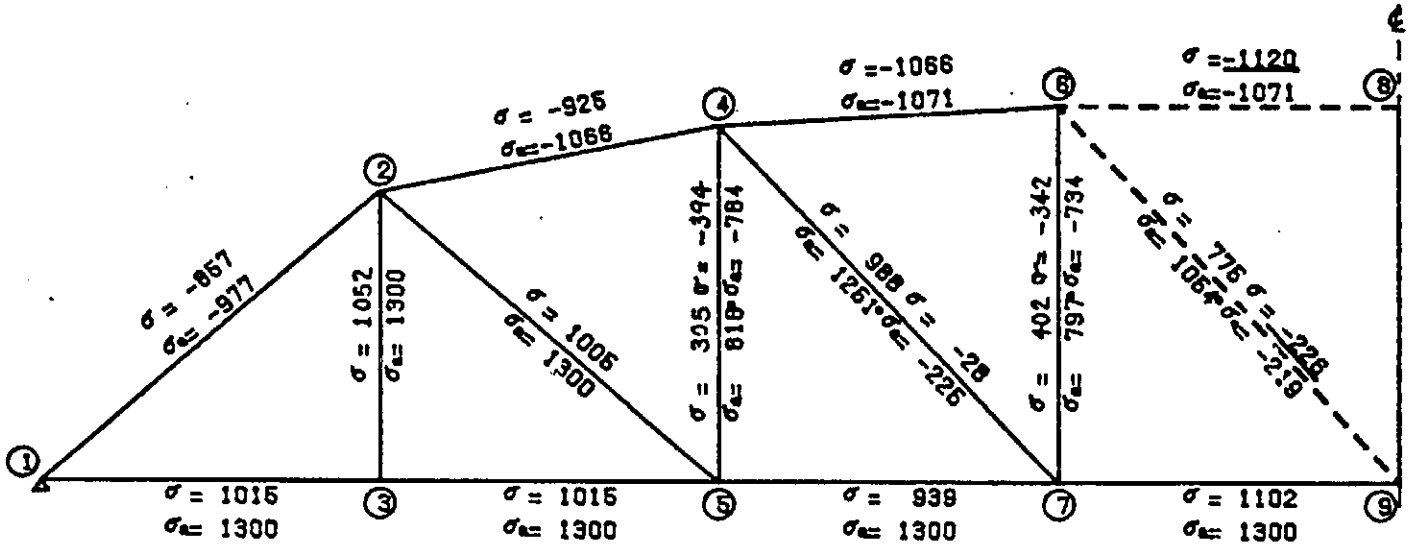
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 63

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	52	930+931	Hat Yai	60.0m	TT	Cleveland	1920		Field Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	459	1304	800	1760
L	3- 5	459	1126	800	1760
L	5- 7	0	0	0	0
L	7- 9	0	0	0	0
U	1- 2	391	966	800	1760
U	2- 4	506	1344	800	1760
U	4- 6	529	1362	800	1760
U	6- 8	577	1537	800	1760
D	2- 5	664	1044	800	1760
D	4- 7	562	882	795*	1716*
D	6- 8	457	830	642*	1384*
V	2- 3	841	1530	800	1760
V	4- 5	309	562	569*	1227*
V	6- 7	269	489	500*	1078*
V	8- 9	0	0	800	1760

Reaction per one Shoe = 140 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1297	1300	868	800
L	3- 5	1003	1300	787	800
L	5- 7	1265	1300	882	800
U	1- 2	884	1300	811	800
U	2- 4	783	1300	718	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σc	σca	σ	σa
Stringer	1122	1300	998	749	576	800
End Floor Beam	907	1300	814	1176	336	800
Int. Floor Beam	1144	1300	1026	1176	424	800

Over stressed members are underlined

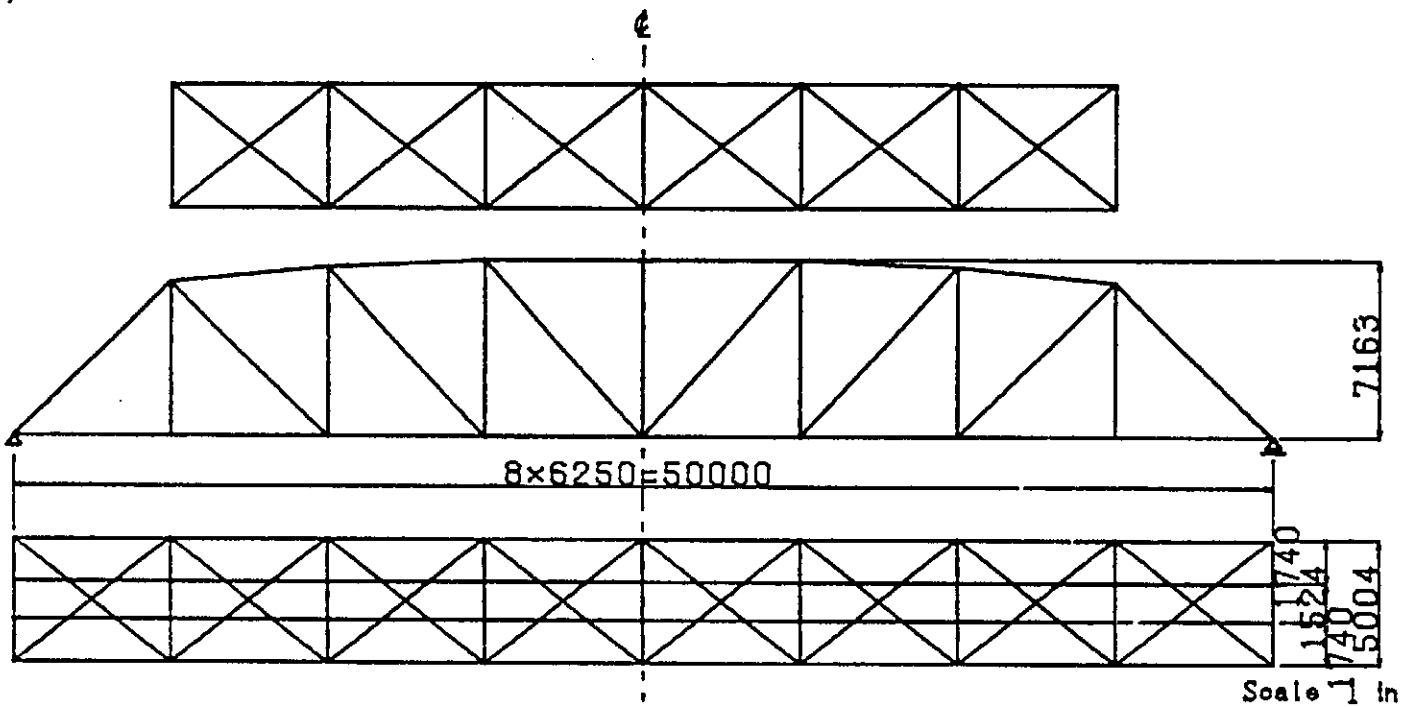
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S - 93

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	75	1063+810	Yala	50.0m	TT	Cleveland	1920	Cleveland 190.A-C	Original Drawing

Outline:



Scale 1 in 300
Dimensions are in millimeters

Observed Conditions:

Main Trusses	Floor Beams	Stringers	Others
* Connection rivets of diagonal members are loose.	* Upper flanges, lower flanges and web plates are slightly corroded. * Excessive stress due to corrosion exists in flange plates.	* Flange plates are corroded under sleepers. * Most of the connection rivets of struts are loose. * Excessive stress due to corrosion exists in upper flange plates.	* Lower side of portal frame is locally corroded. * Shoe rollers are misaligned. * All connection rivets of hangers are loose.

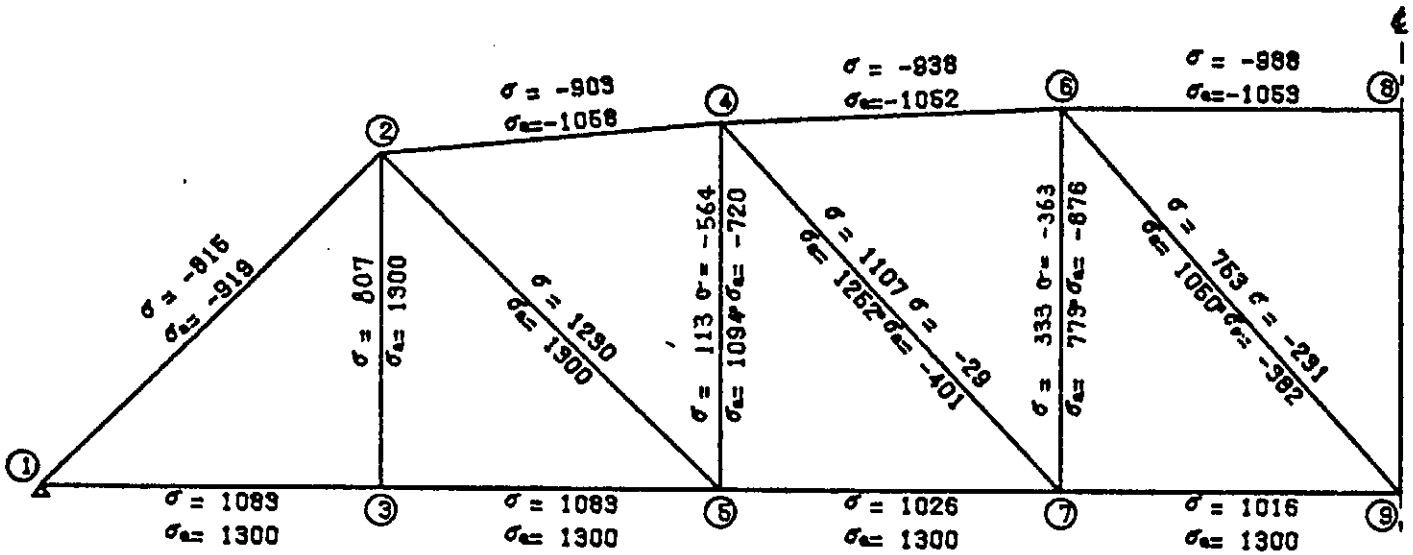
R.S.R. BRIDGE SURVEY SUMMARY SHEET - 2

Span No. S - 93

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	75	1063+810	Yale	50.0m	TT	Cleveland	1920	Cleveland 190.A-C	Original Drawing

Summary of Stresses due to DL 14 Loading, in Kg/cm²

Main Trusses - Members



Main Trusses- Rivets

Member		σ		σa	
		Shear	Bear	Shear	Bear
L	1- 3	410	1234	800	1760
L	3- 5	410	1234	800	1760
L	5- 7	568	1074	800	1760
L	7- 9	444	627	800	1760
U	1- 2	464	924	800	1760
U	2- 4	447	1158	800	1760
U	4- 6	461	1034	800	1760
U	6- 8	509	1092	800	1760
D	2- 5	577	785	800	1760
D	4- 7	570	1036	796*	1718*
D	6- 9	493	897	633*	1365*
V	2- 3	753	1370	800	1760
V	4- 5	455	828	713*	1538*
V	6- 7	292	531	521*	1124*
V	8- 9	0	0	800	1760

Reaction per one Shoe = 120 ton

Lateral Bracings

Member		Flanges		Rivets	
		σ	σa	σ	σa
L	1- 3	1332	1300	800	800
L	3- 5	1089	1300	751	800
L	5- 7	1132	1300	707	800
U	1- 2	520	1300	456	800
U	2- 4	407	1300	357	800

Floor Systems

Member	Flanges				Rivets	
	σt	σta	σo	σoa	σ	σa
Stringer	1073	1300	969	920	2416	1800
End Floor Beam	1156	1300	1009	1178	357	800
Int. Floor Beam	1120	1300	1012	1178	397	800

Over stressed members are underlined

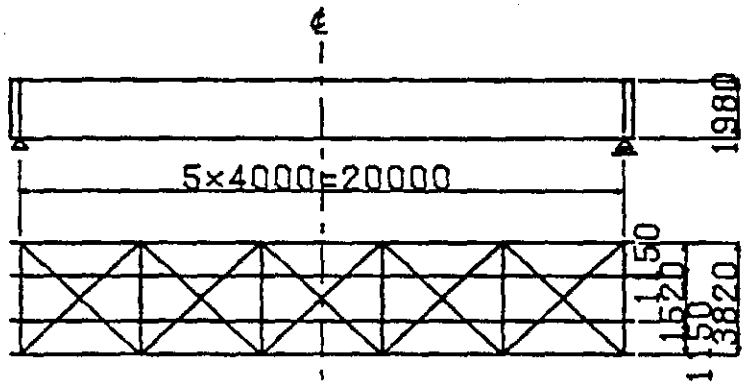
* = Allowable stress due to fatigue

R.S.R. BRIDGE SURVEY SUMMARY SHEET - 1

Span No. S -106

Line	No	Km	District	Span	Type	Manufacture	Year	Drawing Nos.	Remarks
S -Line	82	1122+255	Yale	20.0m	TP	Cleveland	1920	5742.	Original Drawing

Outline:



Scale 1 in 250
Dimensions are in millimeters

Summary of Stresses due to DL - 14 Loading, in Kg/cm²

Main Members

Member	Flanges				Rivets	
	σ_t	σ_{ta}	σ_o	σ_{oa}	σ	σ_a
Main Girder	1158	1300	1063	1119	0	0
Stringer	926	1300	801	1023	784	800
End Floor Beam	967	1300	854	1183	471	800
Int. Floor Beam	1045	1300	923	1123	509	800

Lateral Bracings

Member	Flanges		Rivets	
	σ	σ_a	σ	σ_a
End Lateral	1217	1300	837	800
Int. Lateral	824	1300	567	800

Reaction per one Shoe = 65 ton

Over stressed members are underlined

a = Allowable stress due to fatigue

Observed Conditions:

Main Gliders	Floor Beams	Stringers	Others
* Main girder is supported by sleeper stagings.	* Floor beams are corroded seriously on the right side.	* Rivets are loose at struts of stringer. * Connection rivets of end stringers are loose.	* Some connection rivets of lateral bracings are loose.

付　録　Ⅶ

補修・補強工事のための標準設計図

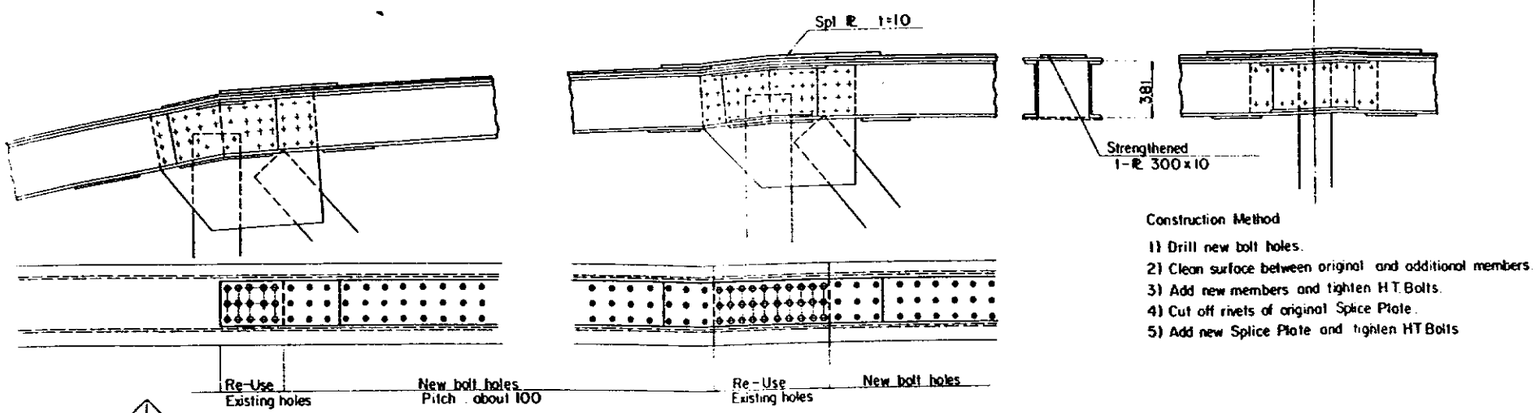
ま　え　が　き

ここに収録する図面は現地調査、応力解析を基に作成した補修・補強工事の標準設計図である。

改良されるべき部材の種類及びその改良方法は決して1つにとどまらず、種々のものがあるがここでは本文Ⅵ章で述べる改良方法を基に1つの方法を示すものである。

STRENGTHENING OF UPPER CHORD MEMBERS S=1/20

CLEVELAND TYPE (L=60m)

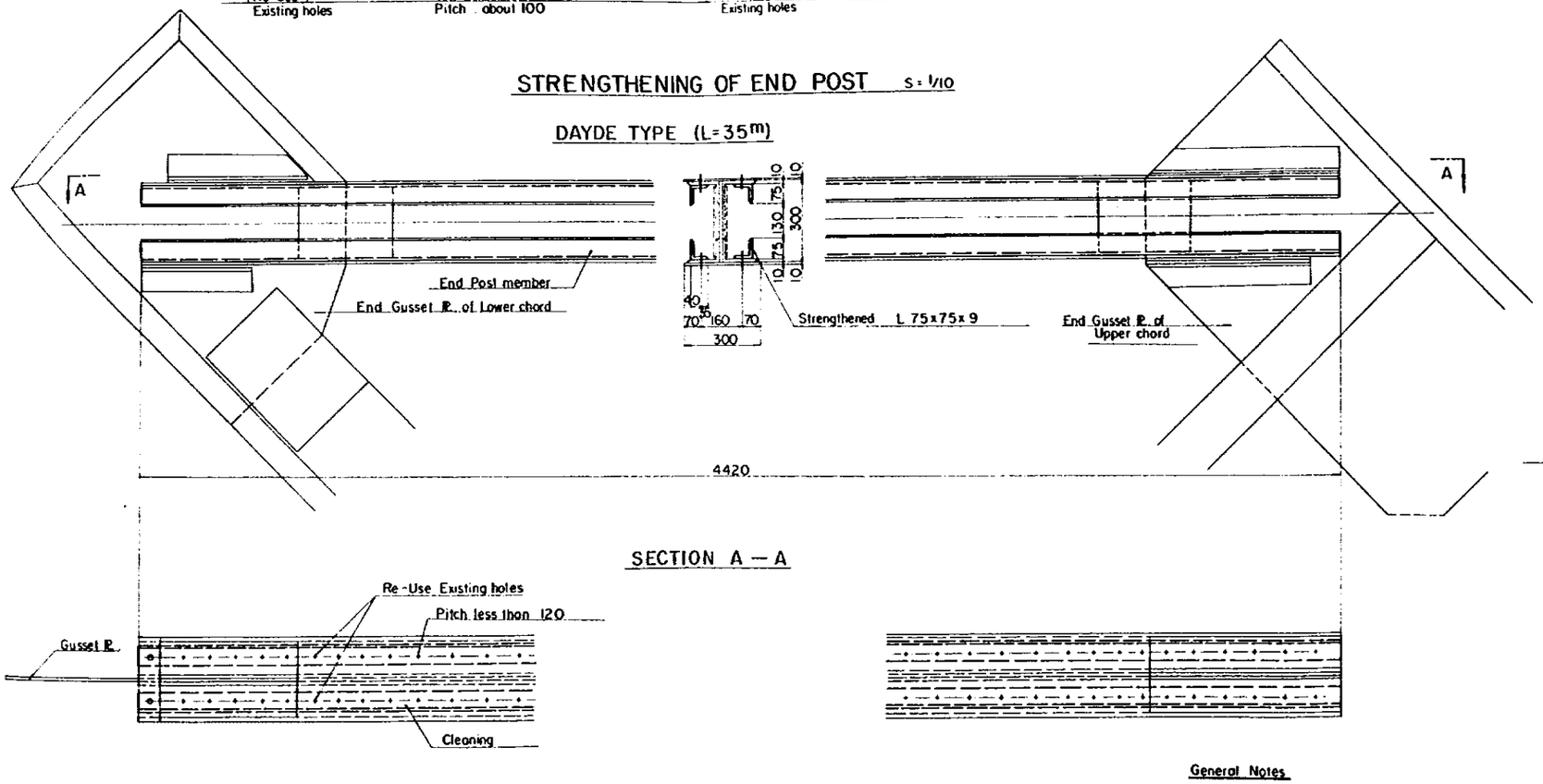


Construction Method

1) Drill new bolt holes.
2) Clean surface between original and additional members.
3) Add new members and tighten H.T.Bolts.
4) Cut off rivets of original Splice Plate.
5) Add new Splice Plate and tighten HT.Bolts

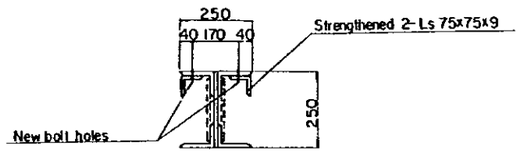
STRENGTHENING OF END POST S=1/10

DAYDE TYPE (L=35m)

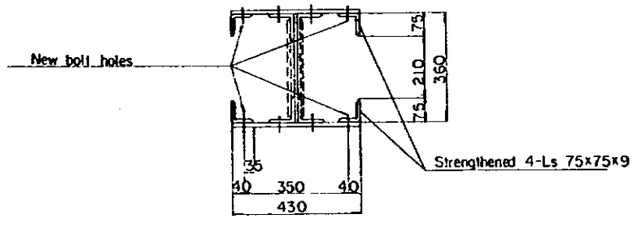


SECTION A — A

DAYDE TYPE (L=25m)

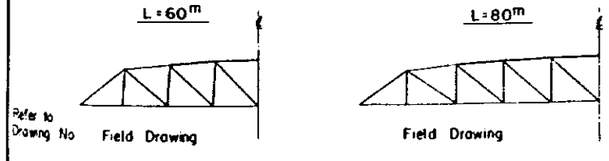


DAYDE TYPE (L=50m)

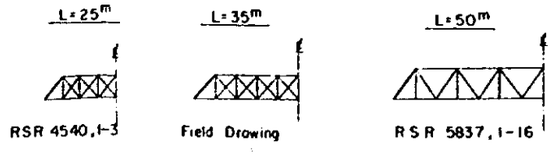


MARKING DIAGRAMS

CLEVELAND TYPE



DAYDE TYPE



General Notes

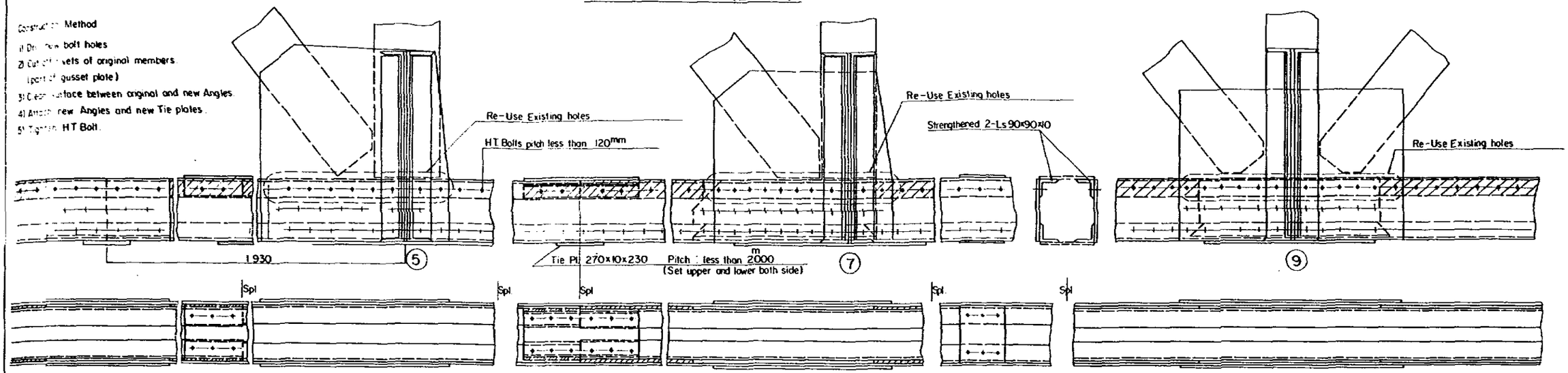
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strenght bolts (HTB) are M22 (ϕ)(F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All rivets are 22ϕ(ϕ), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent.
4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF UPPER CHORD MEMBERS	DL 15 loading	
		Unit mm	Scale 1/20
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF LOWER CHORD S = 1/10

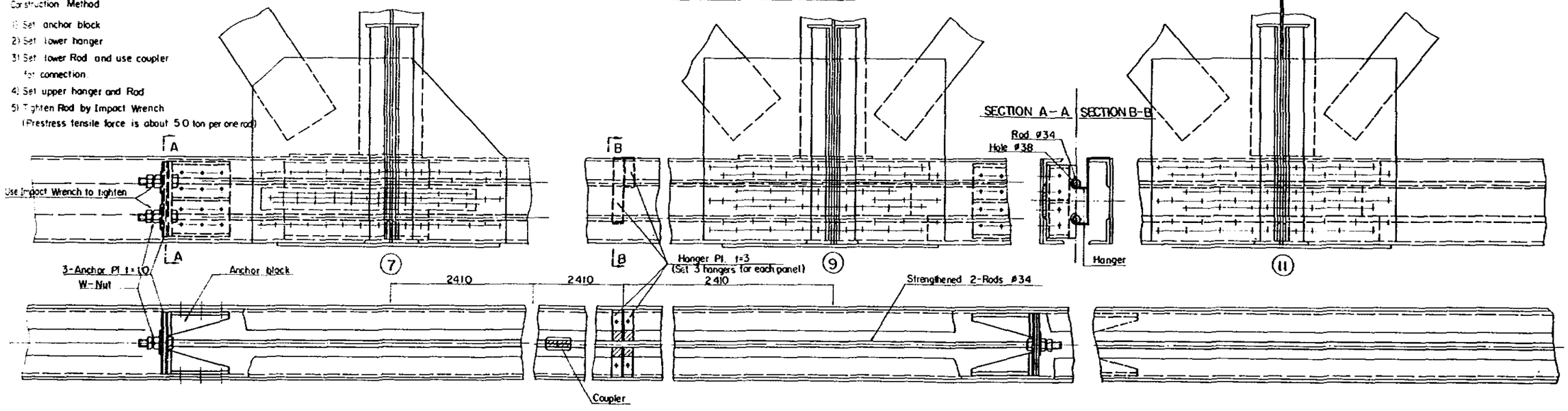
CLEVELAND TYPE (L=48m)

Construction Method
1) Drill new bolt holes
2) Cut off rivets of original members (part of gusset plate)
3) Clean surface between original and new Angles
4) Attach new Angles and new Tie plates
5) Tighten HT Bolt



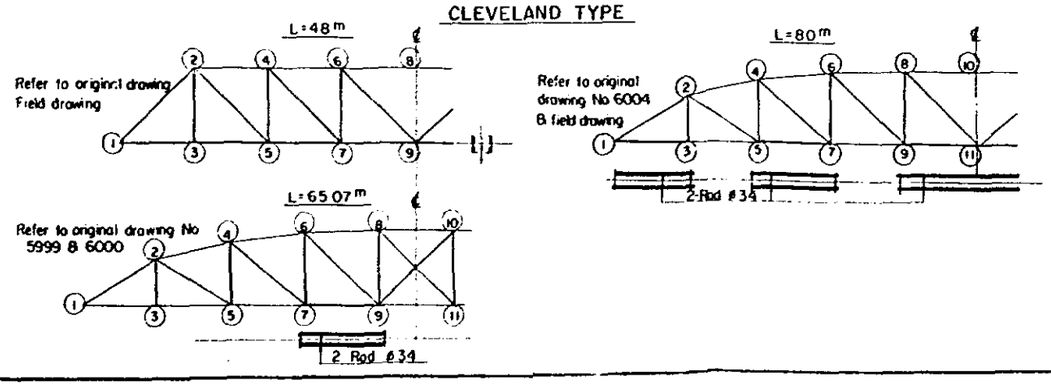
CLEVELAND TYPE (L=65.07m, 80m)

Construction Method
1) Set anchor block
2) Set lower hanger
3) Set lower Rod and use coupler for connection
4) Set upper hanger and Rod
5) Tighten Rod by Impact Wrench (Prestress tensile force is about 5.0 ton per one rod)



MARKING DIAGRAMS

CLEVELAND TYPE



General Notes :

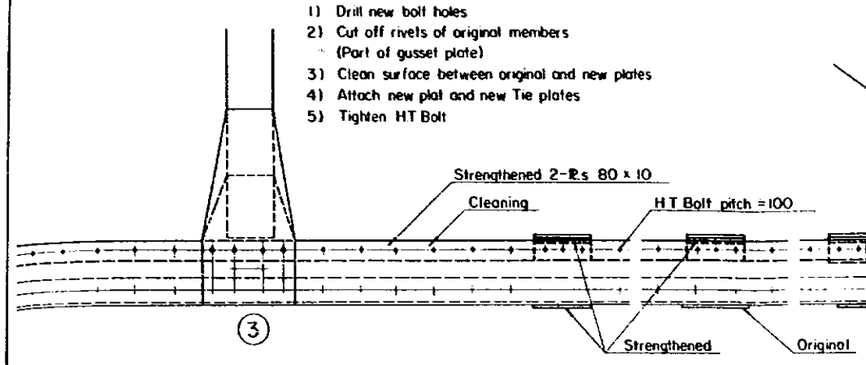
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent
2) All high-strength bolts (HTB) are M22 (ϕ) (F10T), and assumed frictional coefficient of contact surface as follows
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All rivets are 22ø (ϕ), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent.
4) All dimensions to be checked in the field.

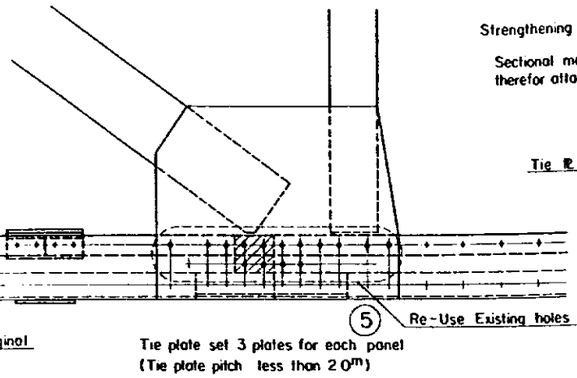
THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF LOWER CHORD	DL 15 loading	
		Unit mm	Scale 1/10
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO	

STRENGTHENING OF LOWER CHORD

CLEVELAND TYPE (L = 40m) S=1/12

Construction Method
1) Drill new bolt holes
2) Cut off rivets of original members (Part of gusset plate)
3) Clean surface between original and new plates
4) Attach new plat and new Tie plates
5) Tighten HT Bolt

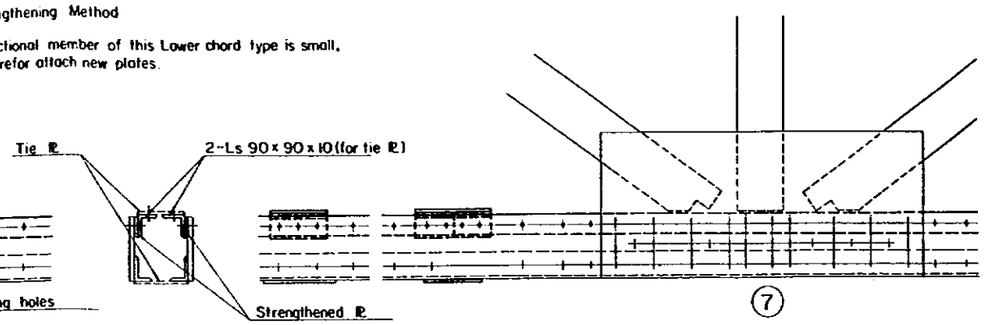


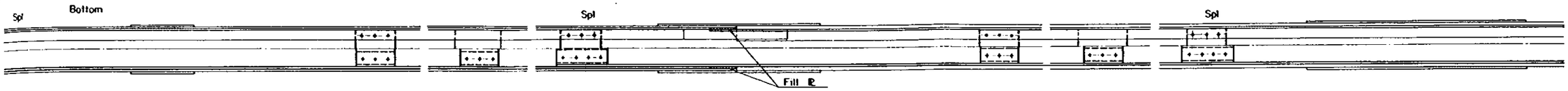


Tie plate set 3 plates for each panel
(Tie plate pitch less than 20m)

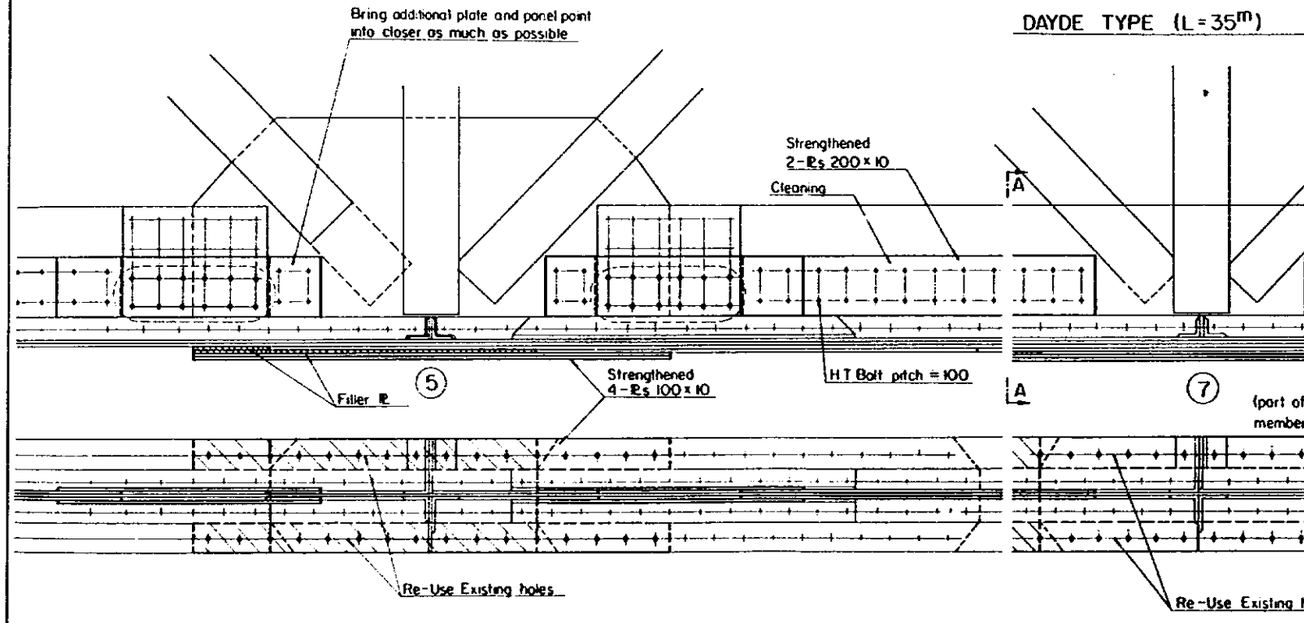
Strengthening Method

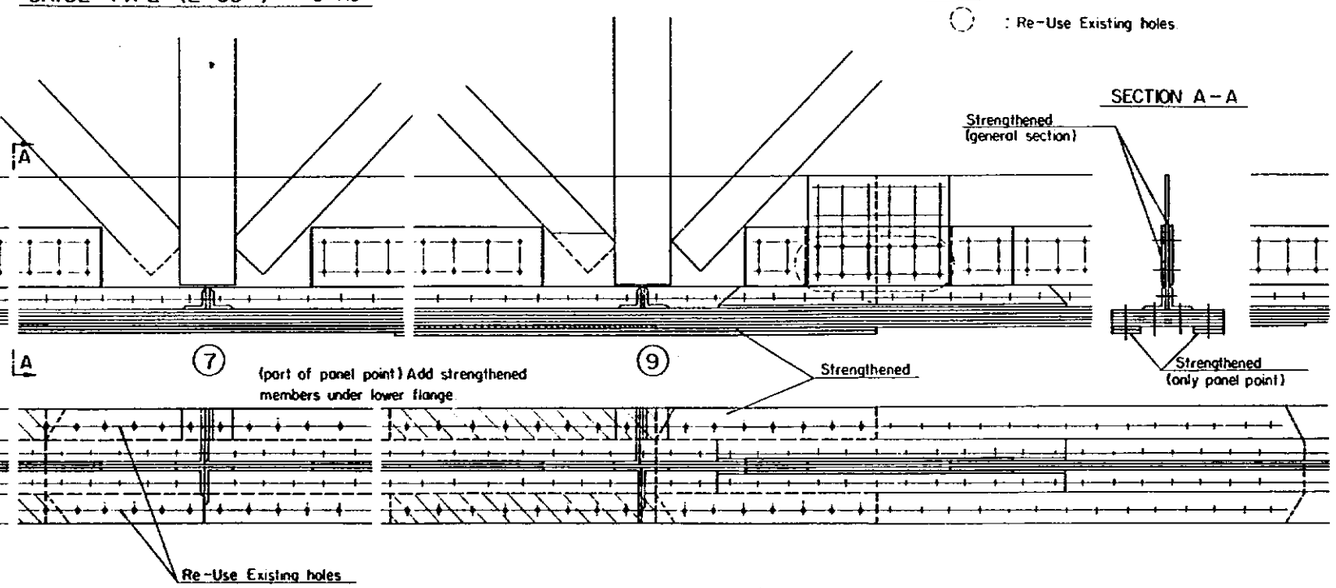
Sectional member of this Lower chord type is small, therefor attach new plates.





DAYDE TYPE (L = 35m) S=1/10



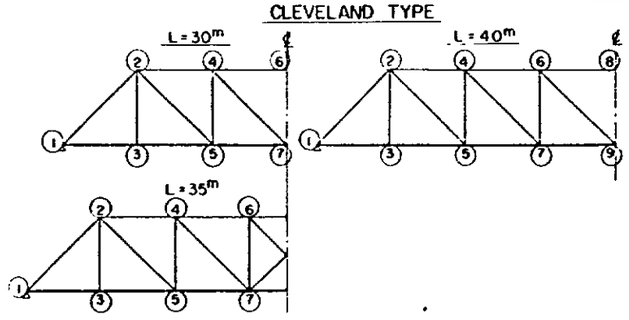


Note ;
○ : Re-Use Existing holes.

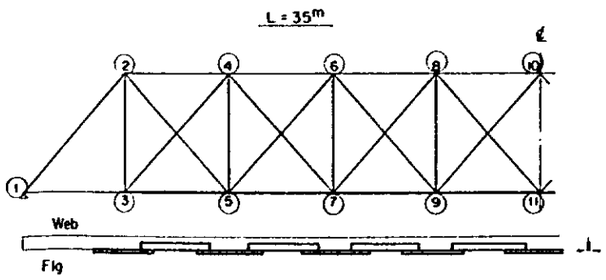
SECTION A-A

MARKING DIAGRAMS

CLEVELAND TYPE



DAYDE TYPE



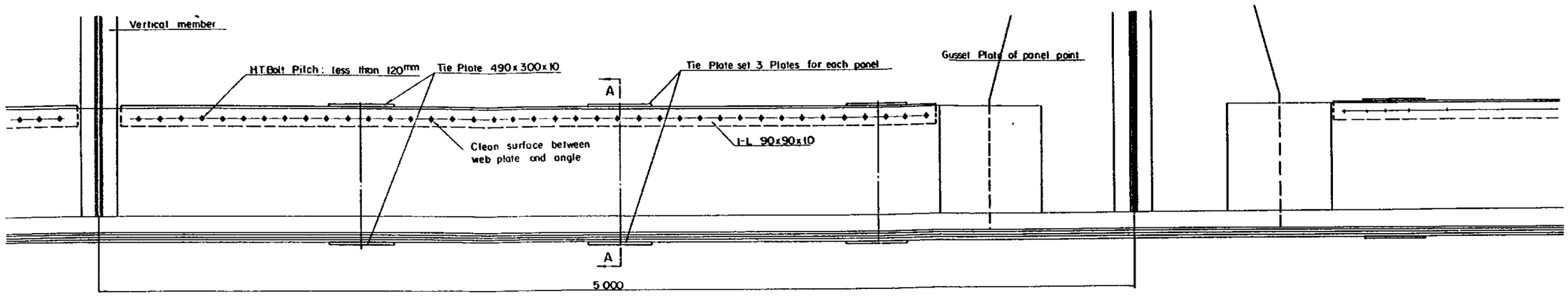
General Notes ;

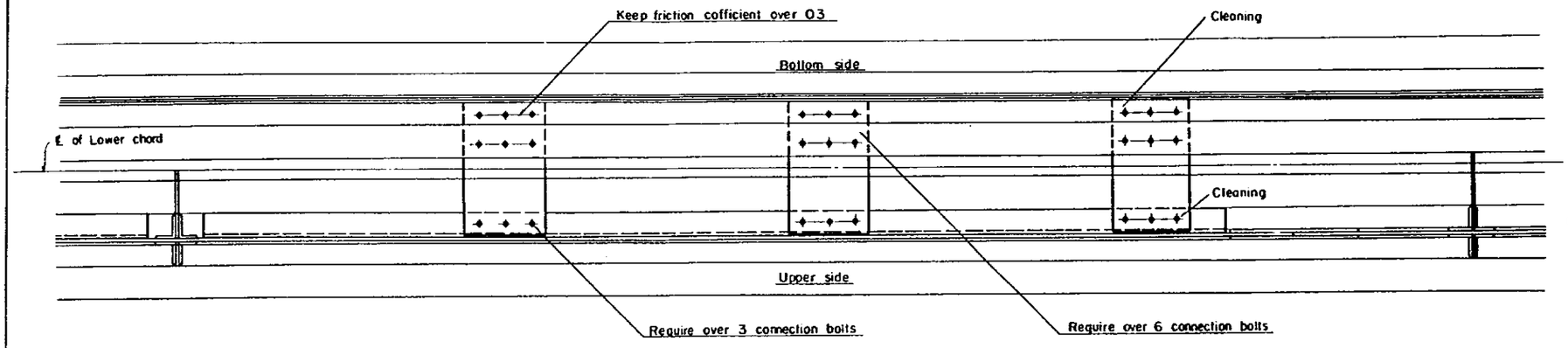
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent
2) All high-strength bolts (HTB) are M22 (φ)(F10T), and assumed frictional coefficient of contact surface as follows
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All rivets are 22φ (φ), and to be rolled steel for SV 34 (JIS G 3104) or materials of equivalent
4) All dimensions to be checked in the field

THE STATE RAILWAY OF THAILAND			
STADARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF LOWER CHORD	DL 15 loading	
		Unit	Scale
		mm	1/12 , 1/10
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

REPAIRING OF DEFORMED LOWER CHORD s = 1/10

DAYD'E TYPE (L = 80.00m)

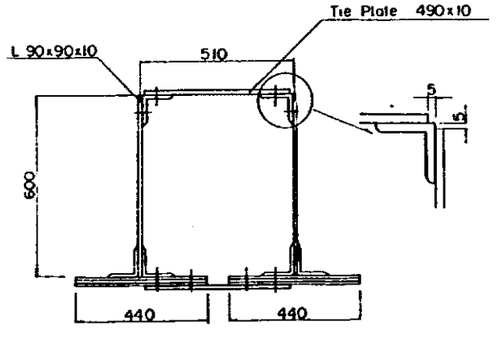




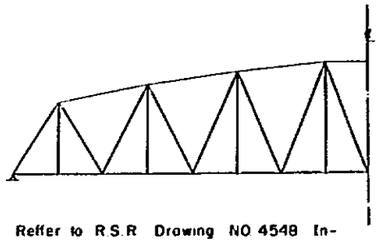
Construction Method

1) Repair the deformation of lower Chord.
2) Drill new bolt holes at web plate of Lower Chord
3) Clean surface between original and additional members.
4) Attach new angles and tie plates.
5) Tighten H.T.Bolts.

SECTION A – A



MARKING DIAGRAMS



Reffer to R.S.R Drawing NO 4548 In-Complete and Field Drawing

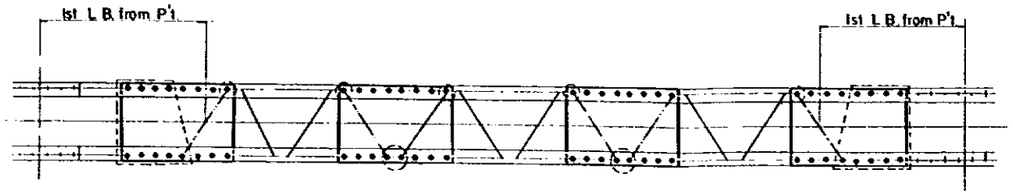
General Notes;

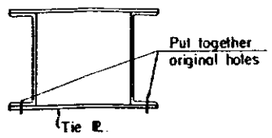
1) All materials are be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (HTB) are M22(ϕ)(F10T),and assume fictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members REPAIRING OF DEFORMED LOWER CHORD	DL. 15 loading Unit mm	Scale 1/10
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF TIE PLATE

UPPER CHORD MEMBER

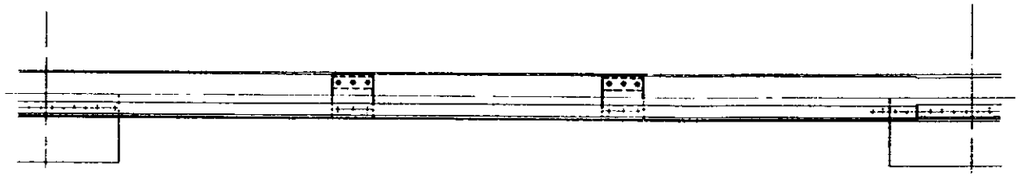


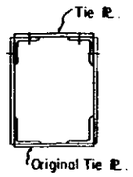


Construction Method

1) Cut off original rivetes
2) Take off original tie plates and lacing bar.
3) Drill new bolt holes.
4) Clean surface between original members and additional plates.
5) Attach new tie plate and tighten H.T.Bolts.

LOWER CHORD MEMBER

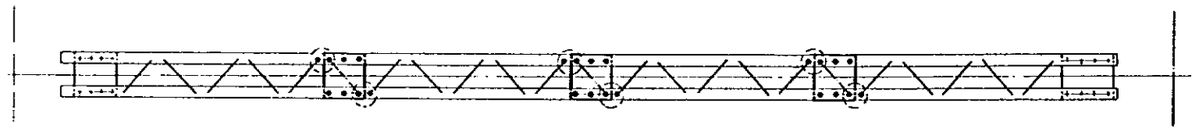


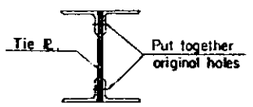


Construction Method

1) Drill new bolt holes.
2) Clean surface between original members and additional plates
3) Attach new tie plates and angles and tighten HT.Bolts.

DIAGONAL MEMBER

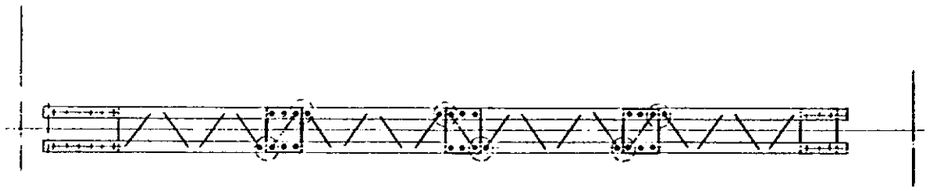


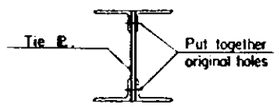


Construction Method

1) Cut off original rivets.
2) Take off original lacing bar.
3) Drill new bolt holes.
4) Clean surface between original member and additional plates.
5) Attach new tie plate and tighten HT.Bolts.

VERTICAL MEMBER



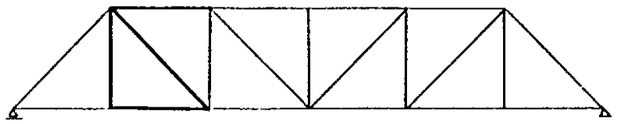


Construction Method
Same as Diagonal Members.

Notes :

○ : Re-Use Existing holes.
——— : Take off original lacing bar.
L.B : Lacing Bar.

MARKING DIAGRAMS



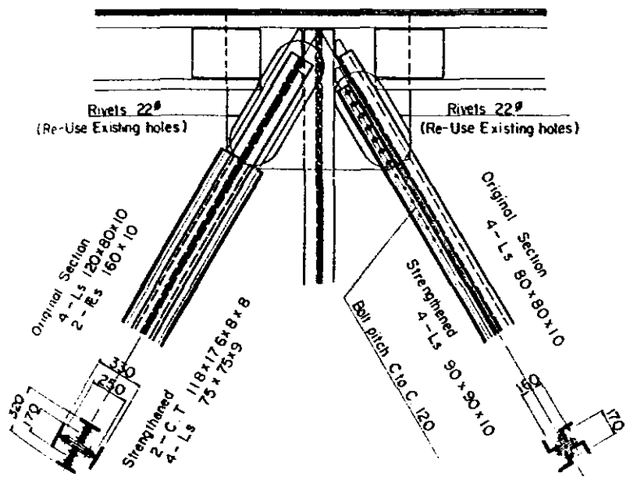
General Notes ;

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (HTB) are M22 (♦) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF TIE PLATE	DL.15 loading Unit mm	Scale
K.M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO	

STRENGTHENING OF DIAGONAL MEMBERS

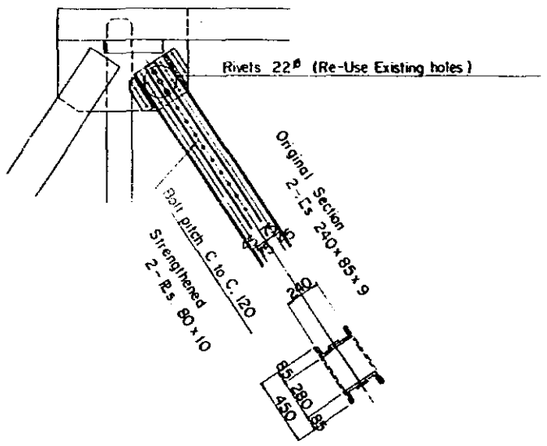
DAYDE TYPE (L=40m, 50m)



Construction Method

1) Add new Angles one by one.
2) Drill new bolt holes.
3) Cut off rivets of original members
4) Clean surface between original and additional members (keep friction coefficient over 0.3)
5) Add new Angles.
6) Rivetting and tighten H.T.Bolt

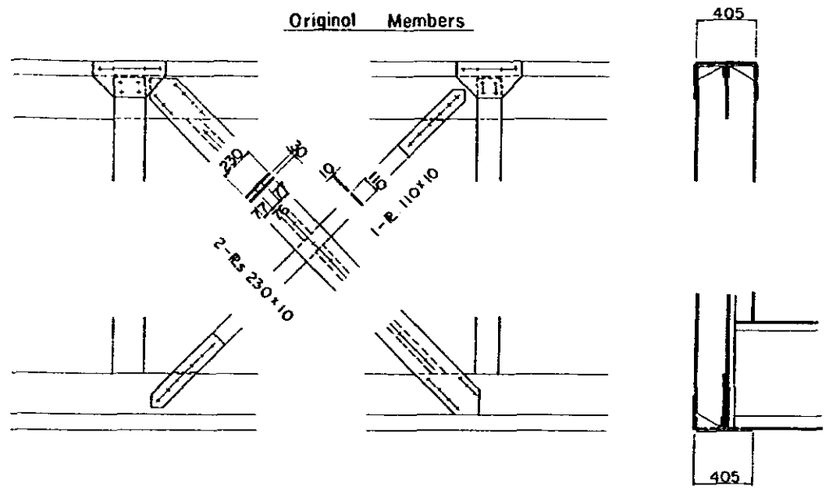
DE VRIES ROBBE TYPE (L=35m)



Construction Method

1) Drill new bolt holes.
2) Cut off rivets of original members (Part of Gusset Plate)
3) Clean surface between original and New members.
4) Add new Plates
5) Rivetting and tighten H.T.Bolts.

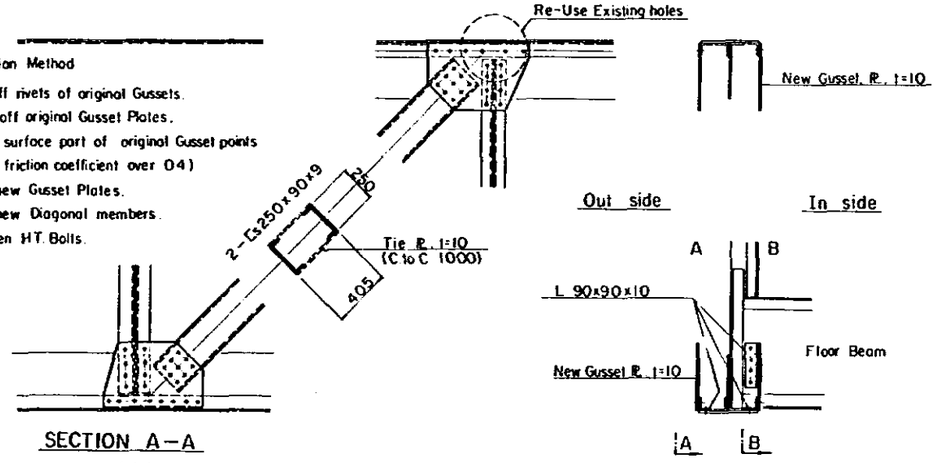
P & W MCLELLAN TYPE (L=25.5m, 31.7m)

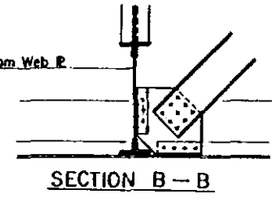


STRENGTHENED MEMBERS

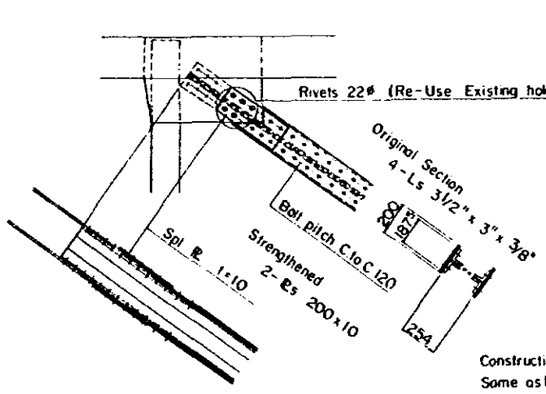
Construction Method

1) Cut off rivets of original Gussets.
2) Take off original Gusset Plates.
3) Clean surface part of original Gusset points (keep friction coefficient over 0.4)
4) Add new Gusset Plates.
5) Add new Diagonal members.
6) Tighten H.T. Bolts.

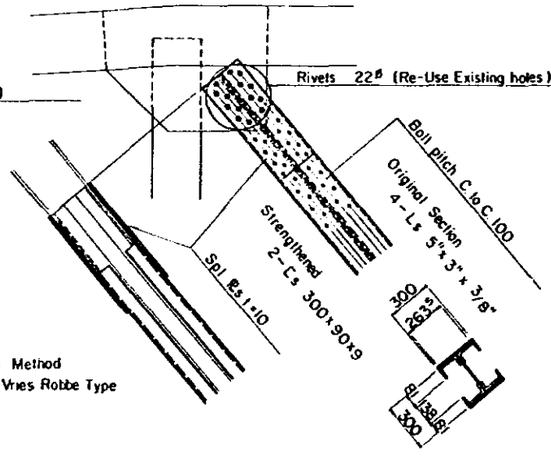




CLEVELAND TYPE (L=30m)

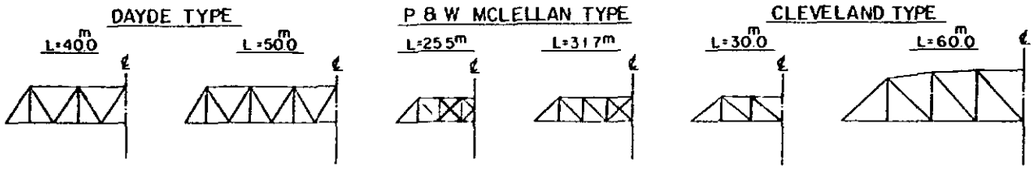


CLEVELAND TYPE (L=60m)



Construction Method
Same as De Vries Robbe Type

MARKING DIAGRAM



General Notes

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent
2) All high-strength bolts (HTB) are M22 (ϕ) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for slitch f ≥ 0.3
3) All rivets are 22ϕ (+), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent
4) All dimensions to be checked in the field

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	STRENGTHENING OF DIAGONAL MEMBERS	DL 15 loading
			Unit mm / Scale
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF VERTICAL MEMBERS

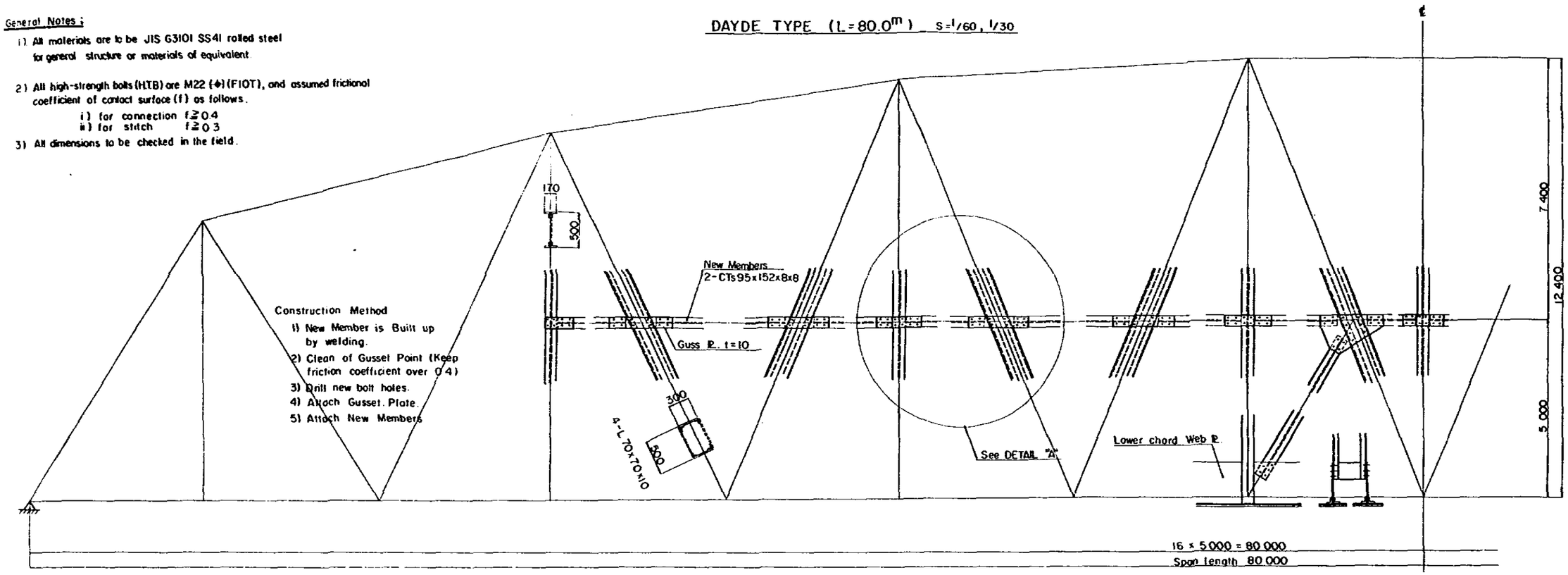
General Notes ;

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.

2) All high-strength bolts (H.T.B) are M22 (Φ) (F10T), and assumed frictional coefficient of contact surface (f) as follows.
   i) for connection f ≧ 0.4
   ii) for stitch f ≧ 0.3

3) All dimensions to be checked in the field.

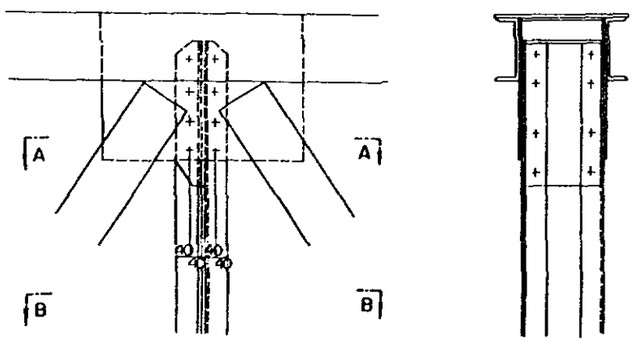
DAYDE TYPE (L = 80.0m) S = 1/60, 1/30



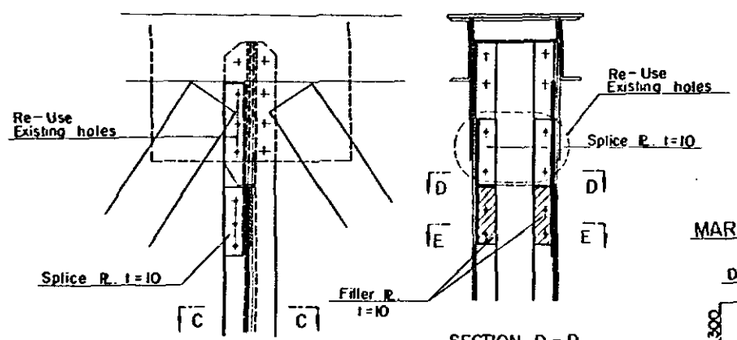
Construction Method
1) New Member is Built up by welding.
2) Clean of Gusset Point (Keep friction coefficient over 0.4)
3) Drill new bolt holes.
4) Attach Gusset Plate.
5) Attach New Members

DE VRIES ROBBLE TYPE S = 1/10

ORIGINAL MEMBER

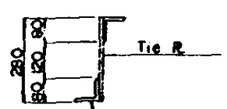


STRENGTHENED MEMBER



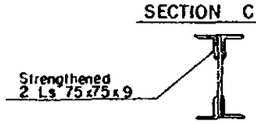
SECTION A-A

SECTION B-B

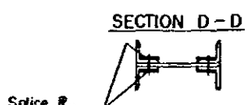


Construction Method
1) Cut off rivets of original Tie Plates
2) Drill new bolt holes.
3) Clean surface between original and new members (Keep friction coefficient over 0.4)
4) Add new Angles
5) Tighten H.T.Bolt

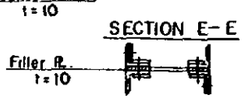
SECTION C-C



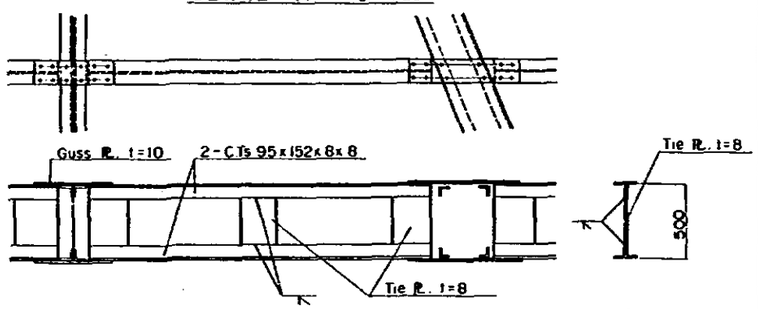
SECTION D-D



SECTION E-E

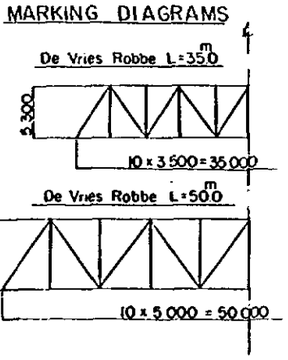


DETAIL "A" S = 1/20



Note Tie P. pitch less than 2.0m

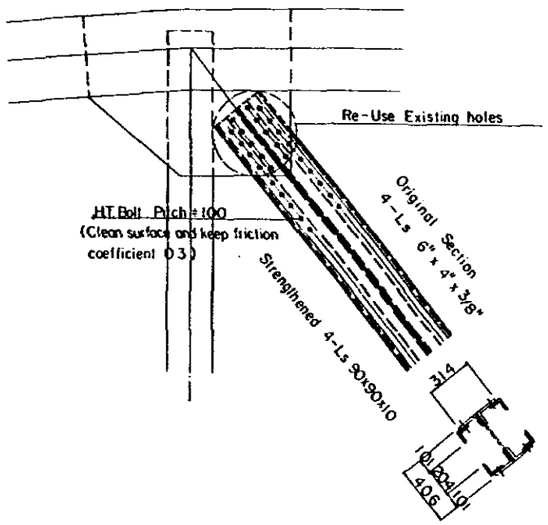
MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members: STRENGTHENING OF VERTICAL MEMBERS	DL. 15 loading	
		Unit: m m	Scale: 1/30, 1/20, 1/10
K.M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO	

STRENGTHENING OF DIAGONAL MEMBER S= 1/20

CLEVELAND TYPE (L=70m, 80m)

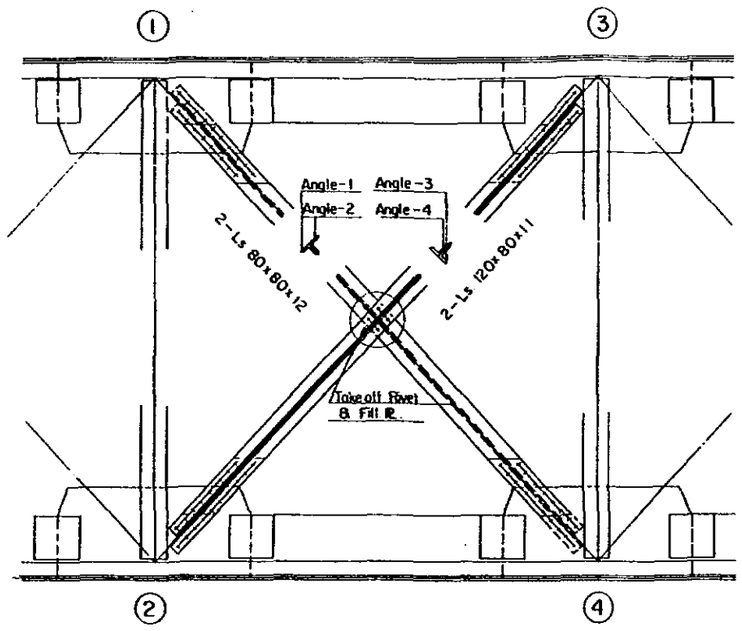


Construction Method

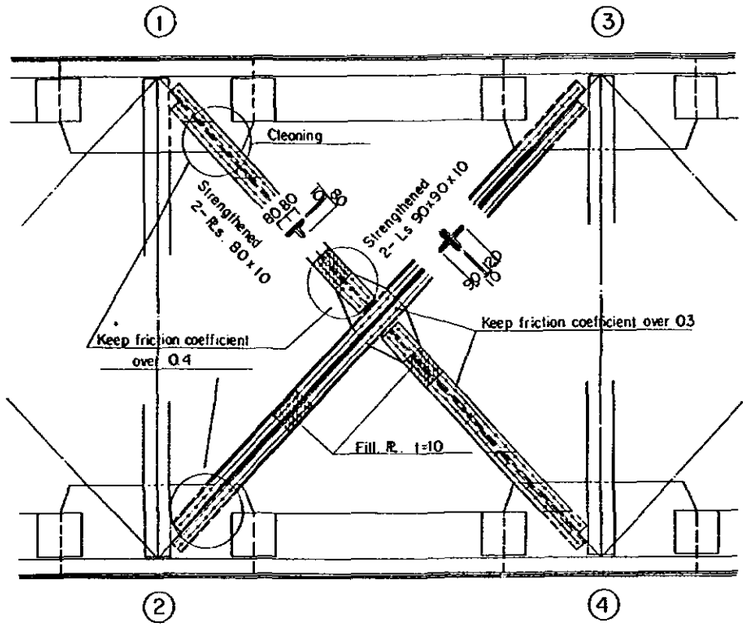
1) Drill new bolt holes.
2) Original connection rivets change to ordinary bolts one by one
3) Clean surface between original and new additional Angles except part of ordinary bolt.
4) Strengthened angles and Riveting or Bolting.

DAYDE TYPE (L=25m, 30m, 35m)

Original Members



Strengthened Members

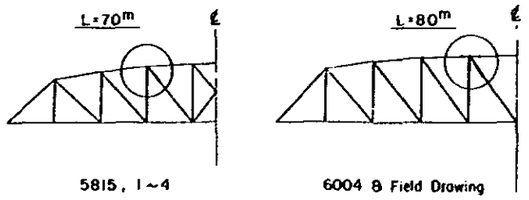


Construction Method

1) Take off ①-④ original member. (Angle-1)
2) Take off filler plate of cross point and attach new gusset plate.
3) Clean surface between original gusset plate and new member.
4) Attach strengthened member to ①-④.
5) Take off another ①-④ member (Angle-2) and strengthen similarly Angle-1 member.
6) Take off ②-③ Angle-3 member and add strengthened Angle.
7) Attach strengthened ②-③ Angle-3 member.
8) Also ②-③ Angle-4 member is strengthened

MARKING DIAGRAM

CLEVELAND TYPE

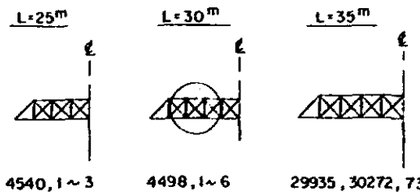


Refer to original Drawing No

5815, 1~4

6004 & Field Drawing

DAYDE TYPE



4540, 1~3
4540, 1~4
or 4544

4498, 1~6
4541

29935, 30272, 73, 75, 76
& Field Drawing

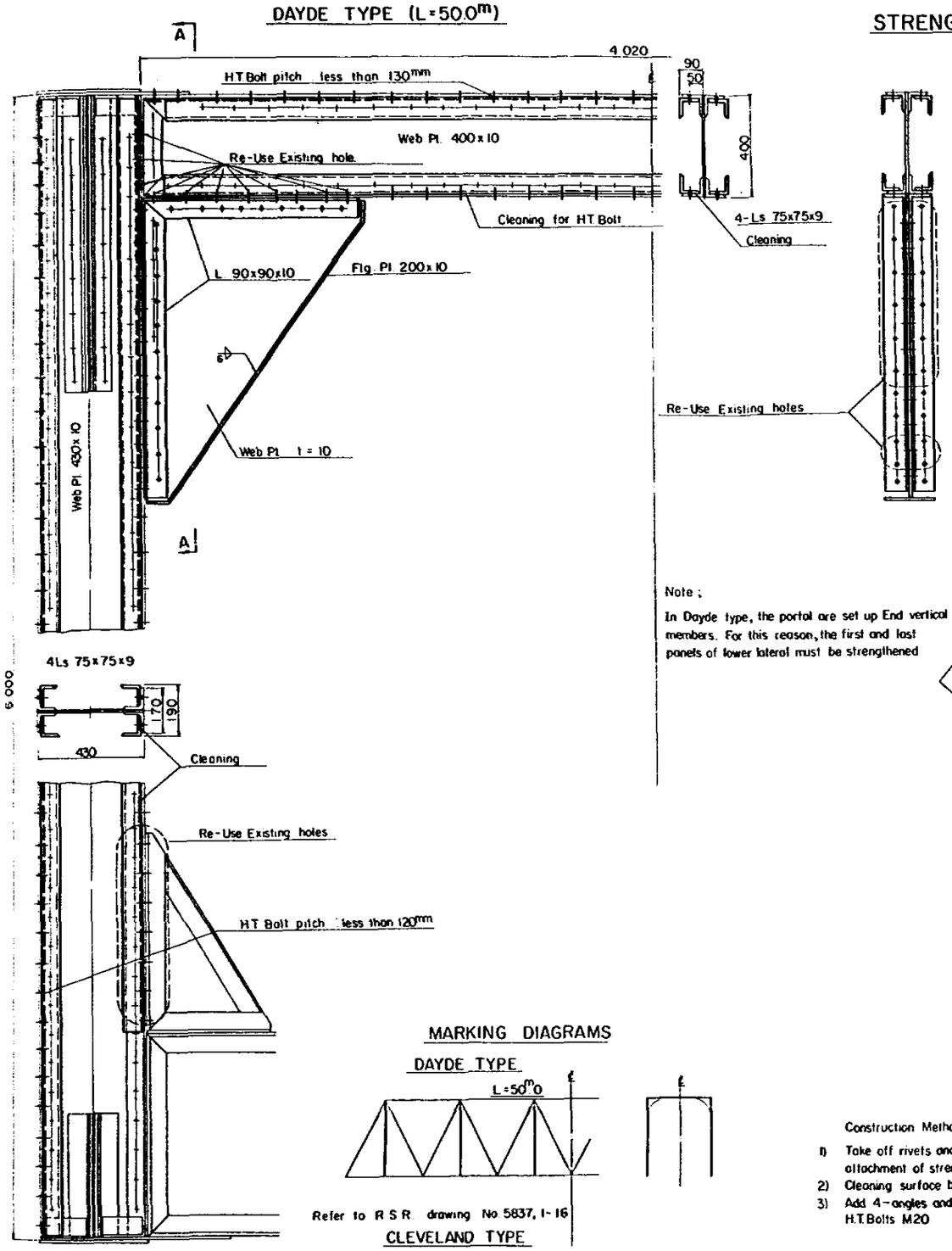
General Notes

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (H.T.B) are M22 (ϕ) (F10T), and assumed frictional coefficient of contact surface(f) as follows
   i) for connection f≥0.4
   ii) for stitch f≥0.3
3) All rivets are 22ϕ (ϕ), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent.
4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF DIAGONAL MEMBER	DL 15 loading	
		Unit	Scale
		mm	1/20
K.M.		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF PORTAL S=1/10

DAYDE TYPE (L=50.0m)



Note ;

In Dayde type, the portal are set up End vertical members. For this reason, the first and last panels of lower lateral must be strengthened

MARKING DIAGRAMS

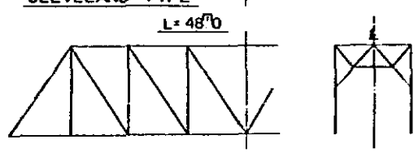
DAYDE TYPE

L=50m0

Refer to R.S.R. drawing No. 5837, I-16

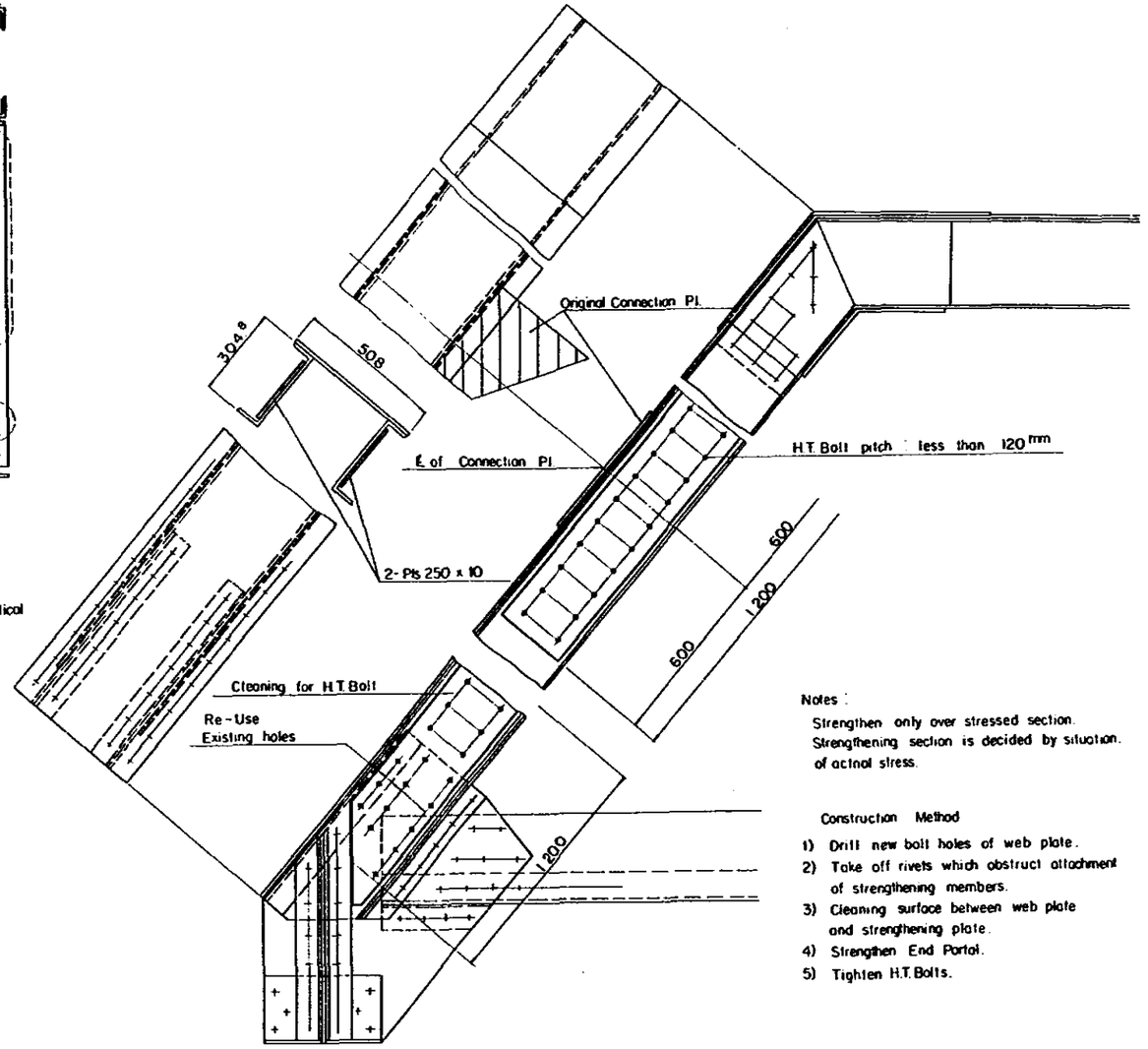
CLEVELAND TYPE

L=48m0



Refer to original drawing No. Cleveland 146 Incomplete and Field drawing

CLEVELAND TYPE (L=48.0m)



Notes :

Strengthen only over stressed section.
Strengthening section is decided by situation of actual stress.

Construction Method

1) Drill new bolt holes of web plate.
2) Take off rivets which obstruct attachment of strengthening members.
3) Cleaning surface between web plate and strengthening plate.
4) Strengthen End Portal.
5) Tighten H.T.Bolts.

Construction Method

1) Take off rivets and gusset plate which obstruct attachment of strengthening angles.
2) Cleaning surface between original angle and new one.
3) Add 4-angles and used gusset plate, and tighten H.T.Bolts M20

General Notes;

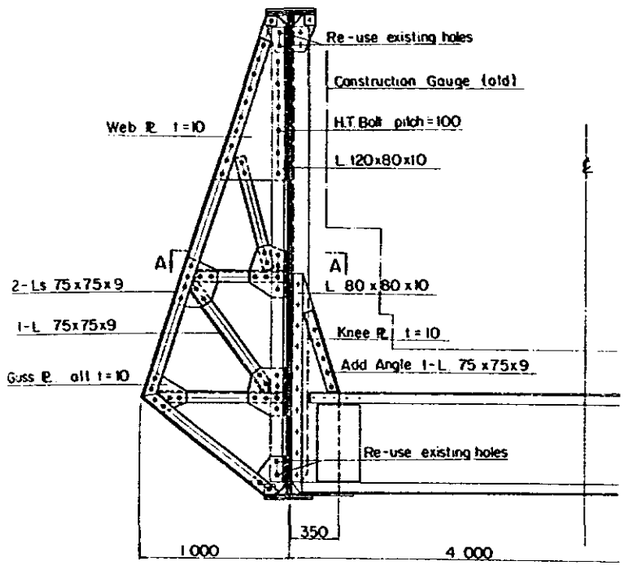
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (H.T.B) are M22 (ϕ)(F10T), and assumed frictional coefficient of contact surface(f) as follows
   i) for connection f ≧0.4
   ii) for stitch f ≧0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	STRENGTHENING OF PORTAL BRACING	DL. 15 loading Unit: mm, Scale: 1/10
K.M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF KNEE BRACING s=1/20

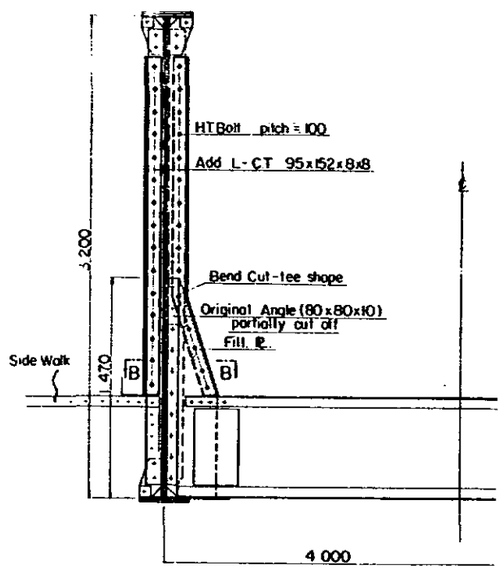
PONY TRUSS TYPE
DAYDE TYPE (L=25.0m)

In the case of without Side Walk

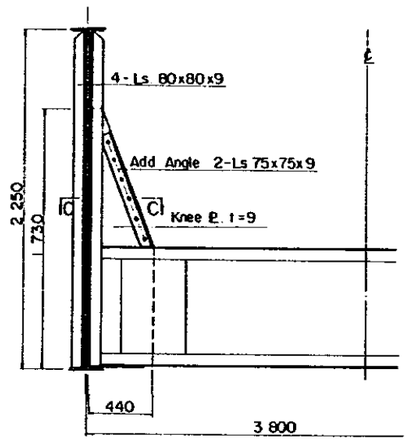


Refer to Original Drawing No 4540, 1-3 or 1-4

In the case of within Side Walk



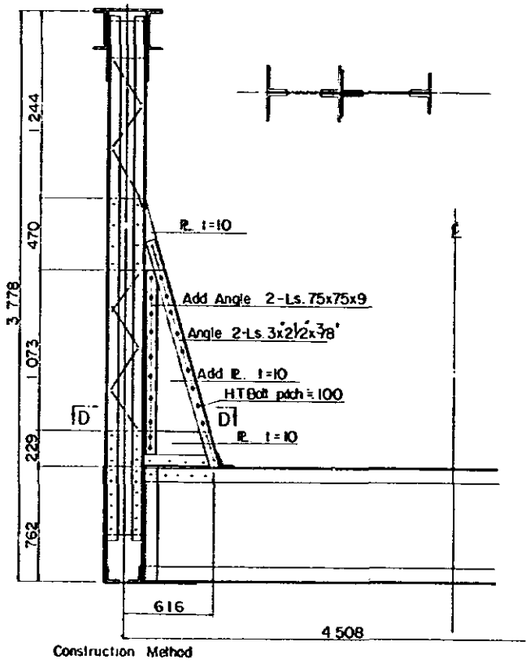
THROUGH PLATE GIRDER TYPE
MAKER : UNKNOWN L=25.0m



Refer to field drawing

PONY TRUSS TYPE
CLEVELAND TYPE (L=30.0m)

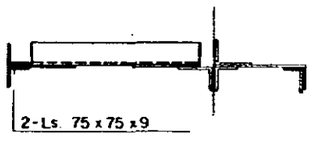
SECTION D – D s=1/10



Construction Method

1) Cut off rivets of original knee members.
2) Take off original knee members.
3) Drill new bolt holes.
4) Clean surface between original and new member.
5) Add new angles and knee plate.
6) Tighten H.T. Bolt.

SECTION A – A

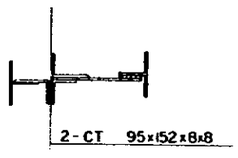


Construction Method

1) Drill new bolt holes of original Vertical member
2) Cut off rivets of original members
3) Take off original gusset plate
4) Clean surface between original and new add member.
5) Add new members and tighten H.T.Bolt.

X Other Doyde Pony Truss Type (L=30m, 35m)
Same as L=25m0

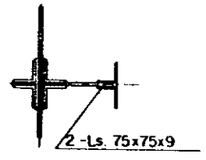
SECTION B – B s=1/10



Construction Method

1) Drill new bolt holes of original Vertical member.
2) Cut off original angle partially.
3) Clean surface between original and new add member.
4) Add new members and tighten H.T.Bolt.

SECTION C – C s=1/10



Construction Method

1) Drill new bolt holes of knee plate.
2) Clean surface between knee plate and angles.
3) Add 2-angles and tighten H.T.Bolt.

General Notes:

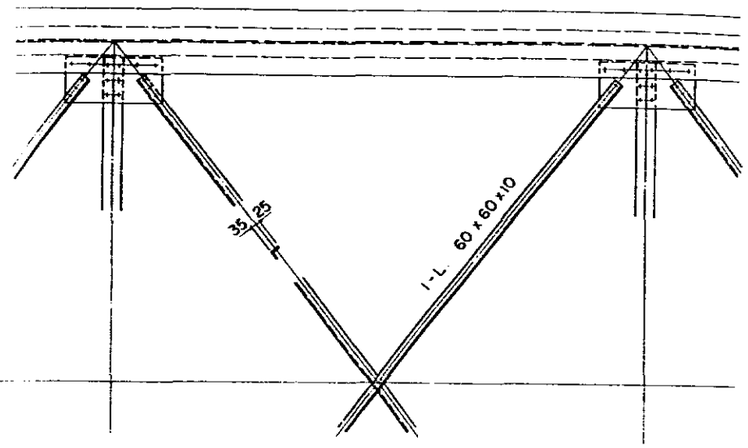
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (H.T.B) are M22 (♦)(F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF KNEE BRACING	DL. 15 loading	
		Unit mm	Scale 1/20
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

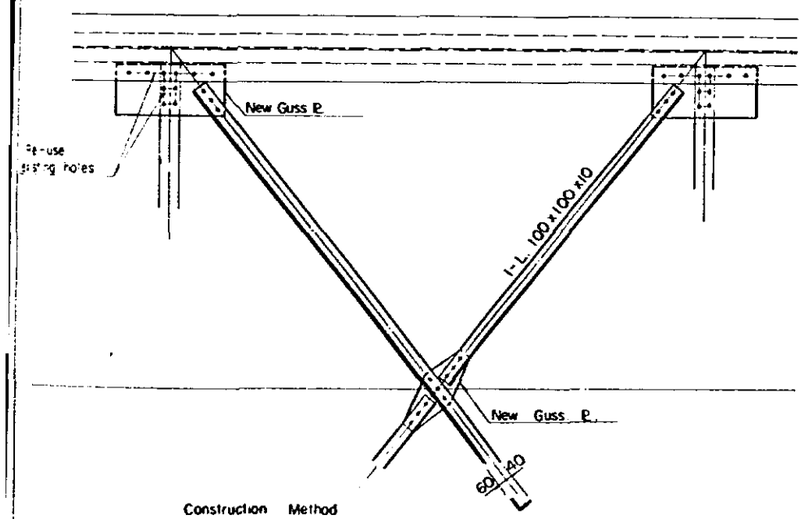
STRENGTHENING AND/OR REPAIRING OF UPPER LATERAL

DAYDE TYPE (L=50.0m) s=1/20

Original Members



Strengthened Members

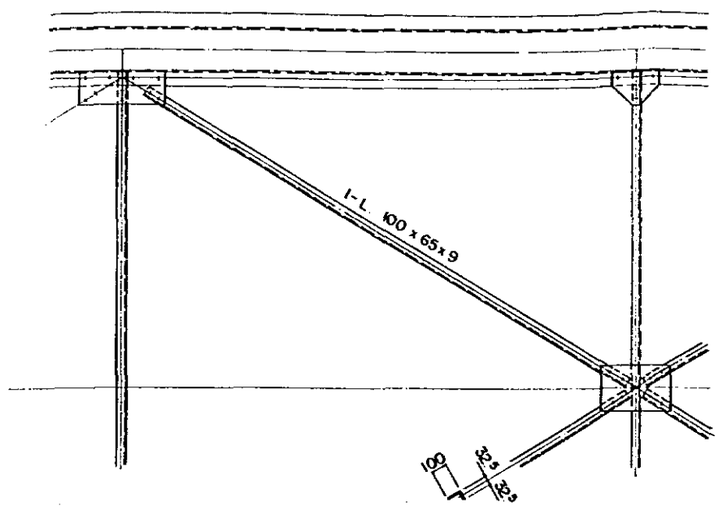


Construction Method

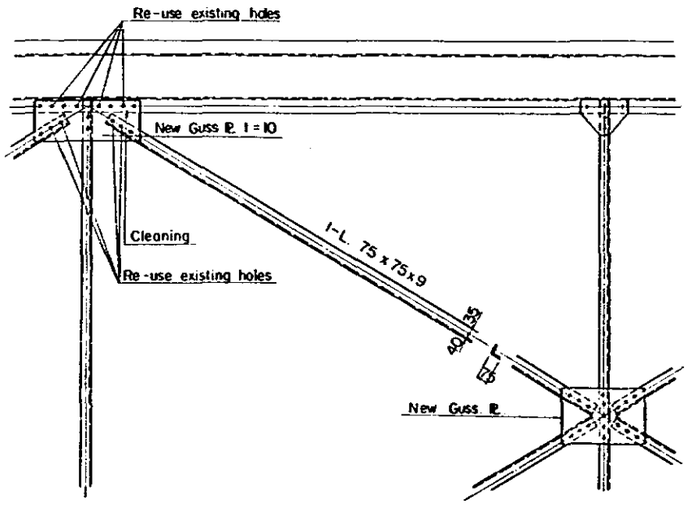
1) Cut off rivets of original members.
2) Take off original member and gusset plate.
3) Clean surface between originals and new members.
4) Attach new angles and gusset plate.
5) Tighten H.T. Bolts.

DE VRIES ROBBE TYPE (L=35.0m) s=1/20

Original Members



Strengthened Members

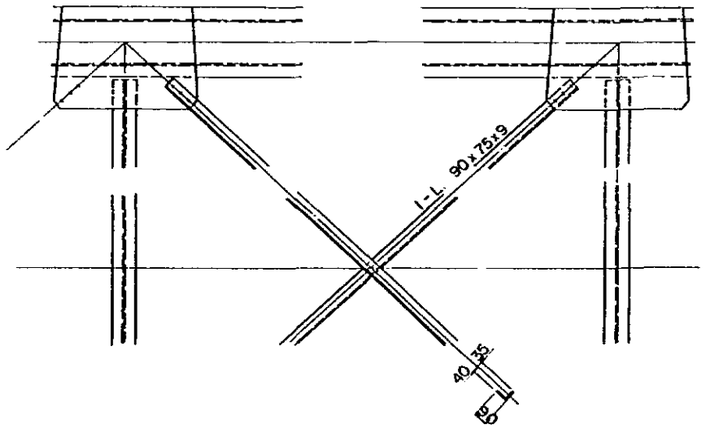


Construction Method

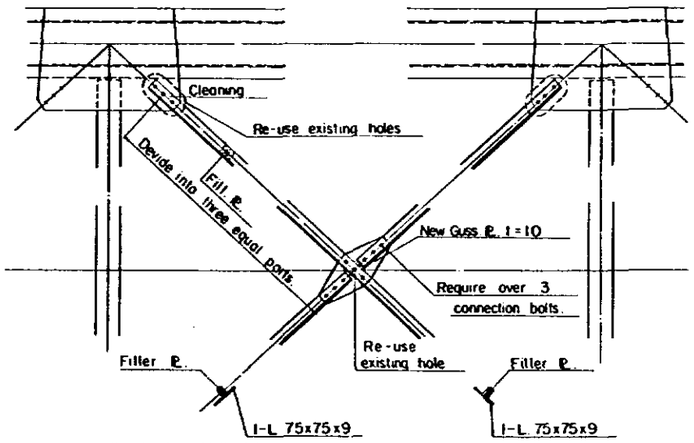
1) Cut off rivets of original members.
2) Take off original members.
3) Drill new bolt holes.
4) Clean surface between originals and new members.
5) Attach new Angles and Gusset plate.
6) Tighten H.T. Bolts.

CLEVELAND TYPE (L=40.0m) s=1/30, 1/20

Original members



Strengthened Members



Construction Method

1) Cut off rivets of original members.
2) Take off original members.
3) Clean surface between originals and new members.
4) Add new Angles and Gusset plate.
5) Tighten H.T. Bolts.

General Notes:

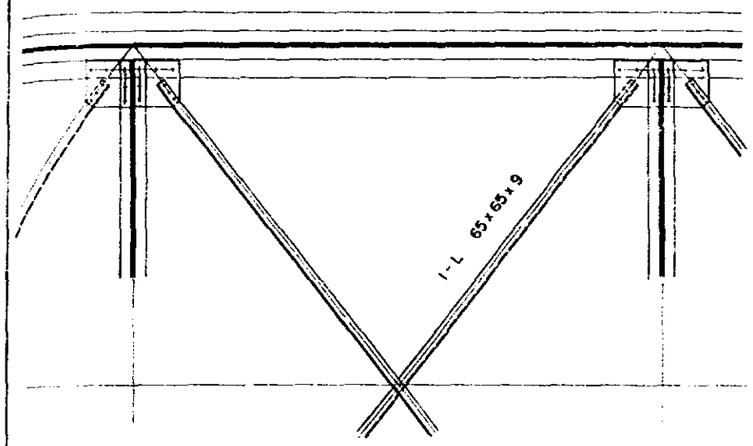
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (H.T.B) are M22 (φ) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≧ 0.4
   ii) for stitch f ≧ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members: STRENGTHENING AND/OR REPAIRING OF UPPER LATERAL	D.L. 15 loading	
		Unit: mm	Scale: 1/20
K.M.		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO	

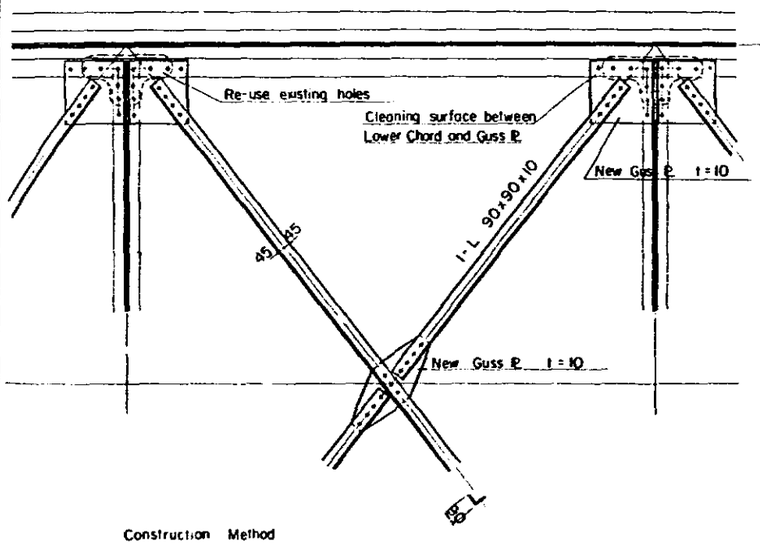
LOWER LATERAL

DAYDE TYPE (L=50.0m) s=1/20

Original Members



Strengthened Members

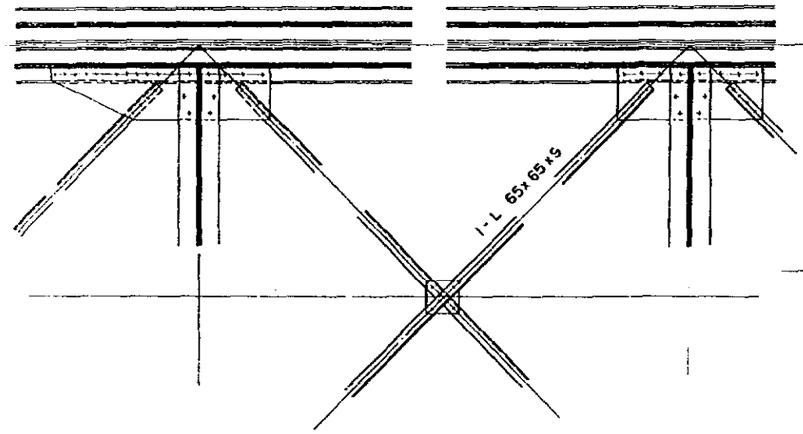


Construction Method

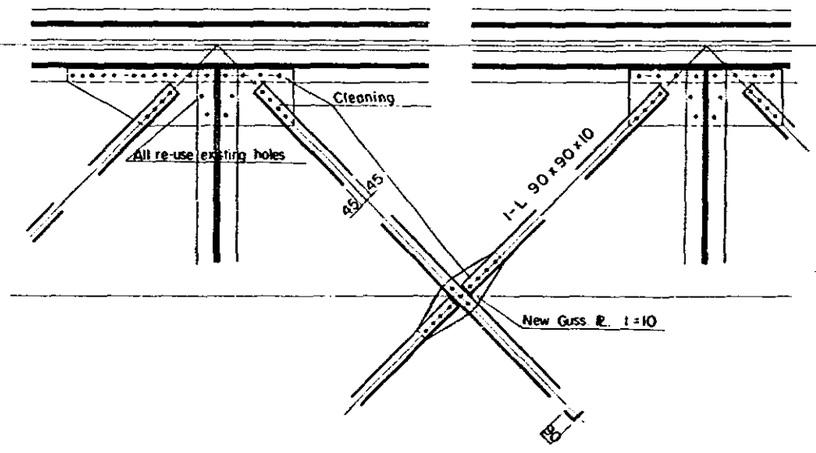
1) Cut off rivets of connection of original members
2) Take off original members and gusset plates
3) Drill new bolts hole at Lower Chord
4) Clean surface between Lower Chord and new gusset plate
5) Attach new gusset plates and new angle
6) Tighten HT Bolt

DE VRIES ROBBE TYPE (L=50.0m) s=1/30,1/20

Original Members



Strengthened Members



Construction Method

Same way as DAYDE TYPE
But can use original gusset plate except cross point one

General Notes ;

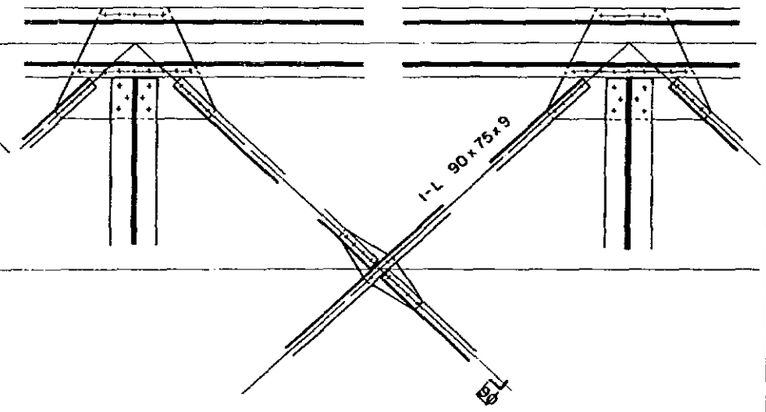
1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivolent.

2) All high-strength bolts (HTB) are M22(♦)(F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≧ 0.4
   ii) for stitch f ≧ 0.3

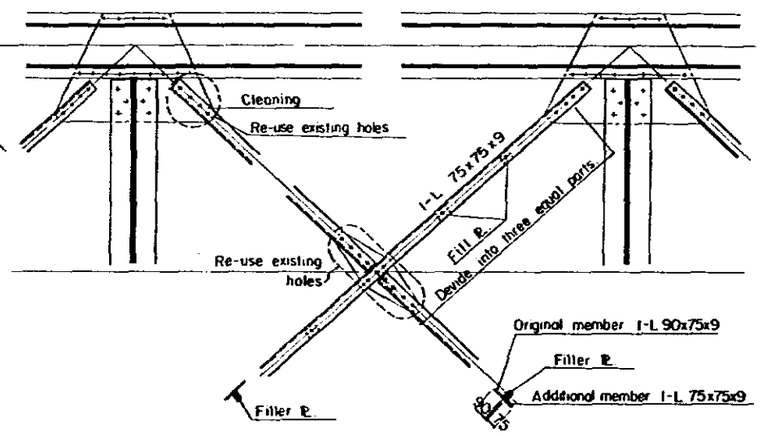
3) All dimensions to be checked in the field.

CLEVELAND TYPE (L=40.0m) s=1/30,1/20

Original Members



Strengthened Members



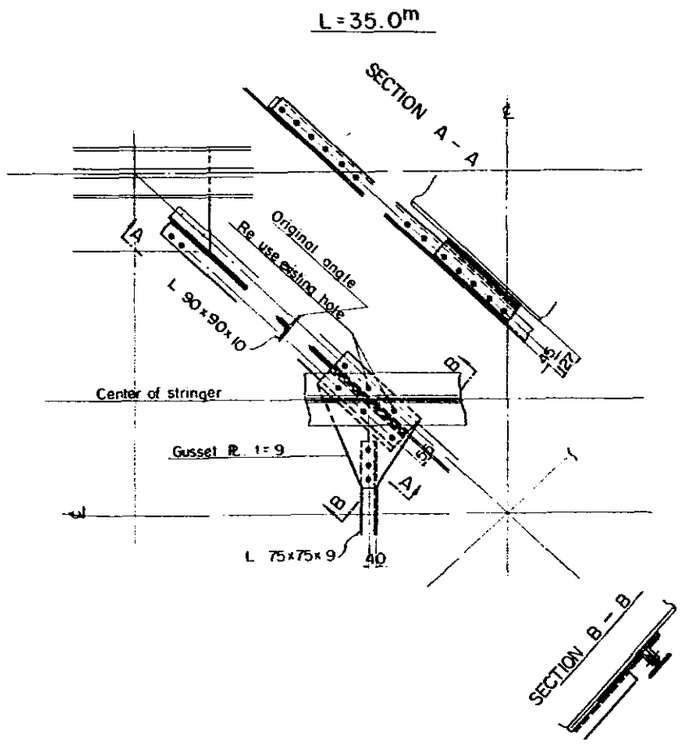
Construction Method

Same way as De Vries Robbe type.

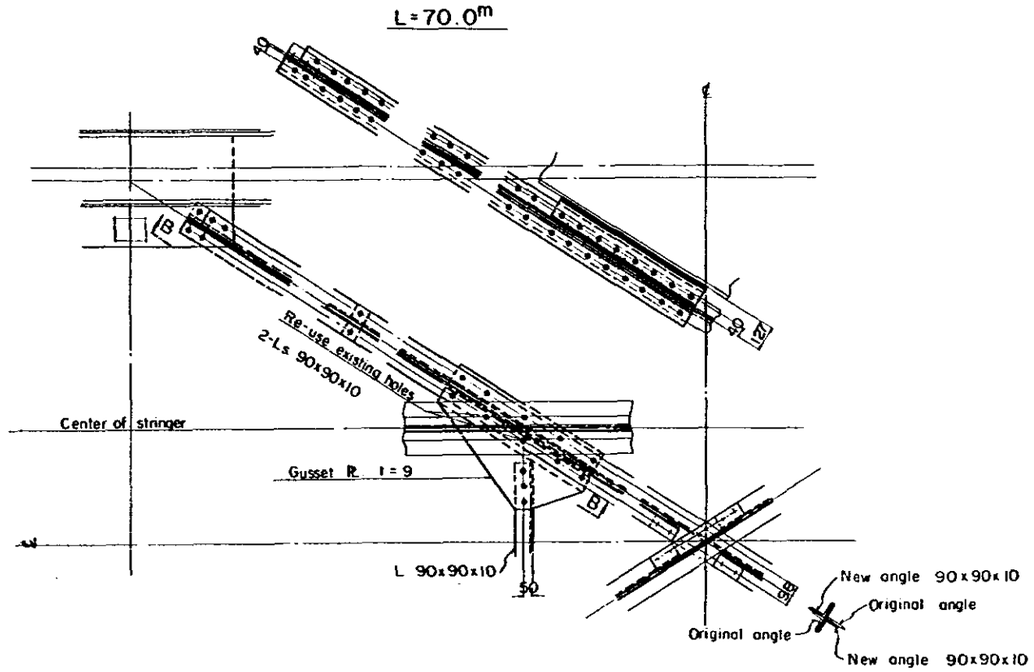
THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members LOWER LATERAL	DL. 15 loading	
		Unit	Scale
		mm	1/30 , 1/20
K. M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF BRAKE TRUSS s=1/15

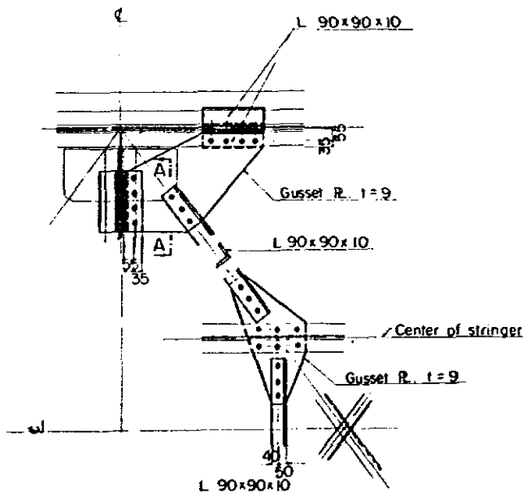
L=35.0m



L=70.0m

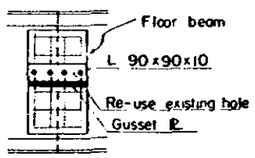


L=30.0m

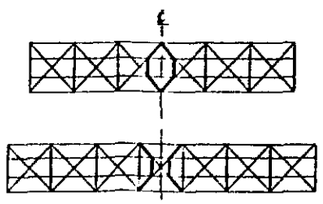


DAYDE Type

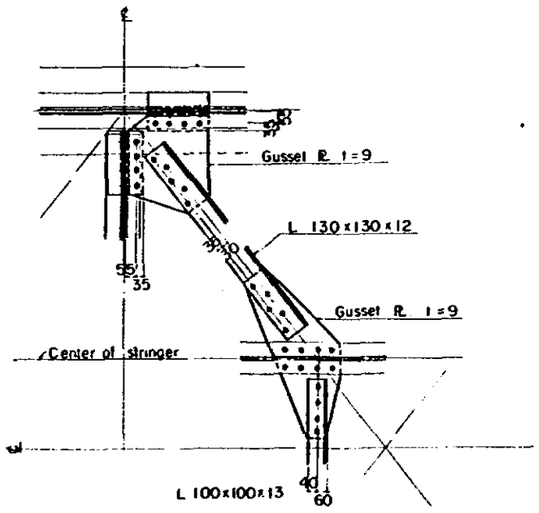
SEC. A-A



MARKING DIAGRAMS



L=50.0m



General Notes ;

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.

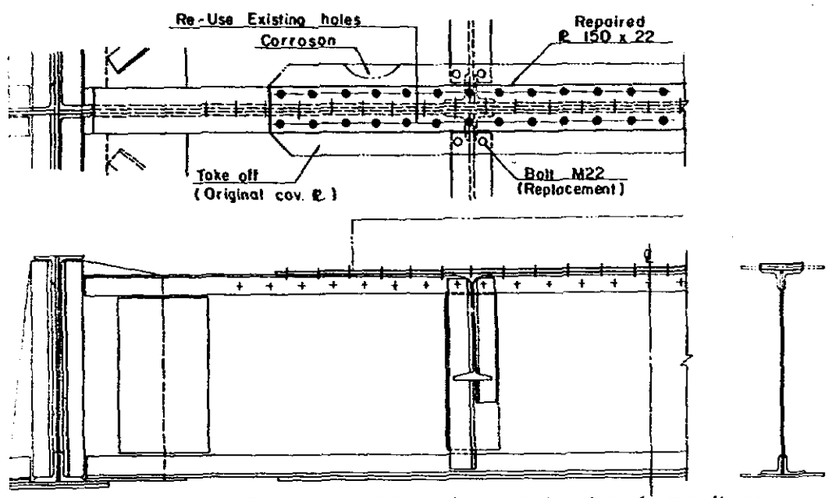
2) All high-strength bolts (H.T.B) are M22 (φ) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3

3) All dimentions to be checked in the field

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF BRAKE TRUSS	DL 15 loading	
		Unit	Scale
		mm	1/15
K.M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

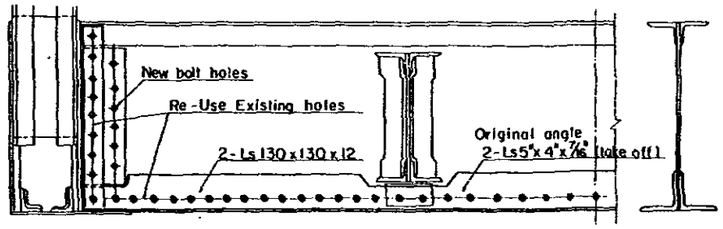
STRENGTHENING AND/OR REPAIRING OF FLOOR BEAM

REPAIRING OF COVER PLATE (Dayde Type)



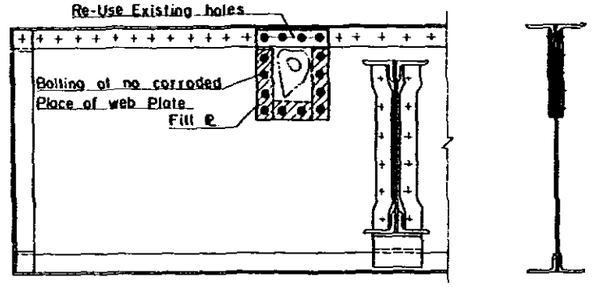
When Cov. Pl has no need to repair, connection rivet of upper flange between stringer and Floor beam have to be changed to spring washer Bolts.

REPAIRING OF LOWER FLG. (Cleveland Type)

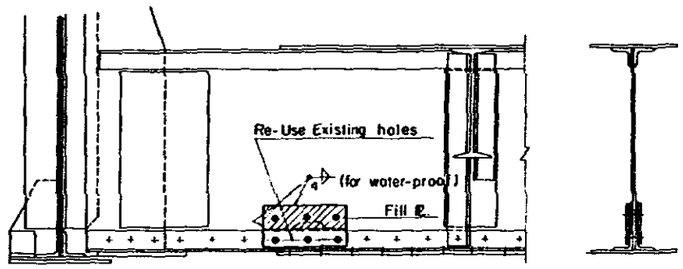


In the case of no clearance for added angle.

REPAIRING OF WEB PLATE

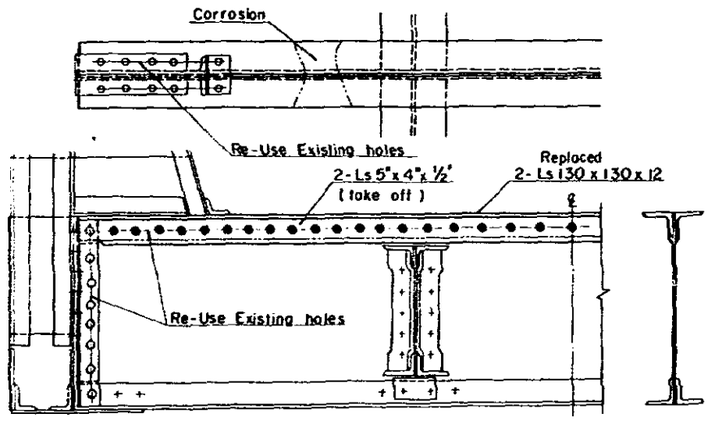


REPAIRING OF WEB PLATE

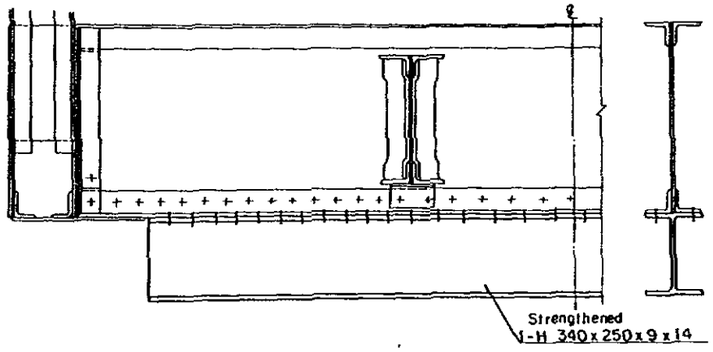


Field welding is for the purpose of waterproof

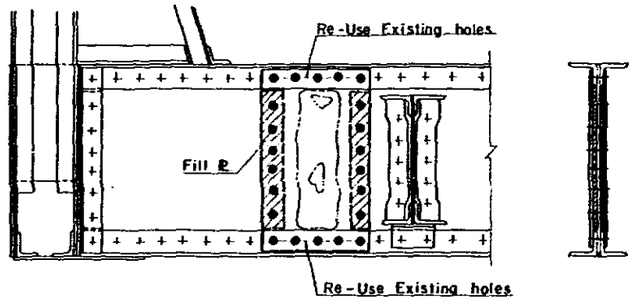
REPAIRING OF UPPER-FLG. (Cleveland Type)



STRENGTHENING AND OR REPAIRING OF UPPER and/or LOWER FLANGE (Cleveland Type)



REPAIRING OF WEB PLATE



General Notes;

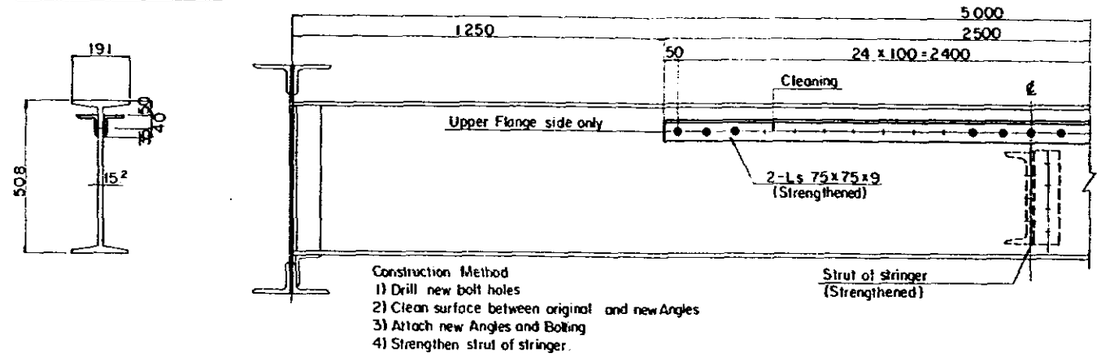
1). All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2). All high-strength bolts (HTB) are M22 (⌖) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f≧0.4
   ii) for stitch f≧0.3
3). All rivets are 22ϕ (⌖), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent.
4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	STRENGTHENING AND/OR REPAIRING OF FLOOR BEAM	DL 15 loading; Unit: mm; Scale
K.M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING AND / OR REPAIRING OF STRINGER AND BRACKET S = 1/10

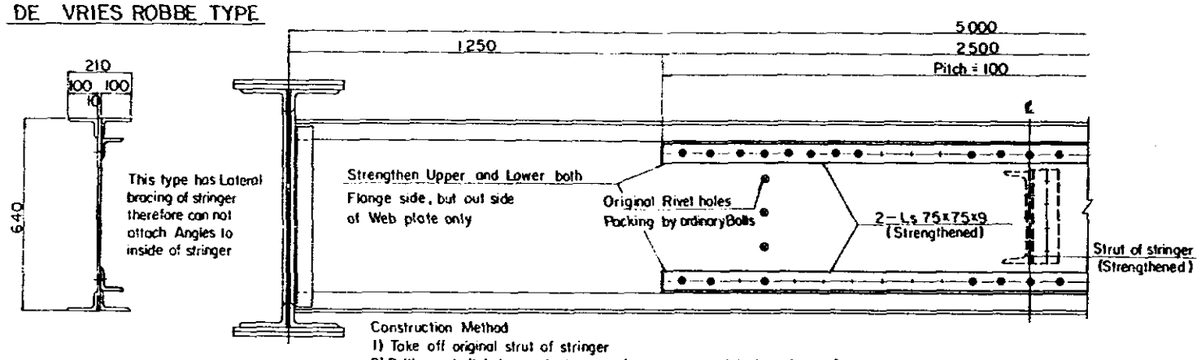
STRENGTHENING AND/OR REPAIRING OF STRINGER

CLEVELAND TYPE



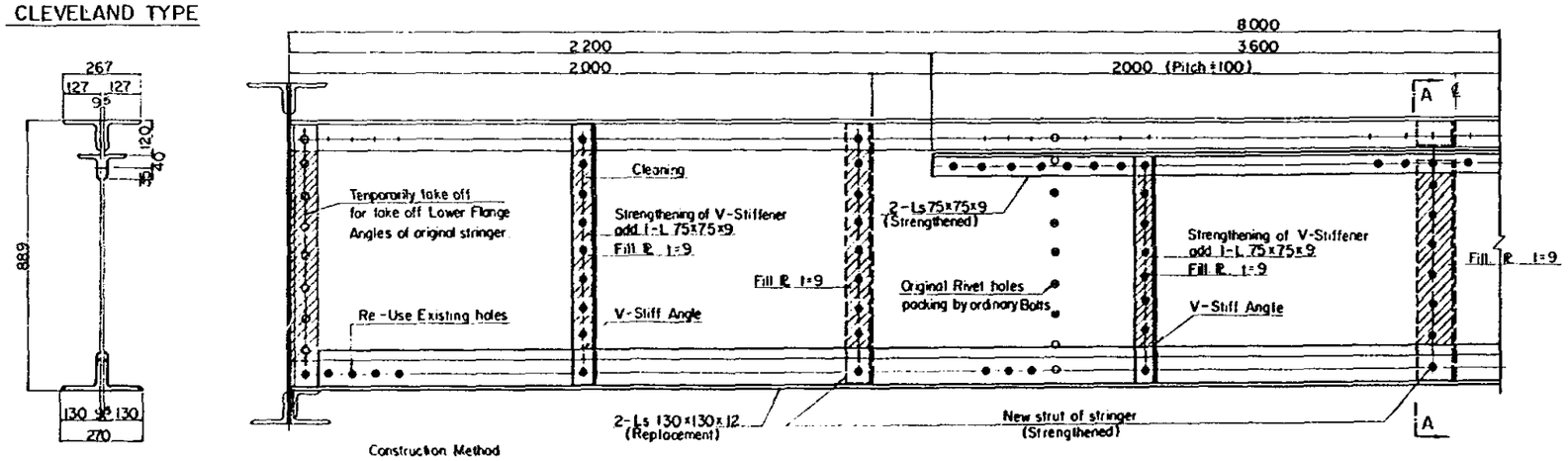
Construction Method
1) Drill new bolt holes
2) Clean surface between original and new Angles
3) Attach new Angles and Bolting
4) Strengthen strut of stringer.

DE VRIES ROBBE TYPE



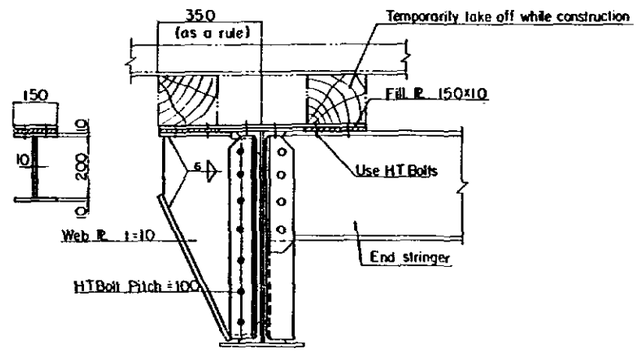
Construction Method
1) Take off original strut of stringer
2) Drill new bolt holes and clean surface between original and new Angles
3) Attach new Angles and Bolting by H.T.Bolts
4) Strengthen strut of stringer

CLEVELAND TYPE

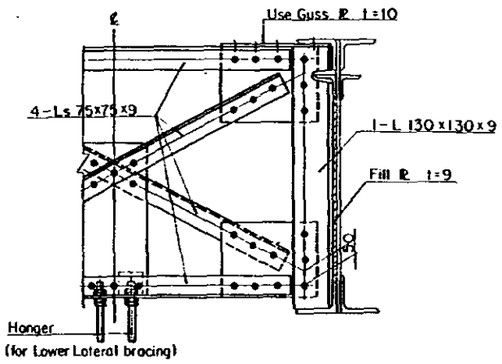


Construction Method
1) Take off original strut of Stringer and connection angle
2) Clean surface between originals and new Angles
3) Attach new Angles and Bolting by HT Bolts
4) Strengthen V-Stiffener and strut of stringer

STRENGTHENING OF BRACKET



SECTION A — A



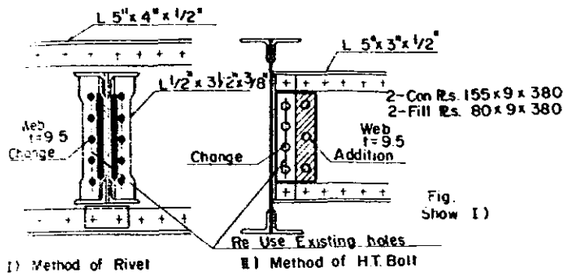
General Notes:

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high strength bolts (H.T.B) are M22 (♦)(F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≧ 0.4
   ii) for stitch f ≧ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING AND/OR REPAIRING OF STRINGER AND BRACKET	DL 15 loading	
		Unit mm	Scale
K.M.		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING AND/OR REPAIRING OF STRINGER'S CONNECTION

CL. 30.0^{m} ℓ = 5.0^{m}



I) Method of Rivet

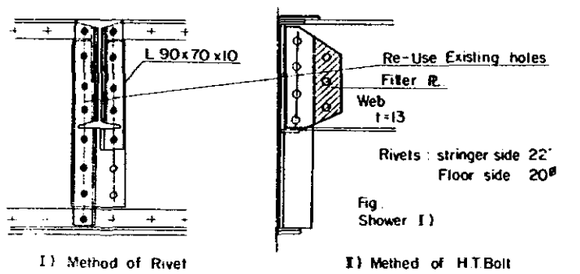
i) Stringer side
Use connection plates and increase the number of rivets

ii) Floor side
Change the existing rivets to new rivets
(No necessary to increase the number of rivets)

II) Method of H.T.Bolt

Existing rivets to be changed to H.T.Bolts
Clean surface between original and additions

D.D 30.0^{m} ℓ = 3.0^{m}



I) Method of Rivet

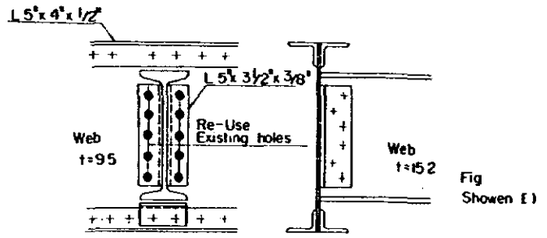
i) Stringer side
Same way as CL 30^{m} type.

ii) Floor side
No necessary to strengthen

II) Method of H.T.Bolt

Same way as CL 30^{m} type.

CL = 35.0^{m} ℓ = 5.0^{m}

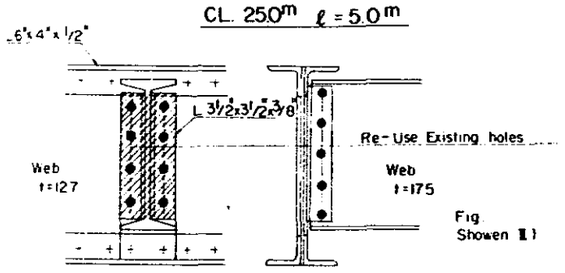


I) Method of Rivet

i) Stringer side
No necessary to strengthen

ii) Floor side
Change the existing rivets to new rivets.
(No necessary to increase the number of rivets)

CL. 25.0^{m} ℓ = 5.0^{m}



I) Method of Rivet

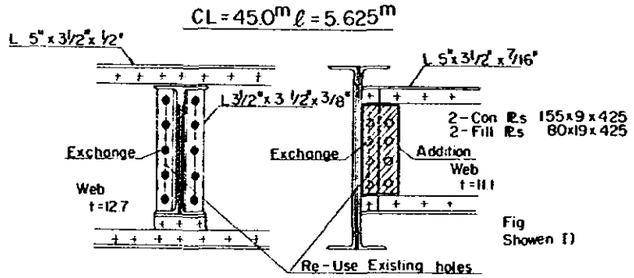
i) Stringer side
Change the existing rivets to new rivets.
(No necessary to increase the number of rivets)

ii) Floor side
Additional rivet necessary only one
therefore use H.T.Bolt is better

II) Method of H.T.Bolt

Same way as CL 30^{m} type

CL = 45.0^{m} ℓ = 5.625^{m}



I) Method of Rivet

i) Stringer side
Same way as CL 30^{m} type

ii) Floor side
Change the existing rivets to new rivets
(No necessary to increase the number of rivets)

II) Method of H.T.Bolt

Same way as CL 30^{m} type

Remark:
In floor side, there are many loose rivets
Tensile stress works to these rivets,
therefore these rivets change to HT Bolts is
better than re-use rivets.

General Notes:

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.

2) All high-strength bolts (HTB) are M22 (ϕ) (F10T), and assumed frictional coefficient of contact surface as follows
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3

3) All rivets are 22^{ϕ} (ϕ), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent.

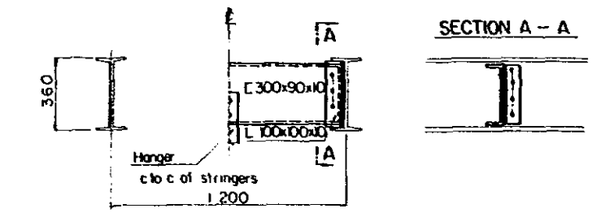
4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND		
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING		
Span Type	Members STRENGTHENING AND/OR REPAIRING OF STRINGER'S	DL 15 loading Unit mm
K M		Designed by
DISTRICT		Checked by
LINE		Checked by
Remarks		Checked by Checked by Checked by
DATE		DRAWING NO

SWAY BRACING OF STRINGERS AND HANGER FOR LOWER LATERAL S=1/15

DAYDE TYPE (L=30m)

ORIGINAL SECTION STRENGTHENED SECTION



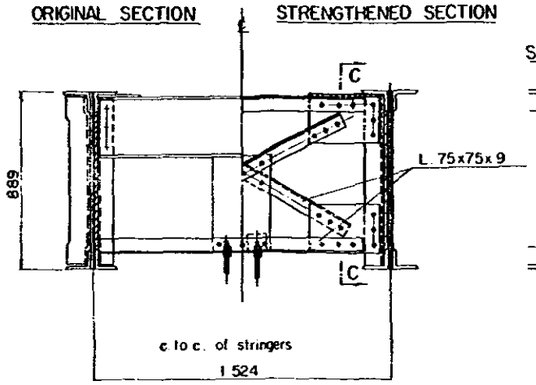
SECTION A – A

Note 1) Strut place to be $\ell/2$ point at stringers
2) Require over 3 connection bolts

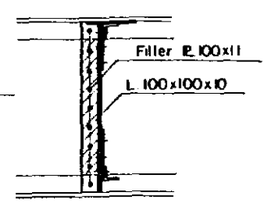
CLEVELAND TYPE (L=70m)

S-1

ORIGINAL SECTION STRENGTHENED SECTION

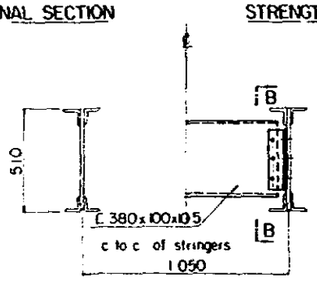


SECTION C – C

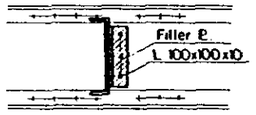


DAYDE TYPE (L=40m)

ORIGINAL SECTION STRENGTHENED SECTION



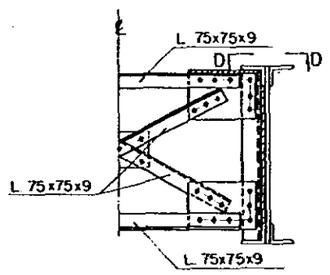
SECTION B – B



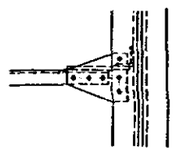
Note 1) Strut place to be $\ell/2$ point at stringers
2) Require over 3 connection bolts

S-2

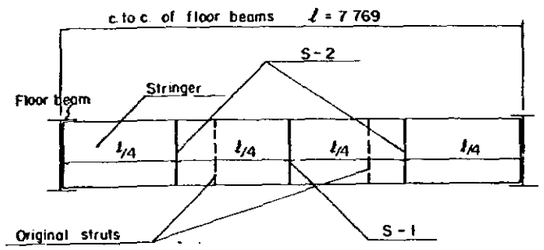
STRENGTHENED SECTION



SECTION D – D



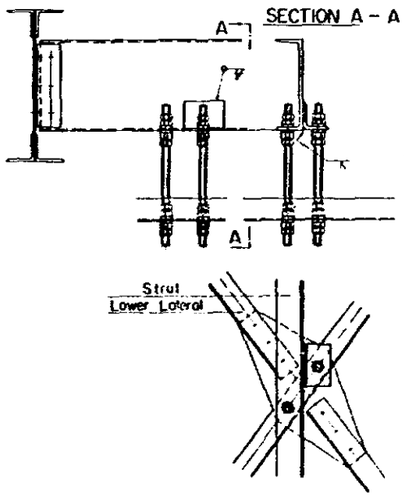
MARKING DIAGRAM



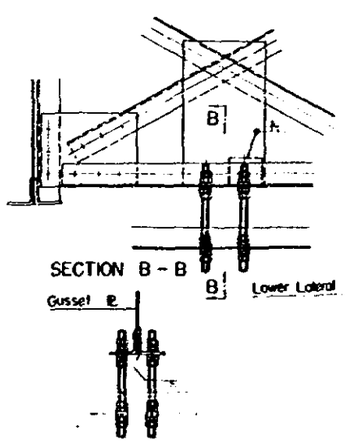
HANGER FOR LOWER LATERAL S=1/10

CHANNEL TYPE STRUT

SECTION A – A



TRUSS TYPE STRUT



General Notes;

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high-strength bolts (H.T.B) are M22 (ϕ) (F10T), and assumed frictional coefficient of contact surface as follows.
   i) for connection f ≧ 0.4
   ii) for stitch f ≧ 0.3
3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members SWAY BRACING OF STRINGER AND HANGER FOR LOWER LATERAL	D.L. 15 loading	
		Unit mm	Scale 1/15 , 1/10
K. M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

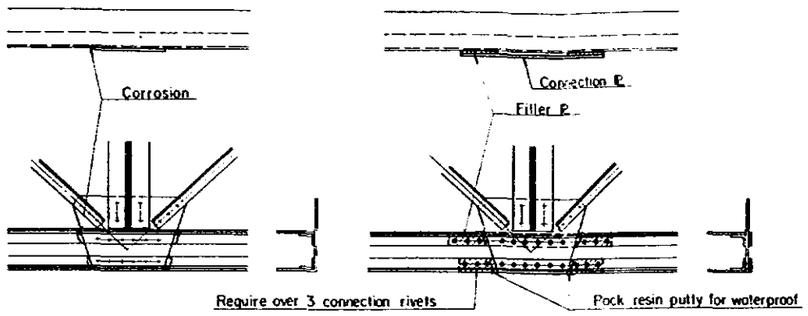
REPAIRING OF LOWER CHORD DUE TO CORROSION S=1/20

REPAIRING OF LOWER CHORD AND GUSSET PLATE

In the case of corroded Lower Chord nearby Gusset plate

ORIGINAL MEMBER

REPAIRED MEMBER



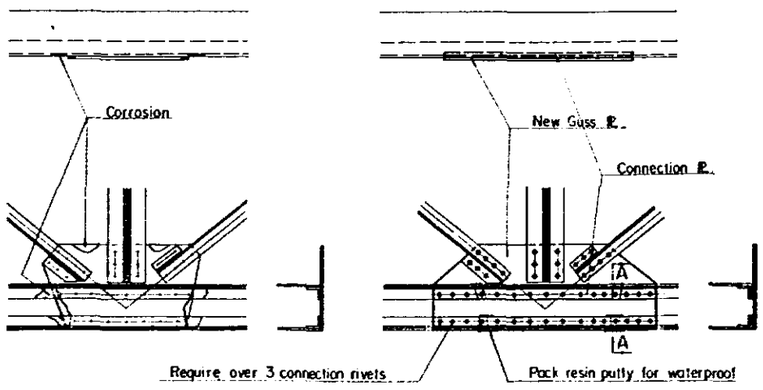
Construction Method

1) Cut off rivets of original members
2) Attach filler plates and connection plates
3) Pack resin putty for waterproof
4) Riveting

In the case of corroded Lower chord and Gusset plate

ORIGINAL MEMBER

REPAIRED MEMBER



Construction Method

1) Cut off rivets of original members
2) Take off orginal gusset plate
3) Attach new gusset plate, new connection plates
4) Pack resin putty for waterproof
5) Riveting

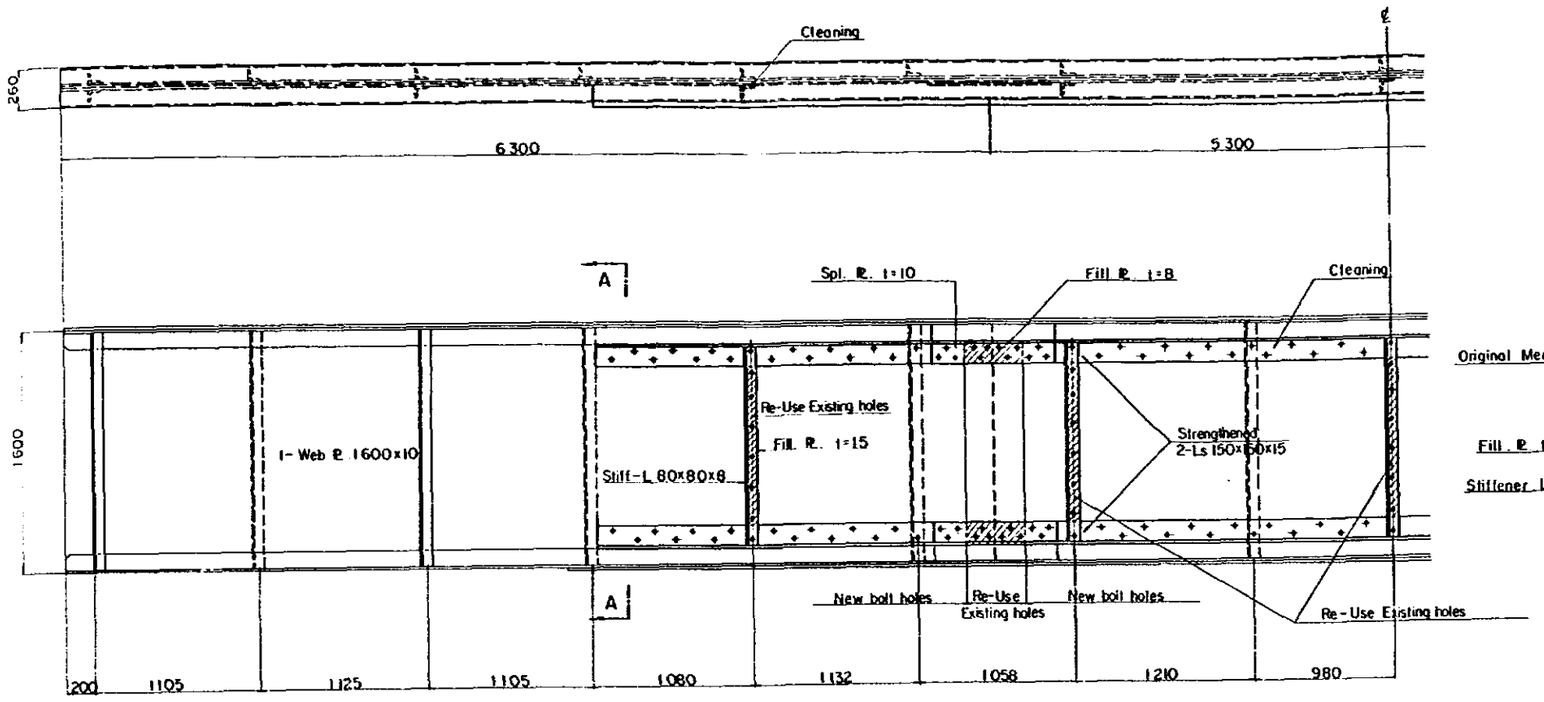
General Notes ;

1) All materials are to be JIS G3101 SS41 rolled steel for structure or materials of equivalent.
2) All rivets are $22^{\phi}(\frac{7}{8})$, and to be rolled steel for SV 34 (JIS G 3104) or materials of equivalent.
3) All dimensions to be checked in the field.

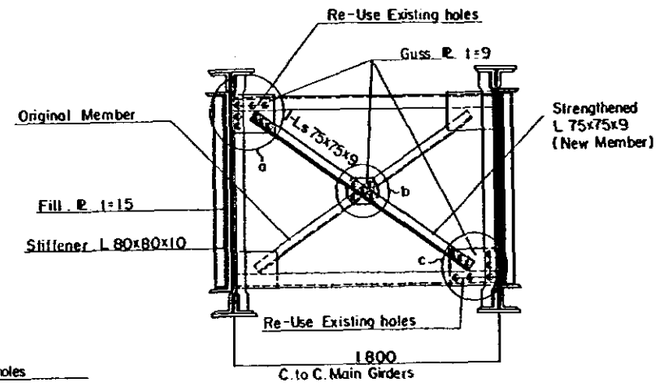
THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	REPAIRING OF LOWER Members CHORD DUE TO CORROSING	DL. 15 loading Unit mm	Scale
K M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF PLATE GIRDER S = 1/20

(L = 17.5m)



SECTION A — A



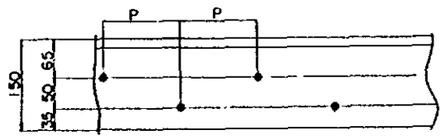
Note :
In the case of Connection Parts a,b,c
Use HT Bolts M20 ϕ (ϕ-)

Construction Method

1) Drill new bolt holes of web plate of main girders.
2) Take off original vertical stiffener which obstruct attachment of strengthening members.
3) Clean surface between web plate and new angles.
4) Add new angles.
5) Tighten HT Bolts.
6) Add filler plates and vertical stiffeners.
7) Tighten HT Bolts.

DETAILS FOR BOLTING

All HT Bolts of main girder obey as follows.



H.T Bolt pitch : P, less than 150 mm

Construction Method

1) Take off rivets and gussets shown Parts a,c.
2) Cleaning surface shown Parts a,b,c.
3) Add new gussets and tighten HT Bolts.
4) Add new angle and tighten HT Bolts.

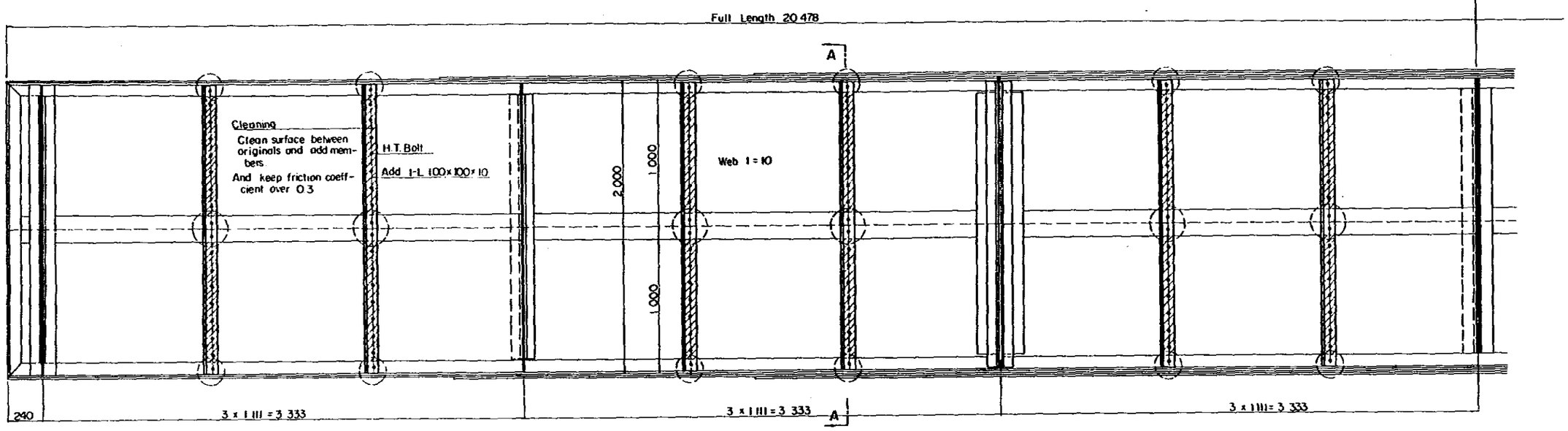
General Notes :

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
2) All high strenght bolts (H.T.B) are M22 (ϕ)(F10T), and assumed friction coefficient of contact surface (f) as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3
3) All rivets are 22 ϕ (ϕ), and to be rolled steel for SV34 (JIS G3104) or materials of equivalent
4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF PLATE GIRDER	DL. 15 loading	
		Unit	Scale
		mm	1/20
K. M.		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

STRENGTHENING OF STIFFENER S=1/15

CLEVELAND TYPE (L=20^{m}0 T.P)



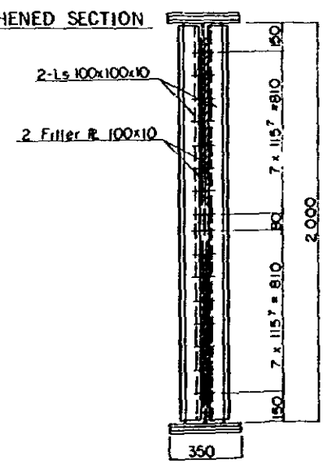
Note ;
◯ : Re-Use Existing holes

Construction Method

1) Repair deformation of web plate befor strengthening of stiffener angles.
2) Drill new bolt holes
3) Cut off rivets of original members
4) Cleaning
5) Attach new Angles and Filler Plates.
6) Tighten H.T.Bolts

SECTION A - A

STRENGTHENED SECTION



ORIGINAL MEMBER SECTION

6-Cov. PL 350×10
4-Ls 90×90×10
1-Web PL. 2000×10

General Notes,

1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.

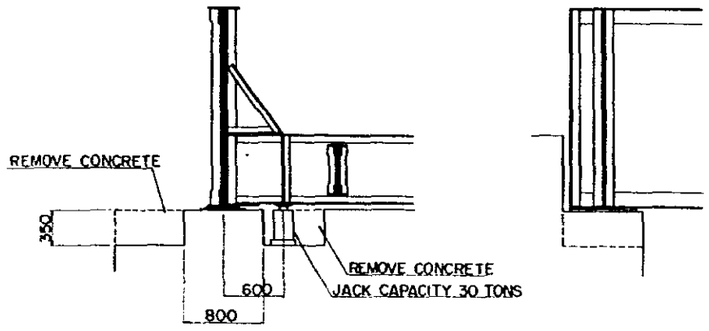
2) All high-strength bolts(HTB) are M22 (φ)(F10T), and assumed friction coefficient of contact surface(f) as follows.
   i) for connection f ≥ 0.4
   ii) for stitch f ≥ 0.3

3) All dimensions to be checked in the field.

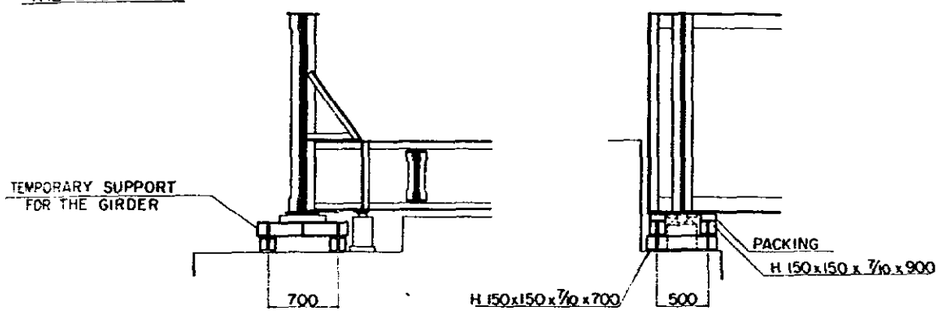
THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members STRENGTHENING OF STIFFENER	DL. 15 loading	
		Unit	Scale
		mm	1/15
K N		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

REINFORCE METHOD OF THE GIRDER AND SHOES

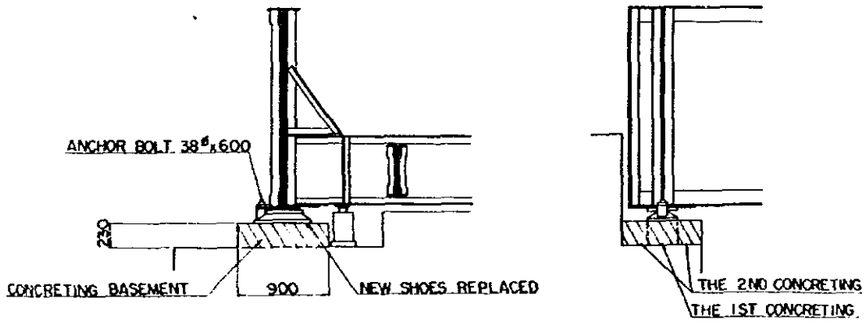
THE 1ST STEP



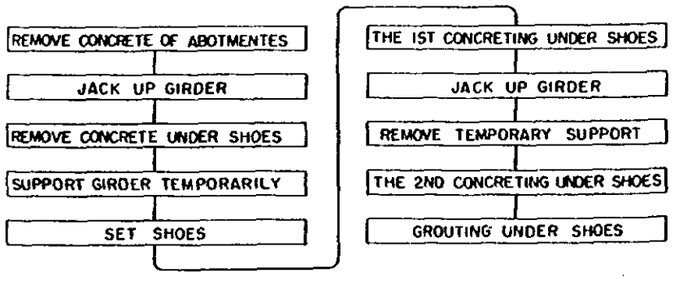
THE 2ND STEP



THE 3RD STEP

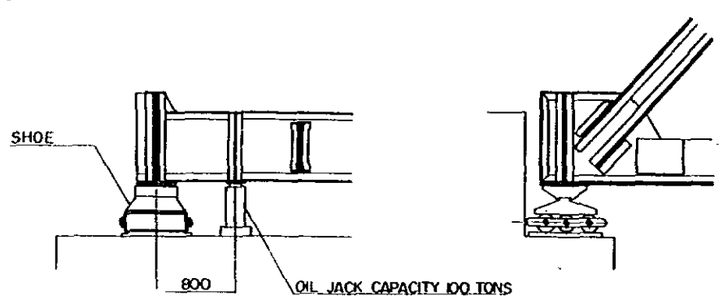


PROCESS OF THE WORKS

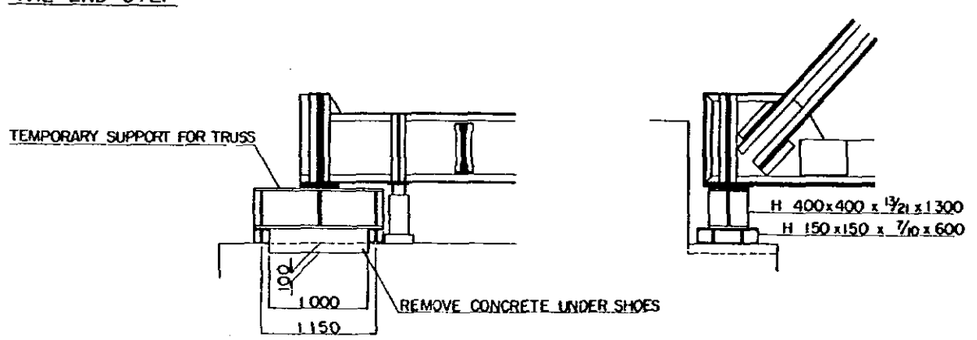


REINFORCE METHOD OF THE TRUSS AND SHOES

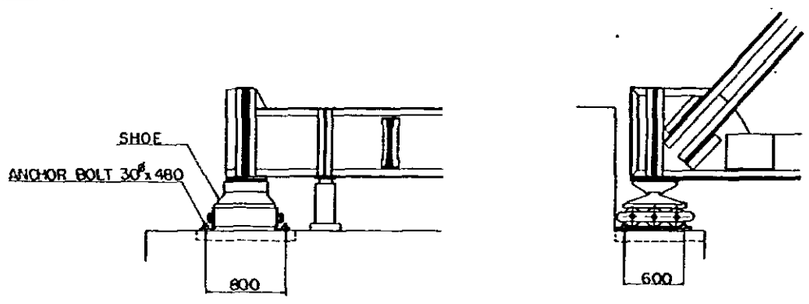
THE 1ST STEP



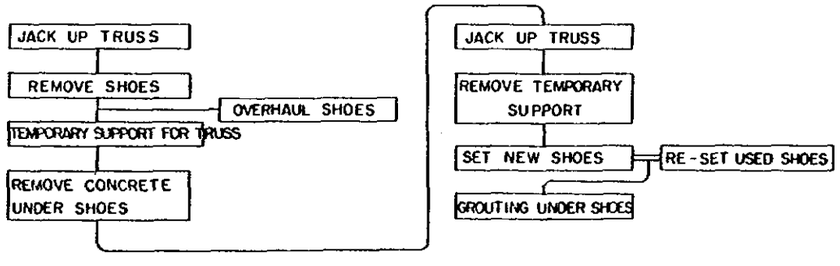
THE 2ND STEP



THE 3RD STEP



PROCESS OF THE WORKS



THE STATE RAILWAY OF THAILAND			
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	REINFORCE METHOD OF SHOES	DL 15 loading
			Unit: mm / Scale
K. M		Designed by	
DISTRICT		Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

付　録　Ⅷ

架換え橋の標準設計図及び施工計画

ま　え　が　き

ここに集録する図面は架換え橋の標準設計図及び施工計画図である。

DRAWINGS FOR NEW BRIDGES FOR REPLACEMENT AND CONSTRUCTIONAL METHOD

Seven bridges are considered for replacement in the project. Explanation for replacement work of these bridges with illustrations and the schematic drawings and approximate steel weight of the new bridges are presented in this appendix.

[1] Bridge at Southern Line $77^{K} + 844^{M}$

1 General

District : Hua Hin

Existing Bridge

Type : Through truss bridge

Span : 1 x 25.5M

c.to.c of main trusses: 4.73 M

New Bridge

Type : Through plate girder bridge

Span : 1 x 25.5M

c.to.c of main girders: 4.0 M

Weight of steel: 39.9 t

2 Method for Execution

2-1 Selection of Method for Execution

The existing bridge is of single-track through truss type, having a span of 25.5m. It will be replaced by a through plate girder bridge during train intervals.

(a) The bridge has an overhead clearance of about 5.5m and there is no river water running underneath during the dry season.

(b) There are no structures nor other obstacles in adjoining areas, and this provides a sufficient space for erection of the new bridge and dismantling of the old bridge.

(c) The bridge is easily accessible to trucks carrying required structural members on highway.

(d) The new girder bridge has a span of 25.5m and weight of about 40 tons.

(e) Soils beneath the bridge are presumably composed of sand.

For reasons of the above site conditions and high rent fee for construction equipment like truck-cranes, it is proposed to replace the existing bridge by the transverse sliding method using stagings and to employ ginpoles for erection of the new plate girders and dismantling of the old truss bridge.

2-2 Sequence of Execution

(1) Preparatory work
Haul road for structural members and site of staging construction will be prepared.

(2) Stagings for erection of the new bridge and scaffolding for transverse sliding of the new and old bridges will be erected adjacent to the existing bridge.

(3) Assembly of new bridge
Main girders, floor beams and stringers will be assembled in that order using a

ginpole with 5-ton capacity. After adjusting the camber of the girders, high strength bolts will be installed in the new bridge to complete the erection on the stagings. Then, sleepers and rails will be set on it.

(4) Removal of shoes from old bridge and remodeling of shoe pedestals

After jacking up the old bridge, its shoes will be removed. The portion of abutment to bear the shoes is remodeled in such a way that holes for anchor bolts to fix the shoes are bored and grooves to fit the ribs attached on the shoe soles are formed by chiselling.

(5) Removal of the old bridge by transverse sliding method

After installing the upper and lower beams and rollers, the old bridge will be removed by transverse sliding with two "TIRFORs" (3 ton-capacity universal pulling apparatus).

(6) Installation of shoes

After transverse sliding of the old bridge, the shoes for the new girders will be placed in position.

(7) Installation of the new bridge by transverse sliding method

The assembled new bridge will be installed in position by means of the transverse sliding method.

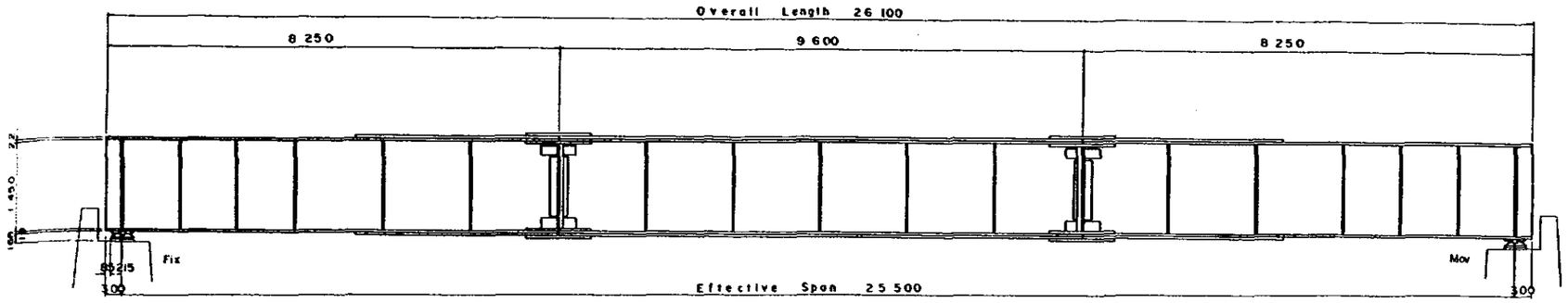
(8) Dismantling of the old bridge

The old bridge removed will be dismantled by means of a 2-ton ginpole crane.

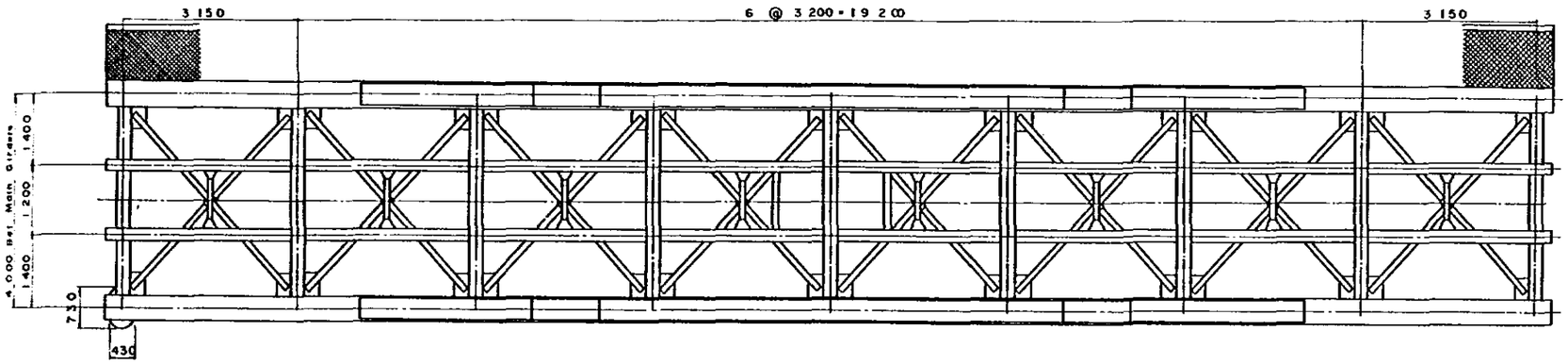
(9) Removal of temporary installations

Stagings and other temporary installations will be dismantled to complete the entire work.

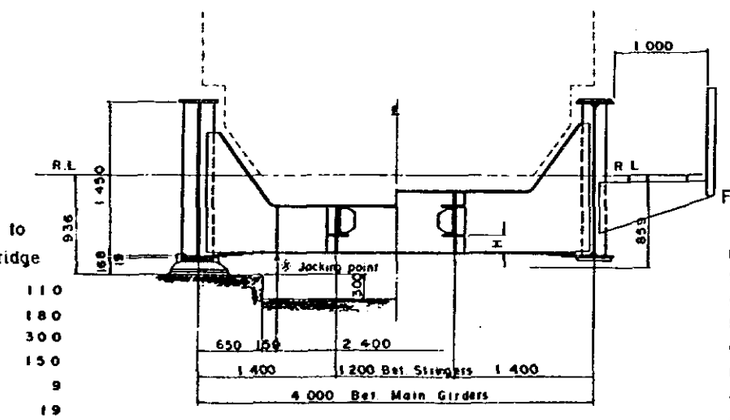
ELEVATION



PLAN



CROSS SECTION



From R.L to Base of Bridge

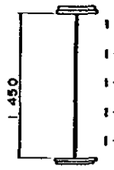
Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	19
Side "	28
Slab	120
Dry Packing	20
	936

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	28
Cover "	28
Splice "	34
H.T.B Head	20
	859

USED SECTION

Main Girders



- 1-PL 360 x 32
- 1-PL 400 x 32
- 1-PL 1450 x 10
- 1-PL 420 x 28
- 1-PL 380 x 28

Intermadiate Floor Beams

- 1-PL 220 x 22
- 1-PL 539 x 10
- 1-PL 210 x 19

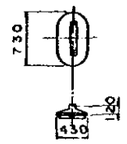
End Floor Beams

- 1-PL 280 x 22
- 1-PL 409 x 10
- 1-PL 280 x 19

Stringers

- 1-PL 200 x 16
- 1-PL 269 x 10
- 1-PL 200 x 15

Shoe



NOTICE

L – Live Load
I – Impact Load
D – Dead Load
LR – Long Rail Load

Rough Weight of Steel

Main Girders	24.7
Inter. Floor Beams	3.7
End Floor Beams	1.2
Stringers	4.4
Lateral Bracings	1.5
Shoes	0.6
Sidewalk	3.8
	39.9 t

Effective Span 25.5 M (T.P)

Main Girder			
Stress			
	M (t.m)	R (t)	
D	89.4	14.03	
L	243.2	44.63	
I	130.6	23.97	
Σ	463.2	82.63	
Used Section			
IN	2 910 000 cm⁴		
Yu	76.39 cm		
Yℓ	80.61 cm		
Actual Stress (kg/cm²)			
	σ	σa	
U.Flg	− 1 216	− 1 242	
L.Flg	+ 1 399	+ 1 400	

End Floor Beam			
Stress			
	M (t.m)	S (t)	
D	1.16	0.91	
L	17.50	12.50	
I	12.20	8.72	
Σ	30.86	22.13	
Used Section			
IN	58 430 cm⁴		
Yu	21.44 cm		
Yℓ	23.56 cm		
Actual Stress (kg/cm²)			
	σ	σa	
U.Flg	−1132	−1 250	
L.Flg	+1244	+1 400	

Int. Floor Beam			
Stress			
	M (t.m)	S (t)	
D	1.76	1.34	
L	20.35	14.54	
I	14.04	10.03	
Σ	36.15	25.91	
Used Section			
IN	81 770 cm⁴		
Yu	27.43 cm		
Yℓ	30.57 cm		
Actual Stress (kg/cm²)			
	σ	σa	
U.Flg	−1 213	−1 250	
L.Flg	+1 351	+1 400	

Stringer			
Stress			
	M (t.m)	R (t)	
D	0.42	0.52	
L	6.00	11.02	
I	4.18	7.68	
Σ	10.60	19.22	
Used Section			
IN	14 160 cm⁴		
Yu	14.71 cm		
Yℓ	15.29 cm		
Actual Stress (kg/cm²)			
	σ	σa	
U.Flg	−1101	−1 237	
L.Flg	+1308	+1400	

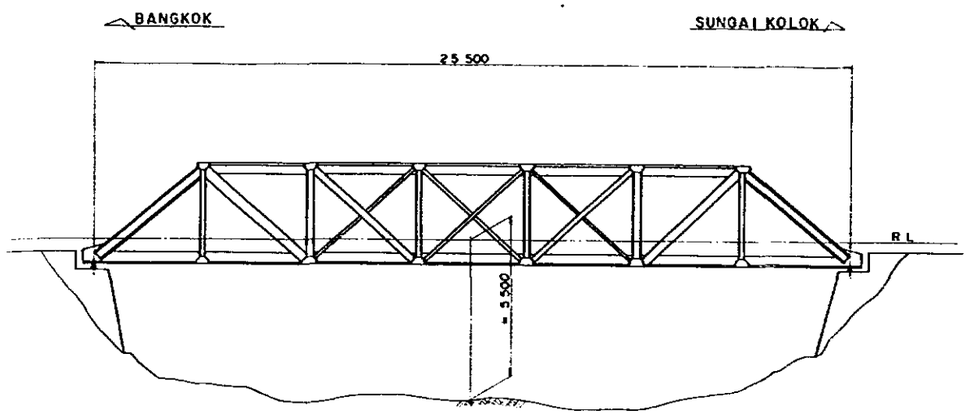
Bearing Stress of Shoes		
Bearing Area = 2 742 cm²	σ = 39 kg/cm²	σa = 40 kg/cm²
Deflection of Main Girder due to Live Load		30 mm

LR = 6.4 t

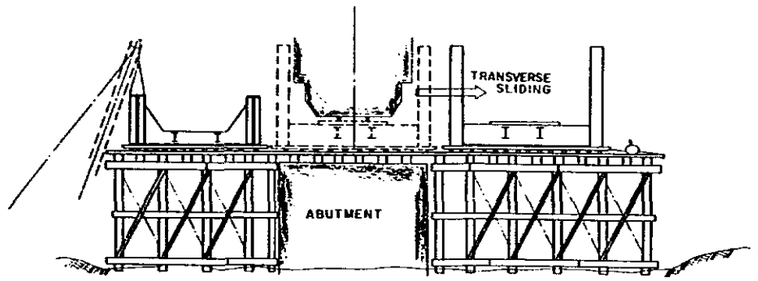
THE STATE RAILWAY OF THAILAND			
TYPE	1 x 25 50M TP.	D.L 15 loading	
		UNITS	mm
Km. 77K + 844M		SCALE : 1 : 50	
District. HuaHin		1 : 30	
Line. SOUTHERN			
Remarks		Designed by	
Replacement for Old Steel Bridge		Checked by	
Span. 1 x 25.50M TT.		Approved by	
DATE		DRAWING NO.	

METHOD OF REPLACEMENT (THE SOUTHERN LINE ($77^{K}+844^{M}$) BRIDGE)

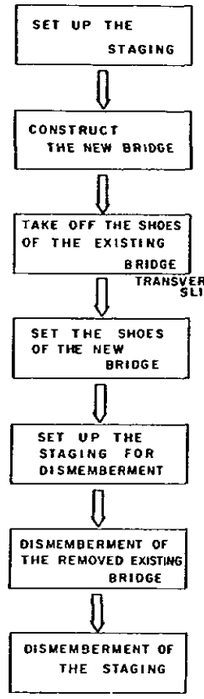
SIDE VIEW OF THE EXISTING BRIDGE S = 1/100



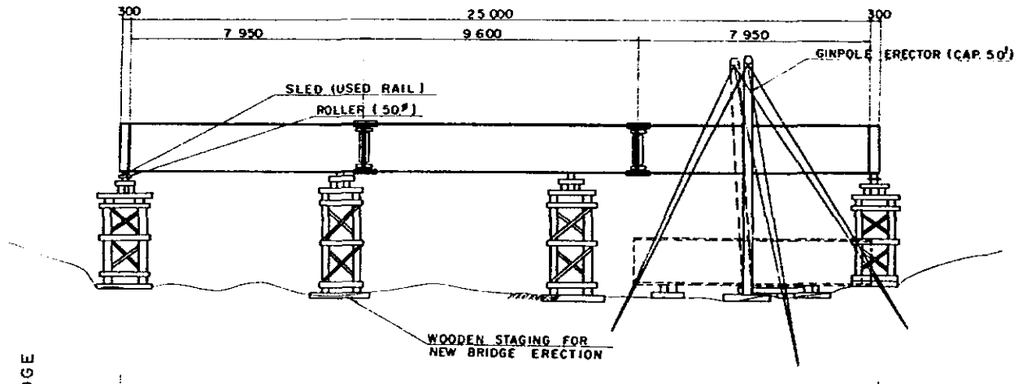
TRANSVERSE SLIDING OF THE EXISTING BRIDGE S = 1/100



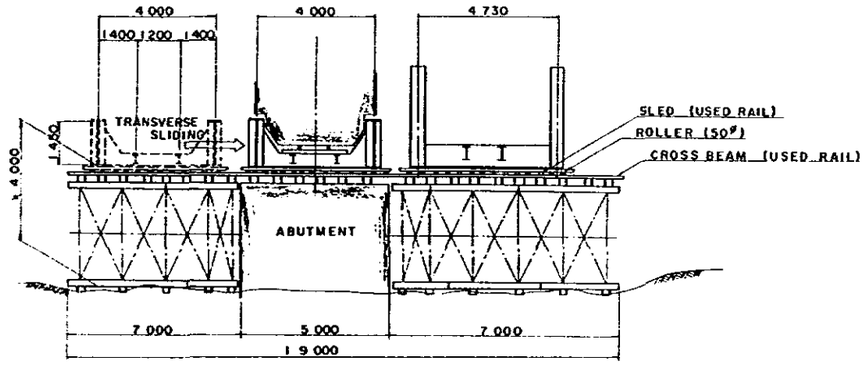
PROCESS OF WORK



ERECTION METHOD OF THE NEW BRIDGE S = 1/100

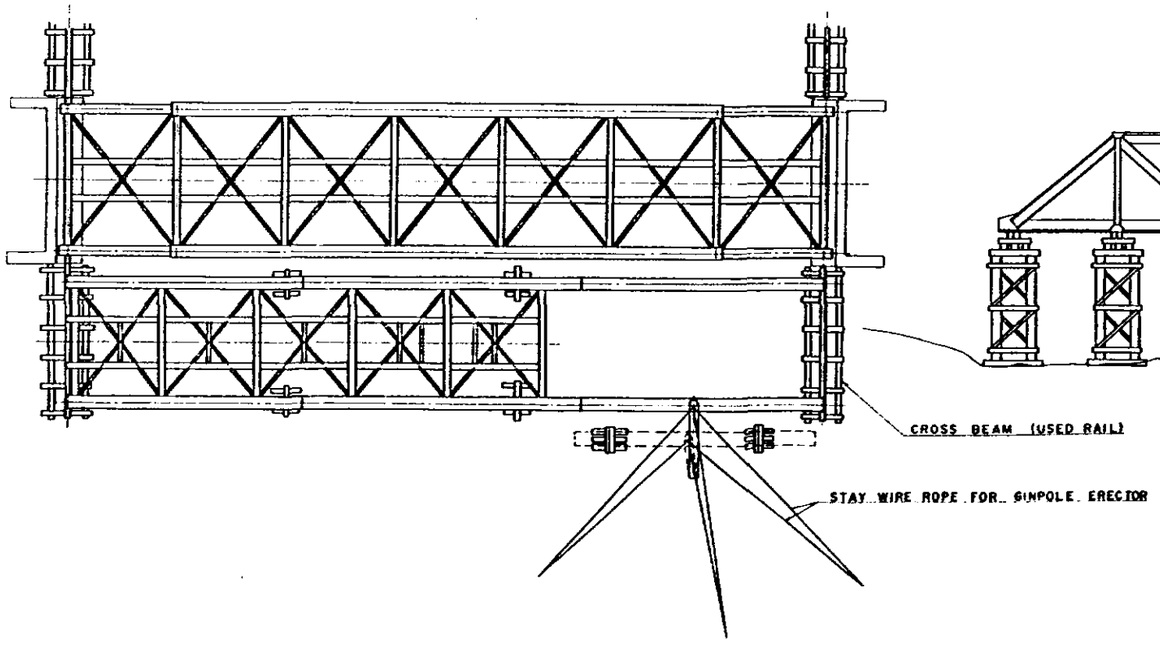


TRANSVERSE SLIDING OF THE NEW BRIDGE S = 1/100

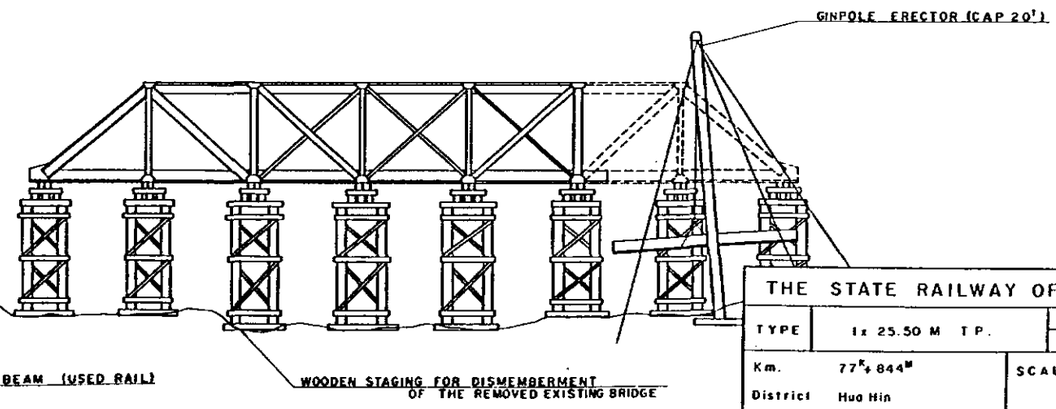


PLANE FIGURE OF THE EXISTING BRIDGE

PLANE FIGURE FOR ERECTION METHOD OF THE NEW BRIDGE



DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S = 1/100



THE STATE RAILWAY OF THAILAND		
TYPE	1 x 25.50 M T.P.	D.L 15 loading
		UNITS: mm
Km. $77^{K}+844^{M}$		SCALE : 1:100
District Hua Hin		
Line. SOUTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span.. 1 x 25.50 M TT		Approved by
DATE		DRAWING NO.

[2] Bridge at Southern Line $120^K + 195^M$

1 General

District : Kanchanaburi

Existing Bridge

Type : Through truss bridge

Span : 8 x 20.8 M

c.to.c of main trusses: 4.0 M

New Bridge

Type : Through plate girder bridge

Span : 8 x 20.8 M

c.to.c of main girders: 4.0 M

Weight of steel: $8 \times 27.4 = 219.2^t$

2. Method for Execution

2-1 Selection of Method for Execution

(1) Of the eight single-track through trusses with a 20.8m span, one on the Bangkok side (left side) and two on the Nantok (right side) exist over high water channel and the remaining five exist over low water channel.
In addition there are two truss bridges which were already erected for replacement.

(2) The overhead clearance above high water channel will be 1.5m on the Bangkok side and about 4.0m on the Nantok side.

(3) The trusses over the low water channel will have an overhead clearance of about 7.0m and the river has a depth ranging from 4.0 to 4.5m.

(4) An excellent roadway to Bangkok is located on the Bangkok side of the bridge site.

(5) A floating crane cannot be towed to the construction site from Bangkok up to the Kwai River, because a dam is built midway on the river.

(6) The new bridge consists of eight trusses having a combined weight of 219.2 tons (27.4 x 8), which increase to about 500 tons when the weight of the old trusses are added. The maximum member weight is about 3.3 tons.

(7) The use of truck-cranes, which are available in Bangkok alone, is recommendable for reasons of the excellent roadway connecting the capital city with the construction site, the heavy weight of the trusses and increased working efficiency. However, the rent for the cranes is expensive, being 1600 Bahts per day.

(8) As the period of construction work is long, piles will have to be driven for erecting the trusses over the low water channel. In such a case, a hoise made by remodeling a pile driver will be used for erection and dismantling.

(9) The RSR has trusses for erection work in stock. Based on the above conditions of execution, the following method is to be considered recommendable:

2-1-1 On land

Stagings will be erected at the site for erection, transverse sliding and dismantling.

2-1-2 On water

New bridges will be erected on the stagings installed on land, moved to the specified position in the longitudinal direction and then shifted transversely by sliding.

The old bridges will also be moved back longitudinally to land for dismantling.

The erection trusses will be installed atop the stagings and rails will be laid on the trusses to permit movement of the bridges. This will apply to erecting and dismantling operations on both land and water.

Hoists made by remodeling pile drivers will be used for erection and dismantling of the bridges.

2-2 Sequence of Execution

2-2-1 On land

(1) Preparatory works

The site of temporary supports for erection trusses and a haul road for materials will be prepared.

(2) Assembly of erection trusses

Erection trusses will be assembled on both sides of the old bridges for erection of new bridges and dismantling of the old ones.
The temporary supports will be made of timbers rising about 2.5m, and positioned on both the upstream and downstream sides of the piers.

(3) Assembly of new bridges

New bridges will be assembled on the erection trusses by means of hoists made by remodeling pile drivers.

(4) Final tightening of high strength bolts of the bridges

After adjusting camber, high strength bolts will be fastened in the bridges and rails will be laid on them.

(5) Removal of shoes

The shoes of the old bridges will be removed and the bridges will be supported temporarily on steel plates.

(6) Transverse sliding

Rollers of 50mm in diameter and rails will be laid under the new and old bridges for transverse sliding and the both bridges will be coupled temporarily and slid transversely at the same time.
A 15HP engine winch will be used for transverse sliding.

(7) Installation of new shoes

On completion of transverse sliding, new shoes will be installed for the new bridges and then the bridges will be placed. Anchor bolt holes will be drilled for fixing the new shoes.

(8) Dismantling of old bridges

The bridges will be dismantled by hoists.

2-2-2 On water

(1) Erection of temporary supports

Timber supports about 5m in height will be erected on piled foundation on both the upstream and downstream sides of the piers.

(2) Erection of erection trusses

Two sets of erection bridge consisting of four trusses in parallel will be used for the erection of the new bridges and another two sets for dismantling of the old bridges. On land each set will be erected to the height of 21m and then transported by trucks on rails to the site of erection where it will be lifted with two ginpoles on to the timber supports. The two sets of erection trusses will be connected by an adequate struts and rails will be laid on the trusses.

(3) Assembly of new bridges

The new bridges will be assembled on the erection truss bridges on land by means of hoists.

After adjusting their camber, high strength bolts will be installed in them.

(4) Longitudinal transport of new bridge

When the tightening of all the high strength bolts is completed, the new bridge will be hauled by four trucks, each having a capacity of 8 tons, on rails on the erection trusses to the place of installation.

(5) Removal of old shoes, transverse sliding and installation of new shoes

The same procedure as for the operation on land will be followed.

(6) Longitudinal transport of old bridges.

The old bridges removed by transverse sliding will be hauled on the trusses in the same way as the new bridges.

(7) Dismantling of old bridges

The old bridges moved to land will be dismantled by means of hoists.

2-2-3 Priority of execution for the right and left river banks

(1) The operation on the left bank (Bangkok side) will be started first, since it is easier to bring construction equipment to this side.

(2) The work will be executed on both land and water.

(3) On completion, the erection trusses and timber supports will be dismantled.

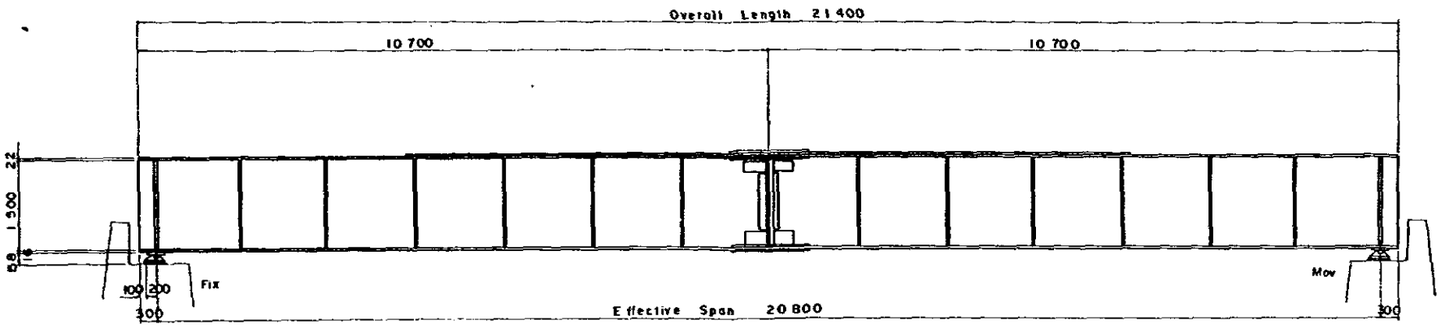
(4) These facilities will then be transported to the right bank by freight cars.

(5) The work on the right bank will be executed in the same way as on the left bank.

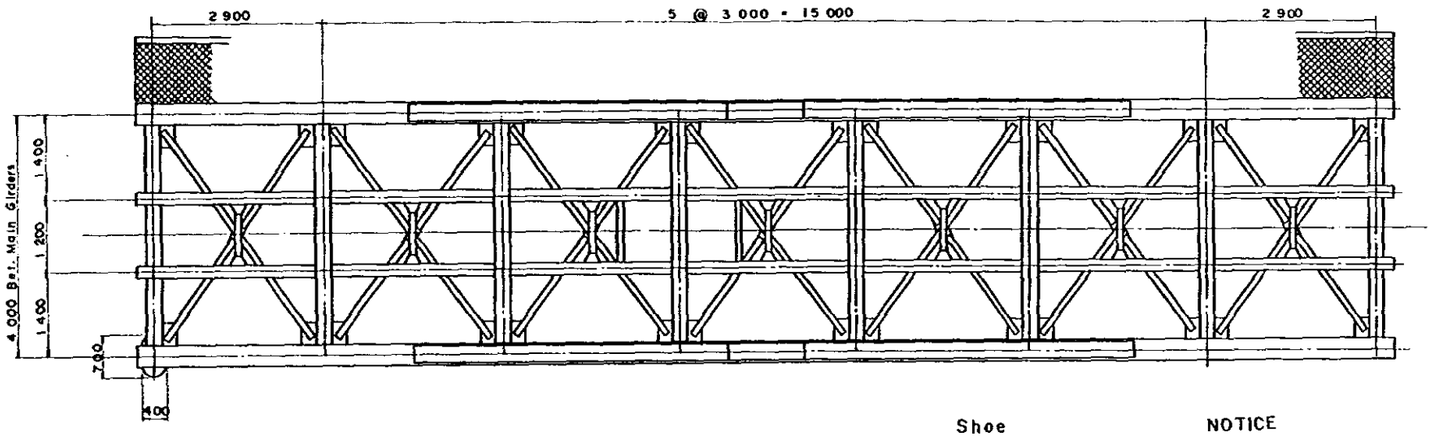
(6) After completion of the work on the right bank, the equipment and facilities will be transported to the left bank.

ELEVATION

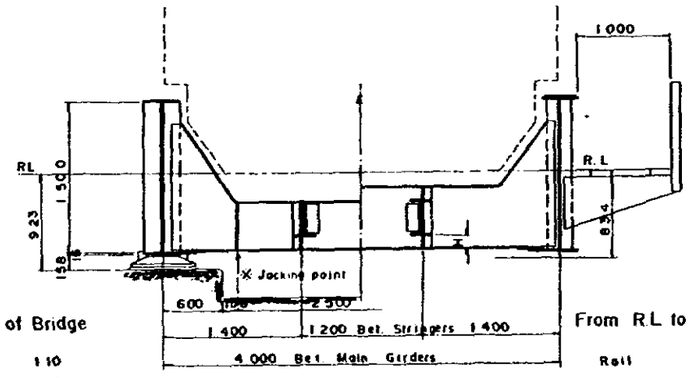
BANGKOK — NAM TOK



PLAN



CROSS SECTION



From R.L to Base of Bridge

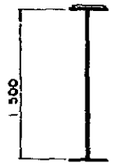
Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	16
Sole "	28
Shoe	110
Dry Packing	20
	923

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	40
Splice "	25
H.T.B Head	20
	834

USED SECTION

Main Girders



1-PL 340 x 22
1-PL 380 x 22
1-PL 1500 x 10
1-PL 410 x 34

Intermediate Floor Beams

1-PL 220 x 22
1-PL 533 x 10
1-PL 210 x 19

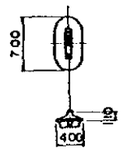
End Floor Beams

1-PL 260 x 22
1-PL 409 x 10
1-PL 260 x 19

Stringers

1-PL 200 x 16
1-PL 269 x 10
1-PL 200 x 15

Shoe



NOTICE

L – Live Load
I – Impact Load
D – Dead Load
LR – Long Rail Load

Rough Weight of Steel

Main Girders	14.6
Inter. Floor Beams	3.1
End Floor Beams	1.2
Stringers	3.6
Lateral Bracings	1.3
Shoes	0.5
Sidewalk	3.1
	27.4 T

Effective Span 20.8 M (T.P)

Main Girder	Stress		
		M (T.M)	R (T)
D		54.1	10.40
L		164.6	38.08
I		97.5	22.54
Σ		316.2	71.02
Used Section			
IN	2 039 000 cm⁴		
Yu	75.99 cm		
Yℓ	81.81 cm		
Actual Stress (kg/cm²)			
		σ	σa
U.Flg		-1179	-1238
L.Flg		+1391	+1400

End Floor Beam	Stress		
		M (T.M)	S (T)
D		1.10	0.87
L		17.02	12.16
I		11.86	8.47
Σ		29.98	21.50
Used Section			
IN	54 670 cm⁴		
Yu	21.46 cm		
Yℓ	23.54 cm		
Actual Stress (kg/cm²)			
		σ	σa
U.Flg		-1177	-1250
L.Flg		+1291	+1400

Int. Floor Beam	Stress		
		M (T.M)	S (T)
D		1.67	1.28
L		19.60	14.00
I		13.55	9.68
Σ		34.82	24.96
Used Section			
IN	81 770 cm⁴		
Yu	27.43 cm		
Yℓ	30.57 cm		
Actual Stress (kg/cm²)			
		σ	σa
U.Flg		-1168	-1234
L.Flg		+1302	+1400

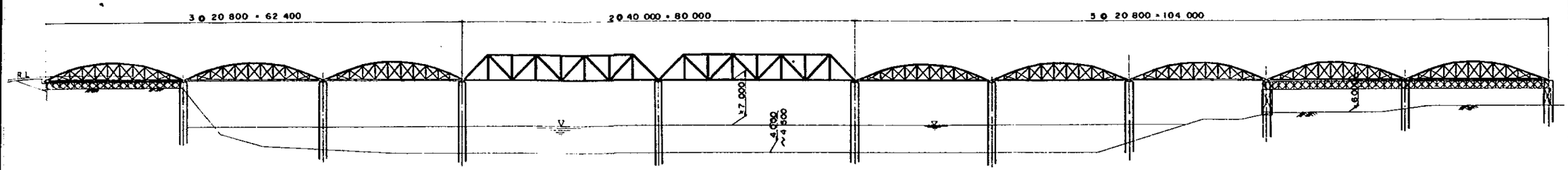
Stringer	Stress		
		M (T.M)	R (T)
D		0.37	0.49
L		5.63	10.75
I		3.93	7.50
Σ		9.93	18.74
Used Section			
IN	14 160 cm⁴		
Yu	14.71 cm		
Yℓ	15.29 cm		
Actual Stress (kg/cm²)			
		σ	σa
U.Flg		-1030	-1250
L.Flg		+1224	+1400

Bearing Stress of Shoes		
Bearing Area = 2 457 cm²	σ = 38 kg/cm²	σa = 40 kg/cm²
Deflection of Main Girder due to Live Load LR = 10.4 T	19 mm	

THE STATE RAILWAY OF THAILAND		
TYPE	8 x 20.80 M TP.	D.L 15 loading
		UNITS: mm
Km. 120K + 195M		SCALE : 1 : 50
District. Hua Hin		1 : 30
Line. SOUTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span. 8 x 20.80 M TT.		
		Approved by
DATE		DRAWING NO.

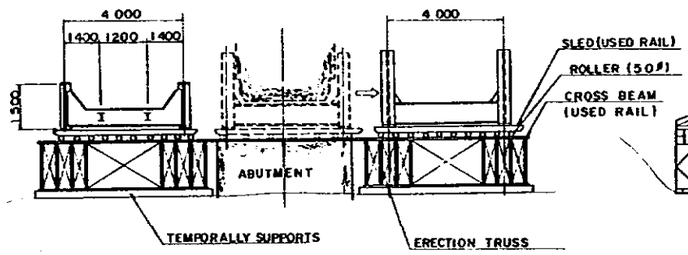
METHOD OF REPLACEMENT (THE SOUTHERN LINE (120K+195M) BRIDGE)
OUTLINE OF ERECTION ON THE GROUND

BANGKOK — NAMTOK

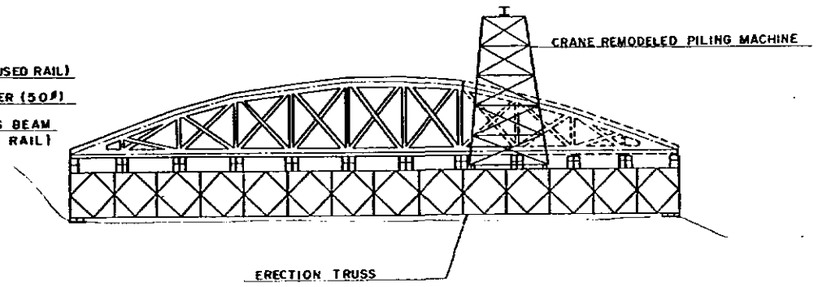


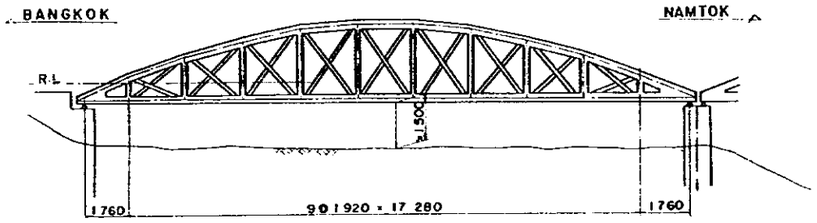
SIDE VIEW OF THE EXISTING BRIDGE S = 1/100

TRANSVERSE SLIDING OF THE EXISTING BRIDGE S=1/100

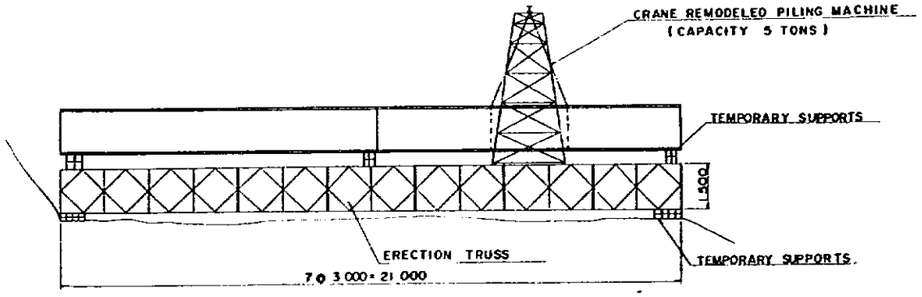


DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S = 1/100

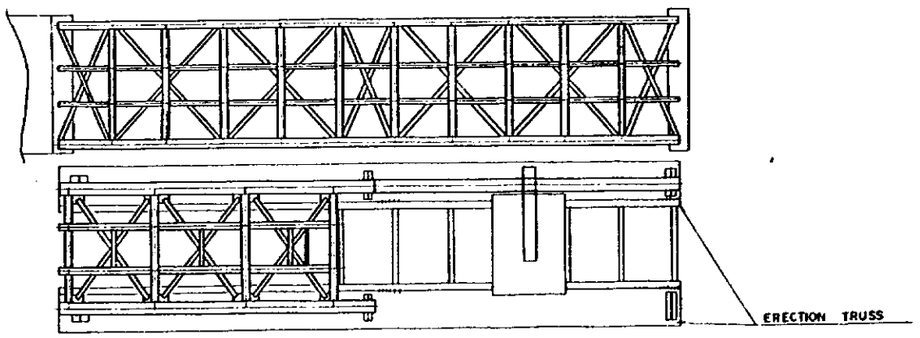




ERECTION METHOD OF THE NEW BRIDGE S = 1/100

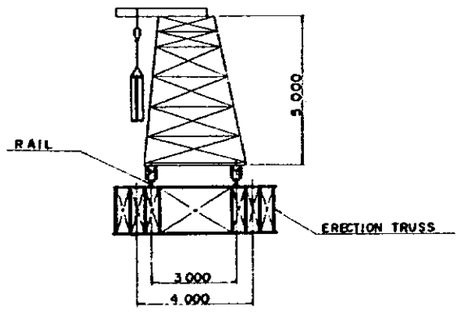


PLANE FIGURE OF THE EXISTING BRIDGE



PLANE FIGURE FOR ERECTION METHOD OF THE NEW BRIDGE

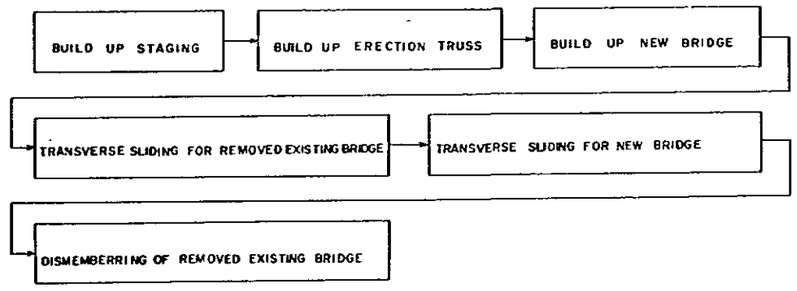
CRANE REMODELED PILING MACHINE S=1/100



NOTE

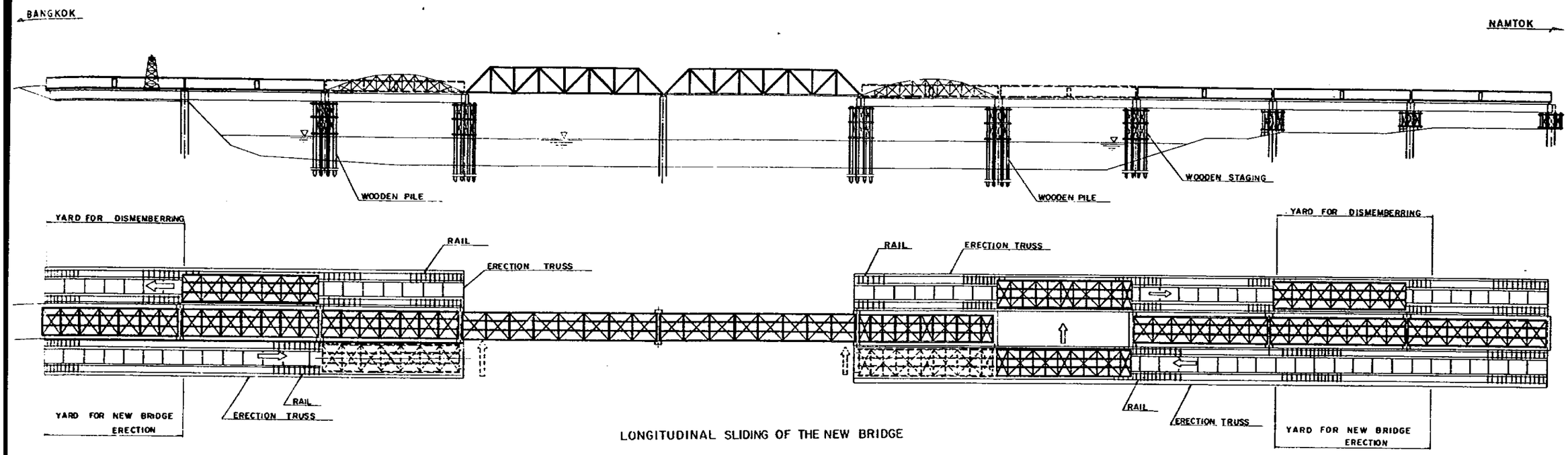
CHECK STRESS OF ERECTION TRUSS

ON THE GROUND PROCESS OF WORKS



THE STATE RAILWAY OF THAILAND			
TYPE	8 x 20.80 M TP.	D.L 15 loading	
		UNITS	mm
Km. 120K+195M District. Hua Hin Line. SOUTHERN		SCALE : 1:100	
Remarks Replacement for Old Steel Bridge Span 8 x 20.80M TT.		Designed by Checked by Approved by	
DATE		DRAWING NO.	

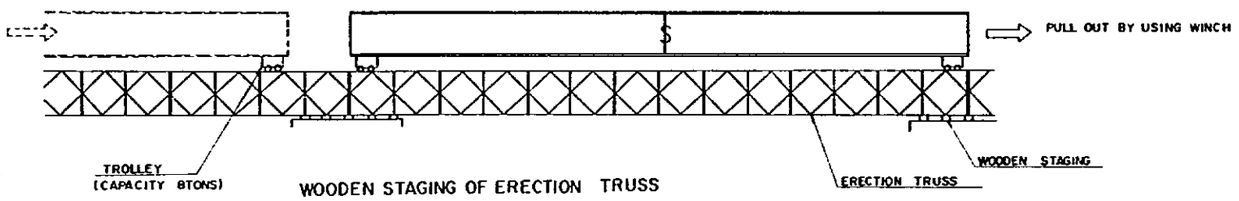
METHOD OF REPLACEMENT (THE SOUTHERN LINE ($120^{K}+195^{M}$) BRIDGE)
OUTLINE OF ERECTION IN THE WATER



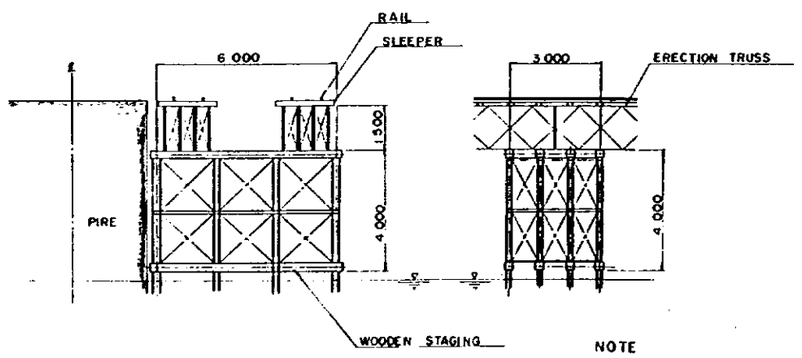
LONGITUDINAL SLIDING OF THE NEW BRIDGE

IN THE WATER PROCESS OF WORKS

1. BUILD UP STAGING
2. BUILD UP ERECTION TRUSS
3. BUILD UP NEW BRIDGE
4. LONGITUDINAL SLIDING OF NEW BRIDGE
5. TRANSVERSE SLIDING OF REMOVED EXISTING BRIDGE
6. TRANSVERSE SLIDING OF NEW BRIDGE
7. LONGITUDINAL SLIDING OF REMOVED EXISTING BRIDGE
8. DISMEMBERRING OF REMOVED EXISTING BRIDGE
9. DISMEMBERRING OF ERECTION TRUSS AND STAGING



WOODEN STAGING OF ERECTION TRUSS



NOTE

CHECK STRESS OF ERECTION TRUSS

THE STATE RAILWAY OF THAILAND		
TYPE	8 x 20.80 M TP.	D.L 15 loading
		UNITS mm
Km. $120^{K}+195^{M}$ District Hua Hin Line. SOUTHERN		SCALE : 1:100
Remarks Replacement for Old Steel Bridge Span 8 x 20.80 M TT.		Designed by Checked by Approved by
DATE		DRAWING NO.

[3] Bridge at Southern Line $153^K + 788^M$

1. General

District : Hua Hin

Existing Bridge

Type : Through plate girder bridge
Span : 1 x 16.0 M
c.to.c of main trusses: 3.49 M

New Bridge

Type : Through plate girder bridge
Span : 1 x 16.0 M
c.to.c of main girders: 4.0 M
Weight of steel: 19.0 t

2. Method for Execution

2-1 Selection of Method for Execution

The existing bridge is of a single-track through girder type with a span of 16m. It will be replaced by a through plate girder bridge during train intervals.

(a) The existing bridge has an overhead clearance of about 5m and the low water channel is about 50cm in depth during the dry season.

(b) The new bridge has a span of 16m and weight of about 19 tons.

(c) There are no structures nor other obstacles in adjoining areas and this provides sufficient space for erecting and dismantling work.

(d) The site is accessible by a road running nearby, which facilitates the transport of construction materials and equipment.

For reasons of the above site conditions and high rent for construction equipment such as truck-cranes, it is proposed to employ the transverse sliding method using stagings for replacement of the existing bridge and to use ginpoles for erecting the new bridge and dismantling the old one.

2-2 Sequence of Execution

(1) Preparatory works

A haul road for materials and equipment and the site for staging construction will be prepared.

(2) Construction of stagings for erection and transverse sliding

Stagings for assembly of the new bridge and transverse sliding of new and old bridges will be constructed adjacent to the existing one.

(3) Assembly of new bridge

Main plate girders, floor beams and stringers will be assembled in that order using a 5-ton ginpole. After adjusting its camber, high strength bolts will be installed in the bridge to complete the assembly. Sleepers and rails will be laid on the new bridge.

(4) Removal of old shoes and remodeling the shoe pedestals

After jacking up the old bridge, its shoes will be removed. The portion of

abutment to bear the shoes is remodeled in such a way that holes for anchor bolts to fix the shoes are bored and grooves to fit the ribs attached on the shoe soles are formed by chiselling.

(5) Removal of old bridge by transverse sliding

After installing the upper and lower beams and rollers, the old bridge will be removed by transverse sliding with two 3-ton universal pulling apparatuses.

(6) Installation of new shoes

After transverse sliding of the old bridge, the shoes for the new bridge will be placed in position.

(7) Installation of new bridge by transverse sliding

The assembled new bridge will be installed in position by means of the transverse sliding method.

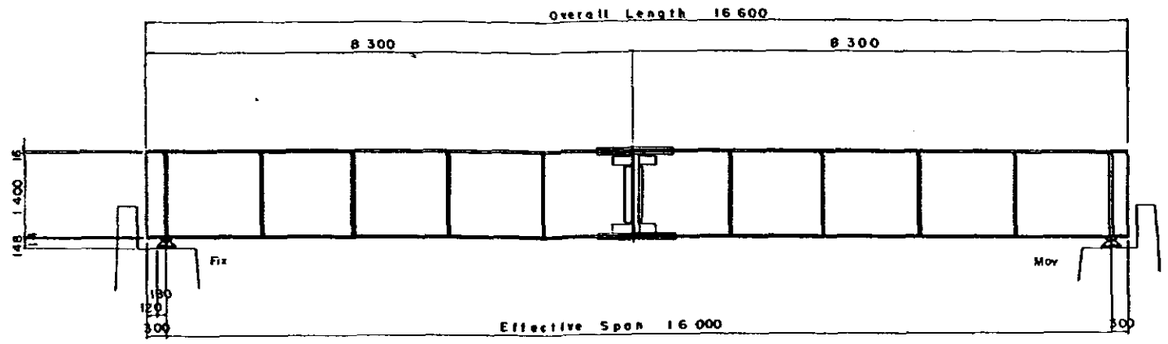
(8) Dismantling of old bridge

The old bridge removed by transverse sliding will be dismantled by means of a 3-ton ginpole.

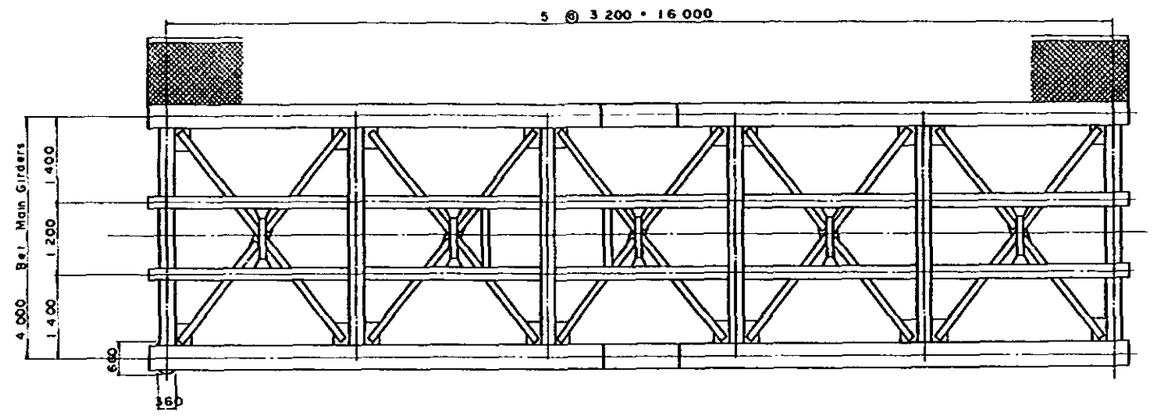
(9) Removal of temporary installations

Stagings and other temporary installations will be dismantled to complete the entire work.

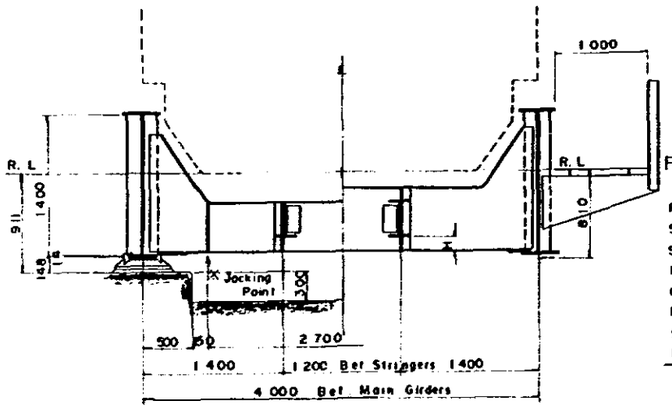
ELEVATION



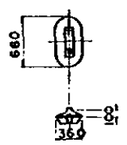
PLAN



CROSS SECTION



Shoe



USED SECTION

Main Girders

1-PL 360 x 28
1-PL 1400 x 10
1-PL 370 x 25

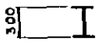
Intermediate Floor Beams

1-PL 220 x 22
1-PL 539 x 10
1-PL 210 x 19

End Floor Beams

1-PL 280 x 22
1-PL 409 x 10
1-PL 280 x 19

Stringers



1-PL 200 x 16
1-PL 269 x 10
1-PL 200 x 15

Effective Span 16.0 M (T.P)

Main Girder		
Stress		
	M (t-m)	R (t)
D	29.1	7.28
L	105.8	31.18
I	67.3	19.83
Σ	202.2	58.29
Used Section		
IN	1 211 000 cm⁴	
Yu	70.98 cm	
Yℓ	74.32 cm	
Actual Stress (kg/cm²)		
	σ	σa
U.Flg	- 1185	- 1 201
L.Flg	+ 1 377	+ 1 400

End Floor Beam		
Stress		
	M (t-m)	S (t)
D	1.17	0.92
L	17.72	12.66
I	12.35	8.82
Σ	31.24	22.40
Used Section		
IN	58 430 cm⁴	
Yu	21.44 cm	
Yℓ	23.56 cm	
Actual Stress (kg/cm²)		
	σ	σa
U.Flg	- 1148	-1250
L.Flg	+1260	+1400

Int. Floor Beam		
Stress		
	M (t-m)	S (t)
D	1.76	1.34
L	20.35	14.54
I	14.04	10.03
Σ	36.15	25.91
Used Section		
IN	81 770 cm⁴	
Yu	27.43 cm	
Yℓ	30.57 cm	
Actual Stress (kg/cm²)		
	σ	σa
U.Flg	- 1 213	-1250
L.Flg	+1 351	+1400

Stringer		
Stress		
	M (t-m)	R (t)
D	0.42	0.52
L	6.00	11.02
I	4.18	7.68
Σ	10.60	19.22
Used Section		
IN	14 160 cm⁴	
Yu	14.71 cm	
Yℓ	15.29 cm	
Actual Stress (kg/cm²)		
	σ	σa
UFlg	- 1101	- 1 237
L.Flg	+1 308	+1 400

Bearing Stress of Shoes		
Bearing Area = 2 098 cm²	σ = 35 kg/cm²	σa = 40 kg/cm²
Deflection of Main Girder due to Live Load L = 8.0 t		12 mm

NOTICE

L - Live Load
I - Impact Load
D - Dead Load
Ln - Long. Roll Load

From R.L to Base of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	14
Sole "	28
Shoe	100
Dry Packing	20
	911

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	25
Splice "	16
H.T.B Head	20
	810

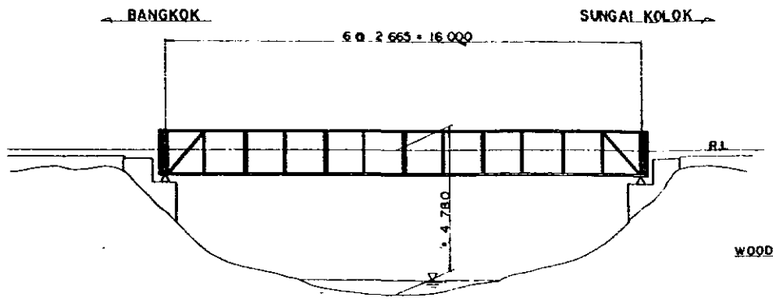
Rough Weight of Steel

Main Girders	9.0
Inter Floor Beams	2.1
End Floor Beams	1.2
Stringers	2.8
Lateral Bracings	0.9
Shoes	0.5
Sidewalk	2.4
	18.9 t

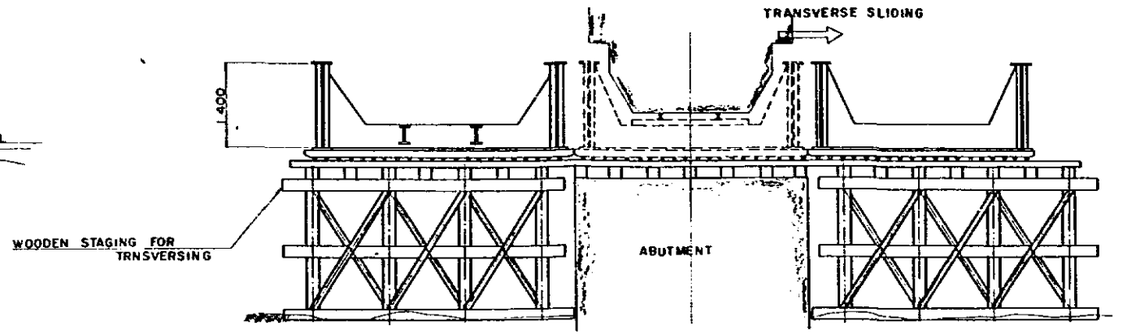
THE STATE RAILWAY OF THAILAND			
TYPE	1 x 16.00M T.P.	D.L 15 loading	
		UNITS	mm
Km 153K+788M		SCALE : 1: 50, 1: 30	
District. Hua Hin			
Line SOUTHERN			
Remarks		Designed by	
Replacement for Old Steel Bridge		Checked by	
Span 1 x 16.00M T.P.			
		Approved by	
DATE		DRAWING NO.	

METHOD OF REPLACEMENT (THE SOUTHERN LINE (153K + 788M) BRIDGE)

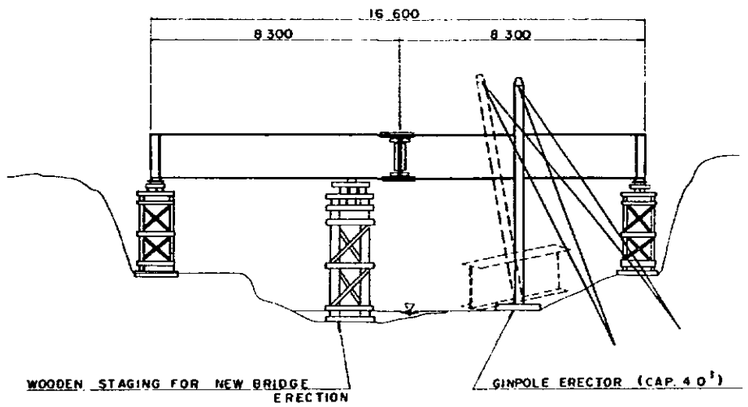
SIDE VIEW OF THE EXISTING BRIDGE S = 1/100



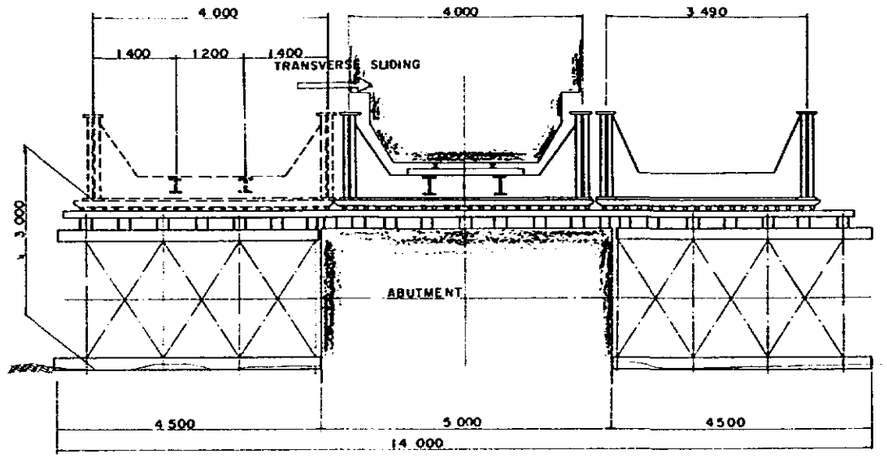
TRANSVERSE SLIDING OF THE EXISTING BRIDGE S = 1/50



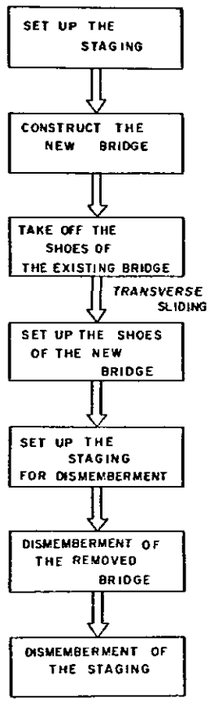
ERECTION METHOD OF THE NEW BRIDGE S = 1/100



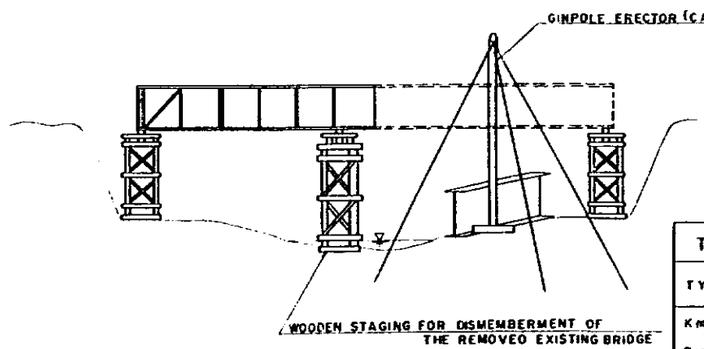
TRANSVERSE SLIDING OF THE NEW BRIDGE S = 1/50



PROCESS OF WORK

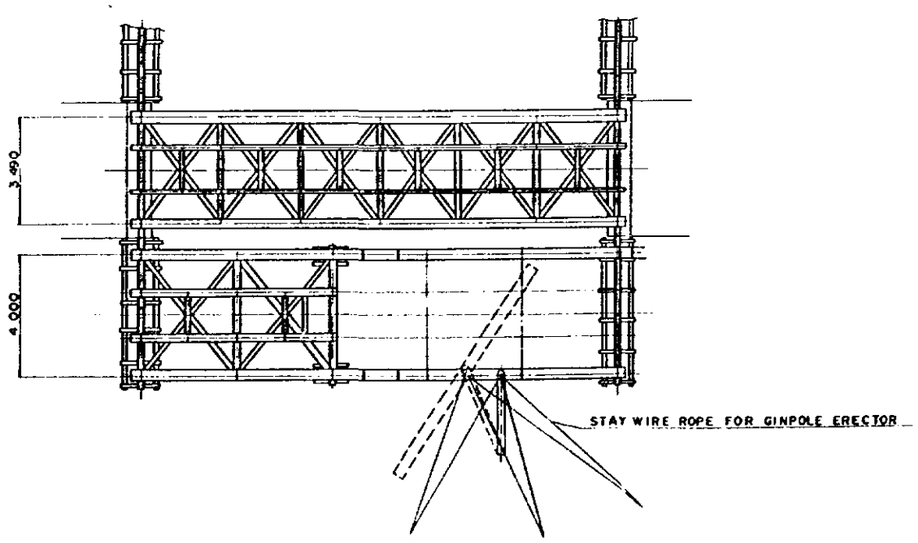


DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S = 1/100



PLANE FIGURE FOR ERECTION METHOD OF THE NEW BRIDGE

PLANE FIGURE OF THE EXISTING BRIDGE



THE STATE RAILWAY OF THAILAND		
TYPE	1×16.00M TP.	D.L 15 loading
		UNITS mm
Km. 453K + 788M District HuoHin Line SOUTHERN		SCALE : 1:100 1: 50
Remarks Replacement for Old Steel Bridge Span 1×16.00M TP.		Designed by Checked by Approved by
DATE		DRAWING NO.

[4] Bridge at Southern Line $993^{K} + 501^{M}$

1. General

District : Yala

Existing Bridge

Type : Through truss bridge

Span : 1 x 30.0 M

c.to.c of main trusses: 4.0 M

New Bridge

Type : Through plate girder bridge

Span : 1 x 30.0 M

c.to.c of main girders: 4.6 M

Weight of steel: 51.2 t

2. Method for Execution

2-1 Selection of Method for Execution

The existing bridge is of a single-track through truss type with a span of 30.0m. It is to be replaced with a through plate girder bridge during train intervals.

(1) Marshland stretches underneath the bridge and there are scattered puddles.

(2) The puddles are shallow and can be filled up.

(3) The site is not accessible by a roadway for bringing construction materials and equipment.

(4) The existing bridge has an overhead clearance of about 4.0m, which should permit the construction of stagings.

(5) The new bridge has a span of 30.0m and weight of 51.2 tons.

For reasons of the above site conditions, it is considered advisable to adopt the transverse sliding method using stagings for the replacement of the existing bridge.

2-2 Sequence of Execution

(1) Preparatory works

(a) The place for construction of stagings will be prepared.

(b) Improvement of the marshy ground and fillingup of the puddles will be carried out.

(2) Construction of stagings

Stagings for erection and transverse sliding will be constructed adjacent to the existing bridge. Square timber foundations will be laid for the stagings. Rails will be laid on the stagings for transverse sliding.

(3) Transport of new bridge

(a) The members for the new bridge will be transported to the neighborhood of the site by freight cars where they will be unloaded.

(b) After unloading, they will be moved by trollies to the erection site.

(4) Assembly of new bridge

Using ginpoles, the main plate girders, floor beams and stringers will be assembled

in that order to complete the assembly. After adjusting its camber, high strength bolts will be installed in the assembly, and sleepers and rails will be laid on the completed bridge.

(5) Removal of old bridge by transverse sliding

(a) The old bridge will be jacked up and rollers will be placed between the bridge and rails for transverse a sliding.

(b) It will then be slid about 6m transversely with a universal pulling.

(6) Transverse sliding of new bridge

(a) The portion of abutment to bear the shoes is remodeled in such a way that holes for anchor bolts to fix the shoes are bored and grooves to fit the ribs attached on the shoe soles are formed by chiselling.

(b) The new bridge will be slid sideways in the same way as the old one.

(c) When slid to the place of erection, the new bridge will be jacked up and, after removing the rollers, installed on to the shoes.

(7) Removal of old bridge

(a) Stagings will be constructed at the panel points of the old bridge. For these stagings the materials obtained by dismantling the stagings used for assembly of the new bridge may be utilized.

(b) By ginpoles installed on the old bridge, the upper chord members, stringers, floor beams and lower chord members will be dismantled in that order.

(8) Dismantling of stagings

The stagings for dismantling of the old bridge and for transverse sliding will be dismantled.

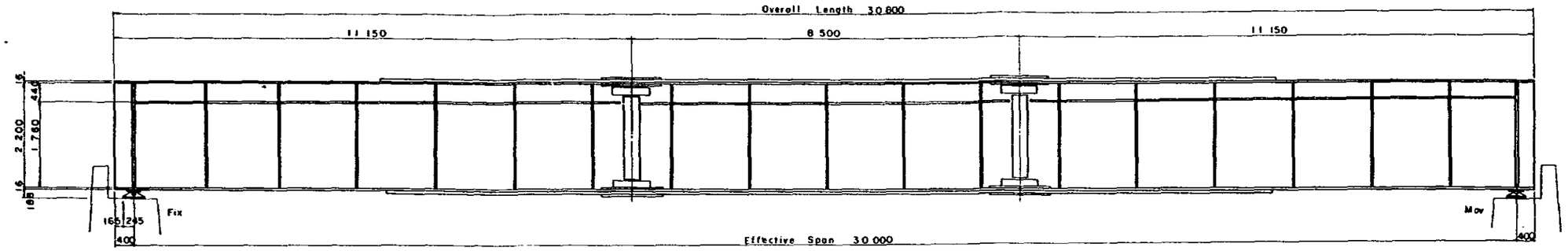
BANGKOK

S.- 993K+501M (NE- 323K+816M)

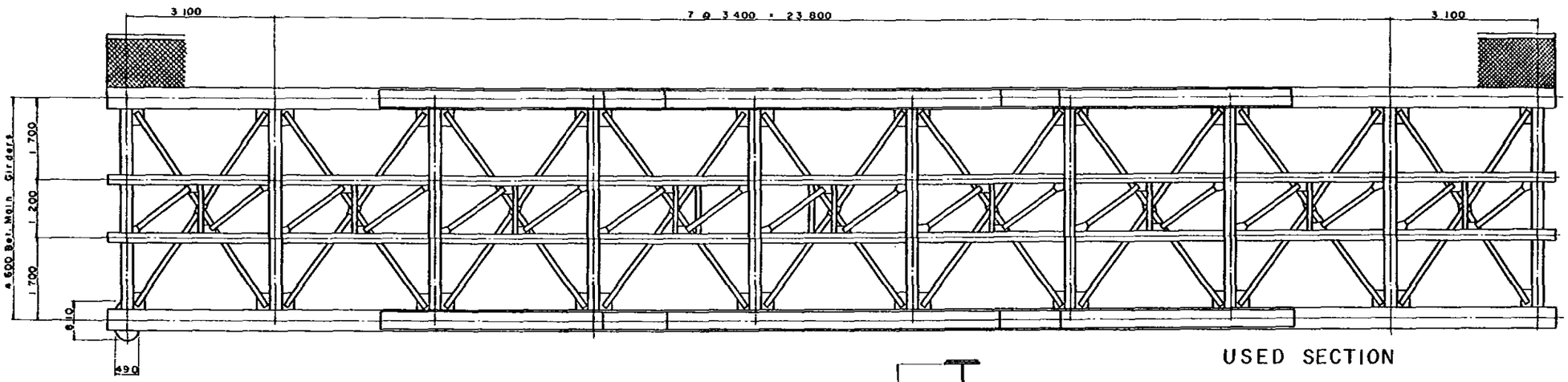
SUNGAI KOLOK

UBON RATCHATANI

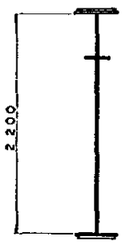
ELEVATION



PLAN



USED SECTION



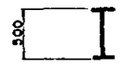
Main Girders

1-PL	420 x 22
1-PL	460 x 22
1-PL	2200 x 11
1-PL	440 x 22
1-PL	400 x 22

Intermediate Floor Beams

1-PL	250 x 22
1-PL	589 x 10
1-PL	240 x 19

End Floor Beams

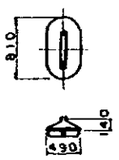


1-PL	250 x 25
1-PL	453 x 10
1-PL	240 x 22

Stringers

1-PL	200 x 16
1-PL	319 x 9
1-PL	200 x 15

Shoe



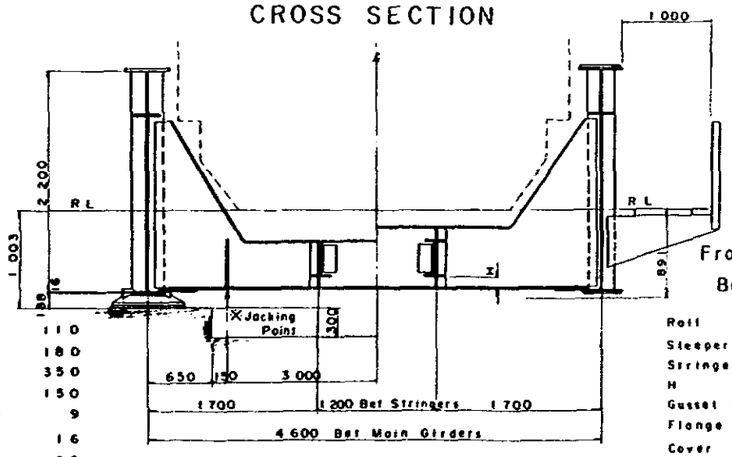
NOTICE

L - Live Load
I - Impact Load
D - Dead Load
Le - Long Rail Load

Rough Weight of Steel

Main Girders	30.8
Inter. Floor Beams	5.9
End Floor Beams	1.7
Stringers	5.7
Lateral Bracings	1.7
Shoes	0.9
Sidewalk	4.5
	51.21

CROSS SECTION



From R.L to Base of Bridge

Rail	110
Sleeper	180
Stringer	350
H	150
Gusset Plate	9
Flange -	16
Sole "	28
Shoe	140
Dry Packing	20
	1 003

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Stringer	350
H	150
Gusset Plate	9
Flange -	22
Cover -	25
Splice -	25
H.T.B. Head	20
	891

Effective Span 30.0 M (T-P)

Main Girder			
	Stress		
	M (t-m)	R (t)	
D	136.1	18.15	
L	328.8	50.49	
I	156.2	23.98	
Σ	621.1	92.62	
Used Section			
IN	5 734 000 cm⁴		
Yu	112.81 cm		
Yℓ	115.99 cm		
Actual Stress (kg/cm²)			
	σ	σa	
U Flg	- 1 222	- 1 248	
L Flg	+ 1 379	+ 1 400	

End Floor Beam		
Stress		
	M (t-m)	S (t)
D	1.42	0.95
L	21.02	12.36
I	14.65	8.62
Σ	37.09	21.93
Used Section		
IN	72 870 cm⁴	
Yu	23.66 cm	
Yℓ	26.34 cm	
Actual Stress (kg/cm²)		
	σ	σa
U Flg	-1 204	-1 250
L Flg	+1 341	+1 400

Int. Floor Beam		
Stress		
	M (t-m)	S (t)
D	2.28	1.45
L	25.51	15.00
I	17.55	10.32
Σ	45.34	26.77
Used Section		
IN	109 900 cm⁴	
Yu	29.81 cm	
Yℓ	33.19 cm	
Actual Stress (kg/cm²)		
	σ	σa
U Flg	-1 230	-1 250
L Flg	+1 369	+1 400

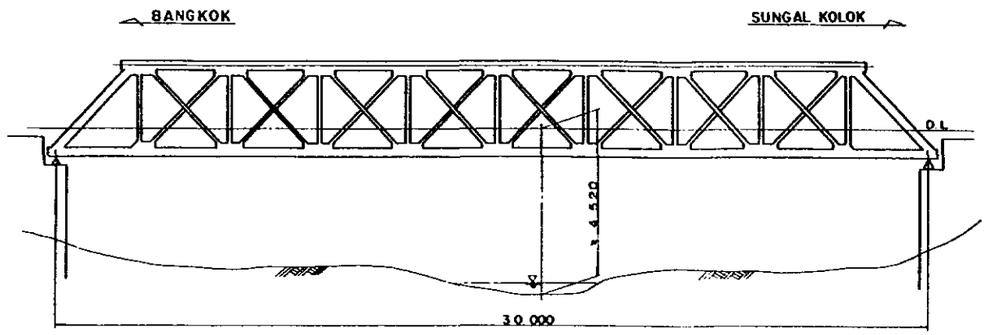
Stringer		
Stress		
	M (t-m)	S (t)
D	0.47	0.55
L	6.38	11.25
I	4.44	7.84
Σ	11.29	19.64
Used Section		
IN	19 770 cm⁴	
Yu	17.16 cm	
Yℓ	17.84 cm	
Actual Stress (kg/cm²)		
	σ	σa
U Flg	- 980	-1 222
L Flg	+1 164	+1 400

Bearing Stress of Shoes		
Bearing Area = 3 454 cm²	σ = 35 kg/cm²	σa = 40 kg/cm²
Deflection of Main Girder due to Live Load Le=15.0 t	29 mm	

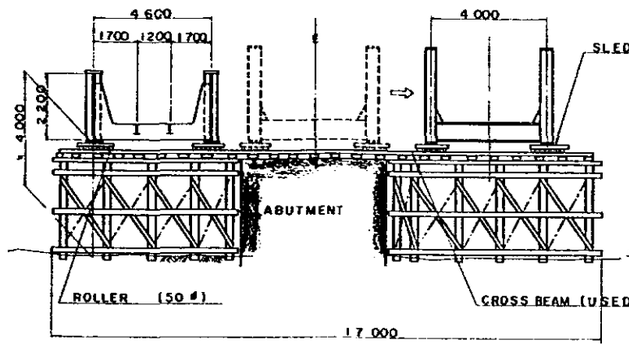
THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.00M T P	D.L 15 loading
		UNITS mm
Km. 993K+503M (323K+816M)		SCALE : 1 : 50 1 : 30
District. Yala, (Lamchi)		
Line. SOUTHERN (NORTH EASTERN)		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span. 1 x 30.00M T T.		Approved by
DATE		DRAWING NO.

METHOD OF REPLACEMENT (THE SOUTHERN LINE (993K+50M) BRIDGE)

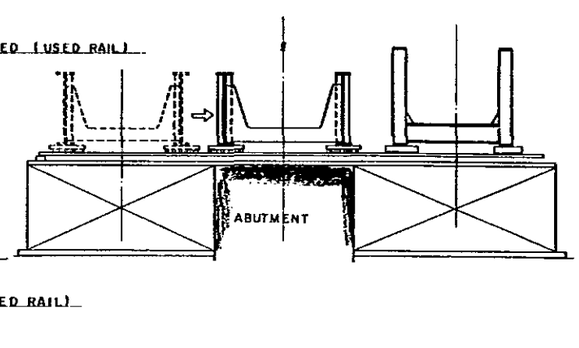
SIDE VIEW OF THE EXISTING BRIDGE S = 1/100



TRANSVERSE SLIDING OF THE EXISTING BRIDGE S = 1/100



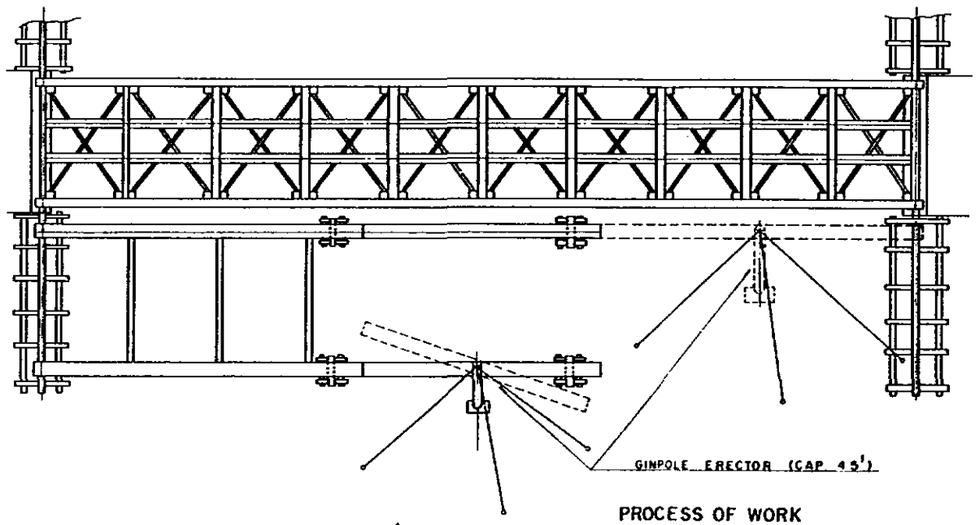
TRANSVERSE SLIDING OF THE NEW BRIDGE S = 1/100

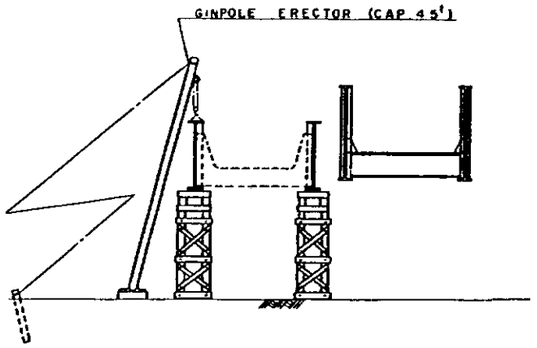


ERECTION METHOD OF THE NEW BRIDGE S = 1/100

PLANE FIGURE FOR ERECTION METHOD OF THE NEW BRIDGE

PLANE FIGURE OF THE EXISTING BRIDGE

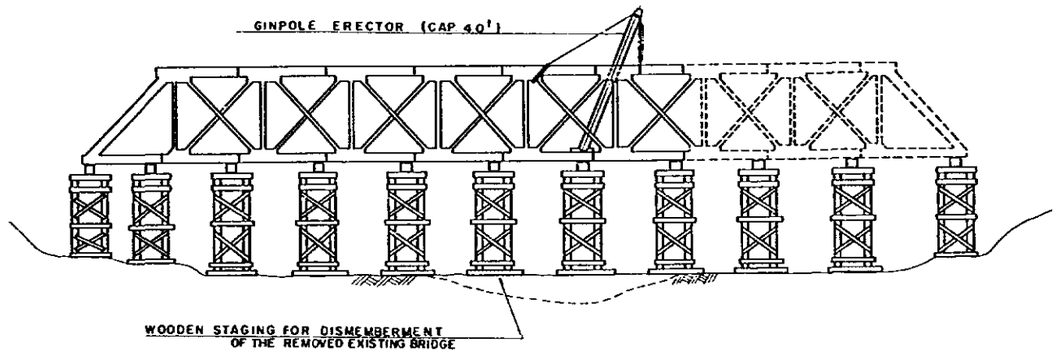




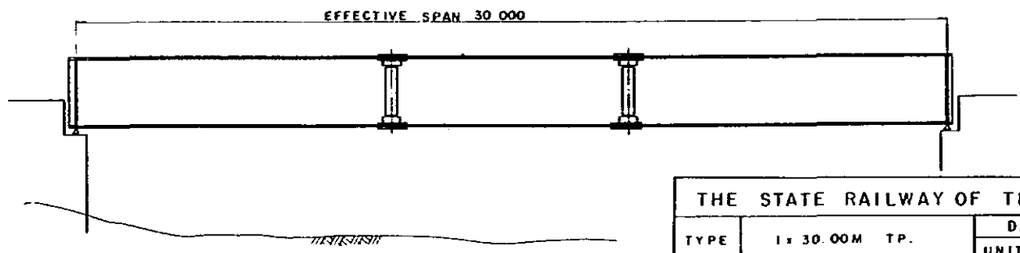
PROCESS OF WORK

SET UP THE STAGING
⇩
CONSTRUCT THE NEW BRIDGE
⇩
TAKE OFF THE SHOES OF THE EXISTING BRIDGE
⇩
TRANSPOSE THE EXISTING BRIDGE AND NEW BRIDGE ⇒ SET THE SHOES OF THE NEW BRIDGE ⇒ SET THE NEW BRIDGE ON THE SHOES ⇒ DISMEMBERMENT OF THE REMOVED EXISTING BRIDGE

DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S = 1/100



SIDE VIEW OF THE NEW BRIDGE AFTER REPLACEMENT S = 1/100



THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.00M TP.	D.L 15 loading
		UNITS mm
Km. 993K+50M District Yala Line. SOUTHERN		SCALE : 1:100
Remarks Replacement for Old Steel Bridge Span. 1 x 30.00M TT.		Designed by Checked by Approved by
DATE		DRAWING NO.

[5] Bridge at Northern Line $70^{K} + 866^{M}$

1 General

District : Bangkok

Existing Bridge

Type : Through truss bridge

Span : 2 x (1 x 31.7 M)

c.to.c of main trusses: 4.7 M

New Bridge

Type : Through plate girder bridge

Span : 2 x (1 x 31.7M)

c.to.c of main girders: 4.6 M

Weight of steel: 2 x 56.7 = 113.4 ^{t}

2 Method for Execution

2-1 Selection of Method for Execution

(a) The existing bridge consists of two single-track through trusses, each having a span of 31.7m. During the replacement work, split switches can be installed before and behind the bridge to permit single-track train operations.

(b) There is river water beneath the bridge during all seasons, and it often rises.

(c) A 10m-wide navigation channel must be secured under the bridge with an overhead clearance of 3m to permit shipping traffic on the river.

(d) The weight of the heaviest member in the new bridge is about 5.0 tons, bringing the total weight to 57 tons.

(e) Overland transport of the construction materials and equipment to the site is easy, because it is located near railway stations and roadways.

(f) The RSR has erection trusses in stock.

For reasons of the above site conditions, it is proposed to use erection trusses for erecting the new bridges and dismantling the existing bridges by suspending them from the erection trusses. Temporary stagings, consequently, will not be required.

2-2 Sequence of Execution

(1) Preparatory works

A haul road for materials and equipment will be prepared after train operation is switched to single-track operation.

(2) Assembly of erection trusses

Erection trusses will be hauled on rails onto the floor system of the existing bridge for assembly. Two sets of the erection truss bridge consisting of four trusses will be stacked one over the other on each side. The spacing between the centers of the erection truss structures on both sides will be 2.5m and they will be provided with struts and braces at 3m spacings.

Rails will be laid on the top of the erection truss assembly and trollies will be installed there to suspend the existing bridge. The erection trusses will be supported in the

neighborhood of the existing abutments and will have a total length of 40m to move out the dismantled bridge members and move in the new girders. About 10m of the truss length will be extended in the direction of the railway station of Ayuthya.

(3) Dismantling of existing bridge

The floor beams of the existing bridges will be lifted by hoists from the erection truss assembly. In other words, the whole old bridge will be suspended through the floor beams from the erection trusses. The existing railway tracks will be dismantled beforehand. Each dismantled structural member of the old bridge will be lifted by the trollies on the top of the erection trusses and hauled in the direction of the railway station to be lowered on to the ground. The trollies will lift the structural members on both upstream and downstream sides at the same time for ballance. The upper chord members, web members, lower chord members, stringers, and floor beams will be dismantled in that order.

(4) Replacement of shoes

The existing shoes will be replaced with new shoes.

(5) Assembly of new bridge

When the dismantling of the existing bridge is finished, the assembly of the new bridge is started, leaving the erection trusses intact.

The sequence of assembly is a reversal of the order of dismantling the old bridge. The floor beams will first be suspended from the erection trusses and the main plate girders and stringers will then be connected to the floor beams. The structural members on the upstream and downstream sides will be hoisted simultaneously from the ground for ballance by means of the trollies and installed in position.

(6) Dismantling of erection trusses

After adjusting the camber of the bridge and fastening high strength bolts, the hoists used for lifting the floor beams will be dismantled, new tracks will be laid and then the erection trusses dismantled and moved in the direction of the railway station.

(7) Switching to single-track train operations

After the dismantling of the erection trusses is completed, the single-track operation is changed over by the split switch in order to replace the other existing bridges located by the side of the new bridge.

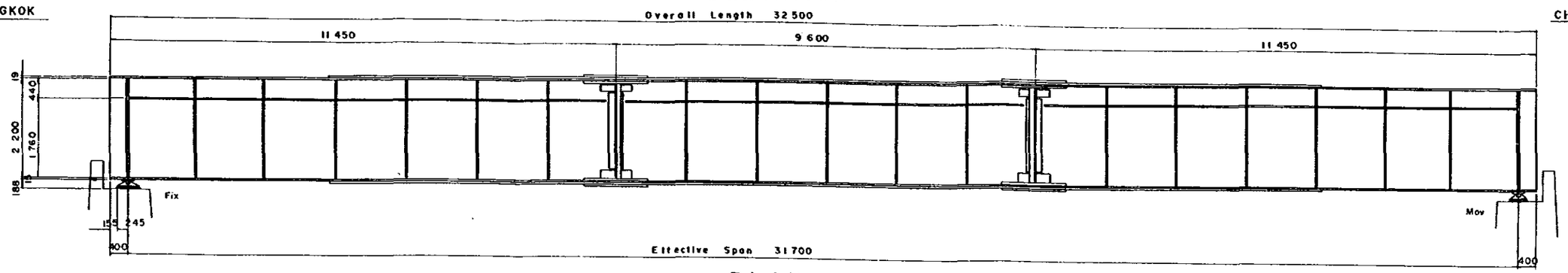
(8) Replacing of the remaining bridge

The other existing bridge will be replaced in accordance with the same procedure as described in (2) through (6) above.

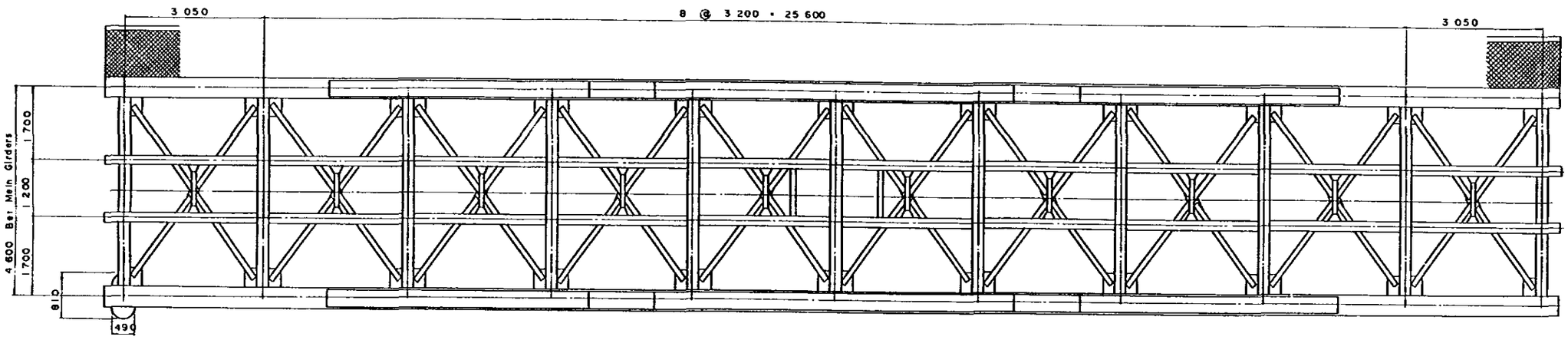
(9) Clearance of site

When the replacement of the two old bridges, the site will be cleared of all obstacles.

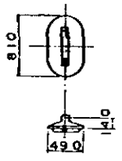
ELEVATION



PLAN



Shoe



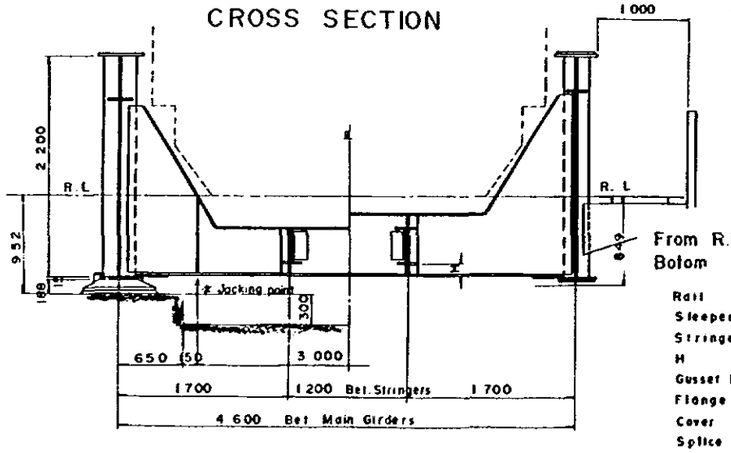
NOTICE

L – Live Load
I – Impact Load
D – Dead Load
Lr – Long Rail Load

Rough Weight of Steel

Main Girders	34.7
Inter. Floor Beams	6.6
End Floor Beams	1.8
Stringers	5.4
Lateral Bracings	2.5
Shoes	0.9
Sidewalk	4.8
	56.7 t

CROSS SECTION



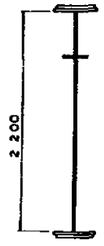
From R.L to Base of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	15
Sole "	28
Shoe	140
Dry Packing	20
	952

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Stringer	300
H	150
Gusset Plate	9
Flange "	25
Cover "	25
Splice "	30
H.T.B Head	20
	849

Main Girders



I-R 420 x 25
I-R 460 x 25
I-R 2 200 x 11
I-R 440 x 25
I-R 400 x 25

USED SECTION

Intermediat Floor Beams

I-R 240 x 25
I-R 533 x 10
I-R 230 x 22

End Floor Beams

I-R 280 x 28
I-R 397 x 11
I-R 260 x 25

Stringers

I-R 200 x 16
I-R 269 x 10
I-R 200 x 15

Effective Span 31.7 M (T.P)

Main Girder			
Stress			
	M (t-m)	R (t)	
D	157.0	19.81	
L	368.4	52.64	
I	165.4	23.64	
Σ	690.8	96.09	
Used Section			
IN	6 411 000 cm⁴		
Yu	113.33 cm		
Y ℓ	116.67 cm		
Actual Stress (kg/cm²)			
	δ	δa	
U.Flg	−1 221	−1 250	
L.Flg	+1 378	+1 400	

End Floor Beam		
Stress		
	M (t-m)	S (t)
D	1.46	0.97
L	21.94	9.00
I	15.30	12.91
Σ	38.70	22.88
Used Section		
IN	69 620 cm⁴	
Yu	21.08 cm	
Y ℓ	23.92 cm	
Actual Stress (kg/cm²)		
	δ	δa
U.Flg	−1 172	−1 250
L.Flg	+1 330	+1 400

Int. Floor Beam		
Stress		
	M (t-m)	S (t)
D	2.17	1.39
L	24.71	14.54
I	17.05	10.03
Σ	43.93	25.96
Used Section		
IN	97 850 cm⁴	
Yu	27.50 cm	
Y ℓ	30.50 cm	
Actual Stress (kg/cm²)		
	δ	δa
U.Flg	−1 235	−1 250
L.Flg	+1 369	+1 400

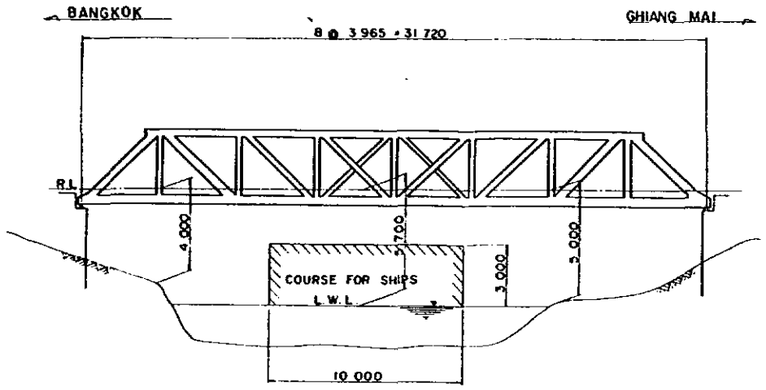
Stringer		
Stress		
	M (t-m)	R (t)
D	0.42	0.52
L	6.00	11.02
I	4.18	7.68
Σ	10.60	19.22
Used Section		
IN	14 160 cm⁴	
Yu	14.71 cm	
Y ℓ	15.29 cm	
Actual Stress (kg/cm²)		
	δ	δa
U.Flg	−1 101	−1 237
L.Flg	+1 308	+1 400

Bearing Stress of Shoes		
Bearing Area = 3 454 cm²	δ = 37 kg/cm²	δa = 40 kg/cm²
Deflection of Main Girder due to Live Load Lr = 15.9 t	32 mm	

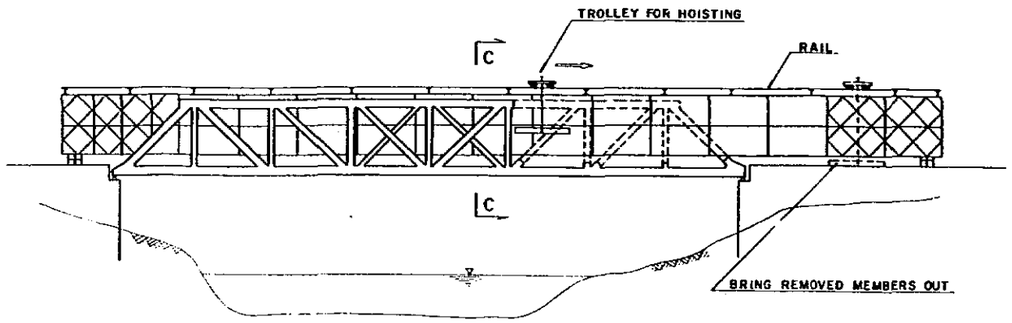
THE STATE RAILWAY OF THAILAND		
TYPE	2 (1 x 31.70 M) TP.	D L 15 loading
		UNITS mm
Km 70⁴ + 866ᴹ		SCALE : 1 : 50 / 1 : 30
District Bangkok		
Line NORTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span 2 (1 x 31.70 M) TT.		Approved by
DATE		DRAWING NO

METHOD OF REPLACEMENT (THE NORTHERN LINE ($70^{K}+866^{M}$) BRIDGE)

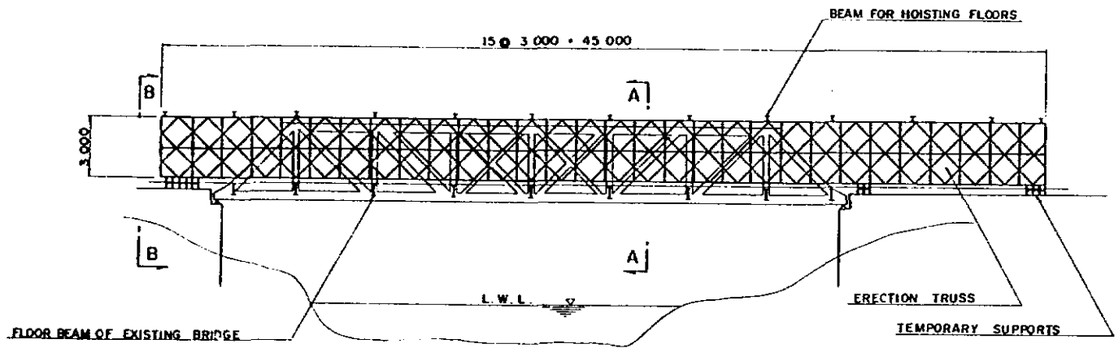
SIDE VIEW OF THE EXISTING BRIDGE S = 1/150



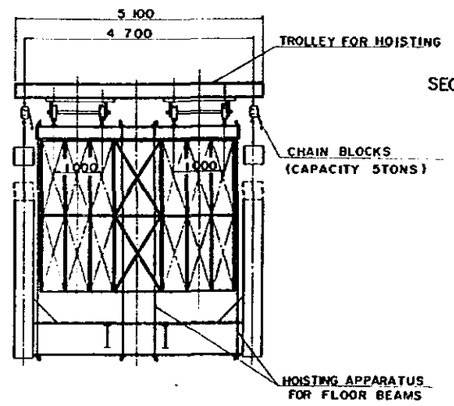
DISMEMBERRING OF THE REMOVED EXISTING BRIDGE S = 1/150



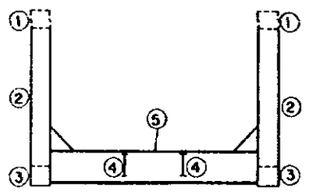
SIDE VIEW OF ERECTION TRUSS S = 1/150



OUTLINE OF DISMEMBERRING EXISTING BRIDGE



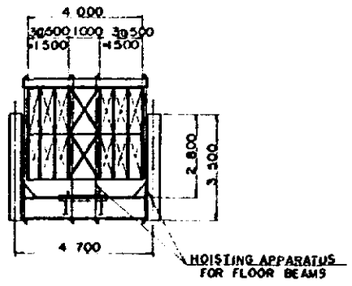
SEQUENCE OF DISMEMBERRING EXISTING BRIDGE



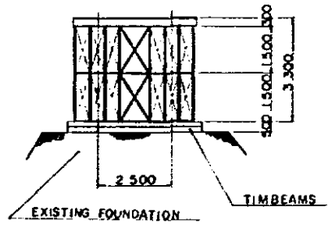
NOTE

1. CHECK STRESS OF ERECTION TRUSS.
2. CARE MOUNTING UNIFORM LOAD ON HOISTING APPARATUS.
3. OPERATE CHAIN BLOCKS AT THE SAME TIME.

A – A S = 1/100



B – B S = 1/100



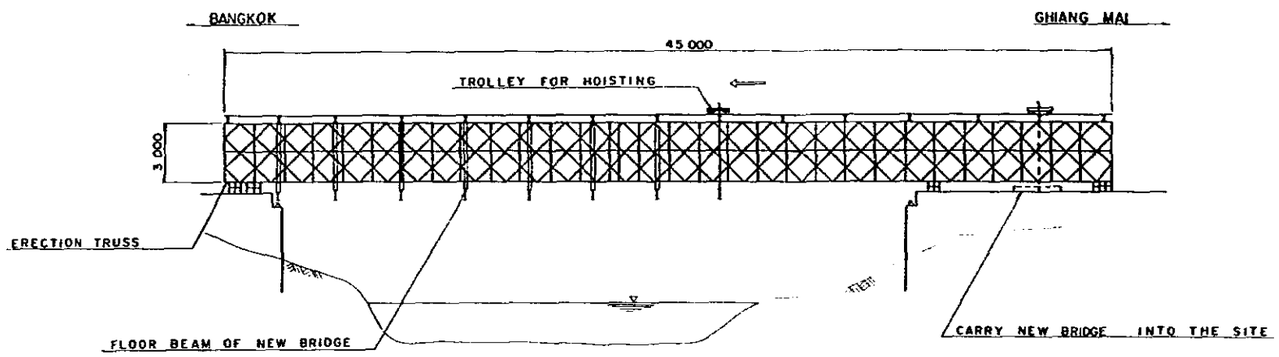
PROCESS OF WORKS NO.1

EXICHANGE RUNNING FOR SINGLE TRACK → SET UP ERECTION TRUSS → DISMEMBERRING TRACK ON SET UP RAIL AND TROLLEY FOR HOISTING OR ERECTION TRUSS → HOIST FLOOR BEAMS BY ERECTION TRUSS → DISMEMBERRING MAIN TRUSS MEMBERS → DISMEMBERRING FLOOR SYSTEM

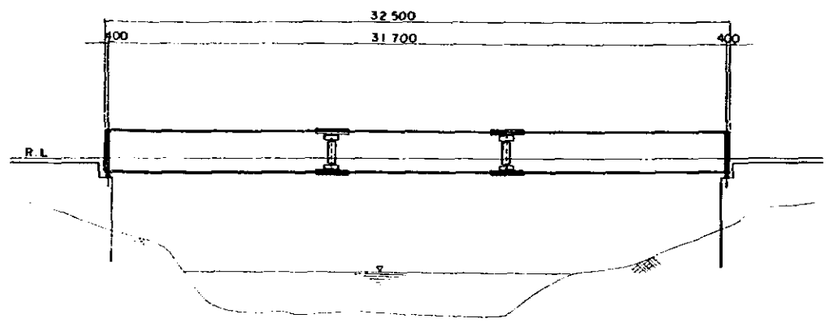
THE STATE RAILWAY OF THAILAND		
TYPE	2(1 x 31.70M) TP.	D.L 15 loading
		UNITS mm
Km. $70^{K}+866^{M}$		SCALE : 1:150 1:100
District Bangkok		
Line. NORTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span. 2(1 x 31.70M) TT.		Approved by
DATE		DRAWING NO.

METHOD OF REPLACEMENT (THE NORTHERN LINE ($70^{K}+866^{m}$) BRIDGE)

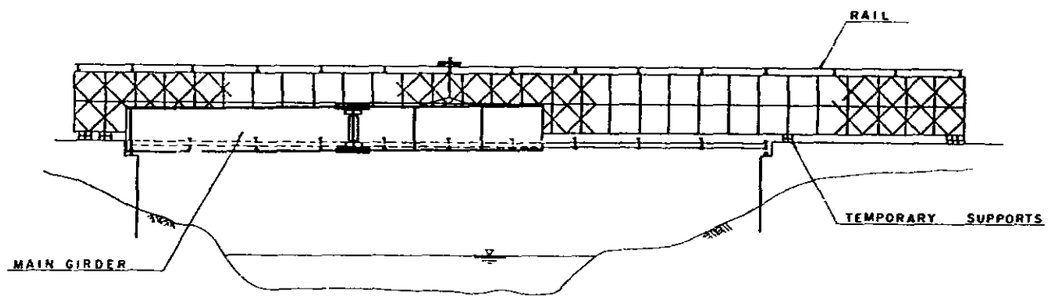
FLOOR BEAM ERECTION OF THE NEW BRIDGE S=1/150



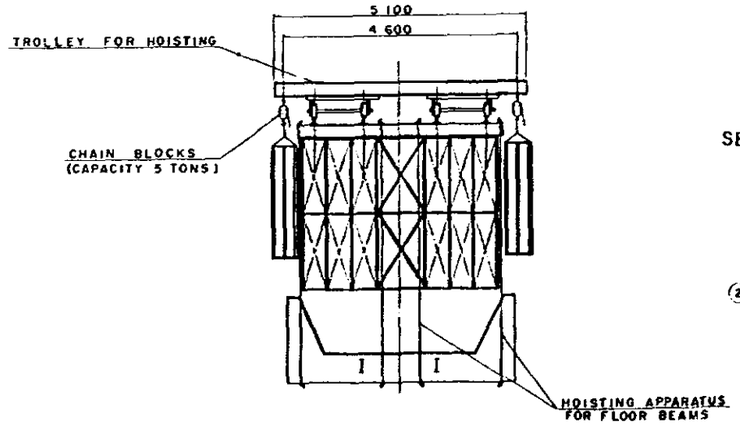
AFTER REPLACEMENT S = 1/150



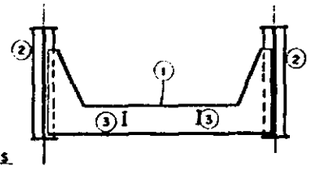
ERECTION OF THE NEW BRIDGE S=1/150



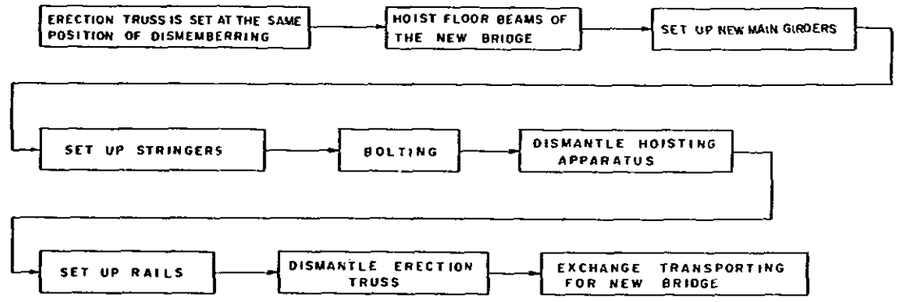
OUTLINE OF HOISTING APPARATUS S = 1/100



SEQUENCE OF SET UP BRIDGE



PROCESS OF WORKS, NO.2



PROCESS OF WORKS NO.1, NO.2

AFTER FINISHING OF THE WORKS PROCESS NO 1, NO.2 DISMEMBERING OF REMAINED TRUSS AND SETING UP NEW BRIDGE WILL BE EXECUTED BY THE SAME SEQUENCE ABOVE MENTIONED

THE STATE RAILWAY OF THAILAND		
TYPE	2 (1×31.70M) T.P.	D.L 15 loading
		UNITS mm
Km. $70^{K}+866^{M}$		SCALE : 1:150 1:100
District. Bangkok		
Line. NORTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span. 2 (1×31.70M) TT.		
		Approved by
DATE		DRAWING NO.

[6] Bridge at Northern Line $557^{K} + 622^{M}$

1. General

District : Lampang

Existing Bridge

Type : Deck truss bridge

Span : 1 x 30.0 M

c.to.c of main trusses: 2.5 M

New Bridge

Type : Deck plate girder bridge

Span : 1 x 30.0 M

c.to.c of main girders: 1.8 M

Weight of steel: .38.3 ^{t}

2. Method for Execution

2-1 Selection of Method for Execution

The existing bridge is of a deck truss type with a 30m span built over a valley flanked by very steep cliffs. It is to be replaced with a deck plate girder bridge during train intervals.

(a) The deepest part of the river beneath the bridge is at a depth of about 10m below the railway level and the river almost dries up during the dry season.

(b) It is almost impossible to bring heavy construction equipment and structural members down under the bridge, since there is no road reaching the site of work.

(c) The site for work must be located on a high bank or a valley.

(d) The total weight of the new bridge is about 38.3 tons, the heaviest single member weighing about 4.6 tons.

For reasons of the above site conditions and limited local experiences with construction works using a cable crane, it is proposed to adopt the transverse sliding method using temporary supports and to use ginpoles for erecting the new bridge and dismantling the existing bridge.

2-2 Sequence of Execution

(1) Preparatory works

A haul road for construction equipment and materials will be built and the site for construction of stagings will be prepared.

(2) Chipping of concrete base for new shoes

The concrete base for the new shoes must be lowered about 50cm to match the level of the new deck plate girders. For this reason, the concrete forming the shoe base will be chipped beforehand as shown in Fig. 1. For this purpose, the existing deck truss must be supported on temporary saddles.

The concrete of the portion where the tempoary saddles will be set is locally chipped first. The existing bridge is supported on the saddles, and the old shoes are removed. Then the concrete at the base of the new shoes is chipped to the required level and the new shoes are temporarily installed.

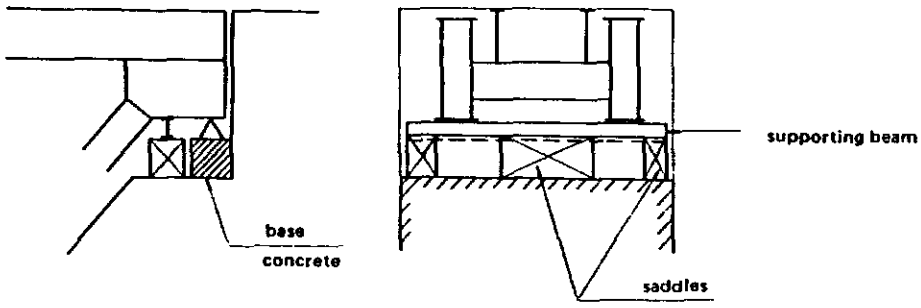


Fig. - 1

(3) Construction of stagings

Stagings for assembly of the new deck plate girder bridge and for transverse sliding of the new and old bridges will be built adjacent to the existing bridge. The stagings will be built on square timber foundations.

(4) Assembly of new deck plate girder

On being unloaded at the place of installation, the structural members will be rolled on logs over the stagings. The structural members will be lifted by ginpoles for assembly. When assembled, the camber of the bridge will be adjusted and high strength bolts will be fastened to complete the new deck plate girder bridge. Rails and sleepers will then be laid on it.

(5) Transverse sliding

After transversely sliding off the existing deck truss, the new bridge will be slid sideways for installation in position and the shoes fixed securely. Train operations will be suspended during this work.

(6) Dismantling and reerection of stagings

After dismantling the stagings used for assembling the new bridge, their materials will be used again to build the stagings for dismantling the old deck truss bridge.

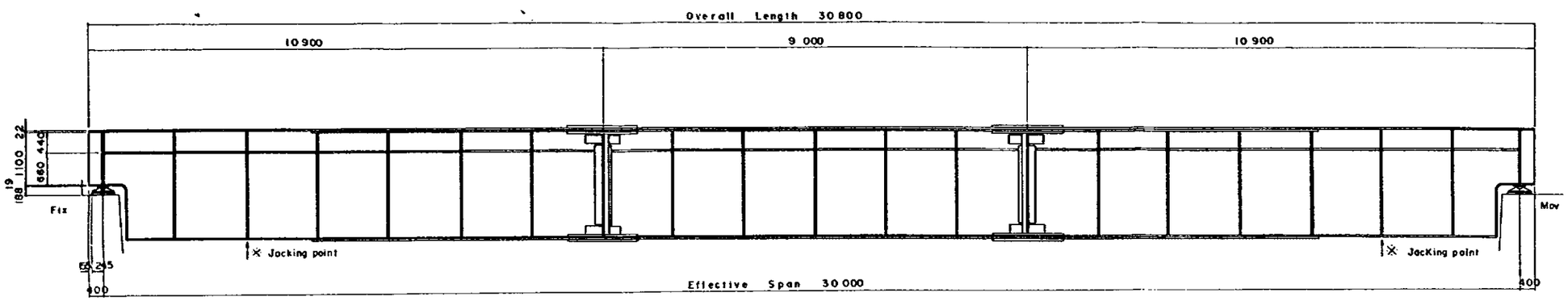
(7) Dismantling of old bridge

The old bridge will be dismantled on the stagings by means of ginpoles and removed.

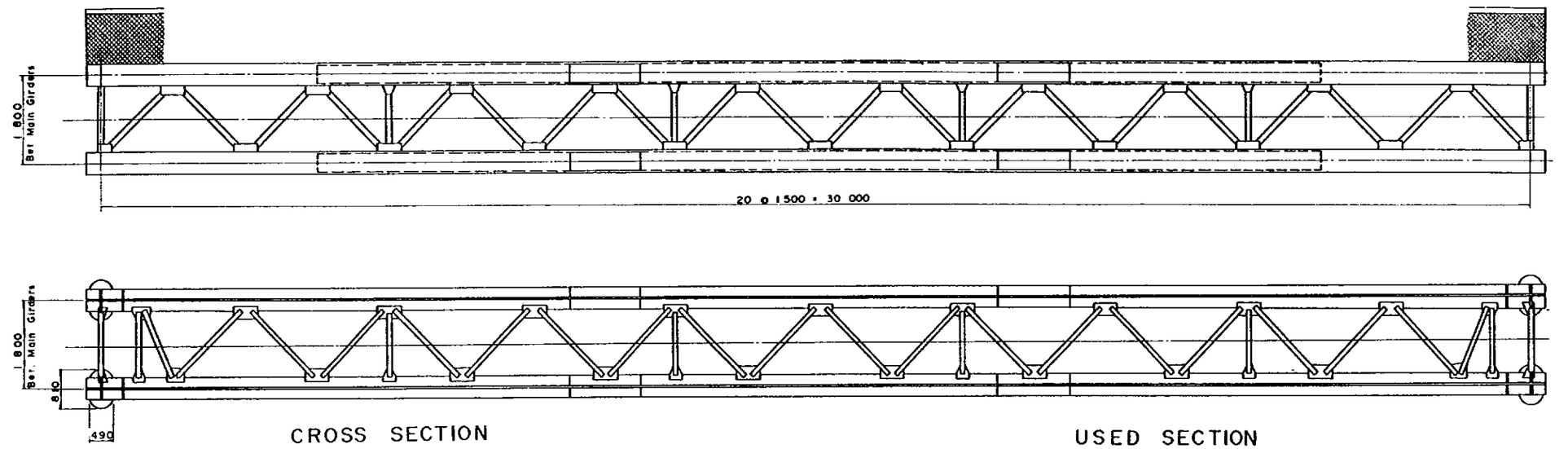
(8) Dismantling of stagings

All the stagings will be dismantled to complete the entire work.

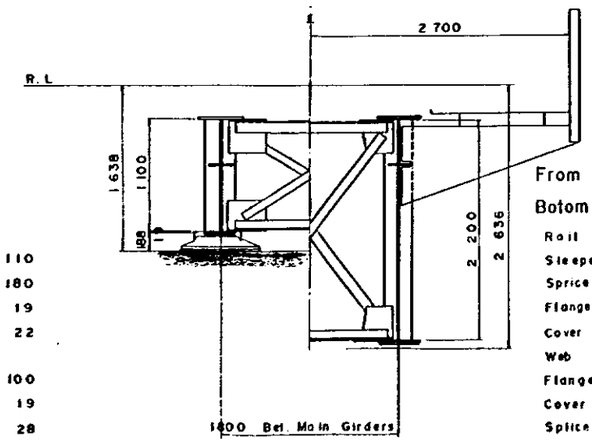
ELEVATION



PLAN



CROSS SECTION



From R.L to Base of Bridge

Rail	110
Sleeper	180
Splice Plate	19
Flange "	22
Web "	1 100
Flange "	19
Sole "	28
Shoe	140
Dry Packing	20
	1 638

From R.L to Botom of Bridge

Rail	110
Sleeper	180
Sprice Plate	19
Flange "	22
Cover "	22
Web "	2 200
Flange "	19
Cover "	19
Splice "	25
H.T.B Head	20
	2 636

NOTICE

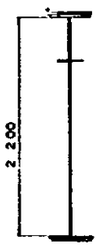
L – Live Load
I – Impact Load
D – Dead Load
LR – Long Rail Load

Rough Weight of Steel

Main Girders	30.2
Lateral Bracings	2.7
Shoes	0.9
Sidewalk	4.5
	38.3 t

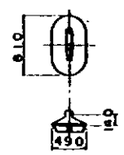
USED SECTION

Main Girders



I-℄ 450 x 22
I-℄ 410 x 22
I-℄ 2 200 x 11
I-℄ 460 x 19
I-℄ 420 x 19

Shoe



Effective Span 30.0M (D P)

Main Girder		
Stress		
	M(t-m)	R(t)
D	112.5	15.00
L	328.8	50.49
I	156.2	23.98
Σ	597.5	89.47
IN	5 386 000 cm⁴	
Yu	110.90 cm	
Yl	117.20 cm	
Actual Stress (kg/cm²)		
	σ	σa
U.Flg	- 1 230	- 1 250
L.Flg	+1 378	+1 400

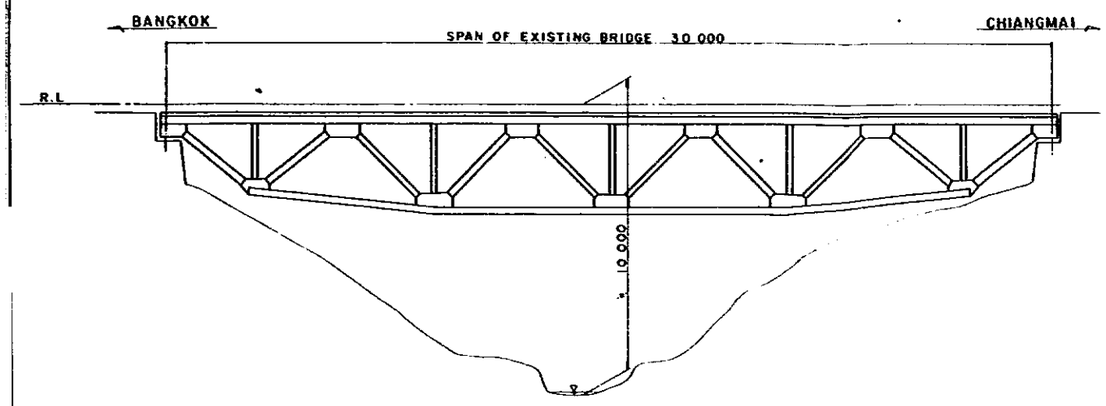
Bearing Stress of Shoes
Bearing Area = 3 454 cm²
S = 35 kg/cm² σa = 40 kg/cm²
Deflection of Main Girder due to Live Load 30 mm

LR = 15.0 t

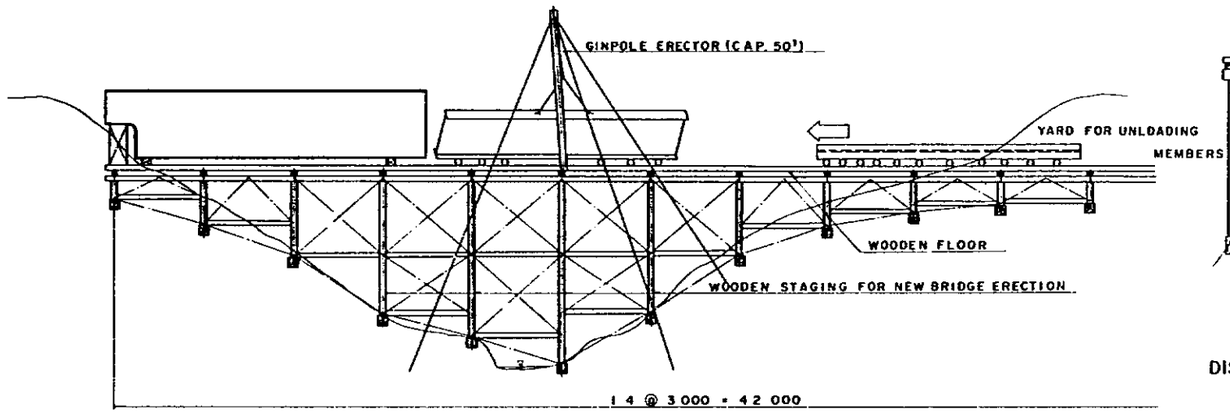
THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.000M DP	D.L 15 loading
		UNITS mm
Km. 577K + 622M		SCALE : 1 : 50
District. Lampang		1 : 30
Line. NORTHERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span 1 x 30.00 M DT.		
		Approved by
DATE		DRAWING NO.

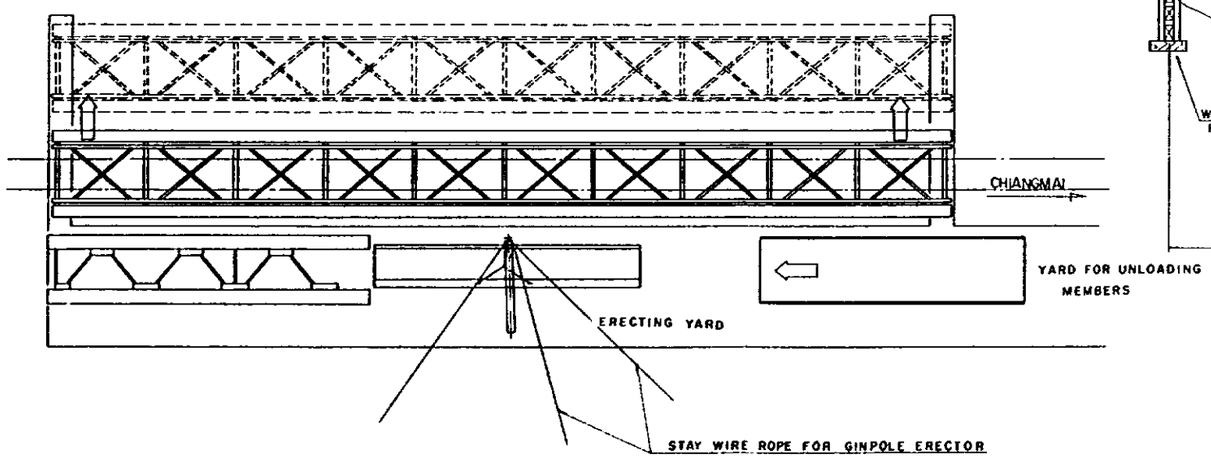
METHOD OF REPLACEMENT (THE NORTHERN LINE (577K+ 622M) BRIDGE)

SIDE VIEW OF THE EXISTING BRIDGE S = 1/100

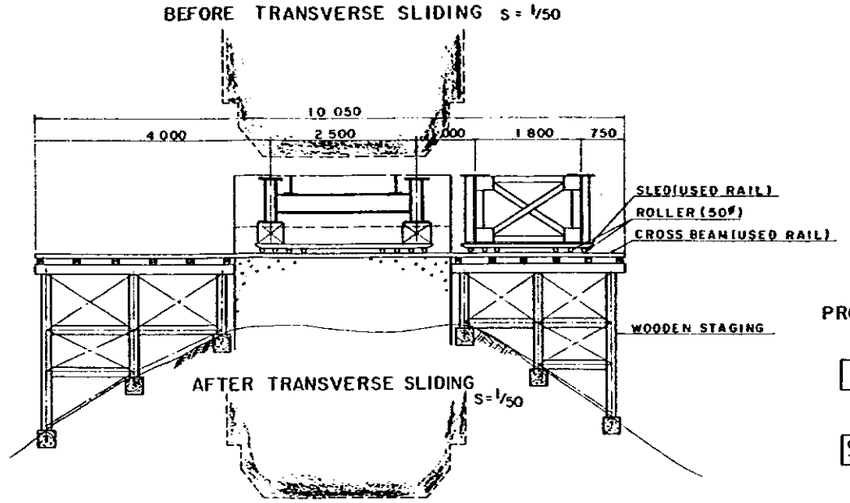


ERECTION METHOD OF THE NEW BRIDGE S = 1/100

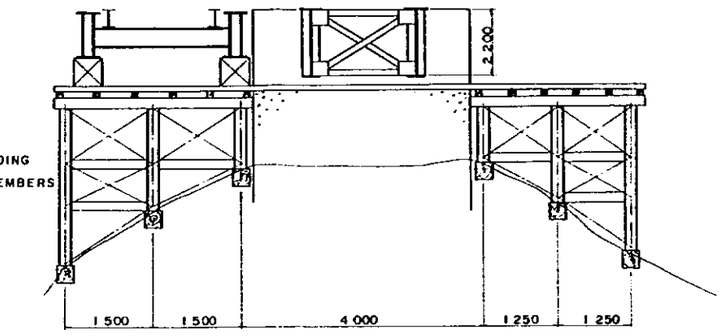




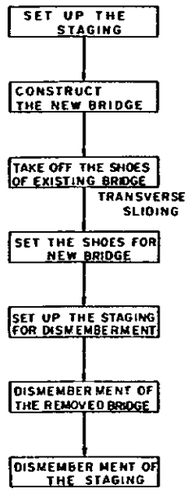
BEFORE TRANSVERSE SLIDING S = 1/50



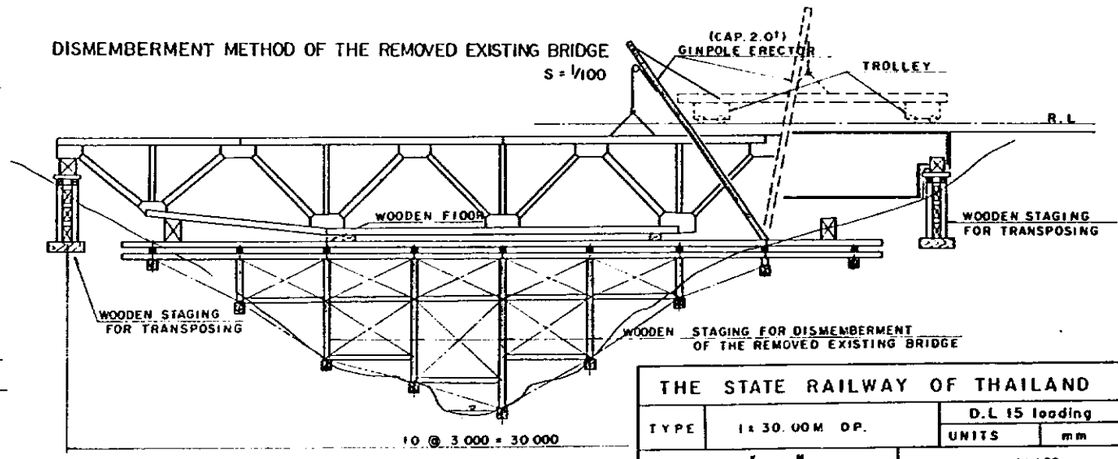
AFTER TRANSVERSE SLIDING S = 1/50



PROCESS OF WORK



DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S = 1/100



THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.00M DP.	D.L 15 loading
		UNITS mm
Km. 577K+ 622M		SCALE : 1 : 100 1 : 50
District. Lampang		
Line. NORTHERN		
Remarks Replacemeal for Old Steel Bridge Span 1 x 30.00M DT.		Designed by Checked by Approved by
DATE		DRAWING NO.

[7] Bridge at North Eastern Line $323^{K} + 816^{M}$

1. General

District : Lam Chi
Existing Bridge
Type : Through truss bridge
Span : 1 x 30.0 M
c.to.c of main trusses; 4.0 M

New Structure
Box-culvert

2. Method for Execution

2-1 Selection of Method for Execution

The existing bridge is of a single-track through truss type with a 30m span. It is proposed to construct a box type concrete culvert under the bridge which will have an adequate cross section to meet the maximum rate of water discharge during the wet season, to remove the bridge and to build a banking.

The existing site conditions are listed below:

(a) The soils of the site are such that replacement of the surface soil layer and construction of the working road will not be necessary.

(b) The ground forming the foundations for the proposed culvert has an adequate bearing capacity, and a mat foundation may be provided for the culvert.

(c) The river current is very slow even during the wet season.

(d) The earth of the site can be used for banking.

Based on the above site conditions, the cross section of the box type concrete culvert and the method for execution are recommended.

2-2 Sequence of Execution

(1) Preparatory works

(2) Excavation and foundation for culvert

Excavation and foundation for the box culvert will be carried out by human power. The earth resulting from excavation will be retained at the site temporarily, as it will be used for banking and refilling.

(3) Construction of box culvert

Boulders will be laid 20cm thick for the foundation of the culvert and rolled adequately and the concrete will be placed to a thickness of 10cm over the boulder foundation. Formwork will be erected on the foundation to place concrete for the box culvert. Placing of concrete for the culvert structure will be carried out for the lower floor slab, side walls, upper floor slab and wings in that order.

(4) Refilling and banking

Both sides of the culvert will be refilled with the earth from the excavation and banking will be executed for the roadbed. Care must be taken so that wood and grass should not be mixed in the filling earth. The fill will be about 30cm thick per course and rolled adequately. It will be repeated until the specified height is attained.

(5) Spreading and leveling of crushed stone

While spreading and levelling crushed stone over the bank, the panel points and stringers of the existing truss bridge will be supported temporarily on timber blocks.

(6) Dismantling of the main truss members

The main trusses of the existing bridge will be dismantled and removed with 3-ton ginpoles.

(7) Dismantling of the floor system

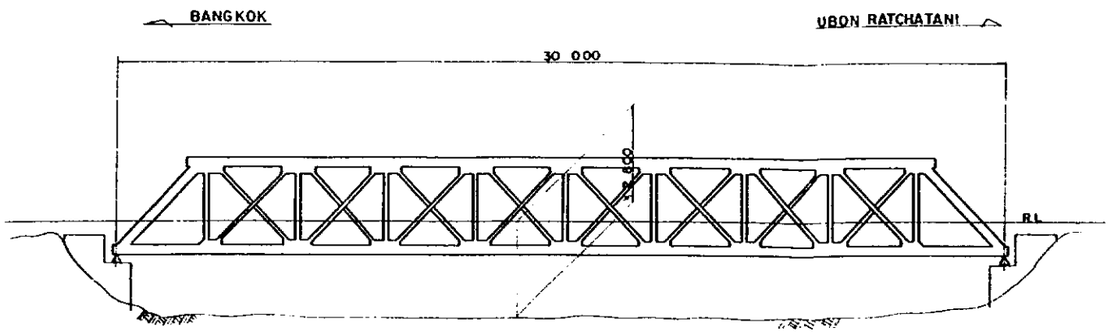
After dismantling the main truss member, the floor system will be once filled with crushed stone. During train intervals, the members of the floor system will be dug out one by one after the rivets are cut off to disconnect the floor beams and stringers. The openings created by the removal of the floor system will be refilled with crushed stone.

(8) Track adjustment

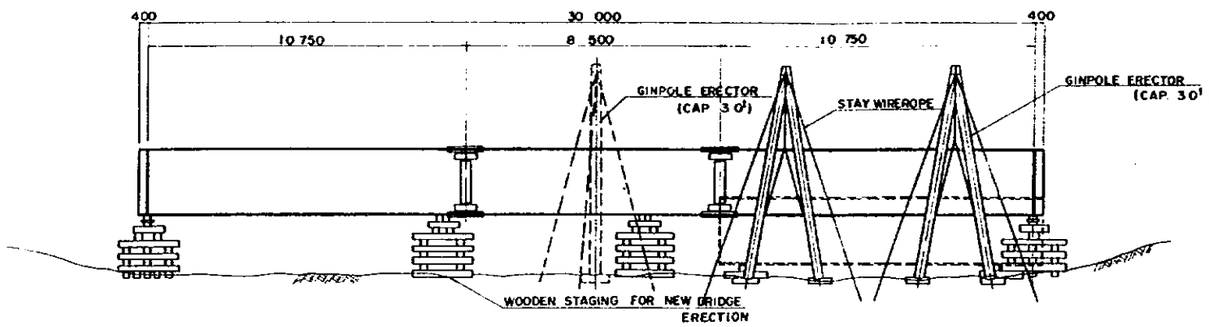
Irregularity in line and longitudinal level of tracks will be corrected and the slope of the bank will be finished to complete the entire work.

METHOD OF REPLACEMENT (THE NORTH EASTERN LINE (323K+816M) BRIDGE)

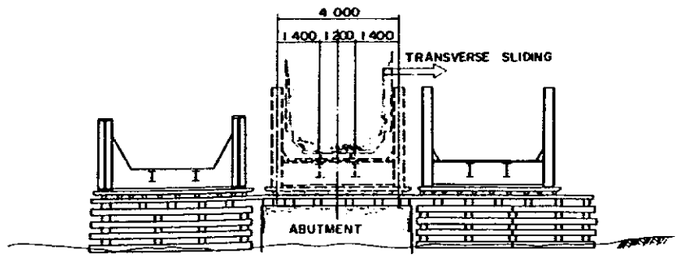
SIDE VIEW OF THE EXISTING BRIDGE S= 1/400



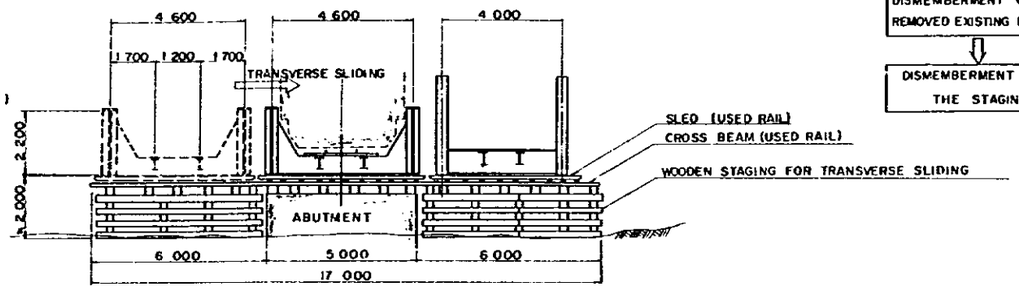
ERECTION METHOD OF THE NEW BRIDGE S= 1/100



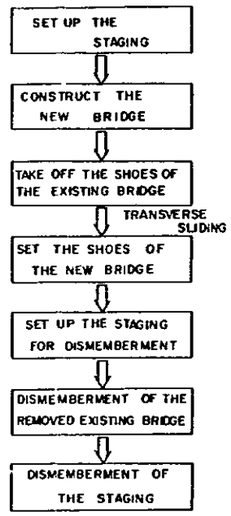
TRANSVERSE SLIDING OF THE EXISTING BRIDGE S= 1/100



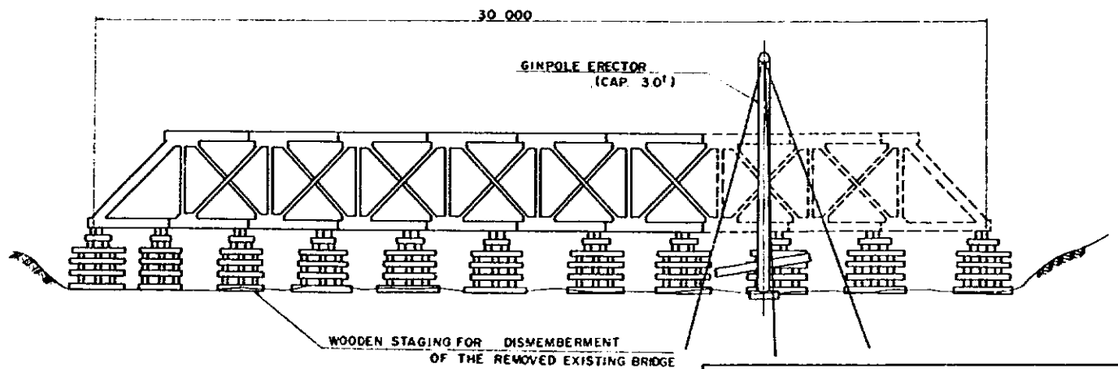
TRANSVERSE SLIDING OF THE NEW BRIDGE S= 1/100



PROCESS OF WORK

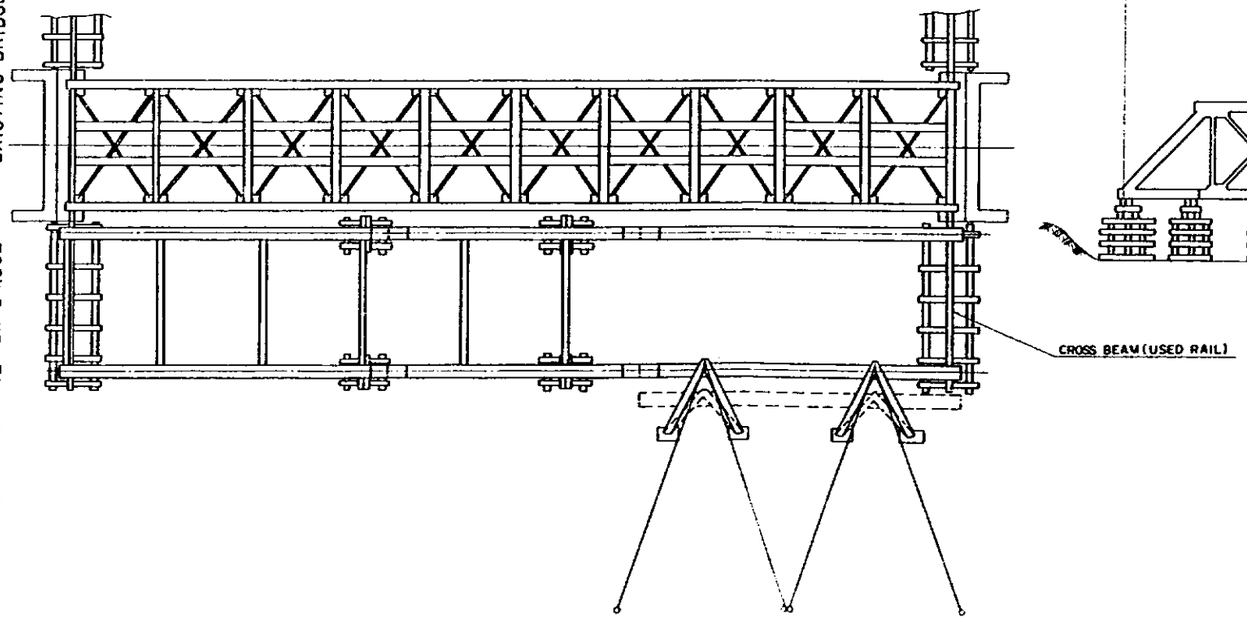


DISMEMBERMENT METHOD OF THE REMOVED EXISTING BRIDGE S= 1/100



PLANE FIGURE OF THE EXISTING BRIDGE

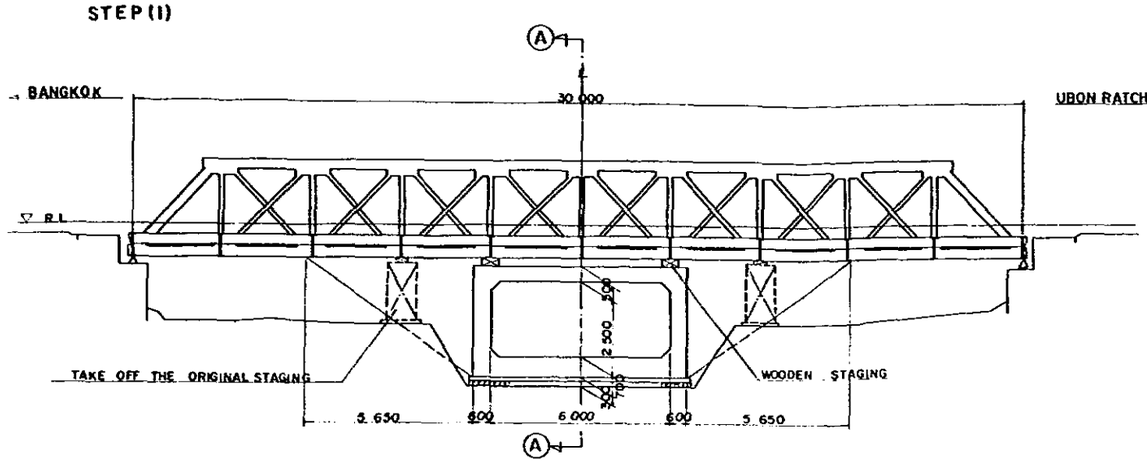
PLANE FIGURE FOR ERECTION METHOD OF THE NEW BRIDGE



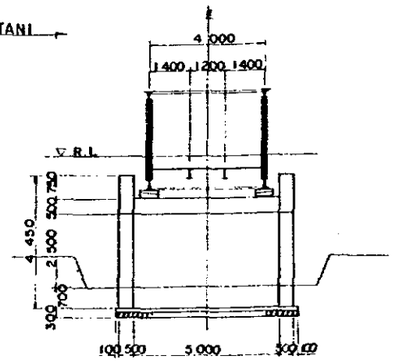
THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.00 M T.P.	D.L. 15 loading
		UNITS mm
Km. 323K+ 816M District Lamchi Line NORTH EASTERN		SCALE : 1:100
Remarks Replacement for Old Steel Bridge Span 1 x 30.00 M T.T.		Designed by Checked by Approved by
DATE		DRAWING NO.

METHOD OF REPLACEMENT (THE NORTH EASTERN LINE (323ᴷ+ 816ᴹ) BRIDGE)

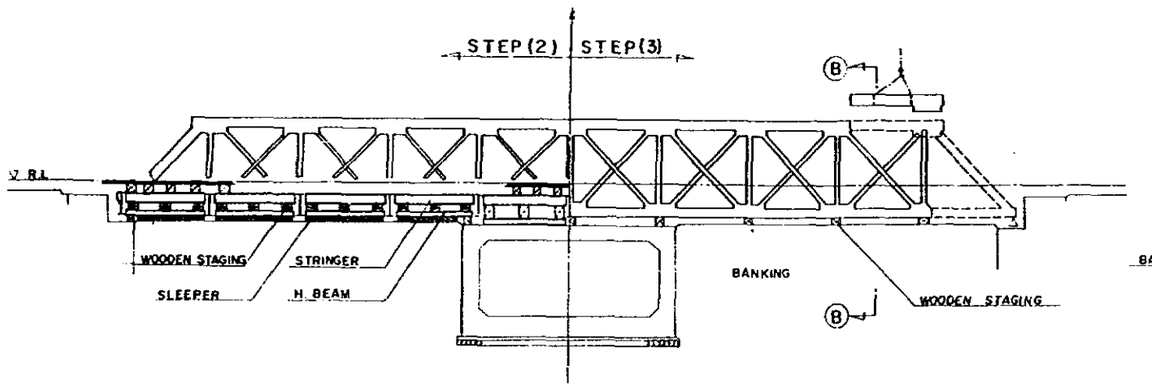
STEP (1)



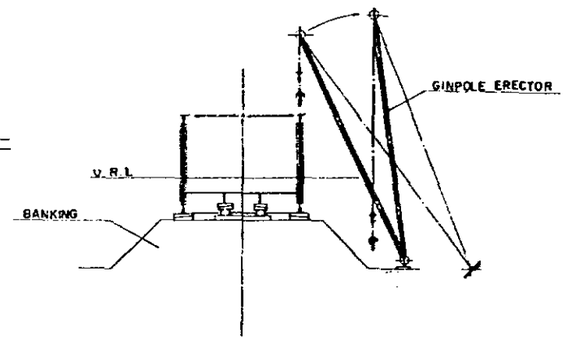
Ⓐ-Ⓐ SECTION



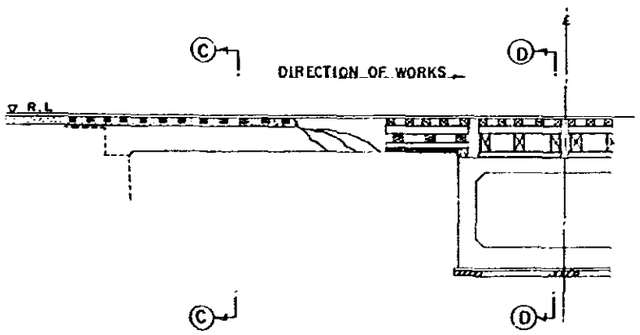
STEP (2) STEP (3)



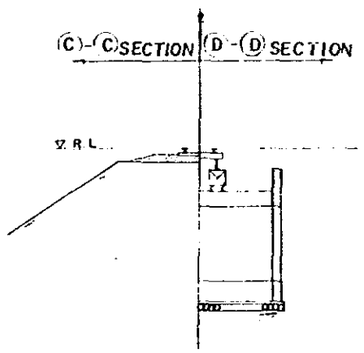
Ⓑ-Ⓑ SECTION



STEP (4)

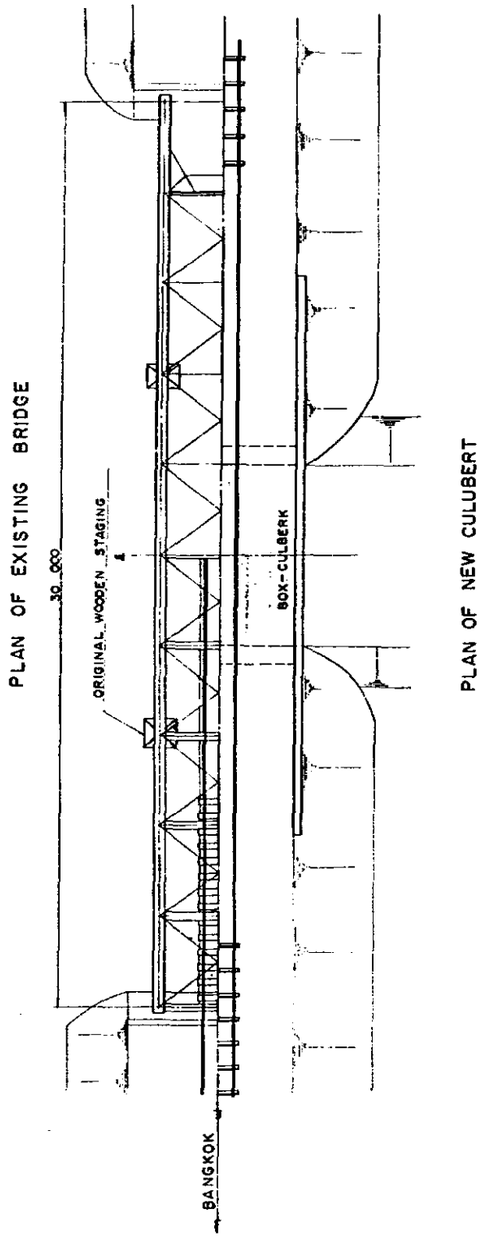


Ⓒ-Ⓒ SECTION Ⓓ-Ⓓ SECTION



PROCESS OF WORKS

1. AFTER CONSTRUCTION THE BOX-CULBERT SET UP WOODEN STAGING ON IT AND SUPPORT THE TRUSS.
2. TAKE OFF THE ORIGINAL STAGING.
3. BANKING UP THE LOWER CHORD THEN FILL UP BY CULBERT.
4. SUPPORT THE STRINGER BY WOODEN STAGING.
5. SUPPORT THE LOWER CHORD BY WOODEN STAGING
6. DISMEMBER MAIN TRUSS AND FLOOR SYSTEM BY GINPOLE ERECTOR.
7. TAKING OFF EACH BLOCK OF THE STRINGER AND THE WOODEN STAGING.
8. *IF THE ABOVE WORKING CAN NOT CARRY OUT WITHIN ALLOWABLE TIMES* FOR THE WORK, SUPPORT THE TEMPORARY SLEEPERS AND WOODEN STAGING.



THE STATE RAILWAY OF THAILAND		
TYPE	1 x 30.00M TP	D.L 15 loading
		UNITS mm
Km 323ᴷ+ 816ᴹ		SCALE 1:50
District Lamchi		1:30
Line NORTH EASTERN		
Remarks		Designed by
Replacement for Old Steel Bridge		Checked by
Span 1 x 30.00 M TT.		Approved by
DATE		DRAWING NO.