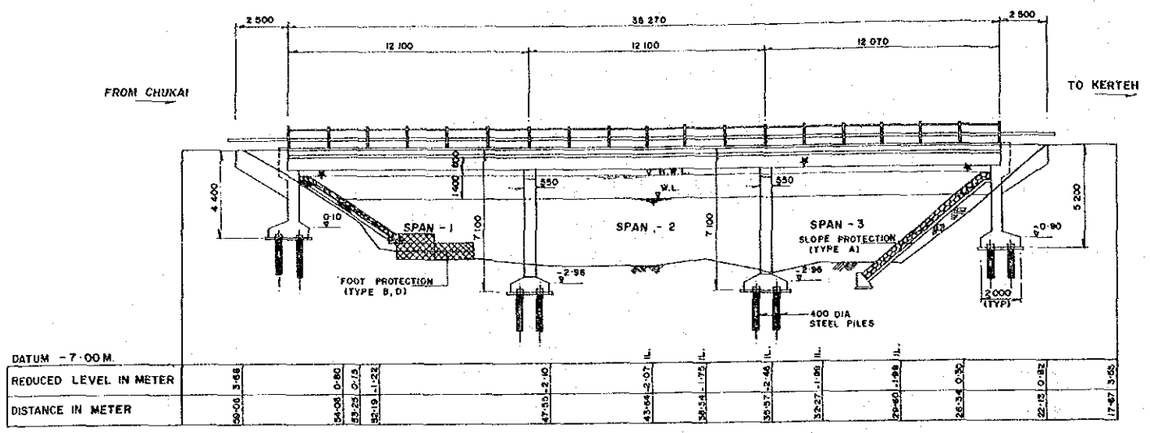
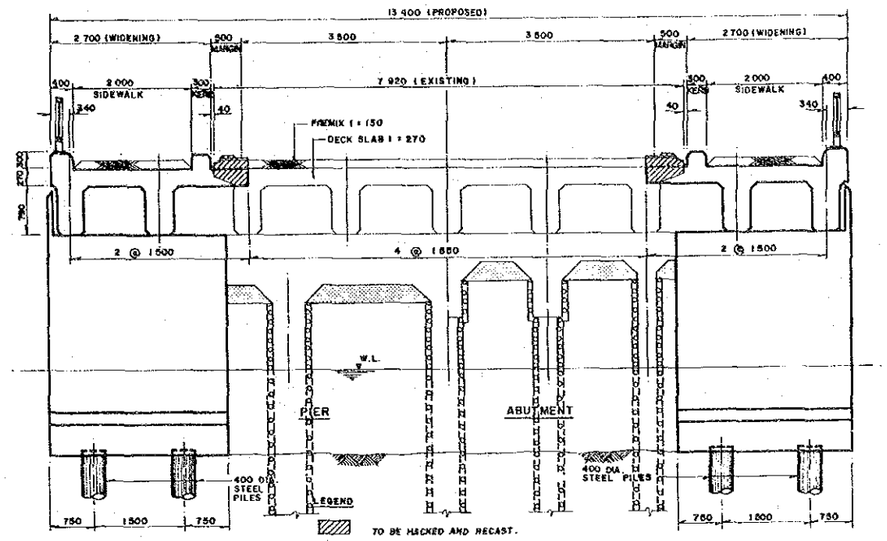
ELEVATION

1 : 150



CROSS - SECTION

1 : 50

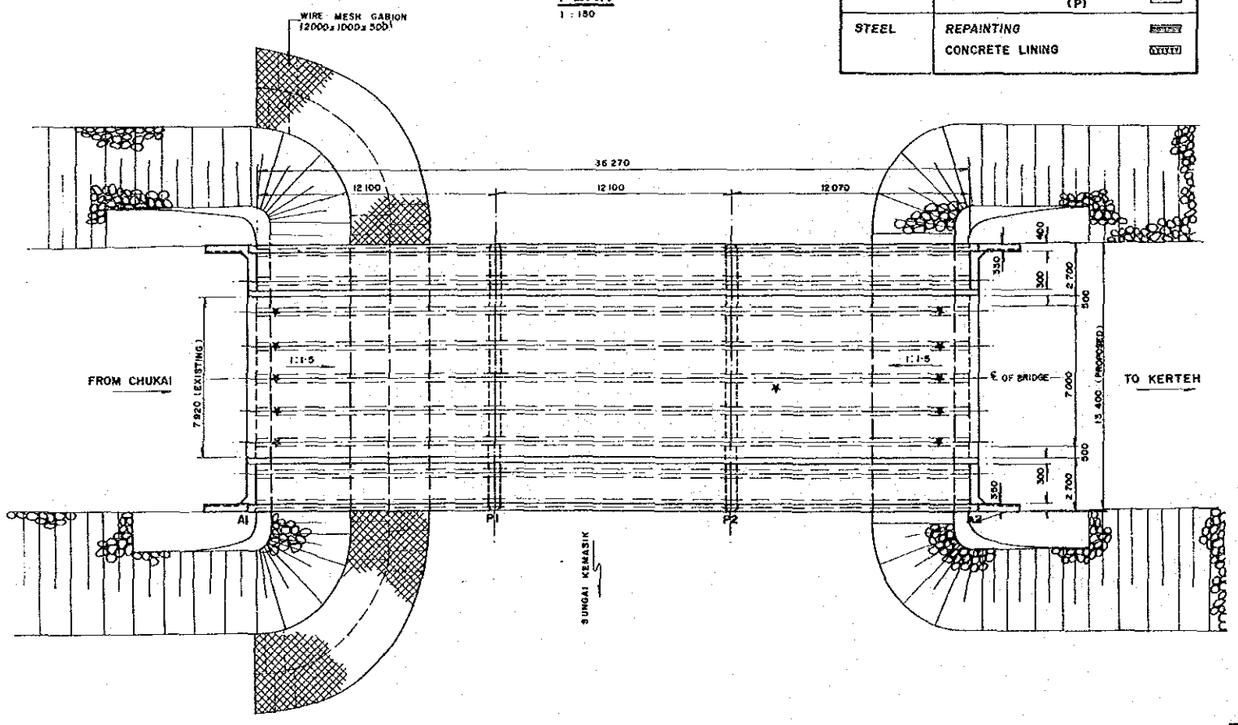


LEGEND OF REHABILITATION WORK

CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

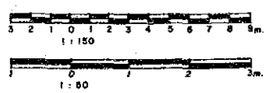
PLAN

1 : 150



MAIN WORK ITEMS

1. ONE LANE TRAFFIC DURING THE WORK AND INSTALLATION OF TRAFFIC CONTROL DEVICES.
2. ADDING SIDEWALK
   - I) WIDENING OF SUBSTRUCTURE ON BOTH SIDES OF THE ABUTMENTS AND PIERS.
   - II) INSTALLATION OF RUBBER BEARING. (REFER TO STD. DWG. MR-D-27, TYPE B)
   - III) WIDENING OF SUPERSTRUCTURE ON BOTH SIDES OF THE CARRIAGEWAY INCLUDING ASPHALT SURFACE LAYER.
   - IV) INSTALLATION OF HANDRAIL.
3. PATCHING TO FLACKING AND HONEY COMB AT BEAM SOFFIT AND SLAB SOFFIT. (REFER TO STD. DWG. MR-D-24)
4. PREPACKED CONCRETE LINING WITH ADDITIONAL REBARS AT ALL CROSSHEAD BEAMS FOR PIERS AND ABUTMENTS. (REFER TO STD. DWG. MR-D-23)
5. CONCRETE LINING TO ALL COLUMNS OF PIERS AND ABUTMENTS. (REFER TO STD. DWG. MR-D-24, TYPE B)
6. INSTALLATION OF EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE B)
7. RECONSTRUCTION OF SLOPE PROTECTION AT BOTH SIDE ABUTMENTS.



JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

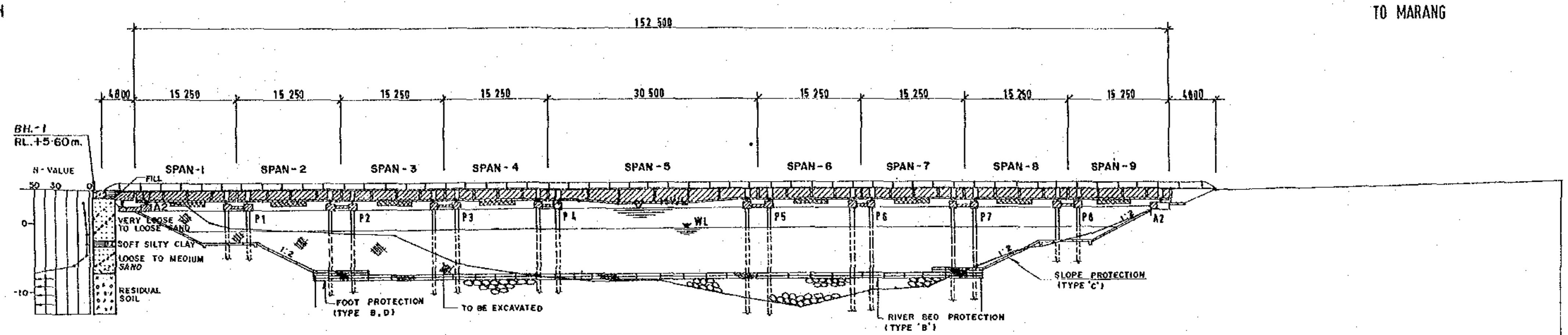
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	3/418/00	AS SHOWN	MR - D - 7

ELEVATION

1:400

FROM DUNGUN

TO MARANG

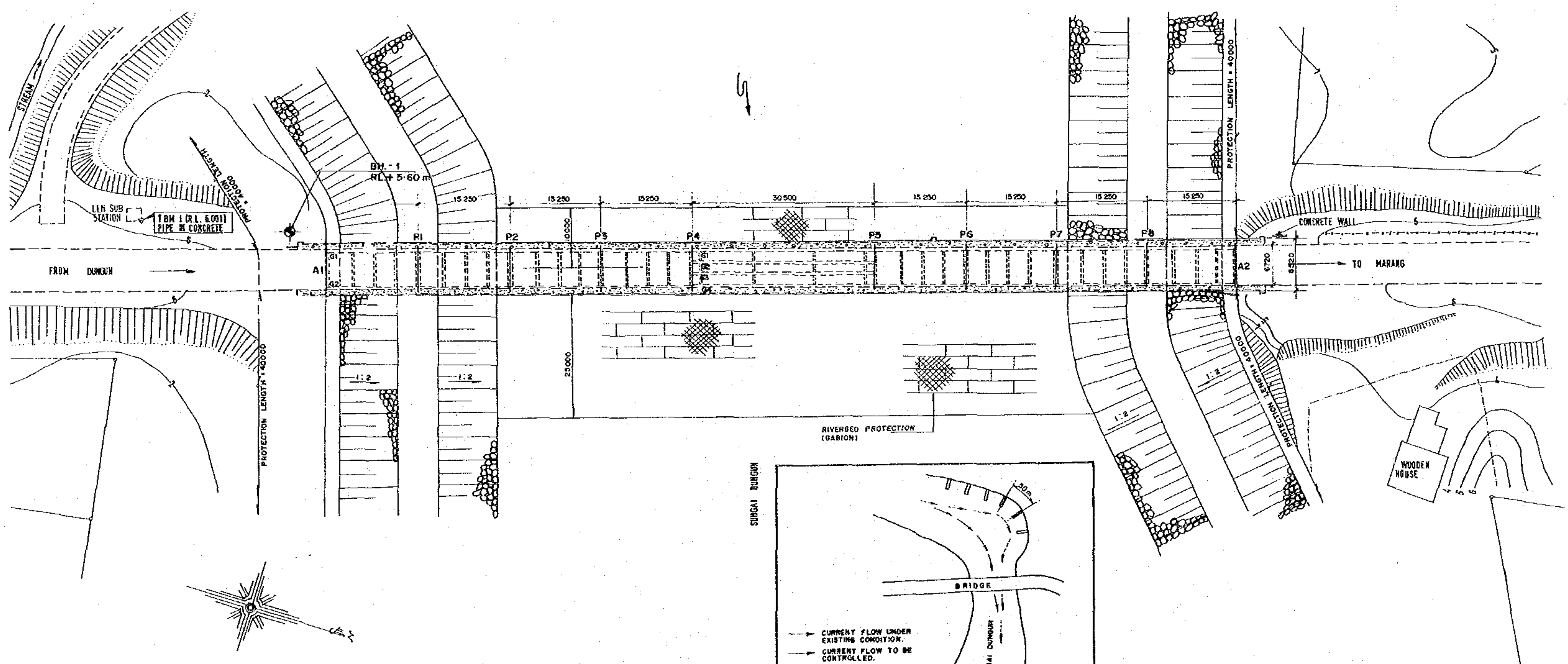


DATUM -20 m

REDUCED LEVEL IN METRES	4.56	3.09	3.02	0.74	-0.03	-0.48	-1.40	-5.20	-7.08	-9.15	-7.95	-10.05	-11.85	-9.45	-8.90	-5.90	-3.00	-2.98	-0.97	1.26	4.52	5.64	5.91	6.04	6.26	6.55	6.80
DISTANCE IN METRES	210.36	204.94	204.11	200.90	197.68	187.44	173.65	164.85	154.87	144.88	134.89	124.90	113.91	103.93	94.94	87.96	79.96	78.79	70.85	66.02	61.32	51.95	41.49	33.91	22.26	10.37	0.00

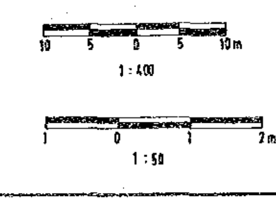
PLAN

1:400



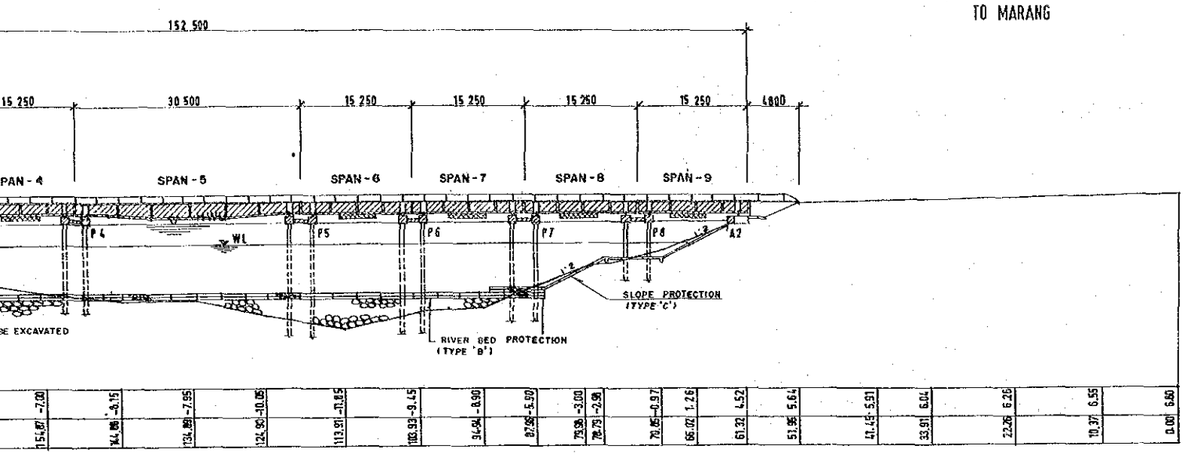
LOCATION OF SPUR DIKES.

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	



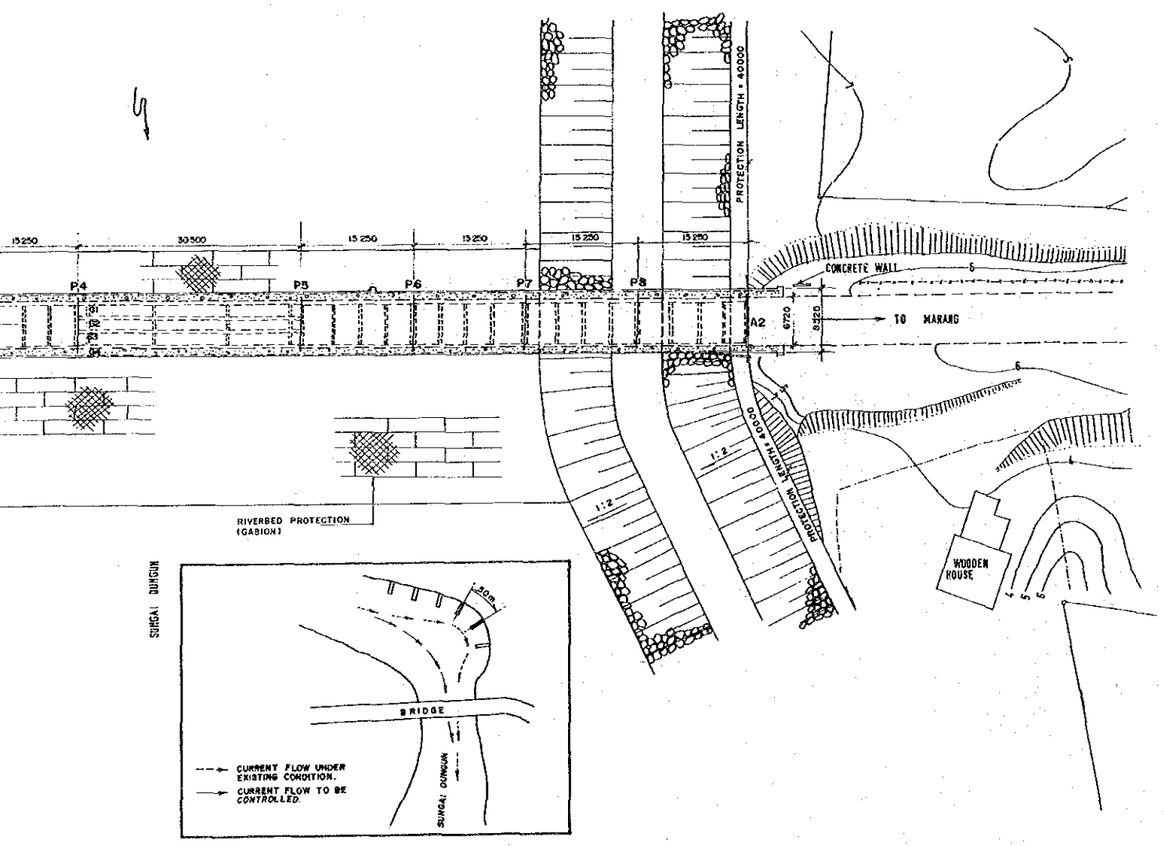
ELEVATION

1:400



PLAN

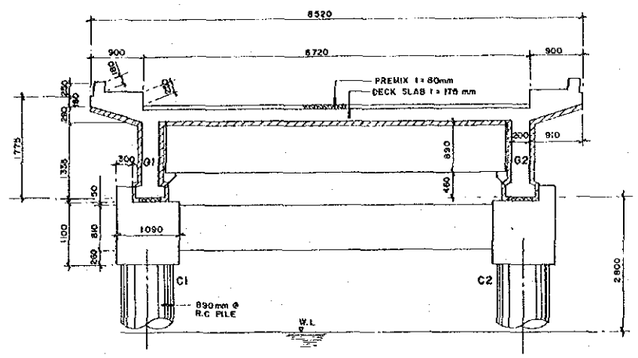
1:400



LOCATION OF SPUR DIKES.

CROSS SECTION

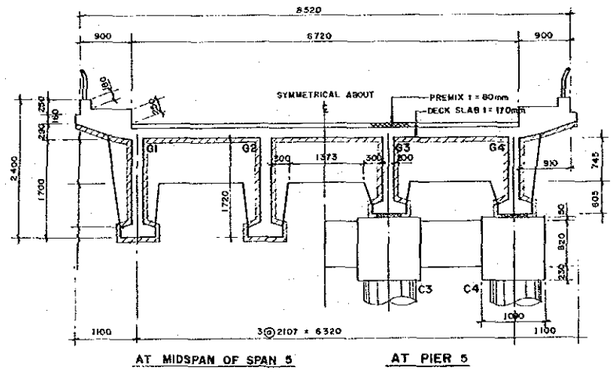
1:50



AT ABUTMENT

CROSS SECTION

1:50



AT MIDSPAN OF SPAN 5 AT PIER 5

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

10 5 0 5 10m
1:400

1 0 1 2m
1:50

MAIN WORK ITEMS

1. PATCHING TO ALL SPALLED CONCRETE, HONEY COMB AND EXPOSED REBAR ON BEAMS, CROSS BEAMS AND PIERS. (REFER TO STD. DWG. MR-D-21)
2. APPLICATION OF PROTECTIVE COATINGS TO THE BEAMS AND SLAB SOFFITS. (REFER TO STD. DWG. MR-D-21)
3. STEEL PLATE BONDING AT BEAM SOFFITS AT ALL SPANS EXCEPT SPAN 5. (REFER TO STD. DWG. MR-D-23)
4. EXTENSION OF DRAINAGE PIPES TO THE LEVEL BELOW THE SOFFIT OF THE BEAM. (REFER TO STD. DWG. MR-D-27)
5. REMOVAL OF VEGETATION.
6. EXCAVATION OF BOTH SIDE BANKS AND CONSTRUCTION OF SLOPE PROTECTION. (REFER TO STD. DWG. MR-D-28)
7. INSTALLATION OF RIVER BED PROTECTION AT PIER 5 & 6. (REFER TO STD. DWG. MR-D-28)
8. INSTALLATION OF SPUR DIKES AT RIGHT SIDE BANK OF UPSTREAM. (REFER TO STD. DWG. MR-D-28)
9. PROVISION OF WATER DROP AT CANTILEVER SLAB. (REFER TO STD. DWG. MR-D-27)
10. INSTALLATION AND REMOVAL OF SCAFFOLDING. (REFER TO STD. DWG. MR-D-29, TYPE A)

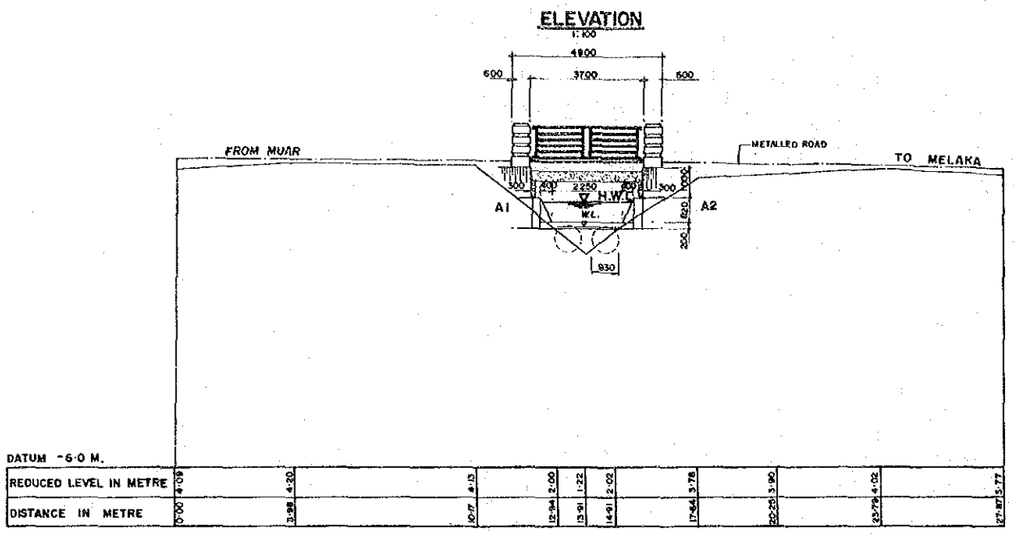
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	3/467/40	AS SHOWN	MR-D-8

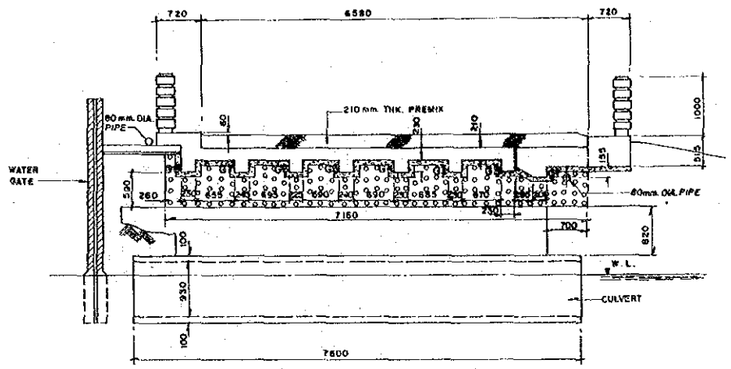
ELEVATION

1:100



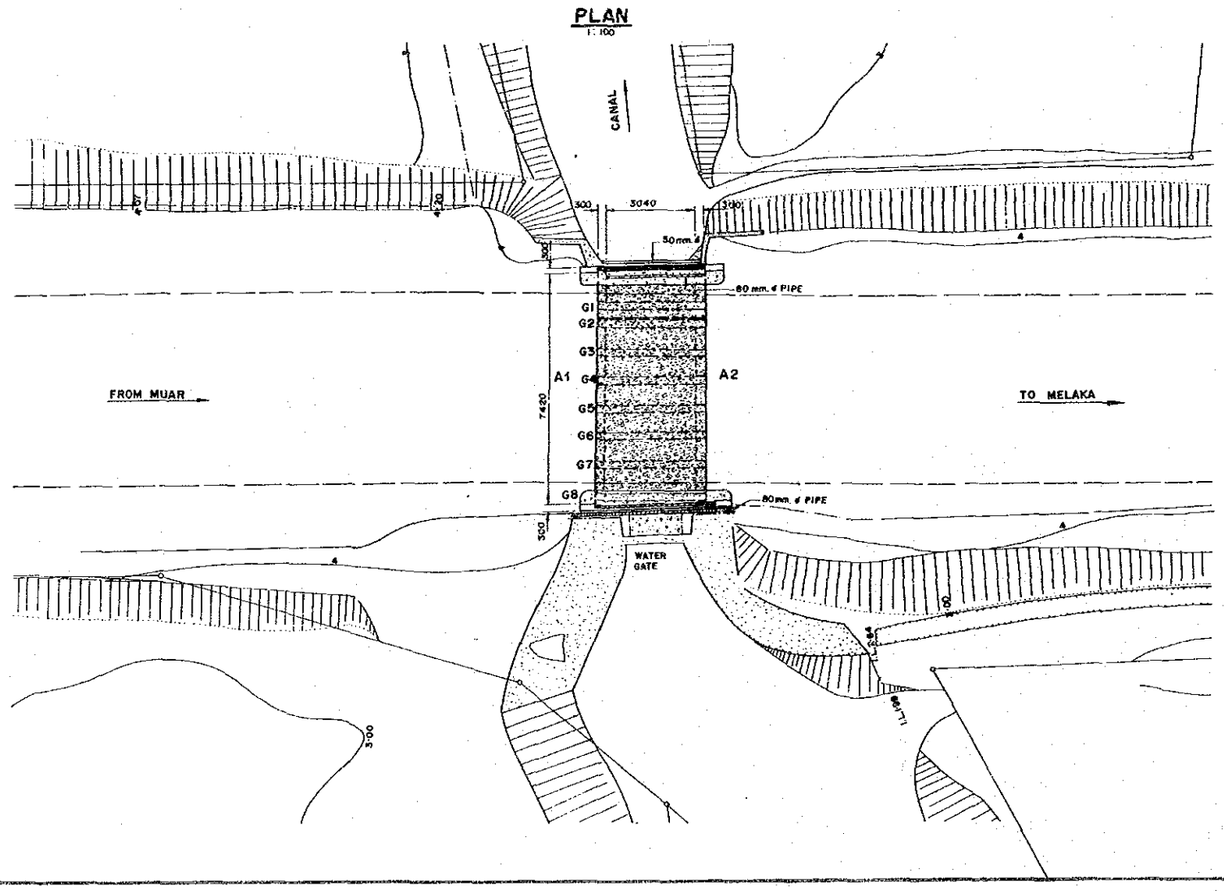
CROSS - SECTION

1:50



PLAN

1:100



MAIN WORK ITEMS

1. GUNITING TO ALL SLAB SOFFITS AND BEAMS. (REFER TO STD. DWG. MR-D-22)
2. PARTIAL LINING FOR BOTH ABUTMENTS. (REFER TO STD. DWG. MR-D-24, TYPE A)

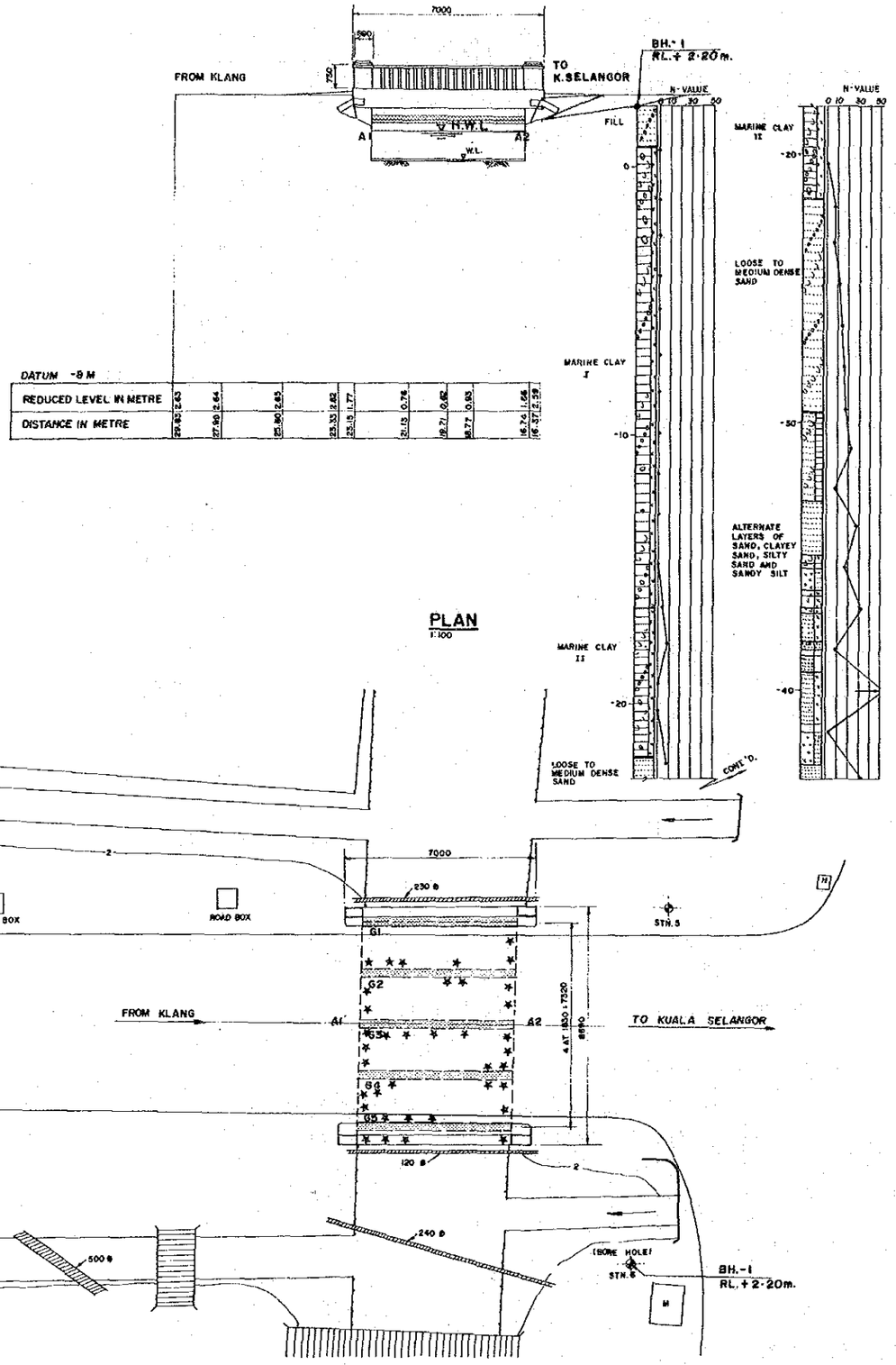
LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	I
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

1:100

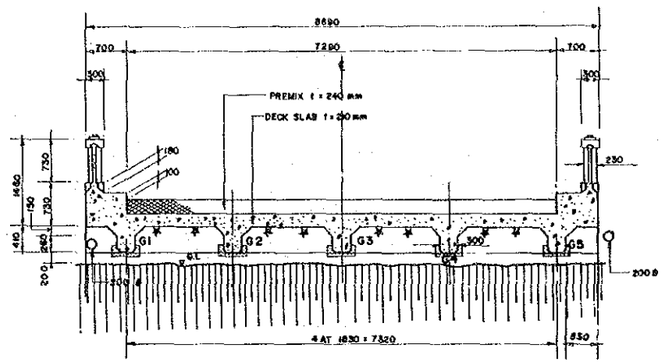
1:50

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	5/208/50	AS SHOWN	MR-D-9

ELEVATION
1:100



CROSS SECTION
1:50



ABUTMENT A2

MAIN WORK ITEMS

1. PREPACKED CONCRETE LINING WITH ADDITIONAL REBARS AT ALL BEAM SOFFIT. (REFER TO STD. DWG. MR-D-23)
2. PATCHING TO ALL FLACKING AND EXPOSED REBAR PORTION OF SLAB SOFFIT. (REFER TO STD. DWG. MR-D-21)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	I
	PROTECTIVE COATING	
	PATCHING	
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

2 1 0 1:100 2 3 4m

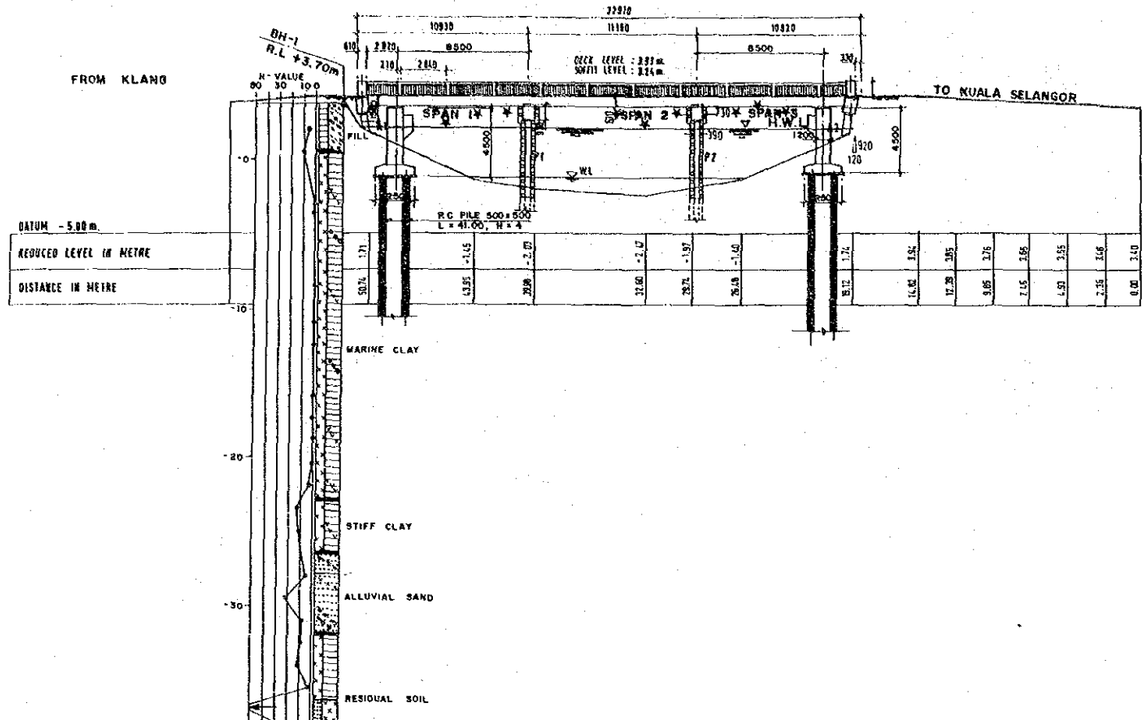
1 0 1:50 1 2m

JICA

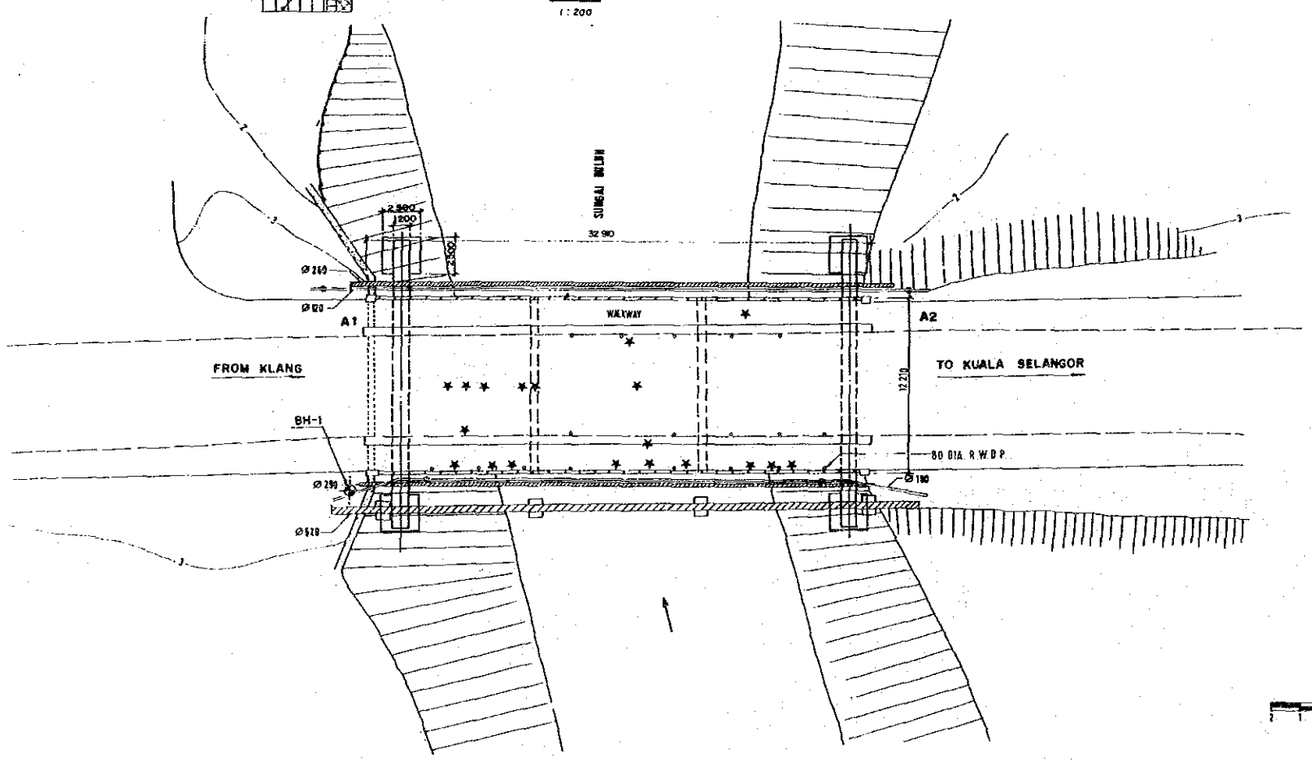
THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	S/465/60	AS SHOWN	MR-D-10

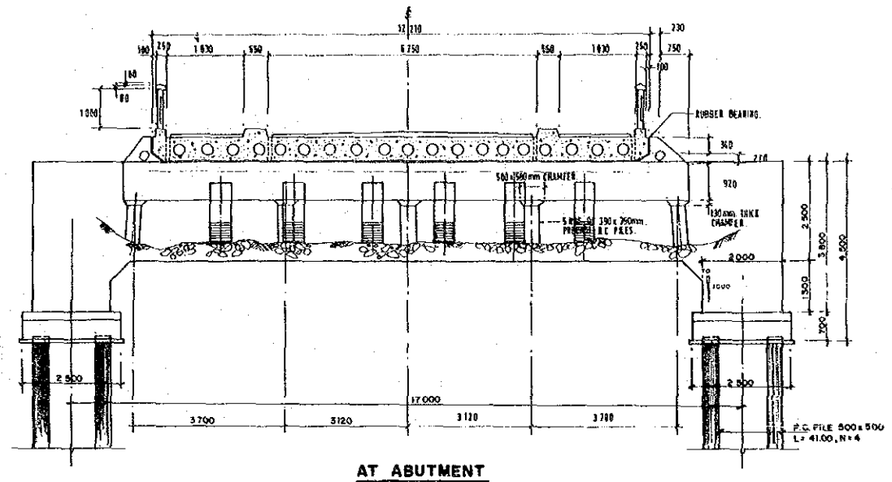
ELEVATION



PLAN



CROSS-SECTION



AT ABUTMENT

MAIN WORK ITEMS

1. INSTALLATION AND REMOVAL OF SCAFFOLDING. (REFER TO STD. DWG. MR-D-29, TYPE A)
2. PATCHING TO ALL DEFECTIVE AREAS OF SLAB SOFFITS. (REFER TO STD. DWG. MR-D-21)
3. STEEL PLATE BONDING ALONG CRACK. (REFER TO STD. DWG MR-D-23)
4. CONSTRUCTION OF RIGID FRAME TYPE ABUTMENTS.
5. TOTAL CONCRETE LINING OF PIERS. (REFER TO STD. DWG. MR-D-24, TYPE B)
6. REPLACEMENT OF EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE B)
7. PROVISION OF WATER DROP AT SLAB EDGE. (REFER TO STD. DWG. MR-D-27)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

1:200 1:75

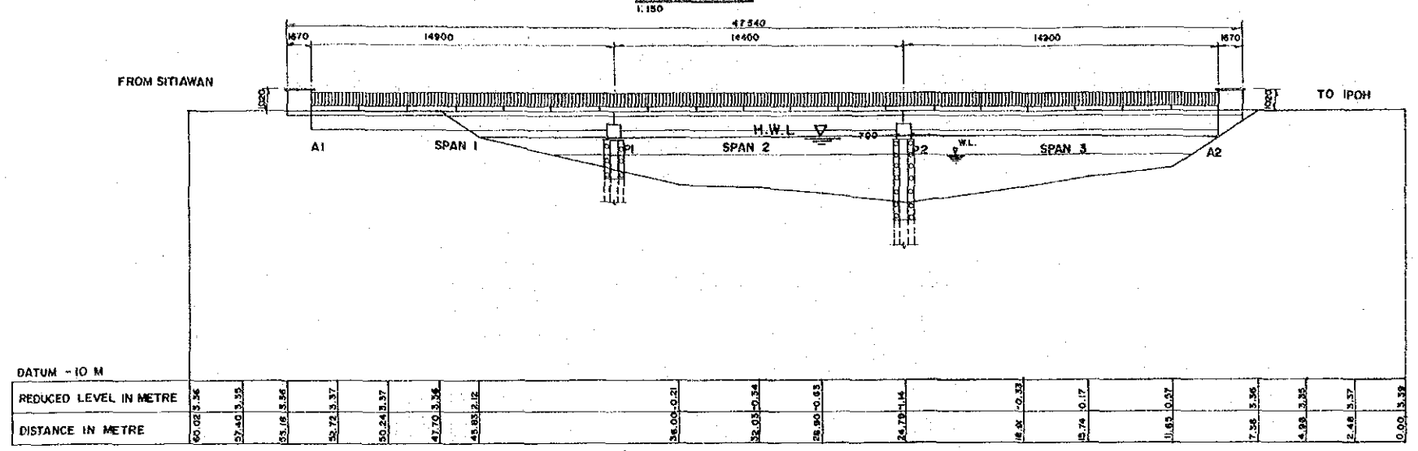
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	5 / 469 / 80	AS SHOWN	MR - D - 11

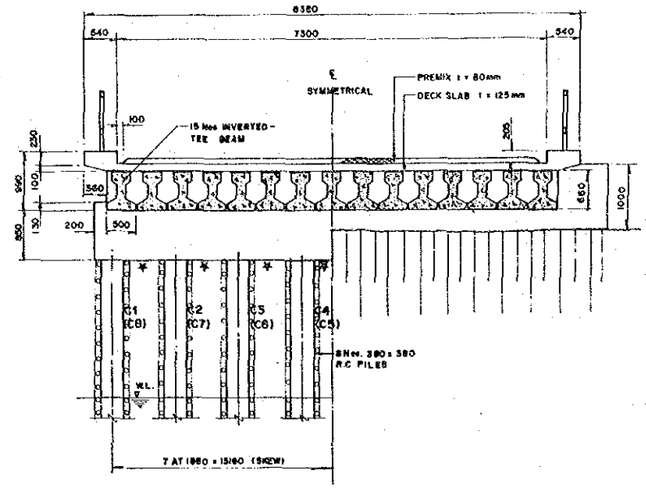
ELEVATION

1:150



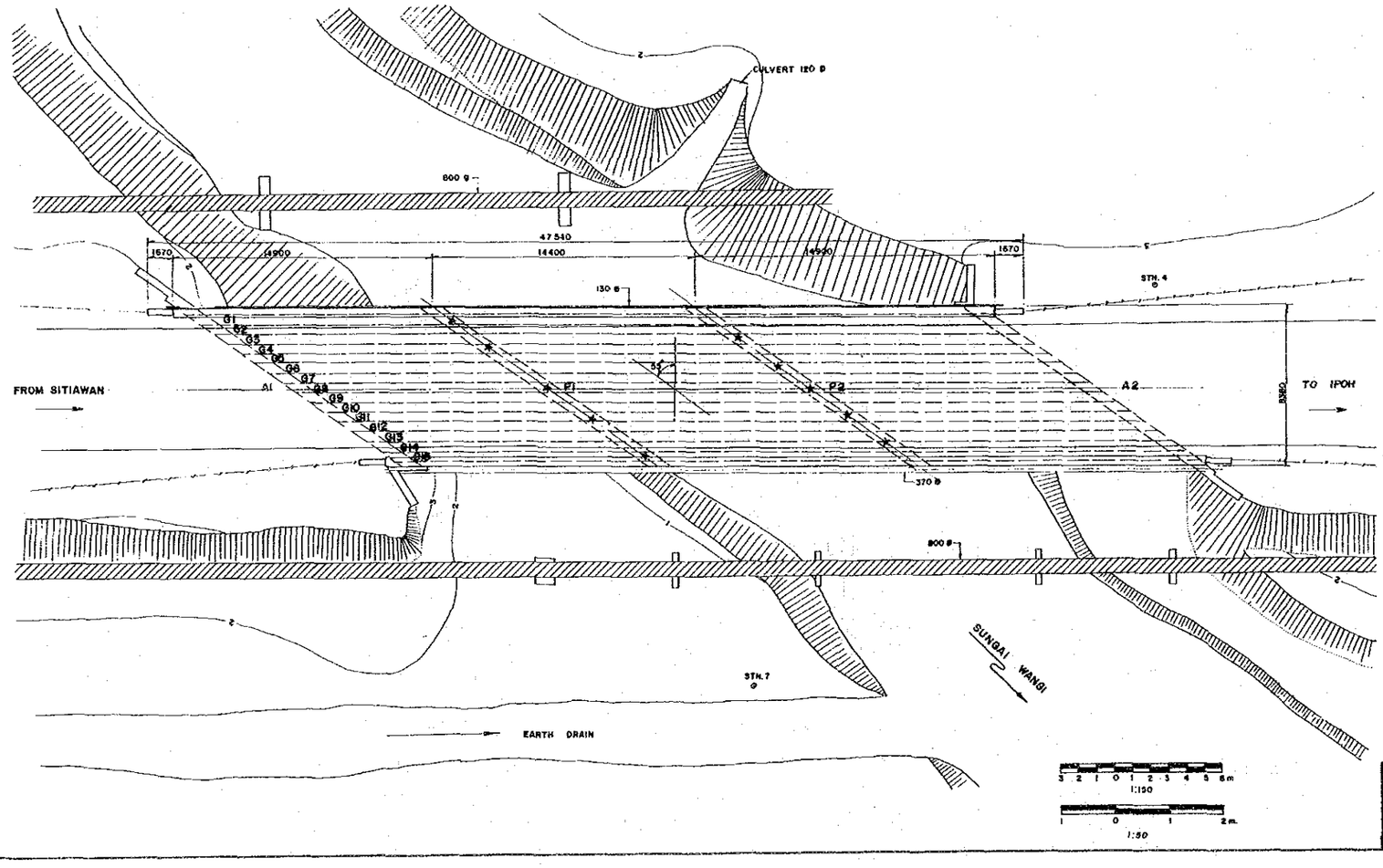
CROSS SECTION

1:50



PLAN

1:150



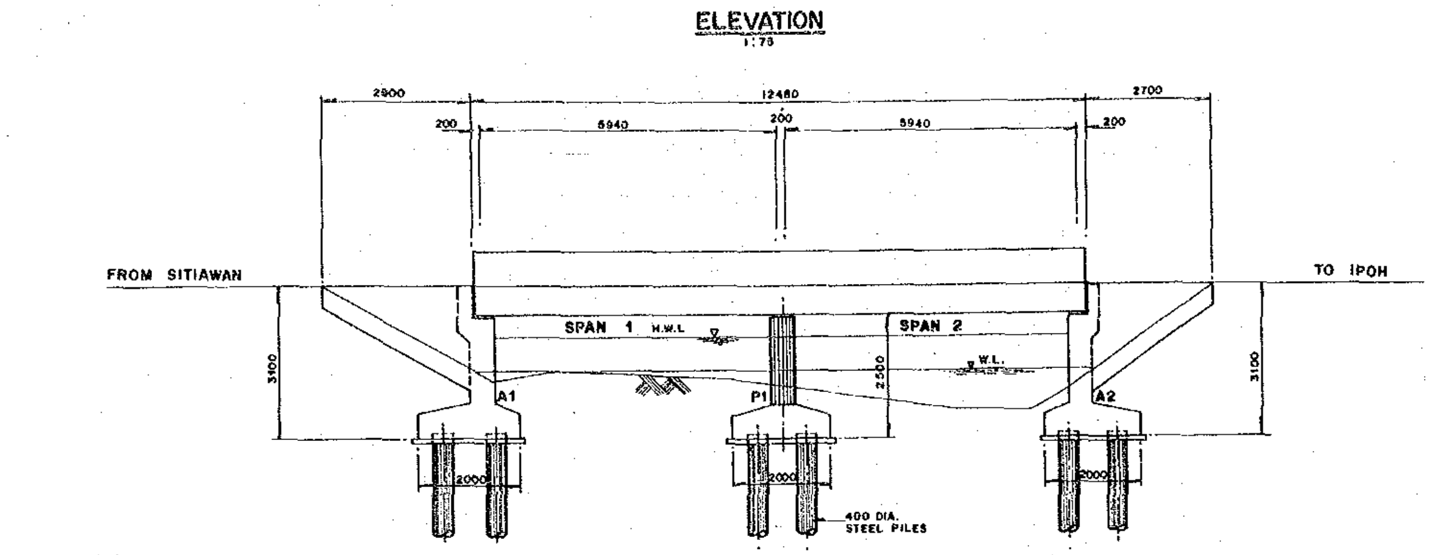
MAIN WORK ITEMS

1. CONCRETE LINING OF ALL PIER COLUMNS. (REFER TO STD. DWG. M-RD-24, TYPE B)
2. PATCHING TO ALL THE FLAKING AND CRACKS PORTION ON PIER CROSSHEADS AND ABUTMENT. (REFER TO STD. DWG. MR-D-21)
3. REPLACEMENT OF EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE B)
4. PROVISION OF WATER DROP AT BOTH CANTILEVER SLABS. (REFER TO STD. DWG. MR-D-27)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	!
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	GENERAL VIEW	5/638/80	AS SHOWN	MR-D-12

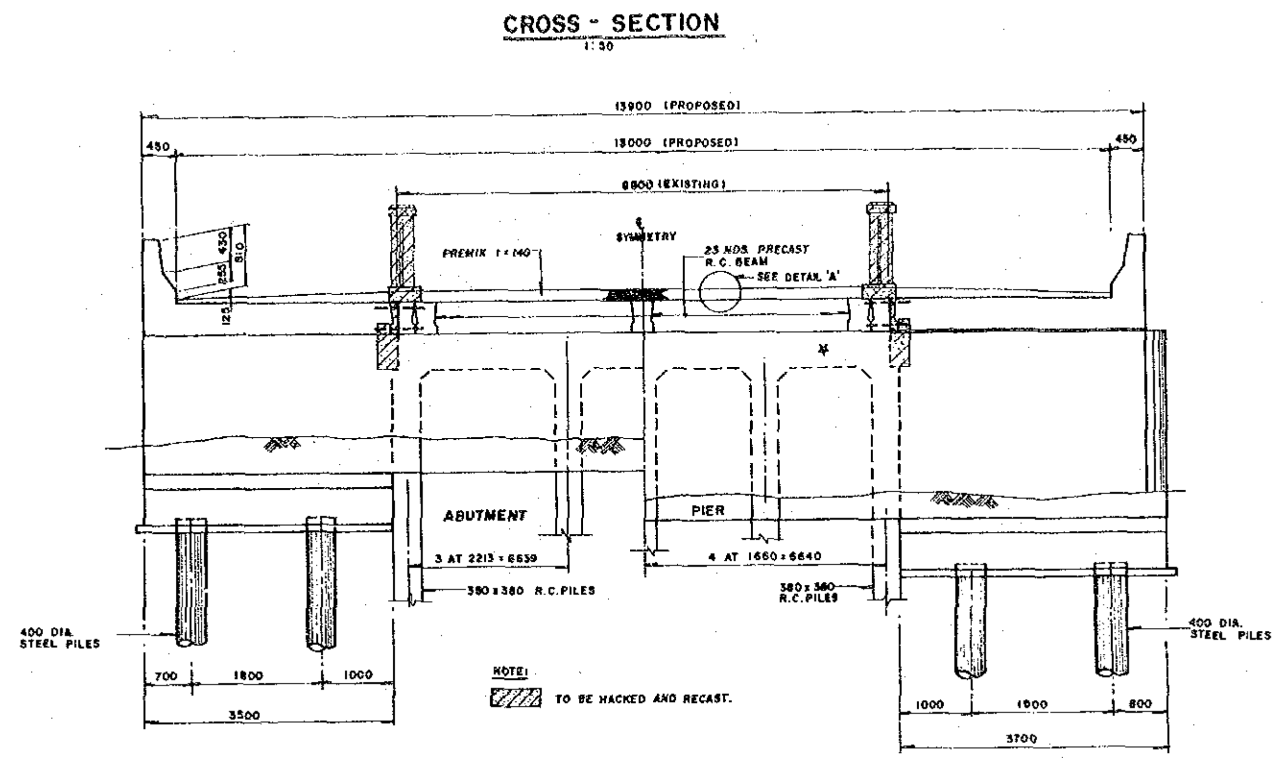
ELEVATION
1:75



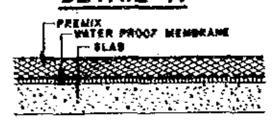
DATUM + 15m.

REDUCED LEVEL IN METER	20·79	20·79	18·86	19·05	18·96	18·88	18·78	18·45	18·29	18·26	18·64	20·80
DISTANCE IN METER	25·54	23·93	20·55	18·09	17·42	15·78	14·89	12·40	11·10	9·66	8·88	0·81

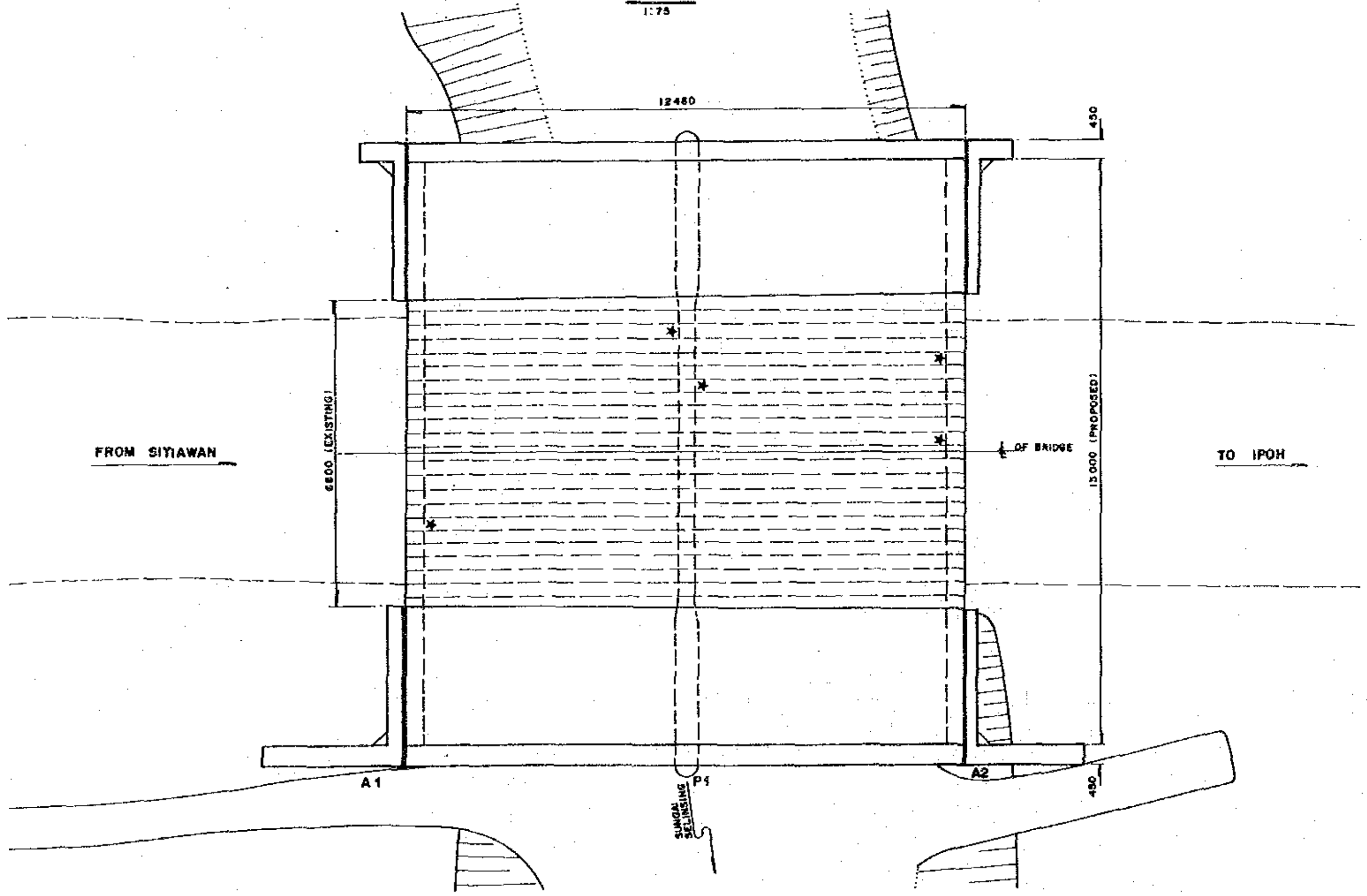
CROSS - SECTION
1:50



DETAIL 'A'



PLAN
1:75



MAIN WORK ITEMS

1. ONE WAY TRAFFIC DURING REHABILITATION WORK.
2. REMOVAL OF EXISTING STEEL RAILING, KERBS AND GABION POSTS.
3. WIDENING OF BRIDGE SUPERSTRUCTURE AND SUBSTRUCTURE TO BOTH SIDES.
4. PROVISION OF WATERPROOF MEMBRANE ON TOP OF DECK SLAB AFTER REMOVAL OF PREMIX. (REFER TO STD. DWG. MR-D-22)
5. PATCH REPAIR FOR ABUTMENT AND PIER UPSTAND R.C. PILES AND CROSSHEAD BEAMS. (REFER TO STD. DWG. MR-D-21)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	ꜛ
	PROTECTIVE COATING	▨
	PATCHING	*
	GUNITING	▨
	WATERPROOF LAYER	▥
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	▨
	STEEL PLATE BONDING	▩
	CONCRETE LINING (A) (P)	▭
STEEL	REPAINTING	■
	CONCRETE LINING	▥

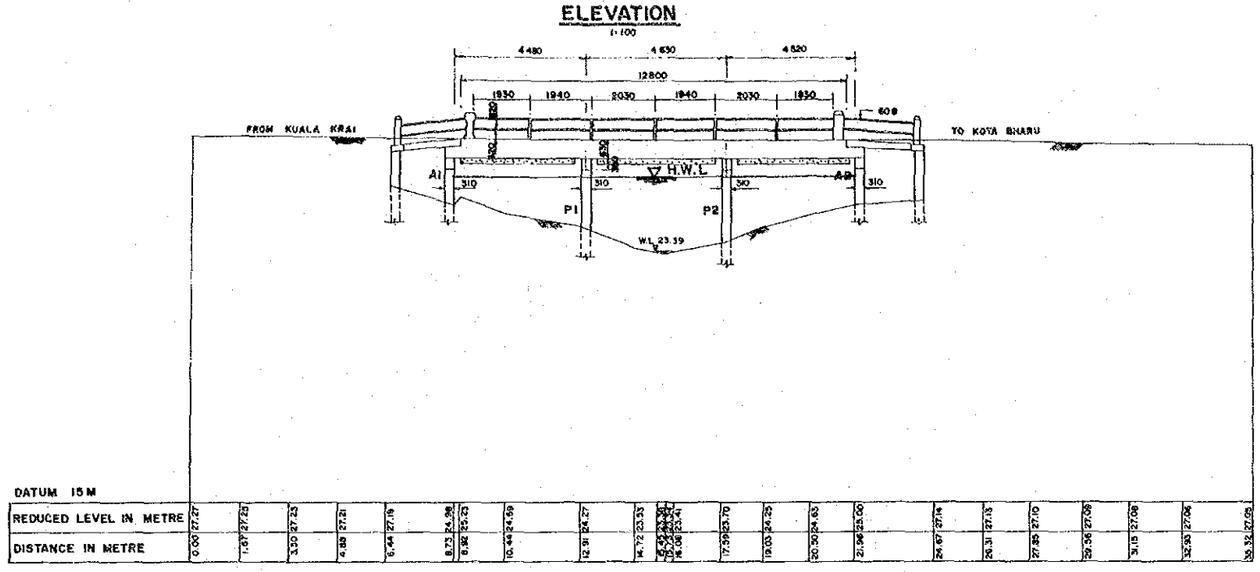
0 1 2 3m.
1:75
0 2m.
1:50

JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	5/678/40	AS SHOWN	MR-D-13

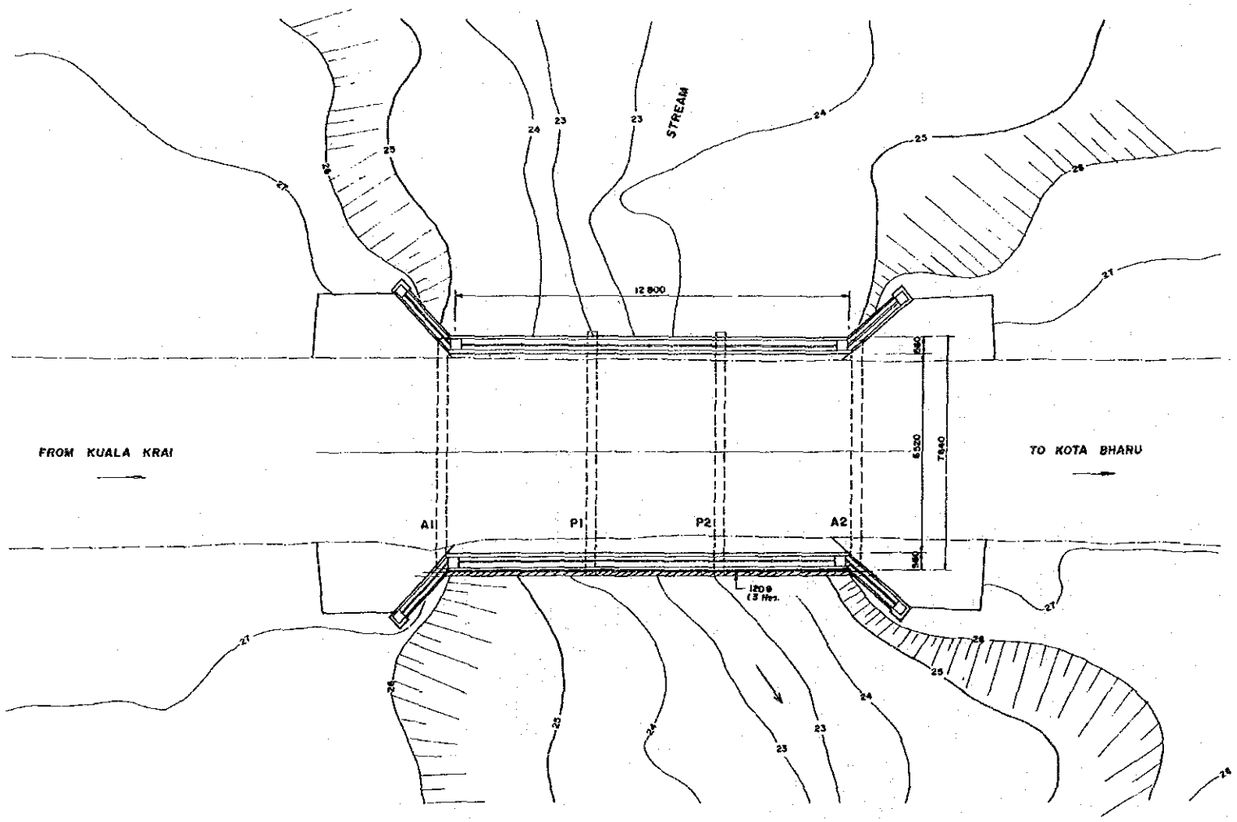
ELEVATION

1:100



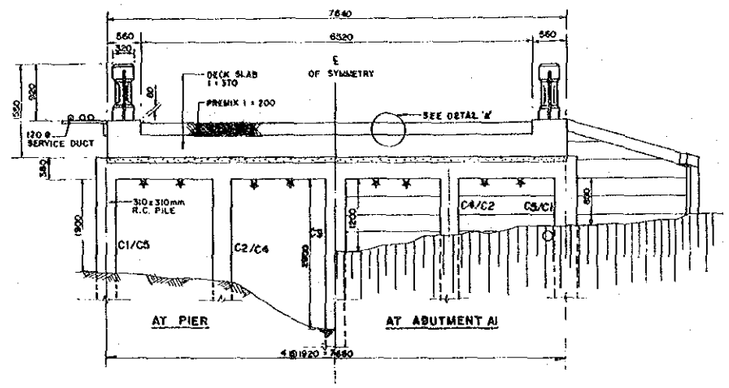
PLAN

1:100



CROSS SECTION

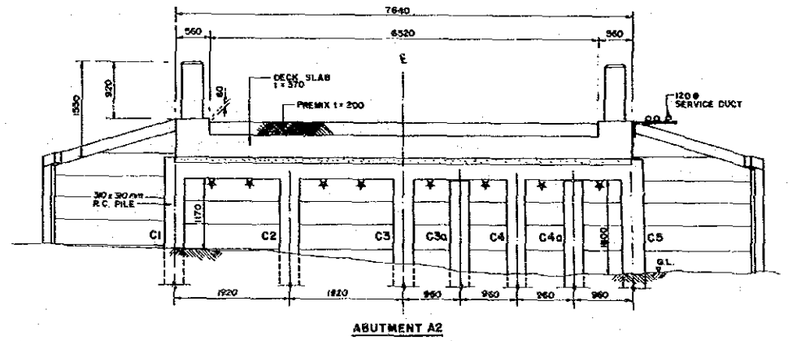
1:50



DETAIL 'A'

CROSS SECTION

1:50



MAIN WORK ITEMS

1. PREPACKED CONCRETE LINING WITH ADDITIONAL DISTRIBUTION REBARS AT SLAB SOFFIT. (REFER TO STD. DWG. MR-D-23)
2. PATCH REPAIR TO CROSSHEAD BEAM OF PIERS AND ABUTMENTS. (REFER TO STD. DWG. MR-D-21)
3. PROVISION OF WATERPROOF MEMBRANE ON TOP OF DECK SLAB AFTER REMOVAL OF PREMIX. (REFER TO STD. DWG. MR-D-22)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

1:100

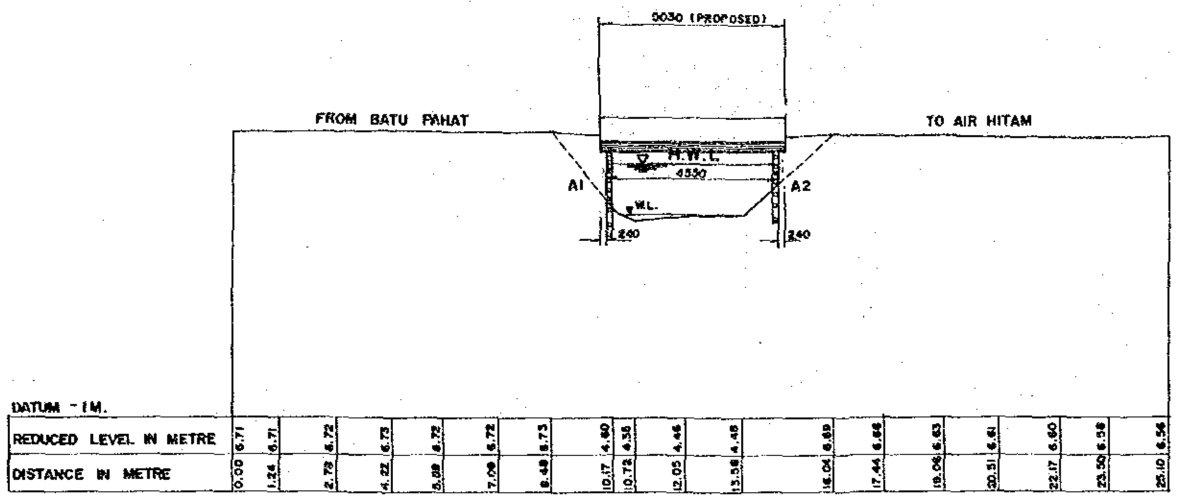
1:50

JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	8/348/50	AS SHOWN	MR-D-14

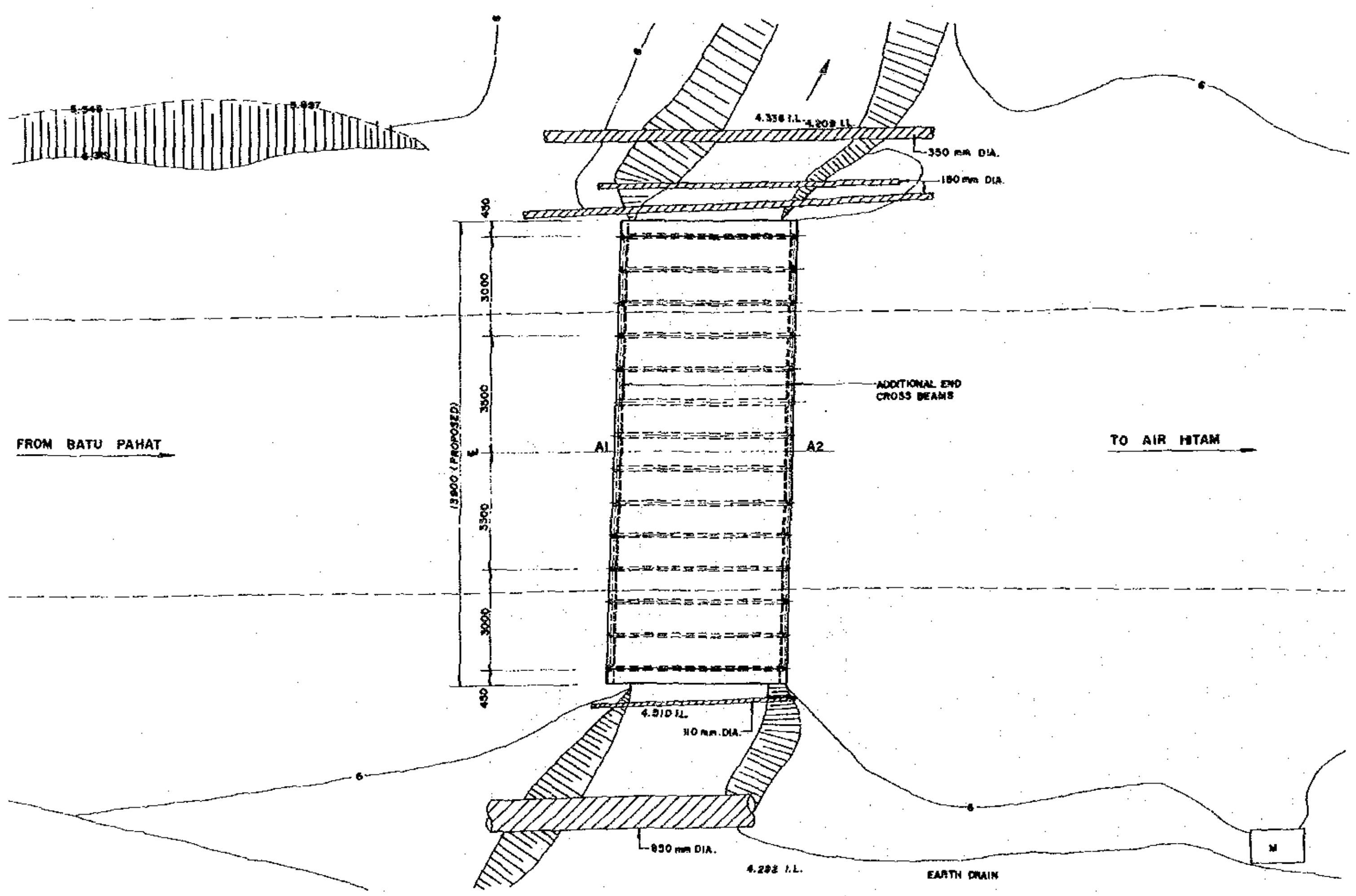
ELEVATION

1:100



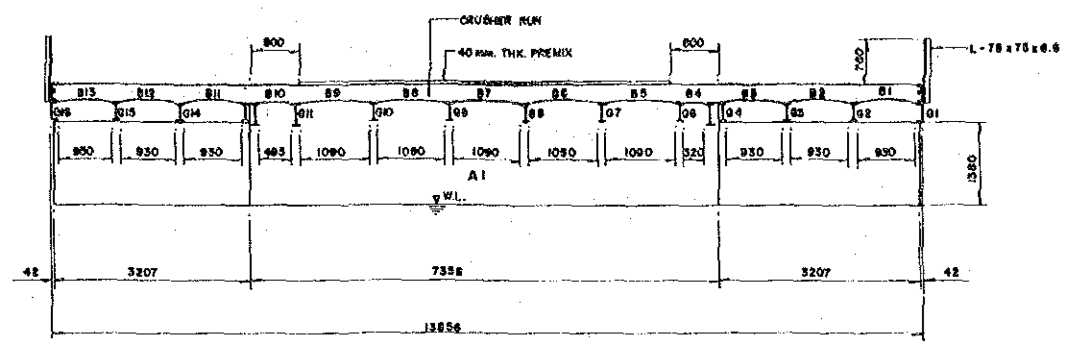
PLAN

1:100



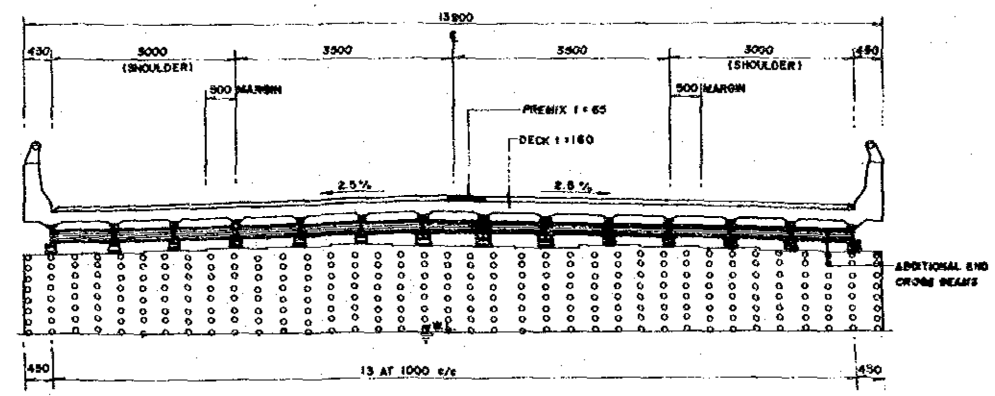
CROSS - SECTION OF EXISTING BRIDGE

1:60



CROSS - SECTION OF PROPOSED BRIDGE

1:60



LEGEND OF REHABILITATION WORK	
CONCRETE	EPOXY INJECTION
	PROTECTIVE COATING
	PATCHING
	GUNITING
	WATERPROOF LAYER
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR
	STEEL PLATE BONDING
	CONCRETE LINING (A) (P)
STEEL	REPAINTING
	CONCRETE LINING

MAIN WORK ITEMS

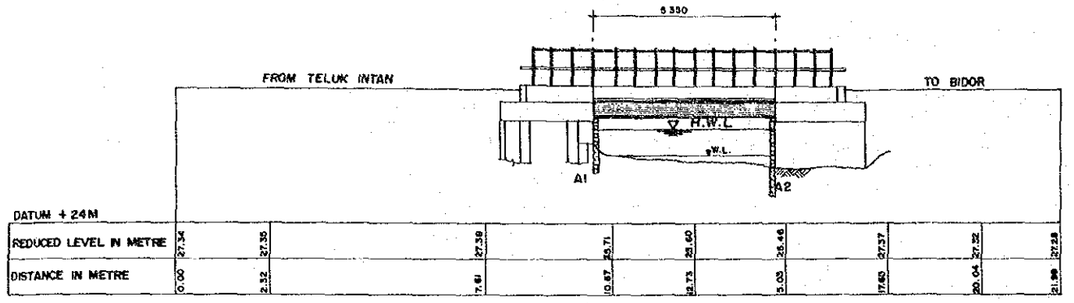
1. ONE WAY TRAFFIC DURING REHABILITATION WORK.
2. REPLACEMENT OF STEEL BUCKLE PLATE TO R.C. SLAB.
   - I) DEMOLITION OF STEEL BUCKLE PLATE.
   - II) REMOVAL OF EXISTING BEAMS.
   - III) REMOVAL OF ALL THE CORRODED MATERIALS BY WET GRIT BLASTING. (REFER TO STD. DWG. MR-D-25)
   - IV) INSTALLATION OF SHEAR CONNECTOR ON TOP FLANGE.
   - V) RAISING BRIDGE SEAT UP TO SPECIFIC ELEVATION.
   - VI) INSTALLATION OF STEEL BEARING (REFER TO STD. DWG. MR-D-27, TYPE A) AND REPAINTING BEAMS WITH END CROSS BEAMS. (REFER TO STD. DWG. MR-D-25)
   - VII) CONSTRUCTION OF R.C. CONCRETE SLAB WITH 65mm HOT MIX.
   - VIII) INSTALLATION OF HANDRAIL AND EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE A)
3. PARTIAL CONCRETE LINING FOR BOTH ABUTMENTS. (REFER TO STD. DWG. MR-D-24, TYPE B)

1:100 — 1:60

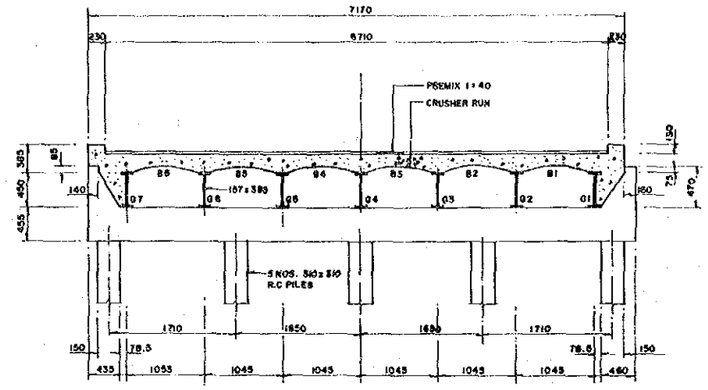
THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	50/010/70	AS SHOWN	MR - D - 15

JICA

ELEVATION
1:75

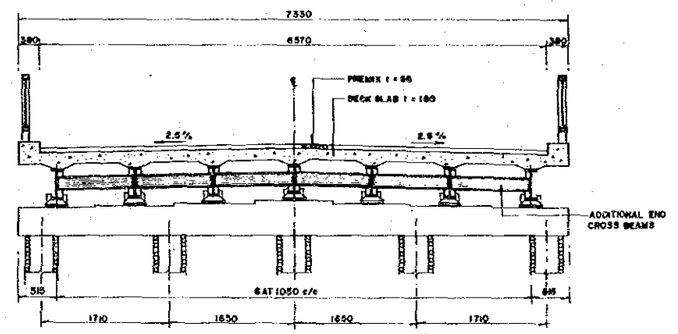


CROSS-SECTION OF EXISTING BRIDGE
1:40

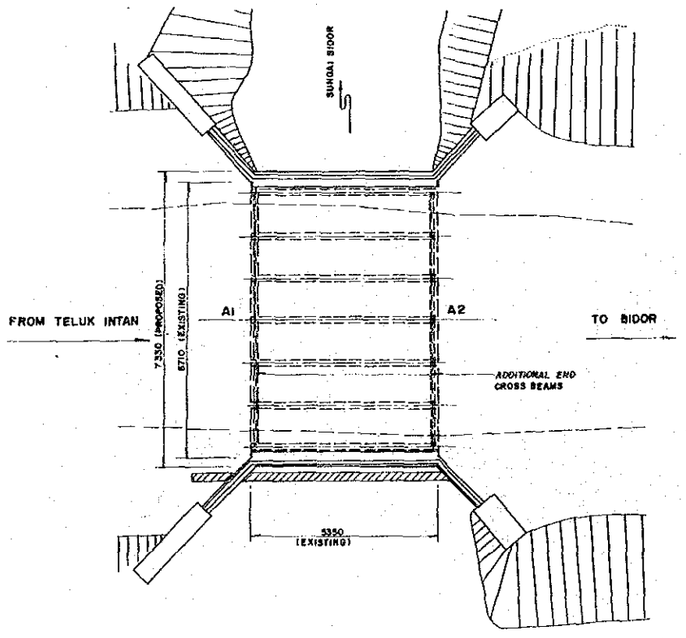


ABUTMENT A1

CROSS-SECTION OF PROPOSED BRIDGE.
1:40



PLAN
1:75



MAIN WORK ITEMS

1. INSTALLATION AND REMOVAL OF TEMPORARY DETOUR ROAD WITH 3 NOS. 1.5m DIAMETER R.C. PIPE CULVERT. (REFER TO STD. DWG. MR-D-29, TYPE B)
2. REPLACEMENT OF STEEL BUCKLE PLATE TO R.C. SLAB.
   - I) DEMOLITION OF STEEL BUCKLE PLATE.
   - II) REMOVAL OF EXISTING BEAMS.
   - III) REMOVAL OF ALL THE CORRODED MATERIALS BY WET GRIT BLASTING. (REFER TO STD. DWG. MR-D-25)
   - IV) RAISING BRIDGE SEAT UP TO SPECIFIC ELEVATION.
   - V) INSTALLATION OF STEEL BEARING (REFER TO STD. DWG. MR-D-27, TYPE A) AND REPAINTING GIRDER WITH END CROSS BEAMS. (REFER TO STD. DWG. MR-D-25)
   - VI) CONSTRUCTION OF R.C. CONCRETE SLAB WITH 65mm THICKNESS OF HOT MIX.
   - VII) INSTALLATION OF HANDRAIL.
   - VIII) INSTALLATION OF EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE A)
3. CONCRETE LINING OF UPSTAND PILES. (REFER TO STD. DWG. MR-D-24, TYPE B)

LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	I
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

2m 1m 0 1m 2m
1:60

2m 1m 0m 1m 2m
1:75

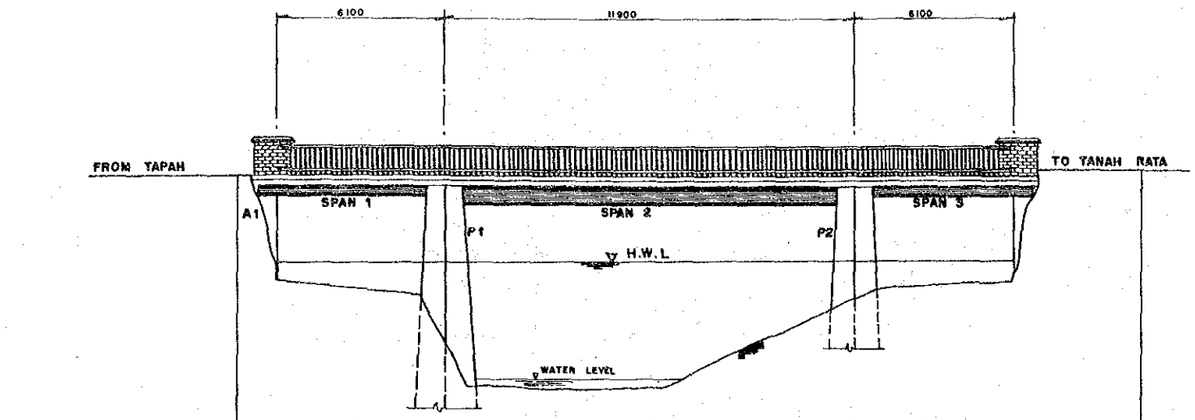
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	58 / 033 / 40	AS SHOWN	MR-D-16

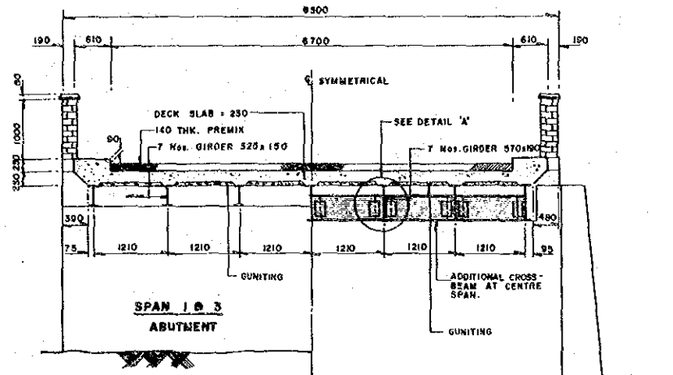
ELEVATION

1 : 100



CROSS - SECTION

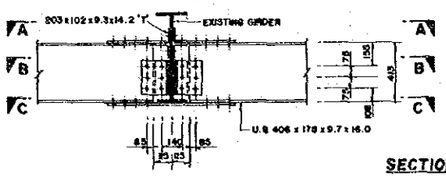
1 : 50



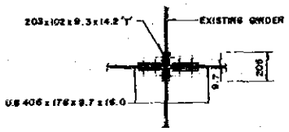
CROSS BEAM CONNECTION DETAILS

1:20

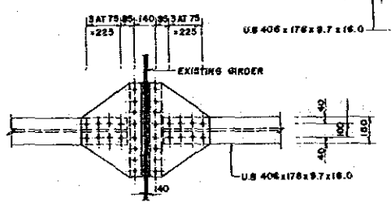
DETAIL 'A'



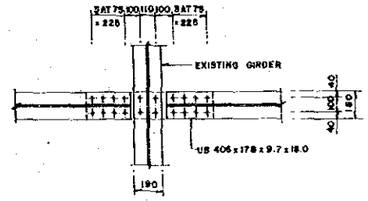
SECTION B - B



SECTION A - A

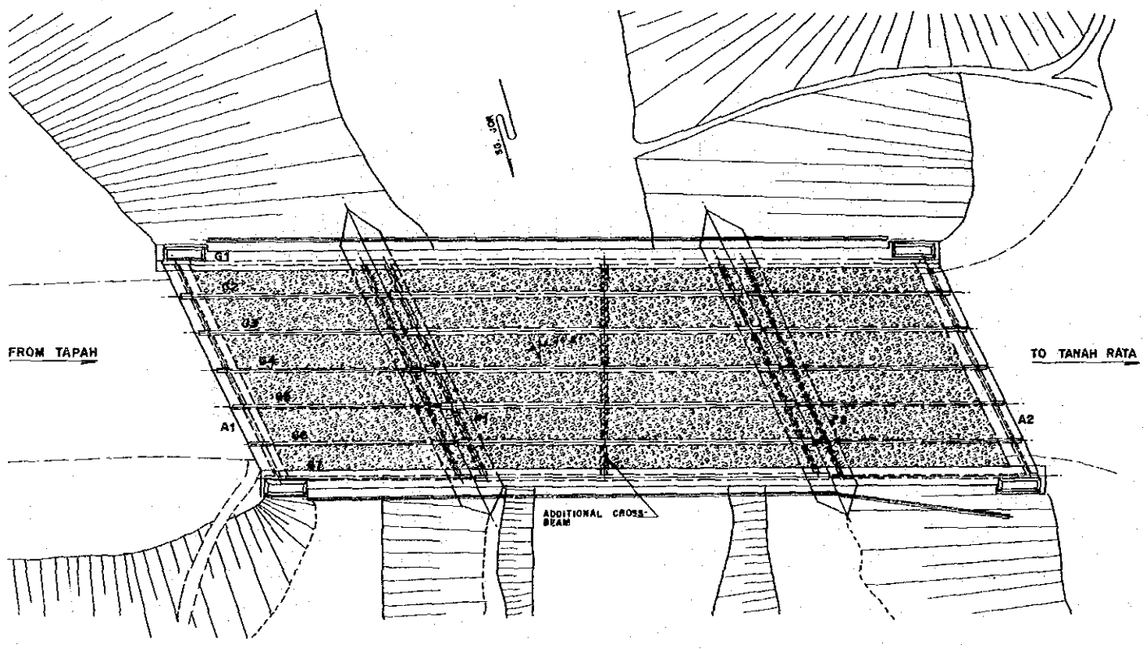


SECTION C - C



PLAN

1:100



LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	I
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

MAIN WORK ITEMS

1. INSTALLATION AND REMOVAL OF SCAFFOLDING. (REFER TO STD. DWG. MR-D-29, TYPE B)
2. GUNITING WITH ADDITIONAL REBARS AT ALL DECK SLAB SOFFITS. (REFER TO STD. DWG. MR-D-23)
3. PROVISION OF CROSSBEAMS TO THE MAIN STEEL BEAM. (SPAN -2)
4. REPAINTING OF ALL STEEL MEMBERS AFTER REMOVAL OF CORRODED MATERIALS BY GRIT BLASTING. (REFER TO STD. DWG. MR-D-25)
5. INSTALLATION OF EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE B)

2 1 0 1 2 3 4m.
1 : 100

1 0 1 2m.
1 : 50

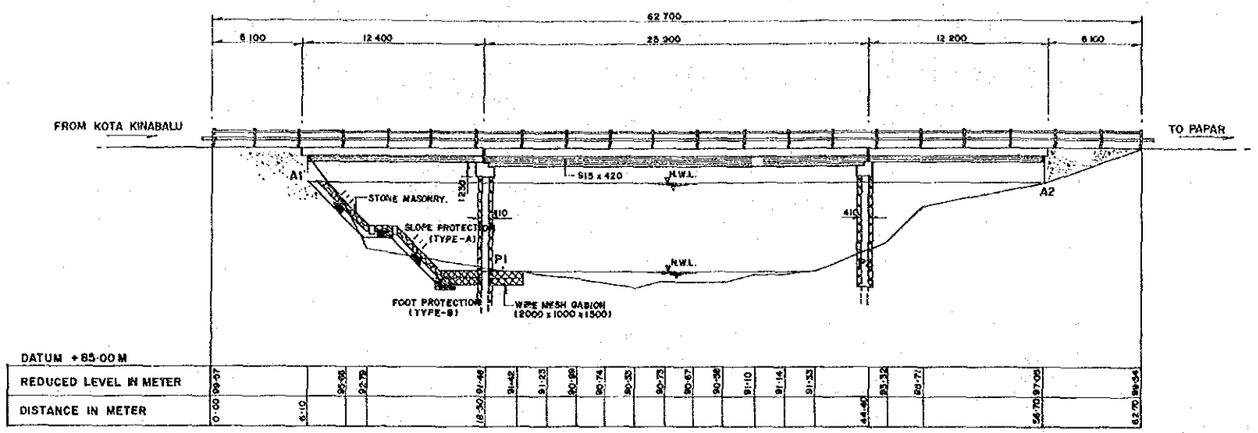
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	59/031/20	AS SHOWN	MR - D - 17

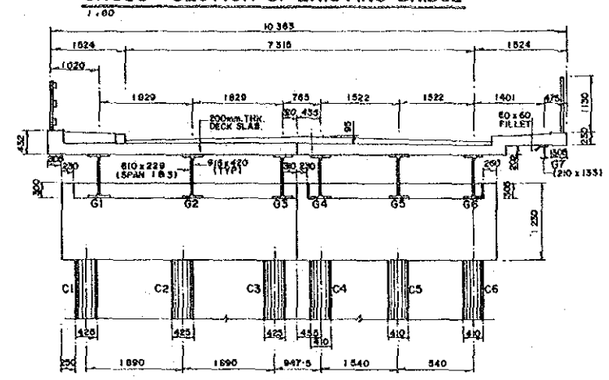
ELEVATION

1 : 200



CROSS - SECTION OF EXISTING BRIDGE

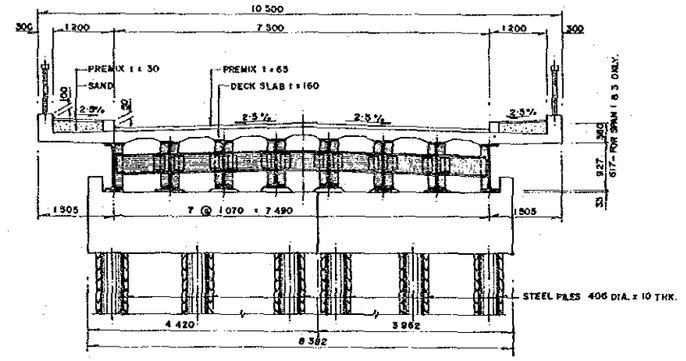
1 : 60



PIER 2

CROSS - SECTION OF PROPOSED BRIDGE.

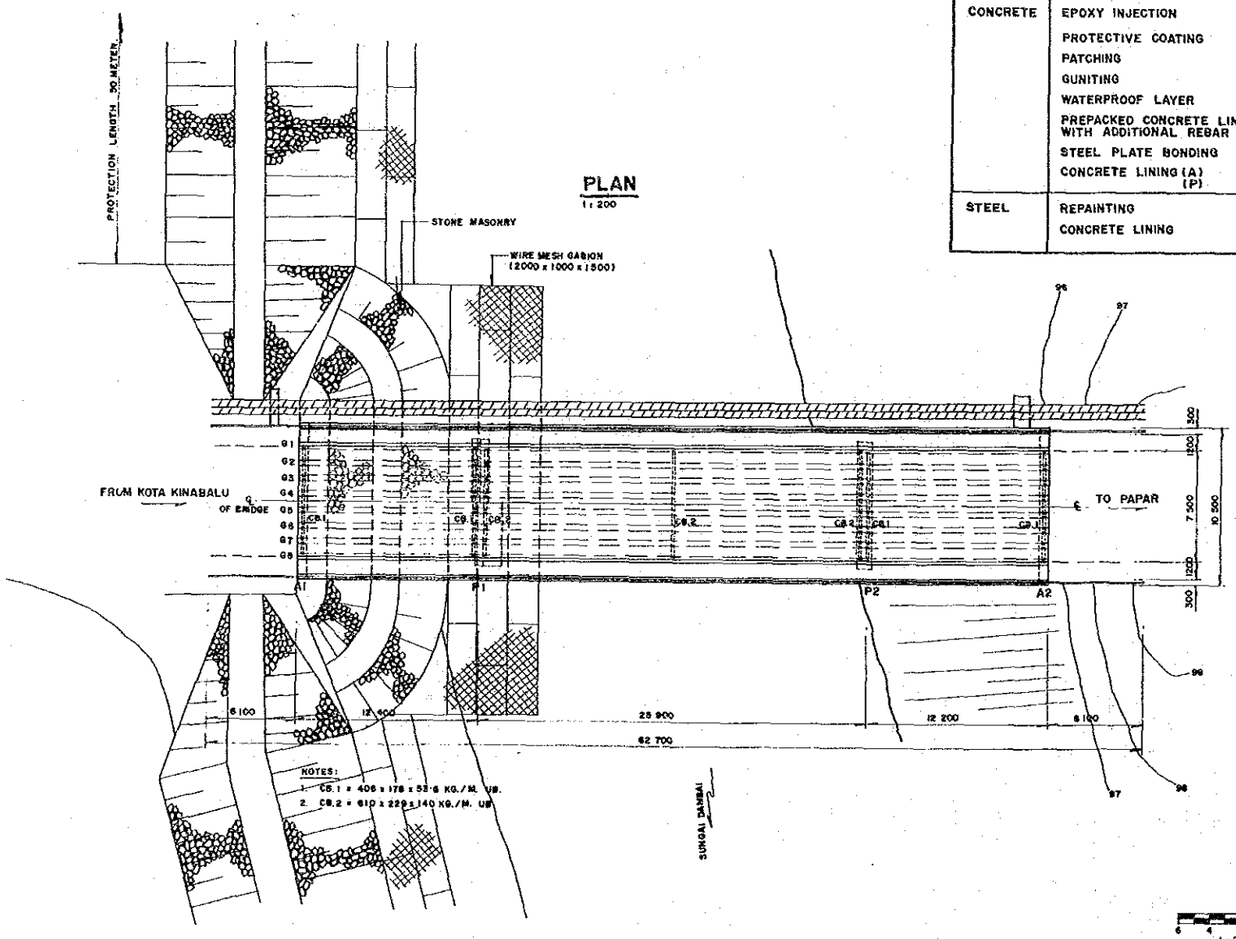
1 : 60



SPAN 2

PLAN

1 : 200



LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

MAIN WORK ITEMS

1. ONE WAY TRAFFIC DURING THE REHABILITATION WORK.
2. DEMOLITION OF DECK SLAB.
3. REMOVAL, REPAINTING AND REINSTALLATION OF THE BEAMS. (REFER TO STD. DWG. MR-D-25)
4. INSTALLATION OF ADDITIONAL MAIN BEAM, NEW CROSS BEAMS AND STEEL BEARING. (REFER TO STD. DWG. MR-D-27, TYPE B)
5. CONSTRUCTION OF R.C. DECK SLAB.
6. INSTALLATION OF ASPHALT SURFACE LAYER, HANDRAIL AND EXPANSION JOINTS. (REFER TO STD. DWG. MR-D-27, TYPE B)
7. CONCRETE LINING OF ALL STEEL PIER COLUMNS. (REFER TO STD. DWG. MR-D-26, TYPE 2)
8. CONSTRUCTION OF SLOPE PROTECTION AT RIGHT SIDE BANK (K.K. SIDE). (REFER TO STD. DWG. MR-D-28)

1 : 200

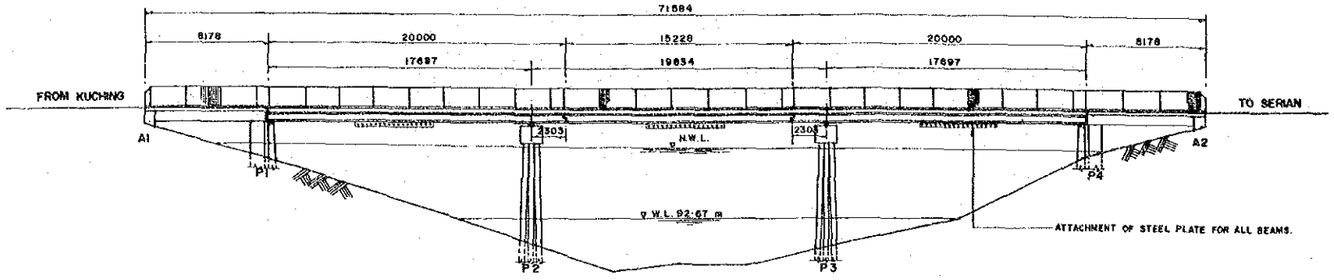
1 : 60

JICA

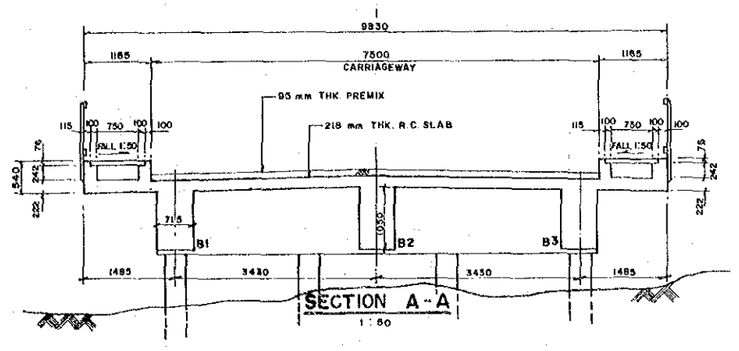
THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	SUNGAI DAMBAI	AS SHOWN	MR - D - 18

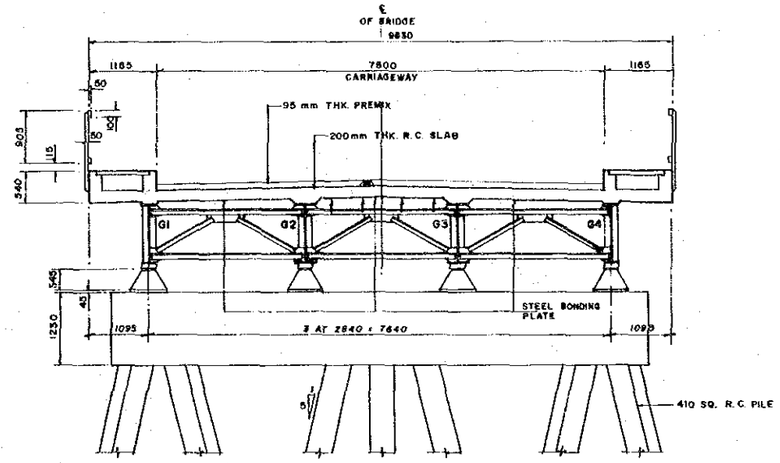
ELEVATION
1:200



DATUM 85 m												
REDUCED LEVEL IN METRE	99.47	96.73	92.61	90.61	89.11	89.61	89.51	90.61			96.77	99.47
DISTANCE IN METRE	0.00	8.18	20.70	25.68	27.00	31.60	36.20	40.80	45.40	46.71	54.74	63.40	71.58

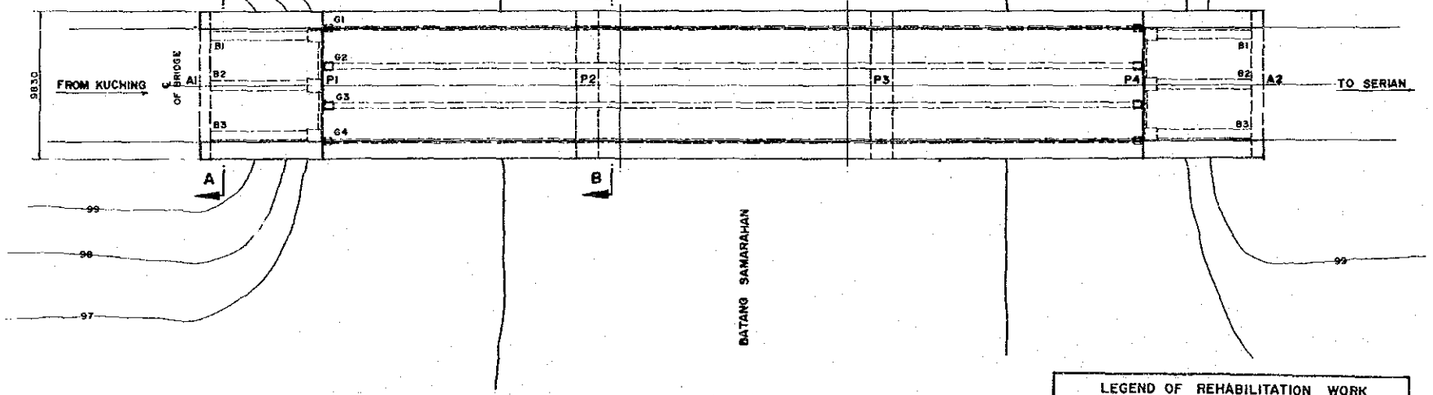


SECTION A-A
1:50



SECTION B-B
1:50

PLAN
1:200



LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

MAIN WORK ITEMS

1. INSTALLATION AND REMOVAL OF SCAFFOLDING. (REFER TO STD. DWG. MR-D-29, TYPE A)
2. EPOXY RESIN CRACK INJECTIONS AT DECK SLAB EXCEEDING 0.2mm WIDTH. -SPAN 3 AND SPAN 4- (REFER TO STD. DWG. MR-D-21)
3. STEEL PLATE BONDING TO THE SLAB SOFFIT. (REFER TO STD. DWG. MR-D-23)
4. ATTACHMENT OF STEEL PLATE TO THE LOWER FLANGE OF THE STEEL BEAM. (REFER TO STD. DWG. MR-D-25)

1:50 2 1 0 1 2

1:200 3 2 1 0 1 2 3 4 5 6

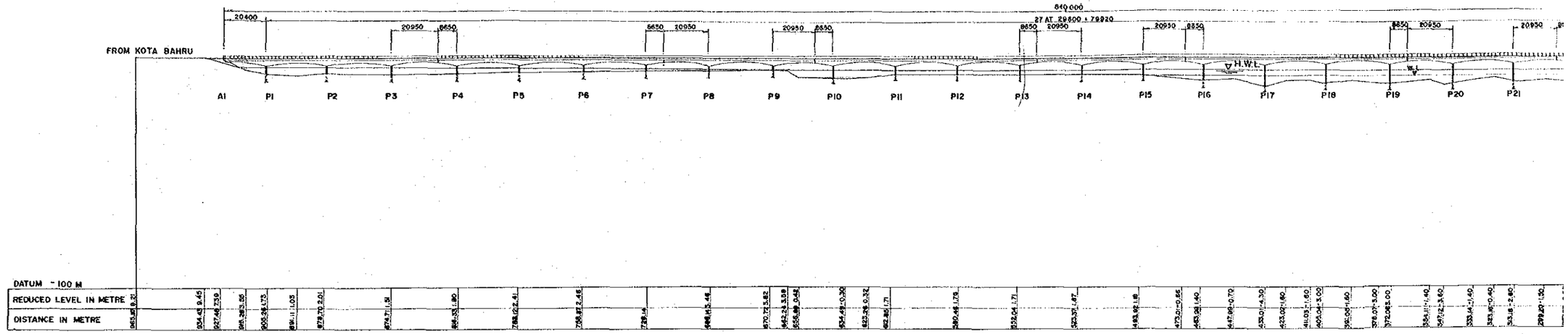
NOTE:
AS BUILT DRAWINGS ARE AVAILABLE

JICA

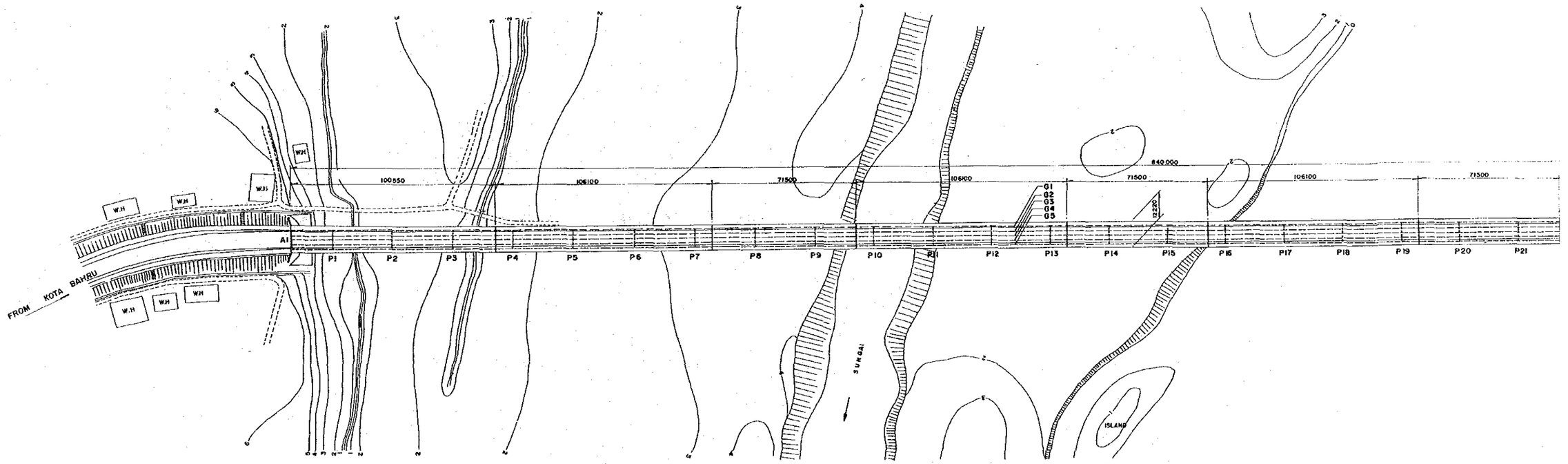
THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

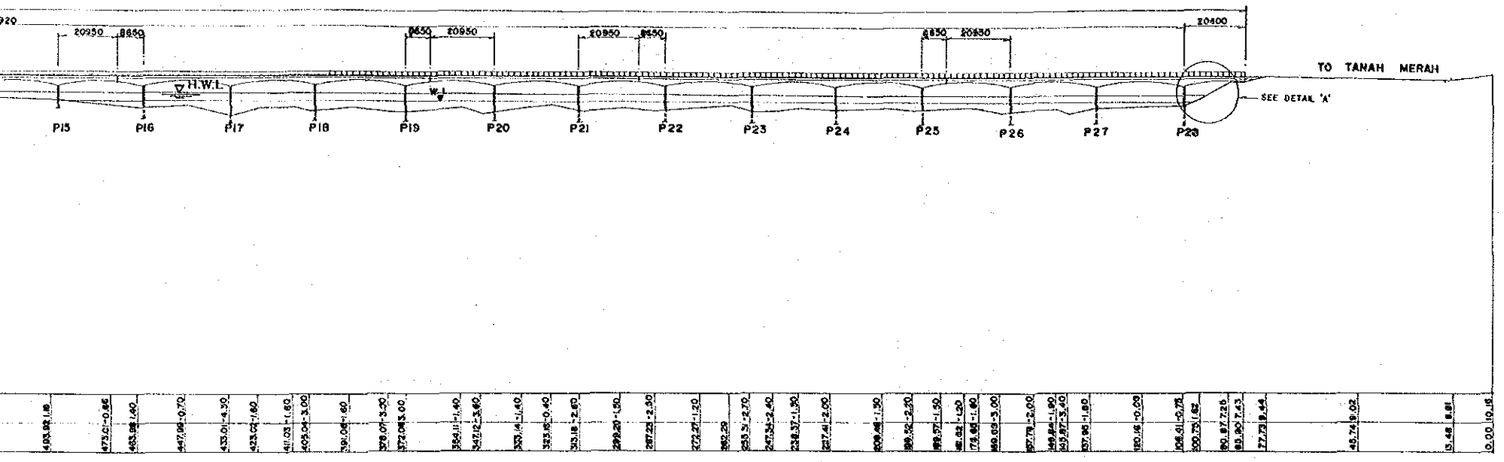
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
GENERAL VIEW	BATANG SAMARAHAN	AS SHOWN	MR - D - 19

ELEVATION
1:1000



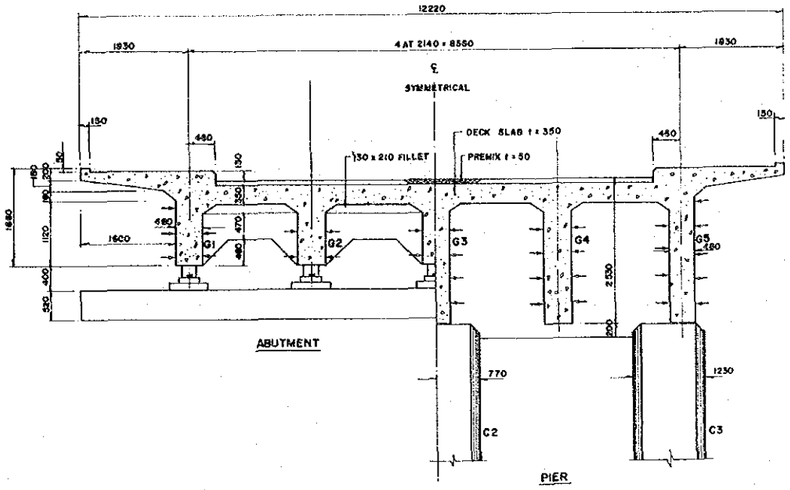
PLAN
1:1000





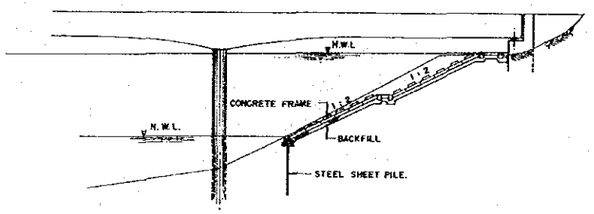
CROSS SECTION

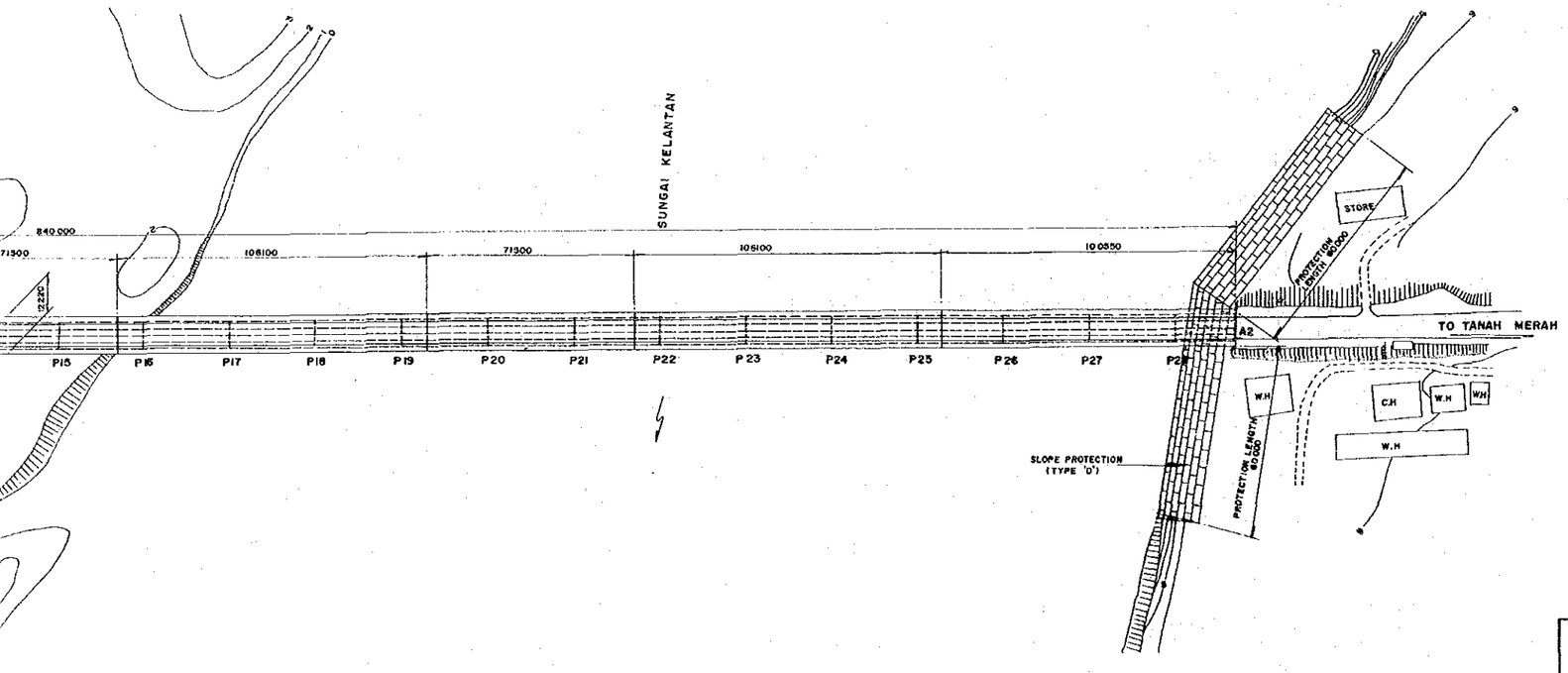
1:50



DETAIL 'A'

1 : 200





LEGEND OF REHABILITATION WORK		
CONCRETE	EPOXY INJECTION	
	PROTECTIVE COATING	
	PATCHING	*
	GUNITING	
	WATERPROOF LAYER	
	PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR	
	STEEL PLATE BONDING	
	CONCRETE LINING (A) (P)	
STEEL	REPAINTING	
	CONCRETE LINING	

MAIN WORK ITEMS

1. PROVISION OF ADEQUATE SCAFFOLDING FOR PROPER ACCESS AND EXECUTION OF EPOXY RESIN CRACK INJECTIONS AND PATCHING. (REFER TO STD. DWG. MR-D-29, TYPE A)
2. EPOXY RESIN CRACK INJECTIONS FOR CRACK WIDTHS EXCEEDING 0.2MM FOR REINFORCED CONCRETE BEAM AND DIAPHRAGMS. (REFER TO STD. DWG. MR-D-21)
3. PATCH REPAIR TO SPALLED DIAPHRAGMS SOFFIT. (REFER TO STD. DWG. MR-D-21)
4. RECONSTRUCTION OF SLOPE PROTECTION AND REVETMENT WITH ADEQUATE FOOT PROTECTION AT LEFT BANK (TANAH MERAH SIDE) (REFER TO STD. DWG. MR-D-28)

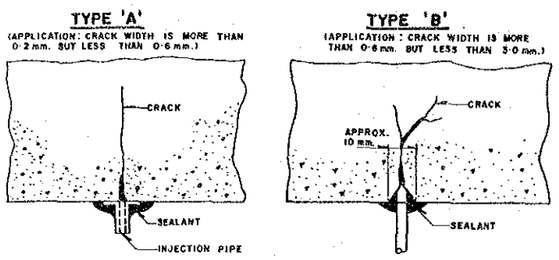
1 0 1 2m.
1:50

20 10 0 10 20 30 40m.
1:1000

JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	GENERAL VIEW	3/710 /00	AS SHOWN	MR-D-20

PROTECTION WORK TO CONRETE

INJECTION



CRACK WIDTH (mm.)	INJECTION PIPE INTERNAL (mm.)
≤ 0·3	50 ~ 100
0·3 ~ 0·5	100 ~ 200
0·5 ~ 1·0	150 ~ 250
1·0 ≤	200 ~ 300

CONCRETE PROTECTION

EPOXY RESIN INJECTION

(A) APPLICATION CRITERIA

- CRACKS ARE NOT ACTIVE AND ITS SURFACE WIDTH IS MORE THAN 0.2 MM, BUT LESS THAN 3.0MM. ①
- REASON OF THE CRACK APPEARANCE IS DUE TO SHRINKAGE OR CREEP OF CONCRETE.
- NO WATER LEAK AND NO LIQUID RUST.
- NO CARBONATION AND NO CHLORIDE ATTACK.

① : IF SURFACE CRACK WIDTH IS MORE THAN 3.0MM, APPLY CEMENT PASTE INJECTION.

(B) WORK SEQUENCE

1) REMOVE ANY LOOSE WEAK MATERIAL ON THE SURFACE AND THOROUGHLY CLEAN THE CRACKS WITH CLEAN OIL-FREE COMPRESSED AIR.
2) SEALED THE CRACKS AT THE SURFACE AND MARKED THE INJECTION POINTS. THE SPACING BETWEEN INJECTION POINTS SHALL BE AS SHOWN ON THE TABLE ABOVE.
3) FIX THE INJECTION PIPES INTO POSITION BY SEALING ITS SURROUNDING AREA.
4) COMMENCE INJECTION OF EPOXY RESIN FROM EITHER THE LOWEST INJECTION POINT IN A VERTICAL CRACK OR FROM EITHER EXTREME END OF A HORIZONTAL CRACK.
5) REMOVE THE INJECTION PIPES AND SEAL THE HOLES AS WORK PROCEEDS.
6) REMOVE THE SEALING STRIP WHEN THE RESIN HAS CURED AND CARRY OUT FINAL SURFACE TREATMENT IF REQUIRED.

(C) SPECIFICATION

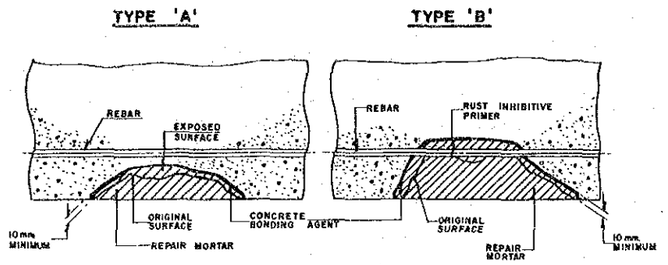
1) MINIMUM COMPRESSIVE STRENGTH OF EPOXY RESIN AT 7 DAYS SHALL BE 80 N/MM².

PROPERTY

A) MINIMUM STRENGTH AT 7 DAYS - 80N/MM².
B) FLEXURAL STRENGTH - 55N/MM².
C) FLEXURAL MODULUS - 3000N/MM².
D) SLANT SHEAR BOND STRENGTH, CONCRETE/CONCRETE - 60N/MM².

2) MINIMUM CURING TIME OF EPOXY RESIN SHALL BE 24 HOURS.

PATCHING



CONCRETE PROTECTION

PATCHING

(A) APPLICATION CRITERIA

- DEFECTS SUCH AS HONEYCOMB, FLACKING, CAVITY ETC. ARE NOT ACTIVE.
- REASON OF THESE DEFECTS ARE MAINLY DUE TO INFERIOR CONCRETE OR POOR WORKMANSHIP.
- MINIMUM CARBONATION, NO CHLORIDE ATTACK AND NO WATER LEAK.
- ADEQUATE CONCRETE COVER.
- DEFECTIVE AREA IS SCATTERRD.

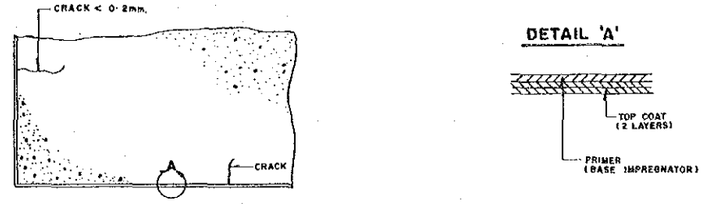
(B) WORK SEQUENCE

1) ALL SPALLED, LOOSE AND DEFECTIVE CONCRETE SHALL BE REMOVED UNTIL SOUND CONCRETE IS REACHED. IN THE EVENT OF REBAR EXPOSED, REMOVAL OF CONCRETE SHALL BE CARRIED OUT TO A FURTHER DEPTH OF 20MM BEHIND THE REBAR.
2) ALL EXPOSED REINFORCEMENT SHALL BE CLEANED OF CORROSION BY WIRE BRUSHING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH BS 4232 SECOND QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967. THE REINFORCEMENT SHALL IMMEDIATELY BE PRIMED WITH ZINC-RICH TYPE PRIMER COMPLYING WITH THE REQUIREMENTS OF BS 4652 (1971).
3) PRIOR TO PATCH REPAIR, DAMPEN THE CONCRETE AND APPLY A THIN LAYER OF CONCRETE BONDING AGENT.
4) FIRMLY PUSH INTO PLACE THE REPAIR MORTAR BY GLOVED HAND OR TROWEL.
5) MAKE GOOD THE FINISHED SURFACE USING A TROWEL OR WOOD-FLOAT.

(C) SPECIFICATION

1) MINIMUM COMPRESSIVE STRENGTH OF REPAIR MORTAR SHALL BE 40N/MM².
2) MINIMUM DRY FILM THICKNESS OF STEEL PRIMER SHALL BE 40 MICRONS.

PROTECTIVE COATING



CONCRETE PROTECTION

COATING

(A) APPLICATION CRITERIA

- CRACKS ARE NOT ACTIVE AND ITS SURFACE WIDTH IS LESS THAN 0.2MM.
- NO WATER LEAKS.
- MINIMAL CARBONATION AND NO CHLORIDE ATTACK.
- ADEQUATE CONCRETE COVER.

(B) WORK SEQUENCE

1) CLEAN THE CONCRETE SURFACE BY WATER BLASTING OR OTHER APPROVED MEANS TO REMOVE OIL, GREASE, LOOSE PARTICLES AND OTHER SURFACE CONTAMINANTS.
2) ALLOW THE CONCRETE TO DRY AND SPRAY SILANE SILOXANE BASED PRIMER UNTIL THE CONCRETE IS SATURATED.
3) ALLOW THE PRIMER TO DRY AND APPLY TWO LAYER OF SOLVENT BASED METHACRYLATE TOP COAT. THE PREVIOUS COAT SHALL ALWAYS BE ALLOWED TO DRY BEFORE OVERCOATING.
4) THE TOP COAT SHALL BE STIRRED WELL BEFORE APPLICATION AND SHALL BE APPLIED BY BRUSH OR ROLLER.

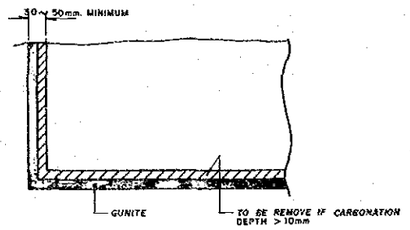
(C) SPECIFICATION

1) MINIMUM DRY FILM THICKNESS OF EACH LAYER OF TOP COAT SHALL BE 70 MICRON.

JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD - DRAWING OF CONCRETE PROTECTION (1)		N.Y.S	MR - D - 21

PROTECTION WORK TO CONCRETE

GUNITING



CONCRETE PROTECTION

GUNITING

(A) APPLICATION CRITERIA

- CRACKS (WIDTH IS LESS THAN 0.22MM) ARE NOT ACTIVE.
- CONCRETE IS SLIGHTLY CARBONATED.
- MINIMUM CONCRETE COVER IS INADEQUATE.
- NO WATER LEAK.
- DEFECTIVE AREA IS EXTENSIVE.

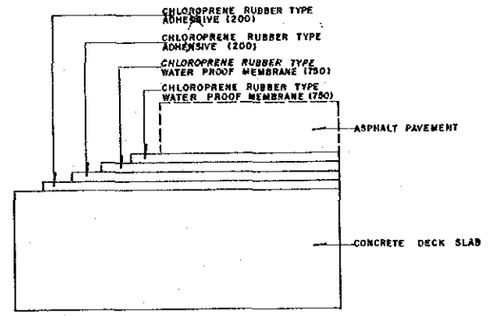
(B) WORK SEQUENCE

1) ROUGHEN THE CONCRETE SURFACE BY APPROVED MECHANICAL MEANS AND CLEAN AWAY ALL LOOSE PARTICLES AND DIRT. IF THE CONCRETE HAS CARBONATED MORE THAN 10MM THE DEFECTIVE CONCRETE SHALL BE REMOVED.
2) WET THE PREPARED SURFACE WITH CLEAN WATER UNTIL SATURATION BUT GUNITING SHALL COMMENCE ONLY WHEN THE CONCRETE HAS SURFACE DRY.
3) SPRAY GUNITE MORTAR WITH SUFFICIENT PRESSURE IN AN EVEN MANNER SO AS TO GIVE A DENSE AND HOMOGENEOUS COVERING TO THE SURFACE. IT SHALL BE APPLIED IN TWO OR MORE COATS AS NECESSARY AND THE SURFACE OF EACH COAT WASHED DOWN BEFORE THE NEXT IS APPLIED.
4) AFTER APPLICATION OF GUNITE, IT SHALL BE CURED BY CONSTANTLY SPAYING WATER FOR AT LEAST 3 DAYS.

(C) SPECIFICATION

1) MINIMUM GUNITE CUBE STRENGTH AFTER 28 DAYS SHALL BE 40N/MM².
2) CEMENT FOR GUNITING SHALL BE ORDINARY PORTLAND CEMENT ACCORDING TO B.S 12.
3) MINIMUM GUNITE THICKNESS SHALL BE 50MM.
4) MINIMUM CURING TIME OF GUNITE SHALL BE 3 DAYS.

WATERPROOF LAYER



NOTE: FIGURE IN ( ) SHOWS STANDARD UNIT RUBBER SOLVENT CONTENT (g/m²).
STANDARD THICKNESS OF WATER PROOF LAYER IS 0·4~1·5mm.

WATERPROOF LAYER

(A) APPLICATION CRITERIA

- WATER STAIN, FREE LIME AND OTHER ASSOCIATED DEFECT ARE OBSERVED AT SLAB SOFFIT.
- DEFECTS THAT ARE NOT ACTIVE.
- WATER IS PENETRATING FROM TOP OF SLAB THROUGH DEFECTIVE CONCRETE OR INFERIOR JOINTS BETWEEN PRECAST MEMBERS.

(B) WORK SEQUENCE

1) REMOVAL OF PREMIX ON DECK BY SCRAPPING AND MILLING.
2) CLEANING OF DECK SURFACE BY POWER GRINDER OR OTHER APPROVED MEANS.
3) LAYING OF BASE SCREED COMPRISING OF ONE PART CEMENT AND FOUR PARTS SAND BY VOLUME USING STEEL TROWEL.
4) APPLY TWO LAYERS OF CHLOROPRENE RUBBER TYPE ADHESIVE AND TWO LAYERS OF CHLOROPRENE RUBBER TYPE WATERPROOF MEMBRANE AS SHOWN IN THE DRAWING.
5) EACH LAYER SHALL BE ALLOWED TO CURE FOR 2 HOURS BEFORE THE APPLICATION OF THE NEXT LAYER.
6) PLACING OF NEW PREMIX OVERLAY.

(C) SPECIFICATION

1) SHEARING STRENGTH SHALL BE GREATER THAN 0.15N/MM² AT 20°C.
2) SHEARING ELONGATION SHALL BE GREATER THAN 1.0% AT 20°C.
3) ADHESIVE STRENGTH SHALL BE GREATER THAN 0.6N/MM² AT 20°C.

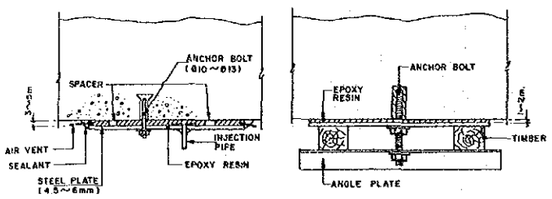
JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD - DRAWING OF CONCRETE PROTECTION (2)		N.T.S	MR - D - 22

REINFORCEMENT WORK TO CONCRETE

STEEL PLATE BONDING

TYPE 'A'
INJECTION TYPE
(APPLICATION : CONCRETE SURFACE IS UNEVEN ROUGH)

TYPE 'B'
PRESSURE BONDING
(APPLICATION : CONCRETE SURFACE BE SMOOTH AND CONCRETE MEMBER DEPTH IS ENOUGH FOR ANCHOR BOTH LENGTH)



STEEL PLATE BONDING

(A) APPLICATION CRITERIA

- INADEQUATE LOAD CARRYING CAPACITY (INADEQUATE AMOUNT OF REINFORCEMENT BAR).
- NO WATER LEAK AND NO CARBONATION.
- INADEQUATE FOR ADDITIONAL STRESS IN BEAMS AND SLAB DUE TO ADDITIONAL DEAD LOAD.
- ACTIVE CRACKS DUE TO BENDING MOMENT OR SHEAR FORCE.
- ADEQUATE CONCRETE COVER.

(B) WORK SEQUENCE

1) CLEAN THE SURFACE OF THE SLAB SOFFIT TO RECEIVE THE STEEL PLATE BONDING WITH A POWER GRINDER OR OTHER APPROVED MEANS.
2) DRILL HOLES INTO THE SLAB AND INSTALL ANCHORS FOR ANCHOR BOLTS.
3) CLEAN THE SURFACE OF THE STEEL PLATE BY WIRE BRUSH SO AS TO BRING OUT ITS TEXTURE.

TYPE A

4) DRILL HOLES ON THE STEEL PLATE FOR ANCHOR BOLTS AND INJECTION PIPES.
5) ATTACH THE INJECTION PIPES AND AIR VENT PIPES.
6) FIT IN STEEL PLATE TO THE PREPARED SURFACE TOGETHER WITH SPACER BLOCKS AND CLAMP IT WITH ANCHOR BOLTS TO PROVIDE CONSISTENT GAP OF 5MM BETWEEN THE PLATE AND THE SLAB SURFACE.
7) SEAL THE PERIPHERAL AREA OF THE STEEL PLATE AS WELL AS THE AREA SURROUNDING THE INJECTION HOLES.
8) INJECT THE EPOXY RESIN THROUGH THE INJECTION HOLES.
9) AFTER THE EPOXY RESIN HAS CURED, PROTECT THE STEEL FROM CORROSION BY APPLYING PROTECTIVE COATINGS.

TYPE B

4) DRILL HOLES ON THE STEEL PLATE FOR ANCHOR BOLTS.
5) APPLY EPOXY RESIN TO THE PLATE SURFACE AND CONCRETE SURFACE.
6) PRESSURE BONDING THE STEEL PLATE TO THE SLAB USING ANCHOR BOLT WITH ANGLE PLATE.
7) AFTER THE EPOXY RESIN HAS CURED, WITHDRAW THE PRESSURE BONDING EQUIPMENT AND PROTECT THE STEEL FROM CORROSION BY APPLYING PROTECTIVE COATINGS.

(C) SPECIFICATION

1) THE EPOXY RESIN SHALL HAVE THE PROPERTIES LISTED BELOW WHEN TESTED IN ACCORDANCE WITH THE RELEVANT STANDARDS.

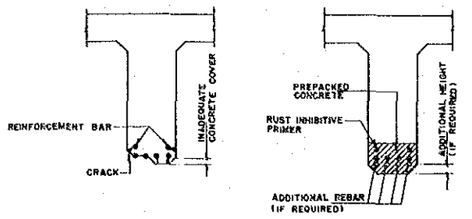
PROPERTY	TYPE A	TYPE B
MINIMUM COMPRESSIVE STRENGTH AT 7 DAYS	80N/MM²	85N/MM²
FLEXURAL STRENGTH	55N/MM²	30N/MM²
FLEXURAL MODULUS	3000N/MM²	4300N/MM²
SLANT SHEAR BOND STRENGTH, CONCRETE/CONCRETE	60N/MM²	-
BOND TO CONCRETE	-	>2.5N/MM²
BOND TO STEEL	-	>20N/MM²

2) MINIMUM CURING TIME OF EPOXY RESIN SHALL BE 24 HOURS.
3) PROTECTIVE COATING SHALL FOLLOW THE SPECIFICATION FOR REMOVAL OF RUST AND REPAINTING.

PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR

(APPLICATION : SOFFIT OF MEMBERS WHERE IS DIFFICULT TO POUR CONCRETE SUCH AS SOFFIT OF BEAM & SLAB)

BEFORE REINFORCEMENT | AFTER REINFORCEMENT



PREPACKED CONCRETE LINING WITH ADDITIONAL REBAR

(A) APPLICATION CRITERIA

- INADEQUATE LOADING CAPACITY.
- VARIOUS ACTIVE CRACKS DUE TO BENDING MOMENT OR SHEAR FORCE.
- INADEQUATE CONCRETE COVER.
- SUFFERED MILD CHLORIDE ATTACK OR ADVANCED CARBONATION.
- DEFECTIVE AREA IS NOT EXTENSIVE.

(B) WORK SEQUENCE

1) REMOVE ALL SPALLED, LOOSE AND DEFECTIVE CONCRETE UNTIL SOUND CONCRETE IS REACHED. BREAKING OUT SHALL EXPOSE THE FULL CIRCUMFERENCE OF THE REBAR AND TO A FURTHER DEPTH OF 20MM BEHIND THE REBAR IF IT IS CORRODED.
2) ALL EXPOSED REINFORCEMENT SHALL BE CLEANED OF CORROSION PRODUCTS BY WIRE BRUSHING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH B.S 4232 SECOND QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967.
3) APPLY PRIME COAT WITHIN 2 HOURS AFTER PREPARING AND CLEANING OF THE REBAR.
4) SECURELY FIX ADDITIONAL REBAR AND ANCHOR BAR AS SHOWN IN THE DRAWING IF REQUIRED.
5) CONSTRUCT THE FORMWORK TO FORM A MINIMUM CONCRETE COVER OF 70MM. FORMWORK SHALL BE SUFFICIENTLY RIGID AND TIGHT TO PREVENT THE LOSS OF GROUT AND TO MAINTAIN FORMS IN THEIR CORRECT POSITION, SHAPE, PROFILE AND DIMENSION.
6) PACK SINGLE-SIZED COARSE AGGREGATE BEHIND THE FORMS TO FILL THE VOIDS.
7) INJECTION OPENINGS ARE TO BE PROVIDED AT THE BOTTOM FACE OF THE FORM FOR THE PURPOSE OF INJECTING GROUT INTO THE PREPACKED AGGREGATES.
8) WET ALL CONCRETE SURFACES SUFFICIENTLY PRIOR TO PLACING CONCRETE.
9) PUMP IN THE GROUT TO FILL THE SPACES BETWEEN THE AGGREGATES BY PRESSURE GROUTING VIA THE INJECTION OPENINGS FROM THE FARTHEST POINT OF THE VOID.
10) FORMWORK SHALL BE REMOVED WHEN THE CONCRETE HAS ACHIEVED THE REQUIRED STRENGTH AND SHALL BE IMMEDIATELY CURED IN ACCORDANCE WITH GOOD CONCRETE PRACTICE.

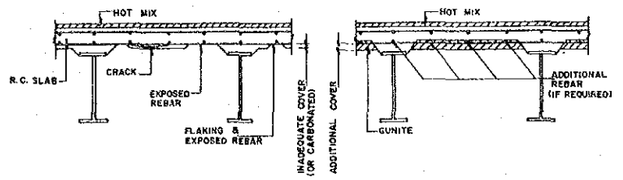
(C) SPECIFICATION

1) THE CEMENT USED SHALL BE ORDINARY PORTLAND CEMENT CONFORMING TO B.S 12.
2) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40 N/MM²/20MM.
3) MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT TO BE 70MM.
4) BARS SHALL BE BENT AND MEASURED IN ACCORDANCE WITH B.S 4466.
5) REINFORCEMENT TO BE WELD SHALL COMPLY WITH THE REQUIREMENTS OF B.S 4360.
6) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S 5135 AND B.S 638.
7) ALL MILD STEEL AND HIGH YIELD BAR TO CONFORM TO M.S 146.
8) LAP LENGTH TO BE 32 X DIAMETER OF BAR.
9) PRIMER SHALL BE ZINC-RICH TYPE PRIMER COMPLYING WITH THE REQUIREMENTS OF B.S 4652 (1971).

GUNITING WITH ADDITIONAL REBAR

(APPLICATION : SOFFIT OF MEMBERS WHERE IT IS DIFFICULT TO POUR CONCRETE DUE TO NOT ENOUGH HEIGHT)

BEFORE REINFORCEMENT | AFTER REINFORCEMENT



GUNITING WITH ADDITIONAL REBAR

(A) APPLICATION CRITERIA

- INADEQUATE LOADING CAPACITY.
- VARIOUS ACTIVE CRACKS DUE TO BENDING MOMENT OR SHEAR FORCE.
- ADEQUATE FOR ADDITIONAL STRESS IN BEAMS AND SLAB DUE TO ADDITIONAL DEAD LOAD.
- BRIDGE IS LOCATED IN RELATIVELY SEVERE CHLORIDE ENVIRONMENT
- ADVANCE CARBONATION.
- DEFECTIVE AREA IS EXTENSIVE.

(B) WORK SEQUENCE

1) REMOVE ALL SPALLED, LOOSE AND DEFECTIVE CONCRETE UNTIL SOUND CONCRETE IS REACHED. BREAKING OUT SHALL EXPOSE THE FULL CIRCUMFERENCE OF THE REBAR AND TO A FURTHER DEPTH OF 20mm BEHIND THE REBAR IF IT IS CORRODED.
2) ALL EXPOSED REINFORCEMENT SHALL BE CLEANED OF CORROSION PRODUCTS BY WIRE BRUSHING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH B.S 4232 SECOND QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967.
3) PRIME COAT SHALL BE BRUSH APPLIED WITHIN 2 HOURS AFTER PREPARING AND CLEANING OF THE REBAR.
4) SECURELY FIX ADDITIONAL REBAR AS SHOWN IN THE DRAWING IF REQUIRED.
5) WET THE PREPARED SURFACE WITH CLEAN WATER UNTIL SATURATION BUT GUNITING SHALL COMMENCE ONLY WHEN THE CONCRETE HAS SURFACE DRY.
6) SPRAY GUNITE MORTAR WITH SUFFICIENT PRESSURE IN AN EVEN MANNER SO AS TO GIVE A DENSE AND HOMOGENEOUS COVERING TO THE SURFACE. IT SHALL BE APPLIED IN TWO OR MORE COATS AS NECESSARY AND THE SURFACE OF EACH COAT WASHED DOWN BEFORE THE NEXT IS APPLIED.
7) AFTER APPLICATION OF GUNITE MORTAR, IT SHALL BE CURED BY CONSTANTLY SPAYING WATER FOR AT LEAST 3 DAYS.

(C) SPECIFICATION

1) THE CEMENT USED SHALL BE ORDINARY PORTLAND CEMENT CONFORMING TO B.S 12.
2) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40N/MM².
3) MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT SHALL BE 70MM.
4) BARS SHALL BE BENT AND MEASURED IN ACCORDANCE WITH B.S 4466.
5) REINFORCEMENT TO BE WELD SHALL COMPLY WITH THE REQUIREMENTS OF B.S 4360.
6) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S 5135 AND B.S 638.
7) ALL MILD STEEL AND HIGH YIELD BAR SHALL CONFORM TO M.S 146.
8) LAP LENGTH SHALL BE 32 X DIAMETER OF BAR.

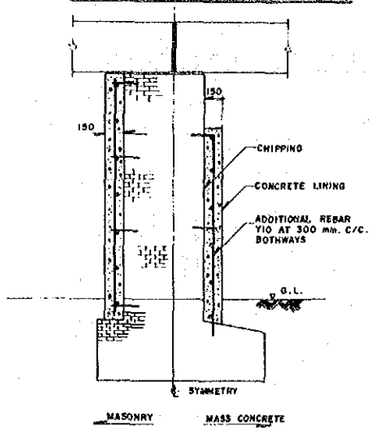
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
STANDARD - DRAWING OF CONCRETE REINFORCEMENT		N.T.S.	MR - D - 23

PROTECTION AND REINFORCEMENT TO SUBSTRUCTURE

CONCRETE LINING TO MASONRY OR MASS CONCRETE (TYPE 'A')



CONCRETE LINING TO MASONRY OR MASS CONCRETE (TYPE A)

(A) APPLICATION CRITERIA

- INADEQUATE MINIMUM COVER OR BRICKS ARE EXPOSED.
- ABRASION OF CONCRETE SURFACE OR LOSS OF CONCRETE MATRIX DUE TO INFERIOR CONCRETE OR CHEMICAL ATTACK.
- CONCRETE IS CARBONATED.

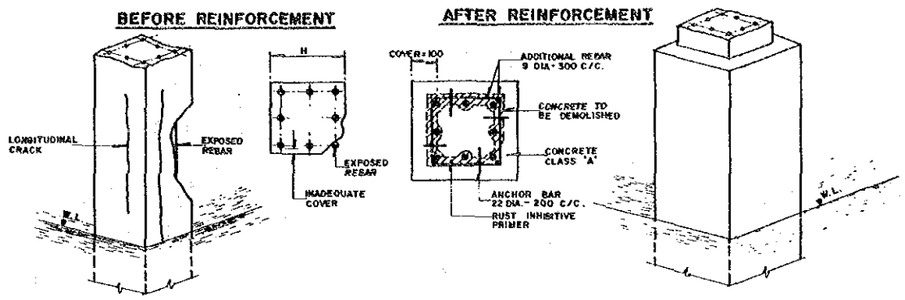
(B) WORK SEQUENCE

1) *REMOVE ALL SPALLED, LOOSE AND POOR QUALITY MORTAR.* PARTICULAR CARE SHOULD BE TAKEN TO ENSURE ALL SURFACES ARE COMPLETELY FREE FROM LAITENCE, OIL, DUST, GREASE, PLASTER AND ANY OTHER DELETERIOUS SUBSTANCES. LAITENCE SHOULD BE MECHANICALLY REMOVED BY HIGH PRESSURE WATER *BLASTING. SMOOTH SURFACES SHOULD BE MECHANICALLY* ROUGHENED BY SCABBLING OR NEEDLE GUN TO FORM A GOOD MECHANICAL KEY.
2) PROVIDE DRILLED HOLES OF 20MM DIAMETER AT 600MM C/C BOTHWAYS AT ALL THE VERTICAL SURFACES. DRILLED HOLES SHALL BE ROUGH SIDED AND FREE OF DUST.
3) INSERT NON-SHRINK CEMENTITIOUS GROUT STAGE BY STAGE TO THE REAR OF THE HOLE TO AVOID AIR ENTRAPMENT.
4) SECURELY FIX DOWEL 16MM DIAMETER ROUND BAR BY INSERTING INTO THE HOLE.
5) PROVIDE A LAYER OF WIREMESH OF 10MM DIAMETER HIGH YIELD AT 300MM C/C BOTHWAY BY TYING TO THE DOWEL BAR.
6) WET ALL SURFACES SUFFICIENTLY.
7) CONSTRUCT THE FORMWORK TO FORM A MINIMUM CONCRETE COVER OF 70MM. FORMWORK SHALL BE SUFFICIENTLY RIGID AND *TIGHT TO PREVENT THE LOSS OF GROUT AND TO MAINTAIN* FORMS IN THEIR CORRECT POSITION, SHAPE, PROFILE AND DIMENSION.
8) PLACE IN CONCRETE OF GRADE 40/20 INTO THE FORMWORK.
9) FORMWORK SHALL BE REMOVED WHEN THE CONCRETE HAS ACHIEVED THE REQUIRED STRENGTH AND SHALL BE IMMEDIATELY CURED IN ACCORDANCE WITH GOOD CONCRETE PRACTICE.

(C) SPECIFICATION

1) THE CEMENT USED SHALL BE ORDINARY PORTLAND CEMENT CONFORMING TO B.S 12.
2) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40N/MM²/20MM.
3) BARS SHALL BE BENT AND MEASURED IN ACCORDANCE WITH B.S 4466.
4) REINFORCEMENT TO BE WELD SHALL COMPLY WITH THE REQUIREMENTS OF B.S 4360.
5) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S 5135 AND B.S 638.
6) ALL MILD STEEL AND HIGH YIELD BAR TO CONFORM TO M.S 146.
7) LAP LENGTH TO BE 32 X DIAMETER OF BAR.

CONCRETE LINING TO PILES (TYPE 'B')



CONCRETE LINING TO PILES (TYPE B)

(A) APPLICATION CRITERIA

- MINIMUM CONCRETE COVER IS INADEQUATE.
- WIDE LONGITUDINAL CRACKS DUE TO CHLORIDE ATTACK OR REBAR EXPOSURE.
- ABRASION OF CONCRETE SURFACE OR LOSS OF CONCRETE MATRIX DUE TO INFERIOR CONCRETE OR CHEMICAL ATTACK.
- CONCRETE IS CARBONATED.

(B) WORK SEQUENCE

1) REMOVE ALL SPALLED, LOOSE AND DEFECTIVE CONCRETE UNTIL SOUND CONCRETE IS REACHED. BREAKING OUT SHALL EXPOSE THE FULL CIRCUMFERENCE OF THE REBAR AND TO A FURTHER *DEPTH OF 20MM BEHIND THE REBAR IF IT IS CORRODED.*
2) ALL EXPOSED REINFORCEMENT SHALL BE CLEANED OF CORROSION PRODUCTS BY WIRE BRUSHING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH B.S 4232 SECOND *QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967.*
3) APPLY PRIME COAT WITHIN 2 HOURS AFTER PREPARING AND CLEANING OF THE REBAR.
4) SECURELY FIX ADDITIONAL REBAR AND ANCHOR BAR AS SHOWN IN THE DRAWING IF REQUIRED.
5) CONSTRUCT THE FORMWORK TO FORM A MINIMUM CONCRETE COVER OF 70MM. FORMWORK SHALL BE SUFFICIENTLY RIGID AND TIGHT TO PREVENT THE LOSS OF GROUT AND TO MAINTAIN FORMS IN THEIR CORRECT POSITION, SHAPE, PROFILE AND DIMENSION.
6) WET ALL CONCRETE SURFACES SUFFICIENTLY PRIOR TO PLACING CONCRETE.
7) PLACE IN CONCRETE OF GRADE 40/20 INTO THE FORMWORK.
8) FORMWORK SHALL BE REMOVED WHEN THE CONCRETE HAS ACHIEVED THE REQUIRED STRENGTH AND SHALL BE IMMEDIATE*LY CURED IN ACCORDANCE WITH GOOD CONCRETE PRACTICE.*

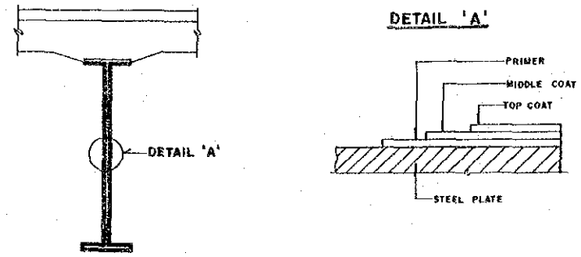
(C) SPECIFICATION

1) THE CEMENT USED SHALL BE ORDINARY PORTLAND CEMENT CONFORMING TO B.S 12.
2) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40 N/MM²/20MM.
3) MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT TO BE 70MM.
4) BARS SHALL BE BENT AND MEASURED IN ACCORDANCE WITH B.S 4466.
5) REINFORCEMENT TO BE WELD SHALL COMPLY WITH THE REQUIREMENTS OF B.S 4360.
6) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S 5135 AND B.S 638.
7) ALL MILD STEEL AND HIGH YIELD BAR TO CONFORM TO M.S 146.
8) LAP LENGTH TO BE 32 X DIAMETER OF BAR.
9) PRIMER SHALL BE ZINC-RICH TYPE PRIMER COMPLYING WITH THE REQUIREMENTS OF B.S 4652 (1971).

JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD-DRAWING OF PROTECTION OF CONCRETE SUBSTRUCTURE		N.T.S.	MR-D-24

PROTECTION AND REINFORCEMENT TO STEEL MATERIAL (1)

REMOVAL OF RUST AND REPAINTING



REMOVAL OF RUST AND REPAINTING

(A) APPLICATION CRITERIA

- ADEQUATE LOAD CARRYING CAPACITY.
- NON-ACTIVE CORROSION AND PAINT DETERIORATION.

(B) WORK SEQUENCE

1) *THOROUGHLY REMOVE CORROSION, FOREIGN MATERIAL, OIL,* GREASE, LOOSE OR PEELING PAINT AND ALL NON-ADHERENT RESIDUES FROM THE STEEL SURFACE BY WIRE BRUSHING OR OTHER APPROVED MEANS.

2) IMMEDIATELY AFTER SURFACE PREPARATION BRUSH APPLIED A LAYER OF PRIMER.

3) ALLOW THE PRIMER TO DRY AND BRUSH APPLIED A LAYER OF MIDDLE COAT.

4) FINALLY, BRUSH APPLIED A LAYER OF TOP COAT AFTER THE MIDDLE COAT HAS DRIED UP.

(C) SPECIFICATION

1) CONVENTIONAL PROTECTIVE COATINGS.

A) PRIMER SHALL BE LEAD BASED ANTI-RUST PAINT AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 60 MICRON.

B) MIDDLE COAT SHALL BE SILICONE-ALKYD RESIN BASED PAINT AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 30 MICRON.

C) TOP COAT SHALL BE SILICONE-ALKYD RESIN BASED PAINT AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 30 MICRONS.

2) HEAVY-DUTY COATING.

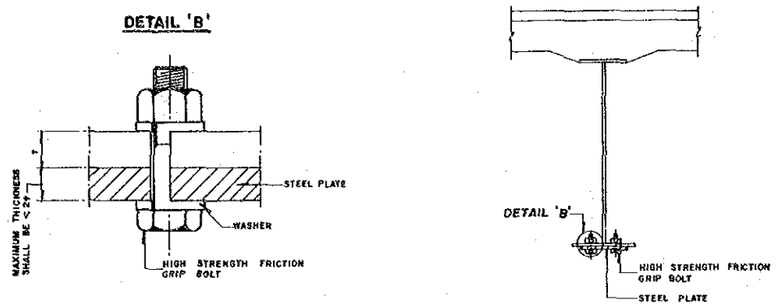
A) PRIMER SHALL BE EPOXY BASED RED OXIDE AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 100 MICRON.

B) MIDDLE COAT SHALL BE EPOXY BASED ALUMINIUM AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 100 MICRON.

C) TOP COAT SHALL BE POLYURETHANE RESIN BASED PAINT AND SHALL PROVIDE A MINIMUM DRY FILM THICKNESS OF 50 MICRON.

3) EACH LAYER OF COATINGS SHALL BE OF DIFFERENT COLOURS.

ATTACHMENT OF STEEL PLATE



ATTACHMENT OF STEEL PLATE

(A) APPLICATION CRITERIA

- INADEQUATE LOAD CARRYING CAPACITY.
- EXCESS BENDING STRESS IS LESS THAN 20% OF ALLOWABLE STRESS.
- NON-ACTIVE CORROSION, PAINT DETERIORATION

(B) WORK SEQUENCE

1) MARK THE POSITIONS FOR THE BOLTS AND DRILL HOLES AT THE MARKED POSITIONS AT BOTH THE BEAM AND THE STEEL PLATE.

2) *THOROUGHLY REMOVE CORROSION, OIL, GREASE, FOREIGN* MATERIAL, LOOSE OR PEELING PAINT AND ALL NON-ADHERENT RESIDUES FROM BOTH THE BEAM SURFACE TO BE IN CONTACT WITH THE STEEL PLATE AS WELL AS THE STEEL PLATE.

3) ATTACH THE PLATE TO THE BEAM BY USING HIGH TENSION FRICTION BOLTS AS SHOWN IN THE DRAWING.

4) PROTECT THE WORKING AREA AGAINST CORROSION ONCE ALL THE BOLTS HAVE BEEN TIGHTENED BY APPLYING PROTECTIVE COATING.

(C) SPECIFICATION

1) *HOLES FOR HIGH STRENGTH FRICTION GRIP BOLTS SHALL* COMPLY WITH THE REQUIREMENTS OF B.S. 4604.

2) HIGH STRENGTH FRICTION GRIP BOLTS SHALL COMPLY WITH THE REQUIREMENTS OF B.S. 4395 AND USE IN ACCORDANCE TO B.S. 4604.

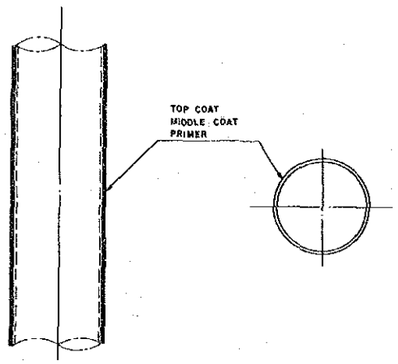
3) STEEL PLATES SHALL COMPLY WITH THE REQUIREMENTS OF B.S. 4360.

4) PROTECTIVE COATING SHALL FOLLOW THE SPECIFICATION FOR REMOVAL OF RUST AND REPAINTING.

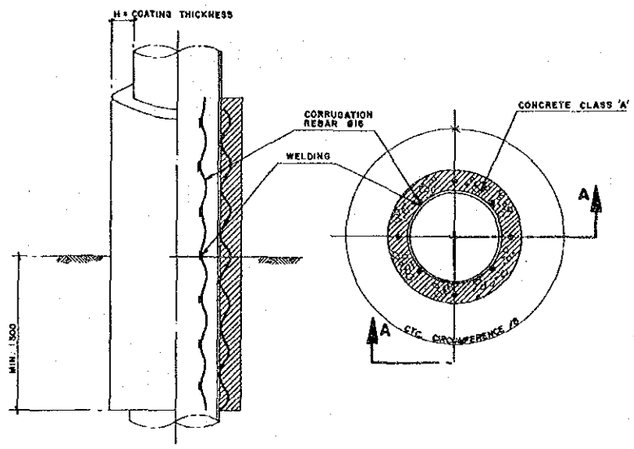
JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD-DRAWING OF STEEL PROTECTION AND REINFORCEMENT(1)		N.T.S.	MR - D - 25

PROTECTION AND REINFORCEMENT TO STEEL MATERIAL (2)

STEEL PILE PROTECTION (1)

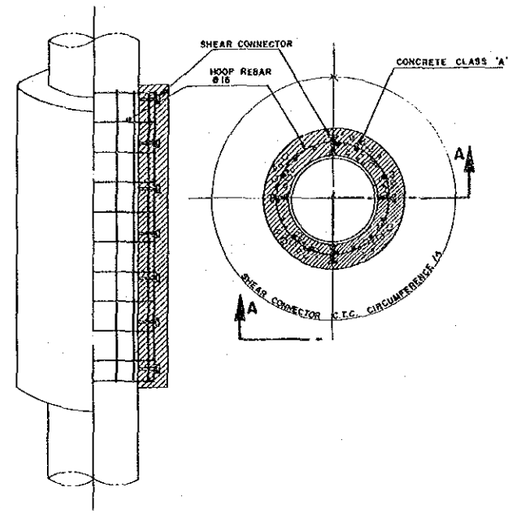


STEEL PILE PROTECTION (2)



SECTION A-A

STEEL PILE REINFORCEMENT



SECTION A-A

REPAINTING

(A) APPLICATION CRITERIA

- STEEL SURFACE IS SLIGHTLY CORRODED BUT LOAD CARRYING CAPACITY IS STILL ADEQUATE.
- BRIDGE IS LOCATED AT NON-SEVERE ENVIRONMENTAL CONDITION.

(B) WORK SEQUENCE

1) THOROUGHLY REMOVE CORROSION, FOREIGN MATERIAL, OIL, GREASE, LOOSE AND ALL NON-ADHERENT RESIDUES FROM OR PEELING PAINT ON THE STEEL SURFACE BY WIRE BRUSHING OR OTHER APPROVED MEANS.
2) IMMEDIATELY AFTER SURFACE PREPARATION BRUSH APPLIED A LAYER OF EPOXY BASED RED OXIDE PRIMER.
3) ALLOW THE PRIMER TO DRY AND BRUSH APPLIED A LAYER OF TAR-EPOXY RESIN BASED MIDDLE COAT.
4) FINALLY BRUSH APPLIED A LAYER OF TAR-EPOXY RESIN BASED COATING AFTER THE MIDDLE COAT HAS DRIED UP.

(C) SPECIFICATION

1) MINIMUM DRY FILM THICKNESS OF PRIME COAT SHALL BE 40 MICRON.
2) MINIMUM DRY FILM THICKNESS OF MIDDLE COAT SHALL BE 120 MICRON.
3) MINIMUM DRY FILM THICKNESS OF TOP COAT SHALL BE 120 MICRON.

CONCRETE COATING

A) APPLICATION CRITERIA

- STEEL SURFACE IS CONSIDERABLY CORRODED BUT LOAD CARRYING CAPACITY IS STILL ADEQUATE
- BRIDGE IS LOCATED AT SEVERE ENVIRONMENTAL CONDITION

B) WORK SEQUENCE

1) PILE COLUMN SHALL BE CLEAN OF CORROSION BY GRIT BLASTING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH B.S. 4232 SECOND QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967.
2) SECURELY FIX THE CORRUGATION REBAR AS SHOWN IN THE DRAWINGS TO THE PILE COLUMN BY WELDING.
3) CONSTRUCT THE FORMWORK TO FORM A MINIMUM CONCRETE COVER OF 70MM. FORMWORK SHALL BE SUFFICIENTLY RIGID AND TIGHT TO PREVENT THE LOSS OF GROUT AND TO MAINTAIN FORMS IN THEIR CORRECT POSITION, SHAPE, PROFILE AND DIMENSION.
4) PLACE IN CONCRETE OF GRADE 40/20 INTO THE FORMWORK
5) FORMWORK SHALL BE REMOVED WHEN THE CONCRETE HAS ACHIEVED THE REQUIRED STRENGTH AND SHALL BE IMMEDIATELY CURED IN ACCORDANCE WITH GOOD CONCRETE PRACTICE.

C) SPECIFICATION

1) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40 N/MM²/20MM.
2) MINIMUM COVER TO MAIN REINFORCEMENT SHALL BE 70MM.
3) BARS SHALL BE BENT AND MEASURED IN ACCORDANCE WITH B.S. 4466.
4) REINFORCEMENT TO BE WELD SHALL COMPLY THE REQUIREMENTS OF B.S. 4360.
5) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S. 5135 AND B.S. 638.

CONCRETE LINING

A) APPLICATION CRITERIA

- STEEL SURFACE IS CONSIDERABLY CORRODED AND ITS LOAD CARRYING CAPACITY IS INADEQUATE
- BRIDGE IS LOCATED AT SEVERE ENVIRONMENTAL CONDITION

B) WORK SEQUENCE

1) PILE COLUMN SHALL BE CLEAN OF CORROSION BY GRIT BLASTING OR OTHER APPROVED MEANS TO ACHIEVE A SURFACE FINISH COMPLYING WITH B.S. 4232 SECOND QUALITY OR SA 2½ OF SWEDISH STANDARD SIS 055900:1967.
2) WELD IN SHEAR CONNECTORS TO THE STEEL SURFACE AS SHOWN IN THE DRAWING.
3) FIX IN PLACE THE MAIN VERTICAL BAR AND HOOP REBAR LINKS IN ACCORDANCE TO THE DRAWING BY USING BINDING WIRES.
4) CONSTRUCT THE FORMWORK TO FORM A MINIMUM CONCRETE COVER OF 70MM. FORMWORK SHALL BE SUFFICIENTLY RIGID AND TIGHT TO PREVENT THE LOSS OF GROUT AND TO MAINTAIN FORMS IN THEIR CORRECT POSITION, SHAPE, PROFILE AND DIMENSION.
5) PLACE IN CONCRETE OF GRADE 40/20 INTO THE FORMWORK.
6) FORMWORK SHALL BE REMOVED WHEN THE CONCRETE HAS ACHIEVED THE REQUIRED STRENGTH AND SHALL BE IMMEDIATELY CURED IN ACCORDANCE WITH GOOD CONCRETE PRACTICE.

C) SPECIFICATION

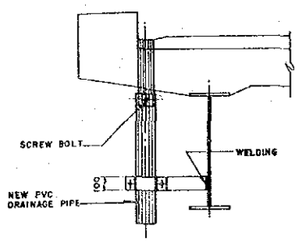
1) MINIMUM CONCRETE CUBE STRENGTH AT 28 DAYS SHALL BE 40 N/MM²/20MM.
2) MINIMUM COVER TO MAIN REINFORCEMENT SHALL BE 70MM.
3) ALL MILD STEEL SHALL CONFORM TO M.S. 146.
4) WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH B.S. 5135 AND B.S. 638.
5) LAP LENGTH SHALL BE 32 X DIAMETER OF BAR.

JICA

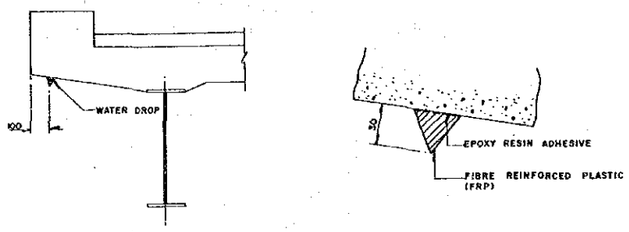
THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
STANDARD-DRAWING OF STEEL PROTECTION AND REINFORCEMENT (2)		N.T.S	MR-D-26

INCIDENTAL FACILITY

EXTENSION OF DRAINAGE PIPE



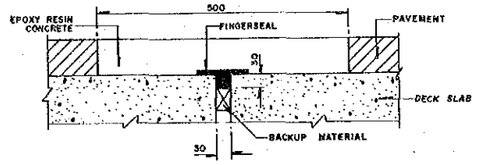
INSTALLATION OF WATER DROP



EXPANSION JOINT

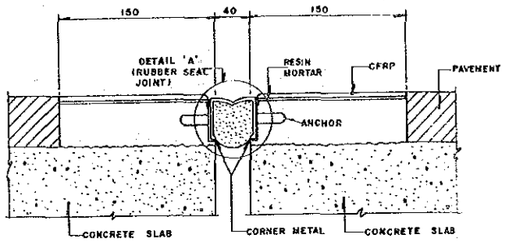
TYPE 'A'

APPLICATION CRITERIA : GIRDER LENGTH ≦ 10m

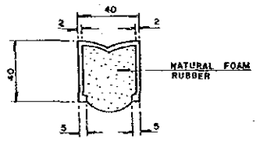


TYPE 'B'

APPLICATION CRITERIA. GIRDER LENGTH > 10 m.

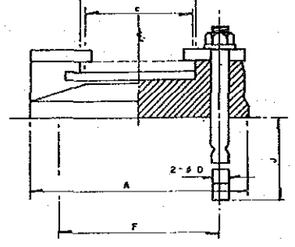


DETAIL 'A' (RUBBER SEAL JOINT)

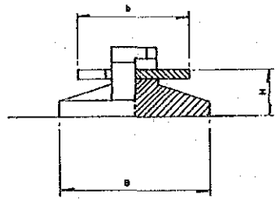


STEEL BEARING

TYPE 'A'



TYPE 'B'

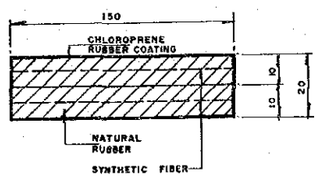


STEEL BEARING	REACTION	DIMENSION (mm.)								
	ton	a	b	c	A	B	H	D	F	J
TYPE 'A'	R≦ 30	216	140	200	420	240	87	25	300	300
TYPE 'B'	30<R≦ 60	316	190	300	610	280	115	25	440	300

RUBBER BEARING

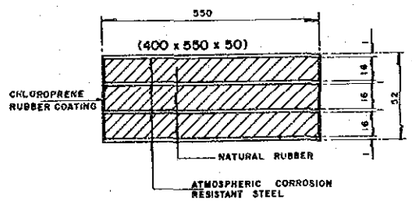
TYPE 'A'

FOR SLAB TYPE BRIDGE



TYPE 'B'

GIRDER TYPE BRIDGE : REACTION LESS THAN 100 TON.



PHYSICAL PROPERTIES REQUIREMENTS

ITEM	UNIT	REQUIREMENT	TEST METHOD
STATIC MODULUS OF TRANSVERSE ELASTICITY	Kg f/cm²	8±1 10±1	JIS K6301-13
NORMAL HARDNESS	DEGREE	50±5 60±5	JIS K6301-5
ELONGATION AT BREAK	%	MORE THAN 440	JIS K6301-3
TENSILE STRENGTH	Kg f/cm²	MORE THAN 150	JIS K6301-3
AGEING TEST . CHANGE IN TENSILE STRENGTH . CHANGE IN ELONGATION AT BREAK	% %	-10 ≈ + 100 MORE THAN-50 (100°C x 70h)	JIS K6301-6
COMPRESSION SET AFTER 24 HOURE AT 70°C AND 25% COMPRESSION MAX.	%	LESS THAN 35	JIS K6301-10
OZONE RESISTANCE TEST	-	NO VISIBLE CRACK	JIS K6301-16
WATER RESISTANCE TEST	%	LESS THAN 10 (50°C x 72h)	JIS K6301-5

FORMATION REQUIREMENTS

IDENTIFICATION OF RUBBER POLYMER	CHLOROPRENE RUBBER
TOTAL RUBBER POLYMER (%) CARBON BLACK (%) ASH (%)	MORE THAN 50 15 ≈ 30 LESS THAN 10

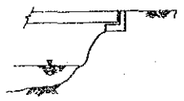
JICA

THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA

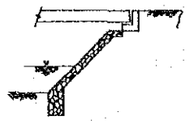
TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
STANDARD- DRAWING OF INCIDENTAL FACILITIES		N.T.S.	MR-D-27

SLOPE PROTECTION

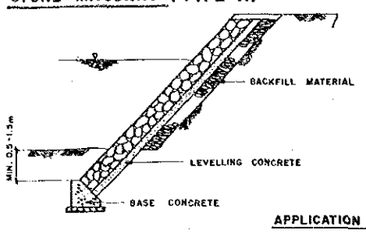
BEFORE REHABILITATION



AFTER REHABILITATION



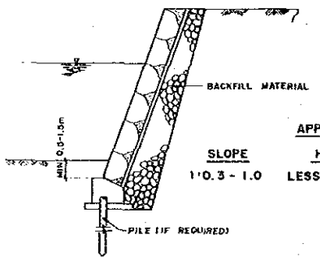
STONE MASONRY (TYPE-A)



APPLICATION CRITERIA

SLOPE	HEIGHT	APPLICATION
1:0.5 - 1.5	LESS THAN 5m	SMALL TO MEDIUM SCALE RIVER

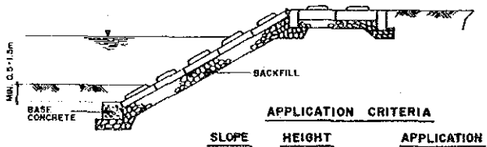
CONCRETE BLOCK MASONRY (TYPE-B)



APPLICATION CRITERIA

SLOPE	HEIGHT	APPLICATION
1:0.3 - 1.0	LESS THAN 3m	RAPID STREAM AND SMALL TO MEDIUM SCALE RIVER

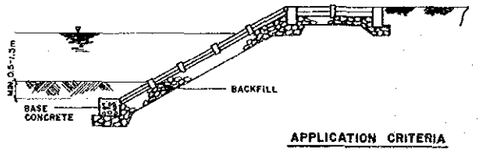
CONCRETE BLOCK PITCHING (TYPE C)



APPLICATION CRITERIA

SLOPE	HEIGHT	APPLICATION
1:1.5-2.0	LESS THAN 5m	MEDIUM TO LARGE SCALE RIVER

CONCRETE FRAME (TYPE-D)

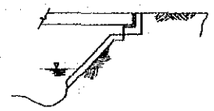


APPLICATION CRITERIA

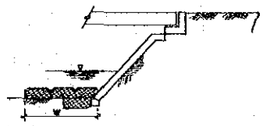
SLOPE	HEIGHT	APPLICATION
1:1.5-2.0	LESS THAN 8m	TIDAL RIVER AND BANK SUBJECTED TO WAVE FORCE

FOOT PROTECTION

BEFORE REHABILITATION



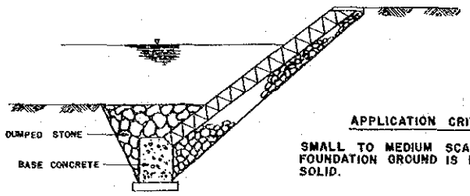
AFTER REHABILITATION



REQUIRED WIDTH OF FOOT PROTECTION

	MEAN FLOOD FLOW VELOCITY (V)		
	2 m/sec > V	2< V < 4m/sec	V > 4 m/sec
WIDTH	2 - 5m	4 - 8m	MORE THAN 6m

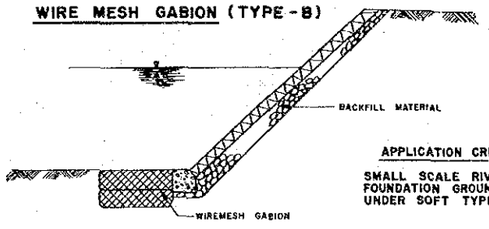
DUMPED STONE (TYPE-A)



APPLICATION CRITERIA

SMALL TO MEDIUM SCALE RIVER AND FOUNDATION GROUND IS RELATIVELY SOLID.

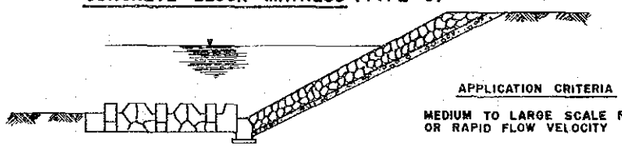
WIRE MESH GABION (TYPE-B)



APPLICATION CRITERIA

SMALL SCALE RIVER AND FOUNDATION GROUND IS UNDER SOFT TYPE.

CONCRETE BLOCK MATRESS (TYPE-C)



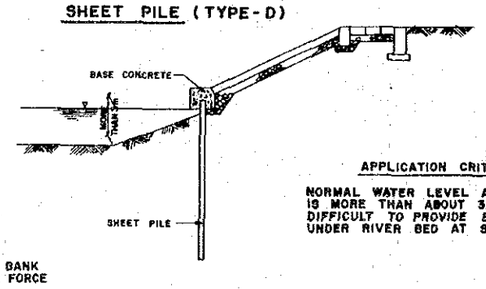
APPLICATION CRITERIA

MEDIUM TO LARGE SCALE RIVER OR RAPID FLOW VELOCITY

WEIGHT OF A CONCRETE BLOCK

	MEAN FLOOD FLOW VELOCITY (V)		
	2m/sec > V	2< V < 4m/sec	V > 4m / sec
WEIGHT	0.2 ~ 1.5 ton	1 ~ 3 ton	MORE THAN 2ton

SHEET PILE (TYPE-D)

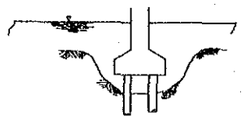


APPLICATION CRITERIA

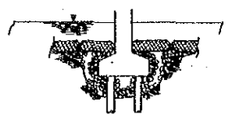
NORMAL WATER LEVEL AT SLOPE TOE IS MORE THAN ABOUT 3.0m AND IT IS *DIFFICULT TO PROVIDE BASE CONCRETE* UNDER RIVER BED AT SLOPE TOE.

RIVER-BED PROTECTION

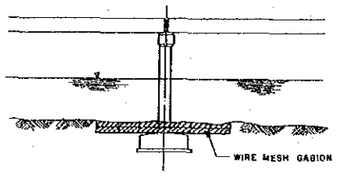
BEFORE REHABILITATION



AFTER REHABILITATION



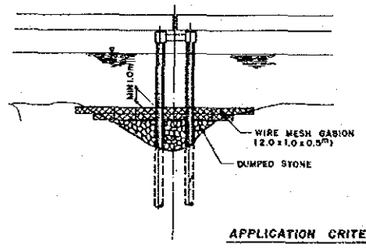
WIRE MESH GABION (TYPE-A)



APPLICATION CRITERIA

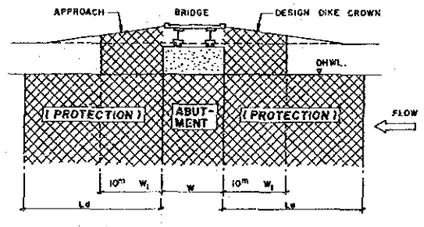
FOUNDATION PROTECTION

DUMPED STONE & WIRE MESH GABION (TYPE-B)



APPLICATION CRITERIA

LOCAL SCOURING



W : WIDTH OF BRIDGE ABUTMENT.

Ld, Lu : LENGTH OF REVETMENT DOWNSTREAM AND UPSTREAM SIDES OF THE ABUTMENT RESPECTIVELY.

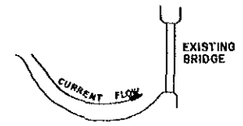
W_1 IS EQUAL TO W OR NOT MORE THAN 10m

Ld, Lu : NOT LESS THAN THE FOLLOWING LENGTH

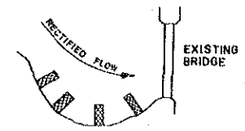
DESIGN DISCHARGE (Q, m^3/sec)	PROTECTION LENGTH (Ld, LU)
$Q < 2{,}000$	10
$2000 \leq Q < 4000$	15
$4000 \leq Q < 6000$	20
$6000 \leq Q < 8000$	25
$Q \geq 8000$	30

RIVER REALIGNMENT

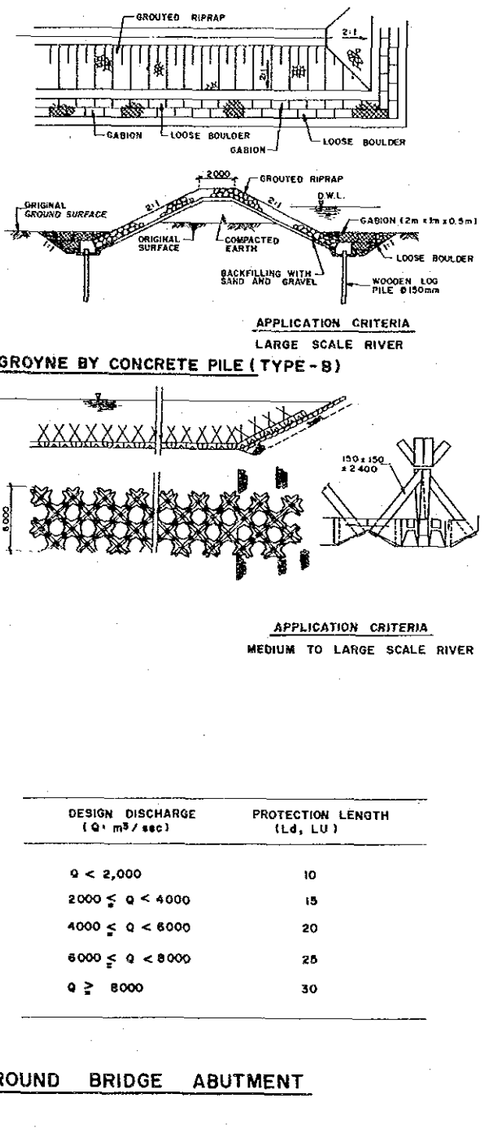
BEFORE REHABILITATION



AFTER REHABILITATION



SPUR DIKE BY STONE MASONRY (TYPE-A)



APPLICATION CRITERIA

LARGE SCALE RIVER

GROYNE BY CONCRETE PILE (TYPE-B)

APPLICATION CRITERIA

MEDIUM TO LARGE SCALE RIVER

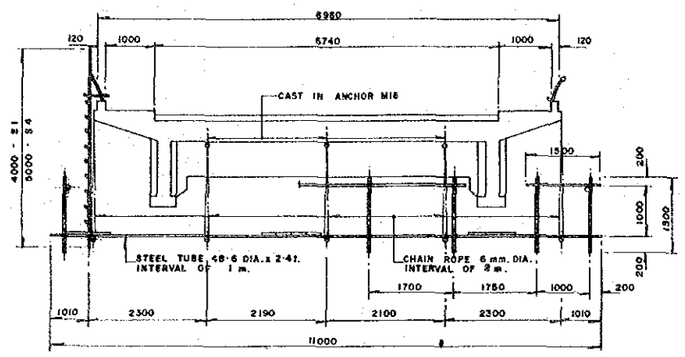
EXTENT OF REVETMENT AROUND BRIDGE ABUTMENT

JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD RIVER TRAINING WORK		N.T.S.	MR-D-28

SCAFFOLDING

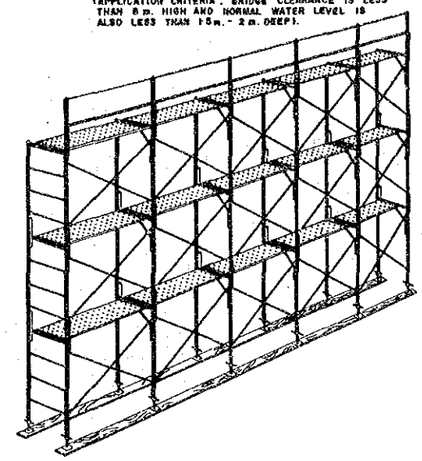
TYPE 'A': HANGING TYPE 1:60

(APPLICATION CRITERIA: BRIDGE CLEARANCE IS MORE THAN 8 m. HIGH AND NORMAL WATER LEVEL IS ALSO MORE THAN 1.5 m. - 2 m. DEEP).



TYPE 'B': GROUND SUPPORT TYPE

(APPLICATION CRITERIA: BRIDGE CLEARANCE IS LESS THAN 8 m. HIGH AND NORMAL WATER LEVEL IS ALSO LESS THAN 1.5 m. - 2 m. DEEP).

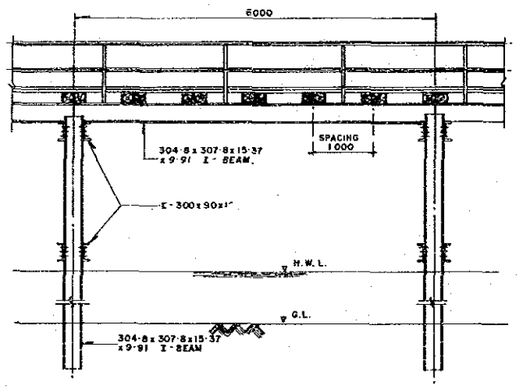


TEMPORARY STEEL BRIDGE

(APPLICATION CRITERIA: LARGE SCALE RIVER)

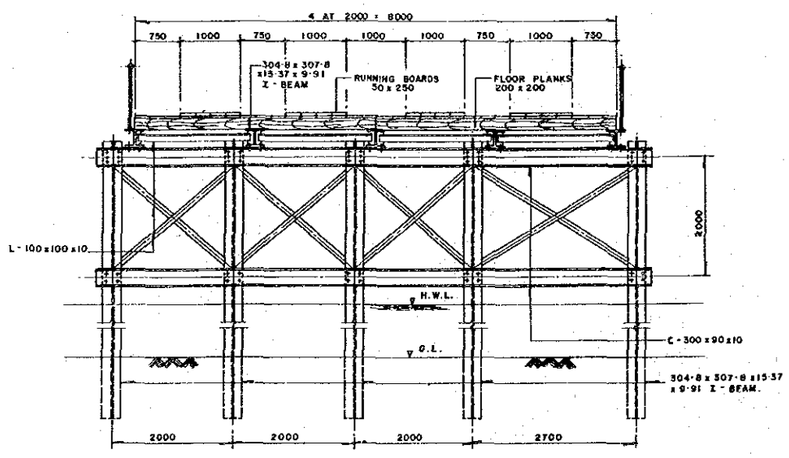
ELEVATION

1:50



CROSS - SECTION

1:50

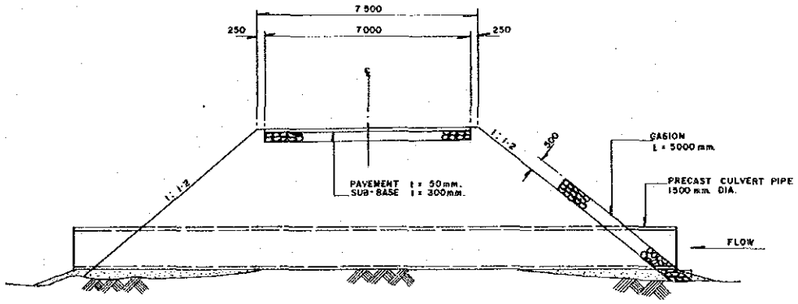


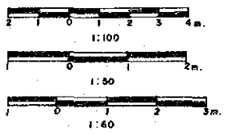
TEMPORARY DETOUR ROAD

TEMPORARY ROAD WITH EMBANKMENT

(APPLICATION CRITERIA: SMALL SCALE RIVER AND FLOOD DISCHARGE IS LESS THAN 40 m3/SECOND).

1:100





JICA	THE STUDY ON THE MAINTENANCE AND REHABILITATION OF BRIDGES IN MALAYSIA			
	TITLE OF DRAWING	BRIDGE NAME / NO.	SCALE	DRAWING NO.
	STANDARD-DRAWING OF TEMPORARY WORKS		AS SHOWN	MR-D-29

JICA