

STUDY WITH PROXY

THE PROGRESS OF THE CHINESE ECONOMY SINCE 1978: A REVIEW OF THE
CHINESE ECONOMY SINCE 1978: A REVIEW OF THE CHINESE ECONOMY SINCE 1978

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JAPAN INTERNATIONAL COOPERATION BANK



THE KINGDOM OF THAILAND

STUDY REPORT

ON

THE PROJECT OF STRENGTHENING AND/OR REPLACEMENT
OF STEEL BRIDGES ON THE STATE RAILWAY OF THAILAND

A Sub-Project for The Trans-Asian Railway Project
of The Economic and Social Commission
for Asia and The Pacific (ESCAP)

APPENDIX IX Detailed Drawings for Repair and/or Strengthening of 12 Bridges

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APPENDIX IX

DETAIL DRAWINGS FOR REPAIR AND OR STRENGTHENING OF 12 BRIDGES

No.	Span length (m)	Type	Line	Location	Manufacturer	Page
(1)	20.0	T.P.	S-Line	1122 +255	Cleveland	3
(2)	25.0	T.T.	S-Line	897 +174	Cleveland	7
(3)	30.0	T.T.	S-Line	929 +903	Cleveland	13
(4)	30.0	T.T.	N-Line	263 +335	Daydé	18
(5)	30.0	D.T.	N-Line	577 +622		24
(6)	35.0	T.T.	S-Line	403 +257	Cleveland	32
(7)	40.0	T.T.	N-Line	311 +599	Daydé	37
(8)	45.0	T.T.	S-Line	672 +874	Cleveland	43
(9)	50.0	T.T.	S-Line	1063 +810	Cleveland	48
(10)	60.0	T.T.	S-Line	930 +931	Cleveland	54
(11)	70.0	T.T.	S-Line	297 +063	Cleveland	61
(12)	80.0	T.T.	NE-Line	479 +741	Daydé	69

APPLICATION OF THE DETAIL DRAWINGS FOR REPAIR AND/OR STRENGTHENING OF 12 BRIDGES

Twelve spans of bridge were selected out of the 214 spans under investigation for preparation of detail designs for repair and/or strengthening. The detail designs were made on the basis of the original drawings owned by RSR or the field drawings prepared by the RSR officials.

It is to be noted that neither these detailed drawings were completed after thorough on-site checks on each of the bridges, nor were field surveys conducted on the peripheral ground conditions for the purpose of making detail plan for execution method. Rather, it only provides one of the means for preparing the detailed drawings or offers exemplars.

Therefore, actual bridges cannot be manufactured directly according to the drawings entitled, "Detail drawings for repair/strengthening of 12 bridges."

It should also be noted that the actual detailed drawings for these bridges will be worked out subsequent to the re-investigation of the following matters in Thailand.

- 1) Confirmation of location of bridges and their working conditions.
- 2) Confirmation of bridge members to be strengthened
- 3) Accurate measurement of dimensions of all the members and parts to be repaired and/or strengthened of bridges
- 4) Check of condition, location and size of corrosion or deterioration in structural members
- 5) Check of loose rivets

For preparation of actual detail drawings for repair and/or strengthening, manufacture or erection of bridges, Chapter VI and VIII of the main report, the standard drawings, the detail drawings for twelve bridges presented here and other appendices shall be fully studied.

GENERAL DIAGRAM

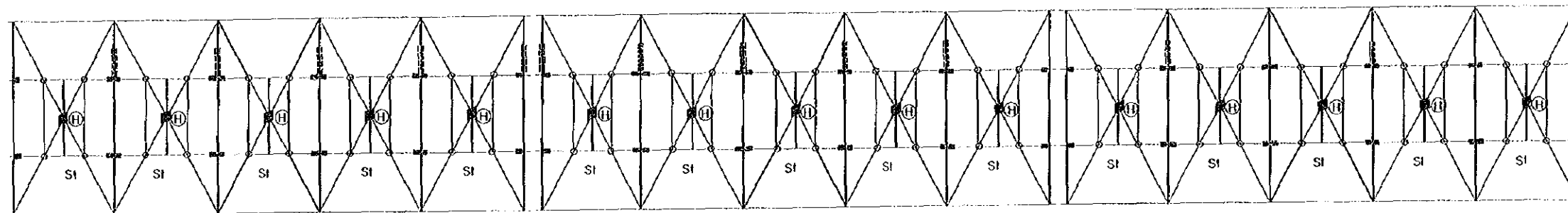
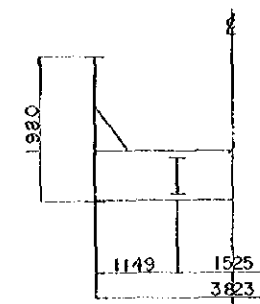
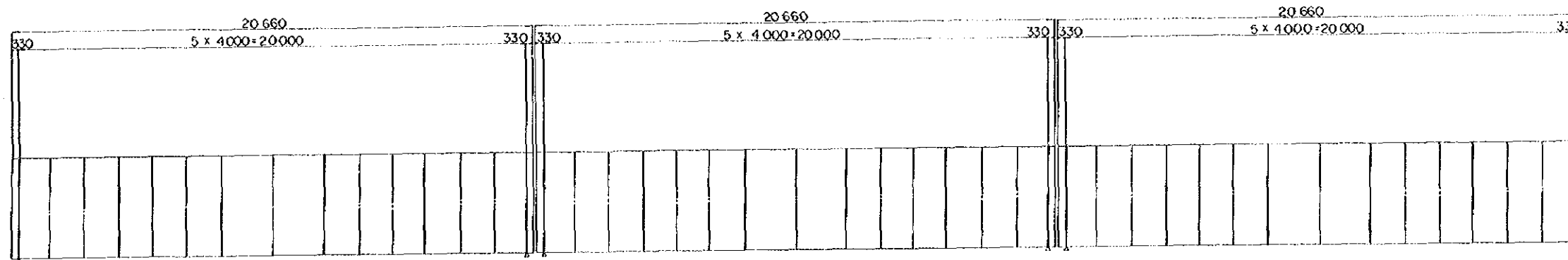
BRIDGE NO. 1

BRIDGE NO. 2

BRIDGE NO. 3

Bangkok

Sungai kolok



MAIN GIRDER

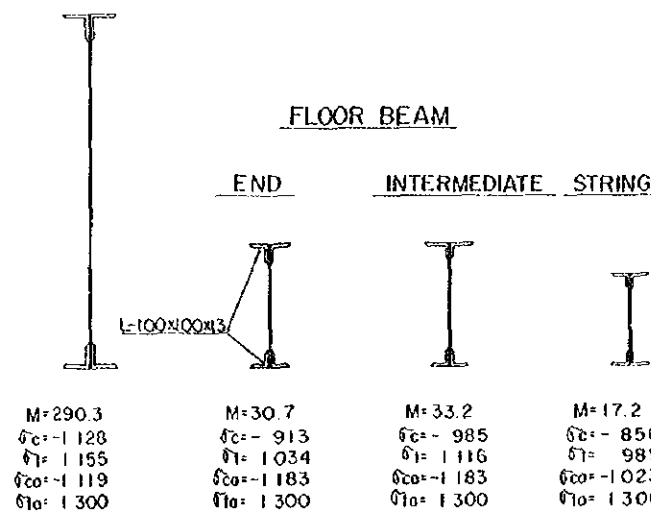
FLOOR BEAM

END

INTERMEDIATE STRINGER

Note:

- 1) Excessive stressed rivets to be strengthened.
- 2) Gusset plates to be improved.
- 3) Defective hanger to be removed.
- 4) New strut to be added.
- 5) Web plates to be repaired.
- 6) Hanger to be added.



General Notes:

- 1) Weak drawings show the original members. Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Marks.

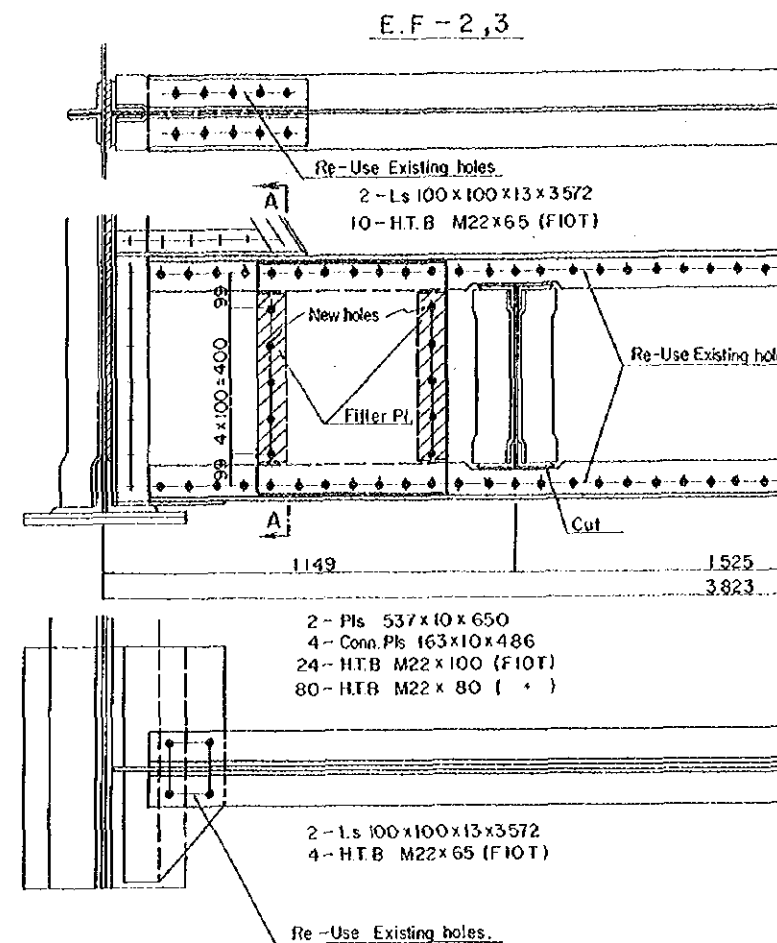
M: Bending moment (t.m)

σ : Actual stress (kg/cm²)

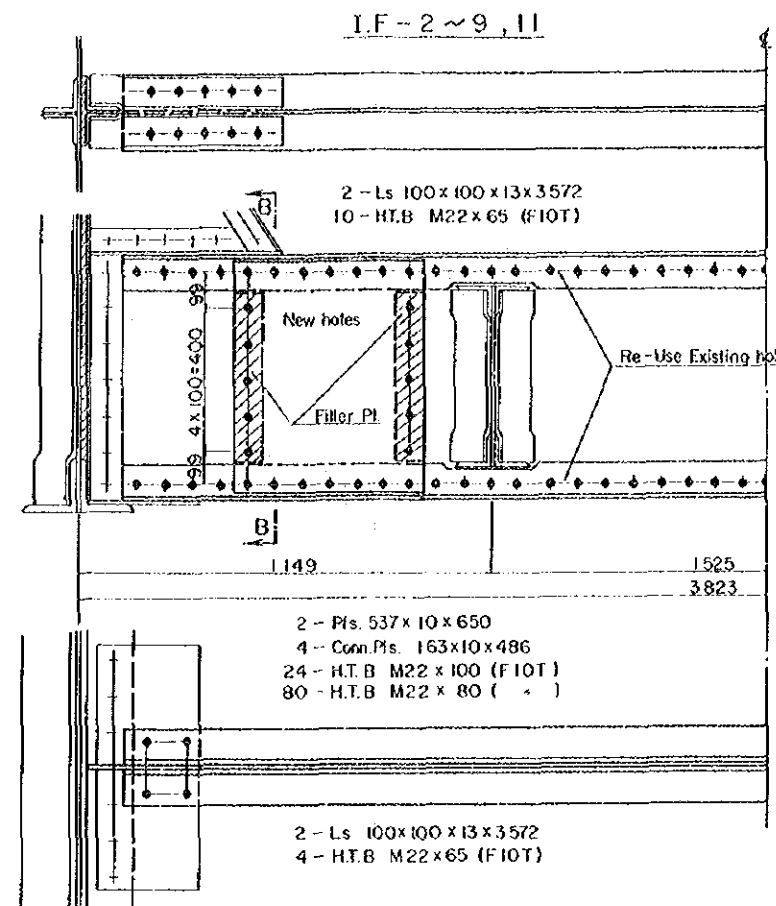
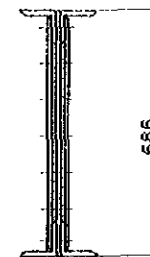
σ_a : Allowable stress (kg/cm²)

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	DL-15 loading	
200 T.T	GENERAL DIAGRAM	Unit	Scale
K. M.	1122 + 255	mm	
DISTRICT	Yolo	Designed by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

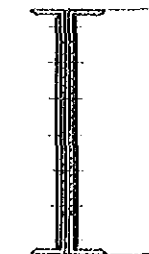
FLOOR SYSTEM (NO.1) S-1/10



SECTION A-A



SECTION B-B



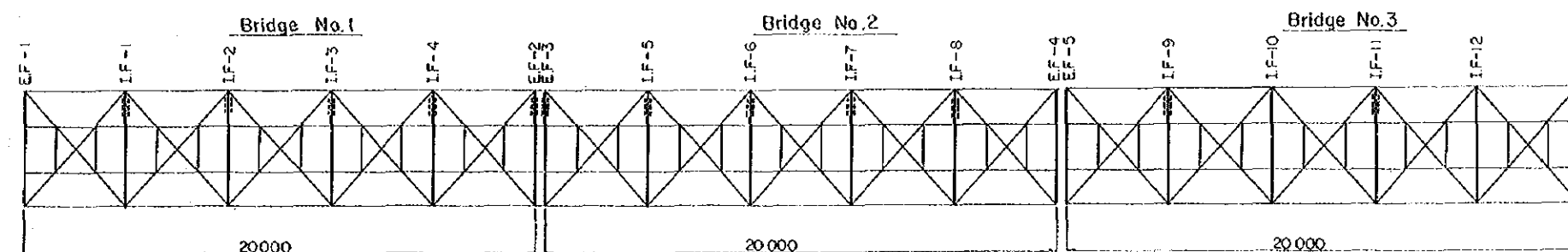
Note:
I.F-1 is only Web Plate.

Note
E.F-1 is only Lower Flange.

General Notes :

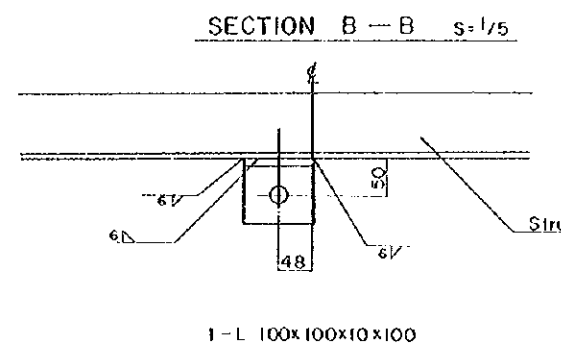
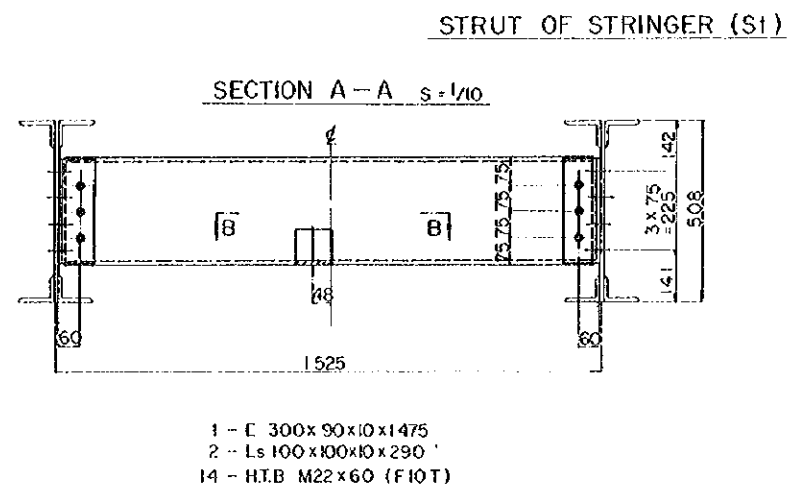
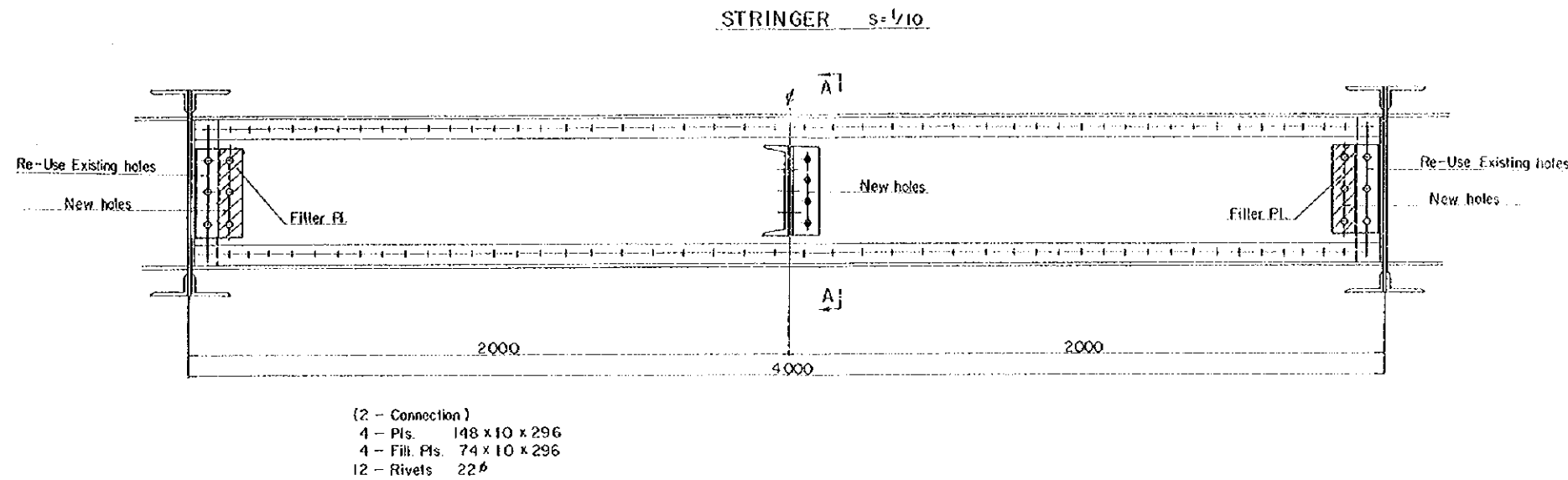
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HT.B) are M22 () (FIOT), and assumed frictional coefficient of contact surface (f) as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3)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

MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM (NO.1)	Unit	Scale
20.0 T.T	K.M.	1122 + 255	mm	1/10
DISTRICT	Yala		Designed by	
LINE	Southern Line		Checked by	
Remarks			Checked by	
			Checked by	
			Checked by	
			Checked by	
DATE			DRAWING NO.	

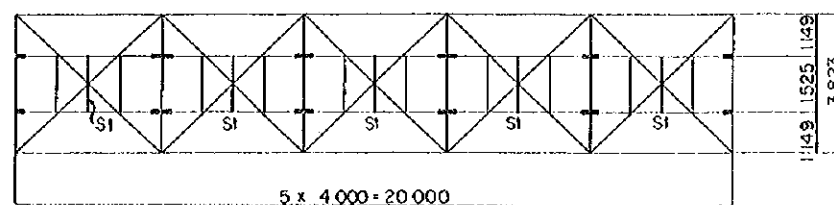
FLOOR SYSTEM (NO.2)



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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22# (F10T), and to be rolled steel for SV34 (JIS G3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

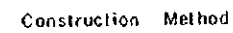
MARKING DIAGRAM Bridge No. 1,2,3



Note:

- : Strengthening of connection.
- S1 : Installation of new strut.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM		DL: 15 loading
200 T.P.		Unit	Scale	
K.M.	1125 + 255	mm	1/10, 1/5	
DISTRICT	Yoto	Designed by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.	5742	

$$S = 1/19$$


- Hanger hole

Bridge No. 1, 2, 3



- ### General Notes

-
- Technical drawing showing two views of a vertical rod assembly.
- Top View:** Shows a vertical rod with two nuts. The top nut is labeled "Nut (Type-3)" and the bottom nut is labeled "Nut (Type-1)". Dimensions include $6V$ for the top section, K for the distance between the nuts, and a "Clearance 133" indicated on the right side.
- Bottom View:** Shows a cross-section of the rod. Dimensions include 48 for the width of the central section, 50 for the width of the outer sections, and 148 for the total width. A label "Center of Strut" is positioned to the left of the central section.

- THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING

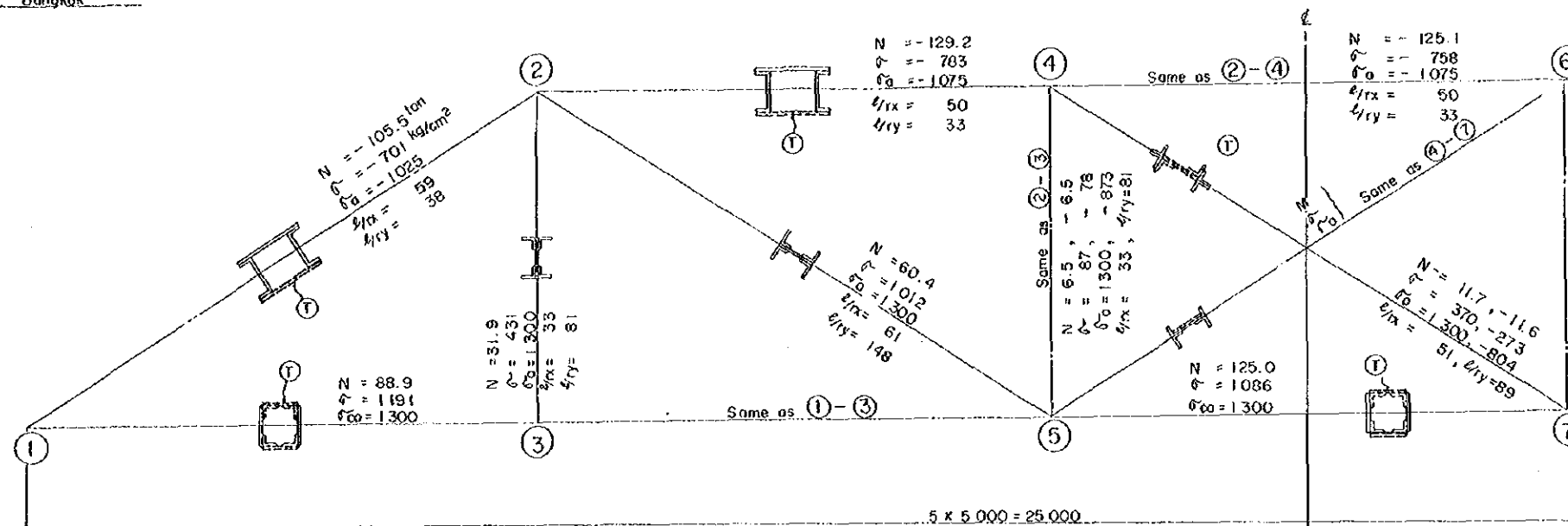
Span Type	Members		LOWER LATERAL BRACING		OL. 15 loading
200 T.P					Unit Scale
					mm 1/16, 1/8
K. M.	1122 + 255				
DISTRICT	Yalo		Designed by _____		
LINE	Southern Line		Checked by _____		
Remarks			Checked by _____		
			Checked by _____		
			Checked by _____		
			Checked by _____		
			Checked by _____		
DATE			DRAWING NO.	5742	

GENERAL DIAGRAMS S=1/30

Bangkok

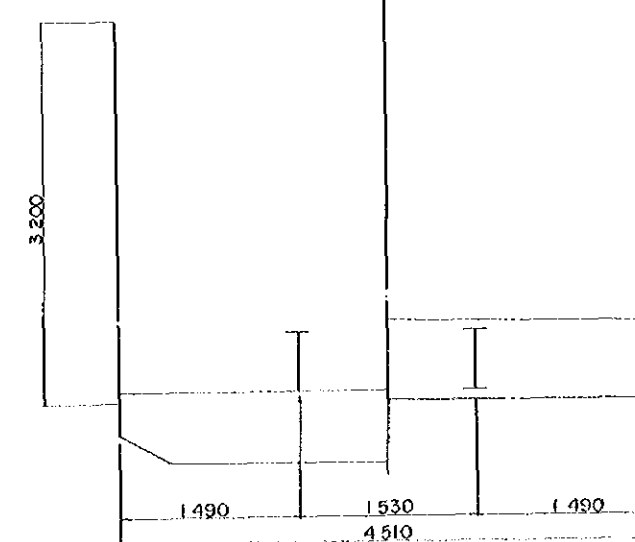
MAIN TRUSS

Hot Yai



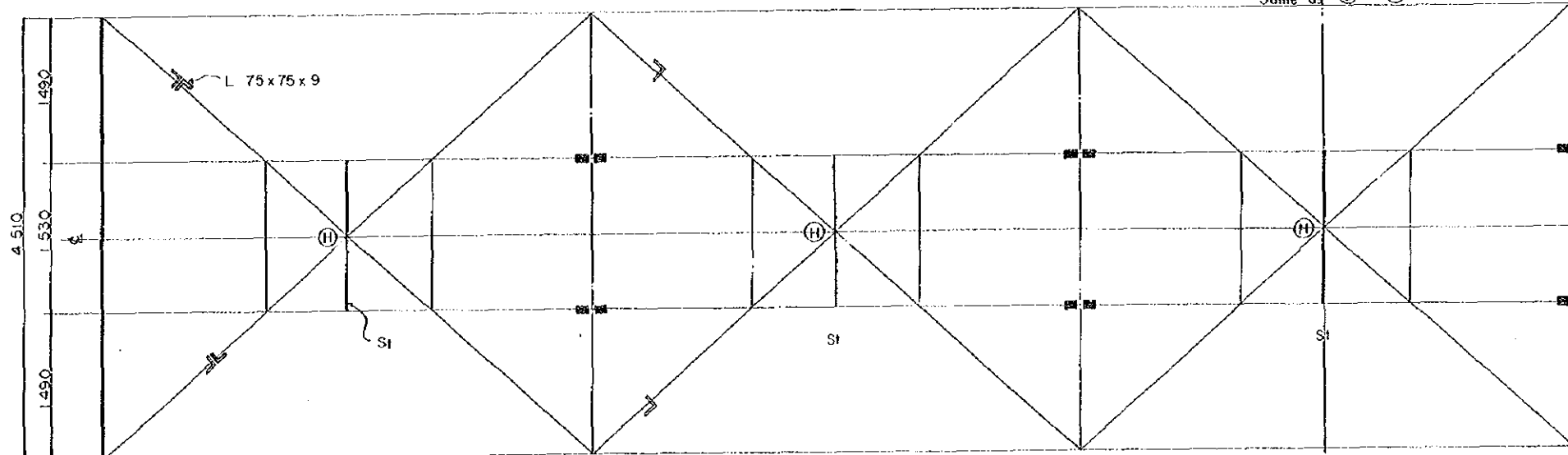
END SECTION

INTERMEDIATE SECTION



FLOOR SYSTEM & LOWER LATERAL

Same as (3)-(5)



FLOOR BEAM

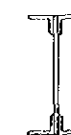
STRINGER

END

INTERMEDIATE



Pl. 270x10



M = 43.5	M = 47.3	M = 26.8
$\sigma_c = -1139$	$\sigma_c = -1080$	$\sigma_c = -1122$
$\delta_t = 913$	$\delta_t = 1176$	$\delta_t = 1122$
$\delta_{ca} = -1184$	$\delta_{ca} = -1188$	$\delta_{ca} = -1078$
$\delta_{ta} = 1300$	$\delta_{ta} = 1300$	$\delta_{ta} = 1300$

Hot Yai side only

Legends :

- 1) : Excessive stressed rivets to be strengthened
- 2) : Hanger to be added.
- 3) : Tie plates to be strengthened.
- 4) : New strut to be added.
- 5) : Web plates to be repaired.

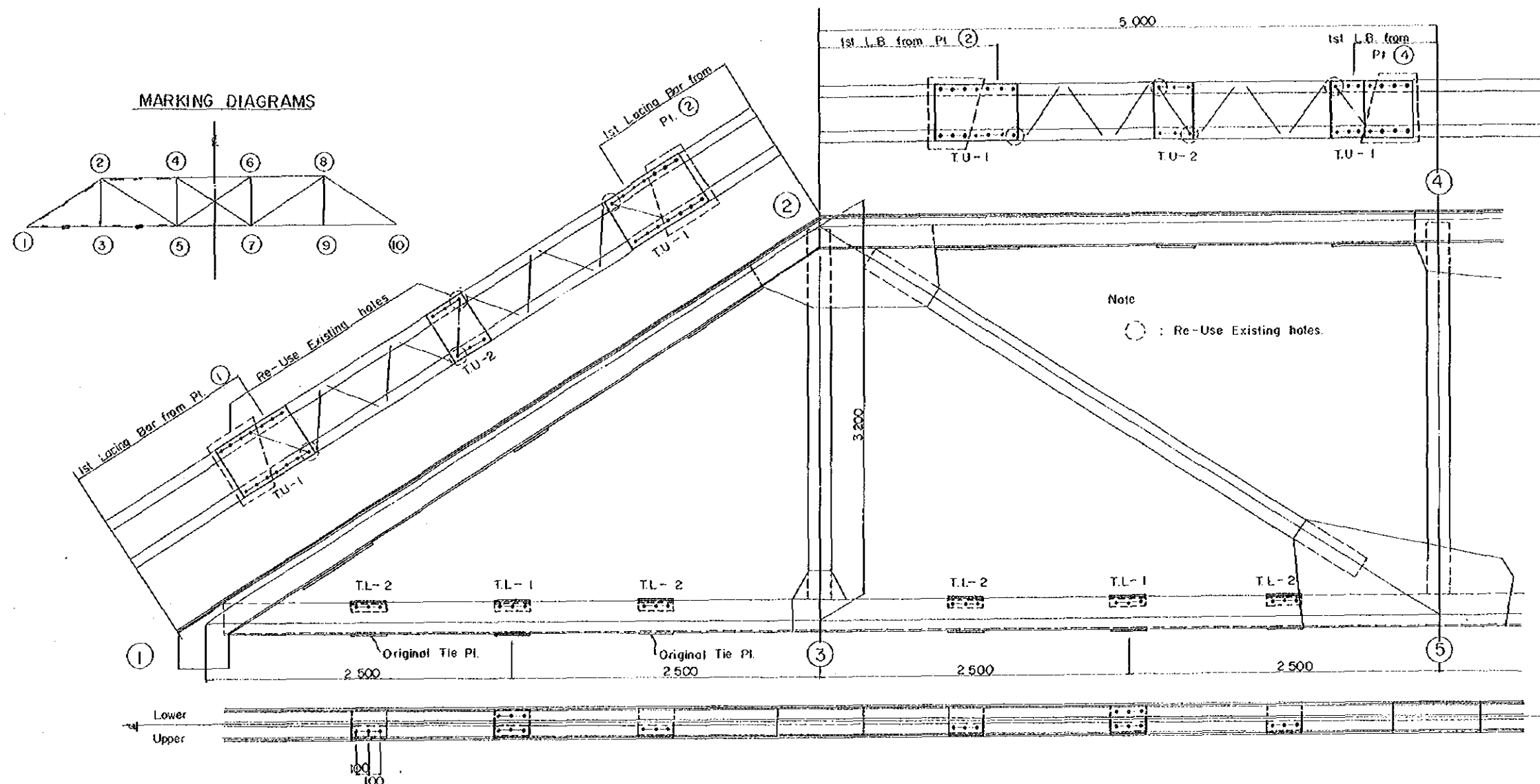
General Notes :

- 1) Weak drawings show the original members.
Deep drawings show the members to be improved.
- 2) Actual stress are based on DL-15 loading.
- 3) Marks
 - M : Bending moment (tm)
 - N : Axial force (t)
 - l : Length of member (cm)
 - r_x, r_y : Radius of gyration of sectional area for x or y axis (cm)
 - λ : Slenderness ratio.
 - σ : Actual stress (kg/cm²)
 - σ_a : Allowable stress (kg/cm²)

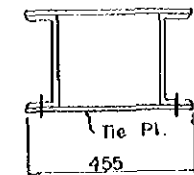
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
25.0 T.T			Unit Scale
K.M	897 + 174	Designed by	
DISTRICT	Hot Yai	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

MAIN TRUSS MEMBERS (NO.1) S=1/20



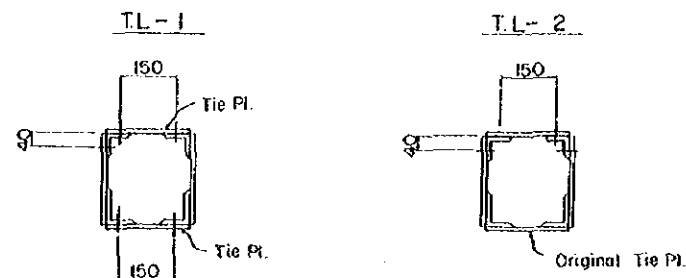
DETAIL T.U. S=1/10



1-Tie Pl. 455 x 10 x 2
n-H.T.B. M22 x 65 (FIOT)

	TU-1	TU-2
l	680	330
n	14	6

DETAIL T.L. S=1/10



2-Tie Pls. 230 x 10 x 280
2-Ls. 75 x 75 x 9 x 280
18-H.T.B. M22 x 60 (FIOT)

1-Tie Pl. 230 x 10 x 280
2-Ls. 75 x 75 x 9 x 280
12-H.T.B. M22 x 60 (FIOT)

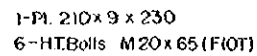
General Notes:

- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (4-1) (FIOT), and assumed frictional coefficient of contact surface as follows:
 - for connection ≥ 0.4
 - for slitch ≥ 0.3
- All dimensions to be checked in the field.

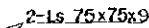
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS MEMBERS (NO.1)	DL 15 loading	Scale
250 T.T.			Unit mm	1/20, 1/10
K.M.	897 + 174	Designed by		
DISTRICT	Hot Yai	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

$$S = 1/20$$

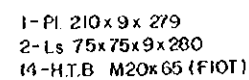
S = 1/10



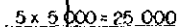
- 1) Drill new bolt holes.
- 2) Clean surface between original and additional members.
- 3) Add new Tie Plates and tighten H.T Bolts.

$$S = 1/10$$


- 1) Drill new bolt holes
- 2) Clean surface between original and additional members.
- 3) Add new angles and tighten H.T. Bolts.
- 4) Add new Tie Plates and tighten H.T. Bolts.



MARKING DIAGRAMS



○

S = 1/10



1-Tie Pl. 210x10x280
2-Ls 75x75x9x280
6-HTB M22x70 (FIOT)
6-HTB M22 60 (FIOT)

```

11 All mple

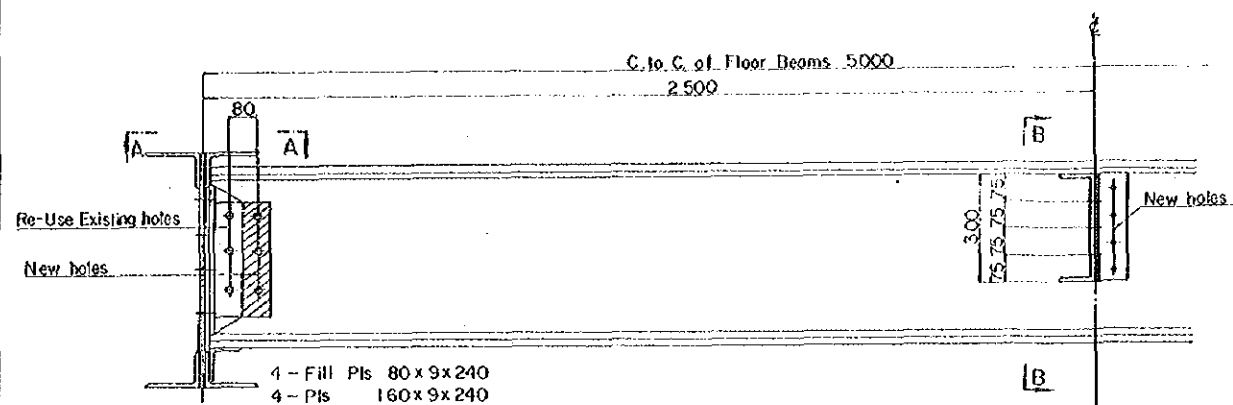
```

- 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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field

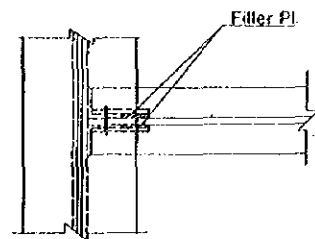
THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO.2)	
250 T.T		Unit	Scale
		mm	1/20, 1/10
K. M.	897 + 174	Designed by	
DISTRICT	Hat Yoi	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

FLOOR SYSTEM S-1/10

STRINGER



SECTION A - A

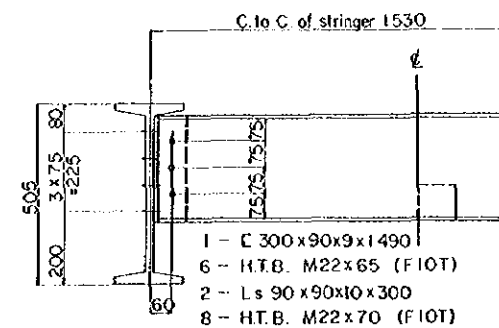


Construction Method for Connection

- 1) Drill new rivet holes to follow with original interval.
- 2) Take off connection rivets.
- 3) Add filler plates and connection plates.
- 4) Riveting.

STRUT OF STRINGER (S1)

SECTION B - B

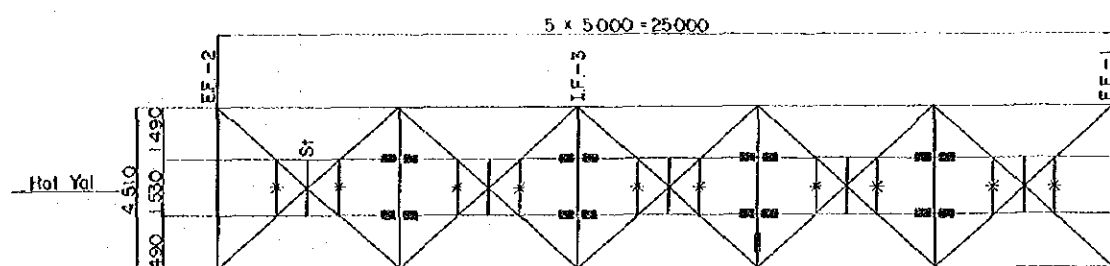


Construction Method for Stringer Strut

Before construction, it is important point that hanger bolts in stringer must be set up to meet bolt holes in lateral. Therefore, pre-investigation is to be done for detail scale.

- 1) Drill new bolt holes.
- 2) Clean surface between stringer and angles for attachment, and tighten H.T. Bolts.
- 3) Clean surface between stringer strut and angles for attachment, and tighten H.T. Bolts.

MARKING DIAGRAMS

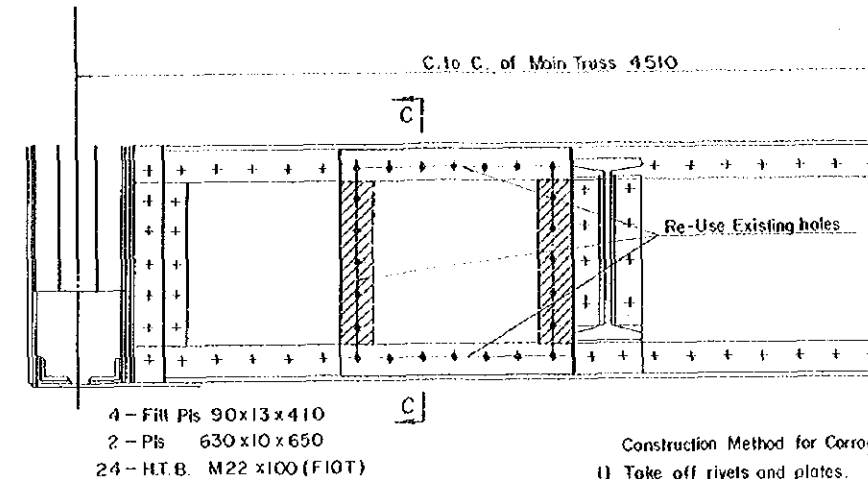


Note :

- : Replacement of loose rivets.
- : Strengthening of connection.
- × : Member to be taken off.

Bangkok

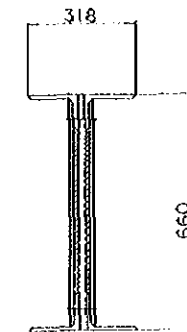
INTER FLOOR BEAM (I.F-3)



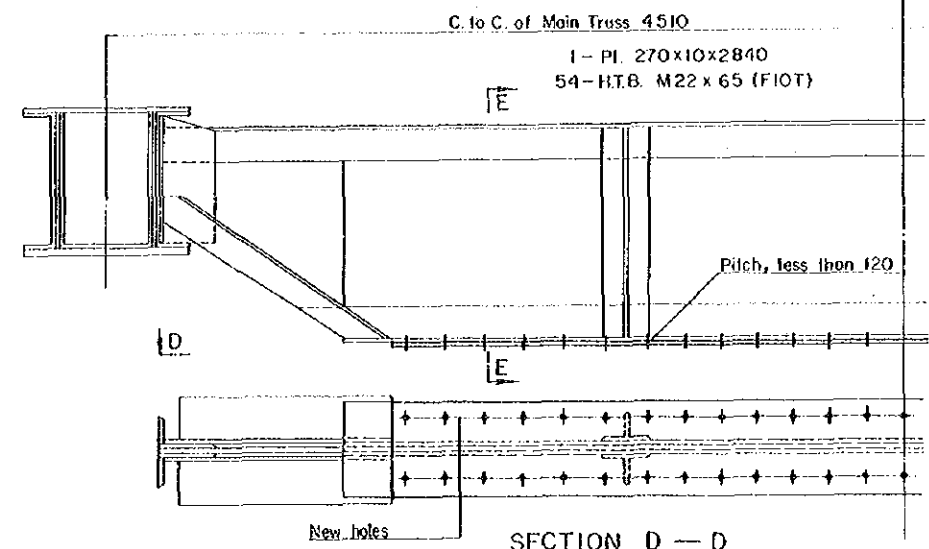
Construction Method for Corroded Plates

- 1) Take off rivets and plates.
- 2) Add filler plates and repair plates.
- 3) Tighten H.T. Bolts.

SECTION C - C



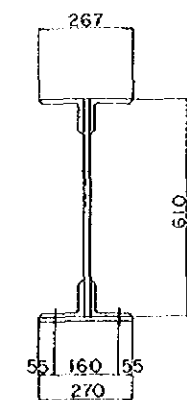
END FLOOR BEAM (E.F-1,2)



Construction Method

- 1) Drill new bolt holes.
- 2) Clean surface between original and new members.
- 3) Add cover plate and tighten H.T. Bolts.

SECTION E - E

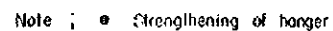
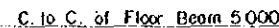


General Notes:

- 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 (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are .22P (FIOT), 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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM	DL 15 loading	
25.0 T.T			Unit	Scale
K.M	897 + 174		mm	1/10
DISTRICT	Hat Yai		Designed by	_____
LINE	Southern Line		Checked by	_____
Remarks			Checked by	_____
			Checked by	_____
			Checked by	_____
			Checked by	_____
DATE			DRAWING NO.	

S: 1/5

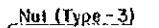


08



- Therefore, pay attention to the value of existing bridge

S = 1/5



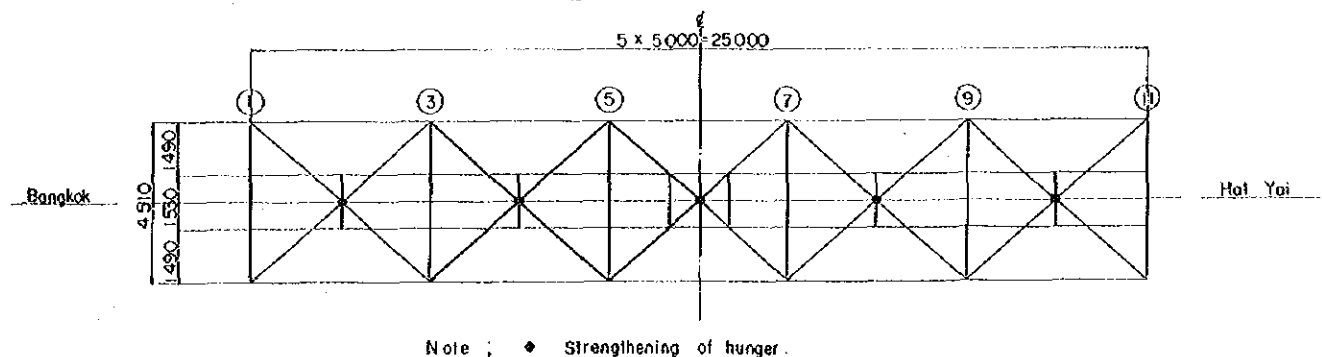
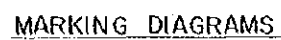
- Lower Lateral

Note ;
All Nuts M22 JIS B1156 or materials
of equivalent.

General Note

31. All dimensions to be checked in the field

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members		LOWER LATERAL BRACING (NO. 1)	D.L. 15 loading Unit Scale mm 1/5
250 T.T.				
K. M.	897 + 174		Designed by	_____
DISTRICT	Hat Yoi		Checked by	_____
LINE	Southern Line		Checked by	_____
Remarks			Checked by	_____
			Checked by	_____
			Checked by	_____
			Checked by	_____
			Checked by	_____
DATE			DRAWING NO.	

$$S = 1/15$$


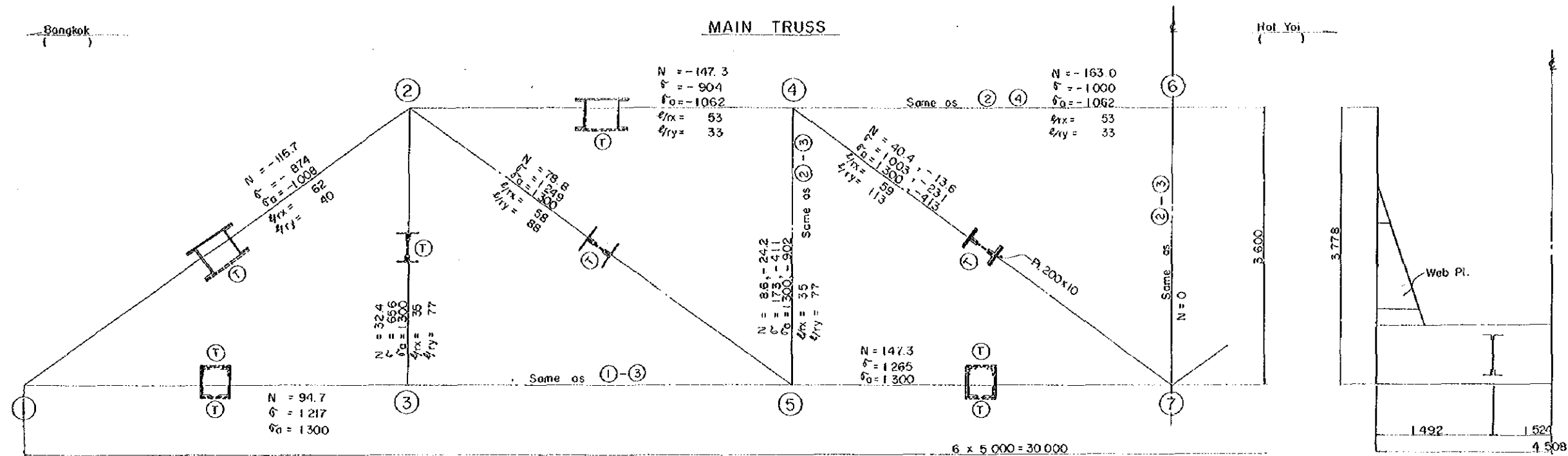
Note ; ♦ Strengthening of hunger .

General Notes:

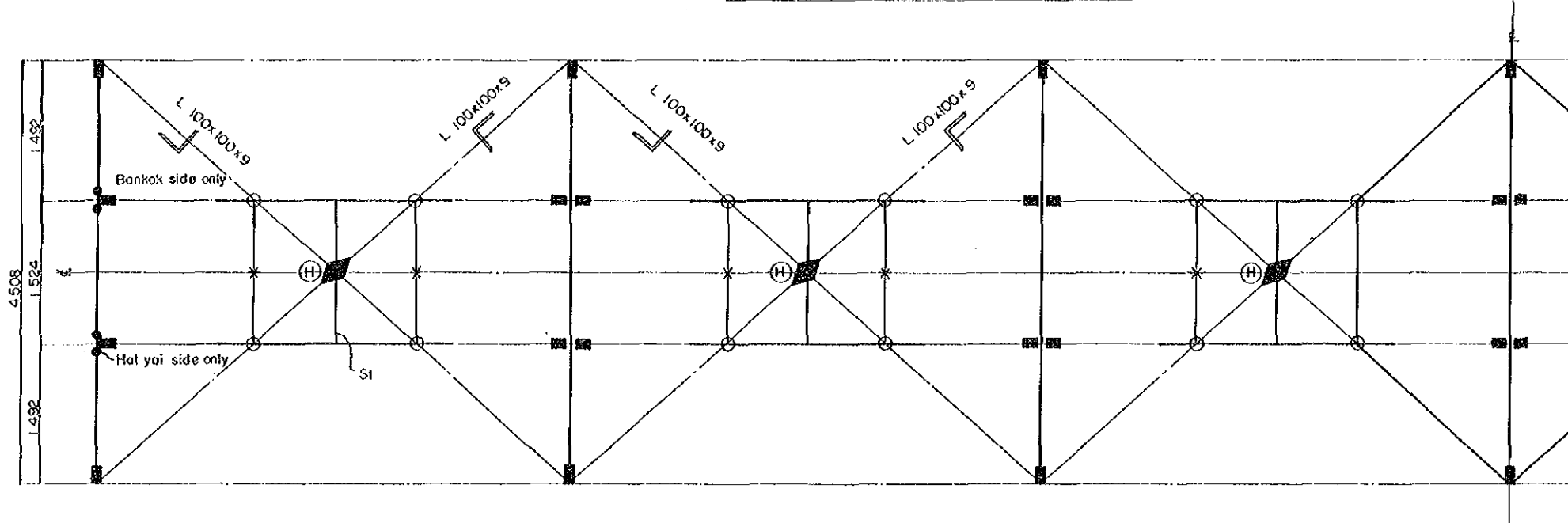
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (1-1/2") (F10T), and assumed frictional coefficient of contact surface (f) as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$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

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type 250 T.T	Members	LOWER LATERAL BRACING AND BRAKE TRUSS	DL 15 loading
			Unit mm Scale 1/15
K. M.	897 + 174	Designed by _____	
DISTRICT	Hat Yai		
LINE	Southern Line	Checked by _____	
Remarks		Checked by _____	
		Checked by _____	
		Checked by _____	
		Checked by _____	
DATE		DRAWING NO.	

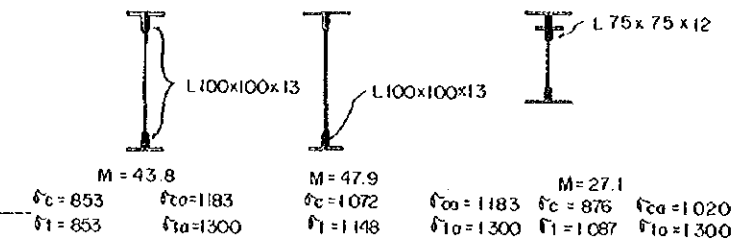
GENERAL DIAGRAM



FLOOR SYSTEM & LOWER LATETAL



END FLOOR INT. FLOOR STRINGER



Legends:

- 1) $\bullet$: Loose rivets to be replaced
- 2) $\blacksquare$: Excessive stressed rivets to be strengthened.
- 3) $\blacklozenge$: Gusset plates to be improved
- 4) $\circ$: Defective hanger to be removed.
- 5) $*$: Defective member to be removed.
- 6) $\textcircled{T}$: Tie plates to be strengthened.
- 7) $\textcircled{H}$: Hanger to be added.
- 8) $\textcircled{SI}$: New strut to be added.

General Notes:

- 1) Weak drawings show the original members.
Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.

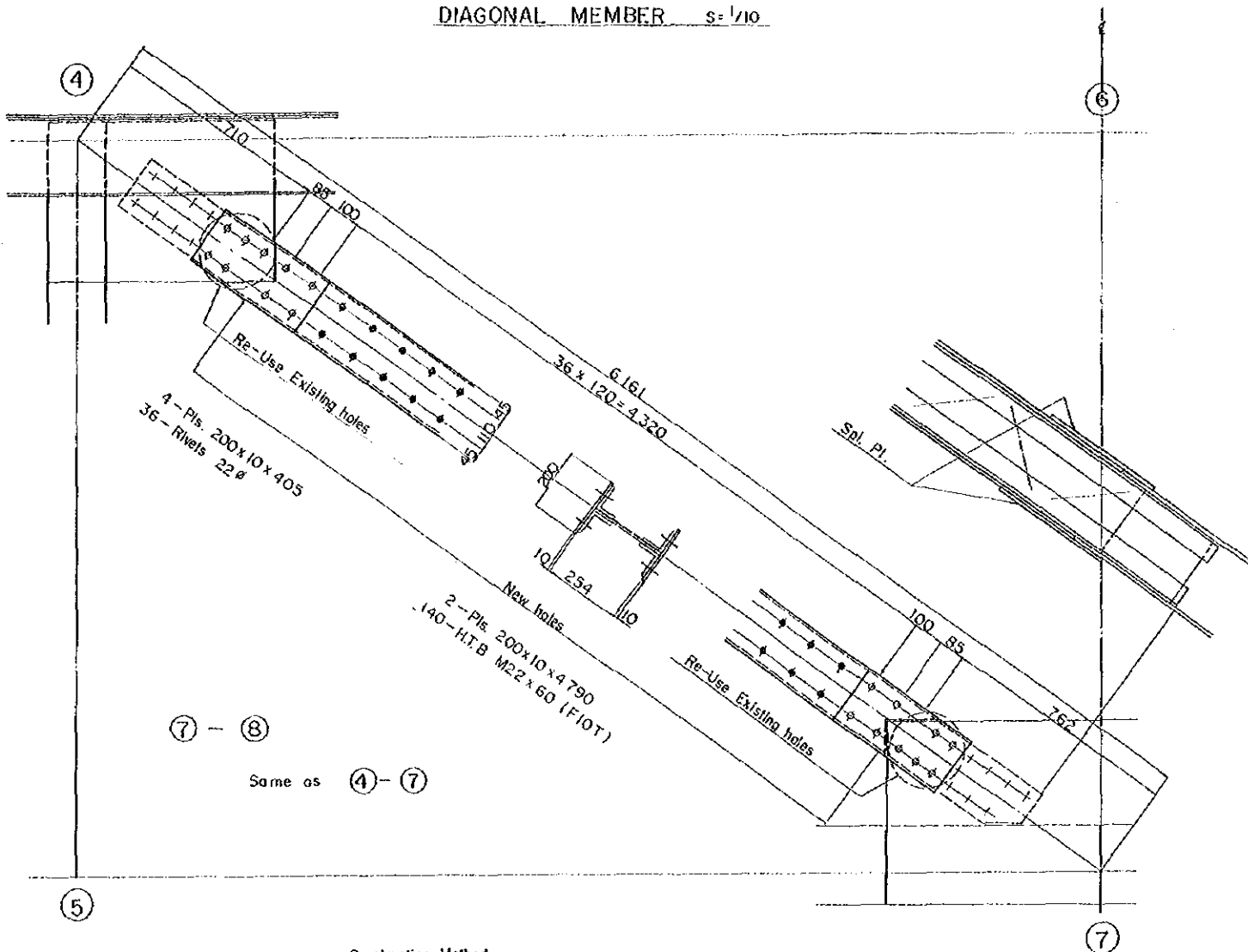
3) Marks

- M : Bending moment (t-m)
N : Axial force (t)
L : Length of member (cm)
 σ_x, σ_y : Radius of gyration of sectional area for x or y axis (cm)
- σ_r : Slenderness ratio.
 σ : Actual stress (kg/cm²)
 σ_a : Allowable stress (kg/cm²)

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
300 T.Y.			Unit Scale
K.M.	929 + 903	Designed by	
DISTRICT	Hot Yoi	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
DATE		DRAWING NO.	

MAIN TRUSS (NO. 1)

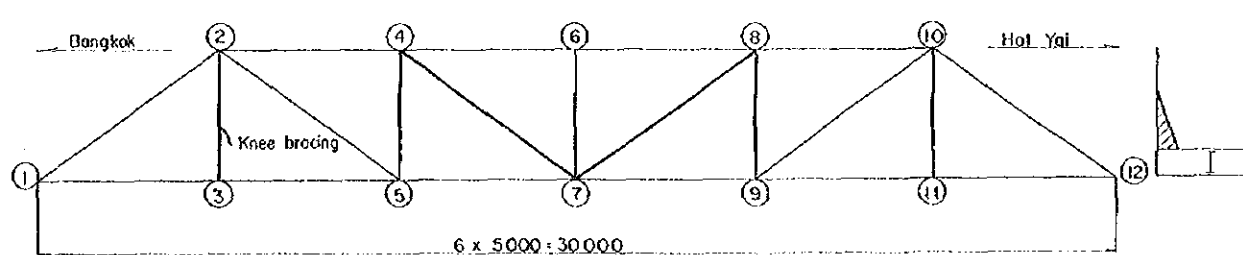
DIAGONAL MEMBER $s = 1/10$



Construction Method

- 1) Drill new bolt and rivet holes.
- 2) Cut off rivets of original members.
- 3) Clean surface between original and new members.
- 4) Add new plates and tighten H.T. Bolts.
- 5) Add splice plate and riveting.

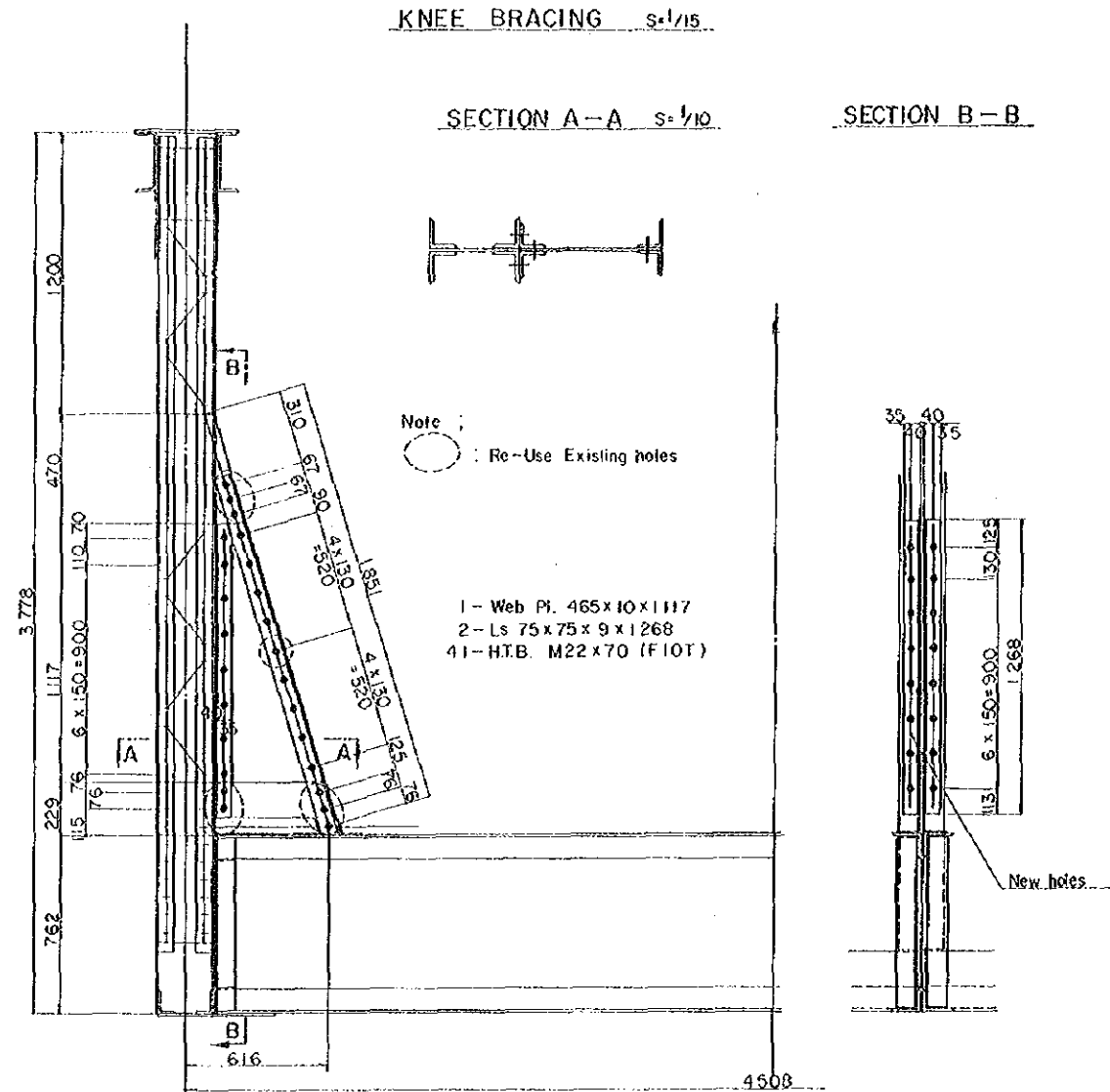
MARKING DIAGRAMS



KNEE BRACING S-1/15

SECTION A-A S=1/10

SECTION B-B



Construction Method

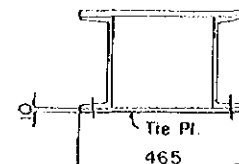
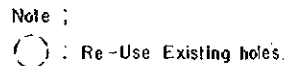
- 1) Cut off rivet of original knee members.
- 2) Take off original knee Angles.
- 3) Drill new bolt holes
- 4) Clean surface between original and new members.
- 5) Add new Angles and knee plate.
- 6) Tighten HT Bolts.

General Notes

- 1) All materials are to be JIS G3101 SS 41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (Φ19T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for slitch $f \geq 0.3$
- 3) All rivets are 22Φ(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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.1)	DL 15 loading	
300 T.T			Unit	Scolo
			mm	1/15, 1/10
K. M	929 + 903		Designed by	
DISTRICT	Itai Yoi		Checked by	
LINE	Southern Line		Checked by	
Remarks			Checked by	
			Checked by	
			Checked by	
			Checked by	
			Checked by	
DATE			DRAWING NO.	

SE 1/20



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

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

	①-③	③-⑤	⑤-⑦
d_1	150	150	130
d_2	230	230	210

Tie Rod

- 1) Cut off original rivets.
- 2) Take off original tie plates or lacing bars.
- 3) Drill new bolt holes.
- 4) Clean surface between original and new members.
- 5) Attach new tie plates and tighten H.T.Bolts.

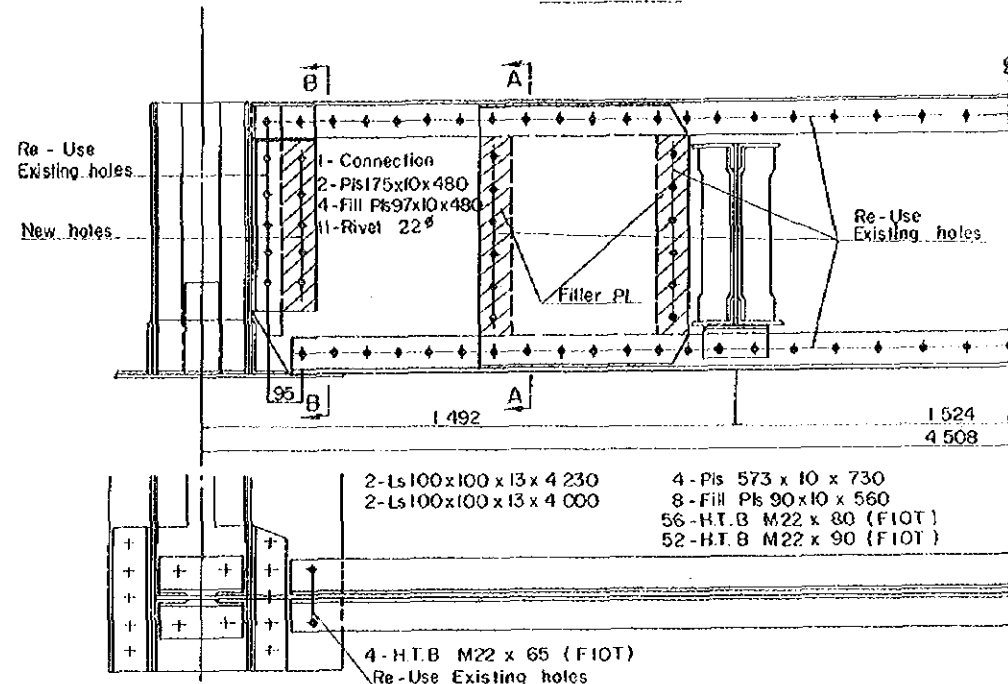
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (1-1) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
-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

- 15 -

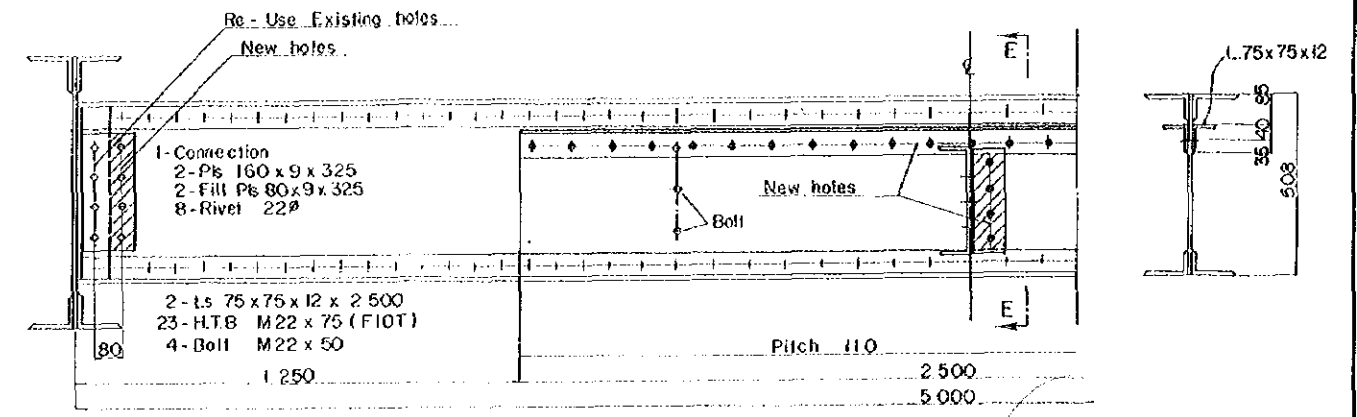
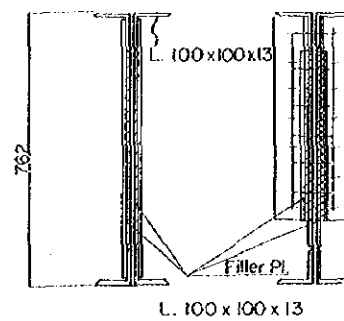
FLOOR SYSTEM s=1/10

FLOOR BEAM

E.F-1,2



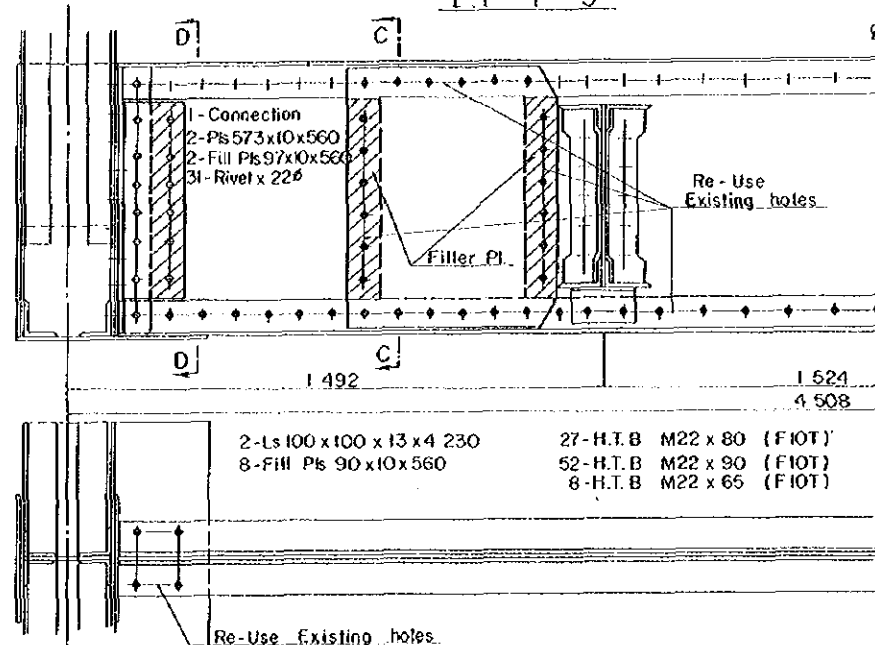
Section A-A Section B-B



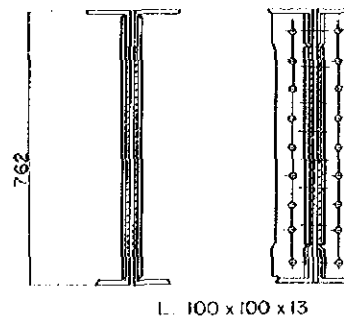
Construction Method

- 1) Drill new bolt holes.
- 2) Clean surface between original members and new angles.
- 3) Attach new angles and tighten HT.Bolts.
- 4) Strengthen Strut of Stringer.

I.F-1-5

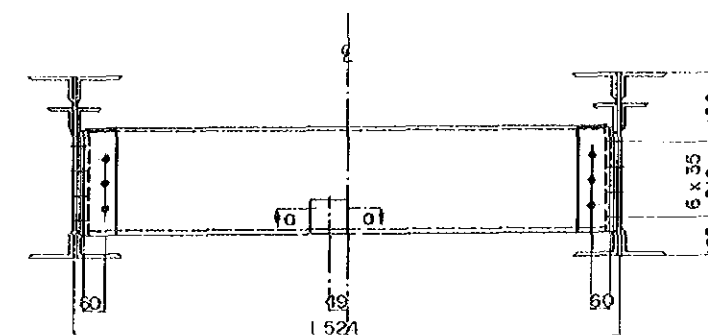


Section C-C Section D-D

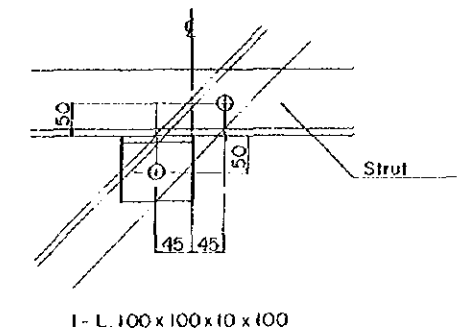


STRUT OF STRINGER (SI)

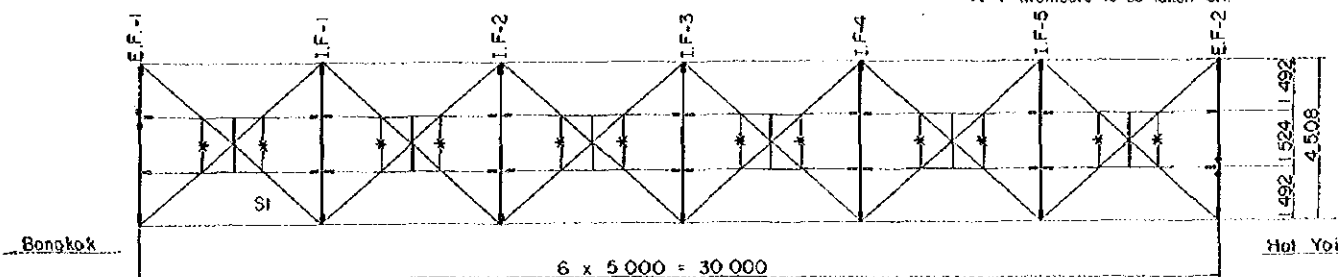
Section E-E



SECTION a-a s=1/5



MARKING DIAGRAMS



- Note :
- Replacement of Loose Rivets
 - Strengthening of Connection
 - × Members to be taken off

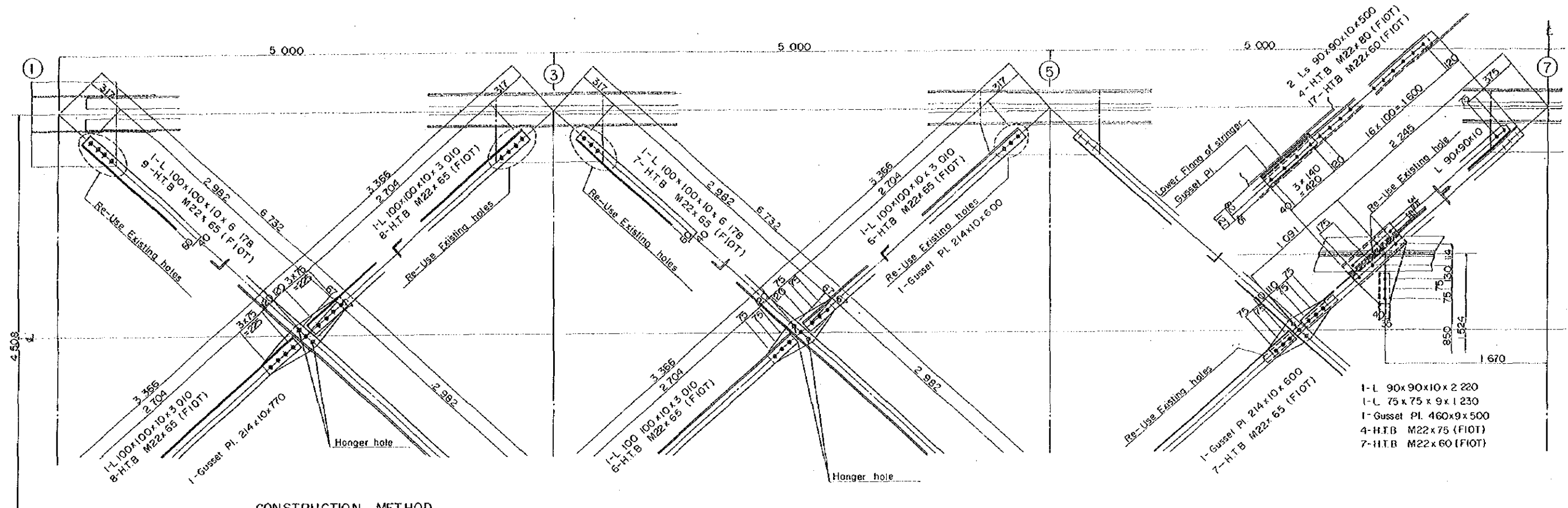
General Notes

- 1) All materials are to be JISG3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B) are M22 (4) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22 ϕ (4), 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

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	FLOOR SYSTEM	
300 LT		OL 15 loading	
		Unit	Scale
		mm	1/10, 1/5
K.M.	929 + 903	Designed by	
DISTRICT	Hot Yai	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
DATE		DRAWING NO.	

LOWER LATERAL BRACING S = 1/15



CONSTRUCTION METHOD

① - ③, ③ - ⑤

- 1) Cut off rivet of original members.
- 2) Take off original members.
- 3) Drill new bolt holes.
- 4) Clean surface between original and new members.
- 5) Attach new angles.
- 6) Tighten HTBolls.

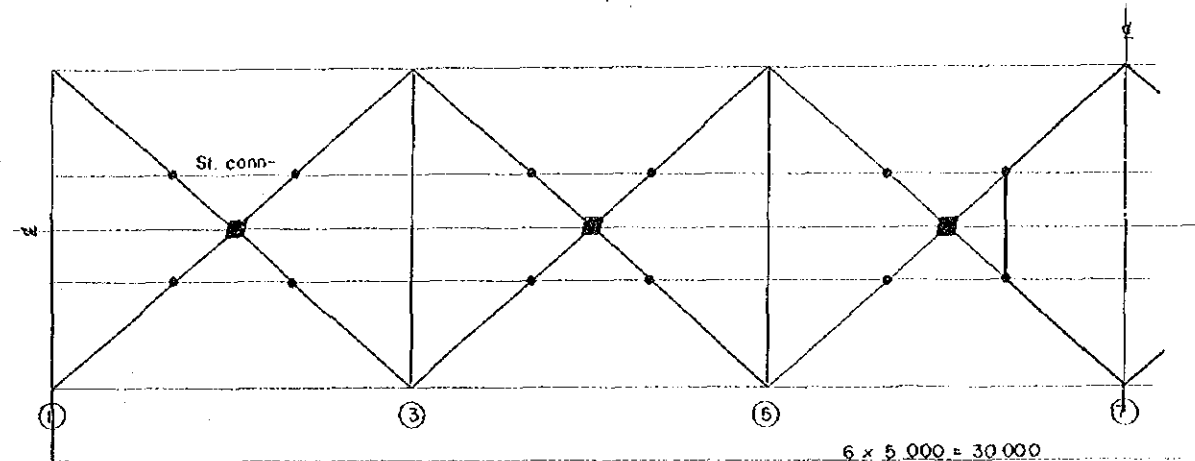
⑤ - ⑦

- 1) Cut off rivet of original members.
- 2) Drill new bolt holes.
- 3) Clean surface between original and new members.
- 4) Attach new connection plate.
- 5) Tighten H.T.Bolls.

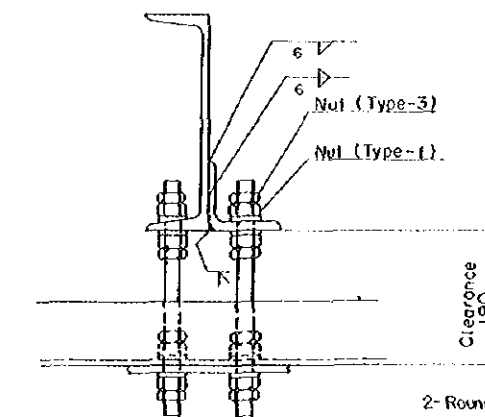
Note

- 1) : Strengthening connection and attaching hanger.
- 2) : Original hanger to be taken off.

MARKING DIAGRAMS



HANGER S = 1/5



- 2-Round Bar 22x330
- 8-Nut M22 (Type-1)
- 8-Nut M22 (Type-3)
- 8-Washer M22

Note

All Nut M22 (JIS B-1156) or materials of equivalent.

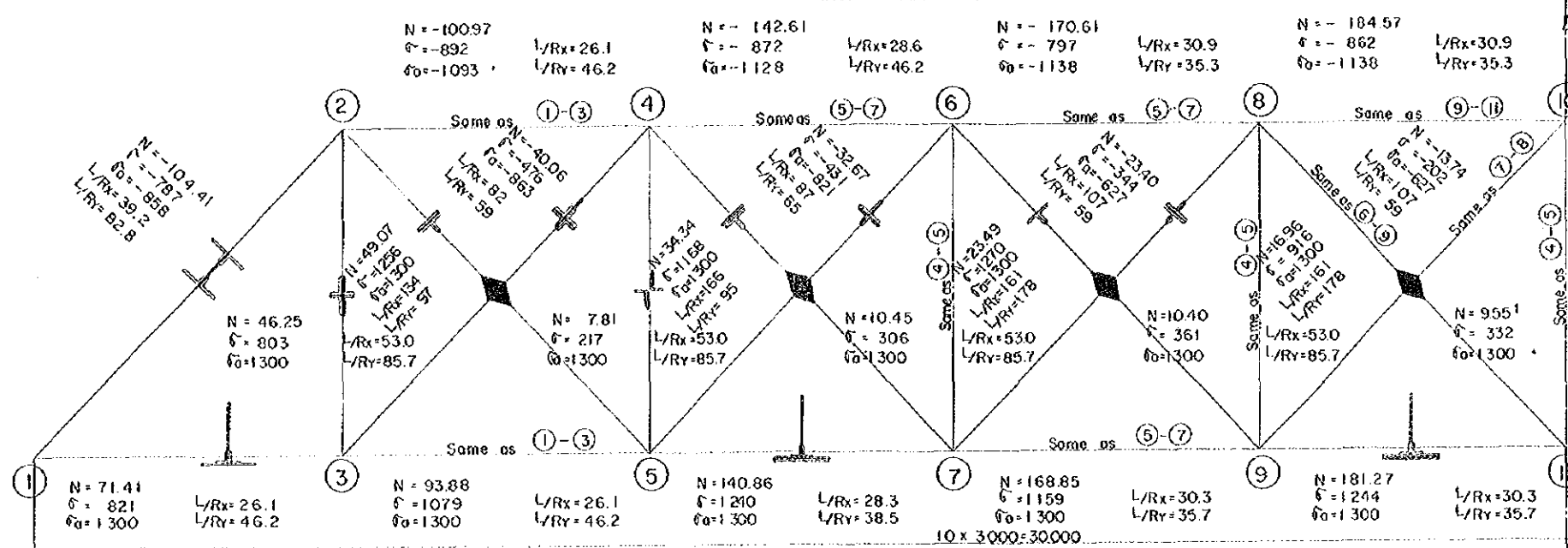
General Note:

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

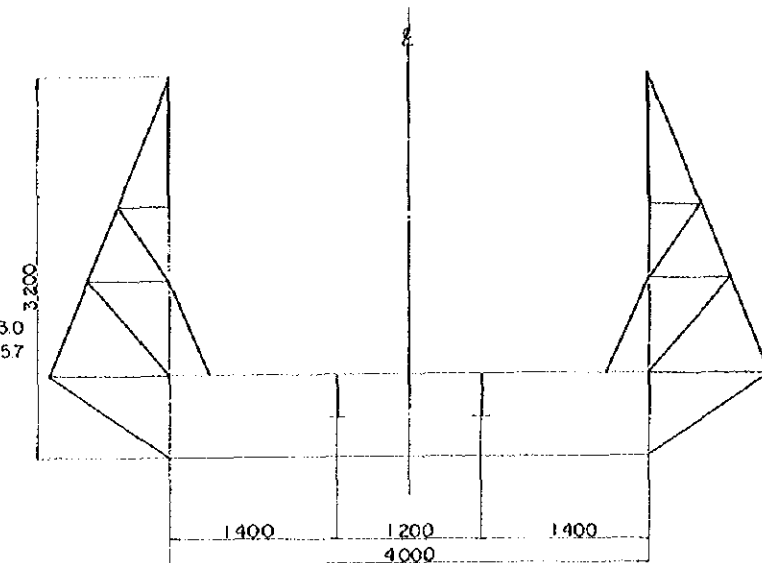
THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	LOWER LATERAL BRACING	OL 15 loading
30.0 T.T.			Unit Scale
			mm 1/15, 1/5
K.M.	929 + 903	Designed by	
DISTRICT	Hot Yai	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
DATE		DRAWING NO.	

GENERAL DIAGRAM

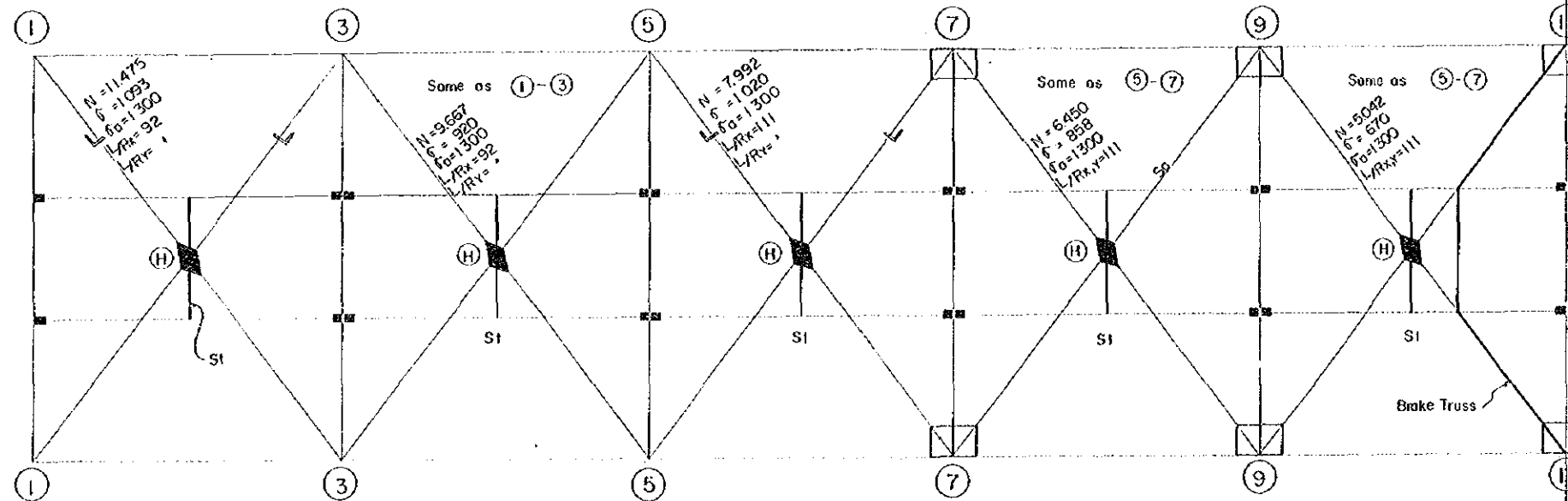
MAIN TRUSS



KNEE BRACING



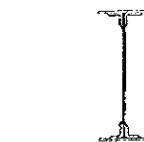
FLOOR SYSTEM & LOWER LATERAL



END FLOOR

INT FLOOR

STRINGER



$M = 31.4$
 $\delta_c = -726$
 $\delta_i = 869$
 $\delta_{co} = -1188$
 $\delta_{to} = 1300$



$M = 34.6$
 $\delta_c = -802$
 $\delta_i = 960$
 $\delta_{co} = -1188$
 $\delta_{to} = 1300$



$M = 9.9$
 $\delta_c = -831$
 $\delta_i = 831$
 $\delta_{co} = -980$
 $\delta_{to} = 1300$

Legends

- 1) Excessive stressed rivets to be strengthened.
- 2) Gusset plates to be improved.
- 3) Hanger to be added.
- 4) New gusset plates to be changed.
- 5) SI : New strut to be added.

General Notes

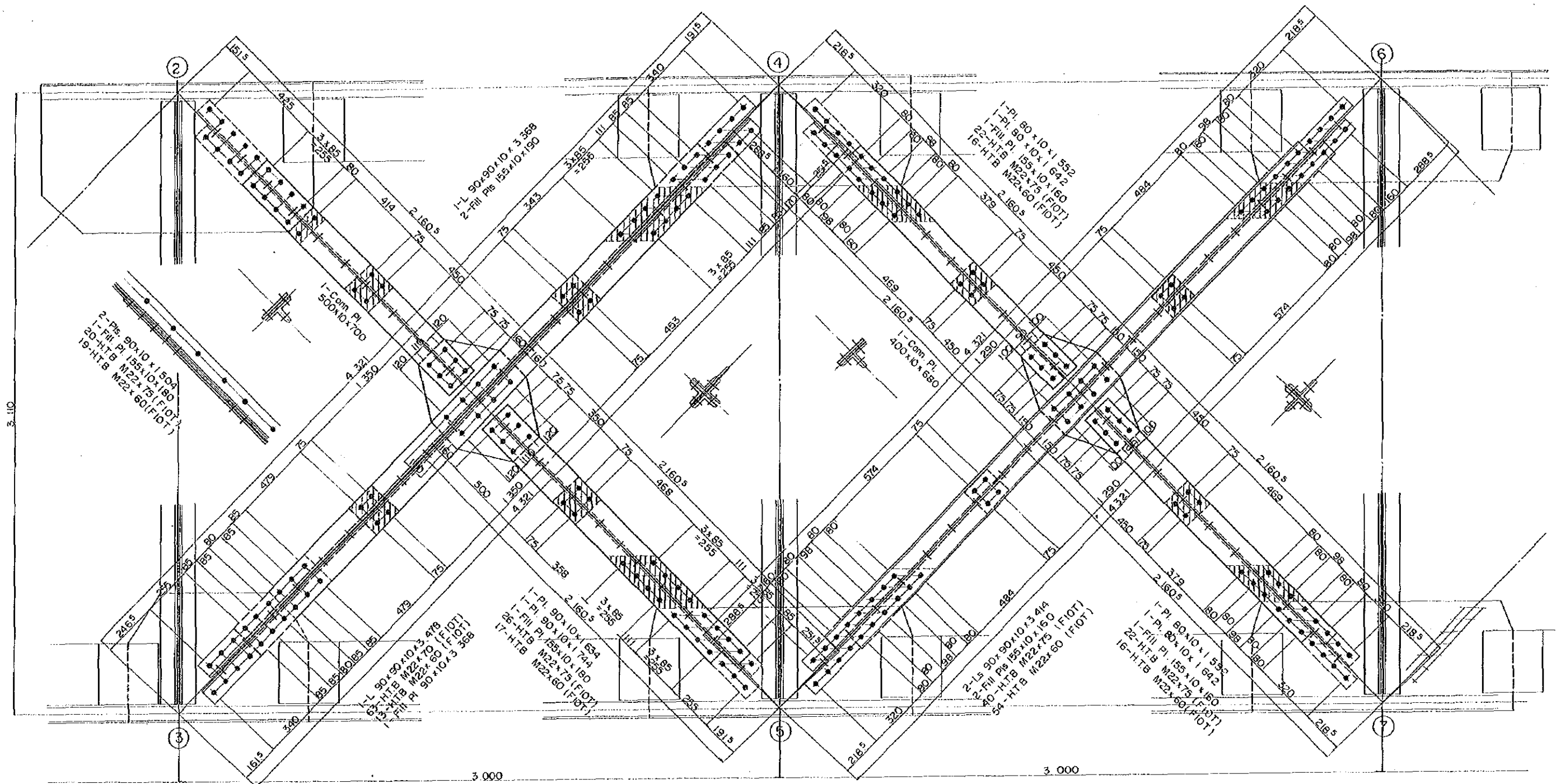
- 1) Weak drawings show the original members.
 Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.

3) Marks

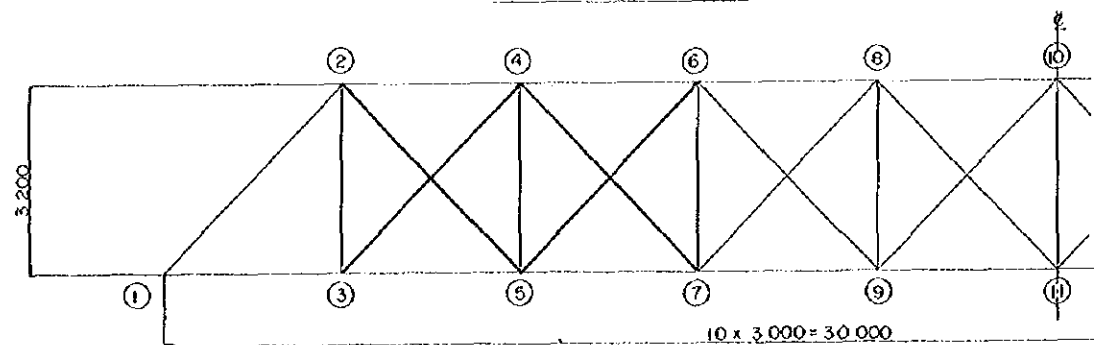
M : Bending moment (t-m)
 N : Axial force (t)
 L : Length of member (cm)
 R_x, R_y : Radius of gyration of sectional area for x or y axis (cm)
 L/R : Slenderness ratio
 δ : Actual stress (kg/cm^2)
 δ_0 : Allowable stress (kg/cm^2)

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
30.0 T.T			Unit Scale
K. M.	263 + 335		mm
DISTRICT	Nakhon Sawan		
LINE	Northern Line		
Remarks	Designed by _____		
	Checked by _____		
	Checked by _____		
	Checked by _____		
	Checked by _____		
DATE	DRAWING NO.		

MAIN TRUSS (NO.1) S=1/10



MARKING DIAGRAMS



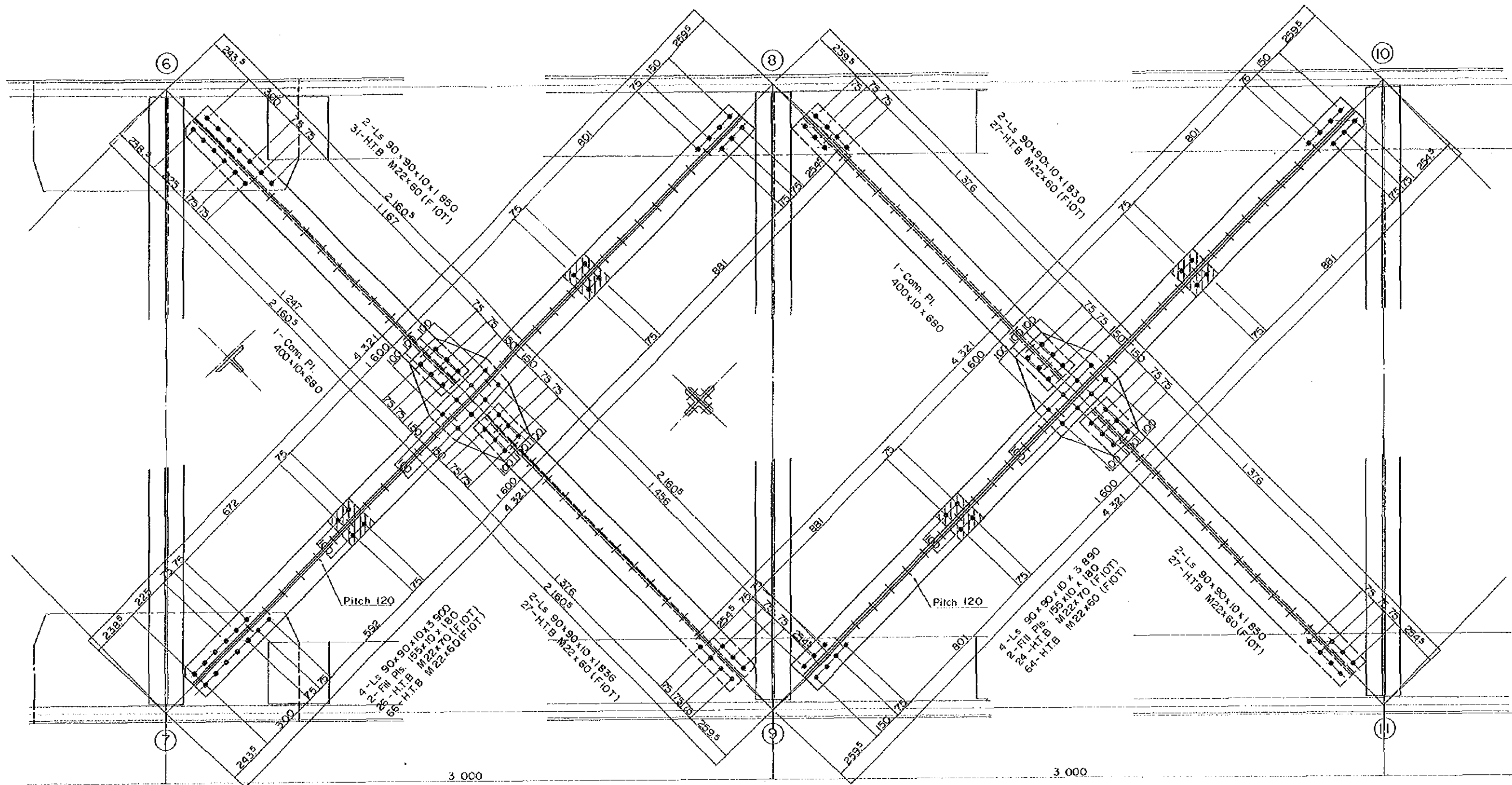
General Notes:

- 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 ≥ 0.4
 - ii) for stitch ≥ 0.3
- 3) All dimensions to be checked in the field.

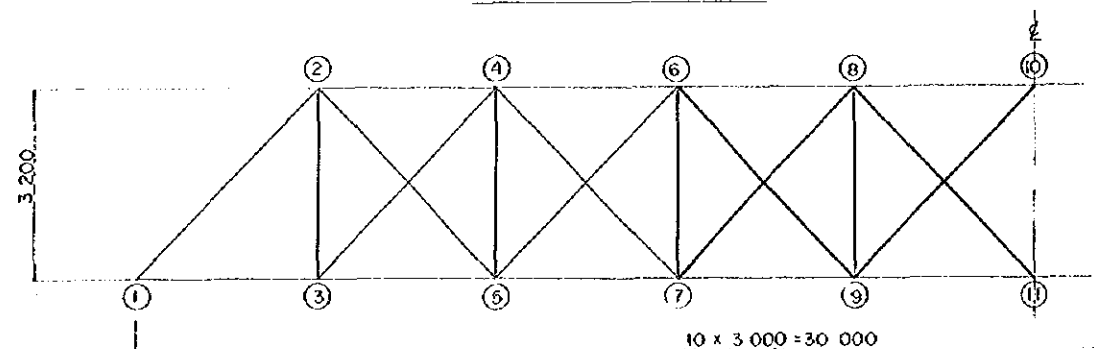
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.1)	Unit	Scale
300 T.T			mm	1/10
K.M.	263 + 335			
DISTRICT	Nakhon Sawan			
LINE	Northern Line			
Remarks				
		Designed by		
		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

MAIN TRUSS (NO.2) S=1/10



MARKING DIAGRAMS



General Notes:

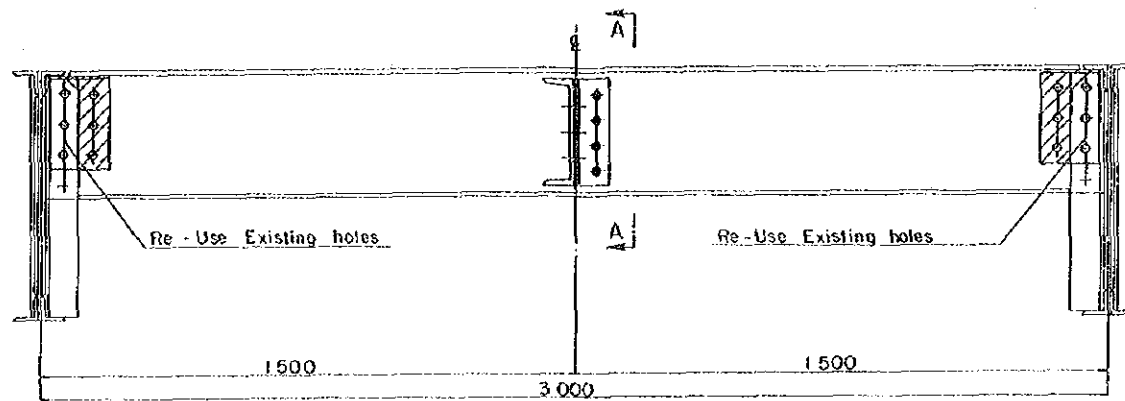
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All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

THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.2)		DL 15 Loading
300 T.T				Unit mm Scale 1/10
K.M.	263 + 335	Designed by		
DISTRICT	Nakhon Sawan	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.	4498	

FLOOR SYSTEM & KNEE BRACING

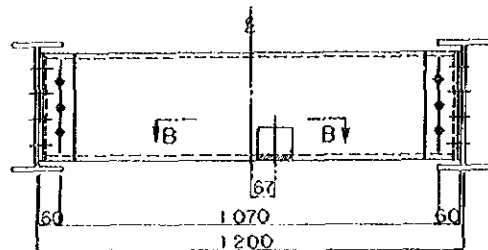
STRINGER S = 1/10



(2 - Connection)
4 - Pls 160 x 10 x 253
4 - Fill Pls 80 x 10 x 253
12 - Rivets 22^d

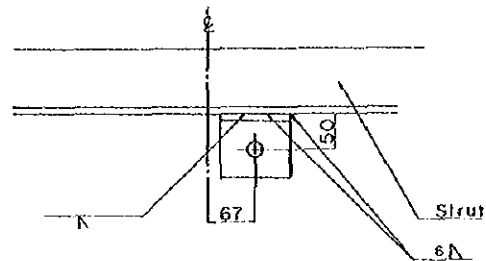
STRUT

SECTION A - A S=1/10



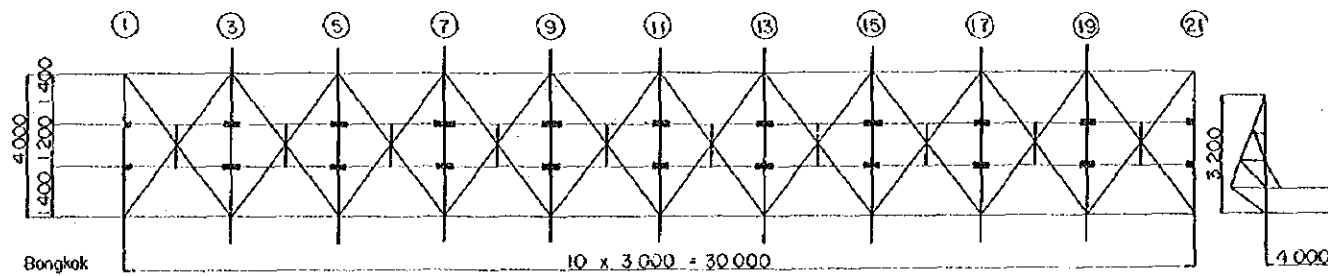
1-C 300 x 90 x 10 x 1 150
2-LS 100 x 100 x 10 x 290
4-H.T.B M22 x 60 (FIOT)

SECTION B - B S = 1/5

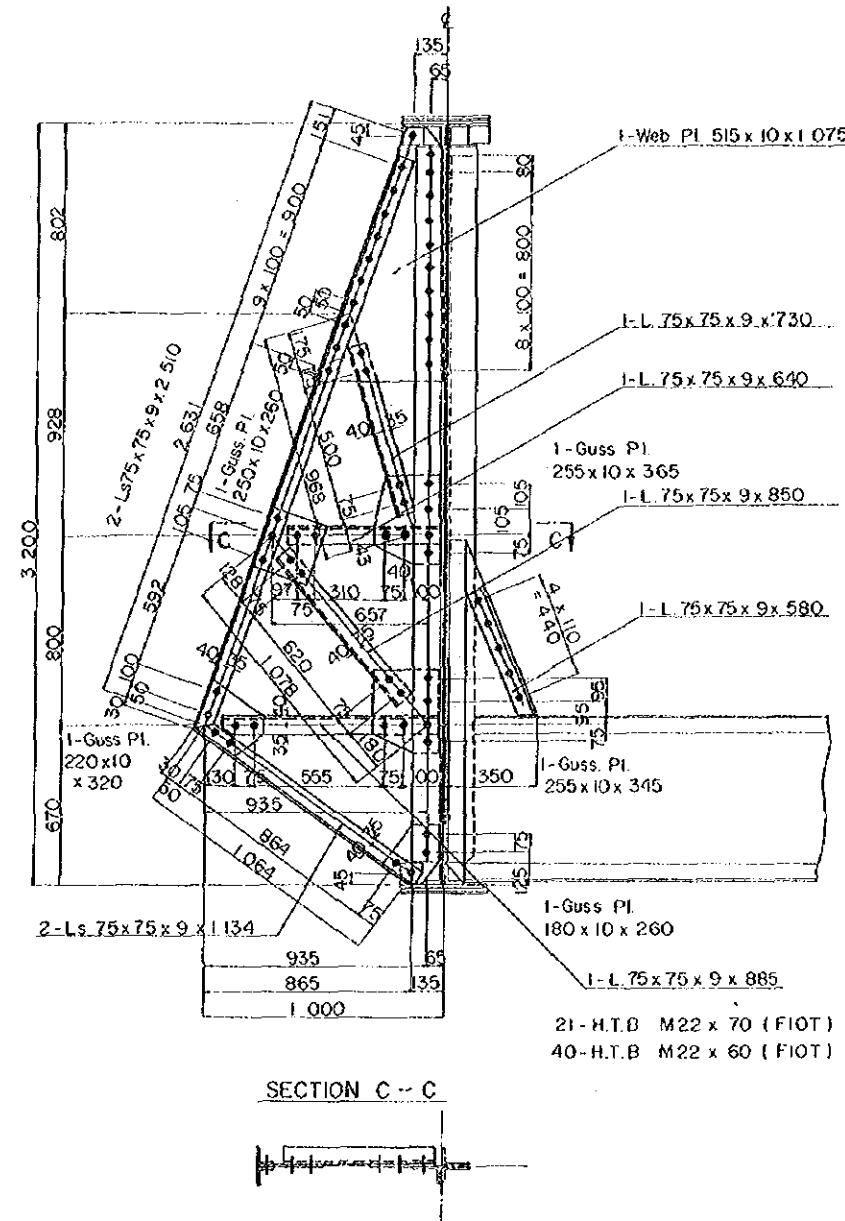


1 - L. 90 x 90 x 13 x 100

MARKING DIAGRAMS



KNEE BRACING \$=1/15



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 added members.
- 5) Add new members and tighten H.T Bolts.

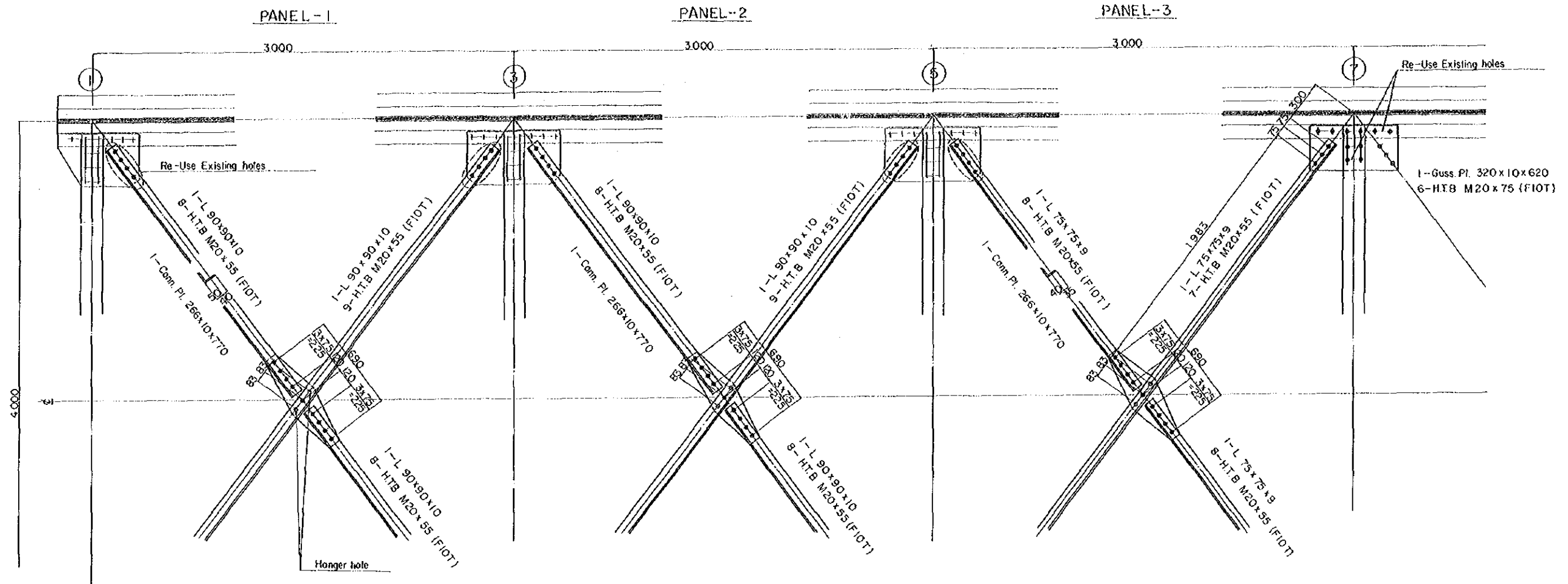
General Notes;

- 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 (♠) (F10T), and assumed frictional coefficient of contact surface as follows.

i) for connection	$f \geq 0.4$
ii) for stitch	$f \geq 0.3$
- 3) All rivets are 22[♠] (♠), 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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM & KNEE BRACING	DL 15 loading	
300 T.T			Unit Scale	
			mm	1/8, 1/10, 1/5
K. M.	263 + 335	Designed by _____		
DISTRICT	Nakhon Sowan			
LINE	Northern Line			
Remarks			Checked by _____	
			Checked by _____	
		Checked by _____		
DATE		DRAWING NO.	4498	

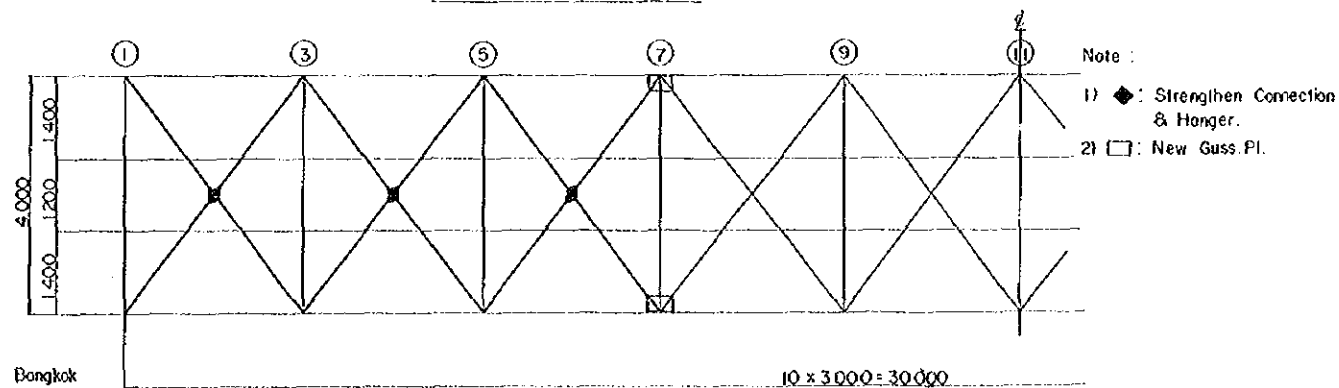
LOWER LATERAL BRACING (NO.1) S-1/15



Note :
 ○ Re-Use Existing holes.

- Construction Method
- 1) Cut off original Rivets.
 - 2) Take off original Members and Gusset Plate.
 - 3) Clean surface between original and new members.
 - 4) Attach new Angles and Gusset Plate.
 - 5) Tighten H.T.Bolts.

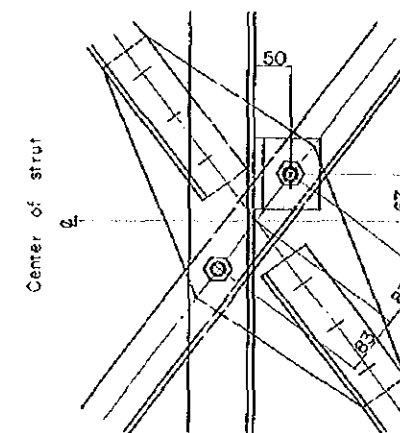
MARKING DIAGRAMS



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 (H.T.B) are M20 (Φ) (FIOT), and assumed frictional coefficient of contact surface as follows.
 i) for connection $f \geq 0.4$
 ii) for slitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	LOWER LATERAL BRACING (NO.1)		
300 T.T		DL 15 Loading	Unit	Scale
K.M	263 + 335	mm	1/15	
DISTRICT	Nakhon Sawan	Designed by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.	4498	

$$S = 1/15$$


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 (μ) as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

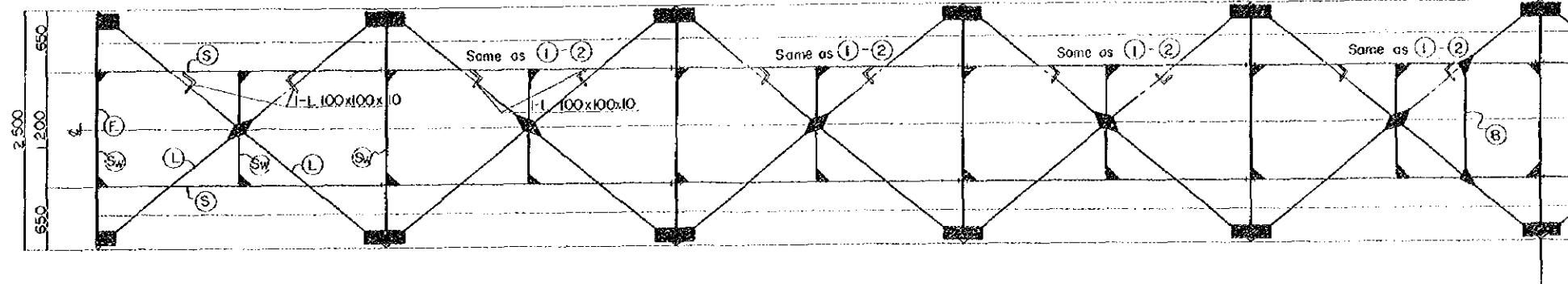
— 23 —

GENERAL DIAGRAM

FLOOR SYSTEM & UPPER LATERAL

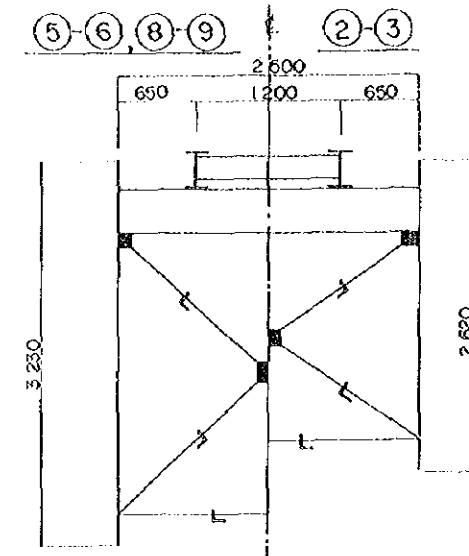
- Note
- 1) (F) : New floor beam and connection
 - 2) (S) : New stringer and connection
 - 3) (S) : New strut of stringer
 - 4) (L) : New lateral bracing
 - 5) (B) : New brake truss
 - 6) (■) : Strengthen Gusset Plates
- Chiang Mai (Fix)

Bangkok (Mov)



MAIN TRUSS

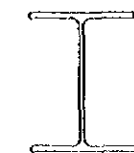
SWAY BRACING



Note : ■ : Strengthen Gusset Plates.

FLOOR BEAM

STRINGER



M = 16.053
 $\delta_c = 811$
 $\delta_l = 811$
 $\delta_{ca} = 1165$
 $\delta_{ta} = 1300$

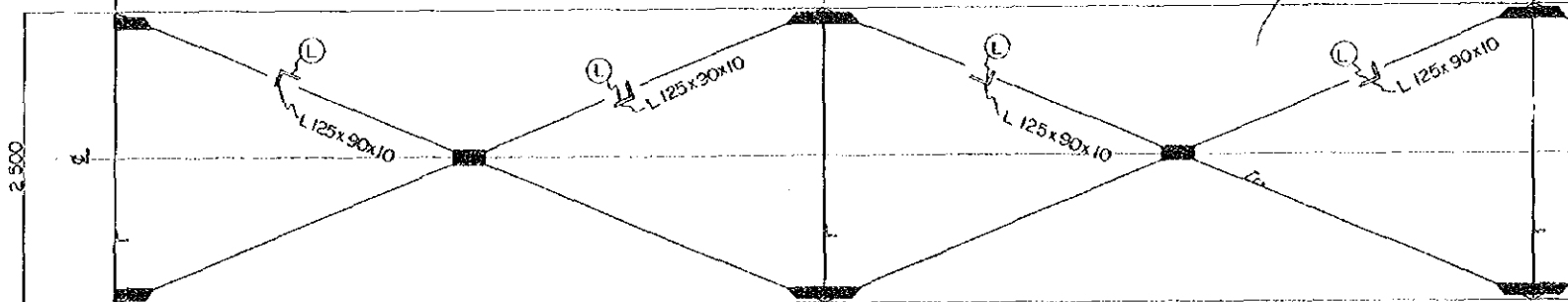


M = 9.865
 $\delta_c = 1132$
 $\delta_l = 1132$
 $\delta_{ca} = 1172$
 $\delta_{ta} = 1300$

10 x 3,000 = 30,000

LOWER LATERAL

1 x 6,000 = 24,000



- Note
- 1) (L) : New lateral bracing
 - 2) (■) : New Gusset Plates.

- Note
- 1) (T) : Strengthen Tie Plates
 - 2) (■) : Strengthen connection

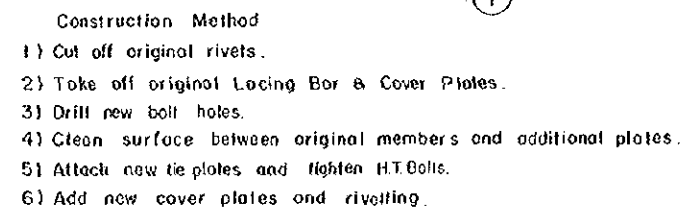
General Note :

- 1) Weak drawings show the original members.
 Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Marks
 M : Bending moment (t.m) δ/r : Slenderness Ratio
 N : Axial force (t) δ : Actual stress (kg/cm²)
 Length of member (cm) δ_a : Allowable stress (kg/cm²)
 δ_x, δ_y : Radius gyration of sectional area for x or y axis (cm)

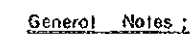
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 Loading
300 D.T			Unit Scale
K.M	577 + 622	Designed by	
DISTRICT	Lampang	Checked by	
LINE	Northern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

UPPER CHORD MEMBER $s = 1/20$



MARKING DIAGRAMS



- 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 22) (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 19 ϕ (ϕ 19), 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			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members MAIN TRUSS (NO. 1)	DL 15 loading	
300 D.T		Unit mm	Scale 1/20
K. M	577 + 622	Designed by _____	
DISTRICT	Lampang	Checked by _____	
LINE	Northern Line	Checked by _____	
Remarks		Checked by _____	
		Checked by _____	
		Checked by _____	
		Checked by _____	
DATE		DRAWING NO.	

LOWER CHORD MEMBER $s = 1/10$

Technical drawing of a rectangular plate. The overall dimensions are 408 (width) and 280 (height). The plate has a central rectangular hole with a width of 100 and a height of 100. The hole is positioned such that there are 35 units of material on the left and right sides, and 338 units of material on the top and bottom. The drawing includes dimension lines and arrows indicating the measurements.

1-1ie Pl. 280x10x408
6-H.TB M22x65 (FIOT)

LOWER TIE PLATE

MARKING DIAGRAMS

General Notes:

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high — strength bolts (H.T.B.) are M22- ϕ -3 (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22 ϕ and 19 ϕ - 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.

- 2-Spl. Pls. 68 x 16 x 920
1-Spl. Pl. 180 x 16 x 580
1-Spl. Pl. 408 x 15 x 920
2-Fill Pls. 408 x 5 x 550
16-Rivets 22¢
22-Rivets 19¢

Construction Method

- 1) Drill new bolt holes
- 2) Cut off original rivets
- 3) Clean surface between original members and additional plates.
- 4) Attach new Tie Plate and tighten H.T.Bolts
- 5) Add new Cover Plate and tighten H.T.Bolts or rivetting.

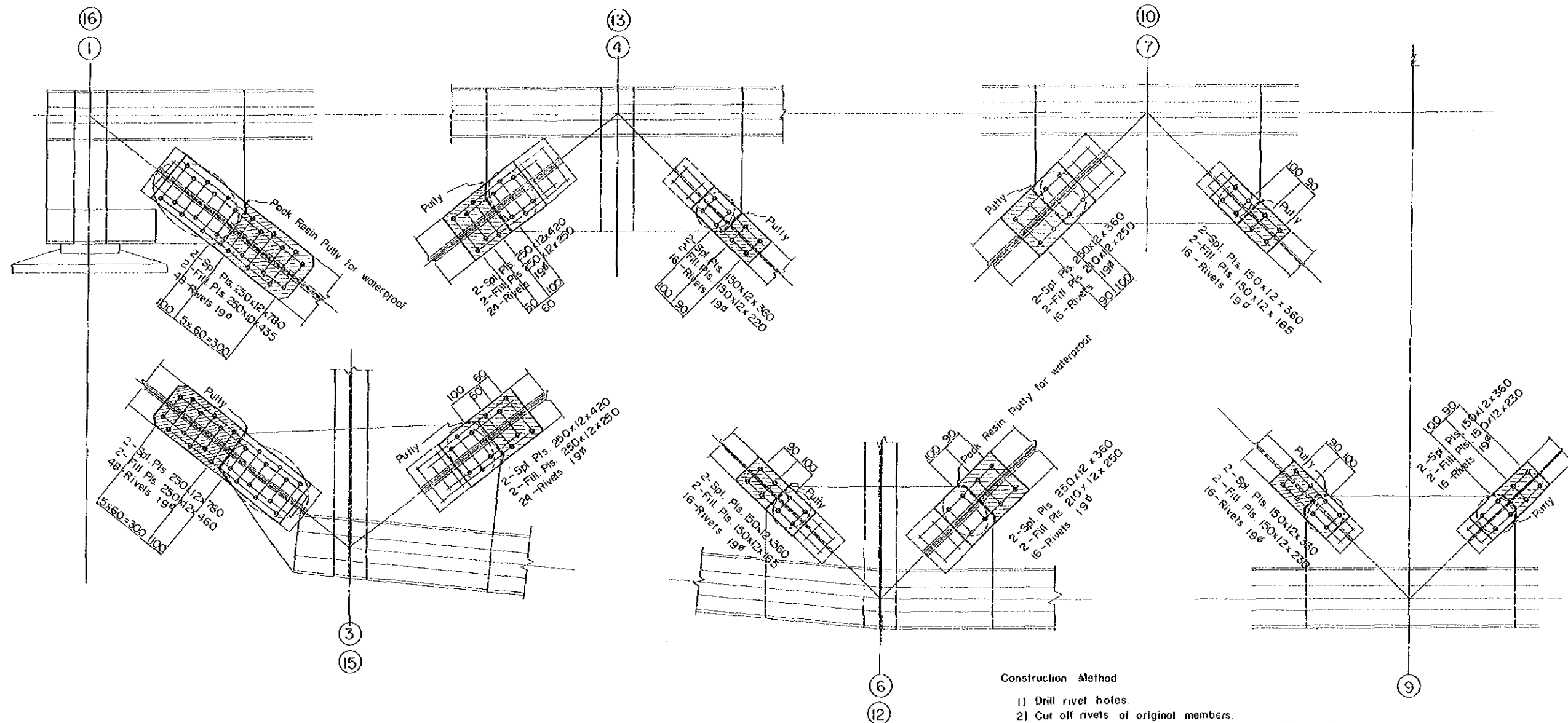
Note

(---) : Re - Use Existing holes

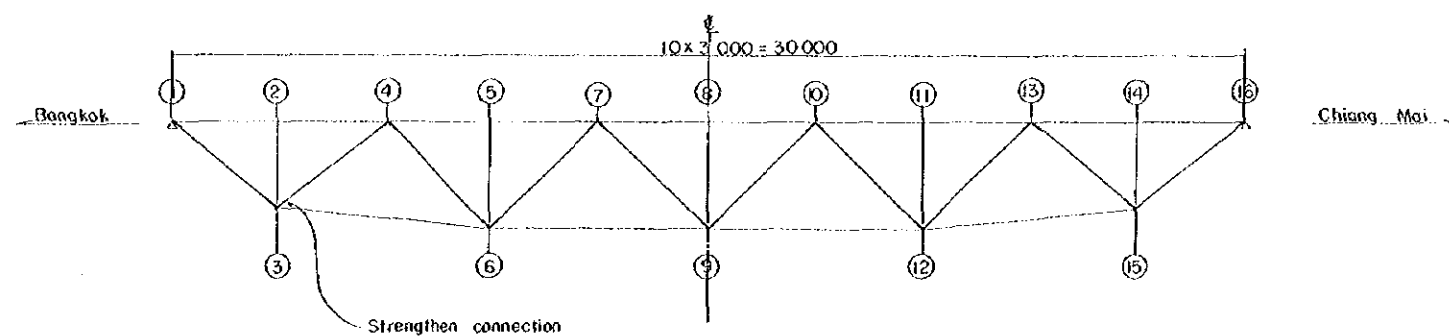
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Spon Type	Members	MAIN TRUSS (NO.2)	DL	15 loading
30.0 D.T			Unit	mm
K.M	577 + 622	Designed by _____ Checked by _____ Checked by _____ Checked by _____ Checked by _____		
DISTRICT	Lompong			
LINE	Northern Line			
Remarks				
DATE		DRAWING NO.		

MAIN TRUSS (NO. 3)

DIAGONAL CONNECTION S=1/10



MARKING DIAGRAMS



Construction Method

- 1) Drill rivet holes.
- 2) Cut off rivets of original members.
- 3) Clean surface between original members and new plates.
- 4) Add splice Plate, Fill Plate and rivetting

Note

- ⊙ : Re-Use Existing holes

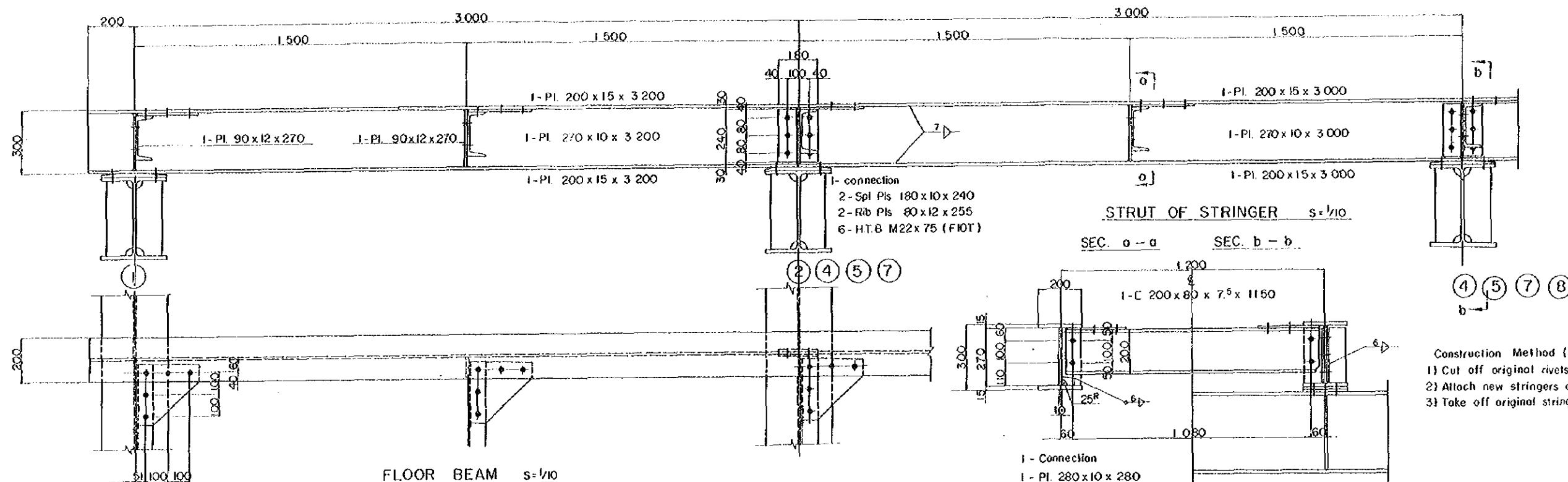
General Notes:

- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All rivets are 19 # (Φ), and to be rolled steel for SV34 (JIS G 3104) or materials of equivalent
- 3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND					
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING					
Span Type	Members MAIN TRUSS (NO.3)		DL 15 loading		
300 O.T.			Unit mm	Scale 1/10	
K. M.	577 + 622	Designed by _____ Checked by _____ Checked by _____ Checked by _____ Checked by _____			
DISTRICT	Lampang				
LINE	Northern Line				
Remarks					
DATE		DRAWING NO.			

FLOOR SYSTEM

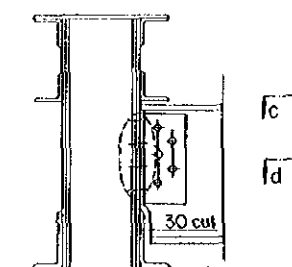
STRINGER $s = 1/10$



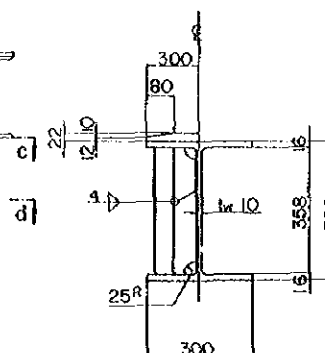
Construction Method (Stringer)
1) Cut off original rivets.
2) Attach new stringers and tighten HT.Bolts.
3) Take off original stringers.

FLOOR BEAM $s = 1/10$

END FLOOR BEAM CONNECTION



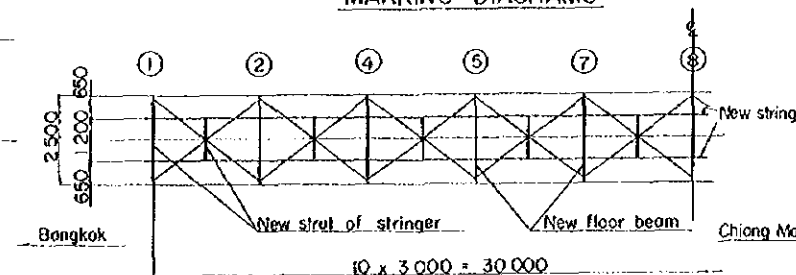
DETAIL e-e DETAIL f-f



General Notes

- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (F10T), and assumed frictional coefficient of contact surface as follows:
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All rivets are 19# (F10T), and to be rolled steel for SV34 (JIS G3104) or materials of equivalent.
- All dimensions to be checked in the field.

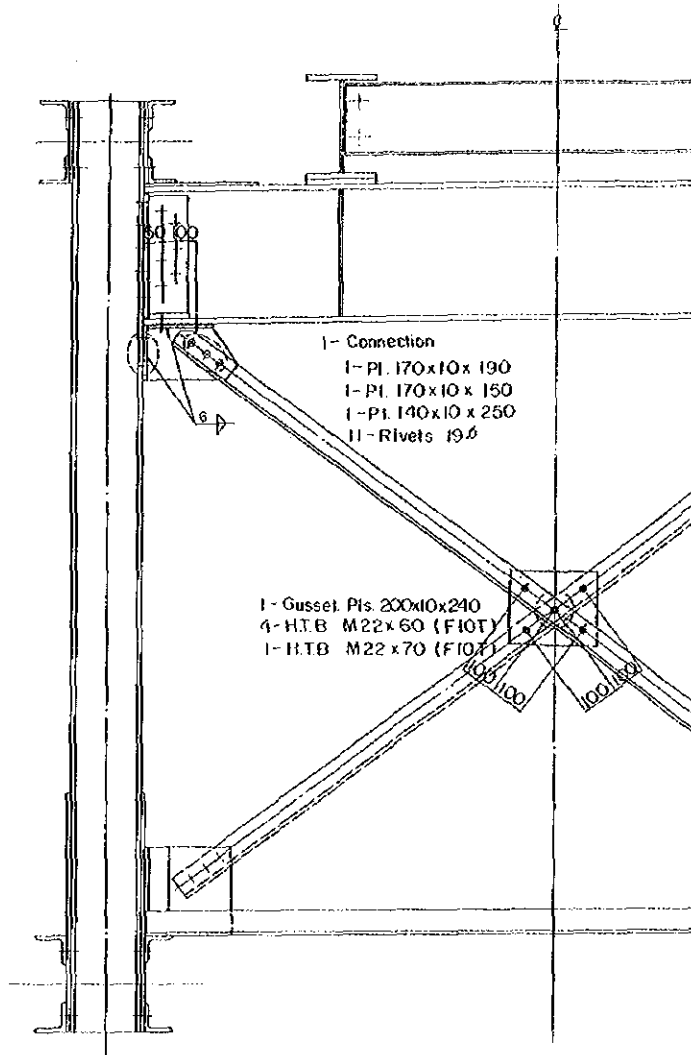
MARKING DIAGRAMS



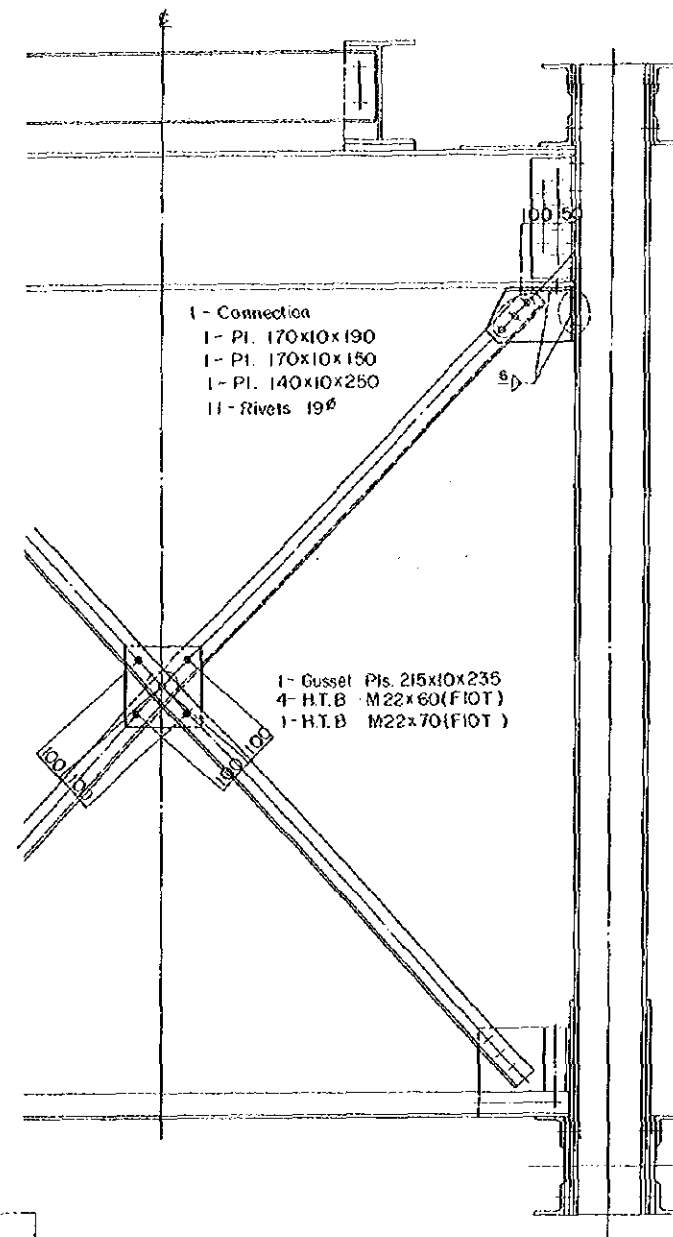
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type 300 D.T.	Members FLOOR SYSTEM	Unit mm	DL 15 loading Scale 1/10	
K. M.	577 + 622	Designed by		
DISTRICT	Lampang	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

SWAY BRACING S-1/10

②-③, ⑭-⑮



⑤-⑥, ⑧⑨, ⑪-⑫



Construction Method

- 1) Drill new bolt holes
- 2) Cut off original rivets.
- 3) Take off original Gusset Plates.
- 4) Clean surface between original members and additional plates.
- 5) Add new Plates or angles.
- 6) Tighten H.T. Bolts or rivetting.

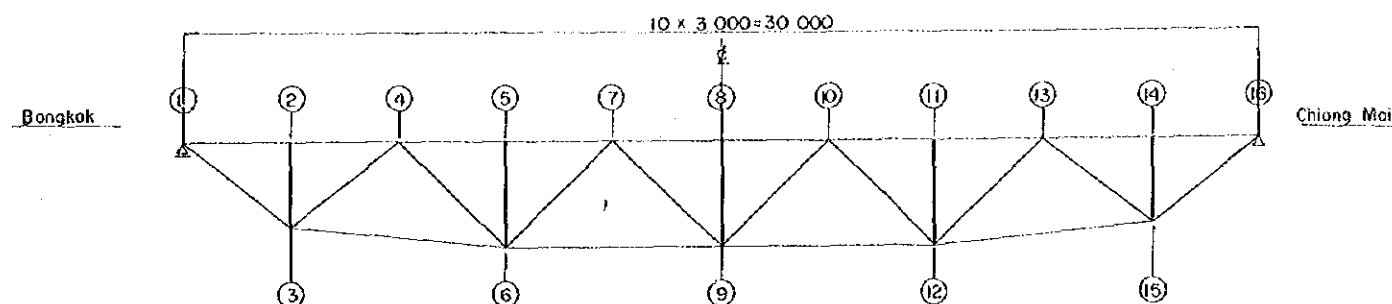
Note

○ : Re- Use Existing holes

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(-)(FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection ≥ 0.4
 - ii) for stitch ≥ 0.3
- 3) All rivets are 19# (-) and to be rolled steel for SV34 (JIS G3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

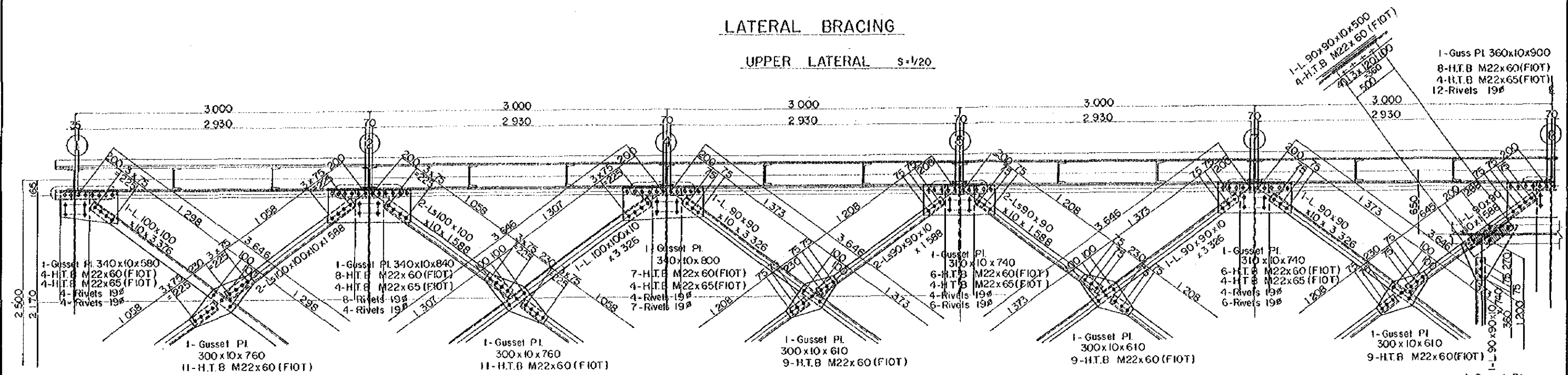
MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	SWAY BRACING	D.L. 15 loading	
30.0 D.T.			Unit	Scale
			mm	1/10
K.M.	577 + 622	Designed by		
DISTRICT	Lampang	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

LATERAL BRACING

UPPER LATERAL $s = 1/20$

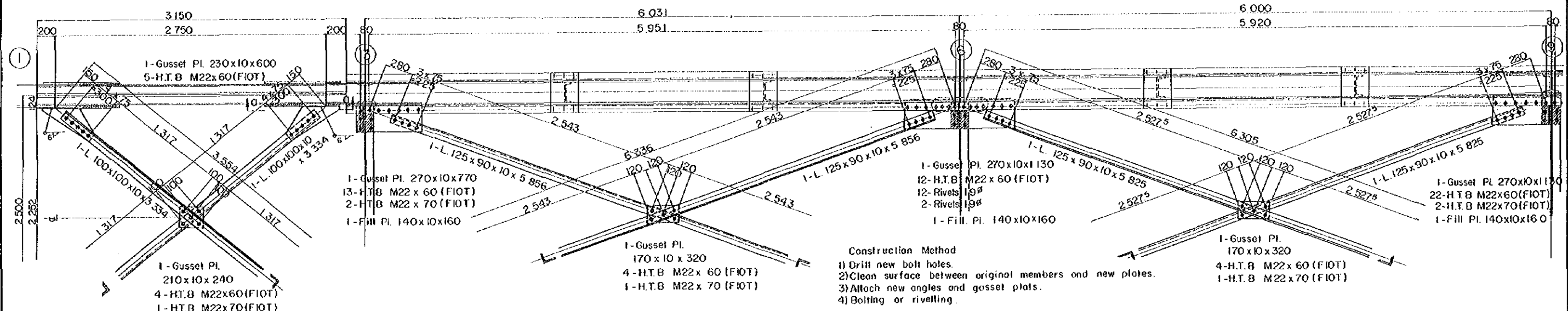


Construction Method

- 1) Cut off original rivets.
- 2) Take off original members and gusset plates.
- 3) Drill new bolt holes.

- 4) Clean surface between original members and additional plates.
- 5) Attach new angles and gusset plates.
- 6) Bolting or rivetting.

LOWER LATERAL $s = 1/20$

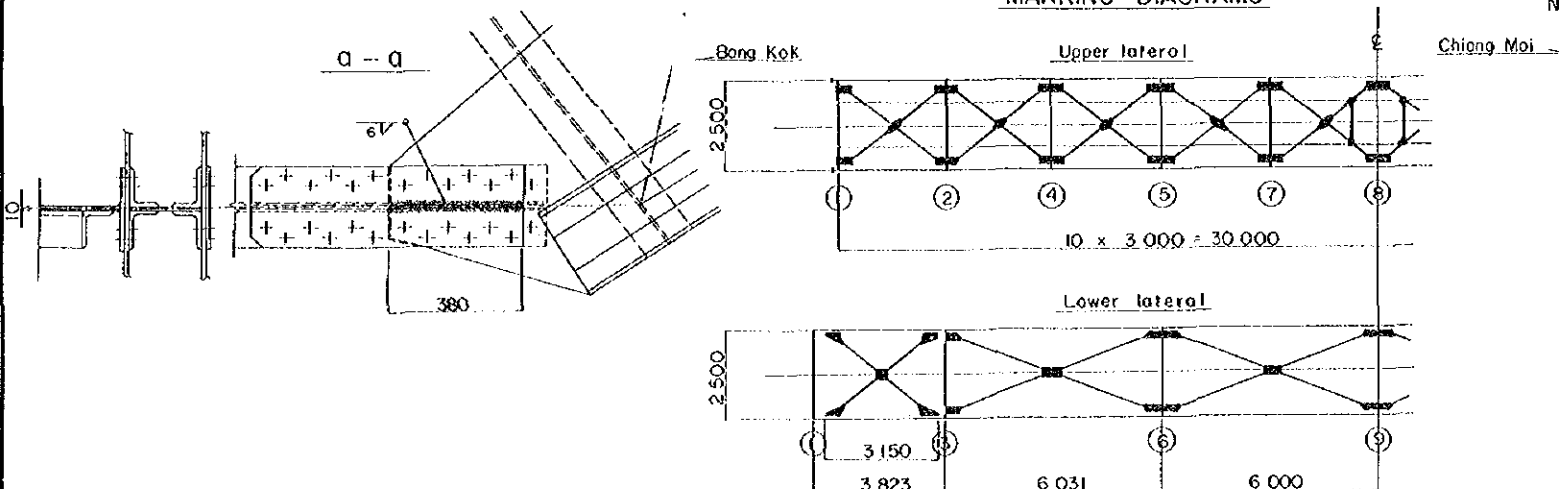


Construction Method

- 1) Drill new bolt holes.
- 2) Clean surface between original members and new plates.
- 3) Attach new angles and gusset plates.
- 4) Bolting or rivetting.

Note: Re - Use Existing holes.

MARKING DIAGRAMS



General Notes:

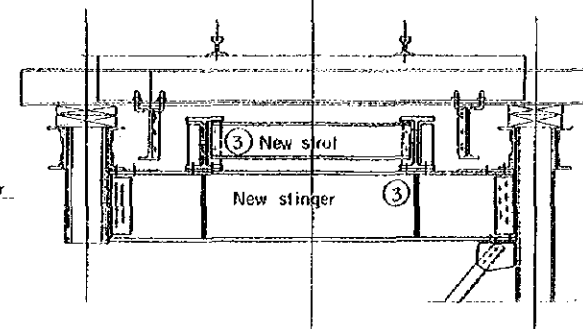
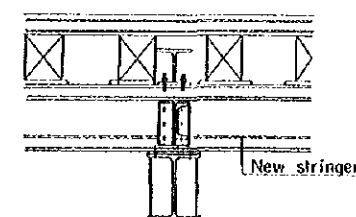
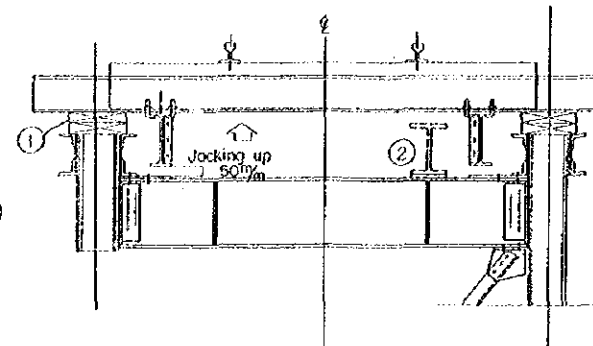
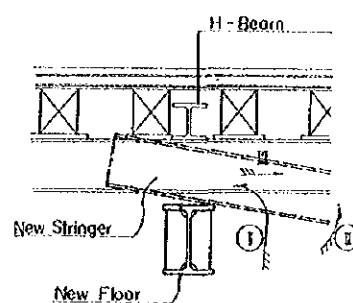
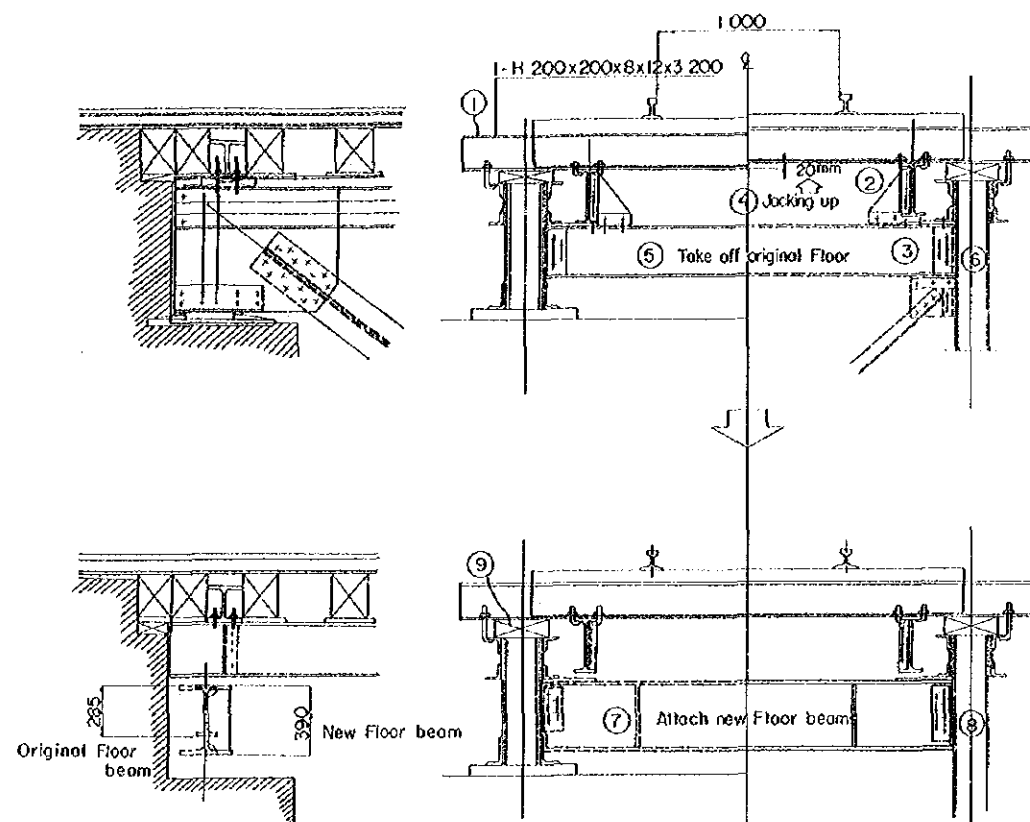
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high strength bolts (H.T.B) are M22(ϕ)(FIOT), and assumed frictional coefficient of contact surface as follows:
 - i) for connection $f \geq 0.4$
 - ii) for slitch $f \geq 0.3$
- 3) All rivets are 19# (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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	LATERAL BRACING	Unit	Scale
3000.T			mm	1/20
K.M	577+622	Designed by		
DISTRICT	Lampang	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

RECONSTRUCTION METHOD OF FLOOR SYSTEM

FOR FLOOR BEAM

FOR STRINGER



Reconstruction method of existing floor beams.

- ① Set up temporary H-Beam or stringer fastening by hook bolts.
- ② Take off knee brackets of stringers.
- ③ Cut off connected rivets between stringers and floor beams.
- ④ Jacking temporary H-Beams up 20mm, and supporting by wooden packing on upper chords.
- ⑤ Take off original floor beams.
- ⑥ Drill new bolt holes for floor beam connections.
- ⑦ Attach new floor beams and original sway bracings.
- ⑧ Bolting the connection by H.T.Bolts.
- ⑨ Take off wooden support on upper chord and jacking place.
- ⑩ Wooden supporting on upper chord and fastening temporary H-Beams by hook bolts.

For this Reconstruction method, 1-panel must be finished within 1 day.

Note ; for lateral sway bracing

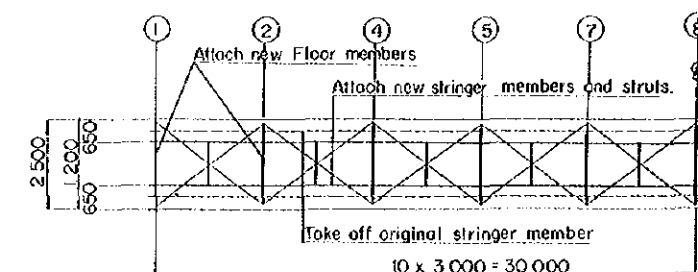
Set up new gusset plate connection and re-use original lateral bracing.
Bolting temporary by service bolts of new gusset plate connections.

Reconstruction method of existing stringers.

- ① Jacking temporary H-Beams up 50mm, and add wooden supporting on upper chord.
- ② Attach new stringers and struts.
- ③ Bolting by H.T.Bolts.
- ④ Set up new packing between sleepers and new stringers by wooden packing.
- ⑤ Jack down original stringers and take off temporary H-Beams.
- ⑥ Take off original stringer by gas cutting.
- ⑦ Set up new lateral bracing.

For this reconstruction method, 1-Panel must be finished within 1 day.

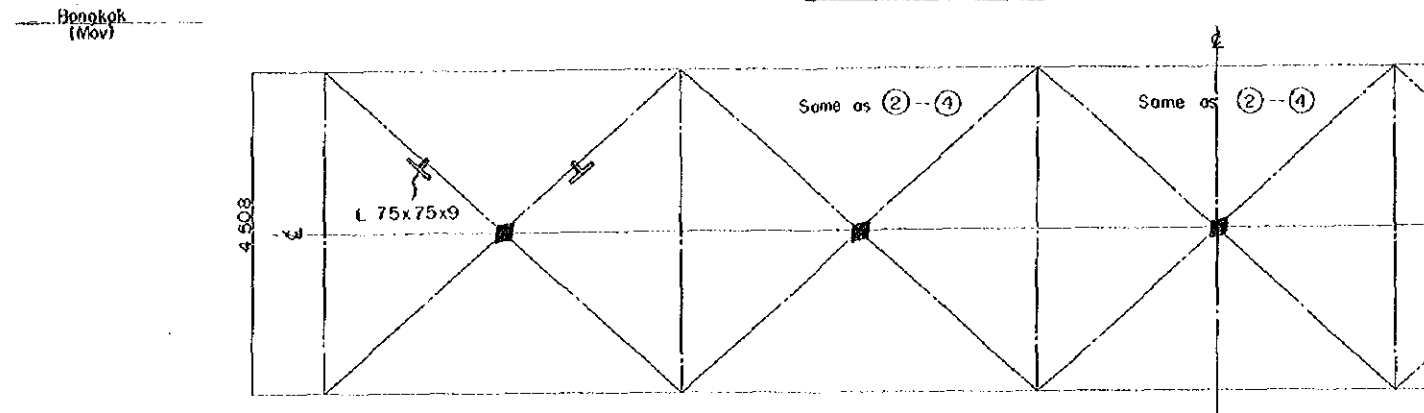
MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	RECONSTRUCTION METHOD OF FLOOR SYST.	DL 15 loading	Unit
300 D.T			Scale	mm
K. M	577 + 622	Designed by		
DISTRICT	Lampang	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

GENERAL DIAGRAM

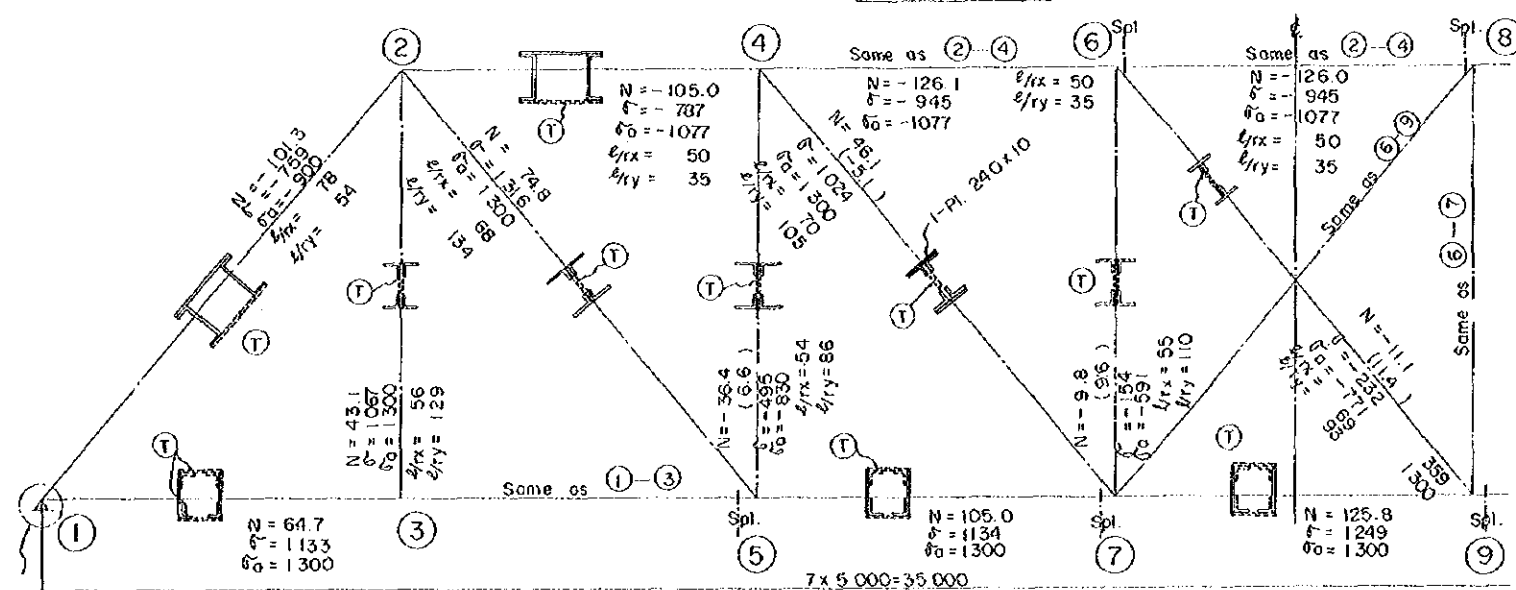
UPPER LATERAL



Chumphon
(Fix)

Note:
1) $\blacklozenge$: Strengthen Guss Plate

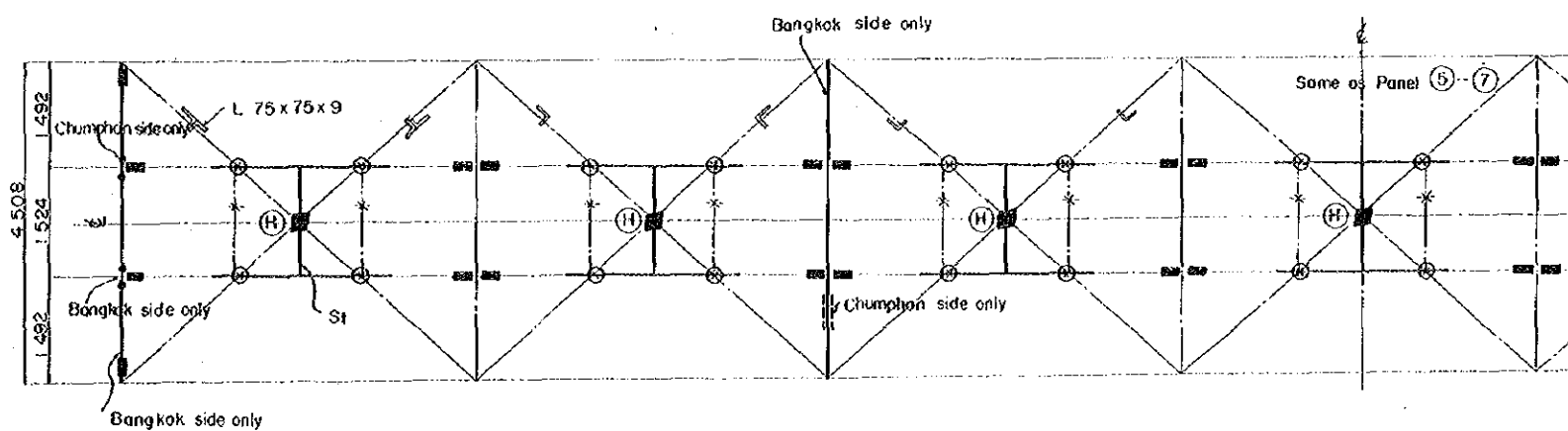
MAIN TRUSS



Note:
1) $\textcircled{T}$: Strengthen Tie plate

Repair misalignment of shoe rollers.

FLOOR SYSTEM & LOWER LATERAL



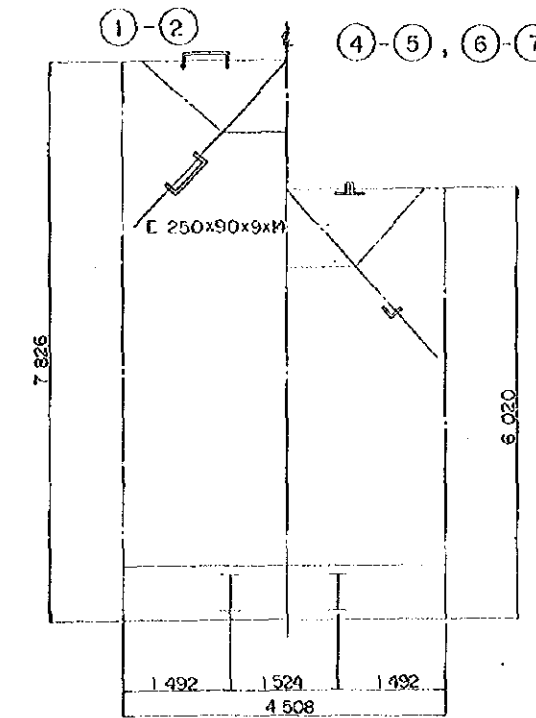
Legends

- 1) $\blacksquare$: Excessive stressed rivets to be strengthened.
- 2) $\bullet$: Loose rivets to be replaced.
- 3) $\blacklozenge$: Gusset plates to be improved.
- 4) $\textcircled{H}$: Hanger to be added.
- 5) $\textcircled{W}$: Web plates to be repaired.
- 6) $\textcircled{X}$: Defective member to be removed.
- 7) $\textcircled{H}$: Defective hanger to be removed.
- 8) $\textcircled{S}$: New strut to be added.
- 9) $\textcircled{T}$: Tie plates to be strengthened.

M : Bending moment (T-m) λ : Slenderness ratio
N : Axial force (T) σ : Actual stress (kg/cm²)
L : Length of member (cm) σ_a : Allowable stress (kg/cm²)
 r_x, r_y : Radius of gyration of sectional area for x or y axis (cm)

PORTAL BRACING

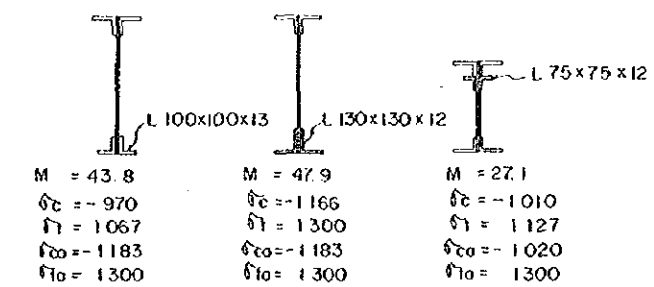
SWAY BRACING



END FLOOR

INT. FLOOR

STRINGER



General Notes :

- 1) Weak drawings show the original members. Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Marks.

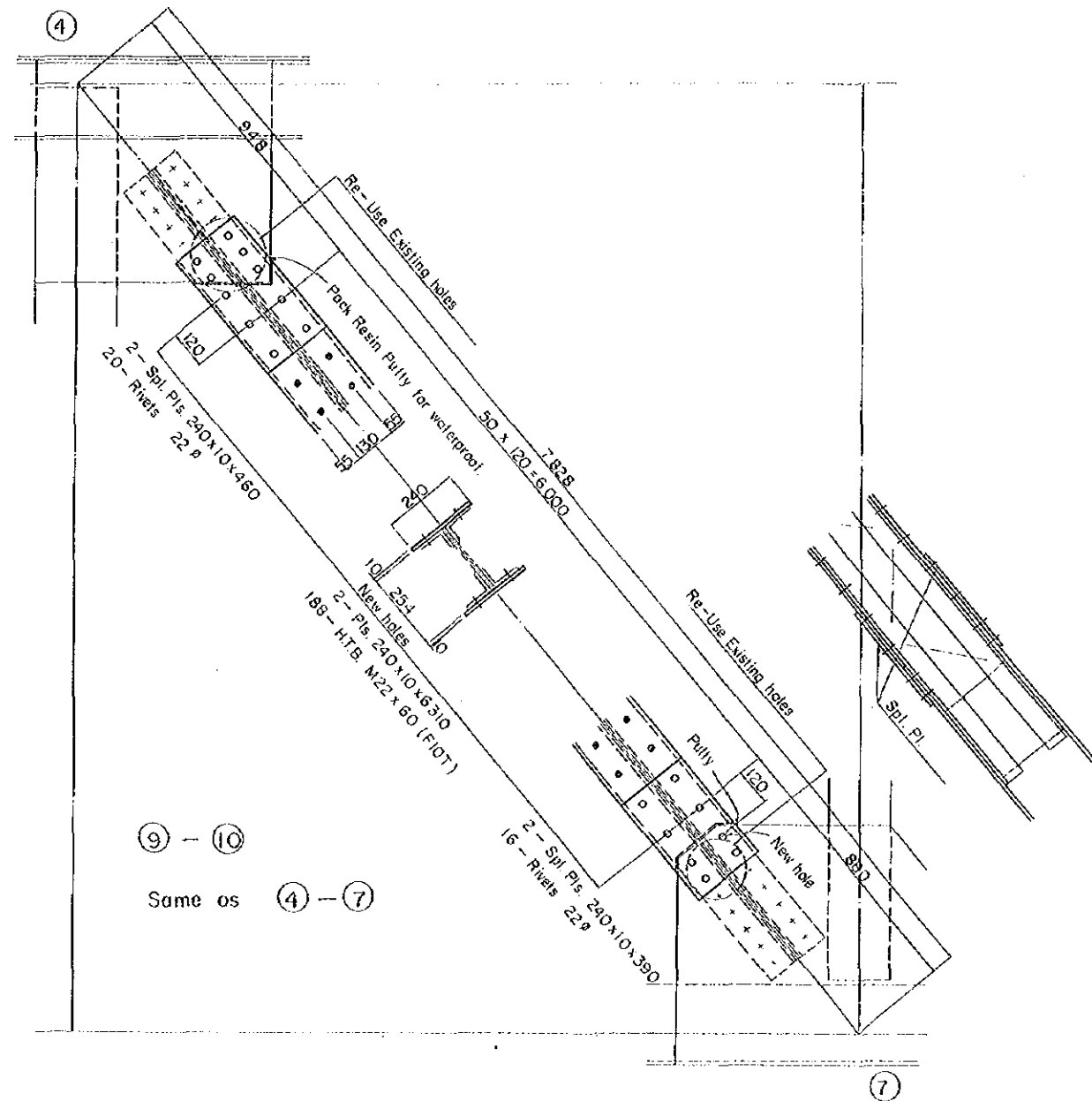
THE STATE RAILWAY OF THAILAND

STANDARD DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
35.0 T.T	103 + 257		Unit Scale
K 14	Chumphon	Designed by	
DISTRICT	Southern Line	Checked by	
LINE		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	5983

MAIN TRUSS (NO.1)

DIAGONAL MEMBER S=1/10

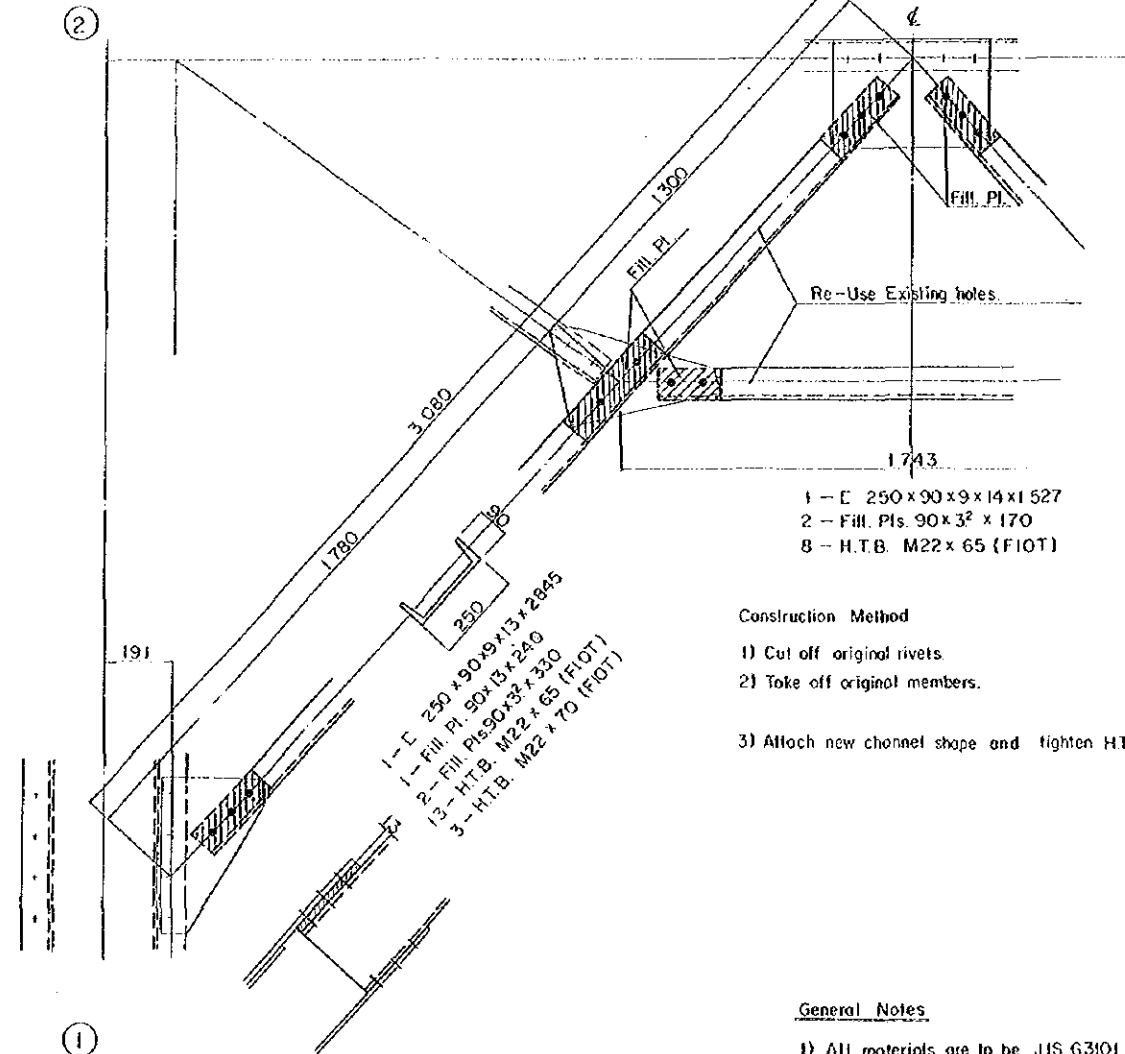
PORTAL BRACING S=1/10



Construction Method

- 1) Drill new bolt and rivet holes.
- 2) Cut off rivet of original members.
- 3) Clean surface between original and new members.
- 4) Add new plates and tighten HT Bolts.
- 5) Add splice plate and riveting.

Note ; : Re-Use Existing holes.



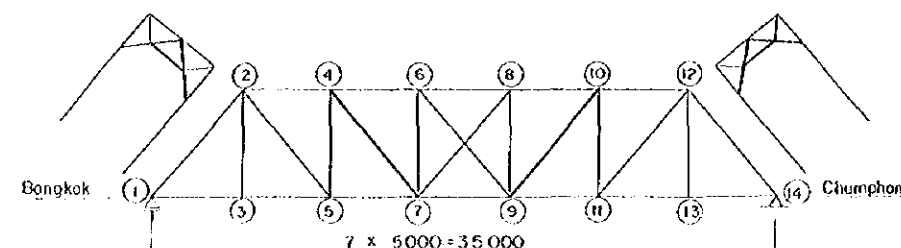
Construction Method

- 1) Cut off original rivets.
- 2) Take off original members.
- 3) Attach new channel shape and tighten HT Bolts.

General Notes

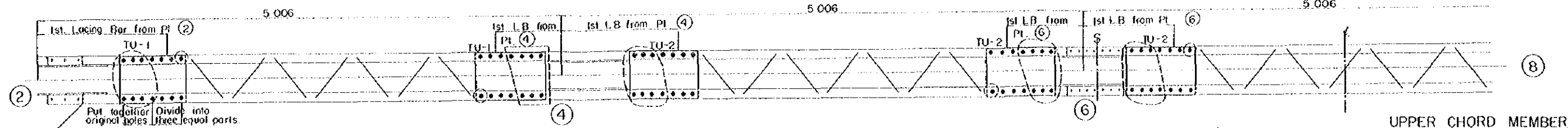
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (φ) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for slitch $f \geq 0.3$
- 3) All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

MARKING DIAGRAMS

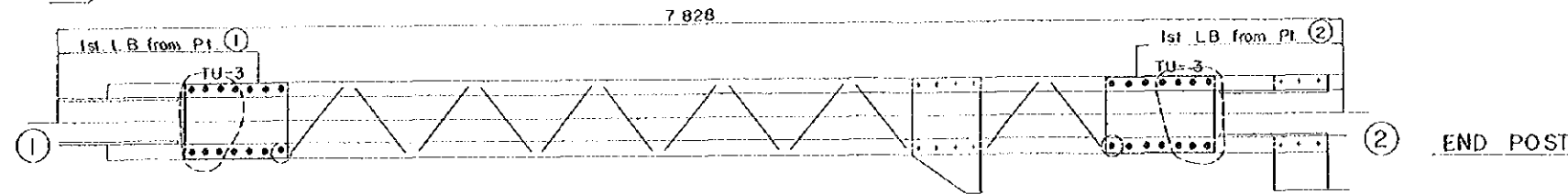


THE STATE RAILWAY OF THAILAND			
DETAIL. DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Spec. Type	Members	Unit	Scale
35.0 T.T.	MAIN TRUSS (NO.1)	mm	1/10
K. M.	403 + 257	Designed by	
DISTRICT	Chum Phon	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	5983

MAIN TRUSS (NO.2) S=1/20

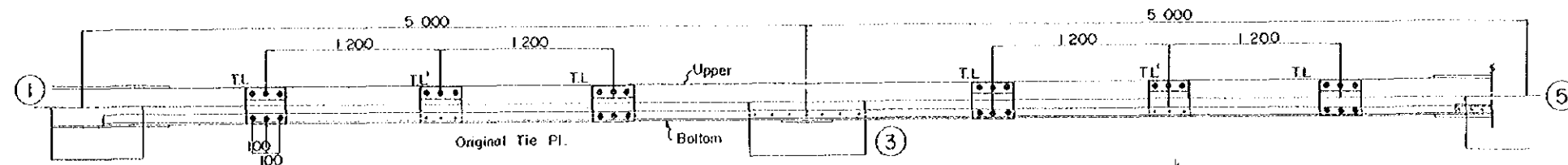
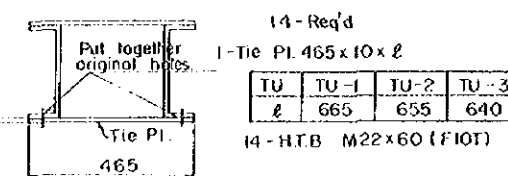


UPPER CHORD MEMBER



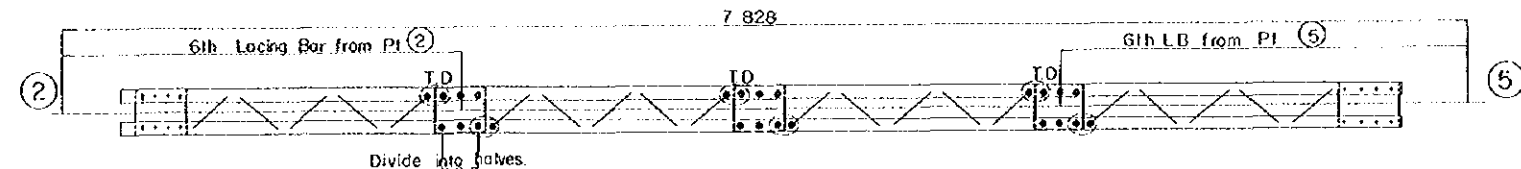
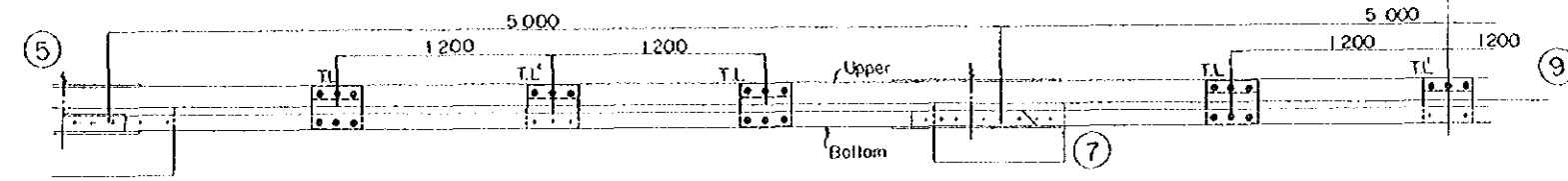
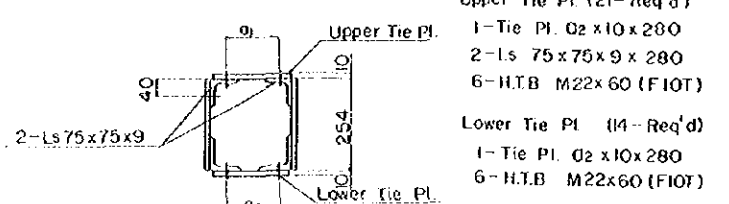
END POST

DETAIL TU S=1/10



LOWER CHORD MEMBERS

DETAIL TL or TL' S=1/10
Note: TL : Add Tie Pl. at Upper and Bottom side.
TL' : Add Tie Pl. at only Upper side.

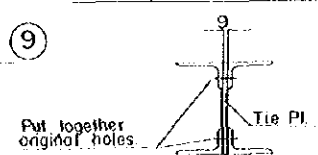


DIAGONAL MEMBERS

Note
D (4)-(7) same as D (2)-(5)

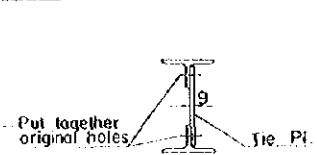


DETAIL TD or TV S=1/10



TD (6-Req'd)
1-Tie Pl. 245x9x280
6-HTB M22x70 (FIOT)
TV (14-Req'd)
1-Tie Pl. 255x9x245
6-HTB M22x70 (FIOT)

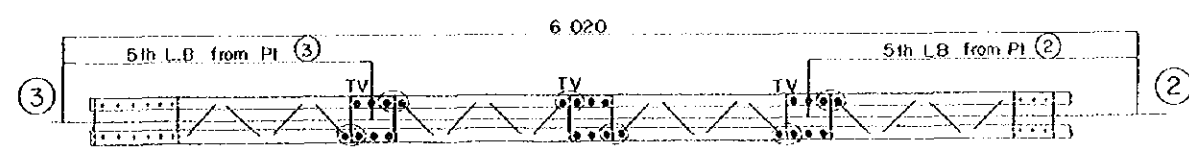
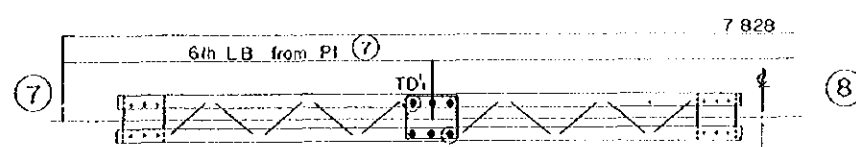
DETAIL TD' or TD2 S=1/10



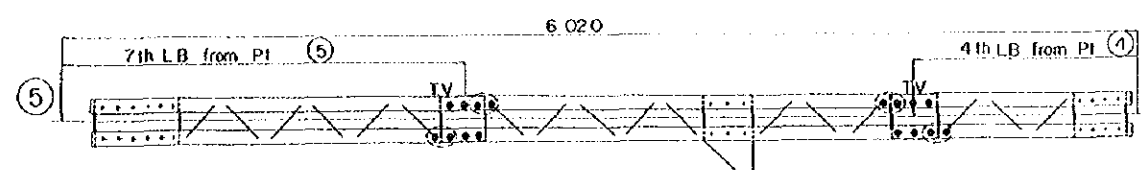
TD' (6-Req'd)
1-Tie Pl. 228x9x280
6-HTB M22x60 (FIOT)
TD2 (1-Req'd)
1-Tie Pl. 228x9x600
16-HTB M22x60 (FIOT)

General Notes:

- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (HTB) are M22 (FIOT), and assumed frictional coefficient of contact surface as follows.
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be checked in the field.



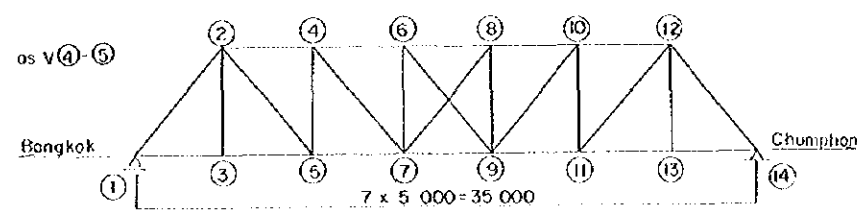
VERTICAL MEMBERS



Note
(4)-(7) same as V (4)-(5)

Note: ○ : Re-Use Existing holes.

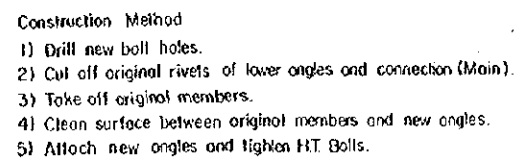
MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO.2)	
35.0 T.T			
K.M	403 + 257	Designed by	
DISTRICT	Chumphon	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	5983

FLOOR BEAM $S = 1/15$

E.F-1 (E.F-2)



Note : In E.F - 2, it's unnecessary to repair lower flange, but to be attach Angles for jacking up.

1 - Connection	4 - Ls 90x90x10x740
2 - Pls 160x9x425	4 - Fill. Pls 90x11x530
2 - Fill. Pls 80x19x425	16 - H.T.B M22x85 (F10T)
10 - Rivets 22#	

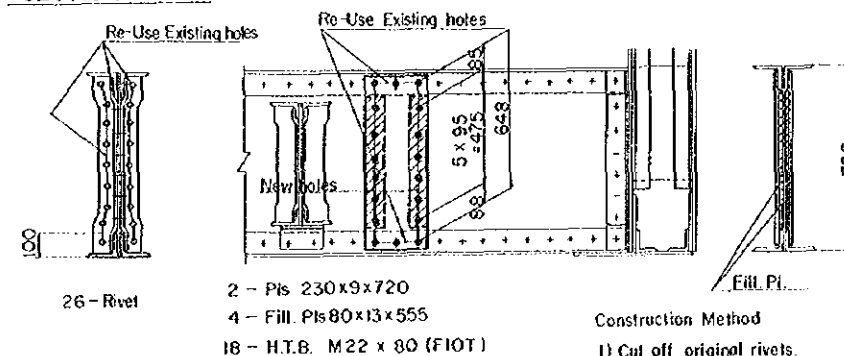
2 - 1.5 100x100x13x4000
35 - H.T.B. M22 x 80 (FIOT)
4 - H.T.B. M22 x 50 (FIOT)

Construction Method

- 1) Drill new bolt holes.
- 2) Cut off original rivets of lower angles and connection (Main).
- 3) Take off original members.
- 4) Clean surface between original members and new angles.
- 5) Attach new angles and tighten H.T Bolts.

- 6) Strengthen connection
(Attach Spl. Pl. and Riveting)
- 7) Jack up, and support temporarily.
- 8) Repair misalignment shoe rollers,
and jack down.

SECTION B - B



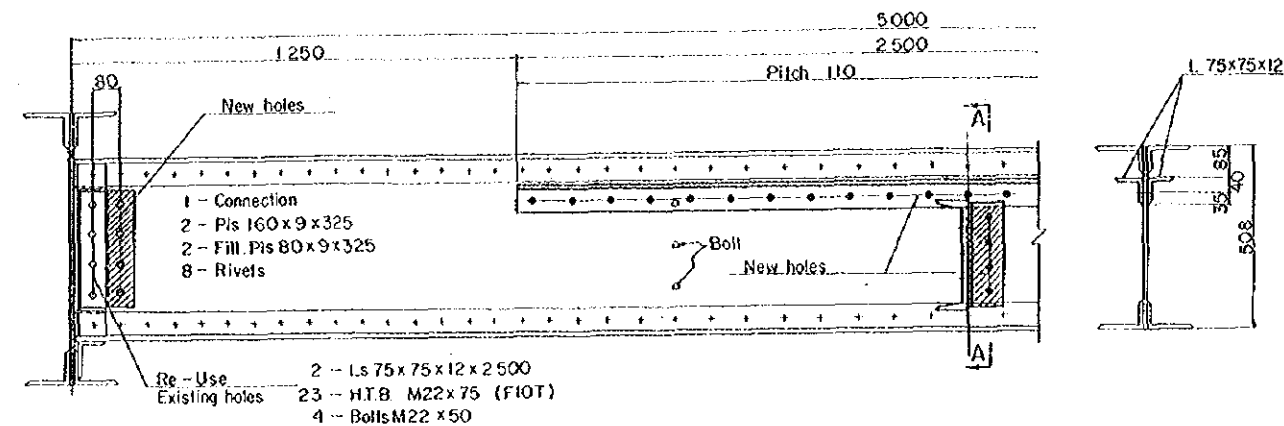
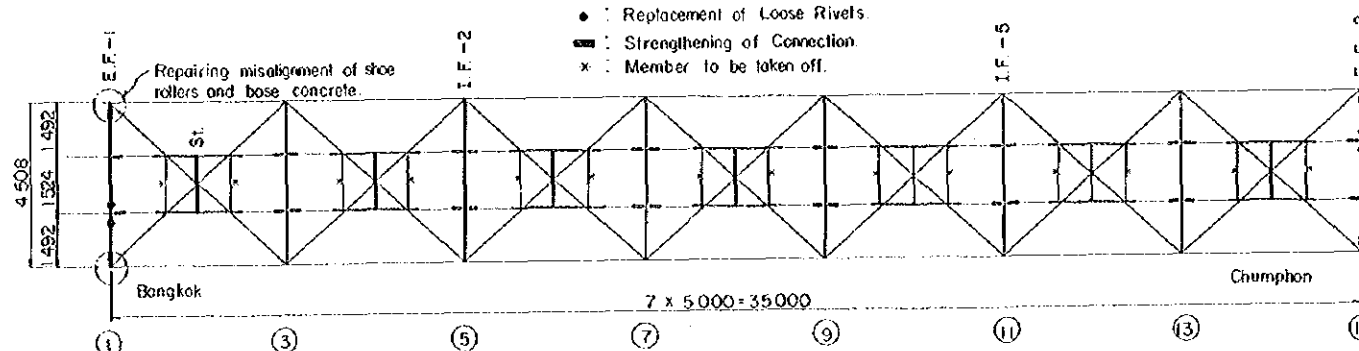
Construction Method

- 1) Cut off original rivets.
- 2)
- 3) Attach new members and

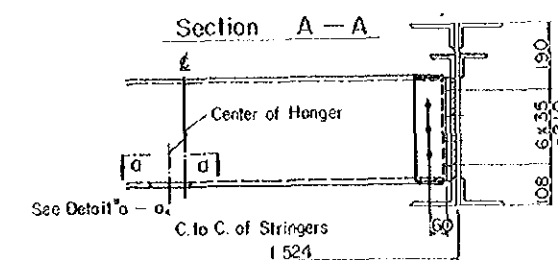
MARKING DIAGRAMS

Note :

- : Replacement of Loose Rivets.
- : Strengthening of Connection.
- × : Member to be taken off.

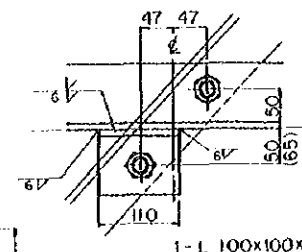


STRUT OF STRINGER (SI)



1 - C 300x90x10x1450
2 - Ls 100x100x10 x 290
2 - Fill Pls. 100x12 x 290
8 - R.T.B. M22x75 (FIOT)
6 - R.T.B. M22x60 (FIOT)

DETAIL "a - a" S=1/5



Note : Size into () shows Panel ①-③ and ⑬-⑮ 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 (HTB) are M22 (φ22) (F10T), and assumed frictional coefficient of contact surface (f) as follows.
 - i) for connection $f \geq 0.4$
 - ii) for slitch $f \geq 0.3$
- 3) All rivets are 22φ (φ22), and to be rolled steel for SV 34 (JIS G3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	D.L. 15 loading Unit Scale mm 1/15, 1/10, 1/5	
35.0 T.I.			
K.M.	403 + 257	Designed by	
DISTRICT	Chumphon	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	5983

$S = 1/15$

5 000



Construction Method (LL-1)

- 1) Cut off rivets of original members.
- 2) Take off original members.
- 3) Drill new bolt holes.
- 4) Clean surface between original and new members.
- 5) Attach new angles and gusset plates.
- 6) Tighten H.T. Bolts

Construction Method (LL-2, LL-3)

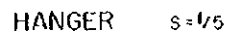
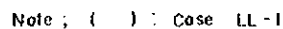
- 1) Cut off rivets of original members.
- 2) Drill new ball holes.
- 3) Clean surface between original and new members.
- 4) Attach new connection plates.
- 5) Tighten H.T.Bolts.

- 4) Attach new connection plates.
- 5) Tighten H.T.Bolls.

Note 2

- ◆ : Strengthen Connection and Hanger.
● : Take off Connection, and Replacement Boils.

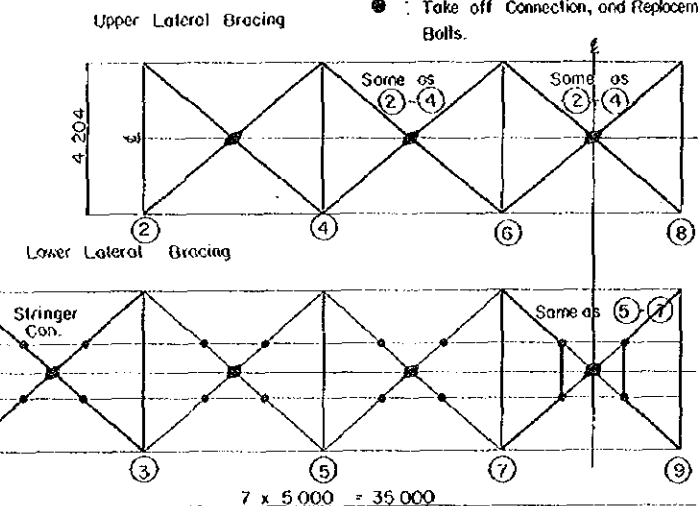
5 000

 $\xi = 1/5$ $s = 1/5$ 

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.

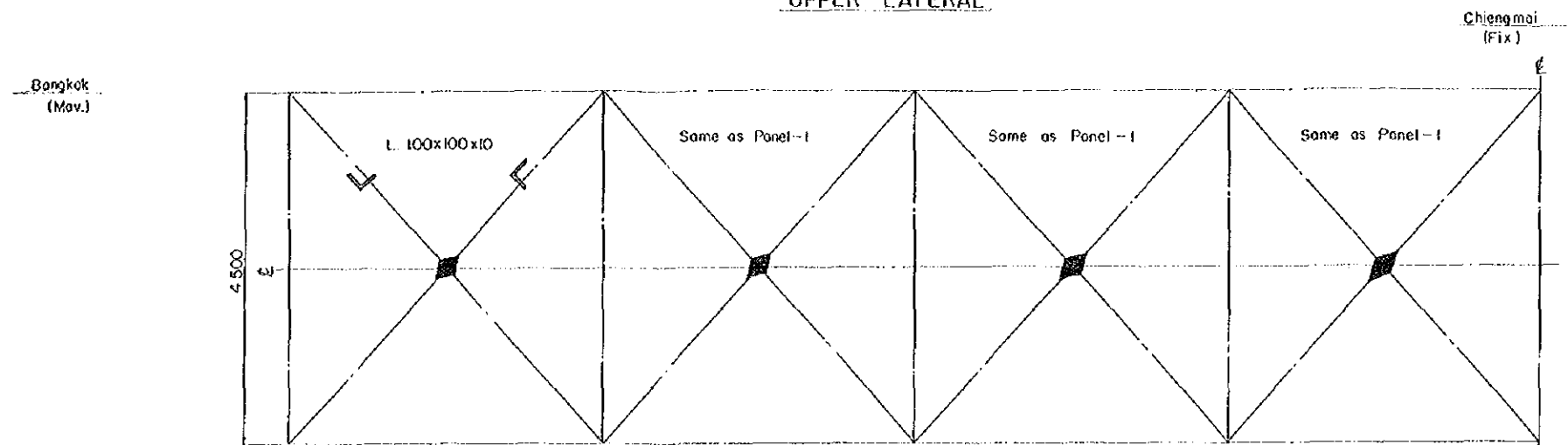
cf. Drawing No.

THE STATE RAILWAY OF THAILAND

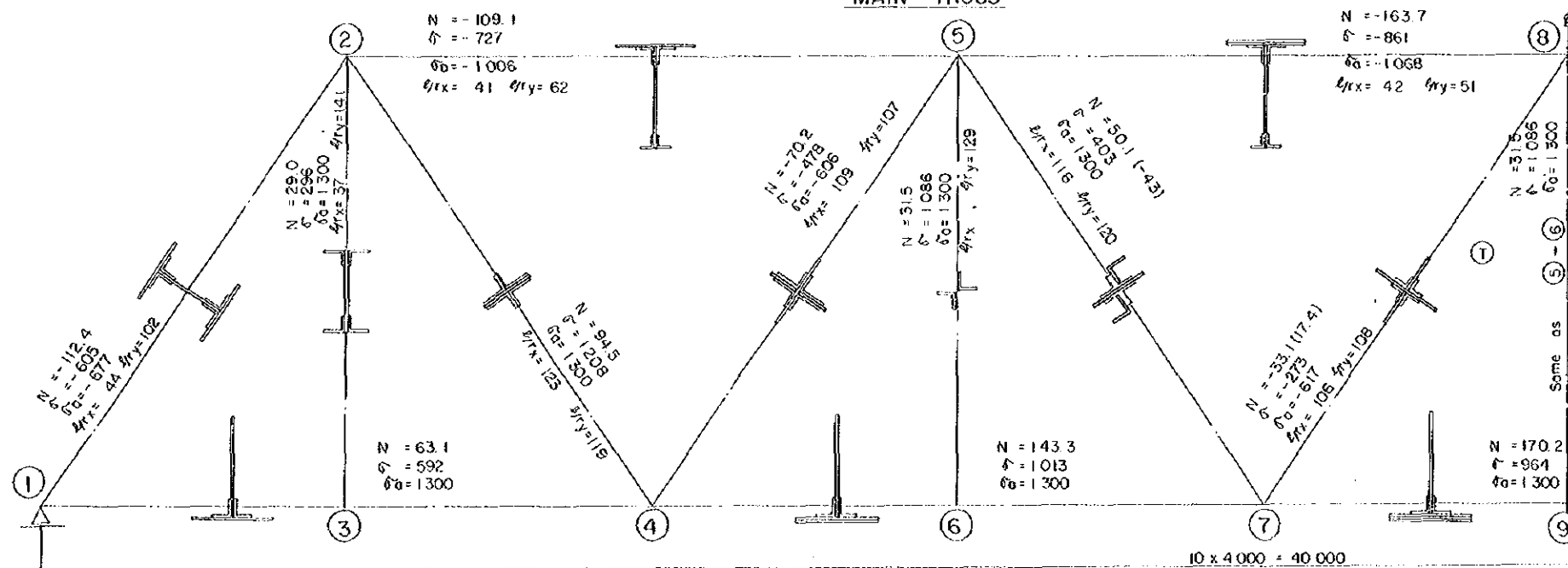
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	LATERAL BRACING	Dt. 15 Unit min Scale 1/15 1/5
35.0 T.T.			
K. M	403 + 257	Designed by	_____
DISTRICT,	Chumphon	Checked by	_____
LINE	Southern Line	Checked by	_____
Remarks		Checked by	_____
		Checked by	_____
		Checked by	_____
		Checked by	_____
DATE	DRAWING NO.		

GENERAL DIAGRAM

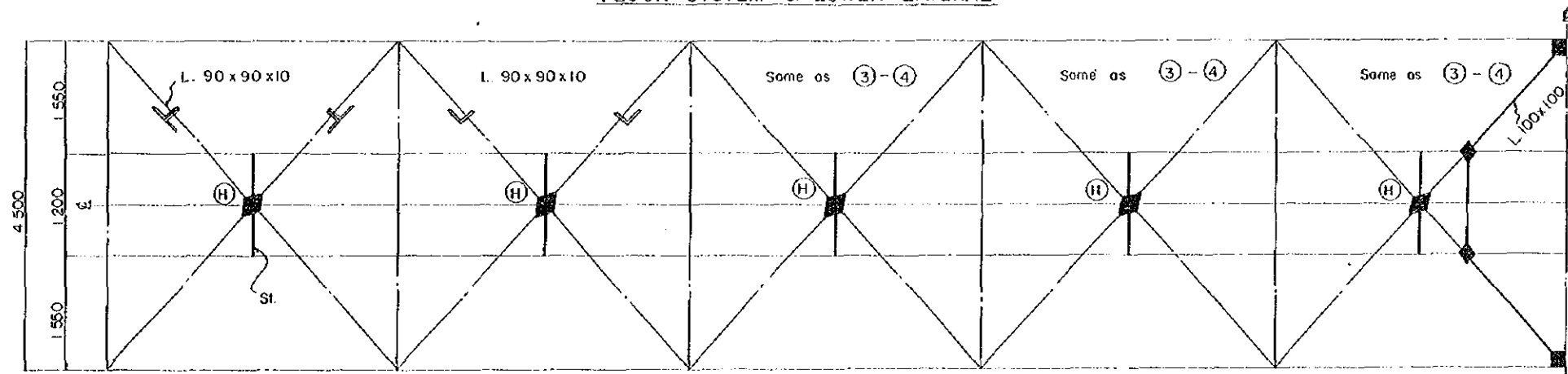
UPPER LATERAL



MAIN TRUSS



FLOOR SYSTEM & LOWER LATERAL

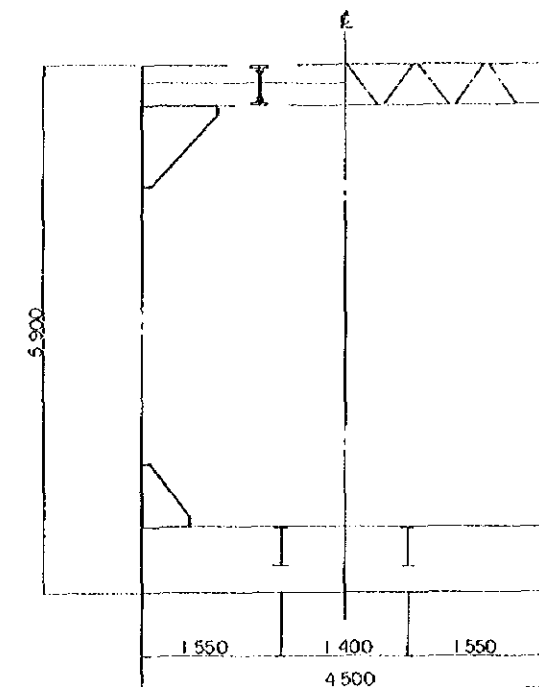


Note

- 1) : Gusset plate to be changed.
- 2) : Hanger of lateral bracing to be added.
- 3) : New strut to be added.

PORTAL BRACING

SWAY BRACING



END & INT. FLOOR BEAM

STRINGER

END	INT.	STRINGER
M = 41.7	M = 44.9	M = 17.2
$\delta_c = 750$	$\delta_c = 759$	$\delta_c = 835$
$\delta_t = 884$	$\delta_t = 894$	$\delta_t = 835$
$\delta_{co} = 1189$	$\delta_{co} = 1189$	$\delta_{co} = 923$
$\delta_{to} = 1300$	$\delta_{to} = 1300$	$\delta_{to} = 1300$

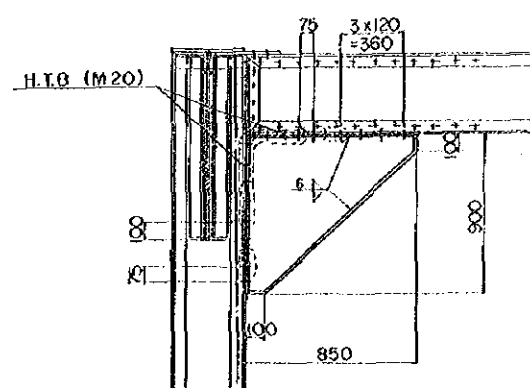
General Notes

- 1) Weak drawings show the original members.
Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Marks
 - M : Bending moment (t-m)
 - N : Axial force (t)
 - δ : Length of member (cm)
 - x, y : Radius of gyration of sectional area for x or y axis (cm)
 - δ/r : Slenderness ratio
 - δ : Actual stress (kg/cm²)
 - δ_o : Allowable stress (kg/cm²)

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	DL-15 loading	
400T.T	GENERAL DIAGRAM	Unit	Scale
K.M	311 + 599	mm	
DISTRICT	Nakhon Sawan	Designed by	
LINE	Northern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

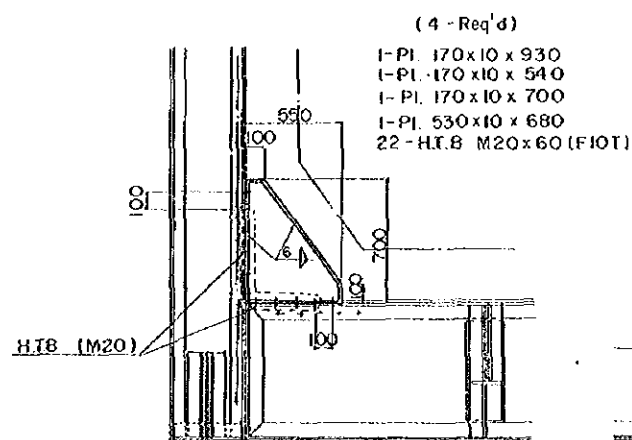
MAIN TRUSS (NO. 1) S=1/20

PORTAL FRAME

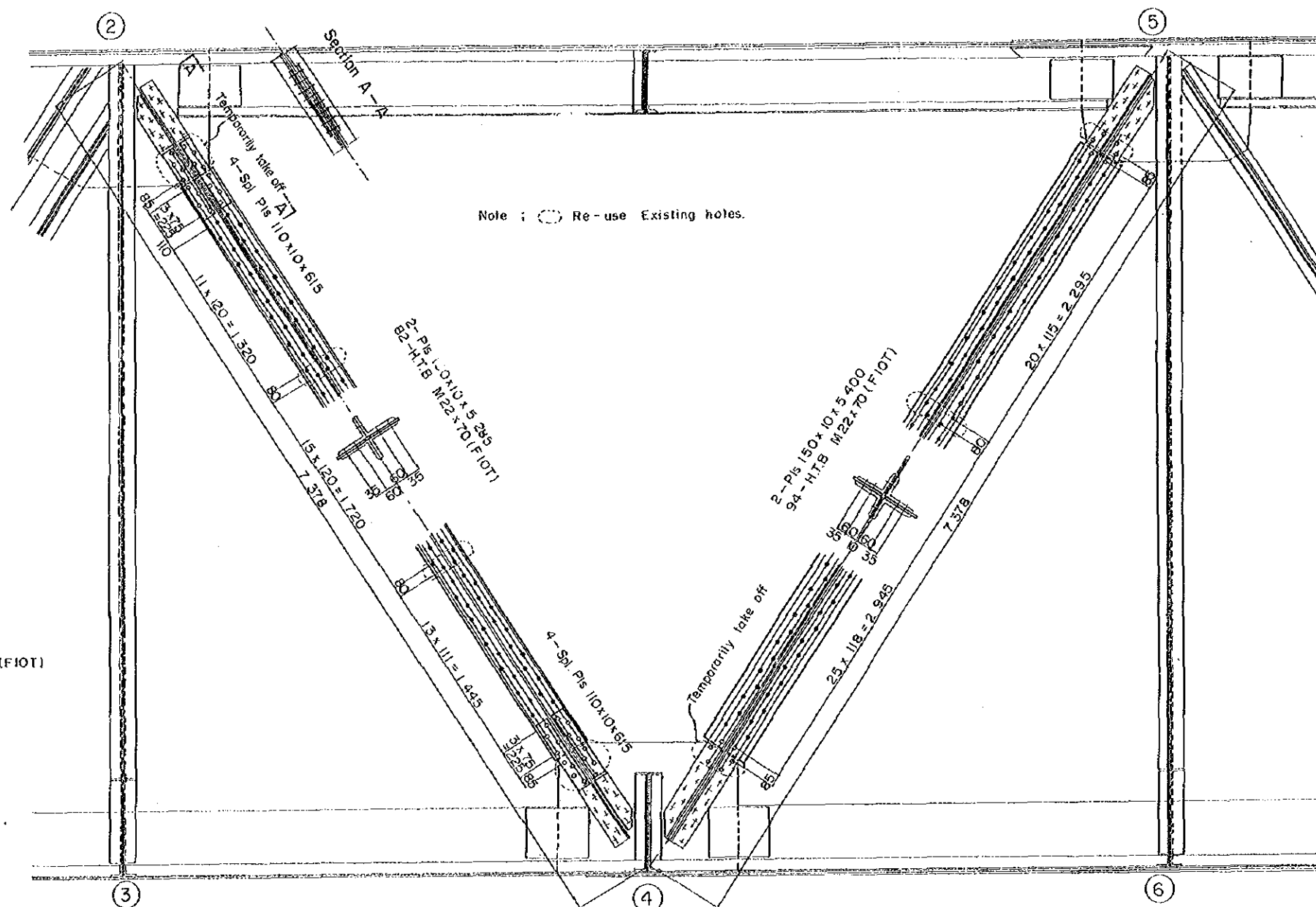


(4 - Req'd)
 1 - Pl. 170 x 10 x 1 275
 1 - Pl. 170 x 10 x 840
 1 - Pl. 170 x 10 x 900
 1 - Pl. 830 x 10 x 880
 38 - H.T.B. M20 x 60 (FIOT)

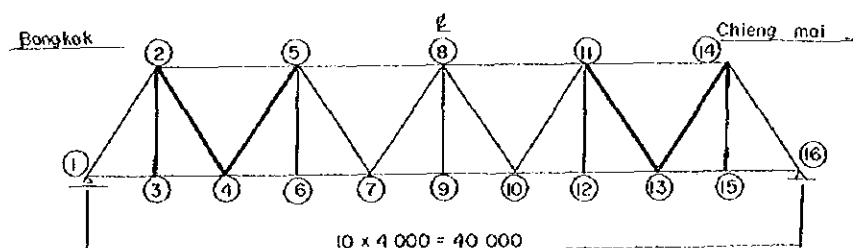
Note
 Change to H.T.B. (M20)



(4 - Req'd)
 1 - Pl. 170 x 10 x 930
 1 - Pl. 170 x 10 x 540
 1 - Pl. 170 x 10 x 700
 1 - Pl. 530 x 10 x 680
 22 - H.T.B. M20 x 60 (FIOT)



MARKING DIAGRAMS

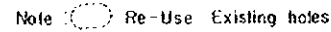


General notes:

- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B.) are M22 (Φ) (FIOT), and assumed frictional coefficient of contact surface as follows.
 i) for connection $f \geq 0.4$
 ii) for stitch $f \geq 0.3$
- 3) All rivets are 22[#] (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

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO. 1)		
400T.T		Unit	Scale	PL 15 loading
K.M	311 + 599	mm	1/20	
DISTRICT	Nakhon Sowan	Designed by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

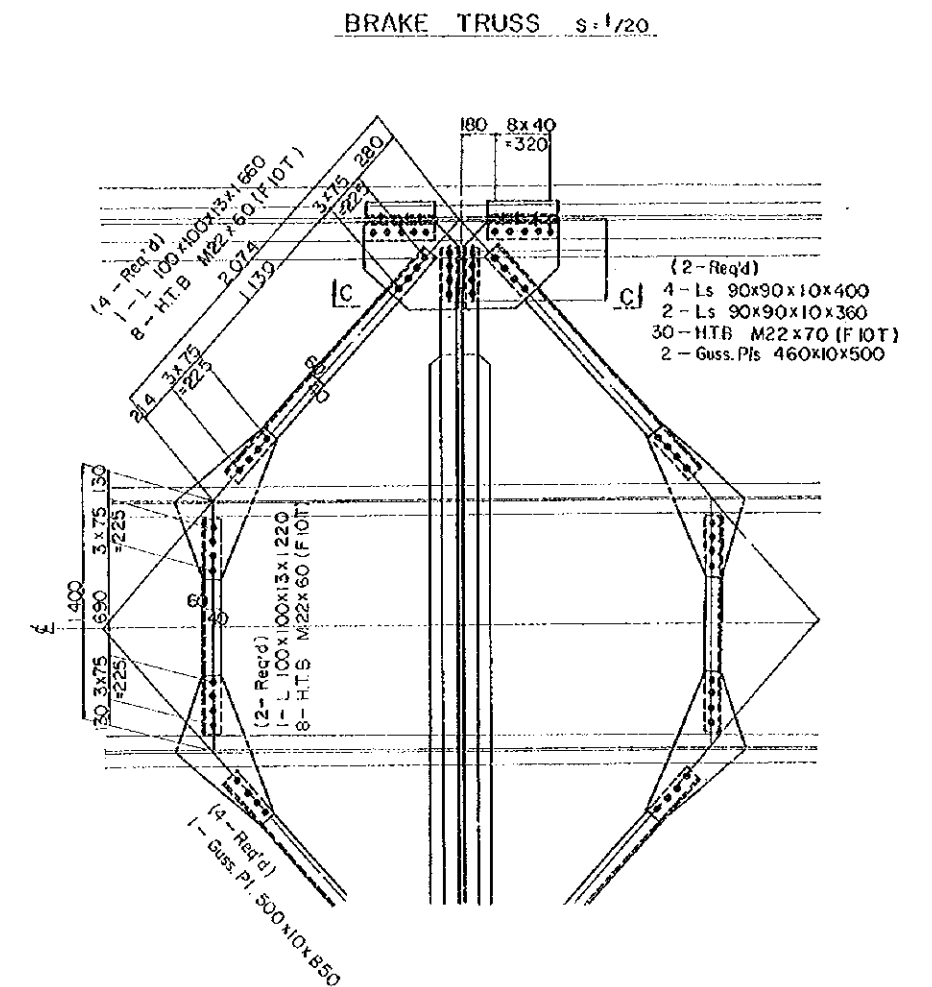
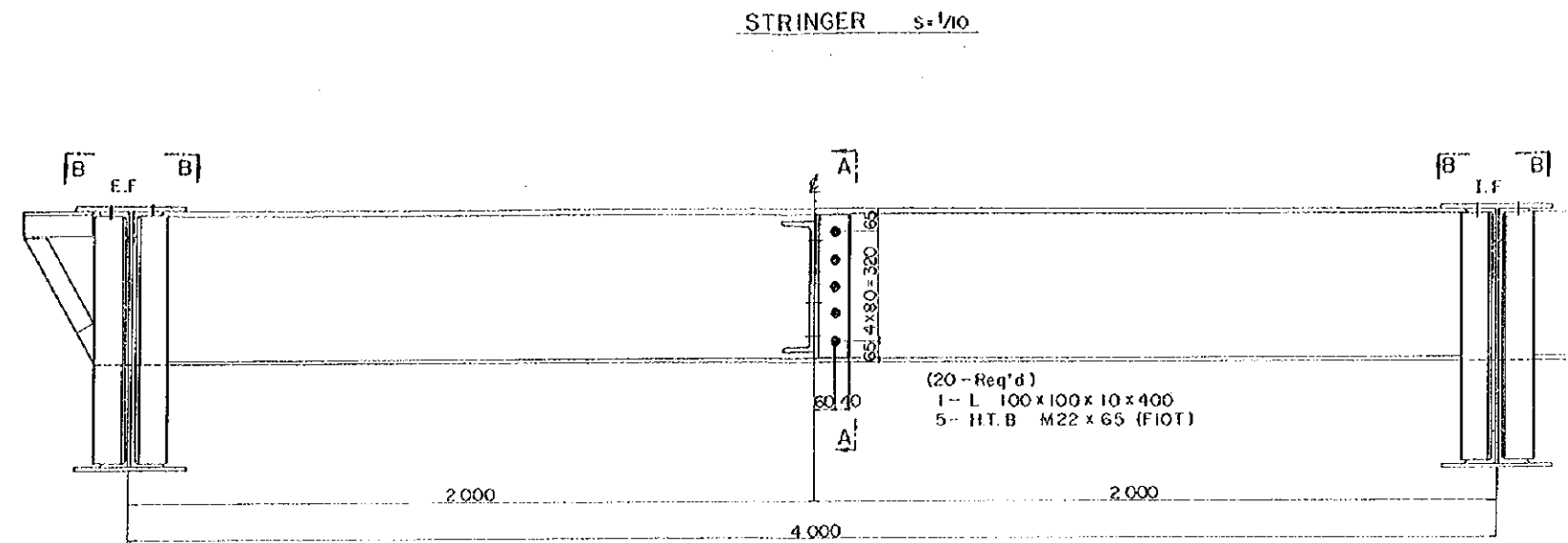
$$S = 1/20$$


- 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 M20 (φ) (FOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 19^φ (φ), and to be rolled steel for SY34 (JIS G3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

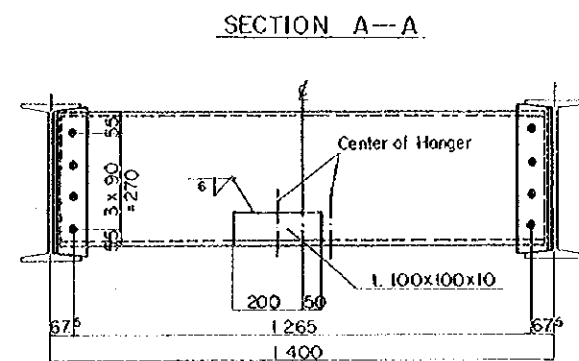
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO.2)	DL 15 loading
40.0 T.T			Unit mm Scale 1/20
K. M.	311 + 599	Designed by	
DISTRICT	Nokhon Sowon	Checked by	
LINE	Northern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE	DRAWING NO.		

FLOOR SYSTEM



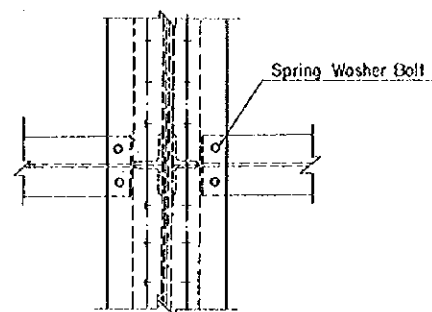
STRINGER STRUT (SI) $s = 1/10$



(10 - Req'd)
1 - C 380x100x10x1345
8 - H.T.B M22x60 (FIOT)
1 - L 100x100x10x250
cf. Drawing Lower Lateral.

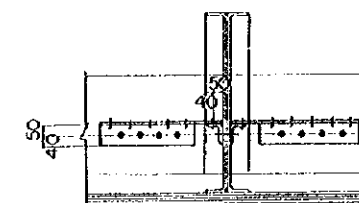
SECTION B-B $s = 1/10$

Change to Spring Washer Bolt.



(22 - Req'd)
4 - Spring Washer Bolts M22

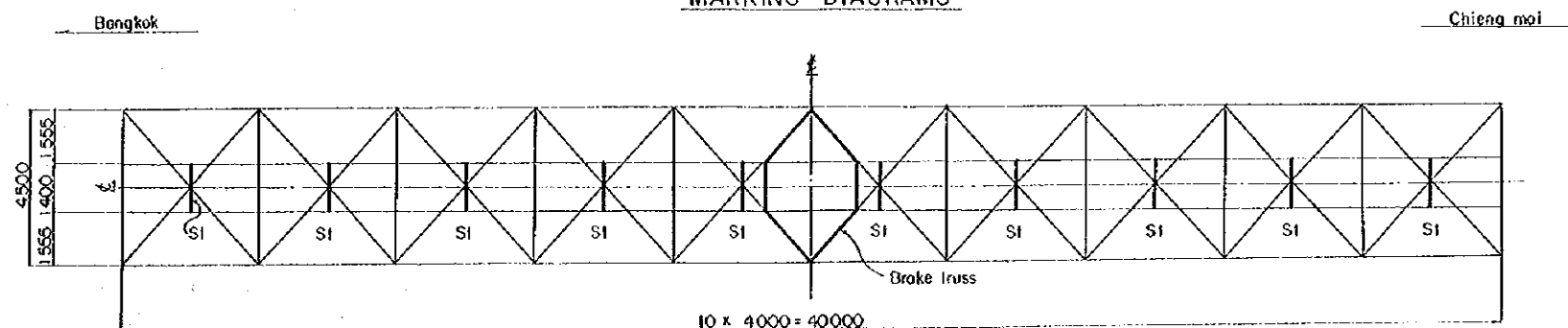
SECTION C-C $s = 1/15$



General Notes :

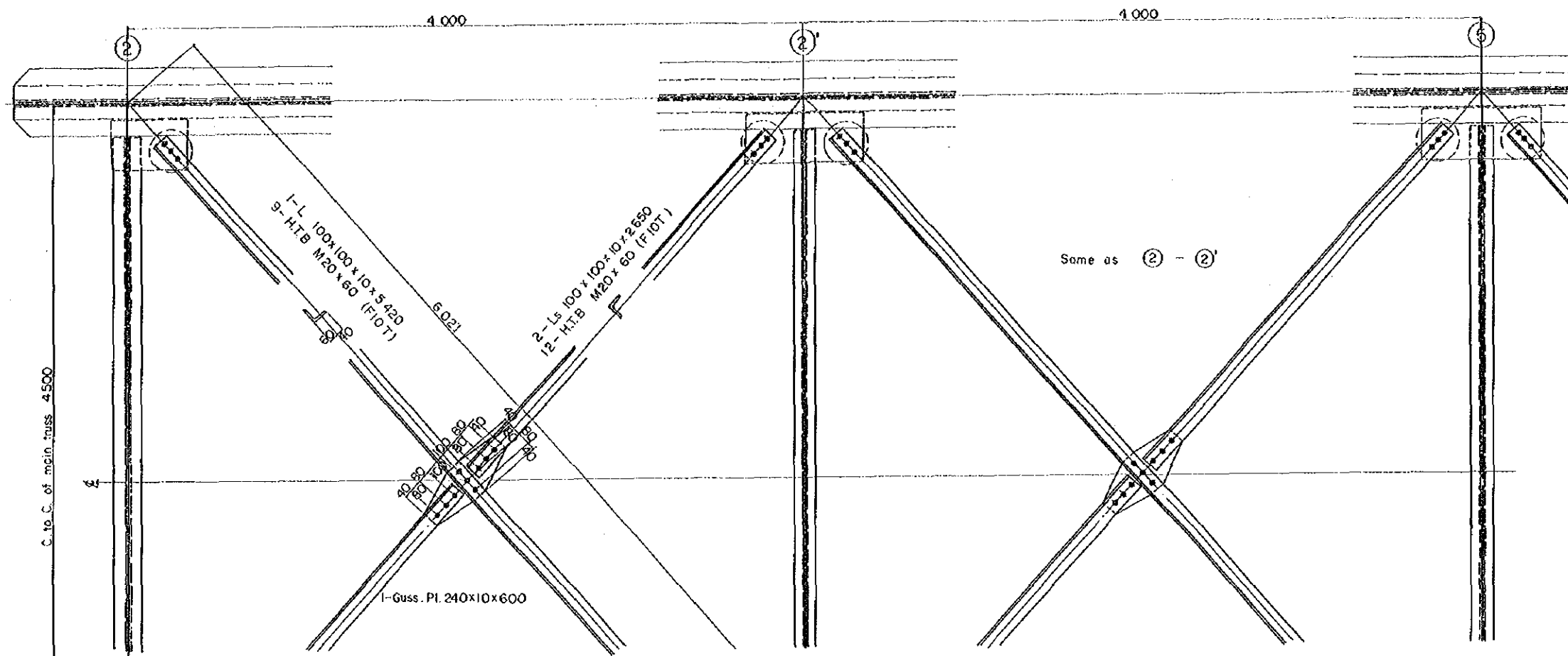
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B) are M22 (φ) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for slitch $\mu \geq 0.3$
-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

MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM	DL 15 loading	Scale
40.0 T.T			Unit	mm 1/15, 1/10
K.M.	311 + 599	Designed by		
DISTRICT	Nakhon Sawon	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

UPPER LATERAL BRACING S-1/15

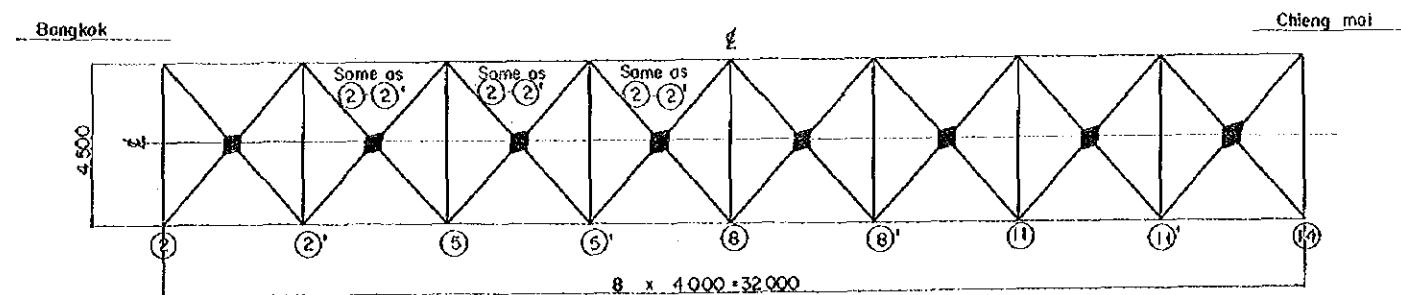


Note : Re-Use Existing holes.

General Notes

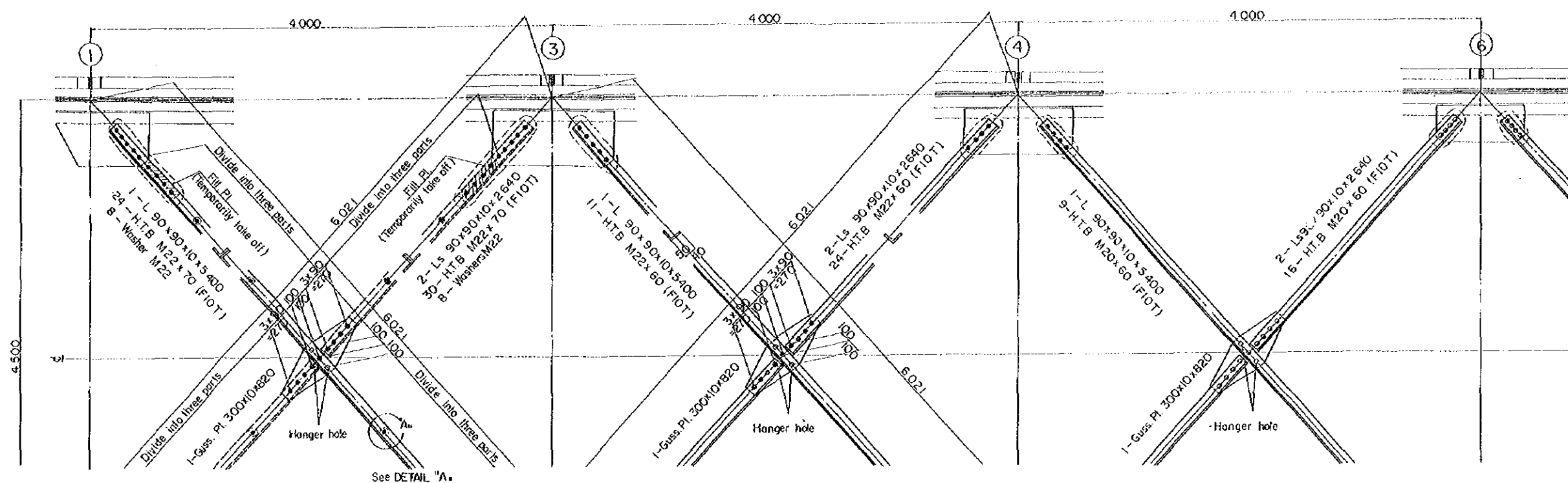
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M20 (φ) (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

MARKING DIAGRAMS

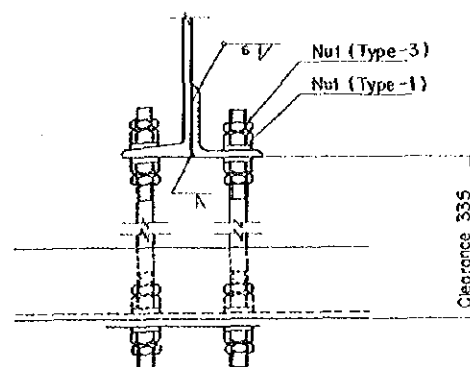


THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	UPPER LATERAL BRACING	DL	IS loading
40.0 T			Unit	Scale
			mm	1/15
K.M.	311 + 599	Designed by		
DISTRICT	Nakhon Sawan	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

LOWER LATERAL BRACING S=1/20



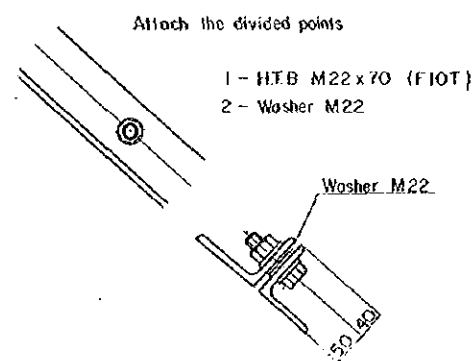
HANGER S=1/5



Note:
All Nut M22 (JIS B1156)
or materials of equivalent.

- 2 - Round Bar 22 ϕ x 480
- 8 - Nut M22 (Type-1)
- 8 - Nut M22 (Type-3)
- 8 - Washer M22

DETAIL "A" S=1/5



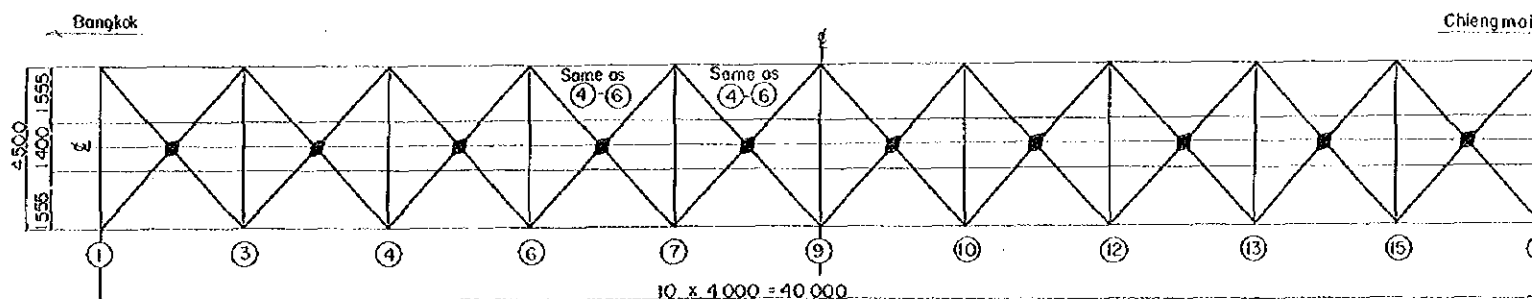
Attach the divided points

- 1 - HTB M22x70 (FIOT)
- 2 - Washer M22

General Notes

- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (HTB) are M22 (ϕ) M20 (ϕ) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - for connection ± 0.4
 - for stitch ± 0.3
- All dimensions to be checked in the field.

MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	LOWER LATERAL BRACING		
40.0 T.Y.				
K.M.	311 + 599	Designed by		
DISTRICT	Nakhon Sawon	Checked by		
LINE	Northern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

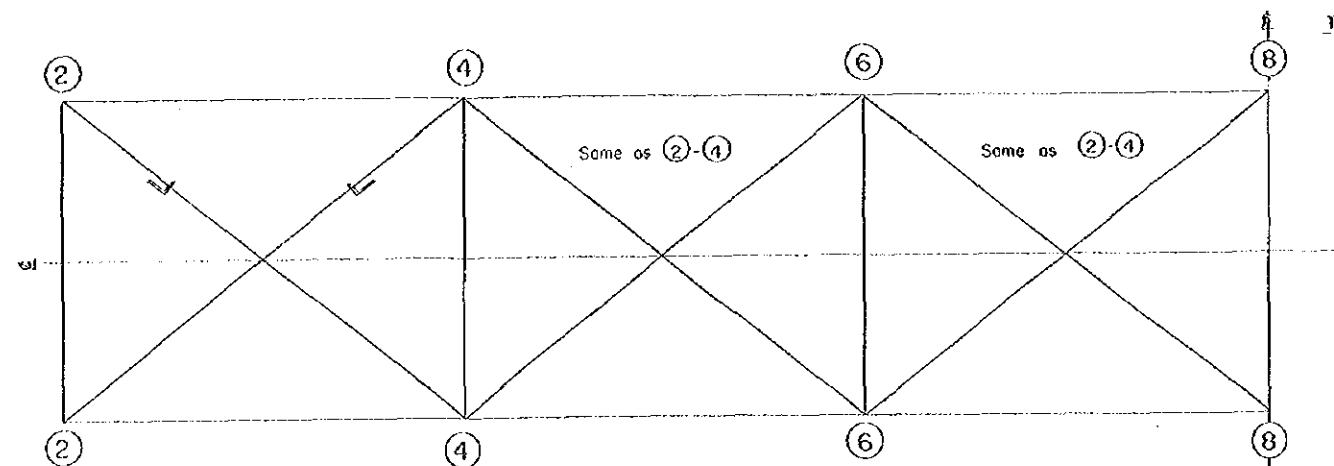
GENERAL DIAGRAM

UPPER LATERAL

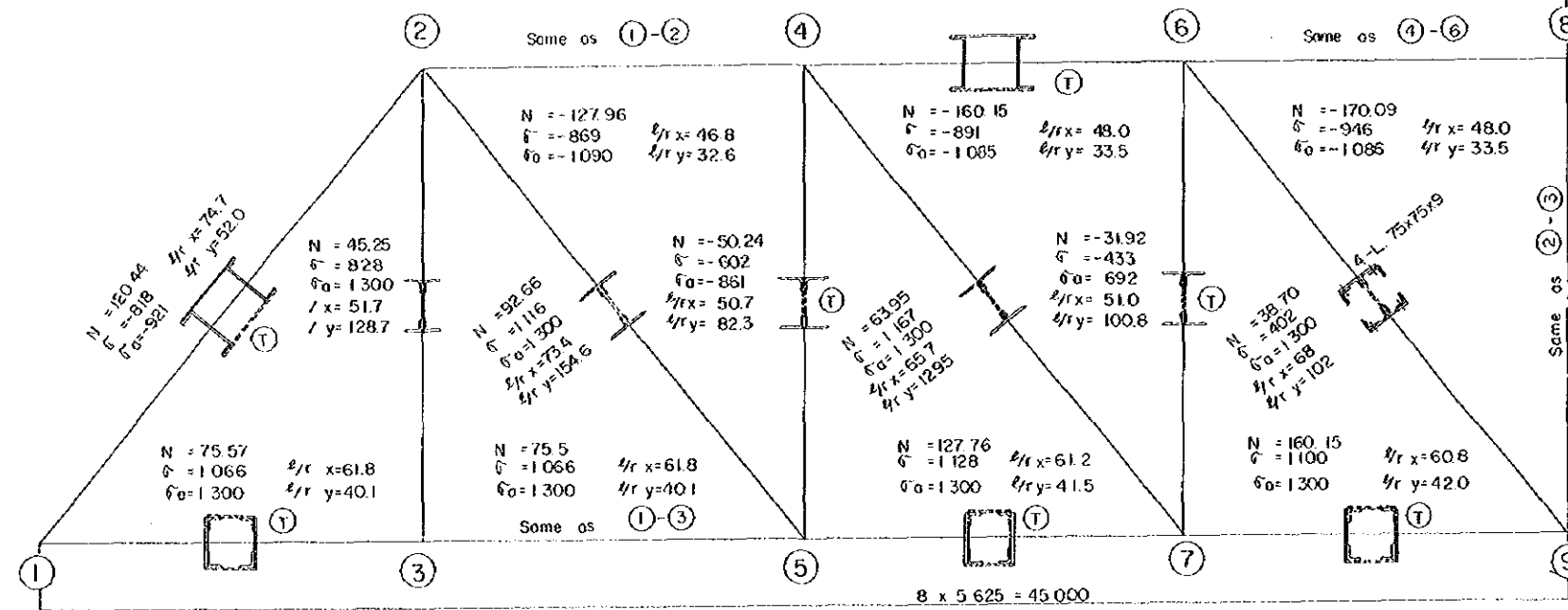
Bangkok

General Notes

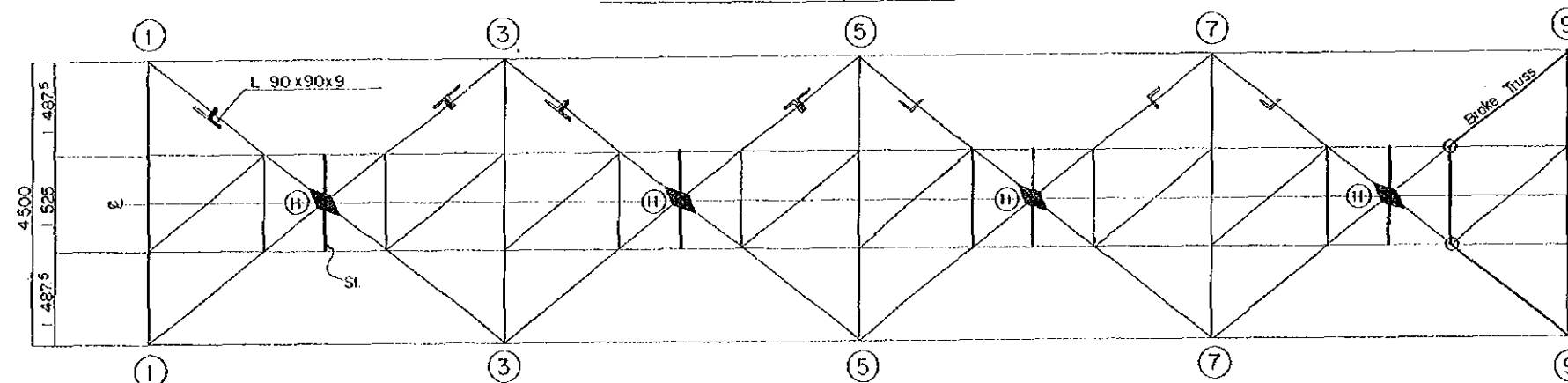
- 1) Weak drawings show the original members.
Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Marks:
 - M : Bending moment (t-m)
 - N : Axial force (t)
 - L : Length of member (cm)
 - r_x, r_y : Radius of gyration of sectional area for x or y axis (cm)
 - L/r : Slenderness ratio
 - σ : Actual stress (kg/cm^2)
 - σ_a : Allowable stress (kg/cm^2)



MAIN TRUSS



FLOOR SYSTEM & LOWER LATERAL



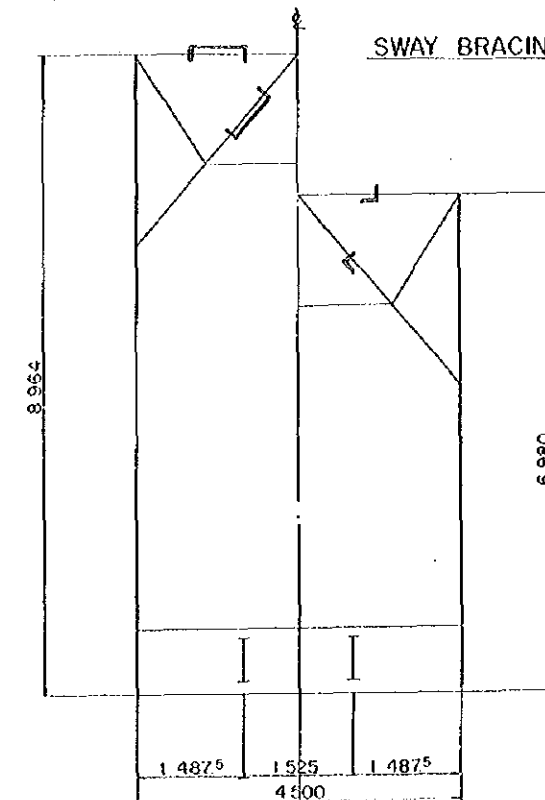
Legends;

- 1) : Gusset plates to be improved.
- 2) : Hanger to be added.
- 3) : Tie plates to be strengthened.
- 4) : Defective hanger to be removed.
- 5) : New strut to be added.

PORTAL BRACING

Thung Song

SWAY BRACING



END FLOOR

INT. FLOOR

STRINGER



M = 42.606	M = 49.335	M = 33.349
$\sigma_c = 1086$	$\sigma_c = 817$	$\sigma_c = 1087$
$\sigma_t = 1203$	$\sigma_t = 904$	$\sigma_t = 1221$
$\sigma_{ca} = 1184$	$\sigma_{ca} = 1184$	$\sigma_{ca} = 1143$
$\sigma_{ta} = 1300$	$\sigma_{ta} = 1300$	$\sigma_{ta} = 1300$

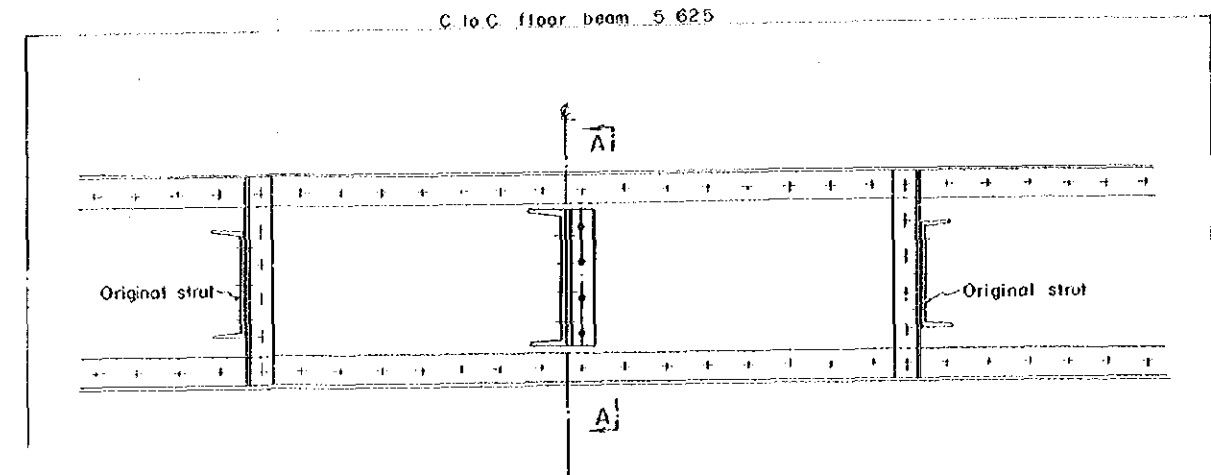
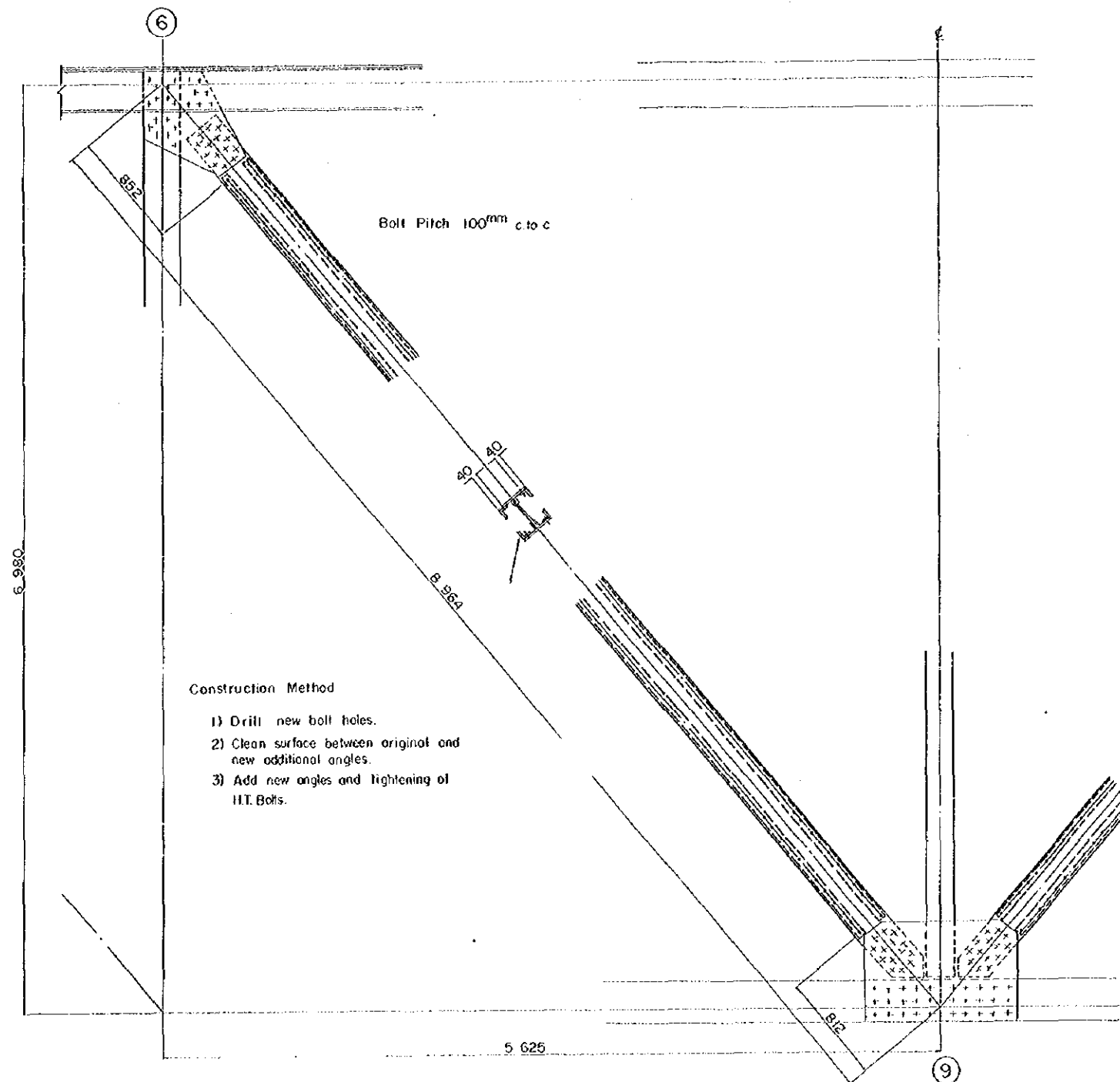
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
45.0 T.T			Unit Scale
K.M	672 + 874	Designed by	
DISTRICT	Thung Song	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
DATE		DRAWING NO.	

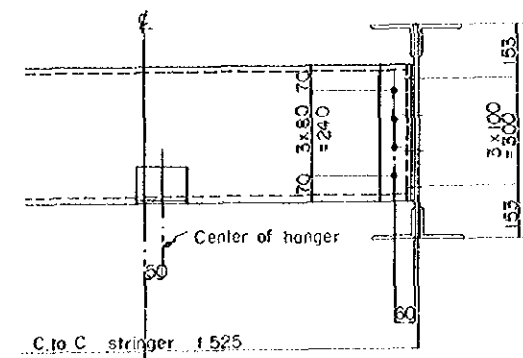
MAIN TRUSS AND FLOOR SYSTEM

DIAGONAL MEMBER $s = 1/20$

STRUT OF STRINGER (SI) $s = 1/10$



SECTION A - A

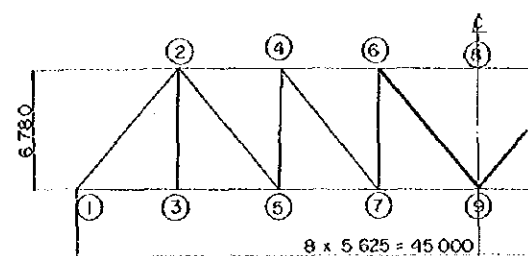


1- L 380x100 x10⁵ x 1480
2- Ls. 100x100x 10x 380
36- H.T.B M22x 60 (FIOT)

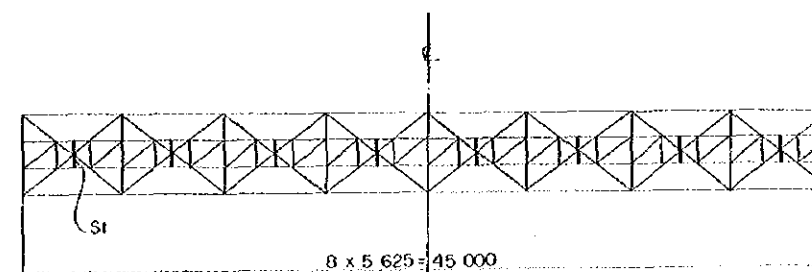
General Notes:

- 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 22) (F10T), and assumed frictional coefficient of contact surface (f) as follows.
 - i) for connection $f \geq 0.4$
 - ii) for slits $f \geq 0.3$
- 3) All dimensions to be checked in the field.

MARKING DIAGRAMS



MARKING DIAGRAMS

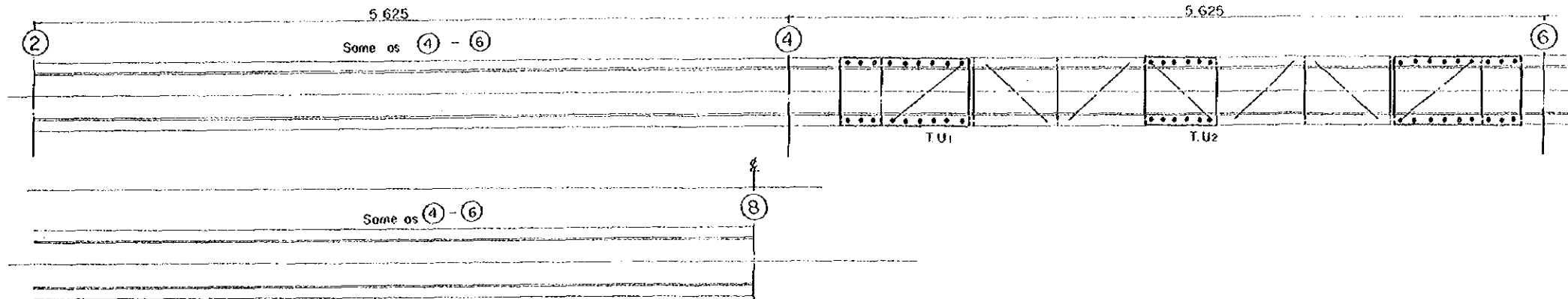


THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS AND FLOOR SYSTEM	OL 15 loading	
450 T.T			Unit mm	Scale 1/20, 1/40
K. M.	672 + 874	Designed by _____ Checked by _____ Checked by _____ Checked by _____ Checked by _____		
DISTRICT	Thung Song			
LINE	Southern Line			
Remarks				
DATE		DRAWING NO.		

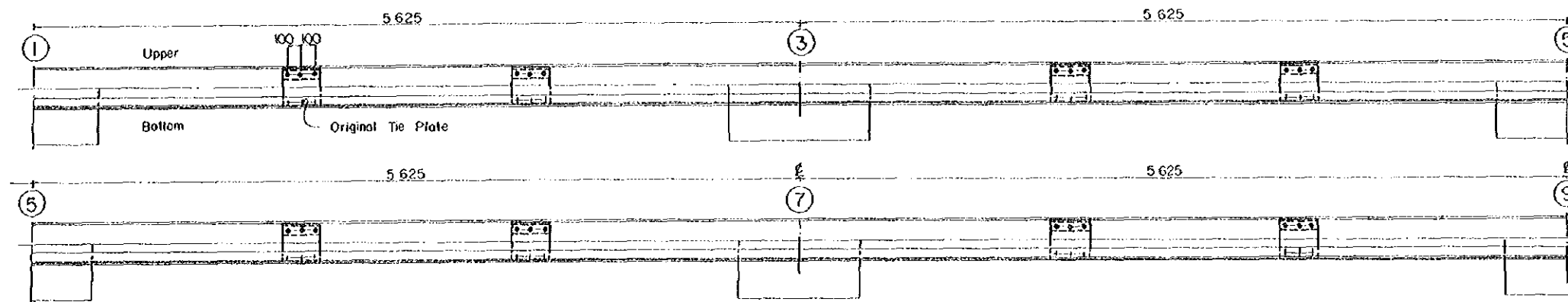
MAIN TRUSS (NO. 2)

UPPER CHORD MEMBERS $s = 1/20$

VERTICAL MEMBERS $s = 1/20$

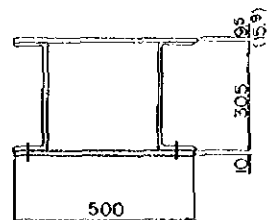


LOWER CHORD MEMBERS $s = 1/20$



END POST MEMBERS

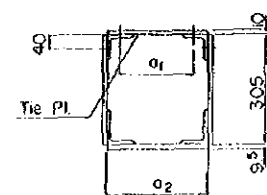
UPPER CHORD & END POST MEMBERS $s = 1/10$



1 - Tie Pl. 500 x 10 x 950
18 - H.T.B. M22 x 65 (FIOT) T.U1

1 - Tie Pl. 500 x 10 x 550
12 - H.T.B. M22 x 65 (FIOT) T.U2

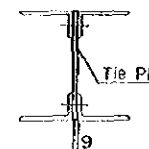
LOWER CHORD MEMBER $s = 1/10$



1 - Tie Pl. 280 x 10 x 92
12 - H.T.B. M22 x 60 (FIOT)
2 - Ls. 75 x 75 x 9 x 280

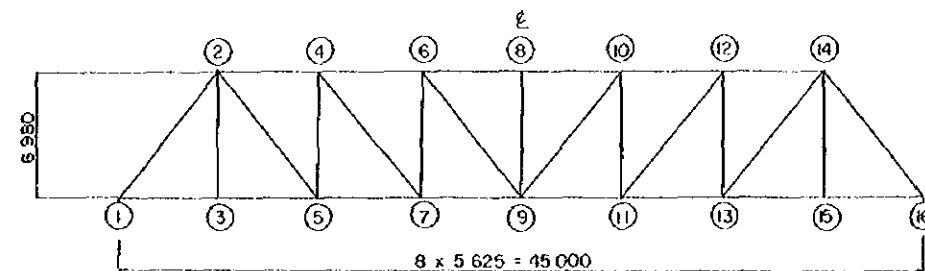
	①-③	③-⑤	⑤-⑦	⑦-⑨
a_1	206	206	193	181
a_2	286	286	273	261

VERTICAL MEMBERS $s = 1/10$



1 - Tie Pl. 250 x 10 x 305
8 - H.T.B. M22 x 60 (FIOT)

MARKING DIAGRAMS



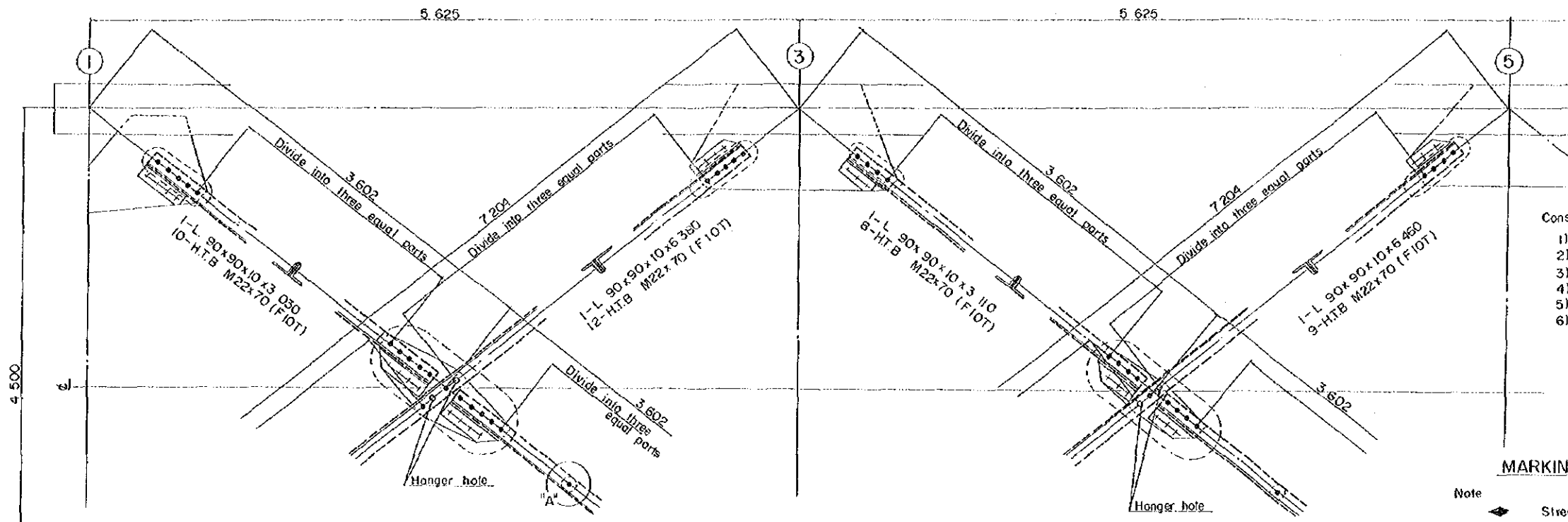
General Notes:

- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (HTB) are M22 (FIOT), and assumed frictional coefficient of contact surface (f) as follows.
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be checked in the field.

Note: $\odot$: Re-use existing holes.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.2)	Unit	Scale
45.0 T.T			mm	1/20, 1/10
K.M	672 + 874	Designed by		
DISTRICT	Thung Song	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

LOWER LATERAL BRACING S=1/15



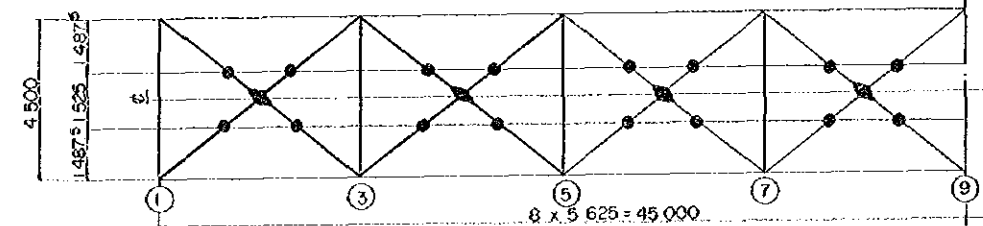
Construction Method (LL-1, LL-2, LL-3)

- 1) Cut off original rivets.
- 2) Take off original members.
- 3) Drill new bolt holes.
- 4) Clean surface between original and new members.
- 5) Attach new angle and connection plate
- 6) Tighten HT Bolts.

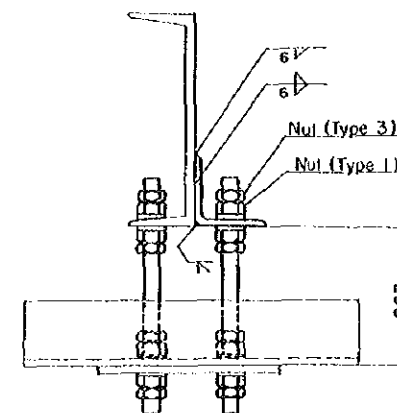
MARKING DIAGRAMS

Note

- ◆ Strengthening of connection and hanger.
- Connection to be taken off.



HANGER S=1/5

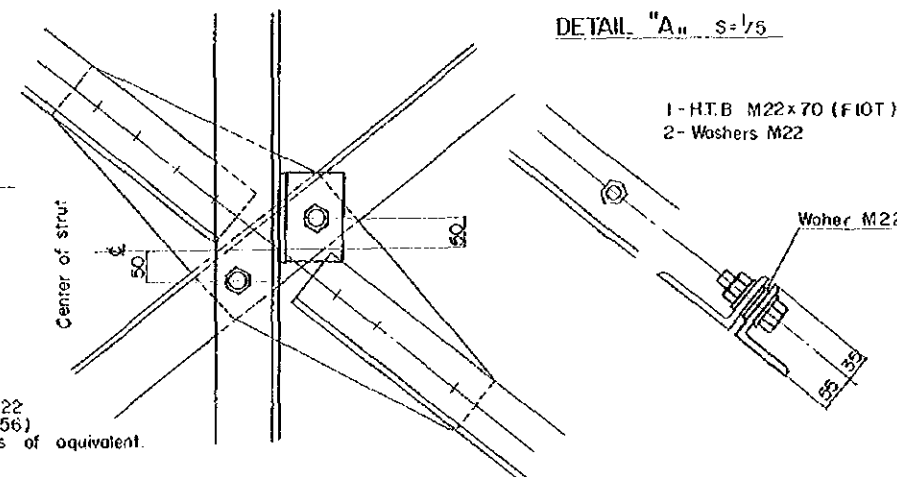


- 2-Round bars 22# x 400
- 8-Nuts M22 (Type-1)
- 8-Nuts M22 (Type-3)
- 8-Washers M22

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 $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

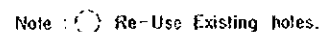
DETAIL "A" S=1/5



Note:
All Nut M22
(JIS B-1156)
or materials of equivalent.

1-L 100x100x10x120

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	DL	Loading	
45.0 T.T	LOWER LATERAL BRACING	unit	Scale	
		mm	1/15, 1/5	
K.M	672 + 874	Designed by		
DISTRICT	Thung Song	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
DATE		DRAWING NO.		

$$S = 1/45$$


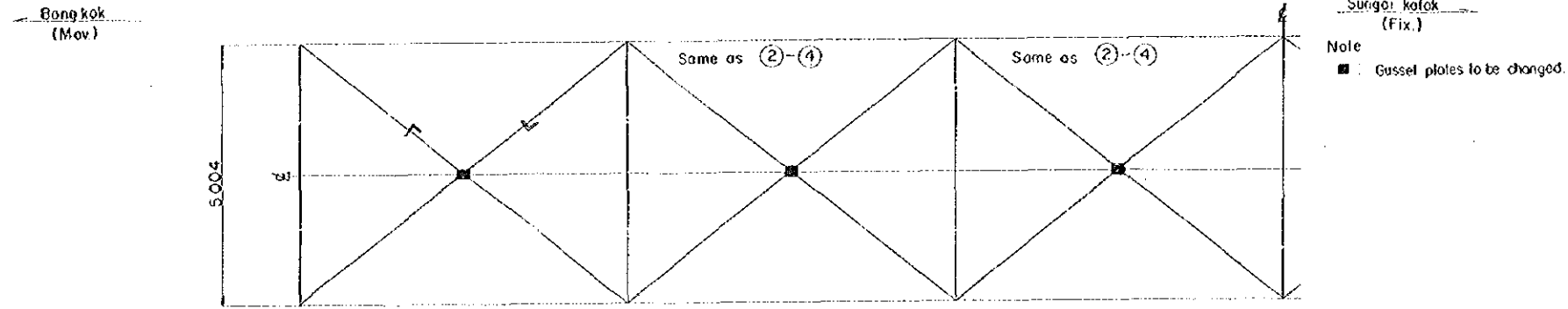
The diagram shows a truss structure with a central vertical line and a horizontal line. The truss is composed of several triangular elements. A vertical force is applied at the center of the truss, pointing upwards. The truss is supported by a horizontal line at the bottom. The internal forces are indicated by arrows within the truss members.

- 1) All materials are to be JIS G3101 S41 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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

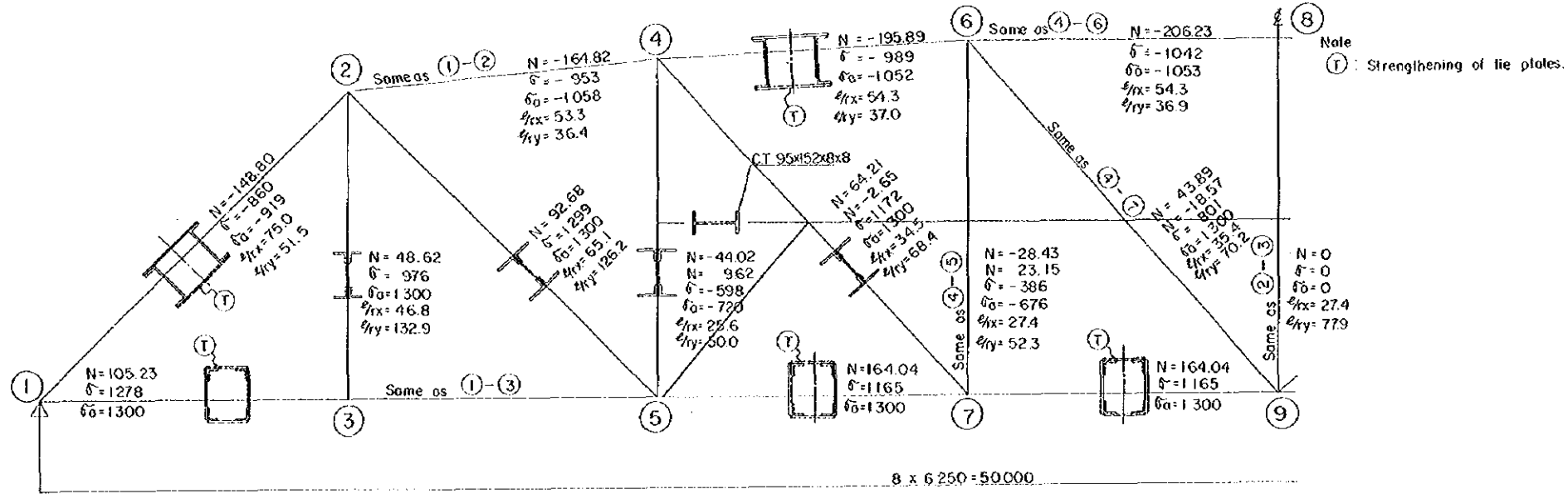
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type 45.0 T.T.	Members	BRAKE TRUSS	DL 15 loading	
			Unit mm	Scale 1/15
K.M.	672 + 874	Designed by		
DISTRICT	Thung Song	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

GENERAL DIAGRAM

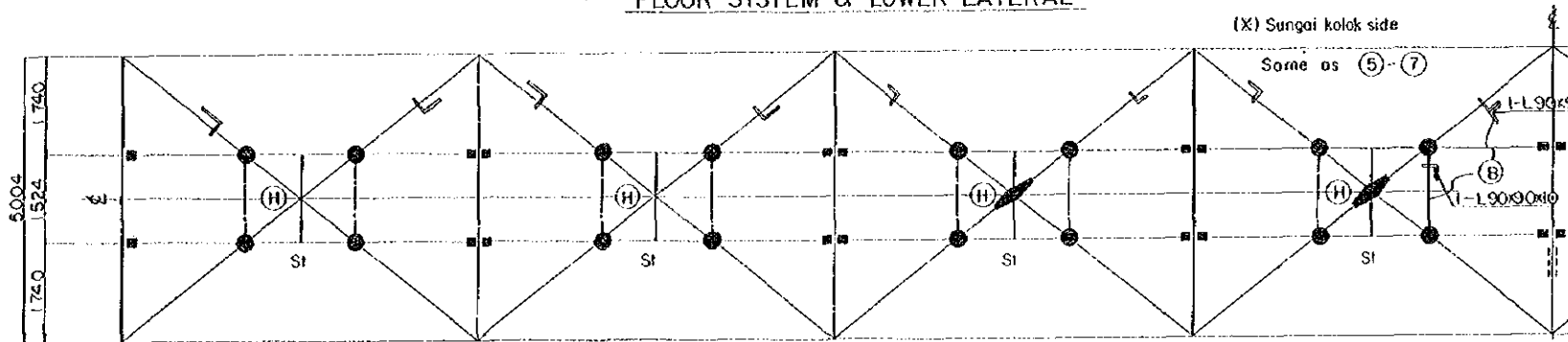
UPPER LATERAL



MAIN TRUSS



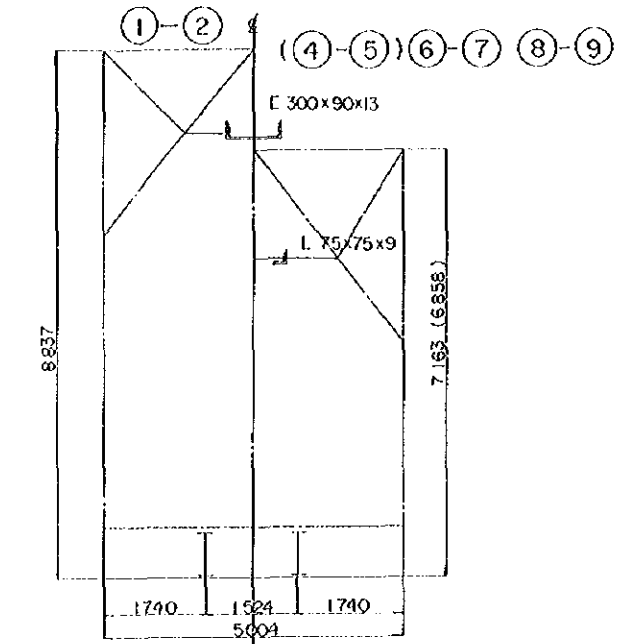
FLOOR SYSTEM & LOWER LATERAL



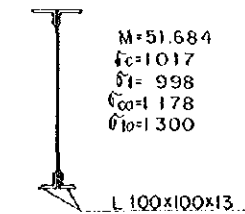
- Legends :
- 1)  : Gussets plates to be improved.
 - 2)  : Excessive stressed rivets to be strengthened.
 - 3)  : Web plates of floor beam to be repaired
 - 4)  : Defective hanger to be removed.
 - 5)  : Hanger to be added.
 - 6)  : New broke truss to be added.
 - 7)  : New strut to be added.

PORTAL BRACING

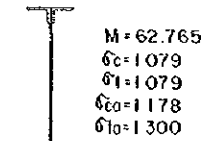
SWAY BRACING



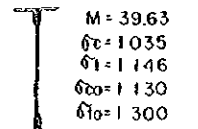
END FLOOR



INT FLOOR



STRINGER



General Note :
 1. The following information is for general information only and is not intended to be used as a basis for any legal or other action.

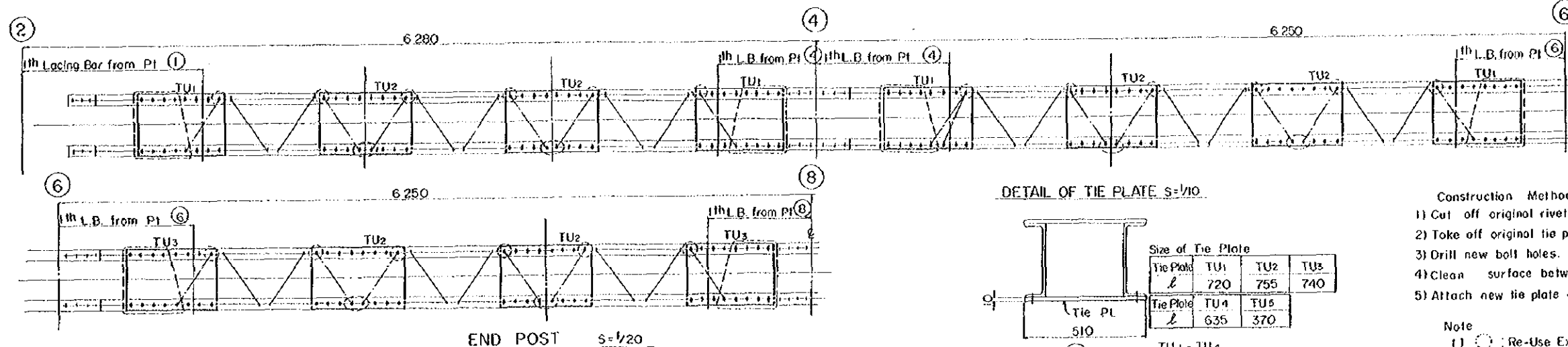
- 1) Weak drawings show the original members.
Deep drawings show the members to be improved.
- 2) Actual stresses are based on DL-15 loading.
- 3) Works

- M : Bending moment (l-m)
 N : Axial force { l }
 l : Length of member (cm)
 r_x, r_y : Radius of gyration of sectional area
 for x or y axis (cm)
 e/r : Slenderness ratio
 σ : Actual stress (kg/cm²)
 σ_a : Allowable stress (kg/cm²)

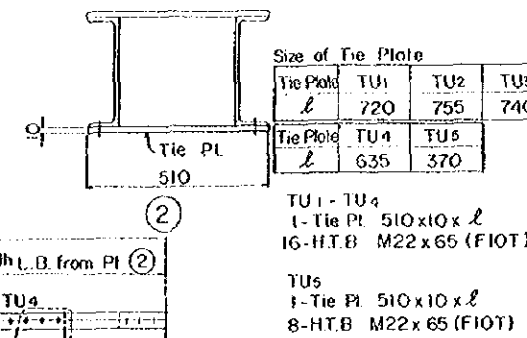
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Spon Type	Members	GENERAL DIAGRAM	Dt. 15 loading	
500 T.T			Unit	Scale
K.M.	1063 + 810	Designed by _____	mm	
DISTRICT	Yala		Checked by _____	
LINE	Southern Line		Checked by _____	
Remarks			Checked by _____	
			Checked by _____	
		Checked by _____		
DATE		DRAWING NO.		

MAIN TRUSS (NO.1)

UPPER CHORD MEMBER $s = 1/20$



DETAIL OF TIE PLATE $s = 1/10$

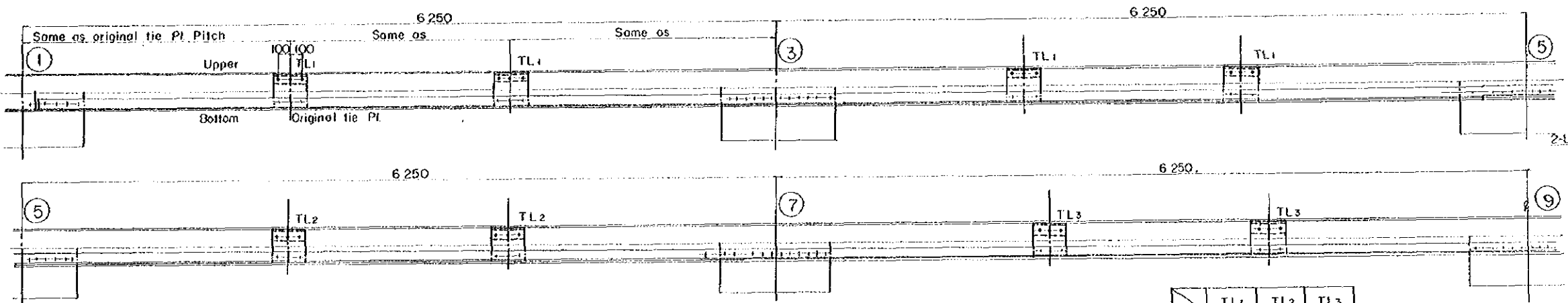


- Construction Method
- 1) Cut off original rivets.
 - 2) Take off original tie plates & lacing bars.
 - 3) Drill new bolt holes.
 - 4) Clean surface between original members and additional plates.
 - 5) Attach new tie plate and tighten HT Bolts.

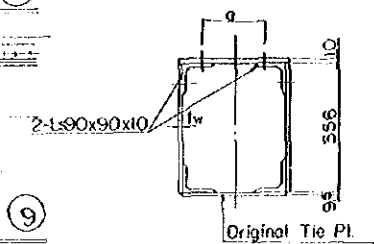
Note

- 1) $\circ$: Re-Use Existing holes.
- 2) $-$: Take off original lacing bar.

LOWER CHORD MEMBER $s = 1/20$



DETAIL OF TIE PLATE $s = 1/10$

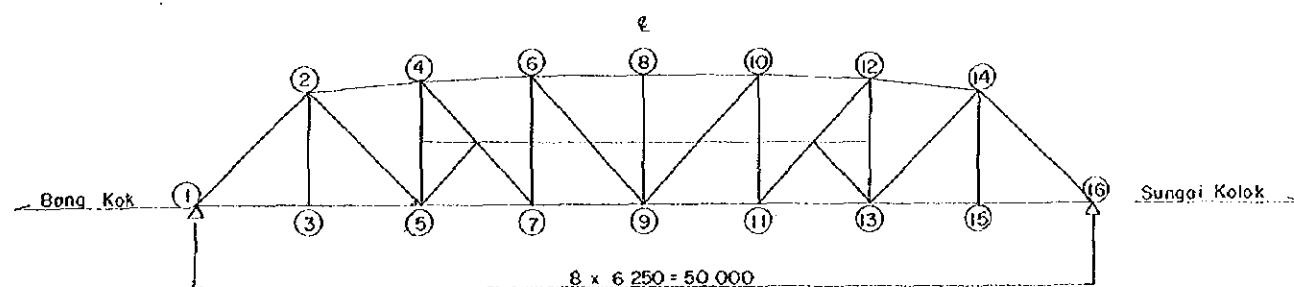


- 1-Tie Pl. 6x10x280
2-Ls 90x90x10x280
6-HT.B M22x65 (FIOT)
6-HT.B M22x ℓ (FIOT)

	TL1	TL2	TL3
a	185	170	160
b	265	250	240
ℓ	60	70	75

- Construction Method
- 1) Drill new bolt and rivet holes.
 - 2) Clean surface between original members and additional members.
 - 3) Attach new tie plates, Angles and tighten HT Bolts.

MARKING DIAGRAMS



General Notes :

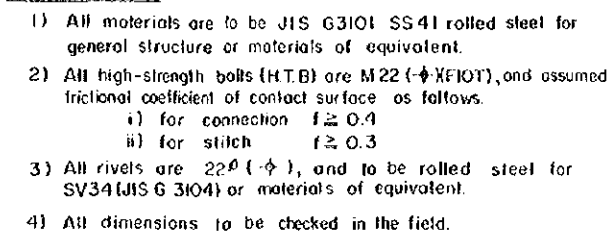
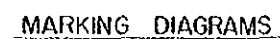
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions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

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.1)		
50.0 T.T		Unit	Scale	DL 15 loading
K. M	1063 + 810	mm	1/20, 1/10	
DISTRICT	Yala	Designed by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

DIAGONAL MEMBER $s = 1/20$



- 1) New members are built up by welding
- 2) Clean surface between new gusset plates and original members
- 3) Drill new bolt holes.
- 4) Attach gusset plates.
- 5) Attach new members.
- 6) Tighten H.T. Bolts.

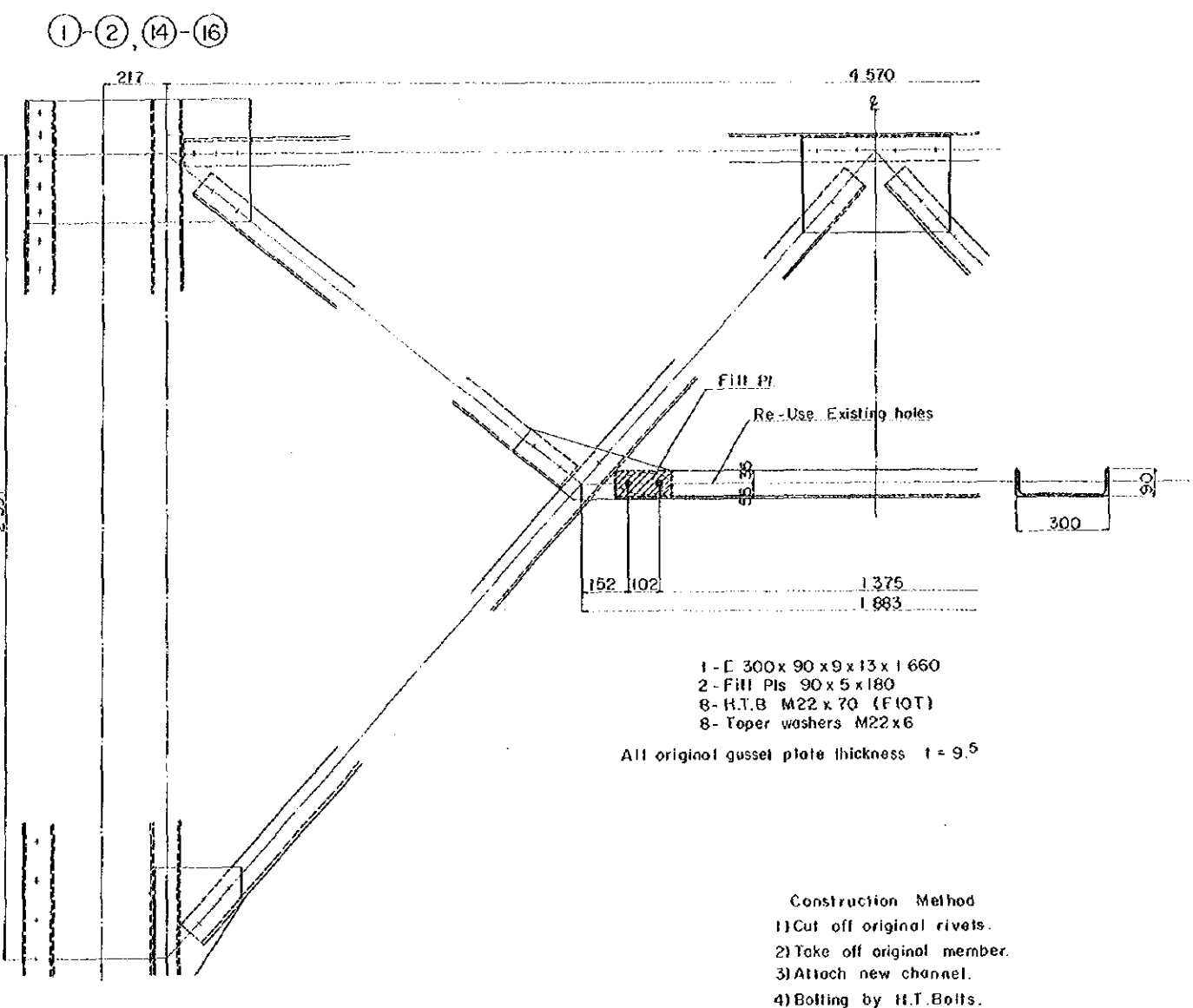
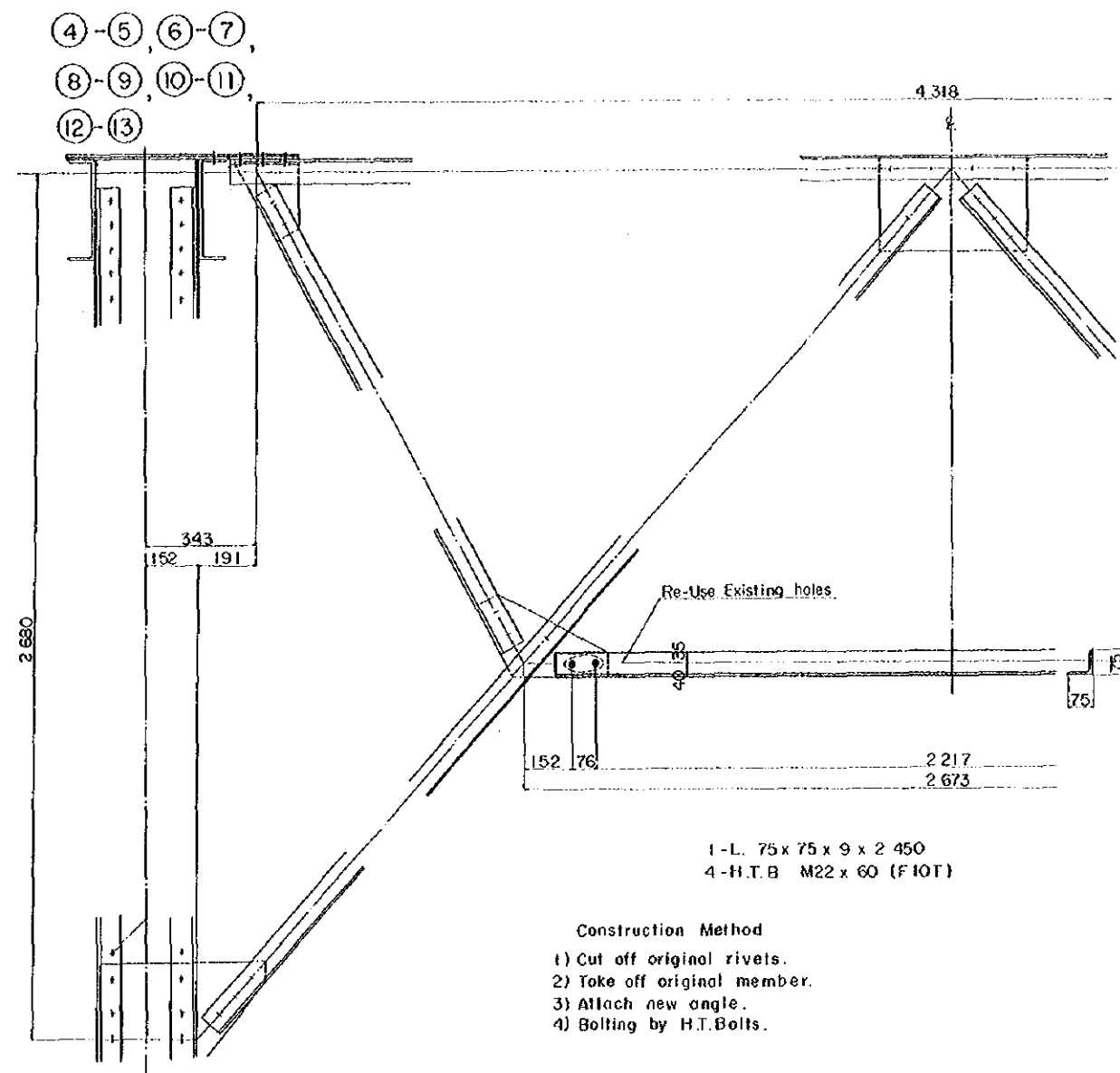


- 50 -

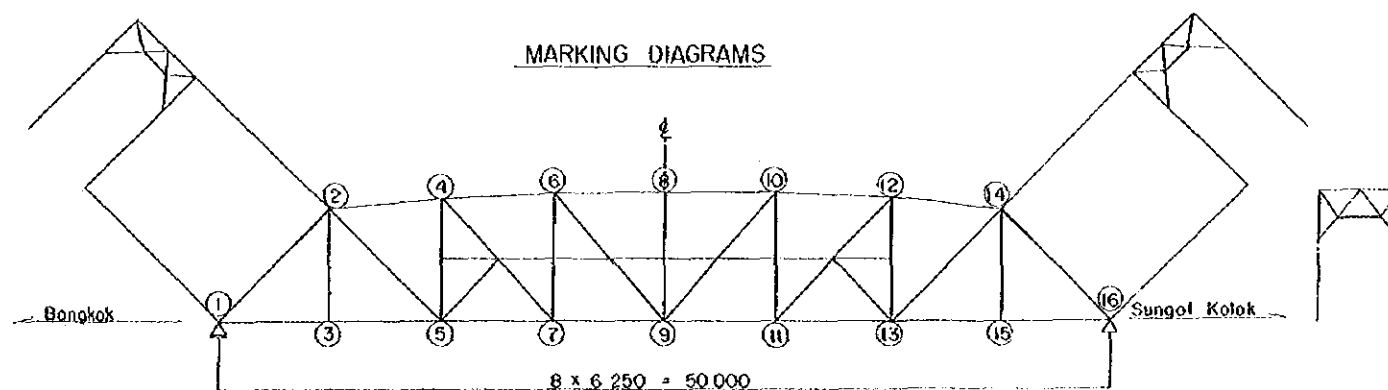
MAIN TRUSS (NO.3)

SWAY BRACING $s = 1/10$

PORTAL BRACING $s = 1/10$



MARKING DIAGRAMS



General Notes

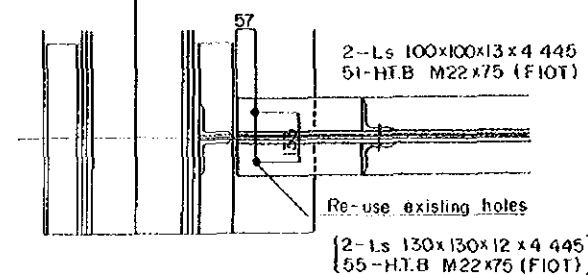
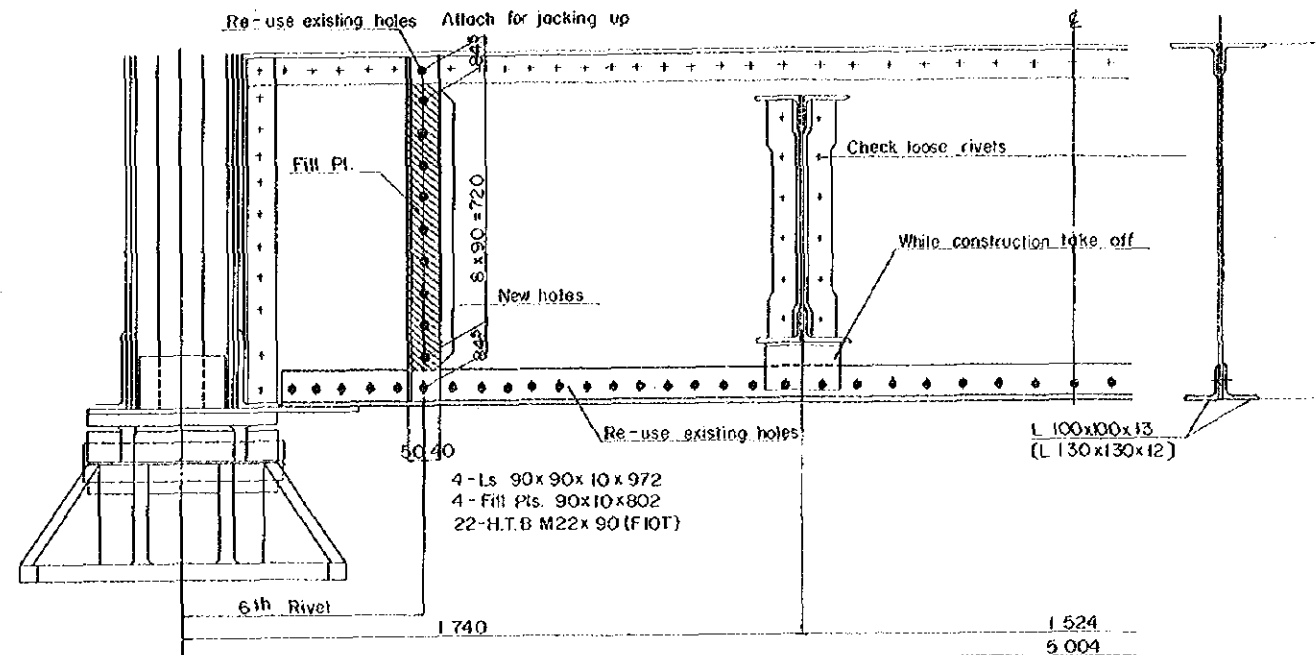
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTB) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions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

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.3)	Unit	DL 15 Loading Scale
50.0 LT			mm	1/10
K.M.	1063 + 810	Designed by		
DISTRICT	Yolo	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

FLOOR SYSTEM

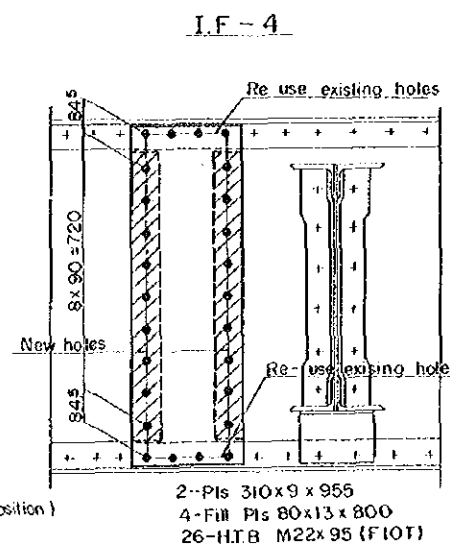
END FLOOR BEAM (INT. FLOOR BEAM I.F-4) $s=1/10$

Note: In I.F-4, it's unnecessary to attach angles for jacking up

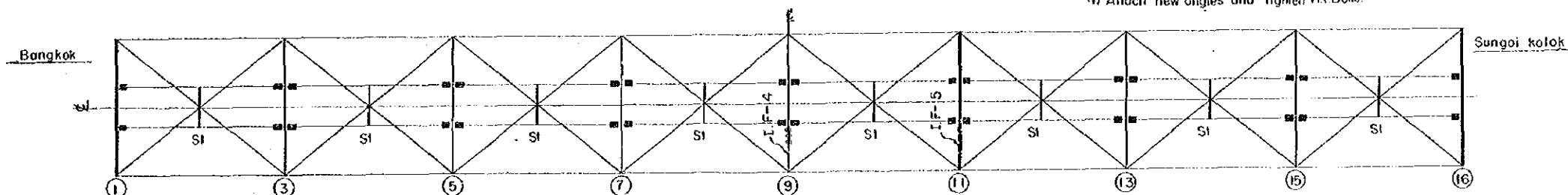


Construction Method

- 1) Drill new bolt holes.
- 2) Cut off original rivets at lower flange angles.
- 3) Take off original members.
- 4) Clean surface between original members and new flange angles.
- 5) Attach new angles and tighten HT.Bolts (Lower and jock position)

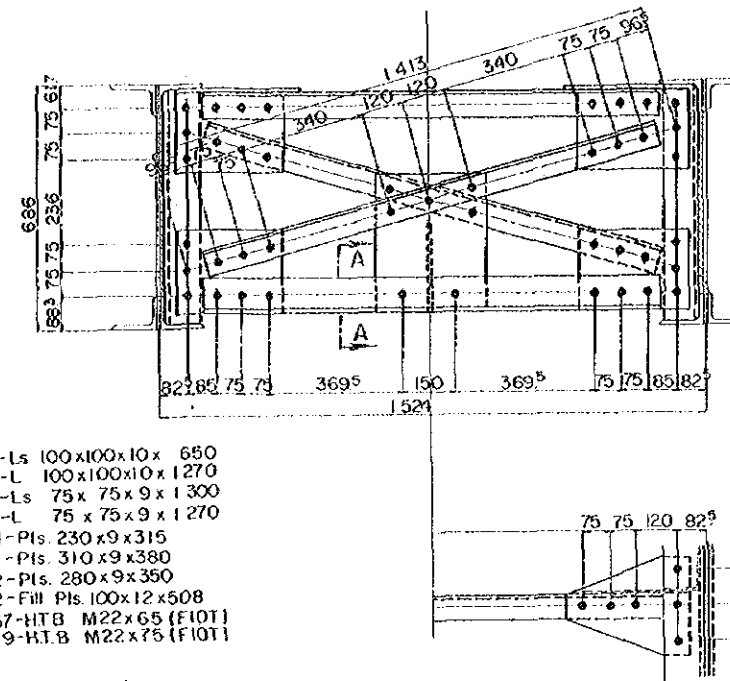


MARKING DIAGRAMS

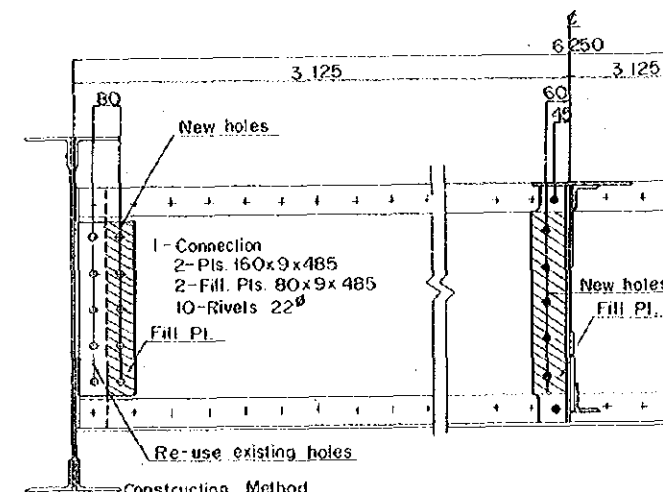


Note: ■ : Strengthening of connection
■ : Repairing of Web plate.
SI : New sway bracing of stringer to be added.

SWAY BRACING OF STRINGER $s=1/10$



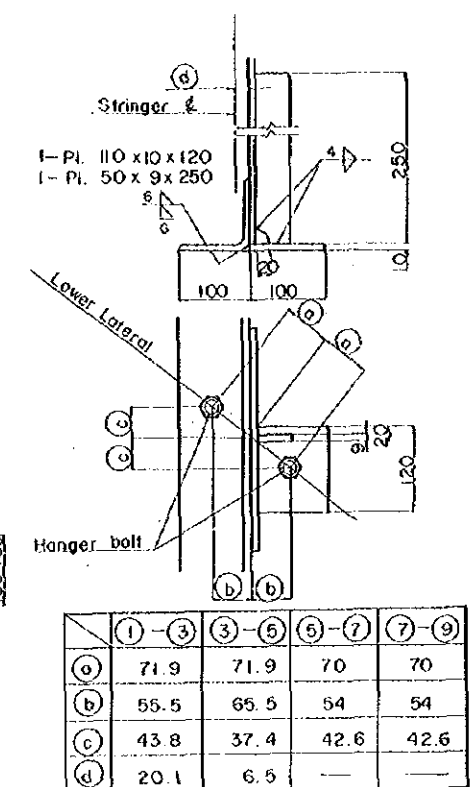
STRINGER $s=1/10$



Construction Method

- 1) Drill new bolt holes.
- 2) Cut off original rivets.
- 3) Clean surface between original members and new angles.
- 4) Attach new angles and tighten HT.Bolts.
- 5) Strengthen sway bracing of stringer.
- 6) Strengthen connection (Attach Spl. Pl. and riveting)

DETAIL A-A $s=1/5$

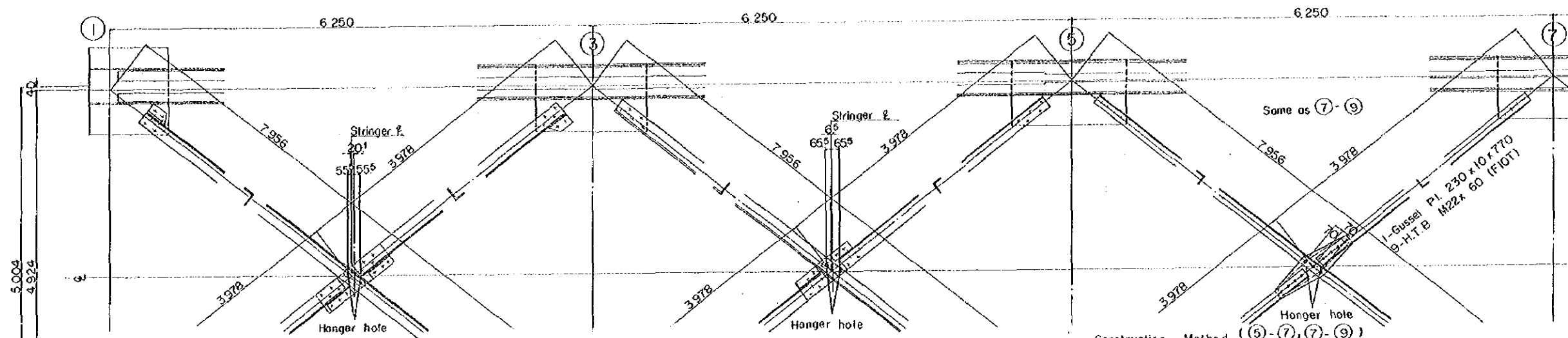


General notes:

- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HT.B) are M22 (Φ) (FIOT), and assumed frictional coefficient of contact surface as follows.
i) for connection $f \geq 0.4$
ii) for stitch $f \geq 0.3$
- 3) All rivets are 22 (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			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type 500 T.T	Members FLOOR SYSTEM	DL 15 loading Unit mm	Scale 1/10, 1/5
K. M. 1063 + 810	Yala	Designed by	
DISTRICT Southern Line		Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

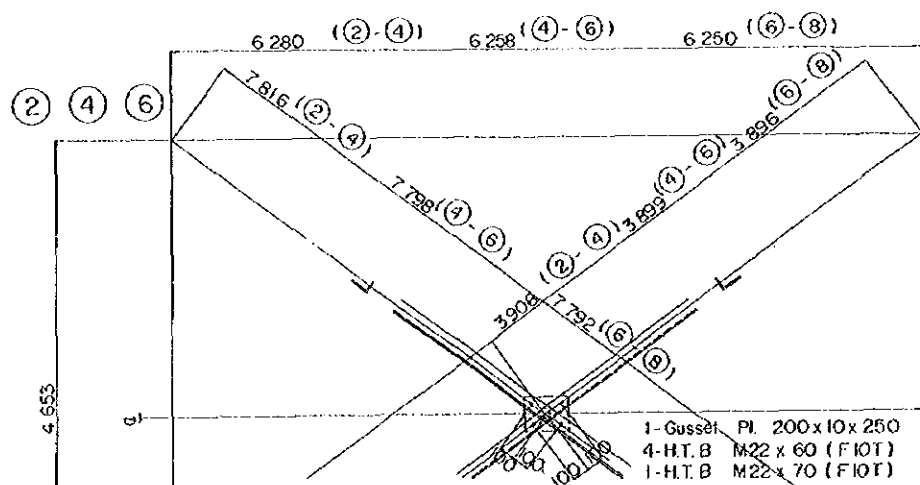
LOWER LATERAL



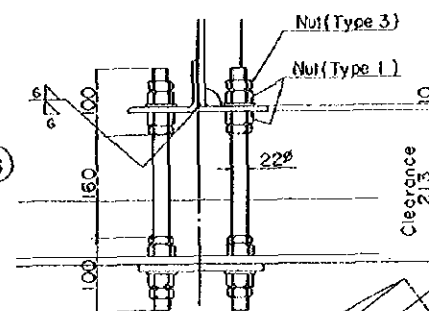
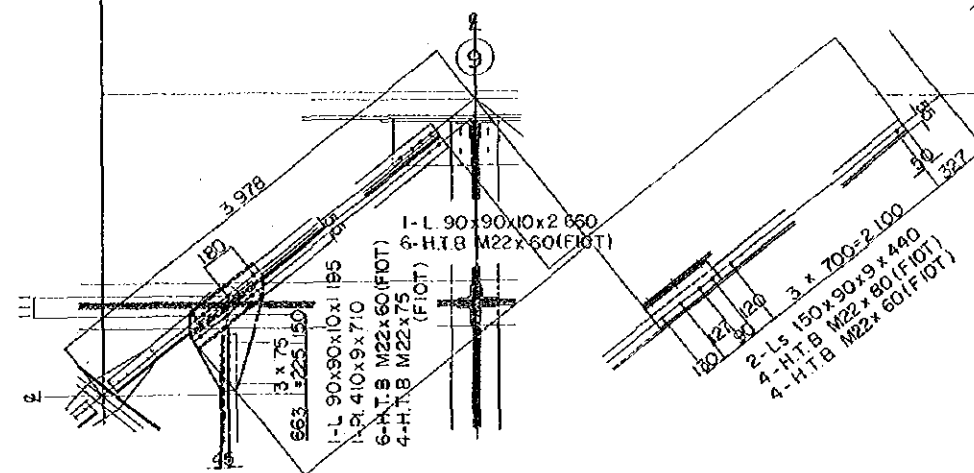
Construction Method (5)-(7), (7)-(9)

- 1) Cut off original rivets.
- 2) Drill new bolt holes.
- 3) Clean surface between original members and additional plates.
- 4) Attach new gusset plate
- 5) Tighten H.T. Bolts.

UPPER LATERAL



BRAKE TRUSS



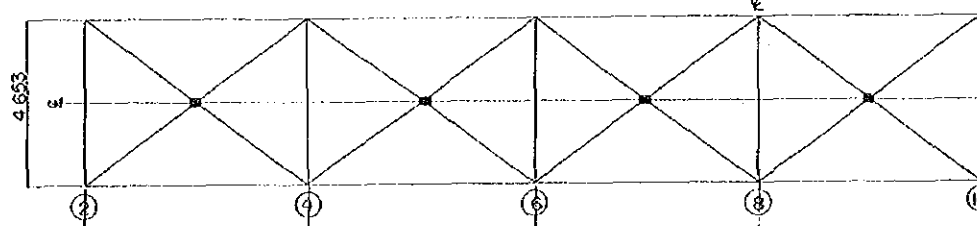
- 2 - Round Bar 22⁸x360
8 - Nuts M22 (Type 1)
8 - Nuts M22 (Type 3)
4 - Washers M22

MARKING DIAGRAMS

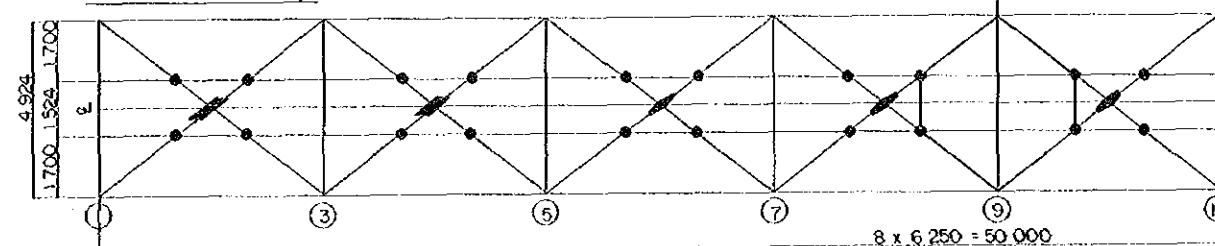
Note; ■ : New gusset plates of upper lateral.

- : Strengthening of gusset plates connection & new hangers
- : New hangers.
- : Original hanger to be taken off.

Upper Lateral Bracing



Lower Lateral Bracing



General Notes :

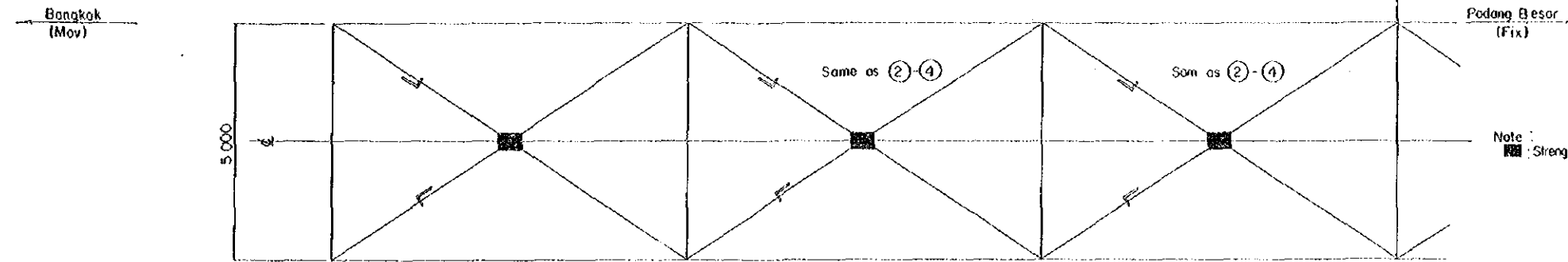
- 1) All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (HTE) are M22 (→ K10T), and assumed frictional coefficient of contact surface(μ) as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

Note ;
 ; Re - Use Existing holes.

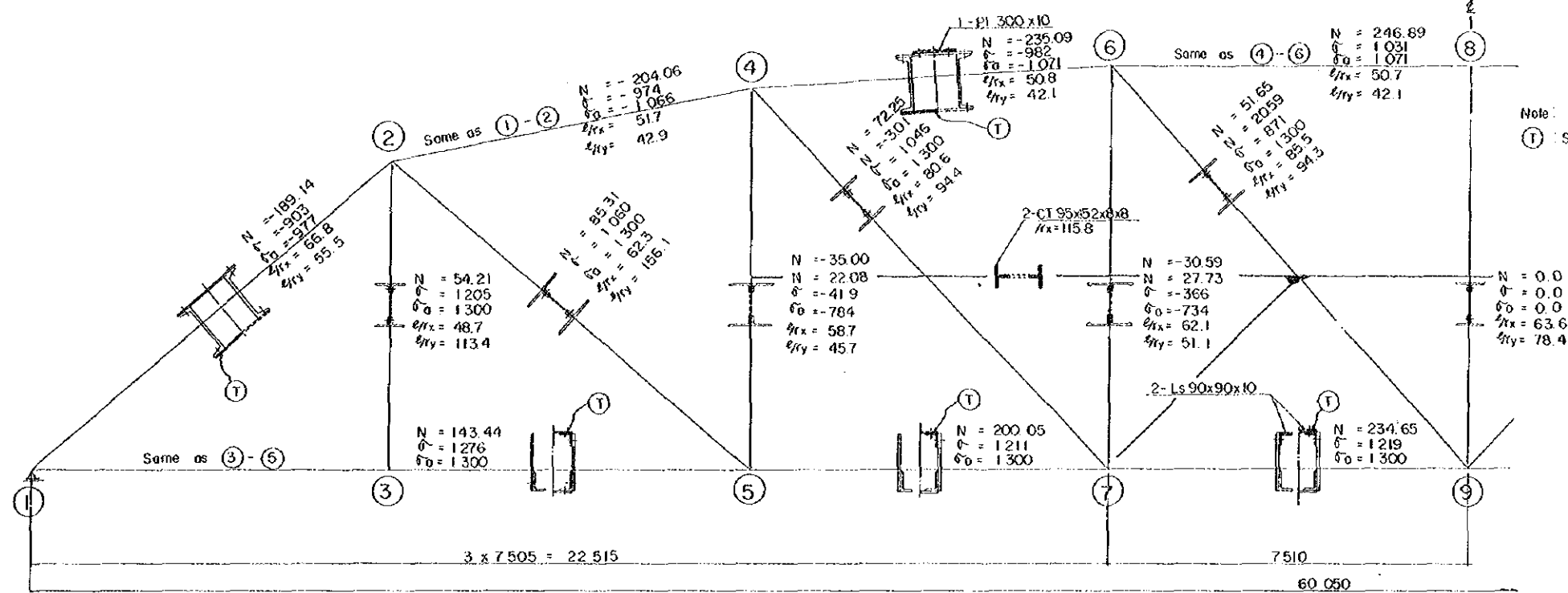
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	LATERAL BRACING	DL 15 loading	
500 T.T			Unit	Scale
			mm	1/20, 1/10
K.M	1063 + 810			
DISTRICT	Yalo		Designed by	
LINE	Soolhorn Line		Checked by	
Remarks			Checked by	
			Checked by	
			Checked by	
			Checked by	
			Checked by	
DATE			DRAWING NO.	

GENERAL DIAGRAM

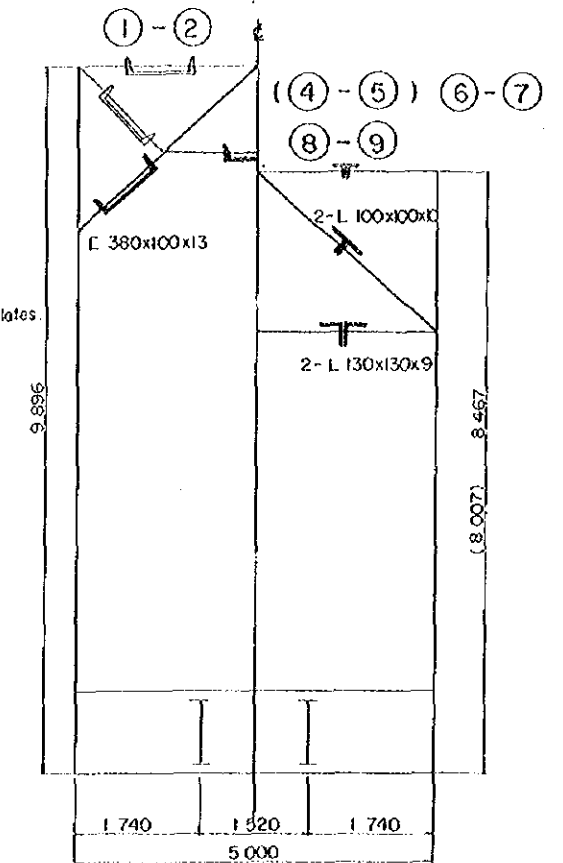
UPPER LATERAL



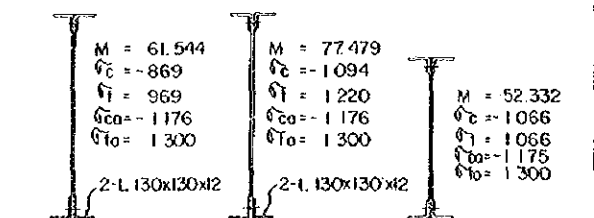
MAIN TRUSS



PORTAL BRACING SWAY BRACING



END FLOOR INT. FLOOR STRINGER



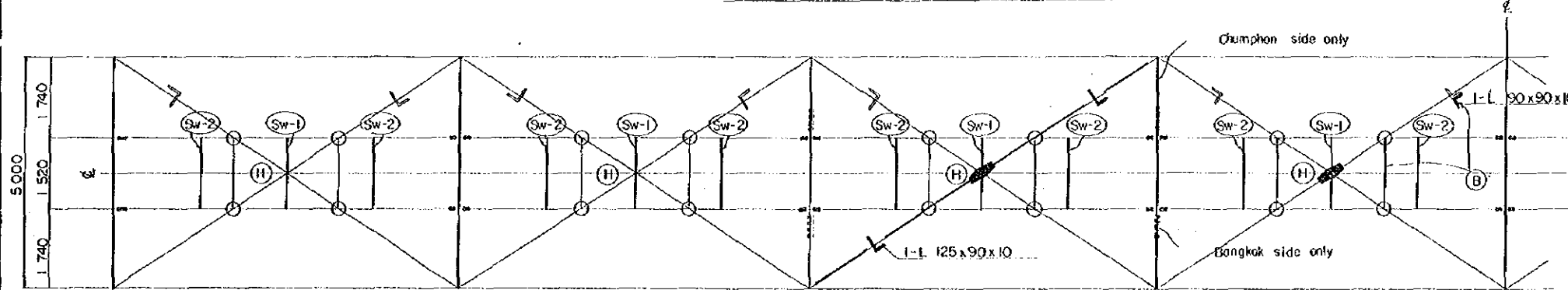
General Note:

- Weak drawings show the original members.
- Deep drawings show the members to be improved.
- Actual stresses are based on DL-15 loading.

3. Marks

M : Bending moment (t.m) $\frac{1}{r}$: Slenderness ratio
 N : Axial force (t) σ : Actual stress (kg/cm²)
 l : Length of member (cm) σ_0 : Allowable stress (kg/cm²)
 σ_x, σ_y : Radius of gyration of sectional area
 for x or y axis. (cm)

FLOOR SYSTEM & LOWER LATERAL



Legends :

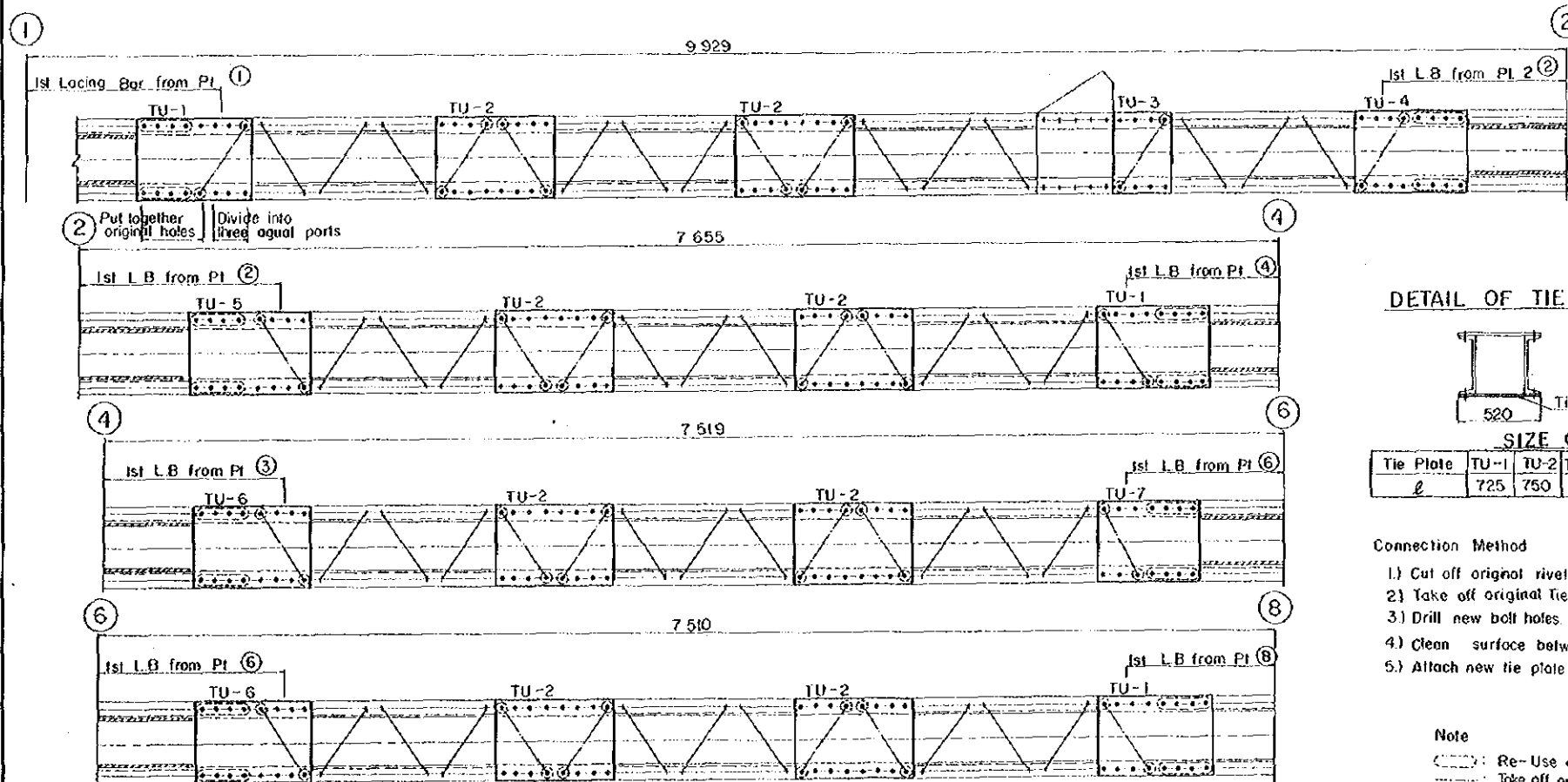
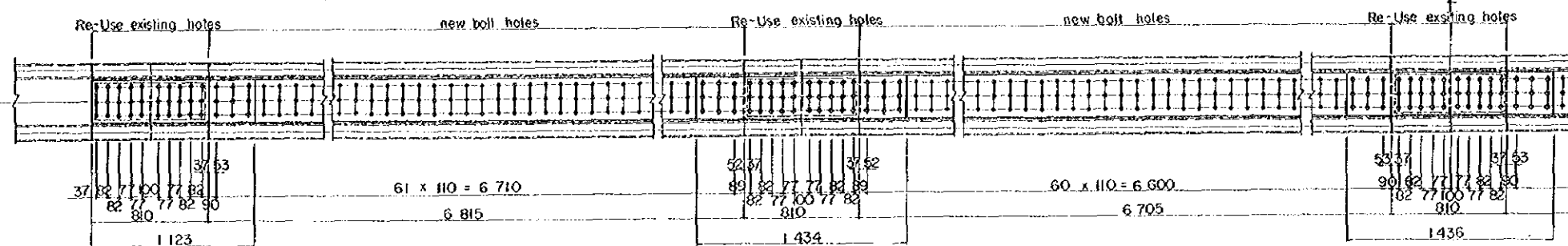
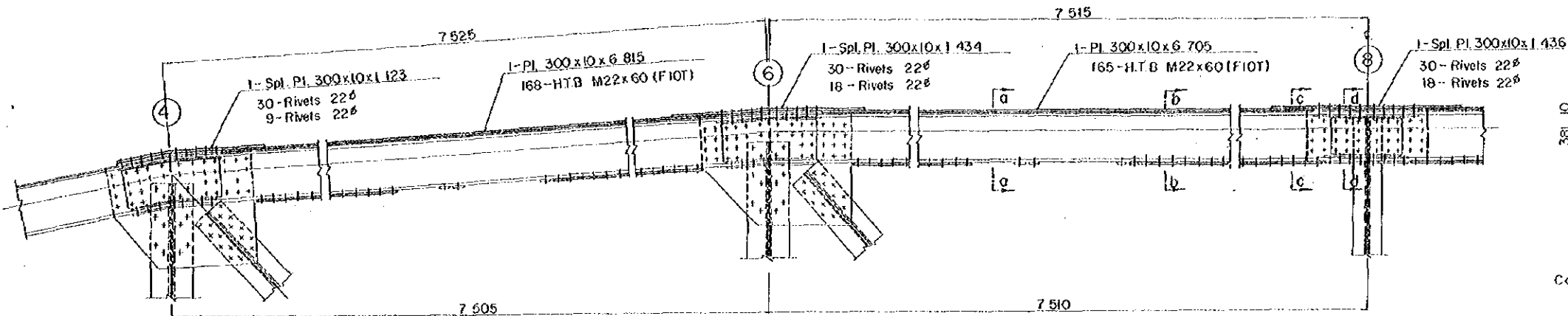
- Excessive stressed rivets to be strengthened.
- Gusset plates to be improved.
- Floor beam to be repaired.
- Defective hanger to be removed.
- Hanger to be added.
- New brack truss to be added.
- New sway bracing of stringer to be added.

THE STATE RAILWAY OF THAILAND

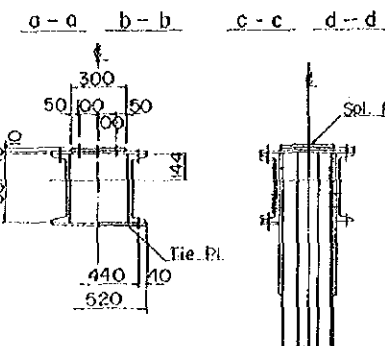
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	GENERAL DIAGRAM	DL-15 loading
60.05 T.T			Unif. Scale
K. M.	930 + 931		mm
DISTRICT	Hot Yoi	Designed by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

MAIN TRUSS (NO.1)

UPPER CHORD MEMBER S=1/20



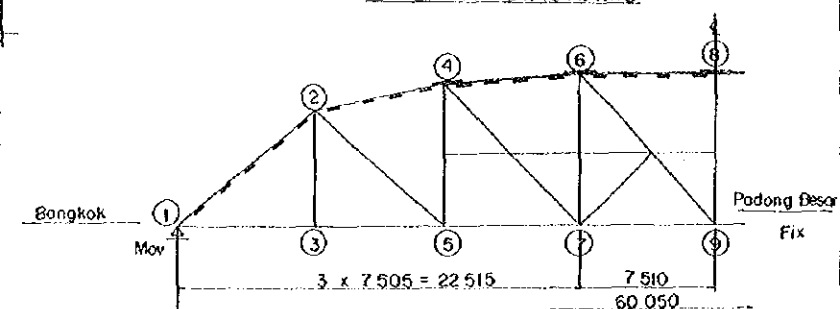
DETAIL S=1/20



Construction Method

- 1) Drill new bolt holes.
- 2) Clean surface between original and additional members.
- 3) Add new members and tighten HT.Bolts.
- 4) Cut off rivets of original splice plate.
- 5) Add new splice plate and tighten HT.Bolts.

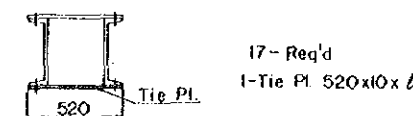
MARKING DIAGRAMS



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 (φ) (FIOT), and assumed frictional coefficient of contact surface (f) as follows.
i) for connection $f \geq 0.4$
ii) for stitch $f \geq 0.3$
- 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.

DETAIL OF TIE PLATE S=1/20



SIZE OF TIE PLATE

Tie Plate	TU-1	TU-2	TU-3	TU-4	TU-5	TU-6	TU-7
l	725	750	365	716	770	740	650

Connection Method

- 1) Cut off original rivets.
- 2) Take off original Tie Plates & Lacing Bar.
- 3) Drill new bolt holes.
- 4) Clean surface between original members and additional plates.
- 5) Attach new tie plate and tighten HT.Bolts.

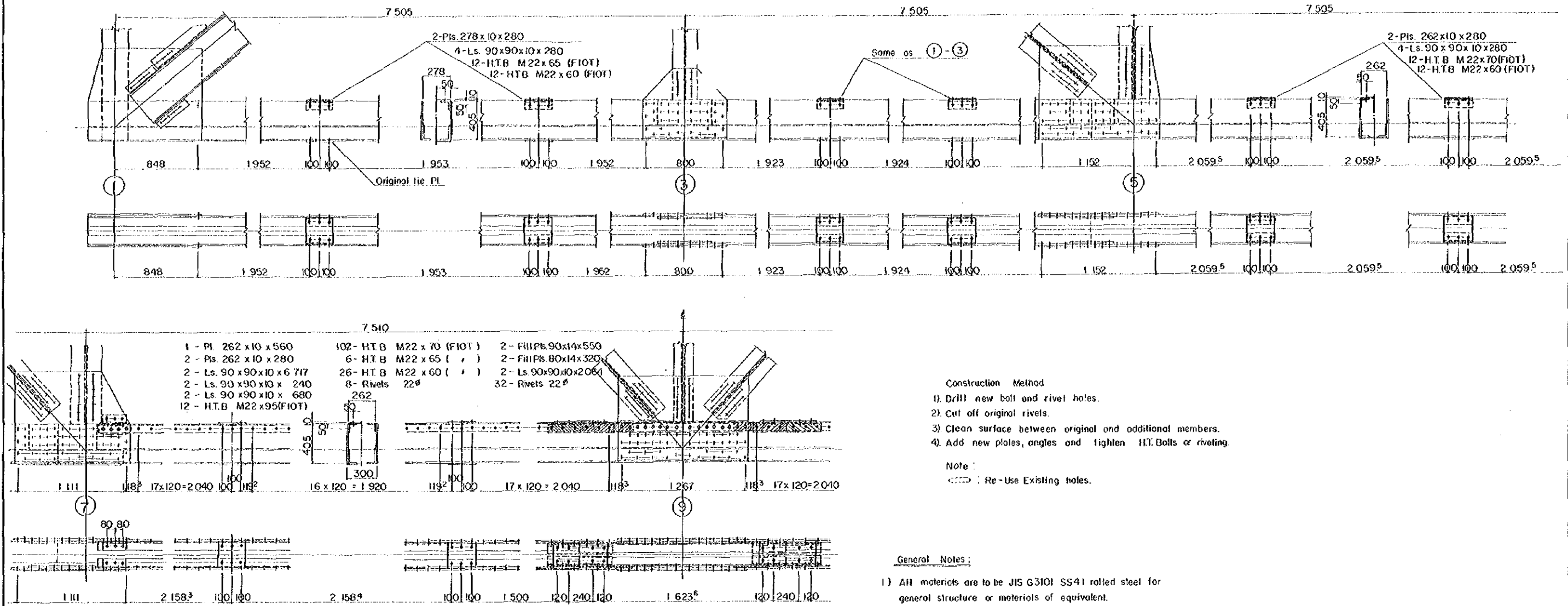
Note

- (---) : Re-Use existing holes
- (---) : Take off original Lacing Bar.

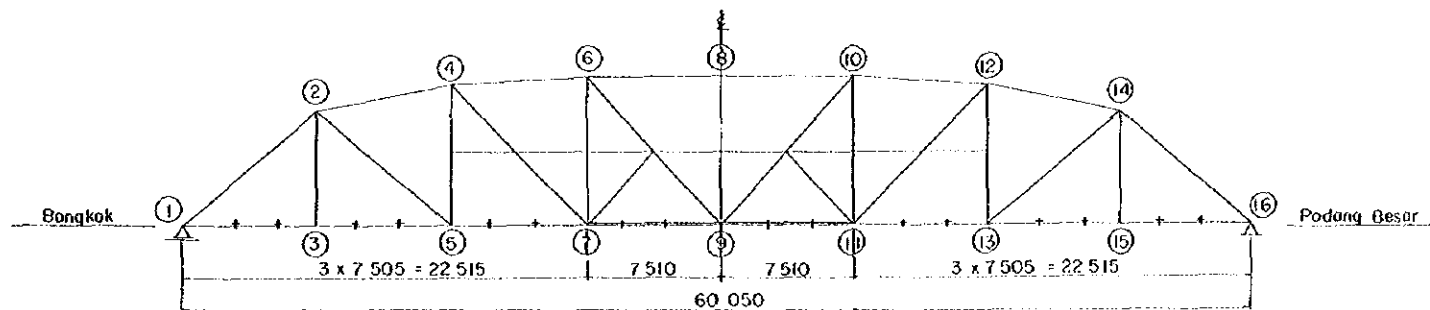
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO.1)	
600 T.T	930 + 931	DL 15 loading	Scale
K.M.	Hot Yai	Unit	mm
DISTRICT	Southern line	Scale	1/20
LINE		Designed by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO	

MAIN TRUSS (NO.2)
LOWER CHORD MEMBER $S = 1/20$



MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type 600 T.T	Members	MAIN TRUSS (NO.2)	DL Unit mm	15 loading Scale 1/20
K. M	930 + 931			
DISTRICT	Hol Yoi	Designed by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO		

DIAGONAL MEMBER $s = 1/20$



- 1.) New members are built up by welding.
- 2.) Clean surface between new gusset plates and original members.
- 3.) Drill new bolt holes.
- 4.) Attach new gusset plates.
- 5.) Attach new members.

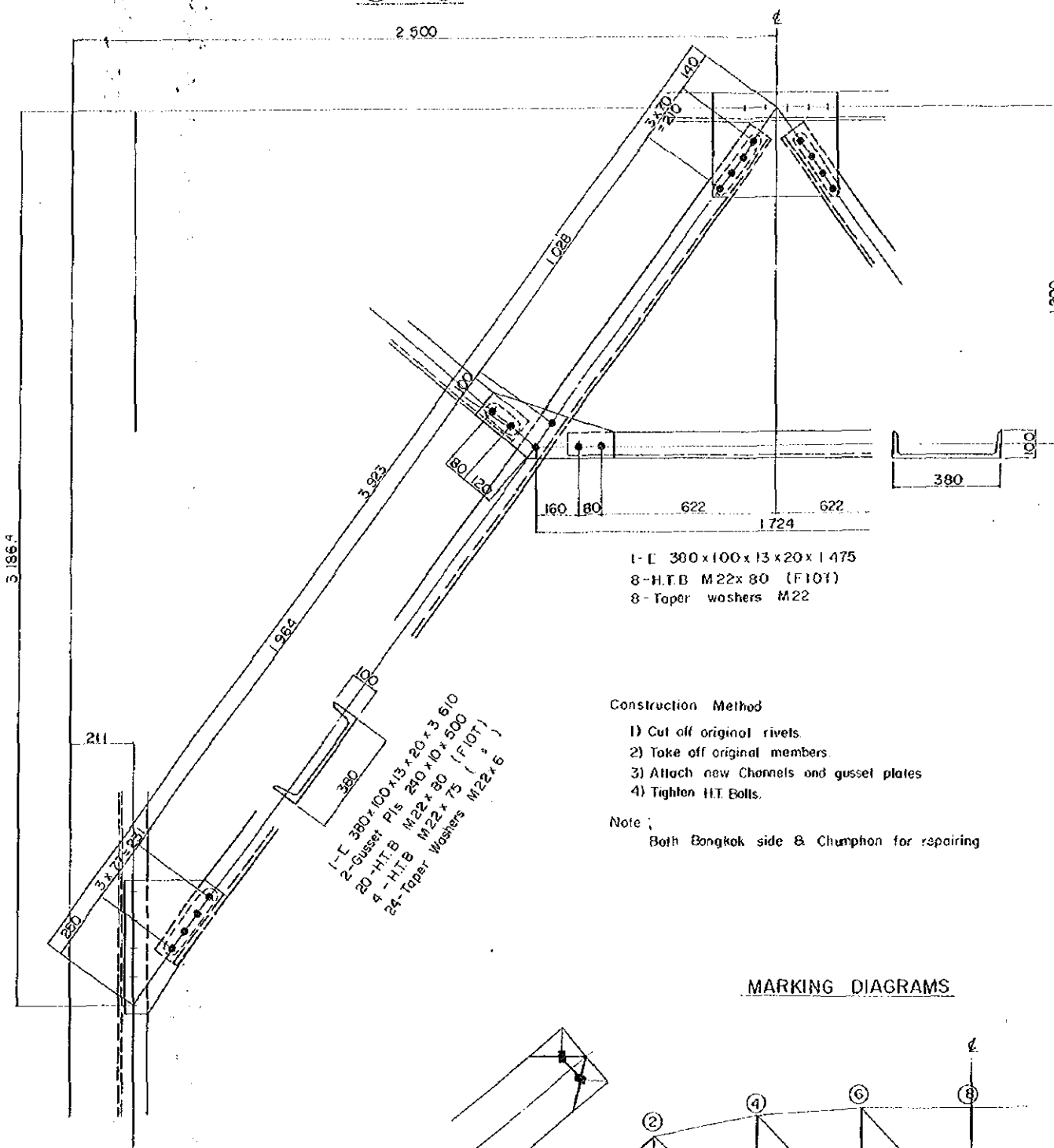
General Notes :

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

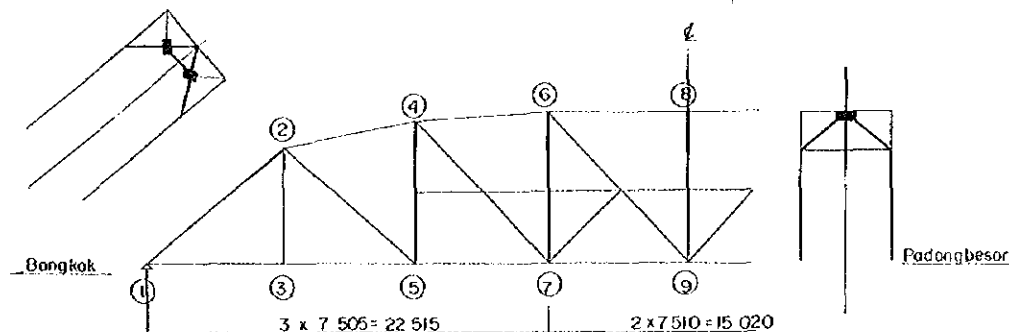
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.3)	DL 15 loading	
600 T.T			Unit mm	Scale 1/20
K. M	930 + 931		Designed by _____	
DISTRICT	Hot Yoi		Checked by _____	
LINE	Southern Line		Checked by _____	
Remarks			Checked by _____	
			Checked by _____	
			Checked by _____	
			Checked by _____	
DATE		DRAWING NO.		

PORTAL BRACING $S = 1/10$

① - ②



MARKING DIAGRAMS



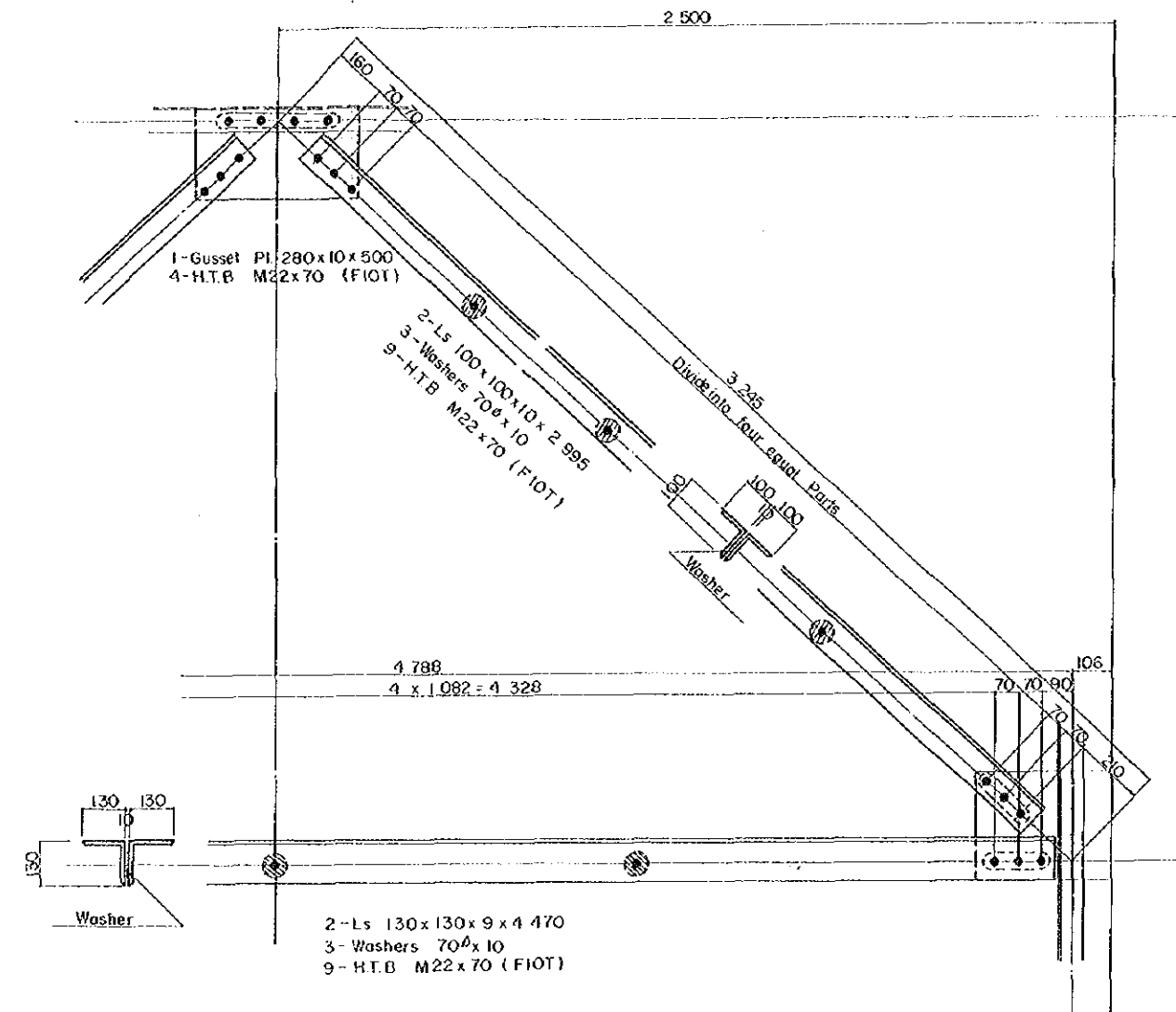
Note

Re- Use existing holes

MAIN TRUSS (NO.4)

SWAY BRACING $S = 1/10$

④ - ⑤ ⑥ - ⑦ ⑧ - ⑨



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 ≥ 0.4
 - ii) for splice ≥ 0.3
- 3) All dimensions to be checked in the field

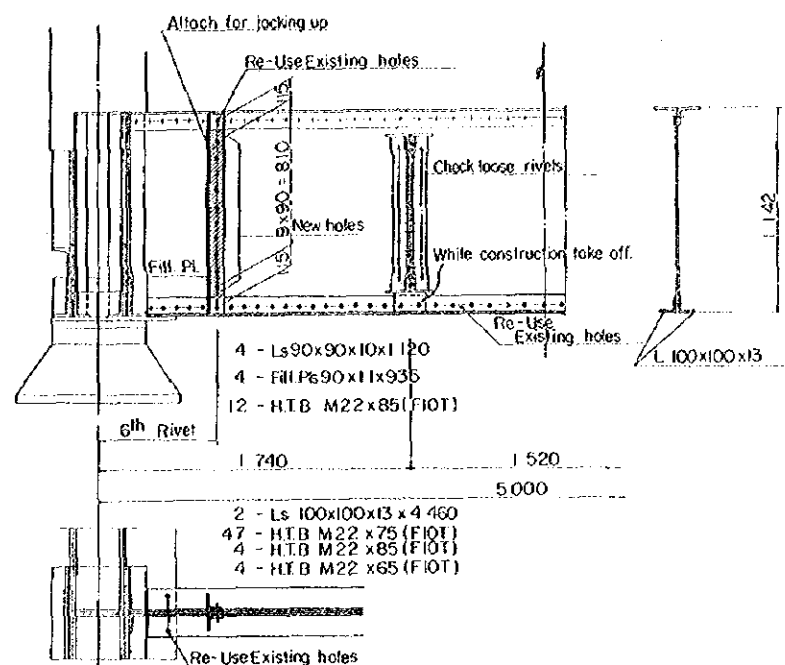
THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	DL 15 loading	Scale
6005 T.T.	MAIN TRUSS (NO.4)	Unit mm	1/10
K.M	930 + 931	Designed by	
DISTRICT	Hoi Yoi	Checked by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
DATE		DRAWING NO.	

FLOOR SYSTEM

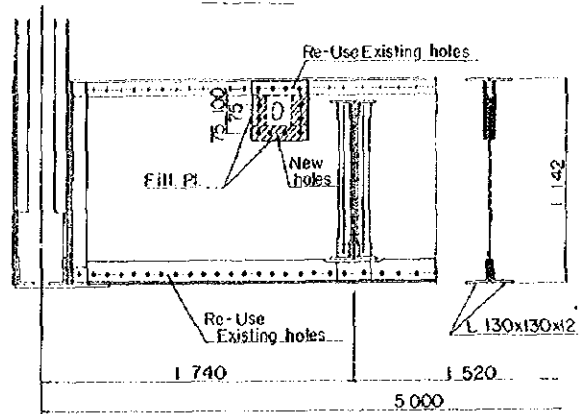
FLOOR BEAM $S = 1/20$

E. F.



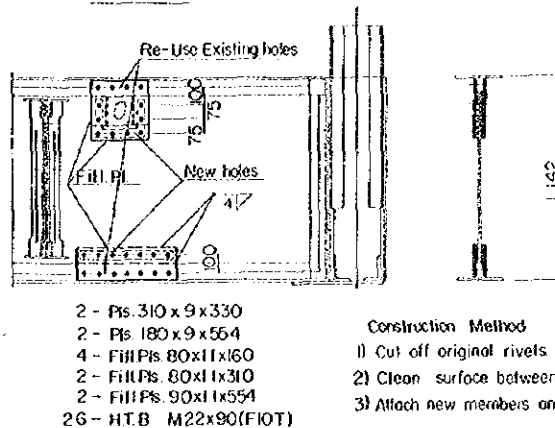
- 1) Drill new bolt holes.
- 2) Cut off original rivets at lower flange angles.
- 3) Take off original members.
- 4) Clean surface between original surface and new flange.
- 5) Attach new angles, and tighten (lower and jack) HT Bolts.

IF - I



- | | |
|---------------------------|------------------------|
| 2 - Ls.130x130x12 x 4 477 | 2 - Pts.310x9x330 |
| 49 - HTB M22 x75 (FIOT) | 4- FilP's 80 xl 1x160 |
| 4 - HTB M22x85 (FIOT) | 2- FilP's 80 xl 1x310 |
| 4 - HTB M22 x65 (FIOT) | 12- HTB M22 x90 (FIOT) |

IF - 2



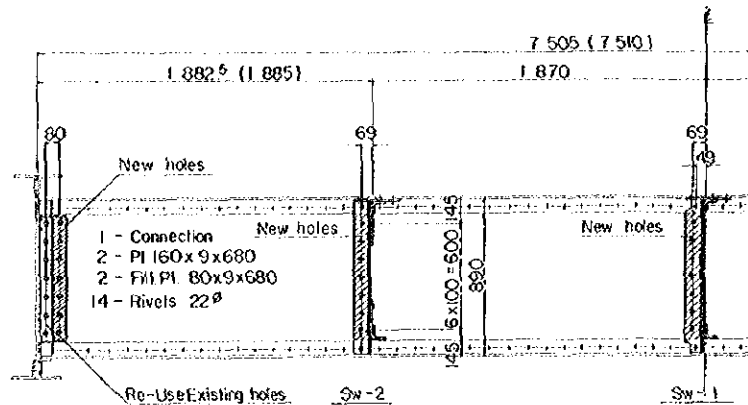
- 2 - PIs. 310 x 9 x 330
2 - PIs. 180 x 9 x 564
4 - Fill PIs. 80 x 11 x 160
2 - Fill PIs. 80 x 11 x 310
2 - Fill PIs. 90 x 11 x 554
26 - HTB M22 x 90 (FIOT)

Construction Method

- 1) Cut off original rivets.
- 2) Clean surface between original and additional plates.
- 3) Attach new members and tighten H.T Bolts.

STRINGER S-1/20

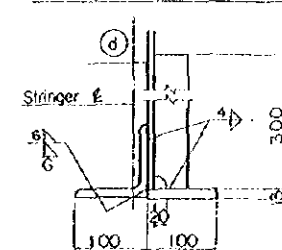
S = 1/20



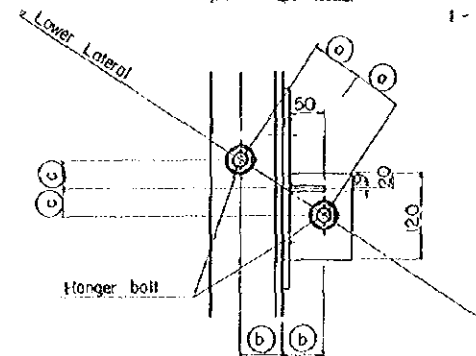
Construction Method

- 1) Drill new bolt holes.
- 2) Cut off original rivets.
- 3) Attach new splice plates and new angles by riveting.
- 4) Strengthen sway bracings of stringer.

DETAIL A-A S=1/5

 $s = 1/5$ 

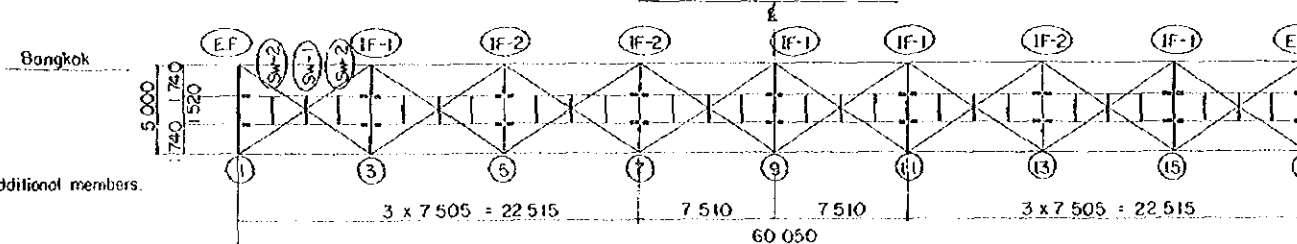
- 1 - Pl. 100 x 13 x 120
1 - Pl. 50 x 9 x 300



	(1) - (3)	(3) - (5)	(5) - (7)	(7) - (9)
(a)	83.7	83.7	70	70
(b)	70.0	70.0	58.5	58.5
(c)	45.9	45.9	38.4	38.4
(d)	26.0	36.3	—	—

Note : * : Strengthening of connection.

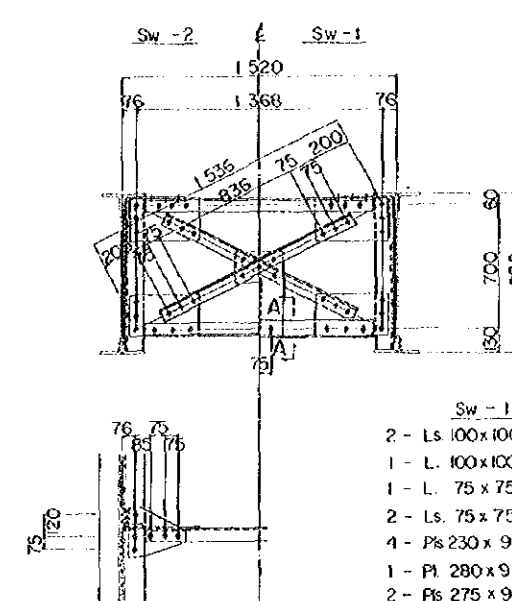
MARKING DIAGRAMS



Construction Method

- 1) Cut off original rivets.
- 2) Take off original members.
- 3) Clean surface between original and additional members.
- 4) Attach new angles.
- 5) Tighten H.T. Bolts.

SWAY BRACING OF STRINGER



- | <u>Sw - 1</u> | <u>Sw - 2</u> |
|--------------------------|--------------------------|
| 2 - Ls. 100x100x10x855 | 2 - Ls. 100x100x10x855 |
| 1 - L. 100x100x10x1268 | 2 - Ls. 75x75x9x1268 |
| 1 - L. 75x75x9x1268 | 2 - Ls. 75x75x9x1206 |
| 2 - Ls. 75x75x9x1206 | 4 - Pls. 230x9x400 |
| 4 - Pls. 230x9x400 | 1 - Pl. 180x9x280 |
| 1 - Pl. 280x9x470 | 2 - Pls. 275x9x315 |
| 2 - Pls. 275x9x315 | 2 - Fill Pls. 100x11x680 |
| 2 - Fill Pls. 100x11x680 | |

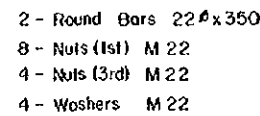
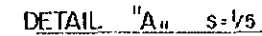
General Notes:

- 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 (Φ22), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22[#] (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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members		FLOOR SYSTEM	DL 15 loading
60.0 T.T				Unit Scale
				mm 1/20, 1/5
K.M	930 + 931			
DISTRICT	Hat Yai		Designed by	
LINE	Southern Line		Checked by	
Remarks			Checked by	
			Checked by	
			Checked by	
			Checked by	
DATE			DRAWING NO.	

$$S = 1/20$$

LOWER LATERAL



- 1) All materials are to be JIS G3101 S541 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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22 ϕ (F4), and to be rolled steel for SV 34 (JIS G 3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

Note :

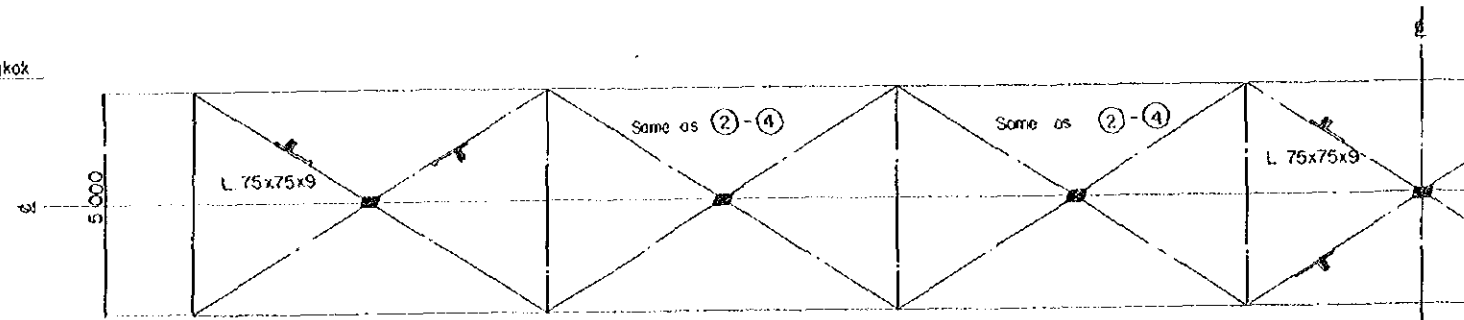
-
- Upper Lateral Bracing
- at the original holes or stringers.
- Lower Lateral Bracing
- Gangkok
- Padang Basor

- 60 -

GENERAL DIAGRAM

UPPER LATERAL

Bangkok



Cumpton

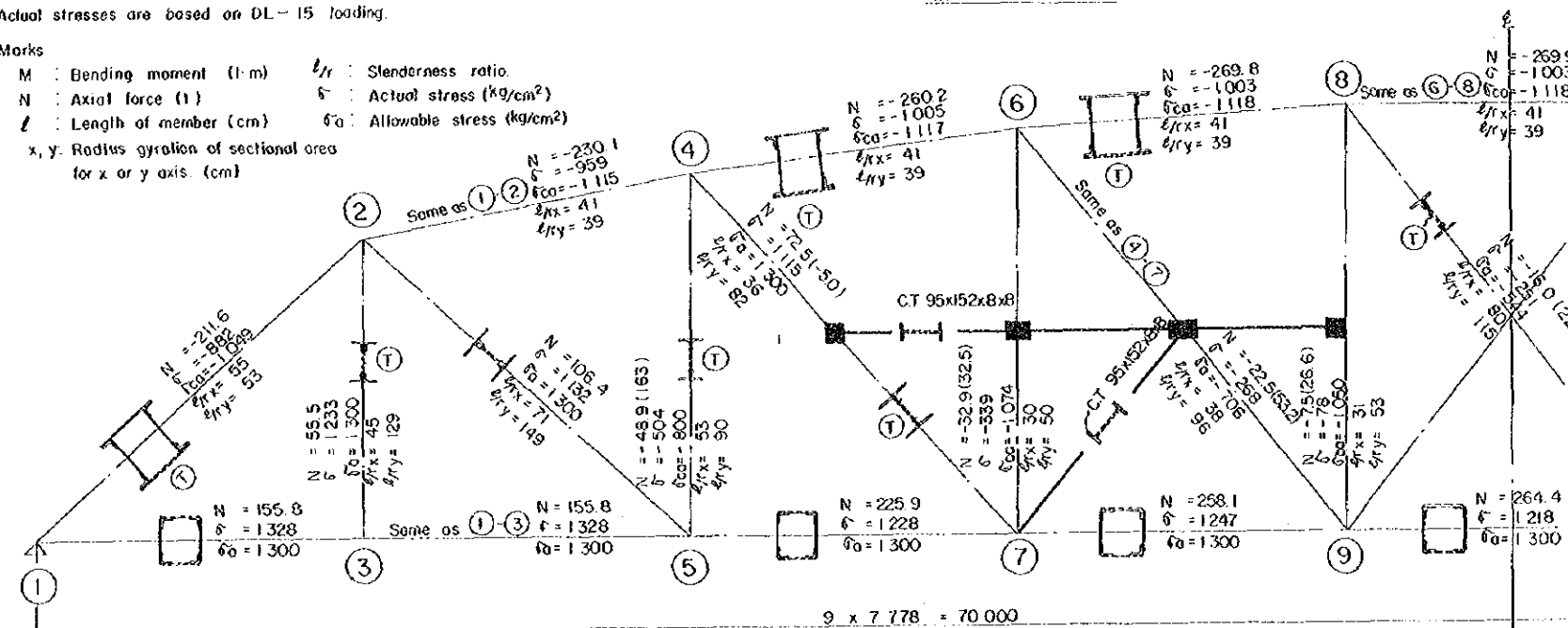
Notes ;
1) $\blacklozenge$: Strengthen Guss. Plate

General Notes ;

- Weak drawings show the original members.
Deep drawings show the members to be improved.
- Actual stresses are based on DL-15 loading.
- Marks

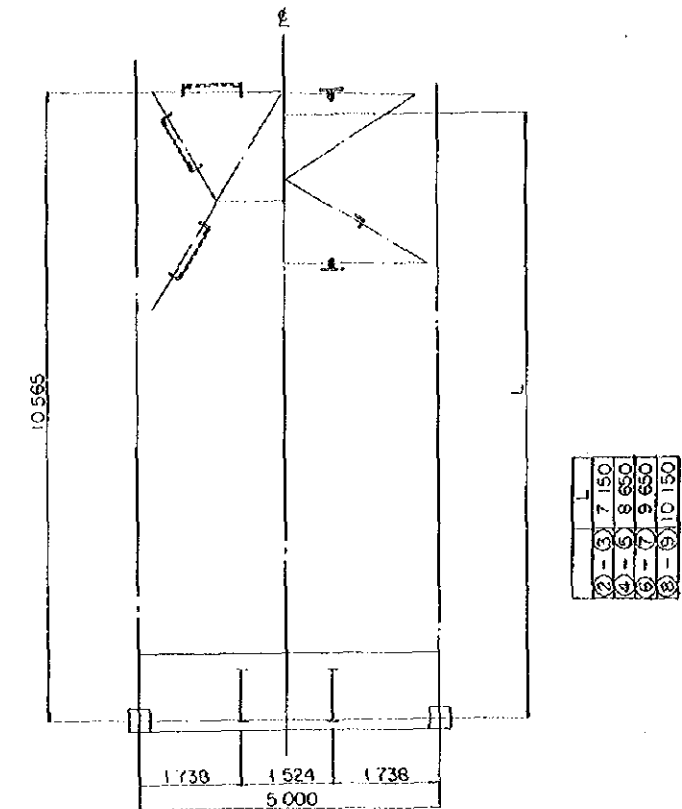
M : Bending moment (t-m) l/r : Slenderness ratio.
N : Axial force (t) σ : Actual stress (kg/cm²)
L : Length of member (cm) σ_a : Allowable stress (kg/cm²)
x, y : Radius gyration of sectional area
for x or y axis. (cm)

MAIN TRUSS



Notes ;
1) (T) : Strengthen Tie Plate
2) $\blacksquare$: Attach Guss. Plate.

PORTAL BRACING SWAY BRACING



END FLOOR

M = 62.3
 $\sigma_c = -793$
 $\sigma_t = 897$
 $\sigma_{ca} = -1178$
 $\sigma_{ta} = 1300$

INT. FLOOR

M = 79.8
 $\sigma_c = -1015$
 $\sigma_t = 1148$
 $\sigma_{ca} = -1178$
 $\sigma_{ta} = 1300$

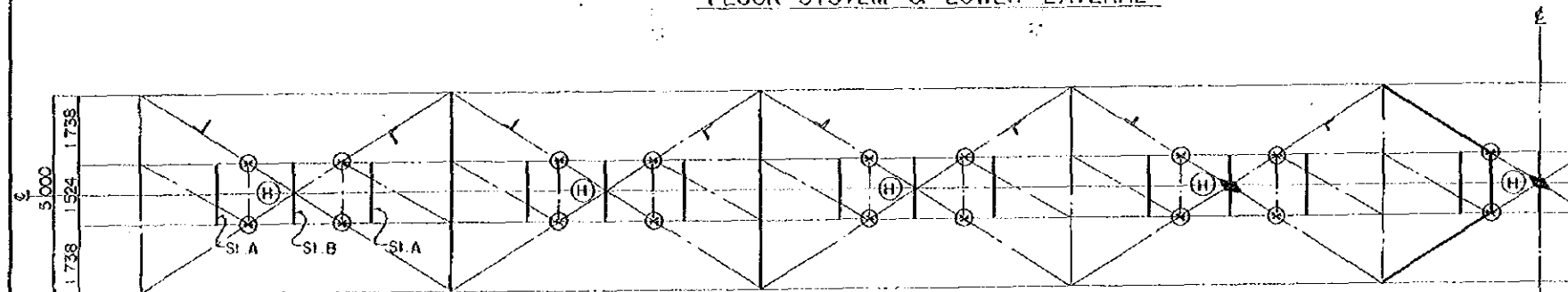
INT. FLOOR

M = 55.4
 $\sigma_c = -820$
 $\sigma_t = 926$
 $\sigma_{ca} = -769$
 $\sigma_{ta} = 1300$

STRINGER

M = 55.4
 $\sigma_c = -820$
 $\sigma_t = 926$
 $\sigma_{ca} = -769$
 $\sigma_{ta} = 1300$

FLOOR SYSTEM & LOWER LATERAL



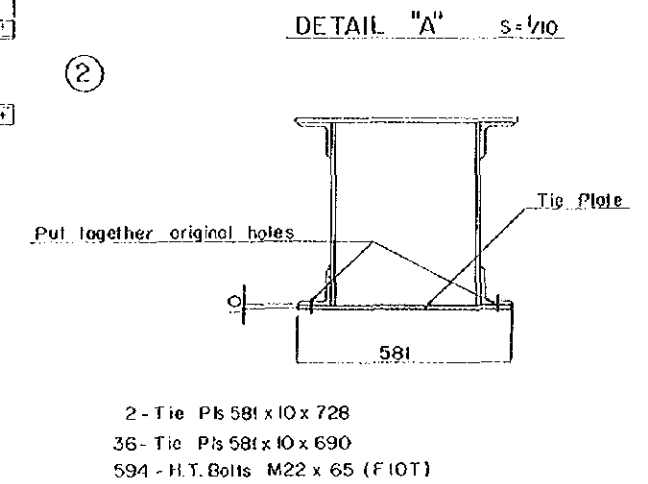
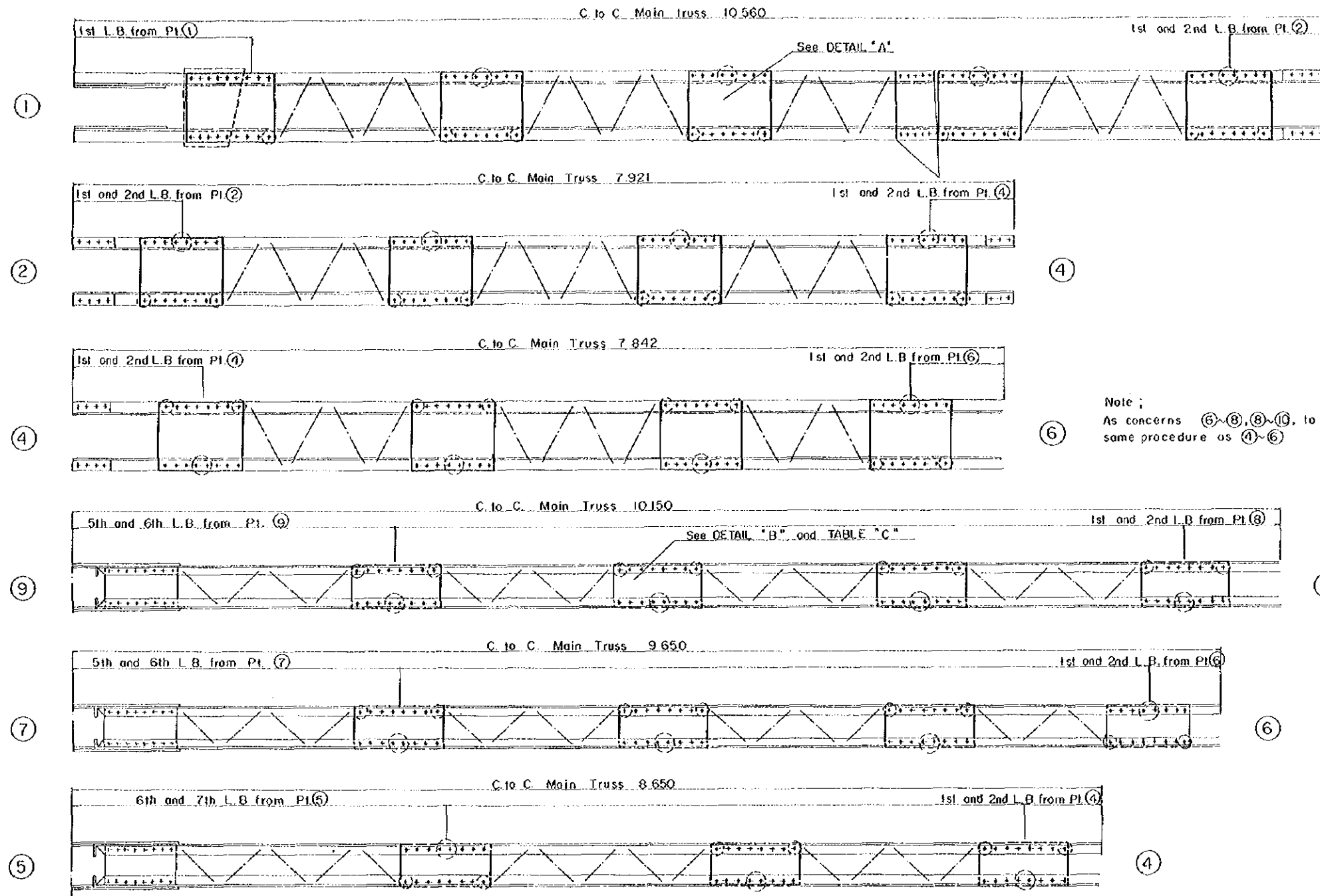
Legends ;

- $\blacklozenge$: Gusset plates to be improved.
- (H) : Hanger to be added.
- (X) : Defective hanger to be removed.
- St A, St B : New struts to be added.

THE STATE RAILWAY OF THAILAND

DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	DL-15 loading	
700T.T	GENERAL DIAGRAM	Unit	Scale
K.M	297 + 063		
DISTRICT	Yolo	Designed by	
LINE	Southern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

MAIN TRUSS (NO. 1) S=1/20



Note:
As concerns (6)~(8), (8)~(10), to do the same procedure as (4)~(6)

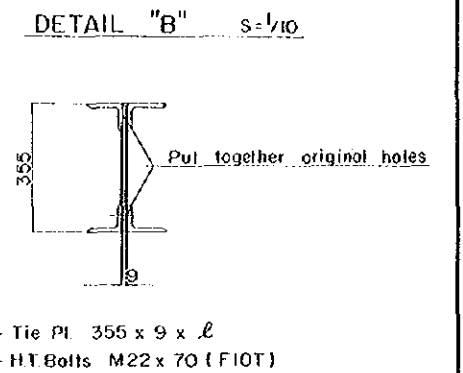
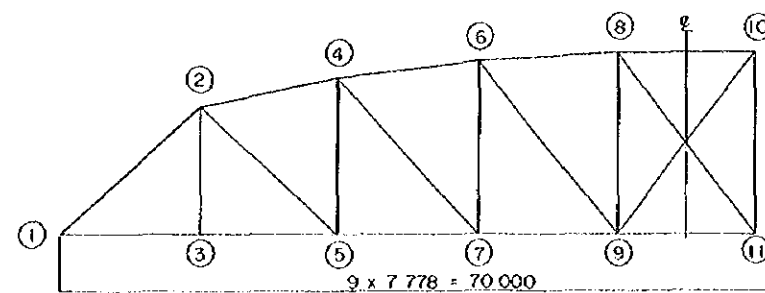


TABLE "C"			
Pl.	(9)~(8)	(7)~(6)	(5)~(4)
ℓ	728	734	740
Number	4	4	3

Note: Re-Use existing holes

MARKING DIAGRAM

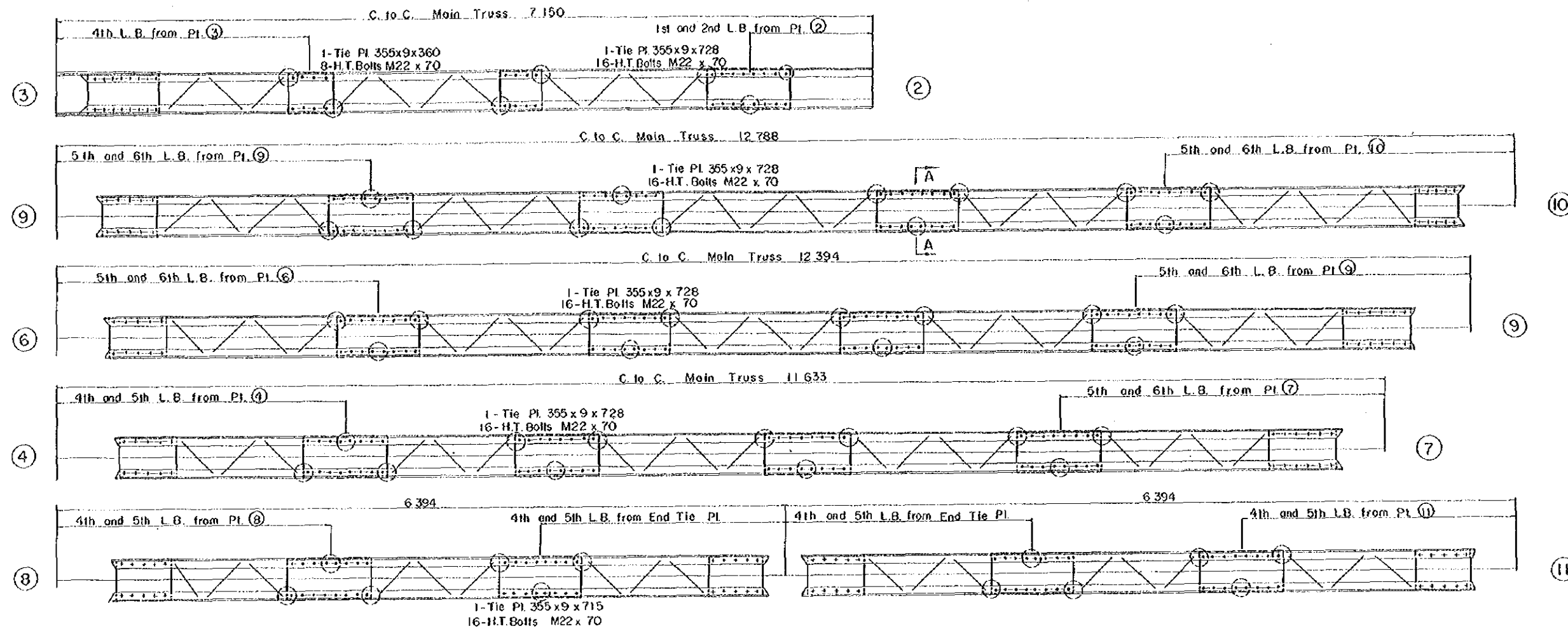


General Notes:

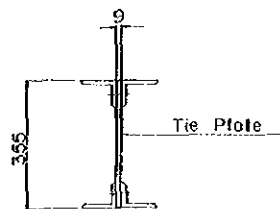
- All materials are to be JIS G3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be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

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO. 1)	DL 15 leading Scale Unit mm 1/20, 1/10
70.0 T.T	K.M.	297 + 063	Designed by
	DISTRICT	Hua Hin	Checked by
	LINE	Southern Line	Checked by
Remarks			Checked by
			Checked by
			Checked by
DATE		DRAWING NO.	

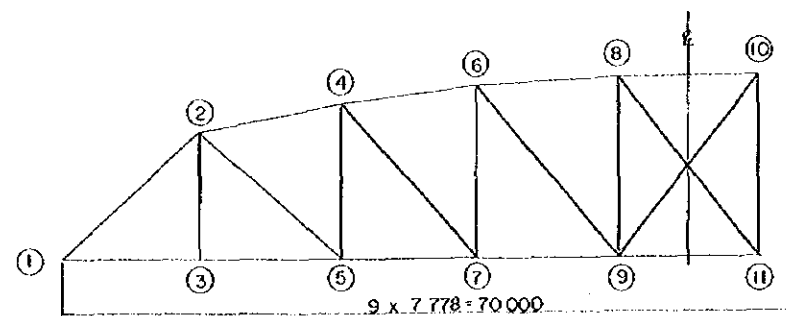
MAIN TRUSS (NO. 2) $S=1/20$



SECTION A - A $S=1/10$



MARKING DIAGRAMS



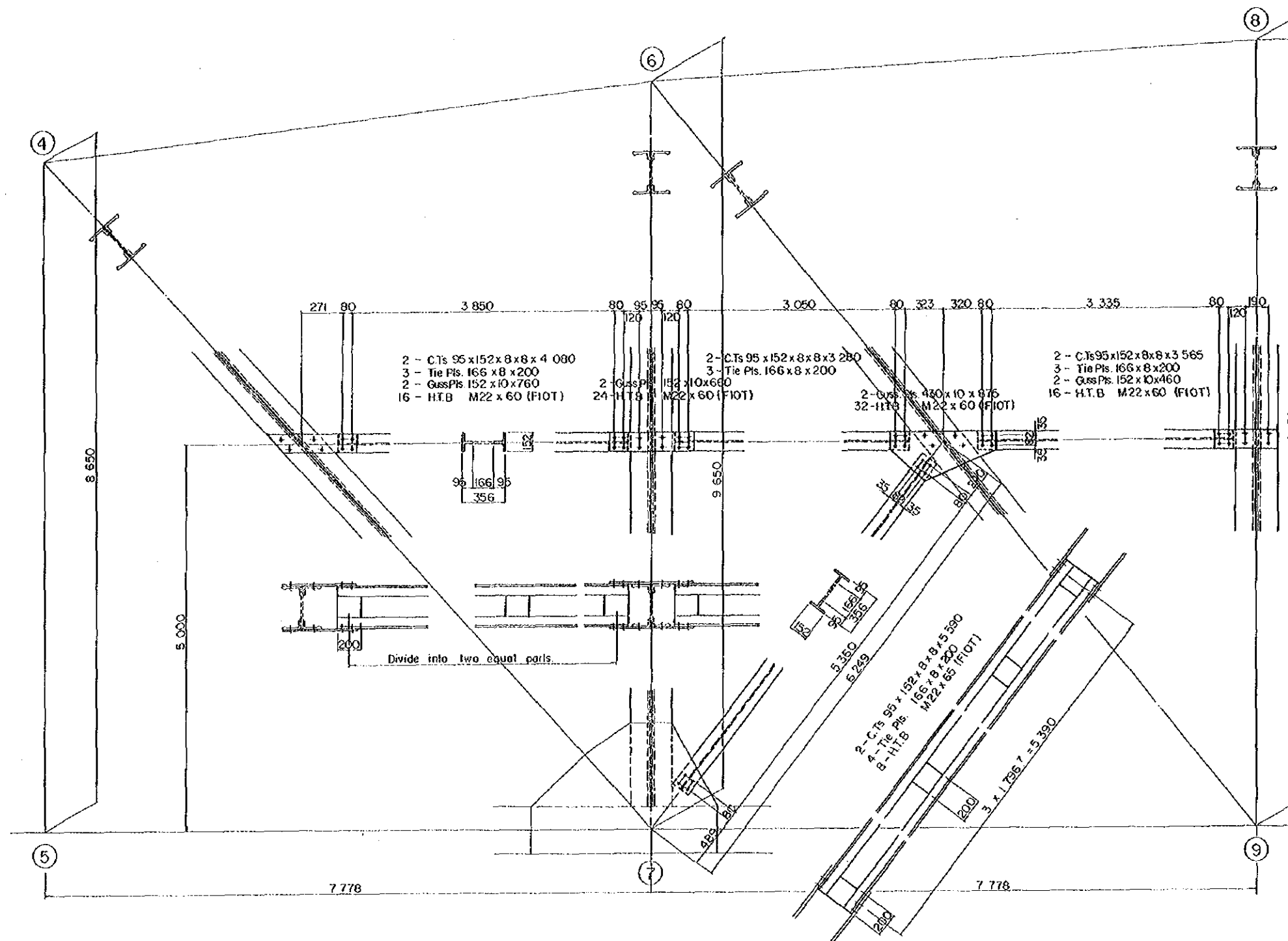
General Notes:

- 1) All materials are to be JIS G 3101 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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

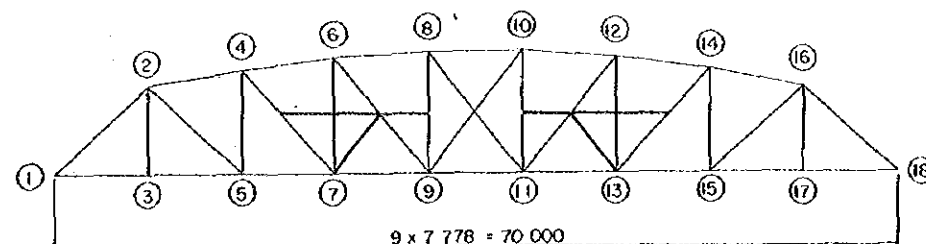
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members MAIN TRUSS (NO. 2)		PL 15 loading	
700 T.T			Unit	Scale
			mm	1/20, 1/10
K. M.	297 +063	Designed by		
DISTRICT	Hua Hin	Checked by		
LINE	Southern Line	Checked by		
Remarks			Checked by	
			Checked by	
			Checked by	
DATE			DRAWING NO.	

MAIN TRUSS (NO. 3)

DIAGONAL MEMBER $s=1/30, 1/20$



MARKING DIAGRAMS



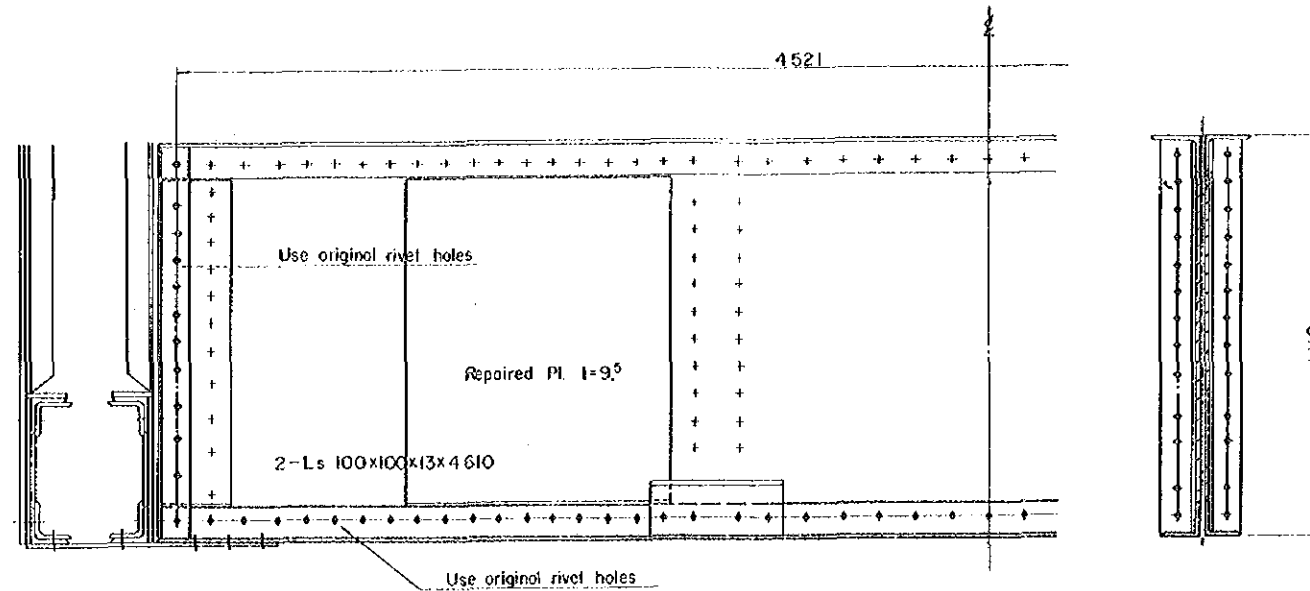
General Notes:

- All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (Φ22) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be checked in the field.

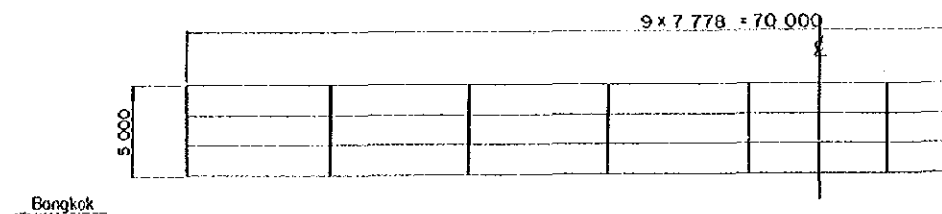
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO. 3)	Unit	Scale
70.0 T			mm	1/30, 1/20
K. M	297 + 063	Designed by		
DISTRICT	Hue Hin	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

REPAIRING OF FLOOR BEAM S-1/10

REPAIRING LOWER FLANGE



MARKING DIAGRAMS



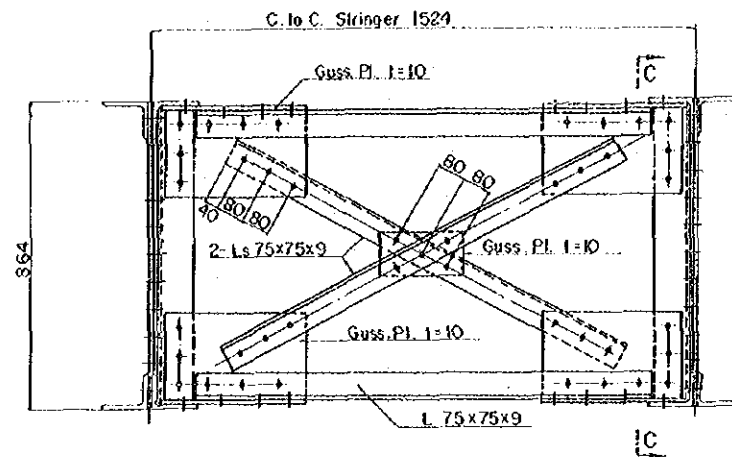
General Notes:

- 1) All materials are to be JIS G3101 SS 41 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 $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All rivets are 22 ϕ (ϕ), and to be rolled steel for SV 34 (JIS G3104) or materials of equivalent.
- 3) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	REPAIRING OF FLOOR BEAM		DL 15 Loading
700 T.T		Unit	Scale	
		mm	1/10	
K. M.	297 + 063	Designed by		
DISTRICT	Hua Hin	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

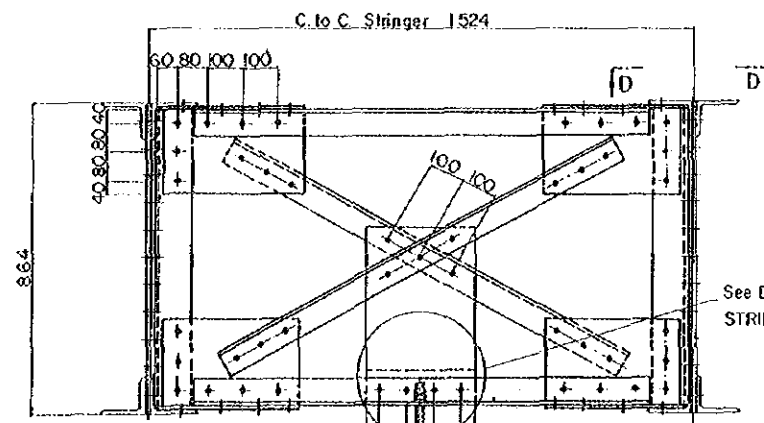
STRENGTHENING OF SWAY BRACING OF STRINGERS $s=1/10$

SECTION A



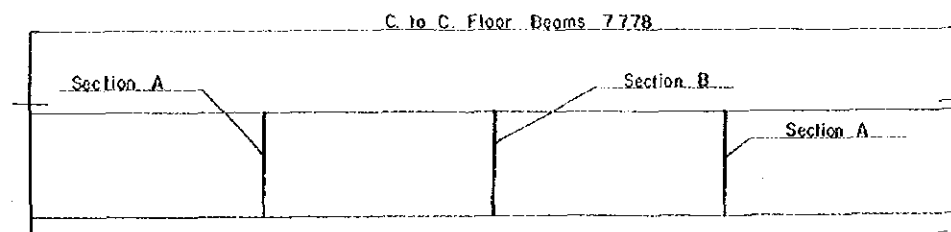
- 4 - Guss. Pls. 240x10x370
- 4 - Guss. Pls. 280x10x380
- 1 - Guss. Pl. 240x10x120
- 2 - Ls 100x100x10x840
- 2 - Ls 75x75x9x1270
- 2 - Ls 75x75x9x1290
- 2 - Fill. Pls. 100x11x650
- 40 - H.T. Bolts M22x60
- 24 - H.T. Bolts M22x65
- 18 - H.T. Bolts M22x75
- 4 - Rivets 22 ϕ x80
- 1 - H.T. Bolts M22x70

SECTION B



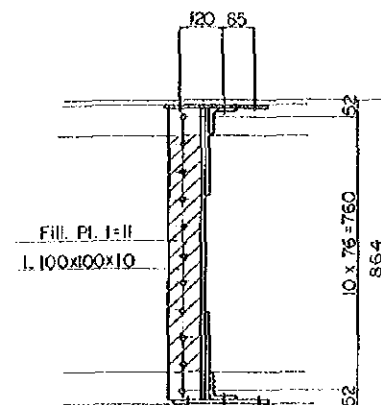
- 4 - Guss. Pls. 240x10x370
- 4 - Guss. Pls. 280x10x380
- 1 - Guss. Pl. 305x10x500
- 2 - Ls 100x100x10x840
- 2 - Ls 75x75x9x1270
- 2 - Ls 75x75x9x1290
- 2 - Fill. Pls. 100x11x650
- 40 - H.T. Bolts M22x60
- 24 - H.T. Bolts M22x65
- 5 - H.T. Bolts M22x70
- 18 - H.T. Bolts M22x75
- 4 - Rivets 22 ϕ

MARKING DIAGRAM

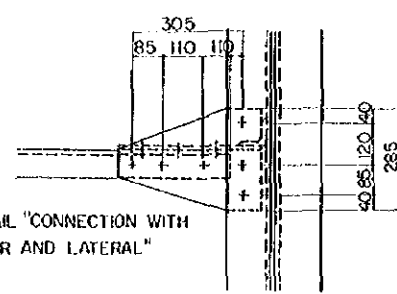


- Notes:
- Struts down by Section A are set up at the point which divide into 4.
 - Struts down by Section B is set up at the point which is settled by Hanger A.

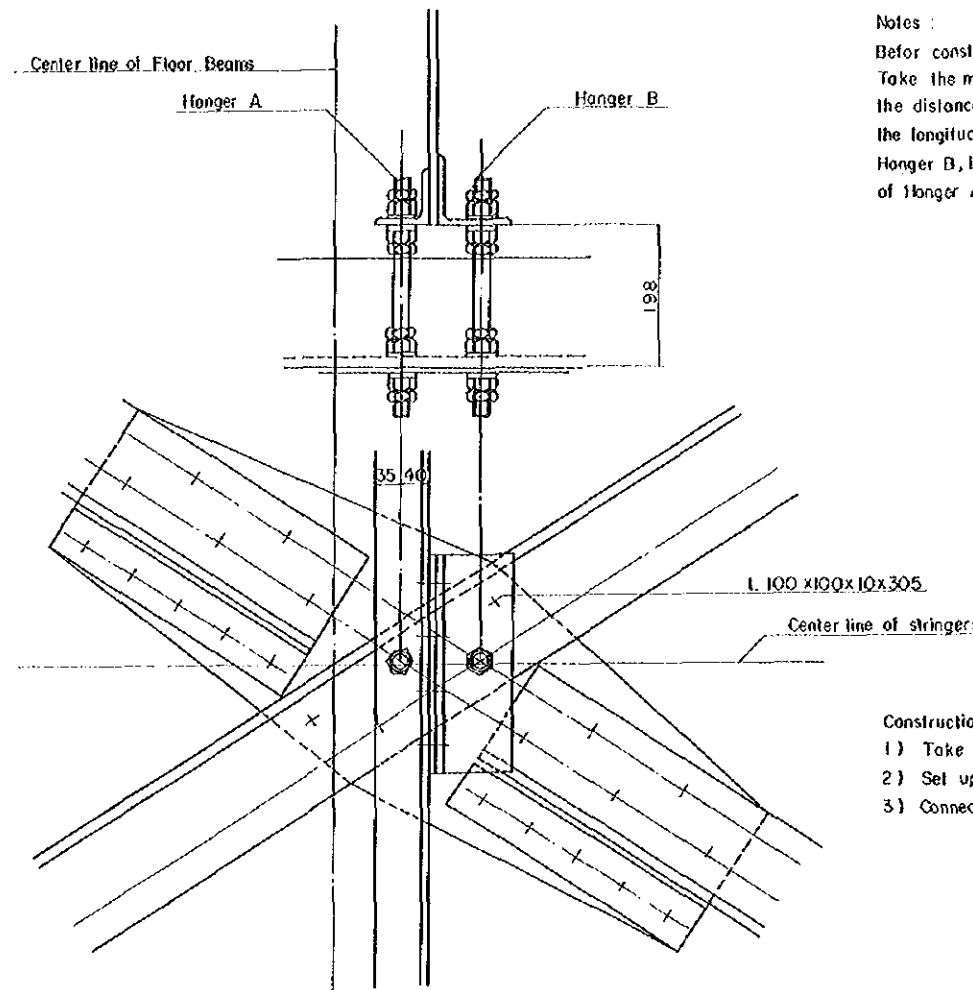
SECTION C -- C



SECTION D -- D



DETAIL "CONNECTION WITH STRINGER & LATERAL" $s=1/5$



- Notes:
- Before construction, we need certain values.
 - Take the measure of three kind values, such as, the distance of Floor Beam from Hanger A, L_A , the longitudinal distance of Hanger A from Hanger B, L_x , and the transversal distance of Hanger A from Hanger B, L_y .

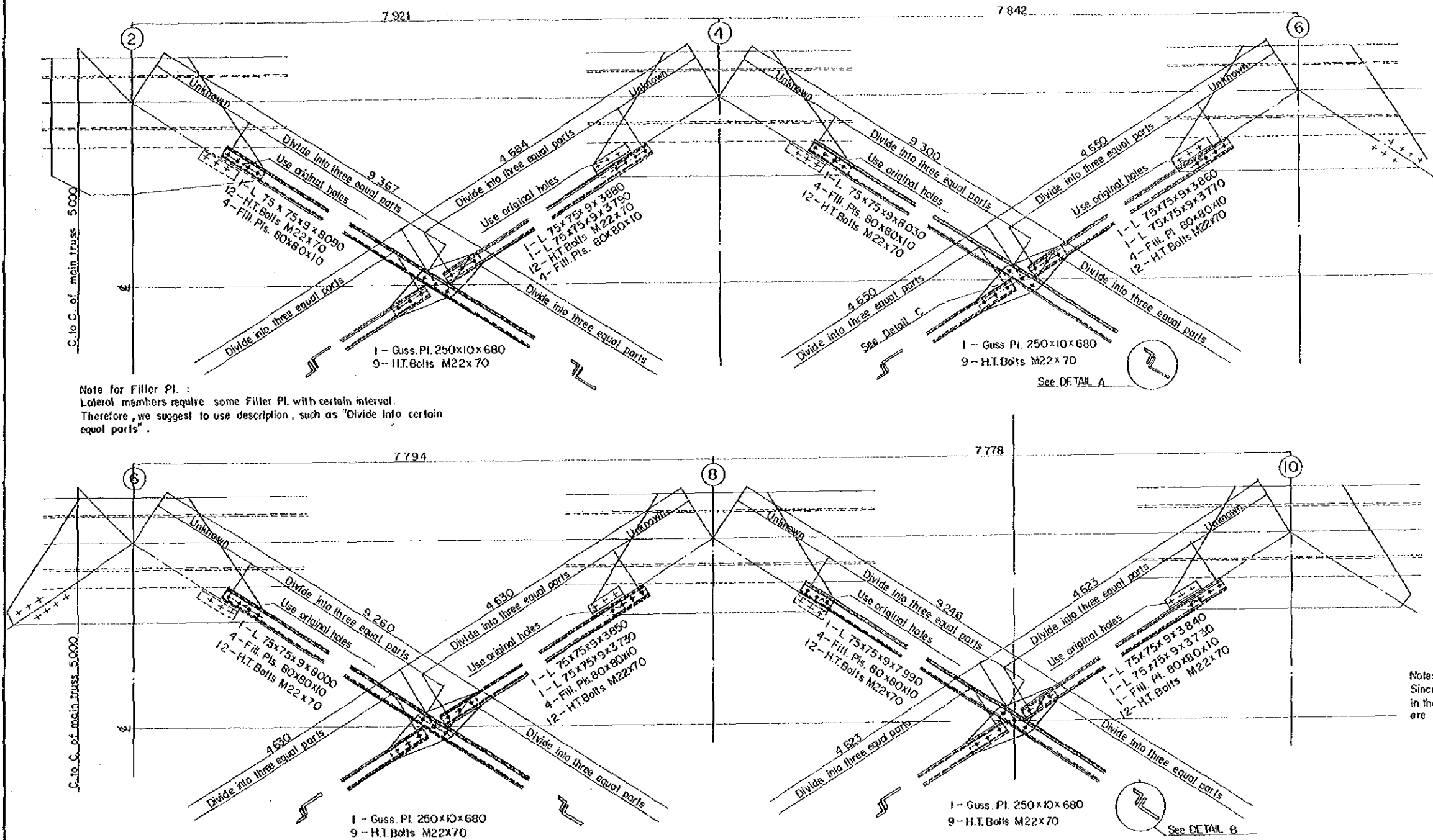
- Construction Method:
- 1) Take off Stringer Bracing.
 - 2) Set up new Strut Bracing at settled place.
 - 3) Connect with Strut Bracing and Lower Lateral.

General Notes:

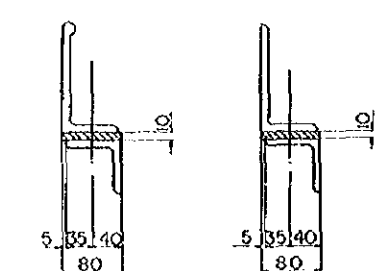
- 1) All materials are to be JIS G 3101 (SS4) rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B.) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - 1) for connection $\mu=0.4$
 - 2) for stitch $\mu=0.3$
- 3) All rivets are 22 ϕ (F), and to be rolled steel SV34 (JIS G 3104) or materials of equivalent.
- 4) All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	STRENGTHENING OF SWAY BRACING OF STRINGER	DL 15 loading	Scale
700 T.T			Unit mm	1/10
K.M.	297 + 063	Designed by		
DISTRICT	Huo Hiu	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

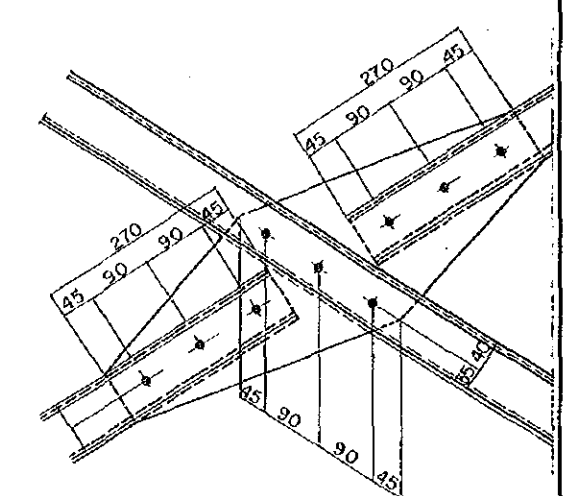
STRENGTHENING OF UPPER LATERAL S=1/30



DETAIL A S=1/5 DETAIL B S=1/5

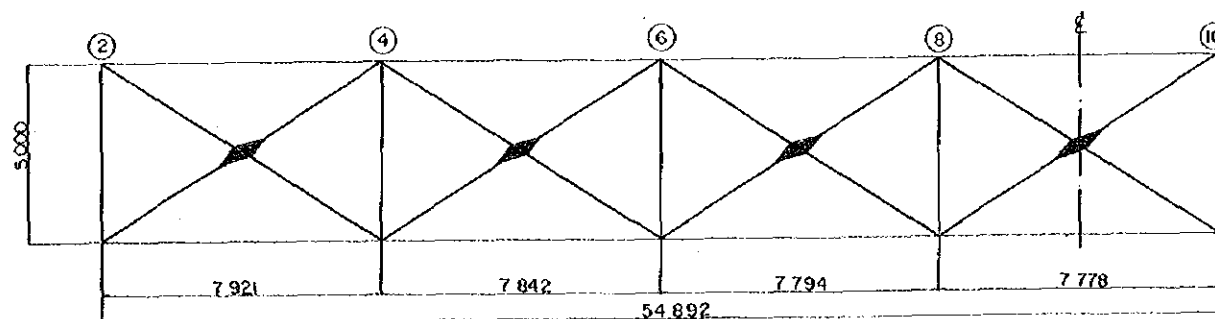


DETAIL C S=1/5



Notes:
Since the center lines of upper lateral are not shown in the Field Drawing. We suggest to unify that the line are drawn along the edge of original member in this case.

MARKING DIAGRAMS



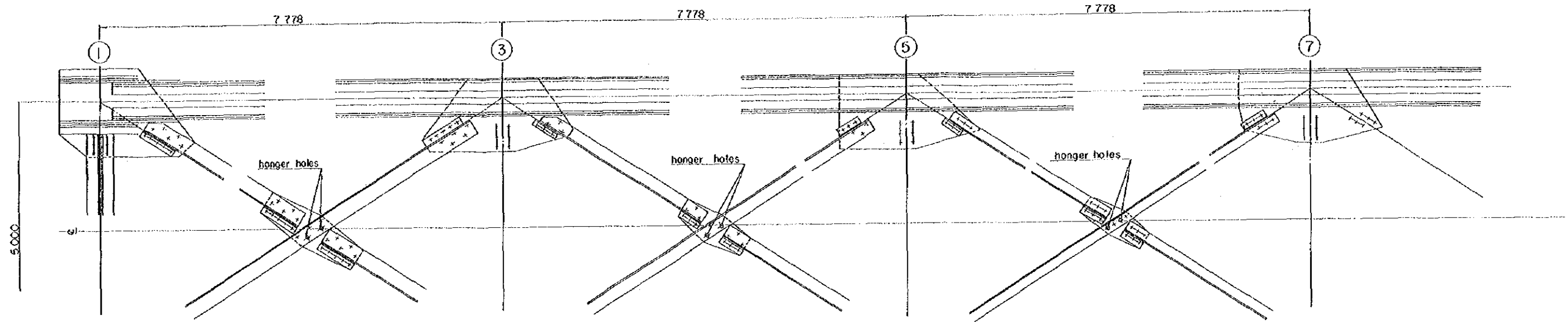
General Notes:

- 1) All materials are to be JIS G 3101 S541 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 $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

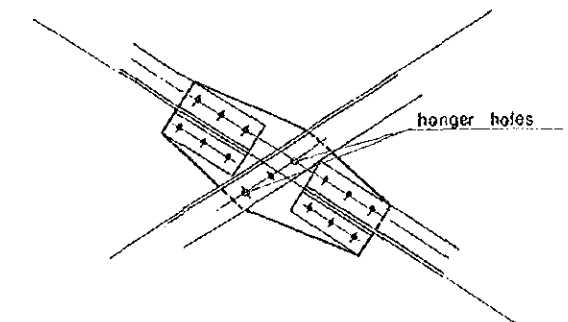
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	STRENGTHENING OF UPPER LATERAL		DL 15 loading
70.0 T.I		Unit	Scale	
		mm	1/30, 1/5	
K.M.	297 + 063	Designed by		
DISTRICT	Hua Hin	Checked by		
LINE	Southern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

STRENGTHENING OF LOWER LATERAL

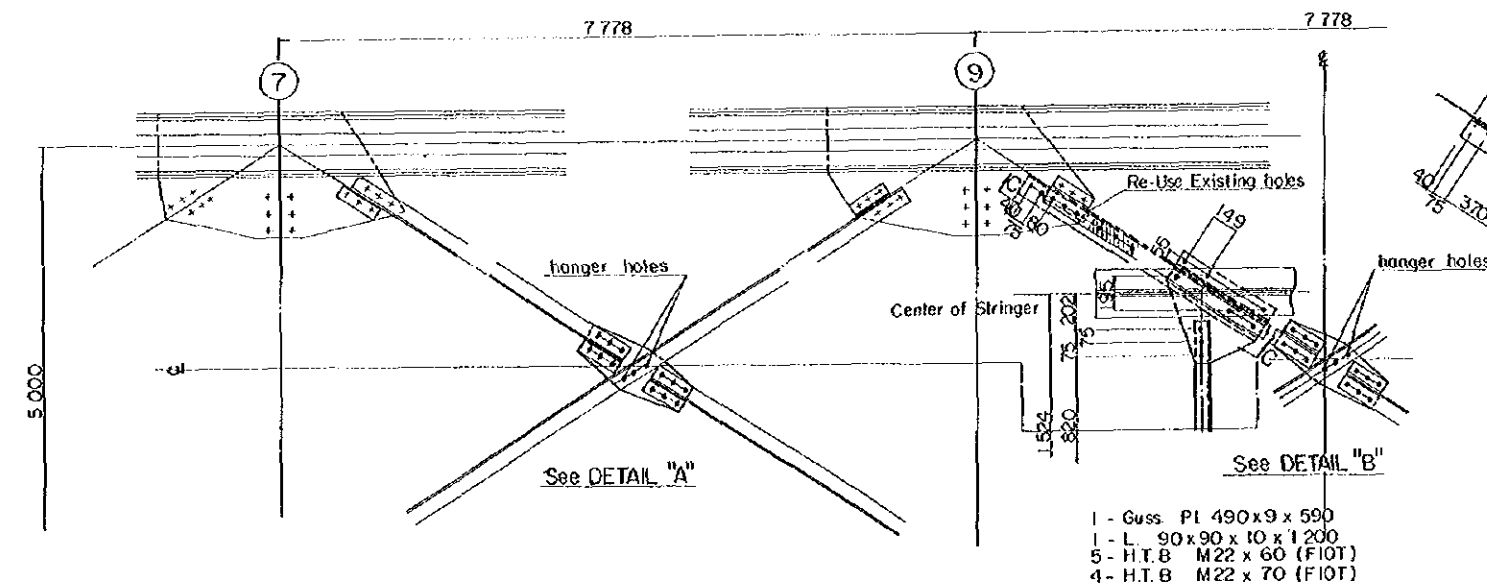
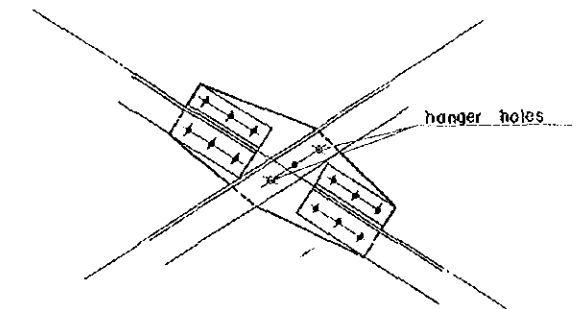
SKELTON S=1/40 DETAIL S=1/20



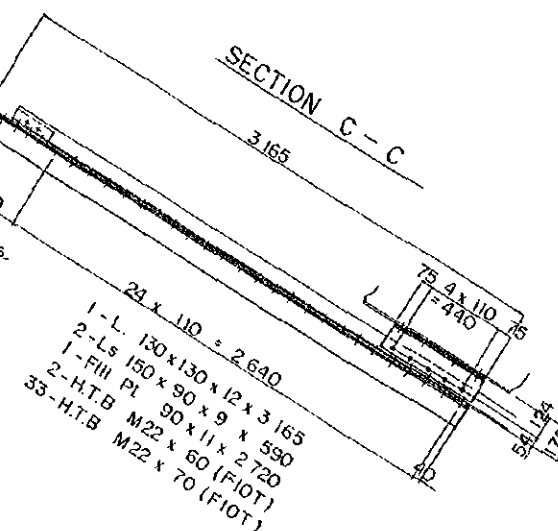
DETAIL "A" S=1/10



DETAIL "B" S=1/10



MARKING DIAGRAMS



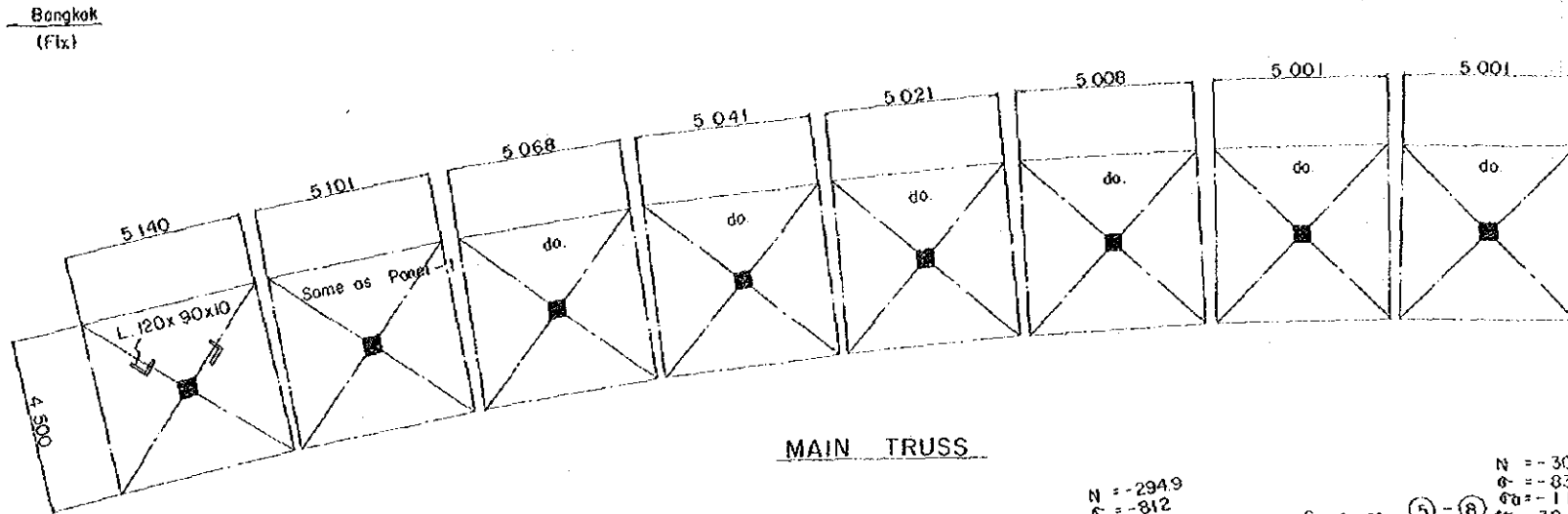
General Notes:

- All materials are to be JIS G 3101 SS 41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (4 1/2" FIOT) and assumed frictional coefficient of contact surface as follows:
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be checked in the field.

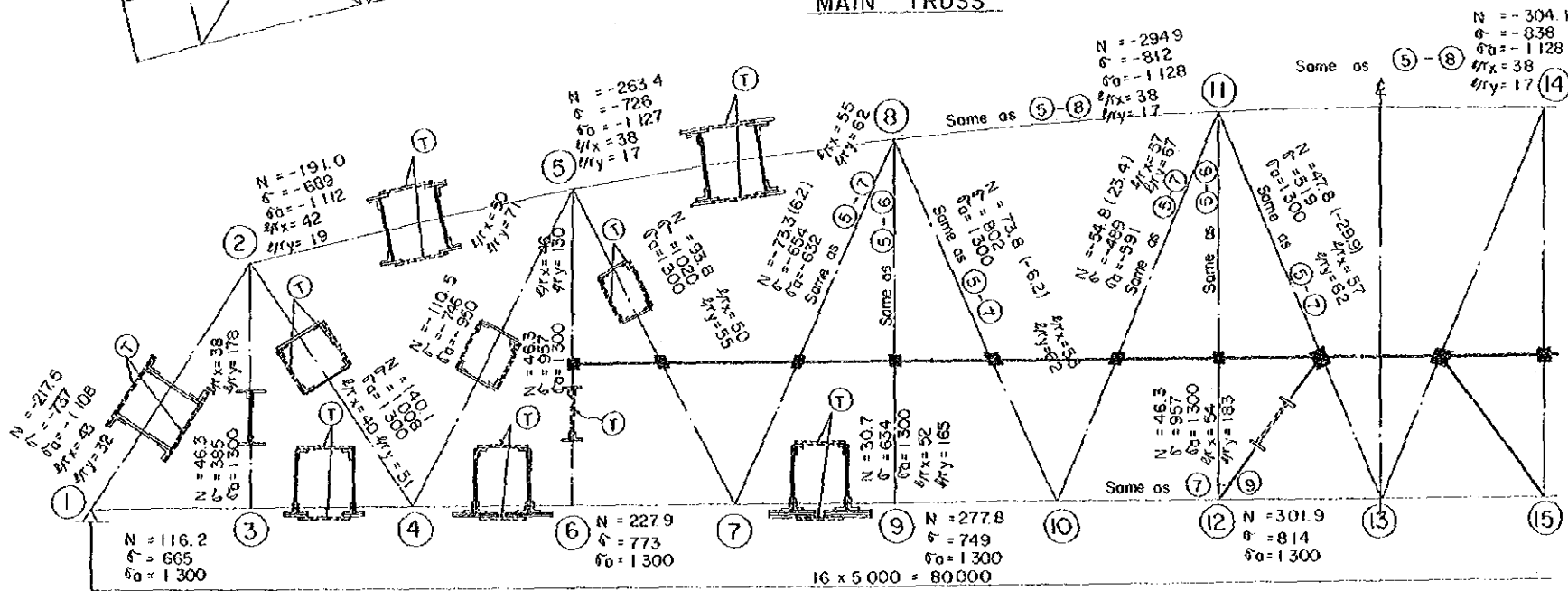
THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	STRENGTHENING OF LOWER LATERAL	
70.0 T.T	297 + 063	Unit	mm
DISTRICT	Hua Hin	Scale	1/40, 1/20, 1/10
LINE	Southern Line	Designed by	
Remarks		Checked by	
		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

GENERAL DIAGRAMS

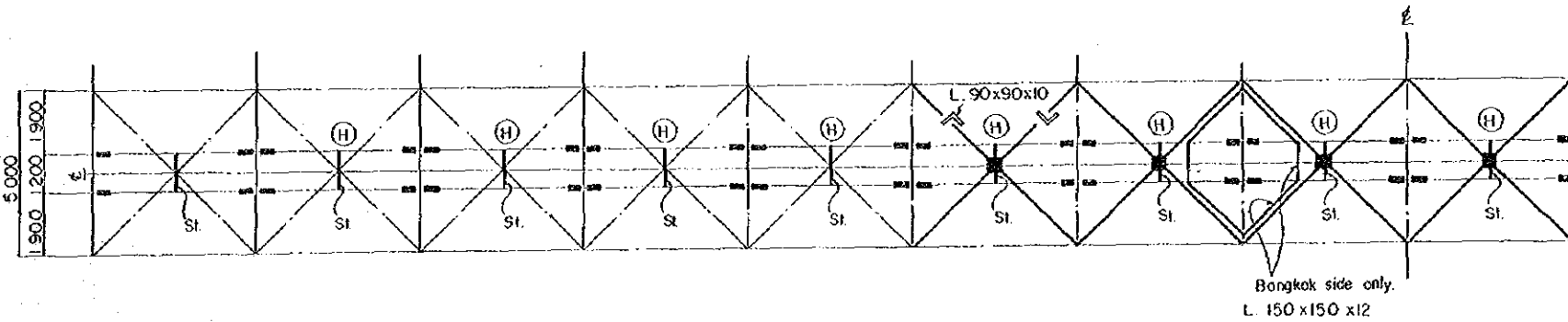
UPPER LATERAL



MAIN TRUSS

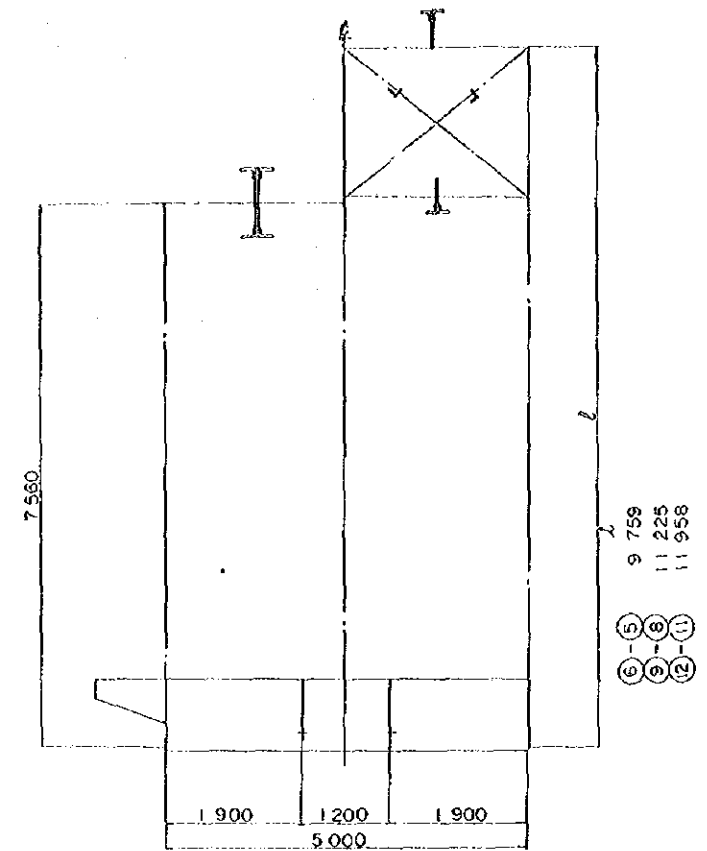


FLOOR SYSTEM & LOWER LATERAL

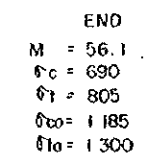


PORTAL

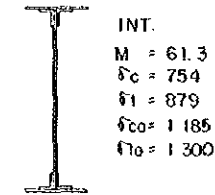
SWAY BRACING



END 8 INT. FLOOR BEAM



STRINGER



$M = 27.1$
 $\delta_C = 861$
 $\delta_H = 1001$
 $\delta_{Ca} = 1092$
 $\delta_{O} = 1300$

General Notes :

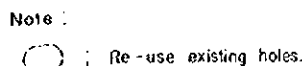
- 1) Weak drawings show the original members.
Deer drawings show the members to be improved.
- 2) Actual stresses are based on DL + IS loading.
- 3) Works

Legends :

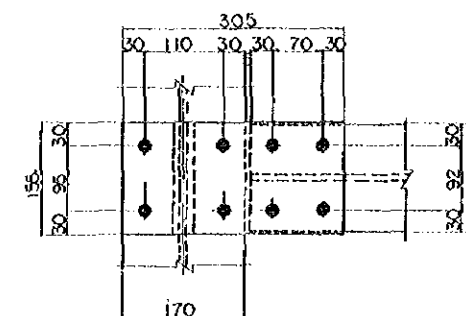
- 1)  : Excessive stressed rivets to be strengthened.
- 2)  : Gusset plates to be improved.
- 3)  : Hanger to be added.
- 4) St. : New strut to be added.

M : Bending moment (t-m) L/r : Slenderness Ratio
 N : Axial force (t) σ : Actual stress (kg/cm^2)
 L : Length of member (cm) σ_d : Allowable Stress (kg/cm^2)
 x, y : Radius gyration of sectional area for x or y axis (cm)

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	GENERAL DIAGRAM	DL 15 loading	
800 T.I			Unit mm	Scale
K. M	479 + 741	Designed by _____ Checked by _____ Checked by _____ Checked by _____ Checked by _____		
DISTRICT	Lom Chi			
LINE	Northeastern Line			
Remarks				
DATE		DRAWING NO.		

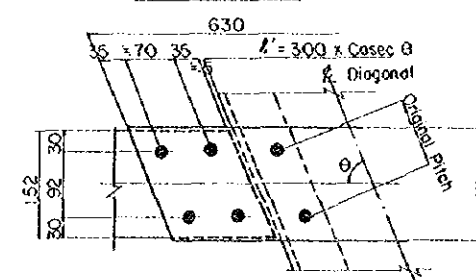
$s = 1/20$ 
$$S = 1/2$$

TYPE C



- | | | |
|-----------------|---------------|-----------------|
| C - 1 (2-Req'd) | 2 - Con. Pls. | 155 x 13 x 305 |
| | 16 - HTB | M20 x 65 (FIOT) |
| C - 2 (4-Req'd) | 2 - Con. Pls. | 155 x 13 x 440 |
| | 24 - HTB | M20 x 65 (FIOT) |

TYPE C' C''



Note: Require over $w = 155$

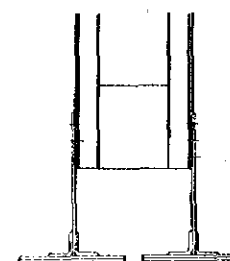
- | | | |
|-------------------|---------------|-----------------|
| TYPE C' (8-Req'd) | 2 - Con. Pls. | 155 x 13 x 630 |
| | 24 - H.T.B | M20 x 65 (FIOT) |
| TYPE C' (2-Req'd) | 2 - Con. Pls | 500 x 13 x 600 |
| | 38 - H.T.B | M20 x 65 (FIOT) |

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 M20 (ϕ - 1) (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

Construction Methods

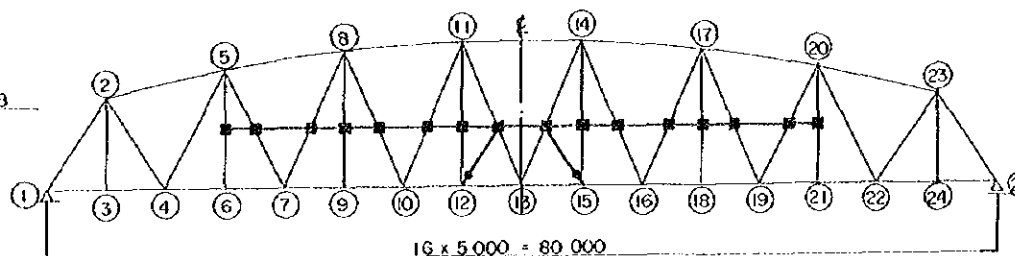
- 1) New members are built up by welding.
- 2) Clean surface between original and new members.
- 3) Attach new members by H.T.Bolts.



(2 - Req'd.)
12-H.T.B
M 20 x 60 (FLOT)

$$S = 1/15$$

MARKING DIAGRAMS



Member	<i>l</i>	L	N
ST-1 (2-Req'd)	2 746	2 480	1
ST-1 (2-Req'd)	4 213	3 870	3
ST-2 (4-Req'd)	3 041	2 780	1
ST-2 (2-Req'd)	3 799	3 460	3
ST-3 (4-Req'd)	3 160	2 900	1
ST-3 (1-Req'd)	3 680	3 340	3
ST-4 (2-Req'd)	4 775	4 840	5

ST-4 $s=1/15$

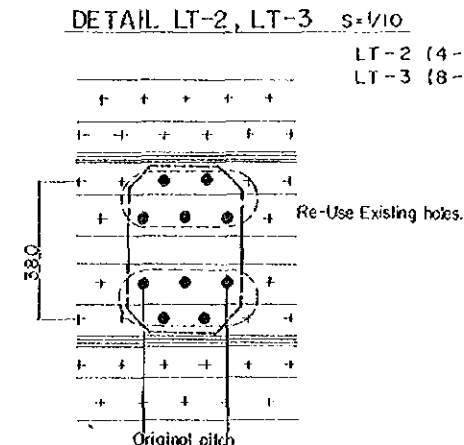
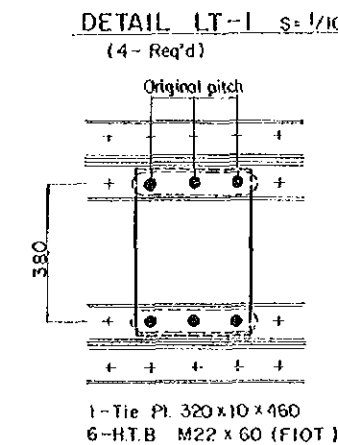
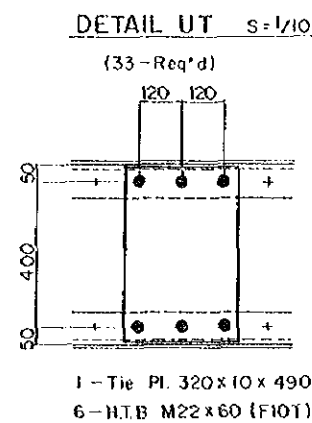
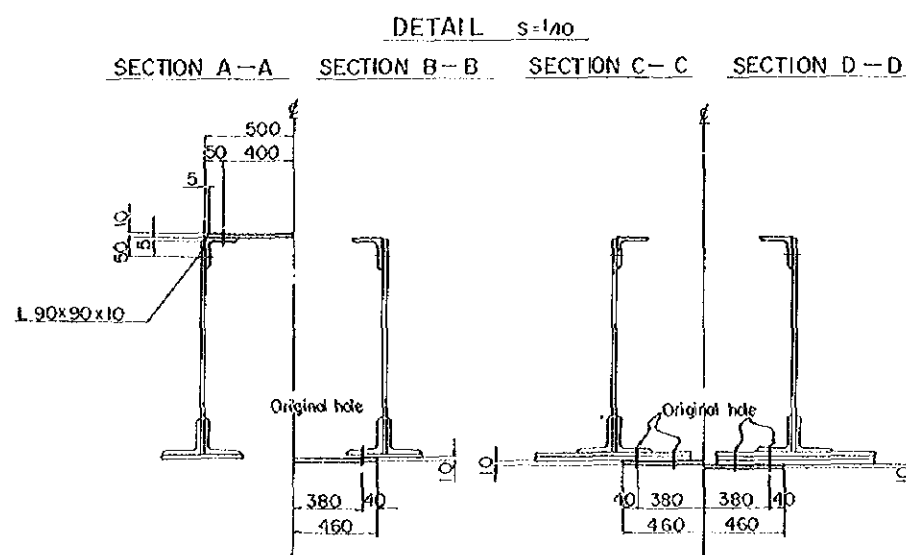
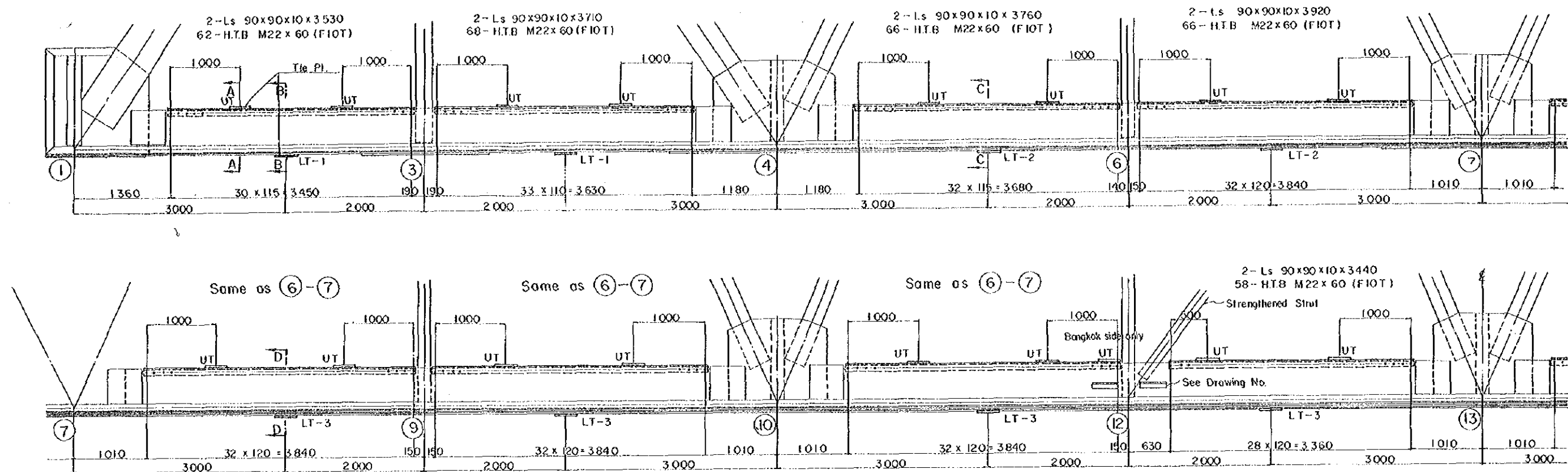
TYPE ST S₁₅

TYPE ST 5-15

2 - C.T. 95 x 152 x 8x8 xL
N - Tie Pls. 200 x 8 x 310
2 - Tie Pls. 310 x 8 x 350

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO.1)	D.L. IS	loading
800 T.T			Unit	Scale
			mm	1/20, 1/15, 1/5
K. M	479 + 741			
DISTRICT	Loei Chi	Designed by		
LINE	Northeastern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

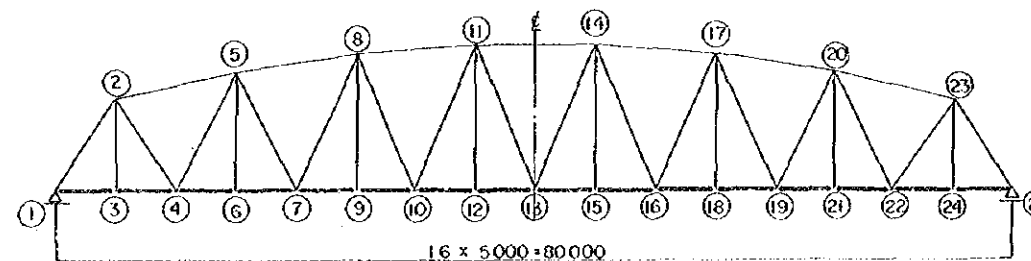
MAIN TRUSS (NO.2) LOWER CHORD MEMBERS $s=1/30$



General Notes

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B.) are M22 (+) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for stitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

MARKING DIAGRAMS



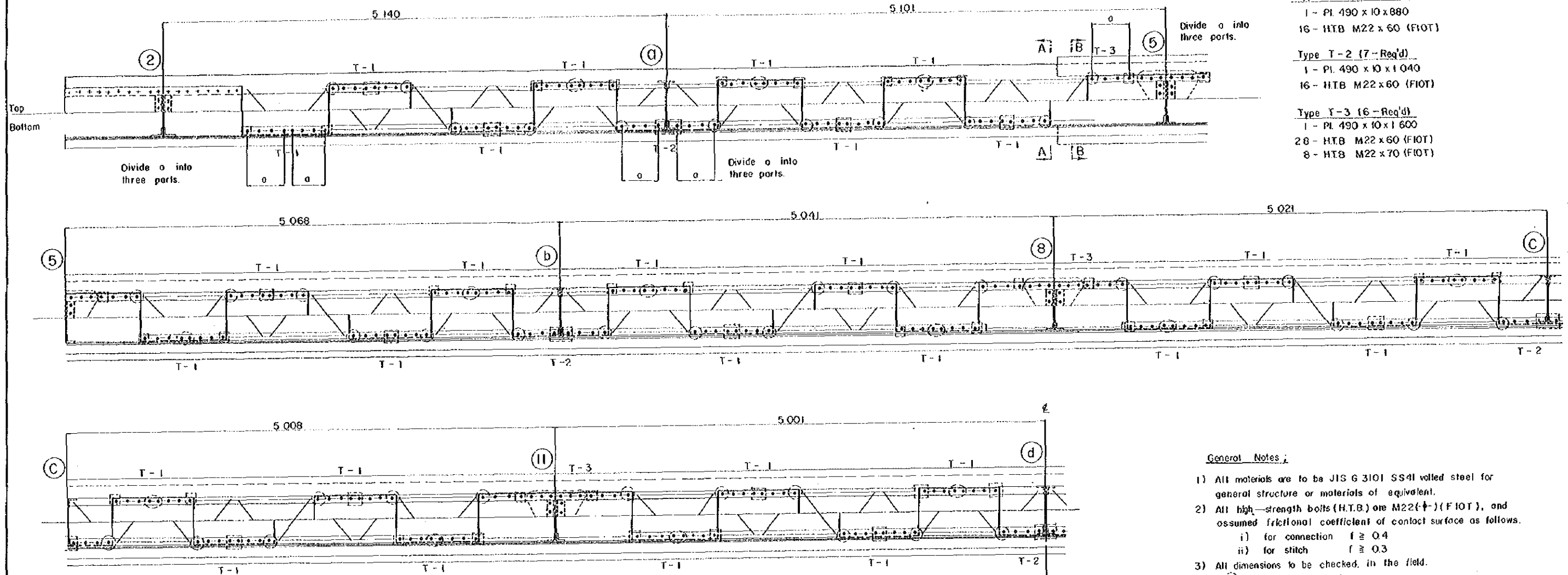
Note:
Rivets pitch of Lower Chord is unknown.
○ : Re-Use Existing holes.

THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	MAIN TRUSS (NO.2)	DL 15 loading
800 T.T			Unit Scale
			mm 1/30, 1/10
K.M.	479 + 741	Designed by	
DISTRICT	Lom Chi	Checked by	
LINE	Northeastern Line	Checked by	
Remarks		Checked by	
		Checked by	
		Checked by	
DATE		DRAWING NO.	

MAIN TRUSS (NO. 3)

UPPER CHORD MEMBERS $s = 1/20$

Note: All Lacing Bar's dimensions is incomplete
Therefore, all dimensions and materials are assumption.



Type T-1 (56-Req'd)

1 - Pl. 490 x 10 x 880
16 - HTB M22 x 60 (FIOT)

Type T-2 (7-Req'd)

1 - Pl. 490 x 10 x 1040
16 - HTB M22 x 60 (FIOT)

Type T-3 (16-Req'd)

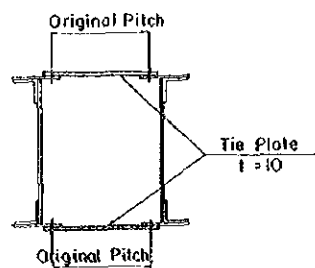
1 - Pl. 490 x 10 x 1600
28 - HTB M22 x 60 (FIOT)
8 - HTB M22 x 70 (FIOT)

General Notes:

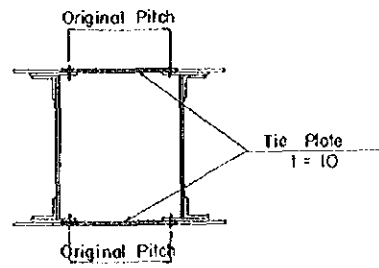
- All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - for connection $f \geq 0.4$
 - for stitch $f \geq 0.3$
- All dimensions to be checked, in the field.
- : Re-use existing holes

□ : Re-use existing holes of the opposite side.

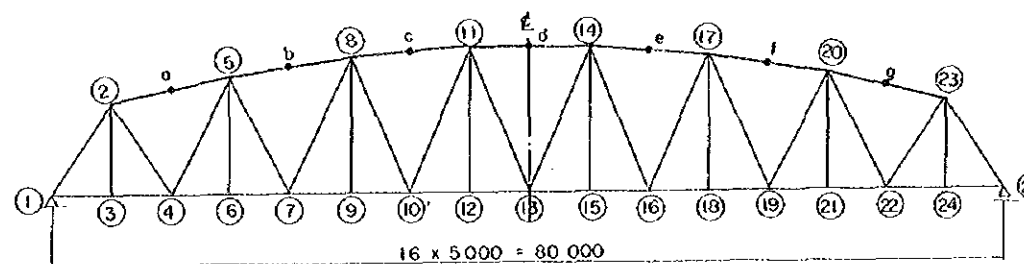
SEC. A - A



SEC. B - B



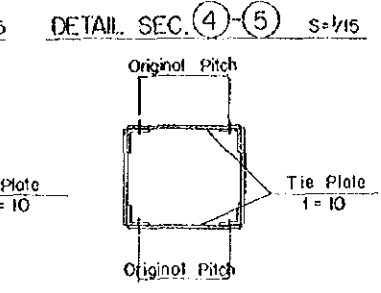
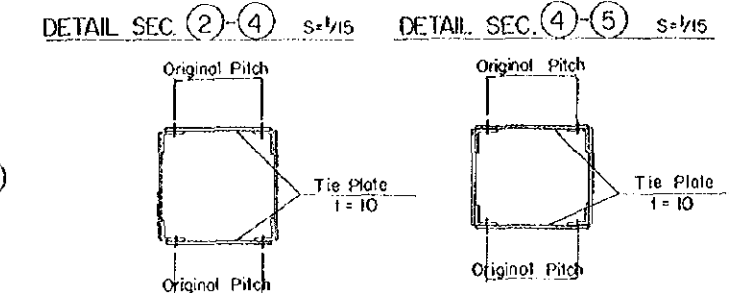
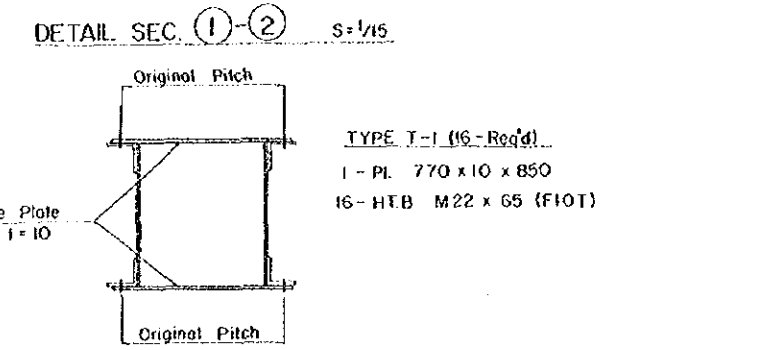
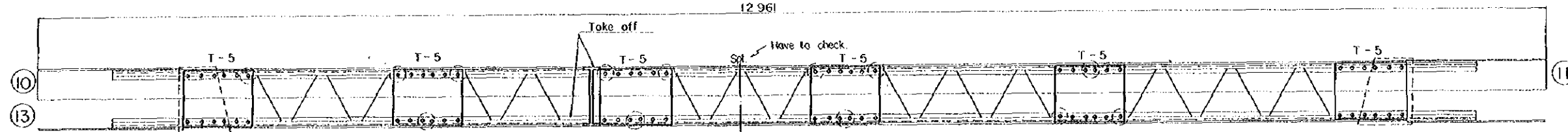
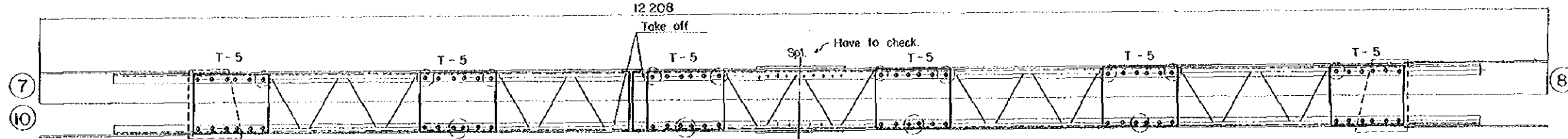
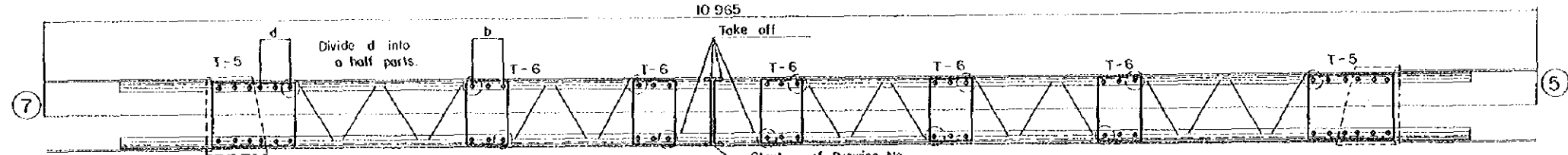
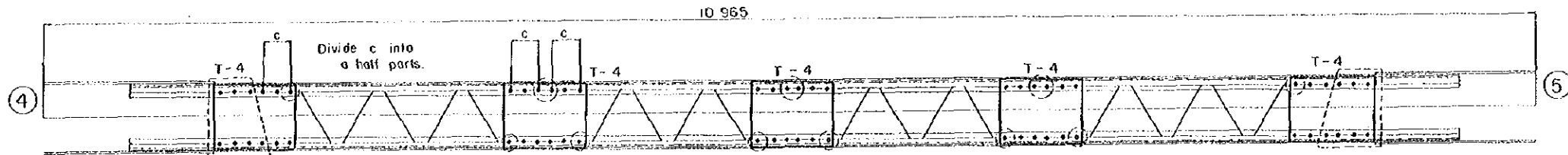
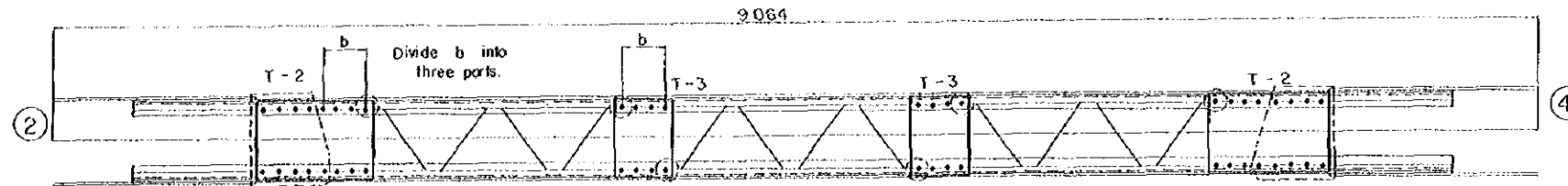
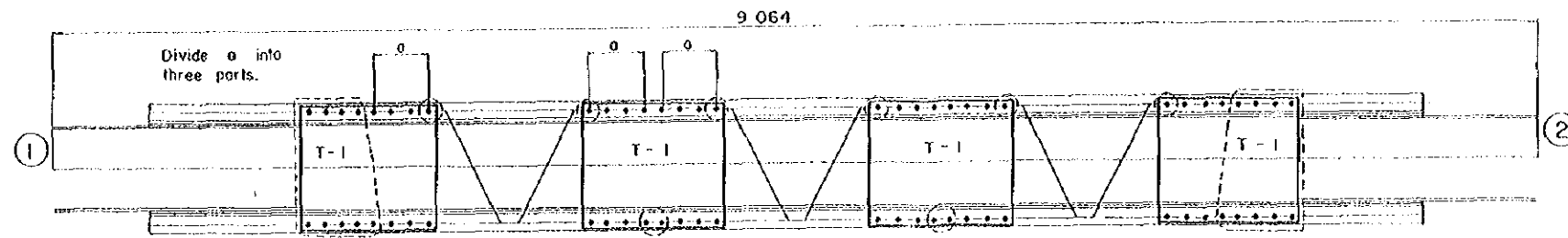
MARKING DIAGRAMS



THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO. 3)		DL 15 loading
80.0 T.T		Unit	mm	Scale
K. M.	479 + 741			1/20
DISTRICT	Lam Chi	Designed by		
LINE	Northeastern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

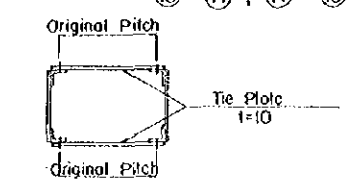
MAIN TRUSS (NO. 4) S=1/20

Note: All facing bar's dimensions is incomplete.
Therefore, all dimensions and materials are assumption.



TYPE T-2 (8-Req'd)
1 - PL 360 x 10 x 460
8 - HTB M22 x 60 (FIOT)

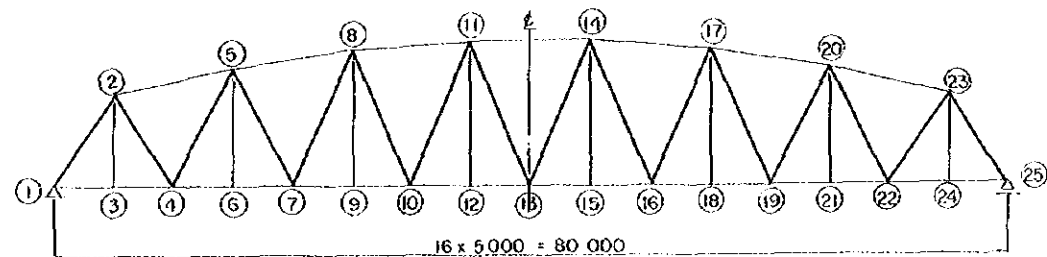
DETAIL SEC. 5-7 S=1/15
Same as Sec. 7-8, 8-10, 10-11, 11-13



TYPE T-5 (16-Req'd)
1 - PL 470 x 10 x 620
12 - HTB M20 x 60 (FIOT)

Note: Re-use existing holes.

MARKING DIAGRAMS



General Notes:

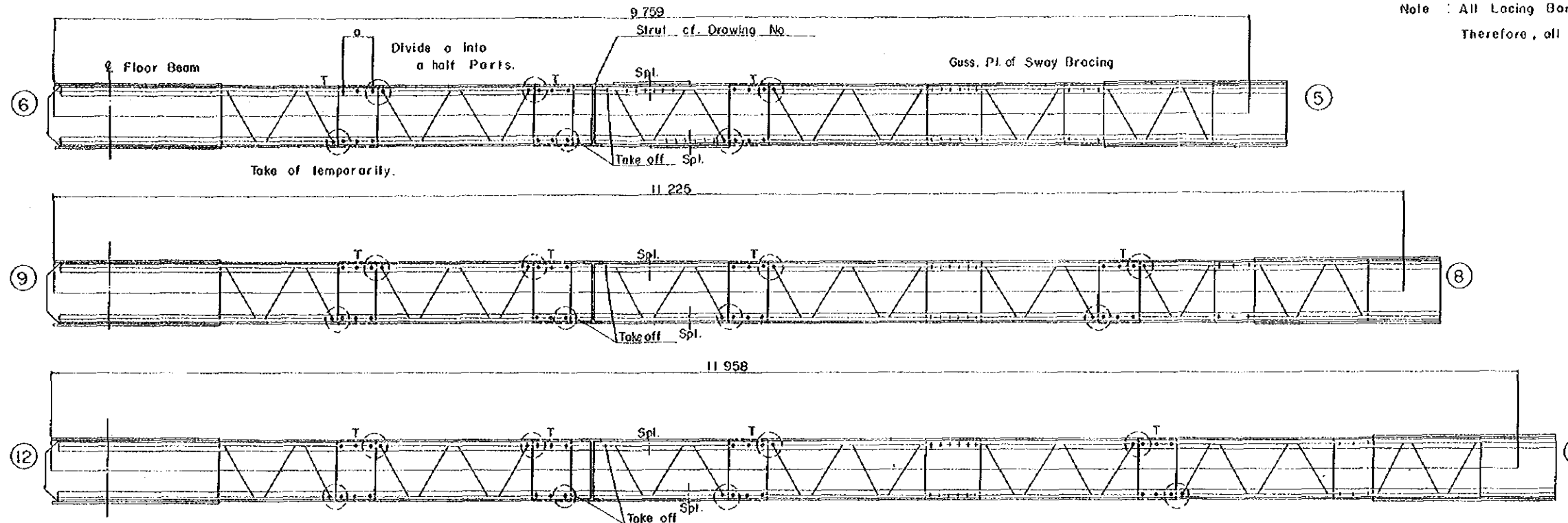
- All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- All high-strength bolts (H.T.B.) are M22 (F10T), and assumed frictional coefficient of contact surface as follows.
 - for connection $\mu \geq 0.4$
 - for stitch $\mu \geq 0.3$
- All dimensions to be checked in the field.

THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	MAIN TRUSS (NO. 4)	O.L. 15 loading	Scale
BOO.T			Unit mm	1/20, 1/15
K.M	479 + 741	Designed by		
DISTRICT	Lam Chi	Checked by		
LINE	Northeastern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

MAIN TRUSS (NO. 5)

VERTICAL MEMBERS S=1/20

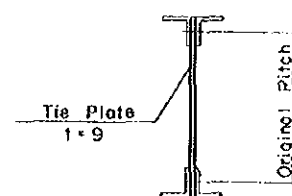
Note : All Lacing Bar's dimensions is incomplete.
Therefore, all dimensions and materials are assumption.



Note :
○ ; Re - Use Existing holes.

DETAIL SEC. ⑤ - ⑥ S=1/10

Same as ⑧ - ⑨
⑪ - ⑫



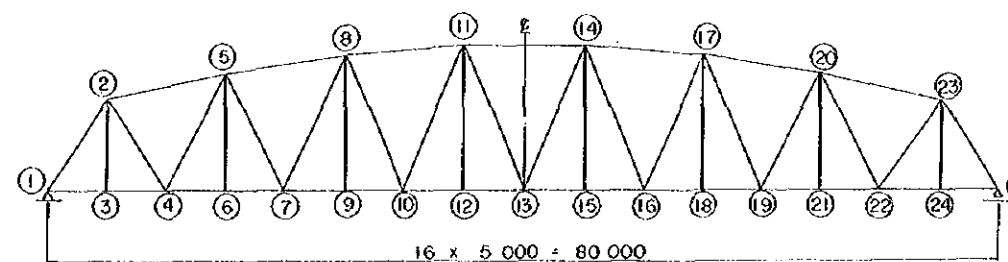
(22 - Req'd)

1 - Pl 320 x 9 x 500
6 - H.T.B M22 x 70 (FIOT)

Other Bolts

38 - H.T.B. M22 x 70 (FIOT)

MARKING DIAGRAMS



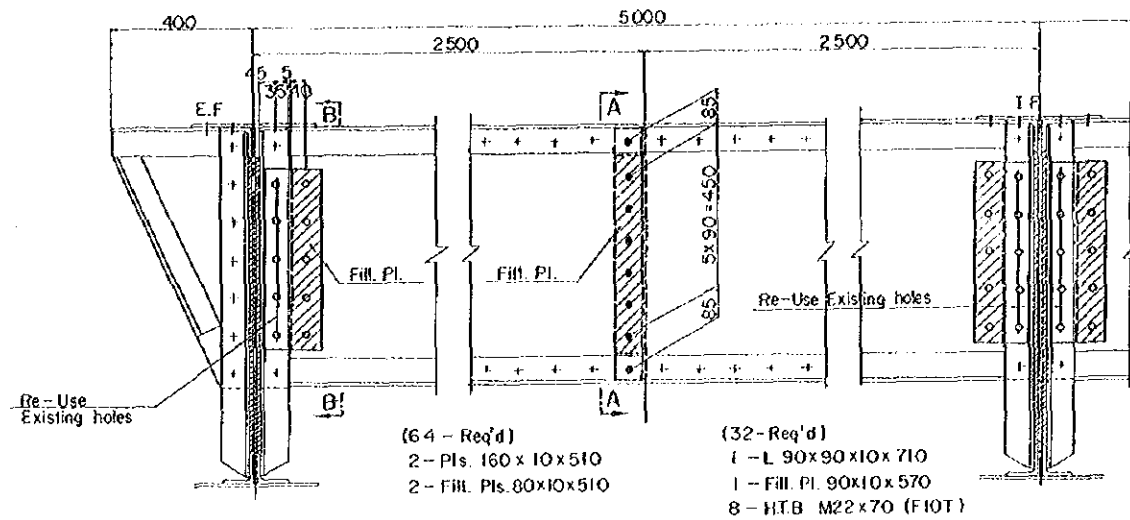
General Notes :

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B) are M22 (4.8) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

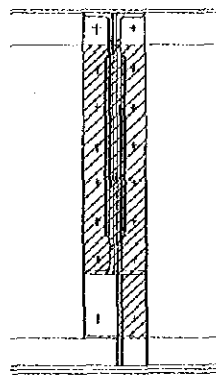
THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type 80.0 T.T	Members MAIN TRUSS (NO. 5)		DL 15 loading	Scale
			Unit mm	1/20, 1/10
K. M.	479 + 741	Designed by		
DISTRICT	Lam Chi			
LINE	Northeastern Line			
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

FLOOR SYSTEM

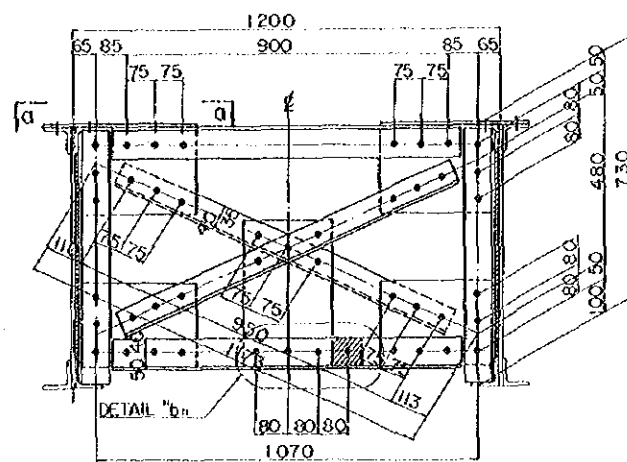
STRINGER S-1/10



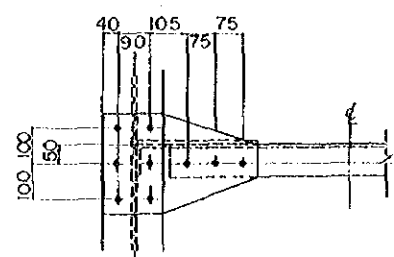
SECTION B-B



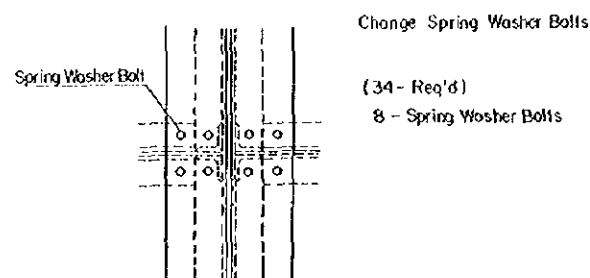
STRUT (SECTION A-A)



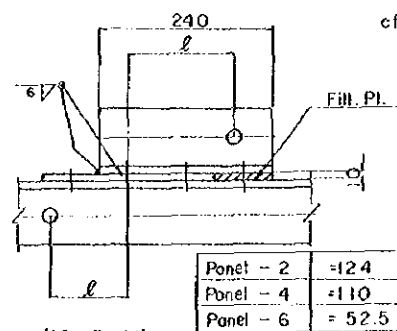
SECTION a-a



SECTION C-C

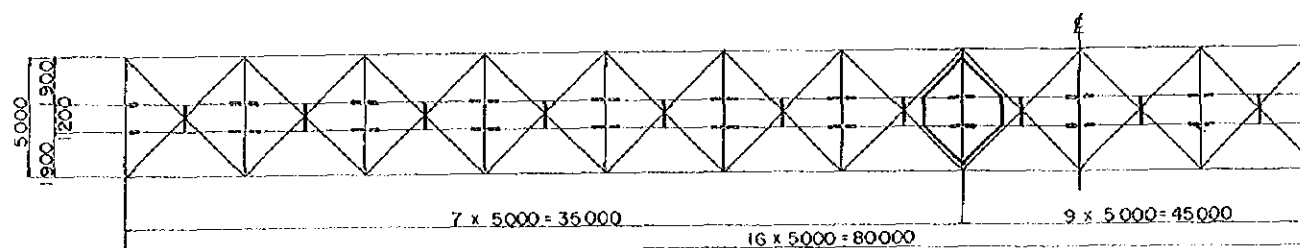


DETAIL "b" S-1/5

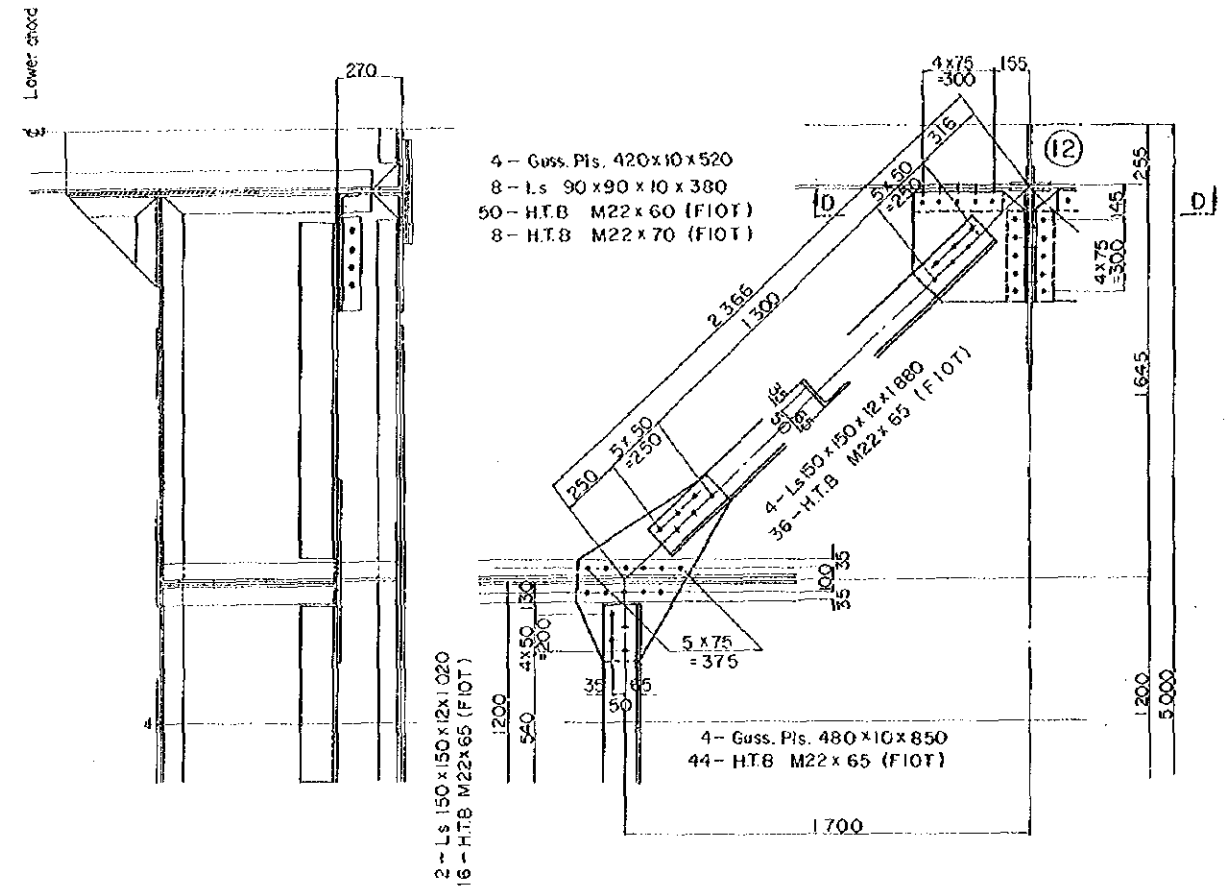


(16 - Req'd)
1 - L 90 x 90 x 10 x 240
1 - FILL Pl. 90 x 10 x 80
3 - H.T.B. M22 x 70 (FIOT)
1 - H.T.B. M22 x 60 (FIOT)

MARKING DIAGRAMS



BRAKE TRUSS S-1/15



General Notes :

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B.) are M22 (4) (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for slitch $f \geq 0.3$
- 3) All rivets are 22 ϕ (4), 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				
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING				
Span Type	Members	FLOOR SYSTEM	DL 15 loading	Scale
800 T.T			Unit	mm
			1/15, 1/10, 1/5	
K. M.	479 + 741		Designed by	
DISTRICT	Lom Ch		Checked by	
LINE	Northeastern Line		Checked by	
Remarks			Checked by	
			Checked by	
DATE			DRAWING NO.	

$$s = 1/20, \quad s = 1/15$$


2-Ls 120 x 90x10 x L
1- Connection Pl. 220 x 240x10
17- H.T.B M22x70 (FIOT)

Note :
Unknown original section and skeleton.
Thereupon suppose to the above mentioned
and that original holes is unused.

- 1) Cut off original rivets.
- 2) Take off original members.
- 3) Clean surface between original and new members.
- 4) Attach new angles and tighten H.T. Bolts.

 : Re - Use Existing holes

Panel	$\bar{z}_1$	$\bar{z}_2$	$\bar{z}_3$	$\bar{L}$
Panel -- 1 (14)	6 832	2 615	501	5 910
Panel -- 2 (13)	6 802	2 600	501	5 880
Panel -- 3 (12)	6 778	2 590	499	5 860
Panel -- 4 (11)	6 757	2 580	498.5	5 840
Panel -- 5 (10)	6 742	2 570	501	5 820
Panel -- 6 (9)	6 733	2 565	501.5	5 810
Panel -- 7 (8)	6 728	2 565	499	5 810

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high — strength bolts (H.T.B.) are M 22 (φ) (F10T), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $f \geq 0.4$
 - ii) for stitch $f \geq 0.3$
- 3) All dimensions to be checked in the field.

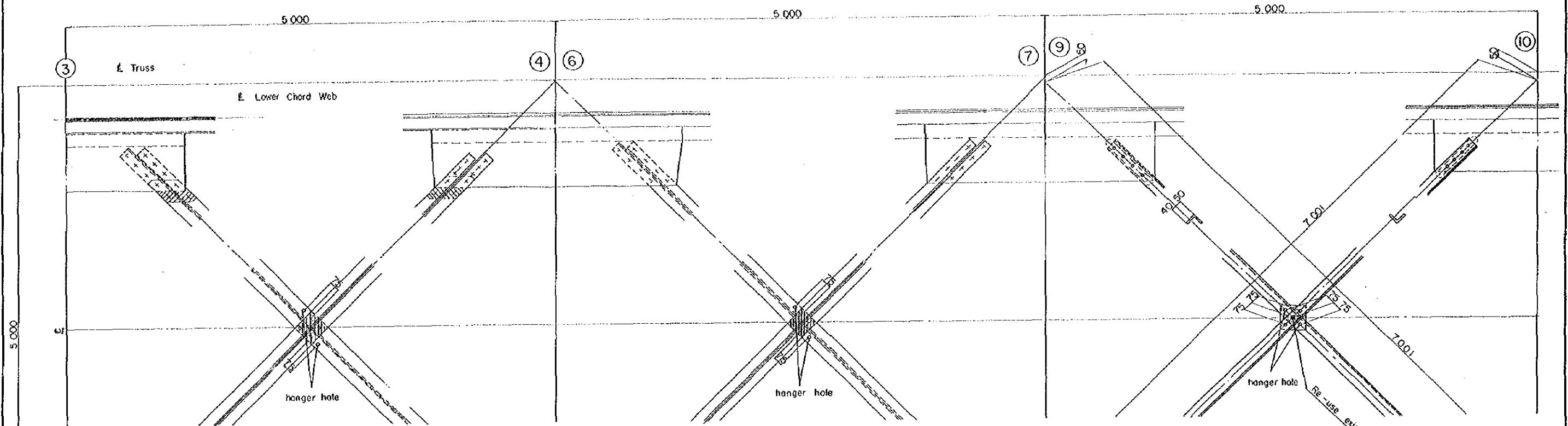
MARKING DIAGRAMS

Note : Parentheses show to the other side



THE STATE RAILWAY OF THAILAND			
DETAIL DRAWING FOR STRENGTHENING AND/OR REPAIRING			
Span Type	Members	UPPER LATERAL BRACING	DL 15 loading
800 T.T			Unit
			mm 1/20, 1/15
K. M	479 + 741	Designed by _____	
DISTRICT	Lam Chi		Checked by _____
LINE	Northeastern Line		Checked by _____
Remarks			Checked by _____
			Checked by _____
		Checked by _____	
DATE		DRAWING NO.	

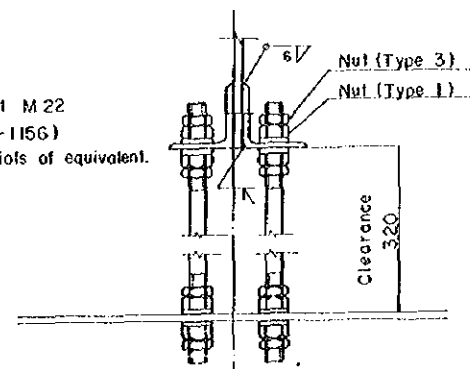
LOWER LATERAL BRACING S=1/20, 1/15



- 2 - Ls. 90 x 90 x 10 x 5 620
- 1 - Guss. Pl. 185 x 10 x 190
- 16 - H.T.B. M22 x 60 (FIOT)
- 3 - H.T.B. M22 x 70 (FIOT)

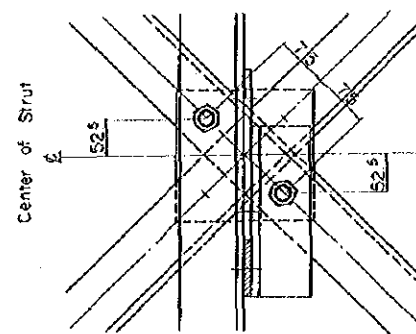
HANGER S=1/5

Note: All Nut M22 (JIS B-115G) or materials of equivalent.



- 2 - Round Bar 22# x 460
- 8 - Nut M22 (Type 1)
- 8 - Nut M22 (Type 3)
- 8 - Washer M22

(9)-(10)



Note:

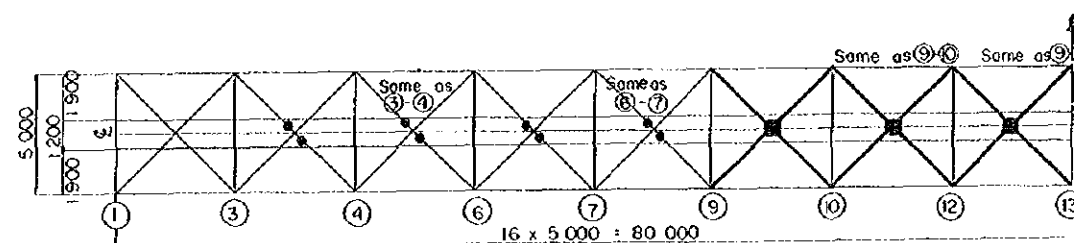
○ : Re-use existing holes

General Notes:

- 1) All materials are to be JIS G 3101 SS41 rolled steel for general structure or materials of equivalent.
- 2) All high-strength bolts (H.T.B.) are M22 (FIOT), and assumed frictional coefficient of contact surface as follows.
 - i) for connection $\mu \geq 0.4$
 - ii) for slitch $\mu \geq 0.3$
- 3) All dimensions to be checked in the field.

MARKING DIAGRAMS

Note: • : show to attach Hanger.

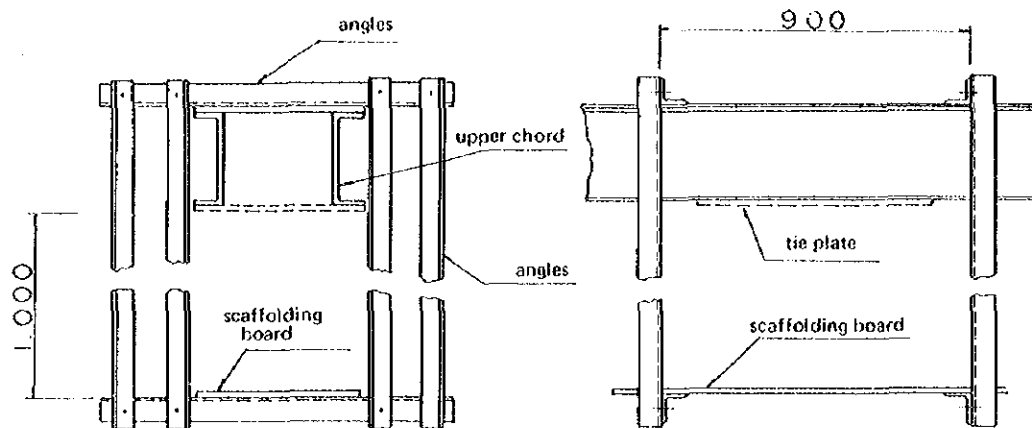


THE STATE RAILWAY OF THAILAND				
DETAIL DRAWING FOR STRENGTHENING AND FOR REPAIRING				
Span Type	Members	DL 15 loading		
800 T.T		Unit	Scale	
K.M	479 + 741	mm	1/20, 1/15, 1/5	
DISTRICT	Lam Chi	Designed by		
LINE	Northeastern Line	Checked by		
Remarks		Checked by		
		Checked by		
		Checked by		
		Checked by		
DATE		DRAWING NO.		

I. Instruction for Improvement of Cleveland Types; 25m (T.T.), 30m (T.T.), 35m(T.T.) and 45m(T.T.)

1. Upper Chord (Installation of tie plate)

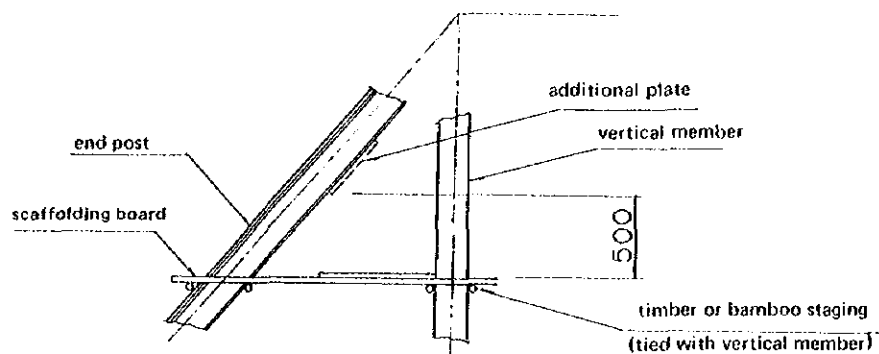
(a) Place a partial staging in the vicinity of a panel point as illustrated below.



- (b) Cut off the connection rivet of tie plates or lacing bars and remove them.
- (c) Mark the position of new holes on the new tie plate to be attached using mould and drill holes on them.
- (d) Install the new tie plates after cleaning of contact surface and fix them with some temporary bolts.
- (e) Install high-strength bolts and replace the temporary bolts with high-strength bolts also.

2. End Post (Installation of tie plates)

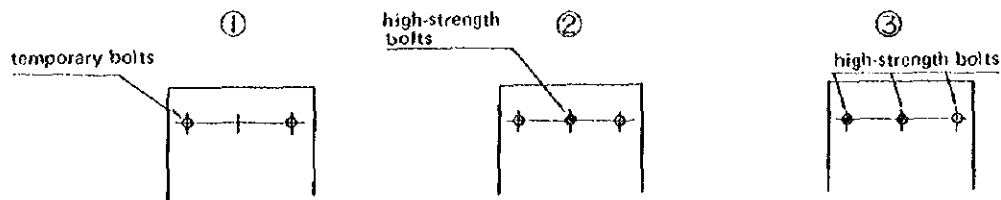
(a) A staging should be provided as illustrated below.



(b) For other works, refer to Para. 1 "upper chord."

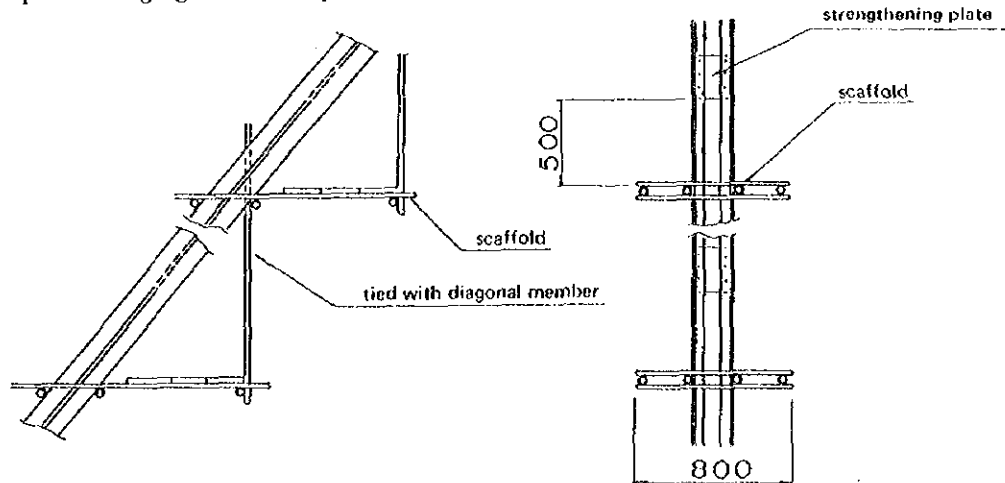
3. Lower Chord (Installation of tie plates)

- A partial staging should be provided. The staging should be wider than the width of lower chord by two meters for strengthening work for web plates.
- For attaching the tie plates, connection angles are fastened on the web plates with high-strength bolts.
- Since a new tie plate has three bolt holes on each side, insert temporary bolts into the two end holes to fix the tie plate.
- Install a high-strength bolt into the center hole and then replace the temporary bolts in the end holes with high-strength bolts one by one.

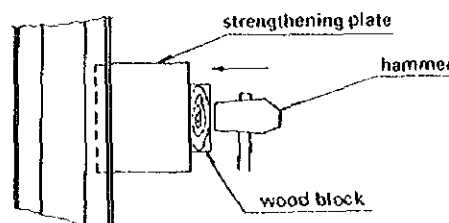


4. Diagonal Member and Vertical Member (Installation of tie plates)

- A partial staging should be provided as illustrated below.

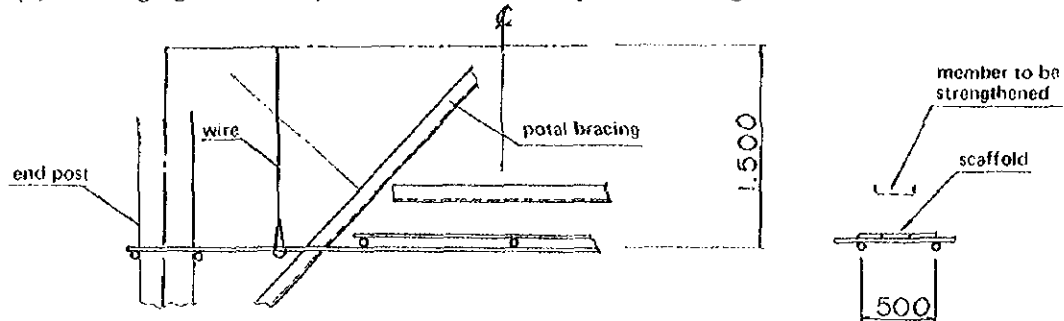


- After cutting off the rivets of lacing bars and remove them, insert a scraper into opening between flange angles and remove old paint and rust.
- Insert a strengthening plate by hammering and tighten it with high-strength bolts.

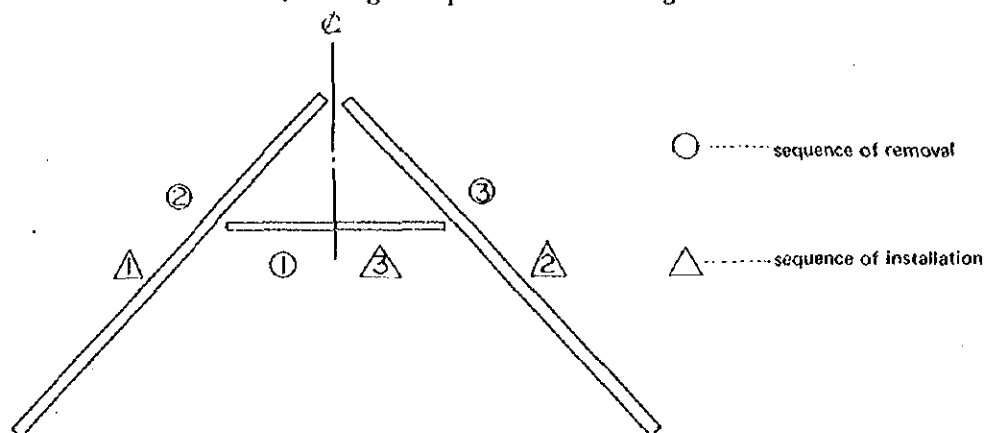


5. Portal Bracing

- (a) A staging should be provided beneath the portal bracing as illustrated below.



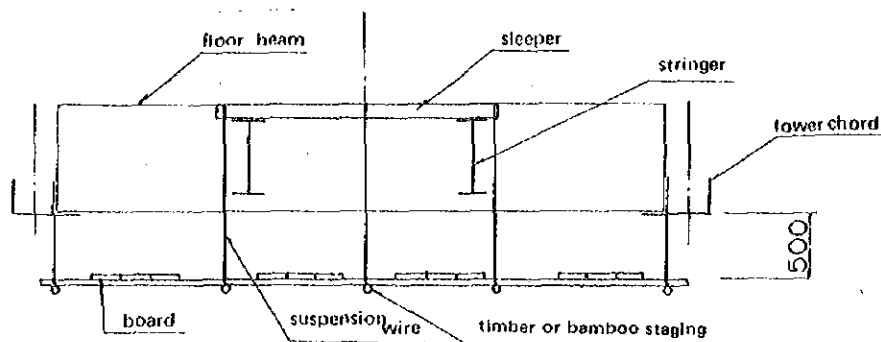
- (b) Cut off connection rivets of members to be strengthened/repared and replace their rivets with temporary bolts.
- (c) Replace the existing members with new ones in such sequence as illustrated below, and fix them with temporary bolts.
- (d) Clean contact surface, of the gusset plates before fixing the new members.



- (e) Install high-strength bolts and replace the temporary bolts with high-strength bolts also.

6. Lower Lateral Member

A full-width staging should be provided beneath the bridge, which can be used also for strengthening work for floor beams and stringers.



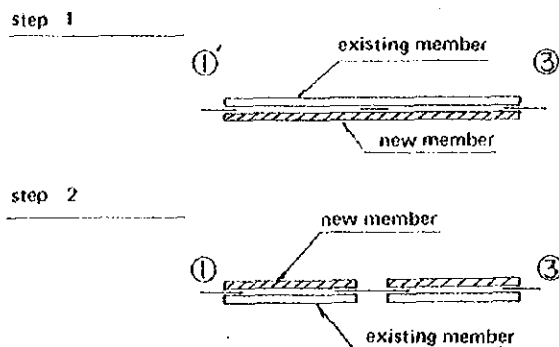
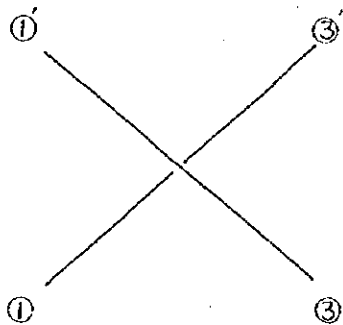
6-1 Strengthening of Members between Panel Points ③ and ⑪

- (a) Cut off the rivets of gusset plates at the intersection point and replace the old gusset plates with new ones.
- (b) Attach hangers to the lower laterals and fasten them with high-strength bolts.

6-2 Strengthening of Members between Panel Points ① and ③ and Panel Points ⑪ and ⑫

The following procedure should be applied in addition to the method given in Para 6-1.

- (a) Drill new holes on the existing angles.
- (b) Cut off rivets connecting the gusset plates of lower chords and fix them with temporary bolts.
- (c) Attach new angles between Panel Points ①' and ③' by loosening the temporary bolts on old angles and retightening the temporary bolts, which should be replaced with high-strength bolts.
- (d) Add new angles between Panel Points ① and ③' in the same method as in Paragraph c).



6-3 Brake Truss

Brake truss is to be installed between Panel Points ⑦ and ⑨.

7. Floor Beams

The following improvement work is carried out for floor beams.

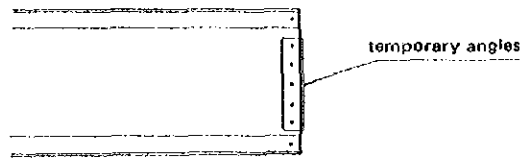
7-1 End Floor Beam (Replacement of flange)

- (a) Drill new holes through the web plate of floor beam, cut off rivets for connection with the lower chord, add new members and drive new rivets.
- (b) Cut off rivets of lower flange and replace them with temporary bolts.
- (c) Complete replacement within two hours during which it is allowed to close the operating line, including removal of the existing members, cleaning, installation of new members and fixing them with temporary bolts.
- (d) Replace the temporary bolts with high-strength bolts.

7-2 Intermediate Floor Beam (Replacement of flange and repair of web plate)

- (a) Cut off rivets for connection with the lower chord and replace them with temporary bolts.

- (b) Replace the connection angles with temporary ones.



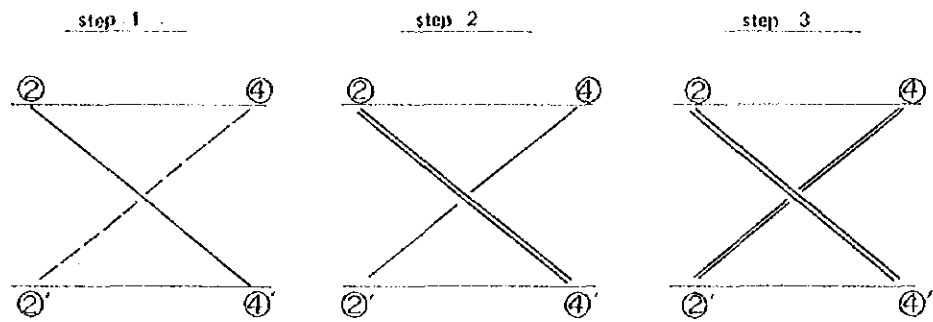
- (c) Replace the old lower flanges with new ones in the same procedure as in Paragraph 7-1, "end floor beam".
- (d) Replace the temporary angles with new connection angles and rivet them together.
- (e) Repair of a corroded web plate is to be carried out as follows;
- 1) Strike the corroded part of the web plate to get rust off.
 - 2) Drill new holes on the web plate.
 - 3) Cut off the rivets of the flange angles which are wrapped by the patch plates.
 - 4) Install plates after cleaning and fix them with temporary bolts.
 - 5) Replace the temporary bolts with high-strength bolts.

8. Stringer

- (a) The railway track is to be supported with temporary rail girders on other devices.
- (b) Improvement of the connections of stringers with floor beams should be firstly carried out by the same procedure as for the floor beam.
- (c) Drill new holes for struts on the web plate of stringer.
- (d) Remove the existing strut and fix the strengthening angles with temporary bolts.
- (e) Fix the new struts with temporary bolts.
- (f) Replace the temporary bolts with high-strength bolts.
- (g) Fasten the lower lateral members with the strut by means of a hanger leaving a distance of 190mm between the member and the strut.

9. Upper Lateral Member

- (a) A full-width staging should be provided as in the case of strengthening of lower lateral members.
- (b) Drill new holes in the existing members.
- (c) Cut off the rivets at the intersection point of lateral members and remove the filler plates.
- (d) Insert new gusset plate into the intersection point and fix it with temporary bolts.
- (e) Cut off the connection rivets on the upper chord side and fix the member with temporary bolts.
- (f) Remove angles between Panel Points (2') and (4'), cut off them to obtain a required length and drill holes on them, and then reinstall them original place.
- (g) Attach new angles between panel Points (2) and (4) .

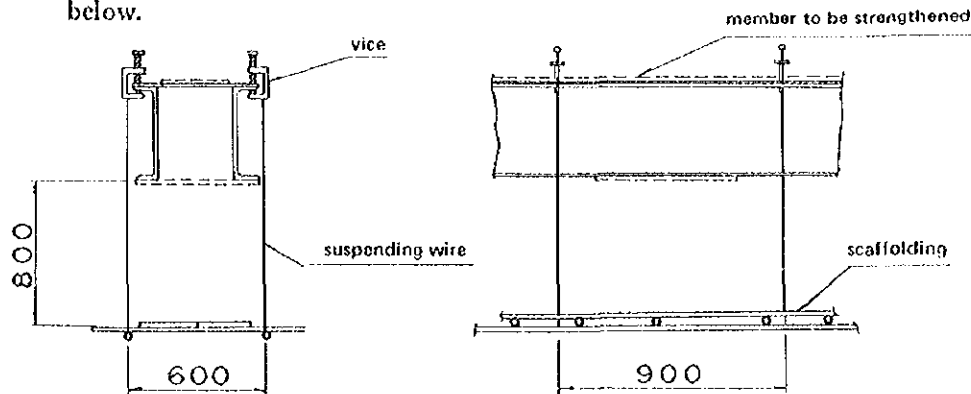


- (h) Attach new angles between Panel Points (2') and (4) , and tighten the entire upper lateral member with high-strength bolts.

II. Instruction for Repair and Strengthening of Cleveland Types ; 50m(T.T.), 60m (T.T.) and 70m (T.T.)

1. Upper Chord

- (a) A full-width staging should be provided beneath the upper chord as illustrated below.



1-1 Strengthening of Upper Chord

- Clean the contact surface of strengthening plate to be attached and cut off the rivets of upper flange plate which are wrapped by the strengthening plate.
- Install the strengthening plate and drill new holes on the original flange plate.
- Tighten them with high-strength bolts.

1-2 Installation of Tie Plate

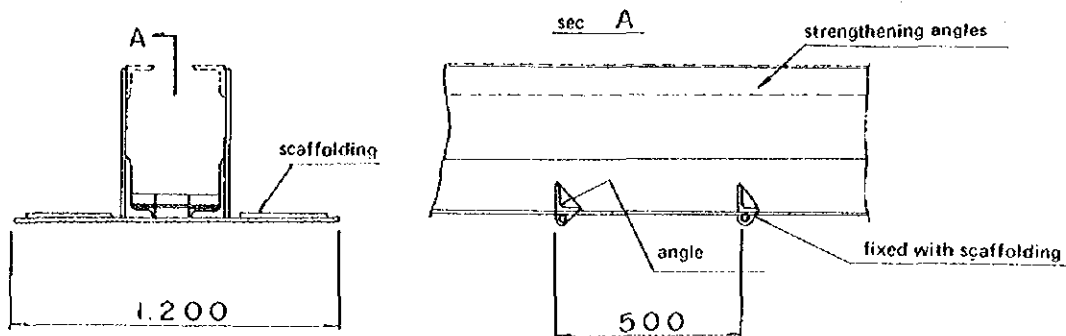
- Replace lacing bars with the plates after strengthening the upper flange, and then tighten them with high-strength bolts.
- As for other works, refer to the instructions in Paragraph 1, Chapter I, "upper chord."

2. End Post

- (a) All the instructions in Paragraph 1 "upper chord" are applicable.

3. Lower Chord (Strengthening of member and installation of tie plate)

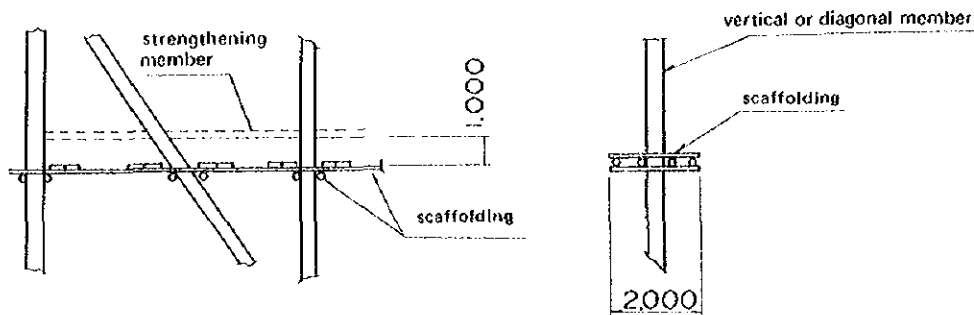
- (a) A full-width staging should be provided Panel Points between (7) , (9) and (11) , and partial stagings for other panels.



- (b) Attach strengthening angles on web plates after cleaning.
- (c) Drill new holes on the web plate, and tighten them with high-strength bolts.
- (d) All the instructions in Paragraph 3, Chapter I, "lower chord" are applicable for other works.

4. Diagonal and Vertical Members

- (a) A staging should be provided along the web members as illustrated below.



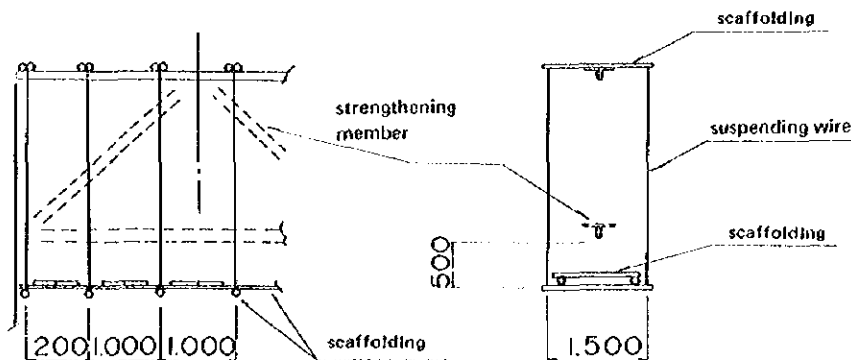
- (b) Refer to the instructions in Paragraph 4, Chapter I, "diagonal and vertical members," for strengthening of diagonal and vertical members.
- (c) Installation of horizontal members.
 - 1) After drilling holes on web members and cleaning the contact surfaces, attach gusset plates with temporary bolts.
 - 2) Install horizontal members with gusset plates and fix them with temporary bolts.
 - 3) Fasten them with high-strength bolts.
 - 4) Attach strengthening members to the existing diagonal and vertical members prior to install the horizontal members.

5. Portal Bracing

- (a) Refer to the instructions in the relative paragraph of Chapter I.

6. Sway Bracing (Replacement)

- (a) A staging should be provided as illustrated below.



- (b) Each members should be pre-assembled with high-strength bolts on the ground or in the bridge shop.
- (c) Remove existing members and install new ones after cleaning the contact surfaces where gusset plates are attached.
- (e) Tighten them with high-strength bolts.

7. Lower Lateral Members

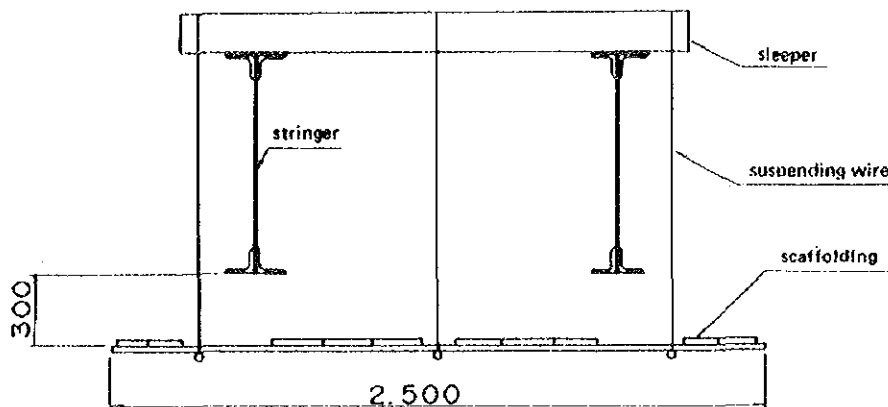
- (a) For strengthening of lower lateral members between Panel Points (5) and (13) , provide full-width stagings so that work can be performed also for stringers and floor beams. But utilize local stagings for stringers for improvement work of other lateral members.
- (b) Replace members between Panel Points (5) and (7) and between (11) and (13) in accordance with the following procedures:
 - 1) Cut off rivets of the gusset plate at the intersection point and install a new gusset plate after cleaning of its contact surface.
 - 2) Cut off rivets connecting the gusset plates of lower chord side.
 - 3) Replace the angle with a new one after cleaning and tighten it with high-strength bolts.
 - 4) Install a hanger between the strut of stringers and the lower lateral, and tighten its connection bolts.
- (c) Install brake trusses in front and rear of the floor beam at Panel Point (9) .

8. Floor Beam

The instructions in Par. 7-1 and Par. 7-2 of Chapter I should be applied.

9. Stringer

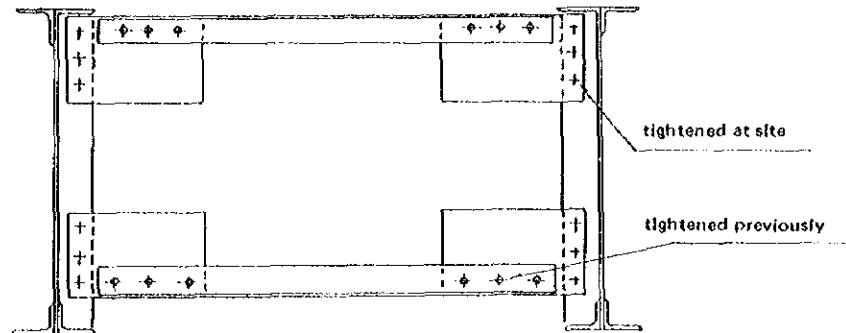
- (a) A staging should be provided for members between Panel Points (1) and (5) and between (13) and (17) .



- (b) Strengthen firstly the connection of stringer with a floor beam and then install struts.

For strengthening the connection of stringer, refer to the relative paragraph in Chapter I.

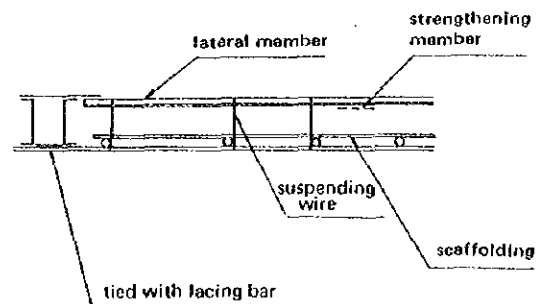
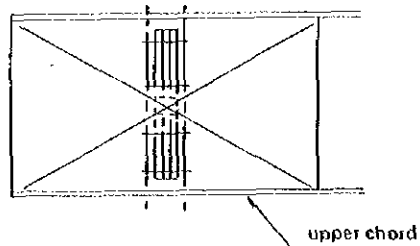
- (c) For installation of the struts between stringers on both sides, attach vertical angle steels on the web plates by high-strength bolts. Prior to it some rivets of the flanges must be cut off.
- (d) Install firstly the horizontal angle steels for the strut having gusset plates at their ends and then diagonal angle steels.
- (e) Tighten them with the vertical angles on the stringer web by high-strength bolts.



- (f) Lastly tighten the connection bolts of the struts and with the upper flanges of the stringers.

10. Upper Lateral Members

- (a) A partial staging should be provided beneath the upper lateral members as illustrated below.



- (b) For the improvement work, the instructions in Para. 6 of Chapter I "lower lateral member" should be adopted.

III. Instructions for Strengthening and Repair of Daydø Type ; 30m (T.T.)

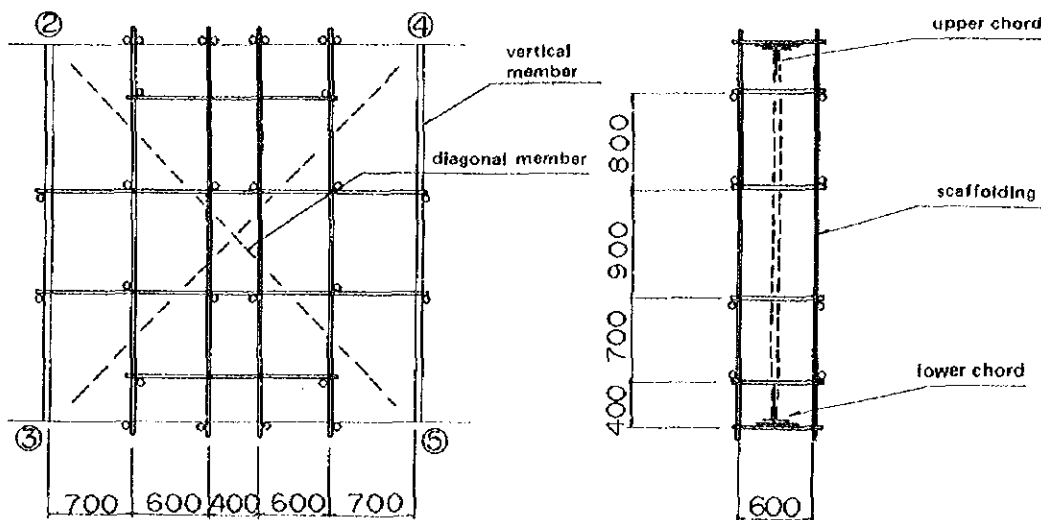
1. Main Truss

In this bridge, the diagonal members are weak, requiring strengthening, while the upper and lower chord members and vertical members are strong enough.

Since there are a number of bridges of this type over the country, a strengthening methods which does not interfere with operation of trains is to be recommended.

1-1 Diagonal Members in the Panels between Panel Points (2) - (4) , (4) - (6) , (14) - (16) and (16) - (18) (See Fig. 6-4 of Main Report)

- (a) Multi-step stagings covering the space between the upper and lower chords should be provided as illustrated below. The stagings must be of such construction as will not interfere with the handling of structural members.



- (b) Strengthening work shall be carried out from the end panels to the central ones.
- (c) Cut off rivets of the filler plate at the intersection point of the diagonal members and replace it with a new gusset plate.
- (d) Cut off the rivets for connection with chord members and replace them with high-strength bolts temporarily.
- (e) Remove one of the angles in Member (2) - (5) , cut it into two, drill new holes and reinstall them after cleaning it.
- (f) Attach strengthening plates to Member (2) - (5) .
- (g) Attach two new angles to Member (4) - (3) after cleaning it.
- (h) Remove the remaining angles in Member (4) - (3) , drill new holes in them, clean and reinstall them.
- (i) Insert filler plate to the opening between the angles, if necessary, and tighten by high strength bolts.

1-2 Diagonal Members in Pannels between Panel Points (6) - (8) , (8) - (10) , (10) - (12) and (12) - (14)

The strengthening method is essentially the same as mentioned in 1-1. But the existing angles are also to be replaced with new ones, because they are too narrow for installation of high-strength bolts.

The holes which are not required should be filled with ordinary bolts.

2. Lower Lateral Member

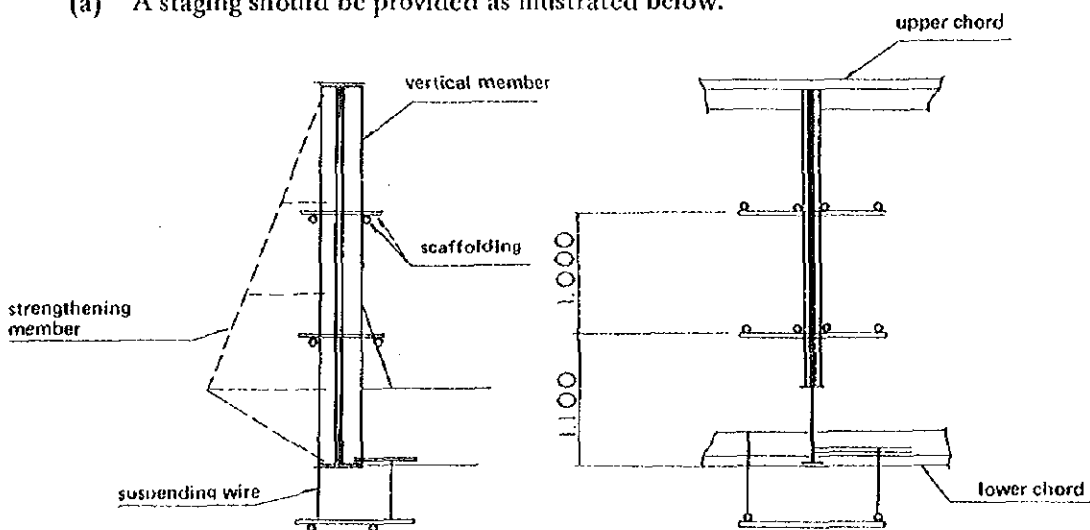
- (a) The same requirements as for Chapter I are applicable to the stagings ;
- (b) Cut off rivets of filler plate at intersection point and replace it with a new gusset plates.
- (c) Cut off all the rivets for connection with the lower chord members and install temporary bolts.
- (d) Replace the existing angles in Member (1) - (3) and (1') - (3) with new angles.
- (e) At Panel Points (7), (9), (11), (13) and (15) install new gusset plates before replacing the existing angles with new ones.

3. Stringer

- (a) Almost all the instructions for Chapter I are applicable to the work for stringers.

4. Knee Bracing

- (a) A staging should be provided as illustrated below.

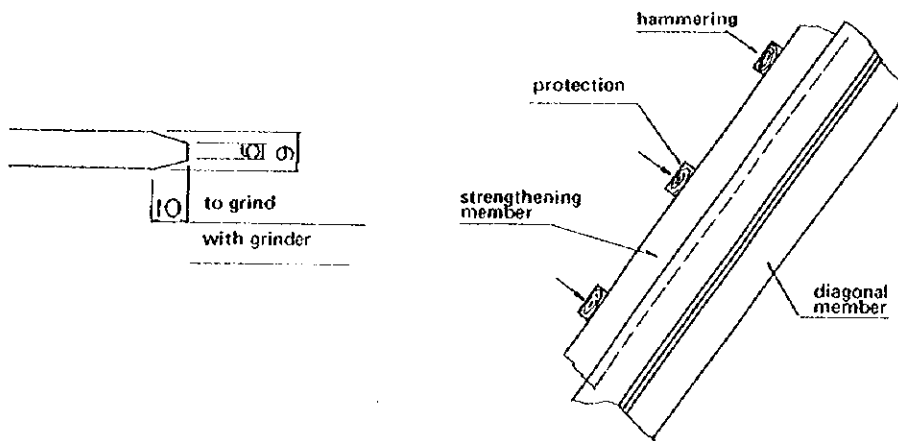


- (b) Drill new holes on vertical member and clean its contact surface.
- (c) Because the weight of each set of the strengthening structures is as small as about 200kg, the strengthening structure can be formed beforehand, and attached to the bridge.
- (d) Install the pre-fabricated strengthening to the vertical member and fix it by temporary bolts.
- (e) Strengthening of the floor beam is to be carried out after completion of the above-mentioned work.

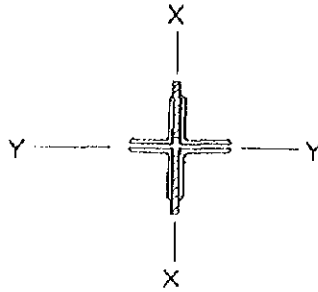
IV. Instructions for Strengthening and Repair of Daydè Type; 40m (T.T.)

1. Diagonal Member (Strengthening of member)

- (a) Staging should be erected over the entire height of the bridge.
- (b) Strengthening works for members in the panels between Panel Points (2) - (4), (4) - (5), (11) - (13) and (13) - (14).
 - i) Cut off rivets which are required to be replaced, and install temporary bolts. But use of high-strength bolts is required for portion where stress is to be transmitted.
 - ii) Remove the existing tie plates.
 - iii) Install new strengthening plates one by one.
Each new strengthening plate is about 5m long and 9mm thick. To insert the plate into a 10mm opening between angles, shape its edge by grinding as illustrated below and hammer the plate uniformly over its entire length through timber protection blocks placed on the other edge of the strengthening plate.

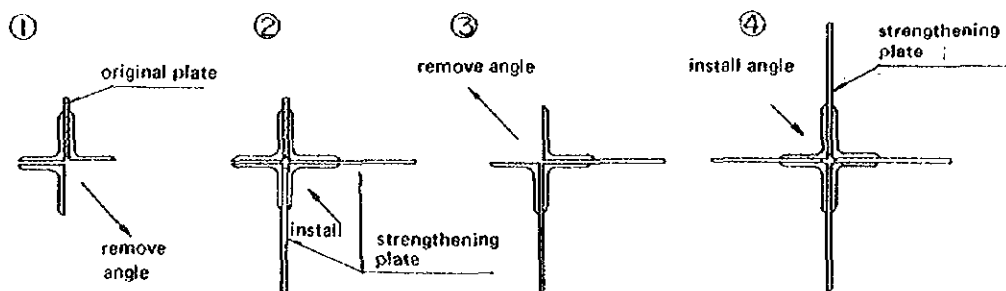


- iv) Install splice plates and tighten with rivets.
- (c) Executing Sequence for Work for Members between Panel Points (5) and (7) and between (10) and (11).
The same procedure as described in i), ii) and iii), Item (b) for Diagonal Member should be adopted.
 - i) Enlarge the existing rivet holes to a diameter of 23.5mm for new rivets having a diameter of 22mm.
 - ii) Install the strengthening angles.
- (d) Executing Sequence for Work for Members between Panel Points (7) and (8) and between (8) and (10).



For Axis Y-Y, follow the same procedure as described in Item (b). However, the removal of the existing plate along Axis X-X is difficult under the existing condition. Therefore, the work must be executed in the following method:

- i) Cut off the stitching rivets of the diagonal member and replace them with temporary bolts.
 - ii) Remove the existing tie plates.
 - iii) Remove one of the four angles composing the member and also the existing plate along Axis X-X.
 - iv) Reinstall the removed angle together with new strengthening plates along Axis X-X and Y-Y.
 - v) Fit strengthening plates to the remaining angle of diagonal member, in the same procedure as described in iii) and iv) above.
 - vi) Perform the operations in iii) and iv) above during a two-hour train interval.
- The sequence of replacement is shown below.

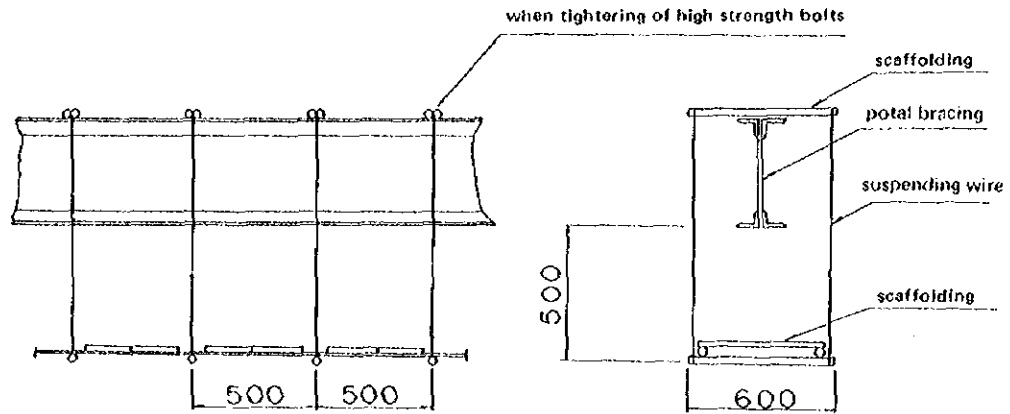


2. Vertical Member (Strengthening of members between Panel Points ② and ③ and between ⑭ - ⑮).

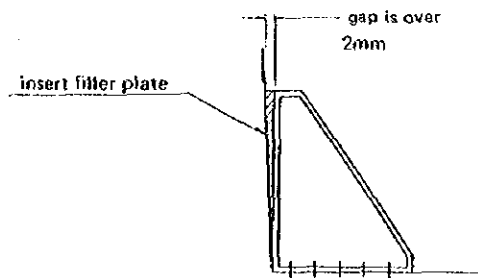
- (a) A staging should be erected over the entire height of the bridge.
- (b) Mark off the vertical member from outside using the same scale as for manufacturing of the strengthening plates and drill holes on them.
- (c) Install angles and tighten them by high strength bolts after cleaning.
- (d) Leave the connection of the corner strengthening parts of the portal and the floor beam untightened with high strength bolts.

3. Portal Bracing

- (a) A staging should be suspended as illustrated below.



- (b) The same procedure as described in Items (b) and (c) of Section 2 "Vertical Member" should be adopted for installation of strengthening angles.
- (c) In installing strengthening members at corners, insert fillers if an opening of over 2mm occurs.



4. Lower Lateral Member

- (a) The same procedure as described in Item (d) of Section 6 "Lower Lateral Member" Chapter I should be adopted for strengthening of member between Panel Points ① and ③ and between ⑱ and ⑳.
- (b) The same procedure as for Chapter IV for strengthening of the other Panel Points.

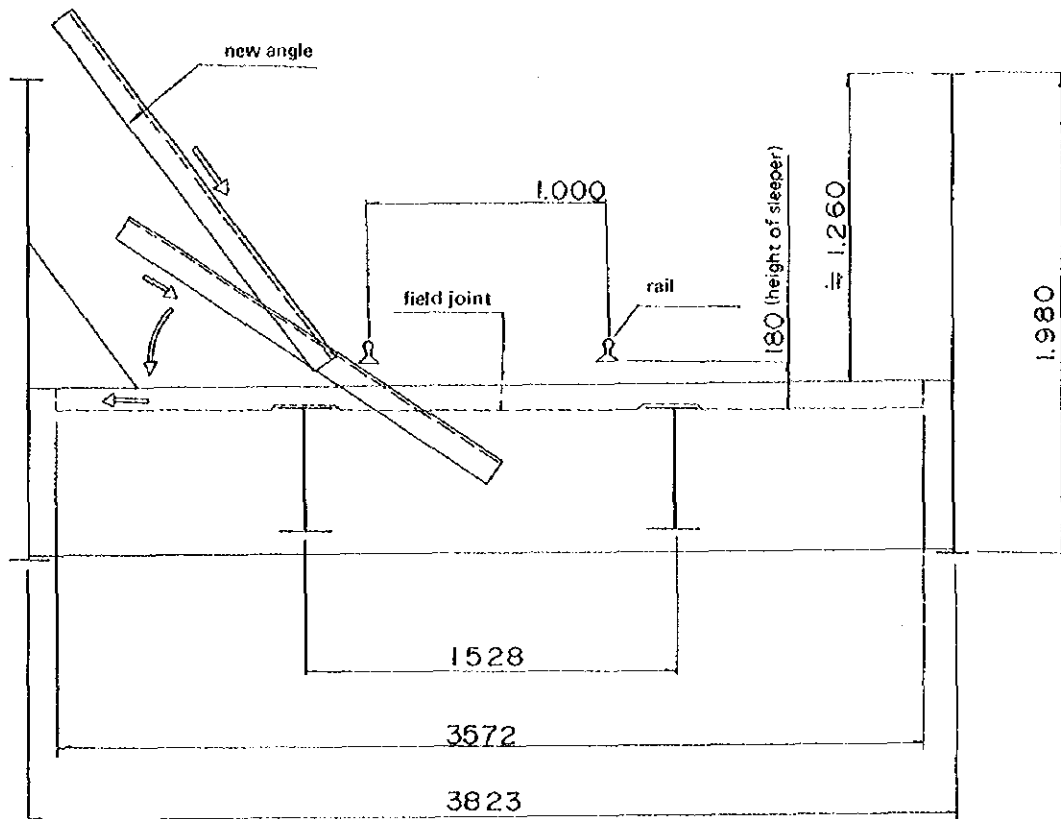
5. Stringer

- (a) Same procedure as for Chapter II is applicable only for installing of struts.

V. Instructions for Strengthening and Repair Cleveland Type ; 20m (T.P.)

1. Floor Beam

- (a) A full-width staging should be provided beneath the bridge which can be used also for improvement works for stringers and lower lateral members.
- (b) Strengthening work for lower flange and upper flange should not be executed at the same time.
- (c) Repair for corroded parts of the web plate should be done after the works on the lower and upper flanges are completed.
- (d) The temporary bolts inserted to the holes of the flange angles which are to be wrapped by patch plate for repair of corroded portion of the web plate should be replaced with high-strength bolts, when the patch plates are attached.
- (e) The same procedure as described in Items (b), (c) and (d) of "End Floor Beam" Chapter I should be adopted for treatment of the lower flange.
- (f) For repair of corroded portions, refer to the procedure in Section 7, "Floor Beam" Chapter I.
- (g) The procedure for replacement of the upper flange is as follows.
 - i) Move sleepers 400mm away from edges of the flange plate.
 - ii) Cut stitching rivets and replace them with temporary bolts and drift pins. Move the sleeper on one side 500mm away to permit the use of a corner drill.
 - iii) If a train is to pass during the above work, place a temporary packing between the sleeper and the flange to support the tracks.
 - iv) Carry out the works for replacement of the flange described in v), vi) and vii) below within a two-hour train interval.
 - v) Remove the existing angles and install new angles.
 - vi) The new angles are to be provided with joints in the middle, to make it possible to be inserted between the rail and stringer diagonally from outside the track and then to be placed horizontally for installation in position.
 - vii) Install splice angles and fasten them with temporary bolts.
 - viii) Tighten the flange angles and web plates with high strength bolts.
 - ix) Cut the original angles in half and remove them into the reverse procedure for installation of the new angles.



2. Stringer
 - (a) The same procedure as described in Paragraph 8 of Chapter I is applicable to the improvement work of stringer.
 - (b) Remove the existing struts after the new strut has been installed.
3. Lower Lateral Member
 - (a) The same procedure as described in Chapter IV is applicable to the improvement work for the lower lateral members.

VI. Instructions for Strengthening or Repair of Deck Truss; 30m (D.T.)

1. Upper Chord Member

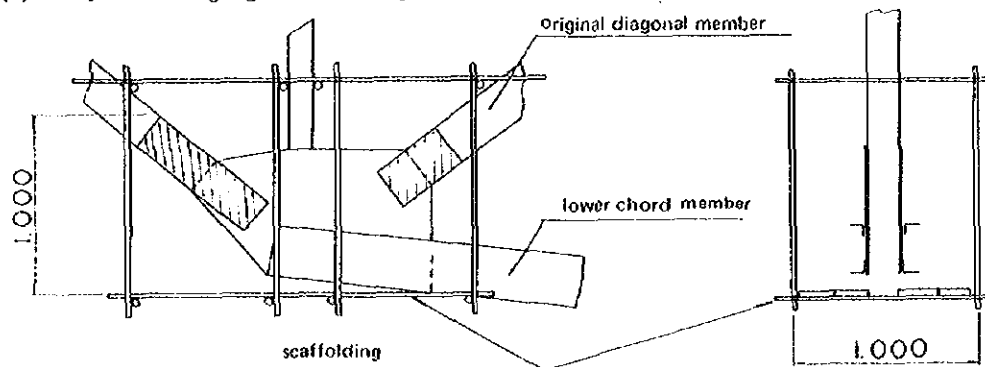
- (a) A full-width staging for the members between Panel Points (4) and (13) and partial stagings for other members should be provided.
- (b) The same procedure as described in Chapter I should be adopted for repair of the members between Panel Points (1) and (4) and between (13) and (16).
- (c) Mark on the upper chord to be repaired using the same scale as used in fabrication in shop and drill new holes on the original members.
- (d) Attach strengthening members to the original members and tighten them with rivets or high-strength bolts.

2. Lower Chord Member

- (a) A full-width staging for the members between Panel Points (6) and (12) and partial stagings for the other members should be provided.
- (b) The same procedure as for Type B should be adopted for repair of the members between Panel Points (3) and (6) and between (12) and (15).
- (c) The same procedure as described in Item (c) of Section 1 "Upper Chord Member" is to be applicable for repair of the members between Panel Points (6) and (12).

3. Diagonal Connection Member

- (a) A partial stagings should be provided as illustrated below.

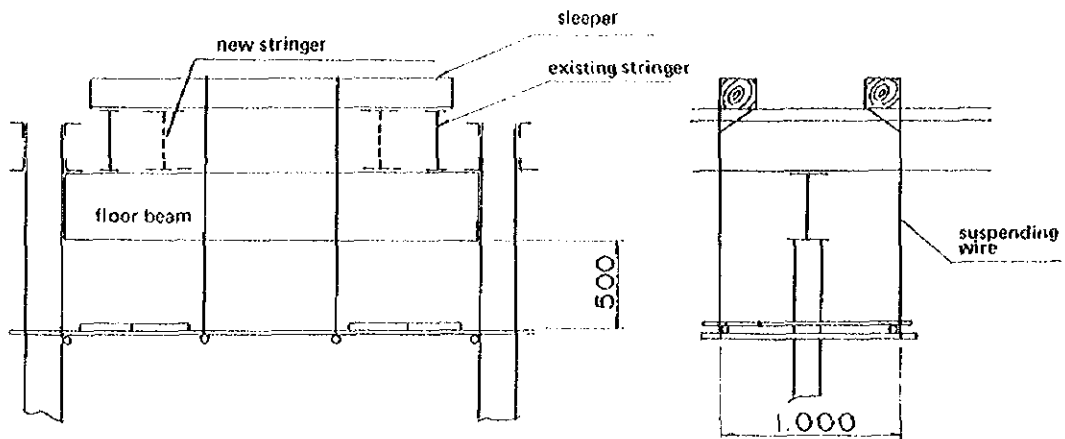


- (b) Drill new holes using the duplicate scale.
- (c) Cut off rivets and replace them with temporary bolts.
- (d) Install splice plates and filler plates and fasten them with temporary bolts.
- (e) Do the above work with respect to each side separately.
- (f) After riveting, fill the opening between gusset plates and fillers with resinous putty or zinc-rich putty.

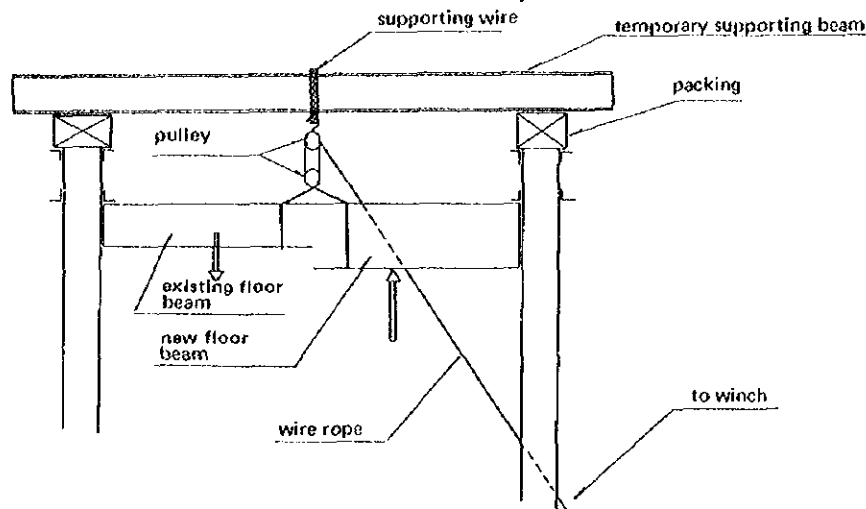
4. Floor Beam

- (a) A full-width staging should be provided beneath the floor beam, which can be used

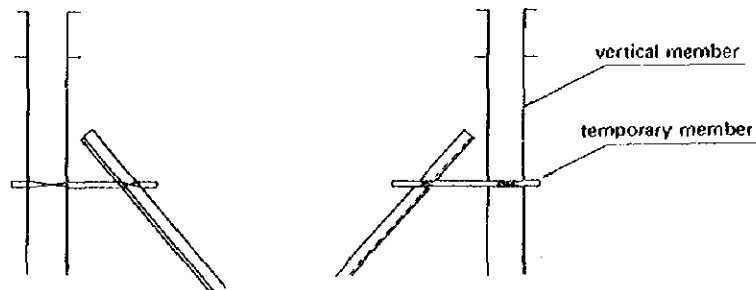
also for repairing the stringers and upper lateral members.



(b) Perform the work in accordance with the procedure as illustrated below.



- (c) Cut off the rivets connecting the floor beam with the vertical member and replace them with temporary high-strength bolts.
- (d) Provide a temporary H-shaped beam and equipment in order to remove the existing floor beam and install a new one.
- (e) Remove gusset plates of sway bracings and fix them with the vertical members temporarily.



- (f) The work for replacement of each floor beam should be carried out within a two-hour train interval.
- 5. Stringer
 - (a) Insert temporary packings under the sleepers.
 - (b) Cut all rivets and replace them with temporary bolts.
 - (c) Insert new stringers inside of the existing stringers from underside as illustrated in Para. 4.
 - (d) Cut the existing stringer and remove it using sleepers.
 - (e) Remove the temporary packings under the sleepers after completion of all the improvement works.
 - 6. Upper Lateral Member
 - (a) Replace gusset plates first.
 - (b) Perform the other operations in accordance with the procedure described in Chapter IV.
 - 7. Lower Lateral Member
 - (a) A full-width staging should be provided beneath the bridge.
 - (b) Drill new holes on the lower chord members for gusset plates.
 - (c) After cleaning the contact surfaces on which the gusset plates are attached, fixed them with temporary bolts.
 - (d) Install lateral angles and tighten them with high strength bolts.
 - 8. Sway Bracing
 - (a) A partial stagings should be provided.
 - (b) Install the new gusset plates to the floor beam.
 - (c) Drill new holes on new angles and install the angles and the gusset plates after cleaning their contact surfaces.
 - (d) Tighten them with high-strength bolts.

VII. Instructions for Strengthening or Repair of Dayde Type ; 80m (T.T.)

The strengthening methods for various members are the same as described in respective past chapters.

- i) As for strengthening of upper chord, lower chord and diagonal members, refer to Chapter I.
- ii) As for strengthening of diagonal members by connecting with horizontal members, and strengthening of stringers and lower laterals, refer to Chapter II.
- iii) As for strengthening of upper laterals, refer to Chapter IV.

