

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

FEASIBILITY STUDY
ON
PAN-PHILIPPINE HIGHWAY REHABILITATION PROJECT
(MINDANAO SECTION)

FINAL REPORT
DRAWINGS

MAY 1995



KATAHIRA & ENGINEERS INTERNATIONAL
NIPPON ENGINEERING CONSULTANTS CO., LTD.

SSF
JR
95-077(4/4)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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1. TYPICAL ROAD SECTIONS

TITLE	DRAWING NO.
TYPICAL CROSS-SECTION: PCC RECONSTRUCTION	H- 1
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3. SLOPE PROTECTION

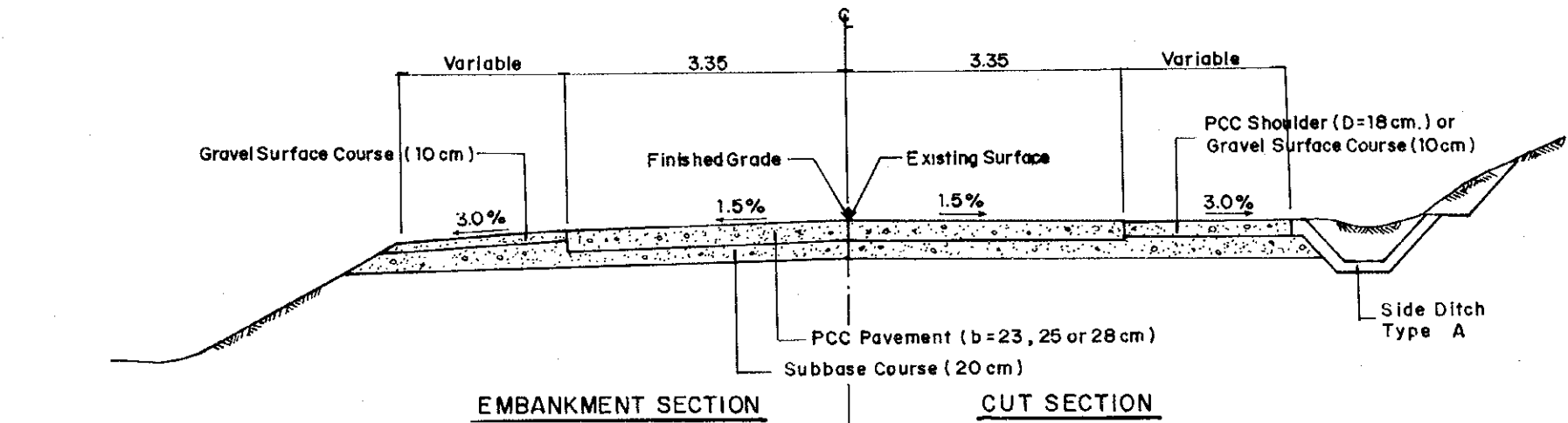
DRAWING NO.	SLOPE NO.	STATION	DRAWING NO.	SLOPE NO.	STATION
S- 1	4-17	1276 + 300	S- 2	4-18	1277 + 400
S- 2	4-18	1277 + 400	S- 3	4-19	1277 + 580
S- 3	4-19	1277 + 700	S- 4	4-21	1278 + 600
S- 4	4-21	1281 + 320	S- 5	4-22	1281 + 463
S- 5	4-22	1281 + 463	S- 6	4-23	1282 + 200
S- 6	4-23	1282 + 200	S- 7	4-24	1282 + 500
S- 7	4-24	1282 + 500	S- 8	4-25	1283 + 500
S- 8	4-25	1283 + 500	S- 9	4-26	1284 + 300
S- 9	4-26	1284 + 300	S-10	4-27	1284 + 700
S-10	4-27	1284 + 700	S-11	4-28	1304 + 875
S-11	4-28	1304 + 875	S-12	4-30	1304 + 952
S-12	4-30	1304 + 952	S-13	4-31	1312 + 800
S-13	4-31	1312 + 800	S-14	4-33	1313 + 350
S-14	4-33	1313 + 350	S-15	4-34	1313 + 380
S-15	4-34	1313 + 380	S-16	4-35	1313 + 400
S-16	4-35	1313 + 400	S-17	4-36	1314 + 400
S-17	4-36	1314 + 400	S-18	4-37	1340 + 950
S-18	4-37	1340 + 950	S-19	4-38	1352 + 800
S-19	4-38	1352 + 800	S-20	4-39	1353 + 400
S-20	4-39	1353 + 400	S-21	4-40	1353 + 450
S-21	4-40	1353 + 450	S-22	4-41	1353 + 600
S-22	4-41	1353 + 600	S-23	4-42	1372 + 800
S-23	4-42	1372 + 800	S-24	4-43	1372 + 800
S-24	4-43	1372 + 800	S-25	5-01	1378 + 500
S-25	5-01	1378 + 500	S-26	5-02	1378 + 800
S-26	5-02	1378 + 800	S-27	5-04	1380 + 600
S-27	5-04	1380 + 600	S-28	5-05	1395 + 800
S-28	5-05	1395 + 800	S-29	5-06	1401 + 300
S-29	5-06	1401 + 300	S-30	5-07	1401 + 850
S-30	5-07	1401 + 850	S-31	5-10	1410 + 200
S-31	5-10	1410 + 200	S-32	5-13	1430 + 950
S-32	5-13	1430 + 950	S-33	5-16	1441 + 000
S-33	5-16	1441 + 000	S-34	5-19	1445 + 700
S-34	5-19	1445 + 700	S-35	5-21	1450 + 100
S-35	5-21	1450 + 100	S-36	5-22	1468 + 100
S-36	5-22	1468 + 100	S-37	5-23	1469 + 925
S-37	5-23	1469 + 925			

4. COUNTERMEASURES AGAINST FLOOD

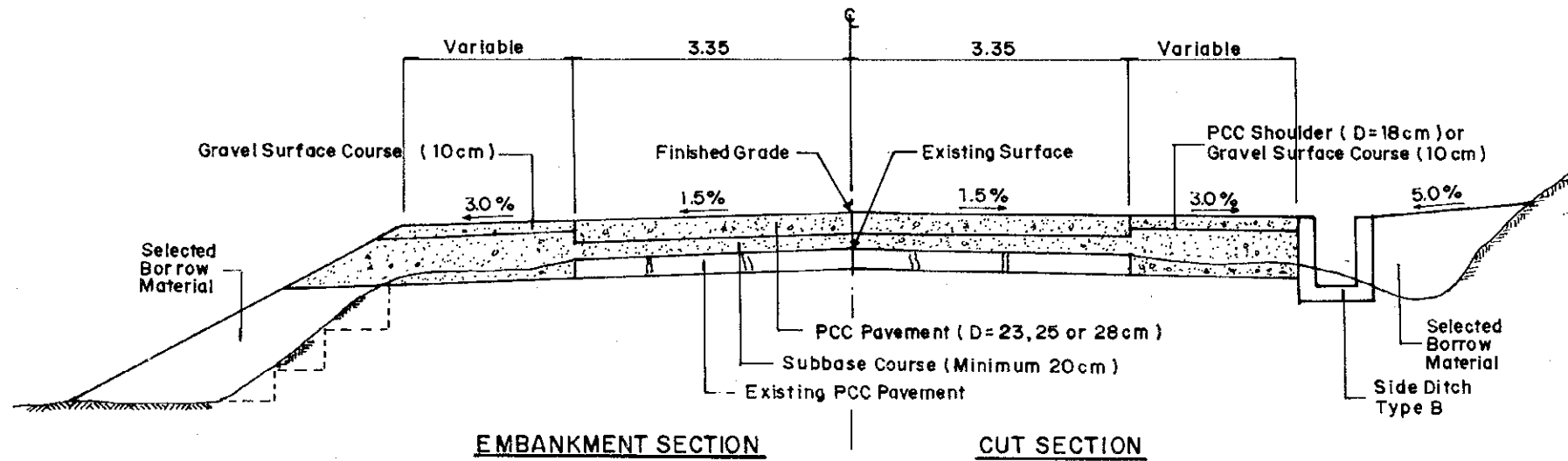
DRAWING NO.	FLOOD NO.	TYPE	STATION	DRAWING NO.
S-38	1	I	1160 + 700 - 1161 + 700	F- 1
S-39	2	I	1163 + 600 - 1164 + 100	F- 2
S-40	3	III	1164 + 750 - 1165 + 100	F- 3
S-41	4	III	1165 + 800 - 1165 + 880	F- 4
S-42	5	III	1166 + 600 - 1167 + 900	F- 5
S-43	6	III	1182 + 100 - 1182 + 590	F- 6
S-43	7	III	1183 + 100 - 1183 + 260	F- 7
S-44	8	III	1184 + 250 - 1185 + 200	F- 8
S-45	9	III	1187 + 600 - 1189 + 200	F- 9
S-46	10	I	1192 + 000 - 1193 + 800	F-10
S-47	11	III	1196 + 400 - 1196 + 720	F-11
S-48	12	III	1197 + 556 - 1197 + 571	F-12
S-49	13	III	1199 + 600 - 1203 + 870	F-13
S-49	14	II	1219 + 700 - 1220 + 100	F-14
S-50	15	II	1224 + 200 - 1224 + 640	F-15
S-51	16	IV	1355 + 200 - 1364 + 200	F-16
S-51	17	IV	1393 + 400 - 1398 + 300	F-17
S-51	18	IV	1460 + 500 - 1468 + 000	F-18

2. BRIDGE REHABILITATION

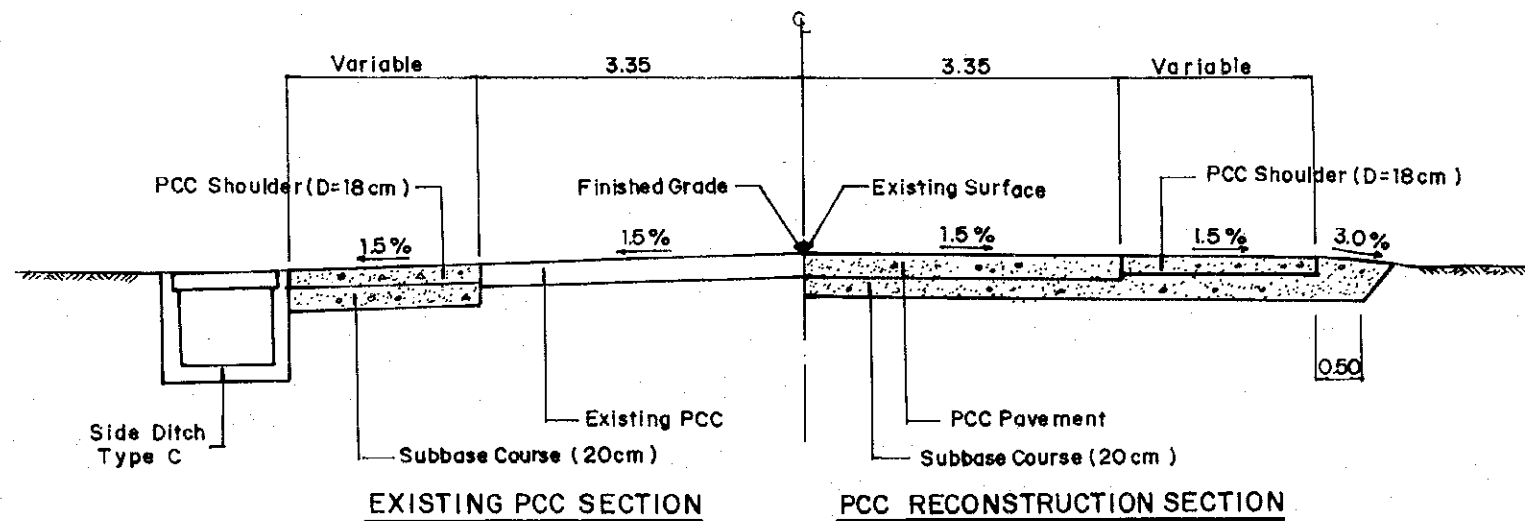
BRIDGE NO.	STATION	NAME OF BRIDGE	DRAWING NO.
B- 1	2-05	1172 + 500	S-10
B- 2	2-07	1173 + 430	S-11
B- 3	2-08	1177 + 000	S-12
B- 4	2-09	1177 + 200	S-12
B- 5	2-10	1177 + 400	S-13
B- 6	2-11	1179 + 000	S-14
B- 7	2-12	1180 + 700	S-15
B- 8	2-13	1181 + 400	S-16
B- 9	3-01	1239 + 200	S-17
B-10	3-02	1239 + 620	S-18
B-11	3-03	1239 + 900	S-19
B-12	3-04	1240 + 150	S-20
B-13	3-05	1240 + 600	S-21
B-14	4-01	1241 + 100	S-22
B-15	4-02	1243 + 000	S-23
B-16	4-03	1244 + 850	S-24
B-17	4-04	1244 + 965	S-25
B-18	4-05	1245 + 250	S-26
B-19	4-06	1247 + 200	S-27
B-20	4-07	1247 + 360	S-28
B-21	4-08	1247 + 500	S-29
B-22	4-09	1247 + 800	S-30
B-23	4-10	1249 + 750	S-31
B-24	4-11	1251 + 150	S-32
	4-12	1251 + 300	S-33
	4-13	1271 + 900	S-34
	4-14	1272 + 600	S-35
	4-15	1275 + 010	S-36
	4-16	1275 + 800	S-37



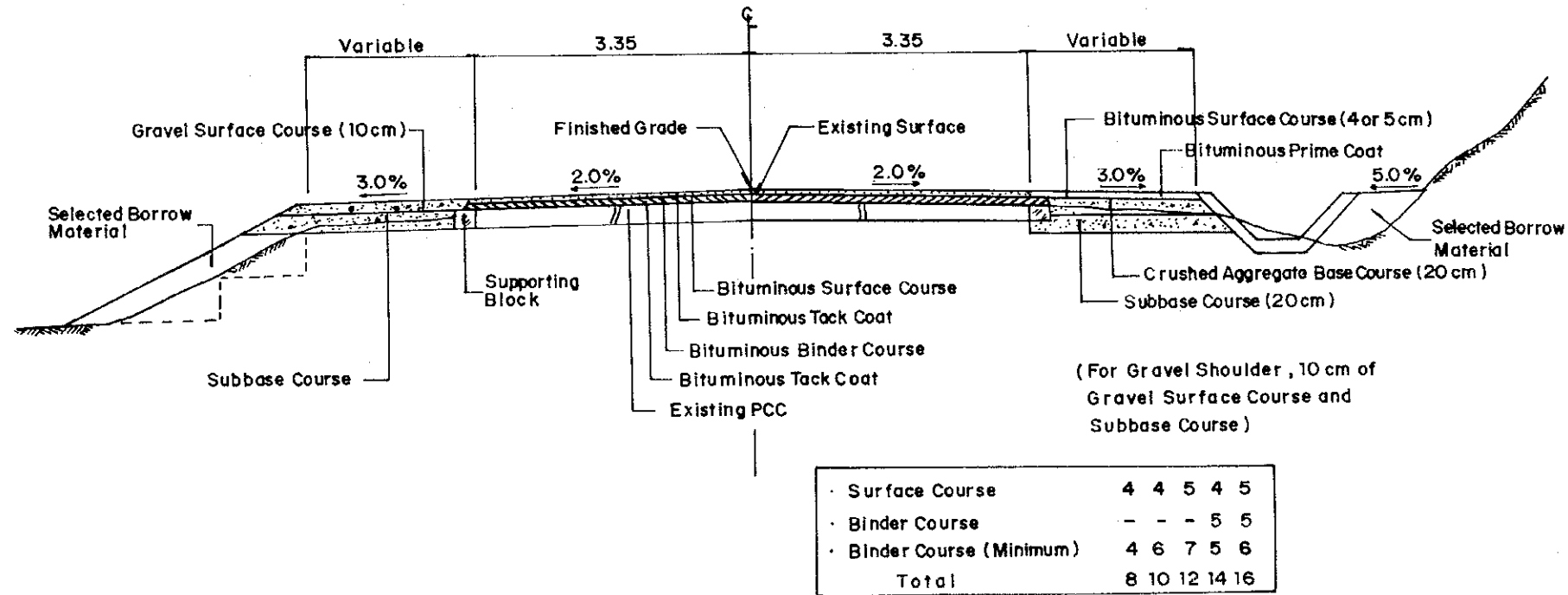
SECTIONS WHERE ROAD ELEVATION CAN NOT BE RAISED



SECTIONS WHERE ROAD ELEVATION CAN BE RAISED

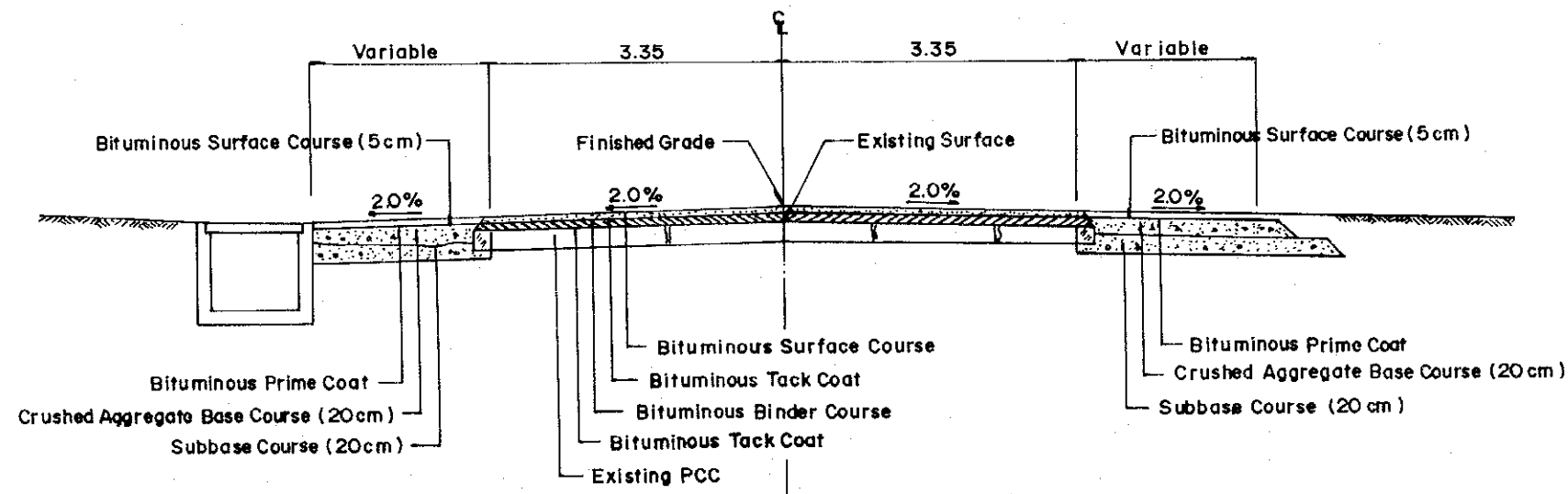


URBAN SECTION

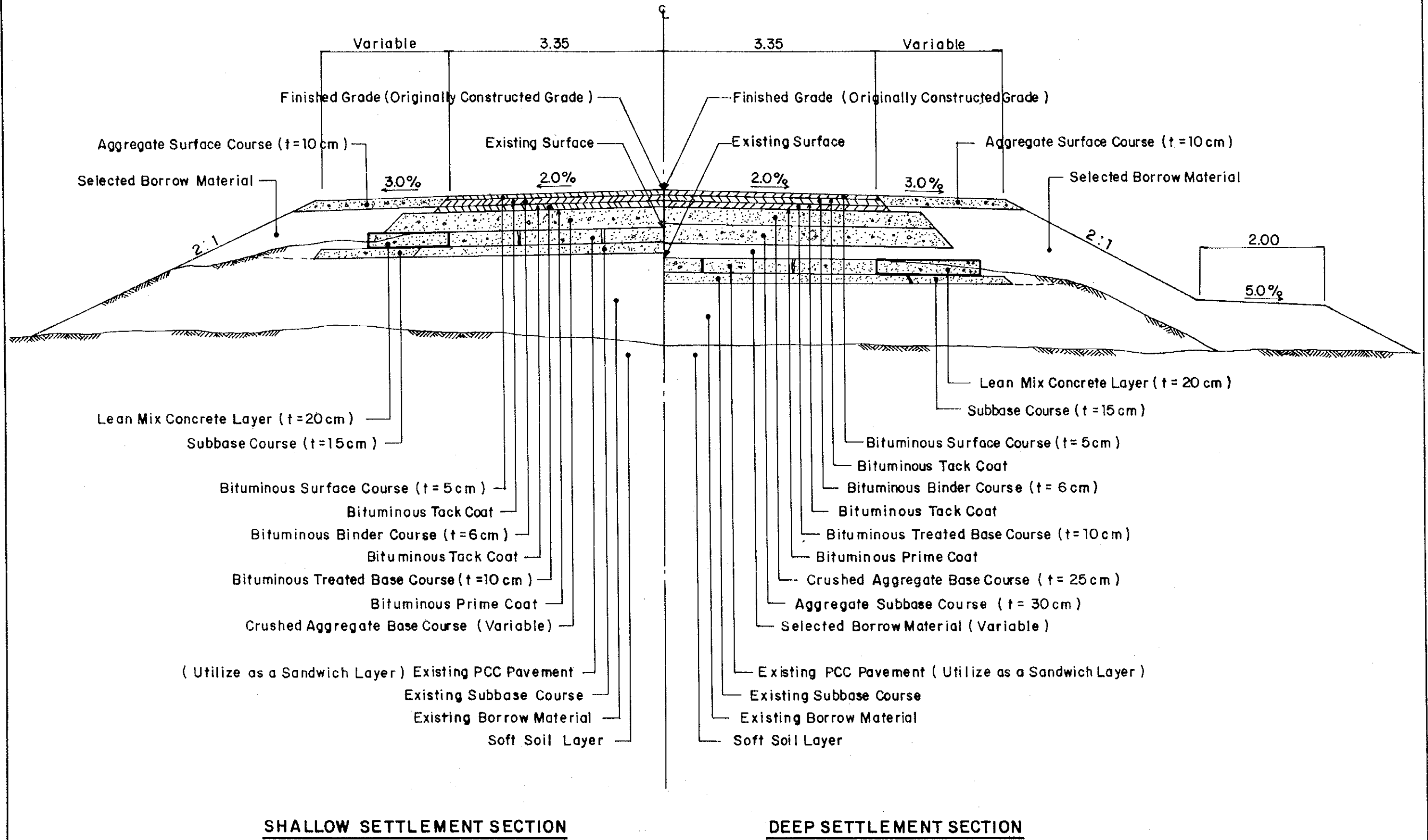


EMBANKMENT SECTION

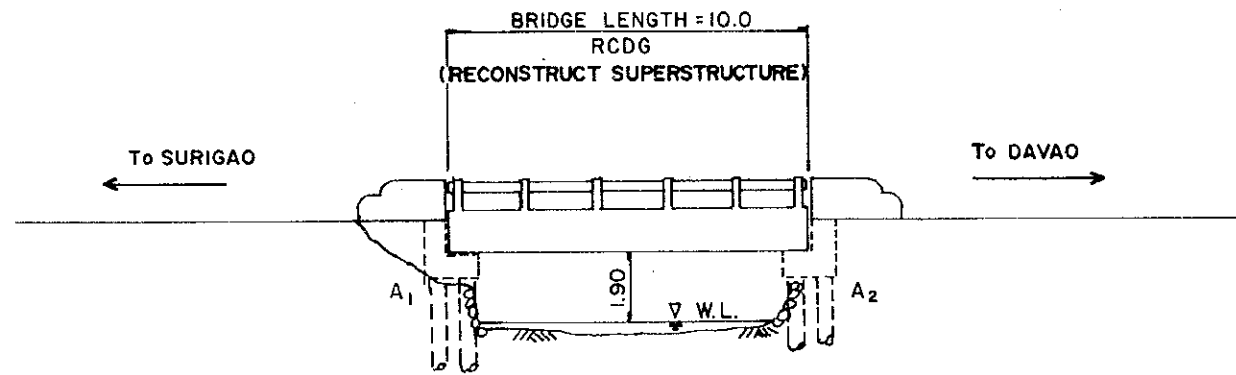
CUT SECTION



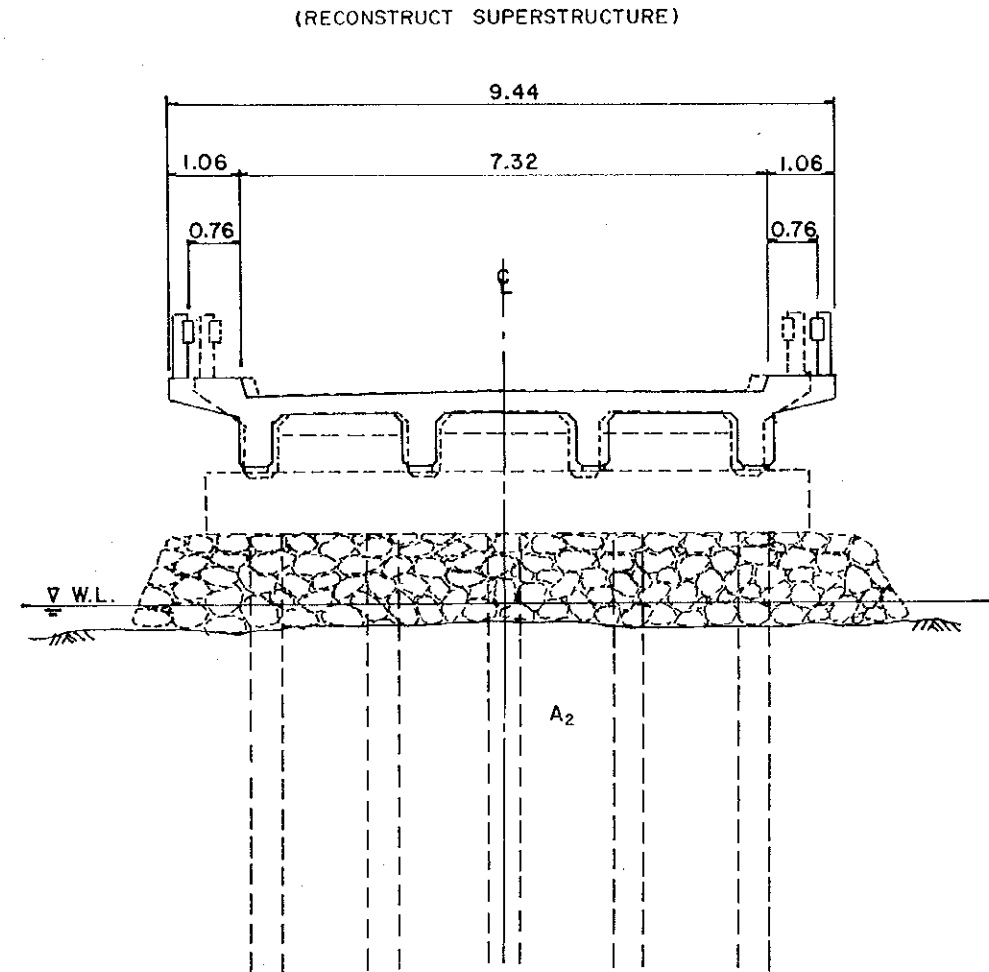
URBAN SECTION



PROFILE
SCALE: 1:200

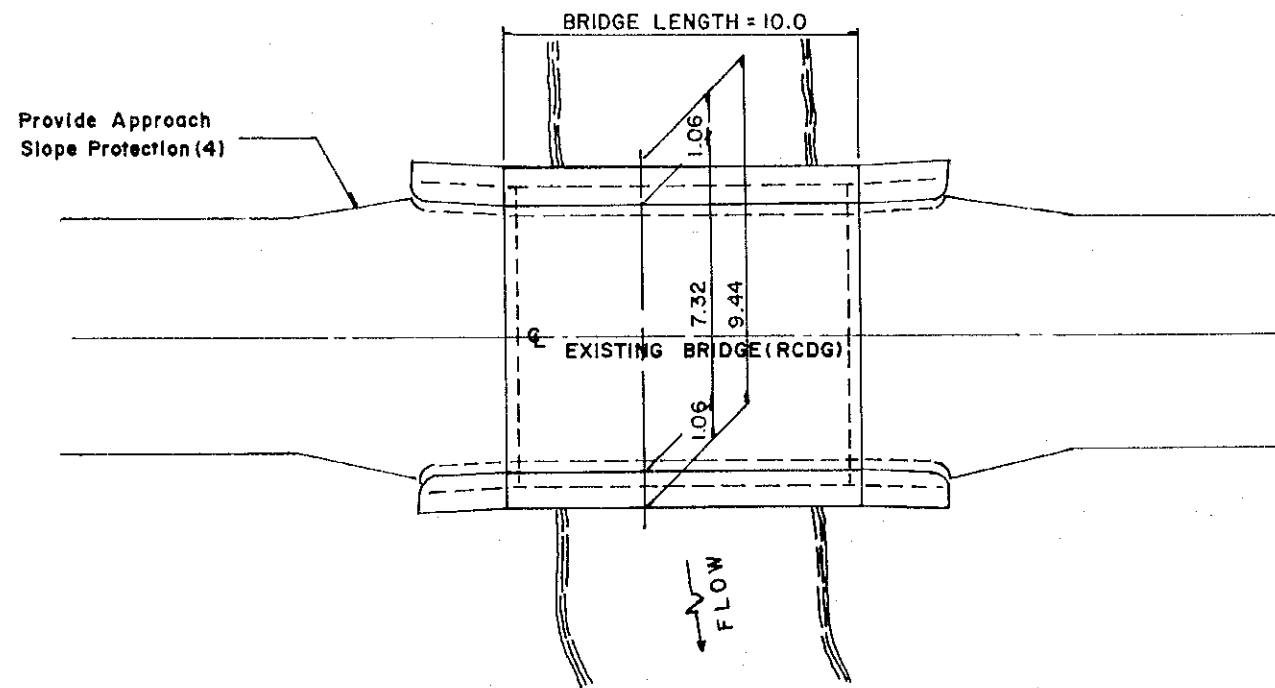


CROSS SECTION
SCALE: 1:100

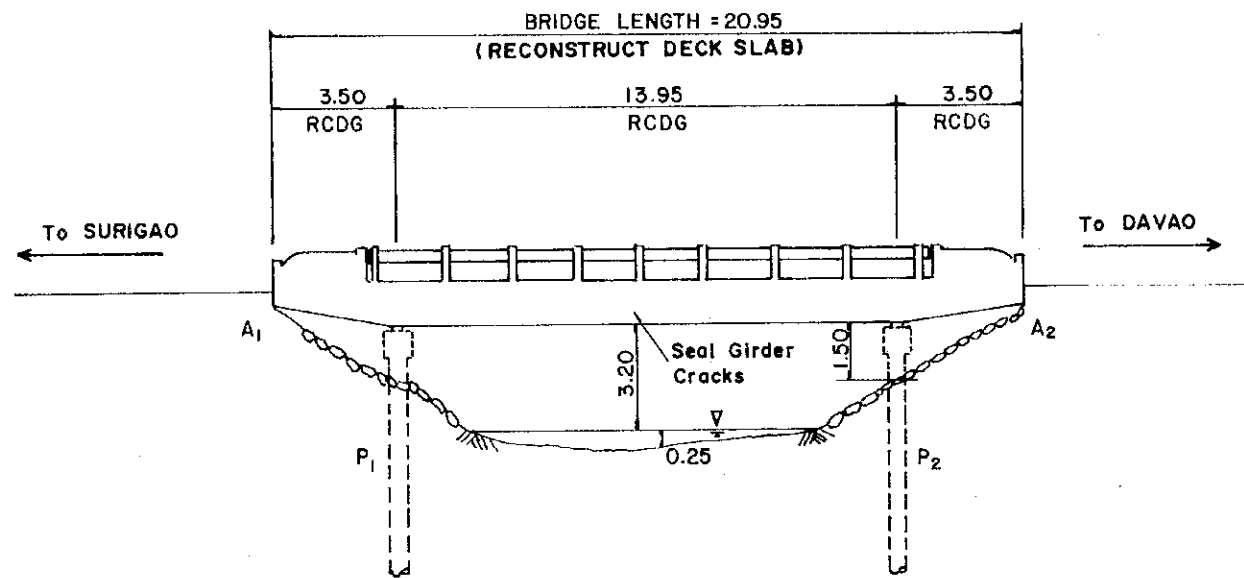


DETOUR BRIDGE : TEMPORARY ONE-LANE

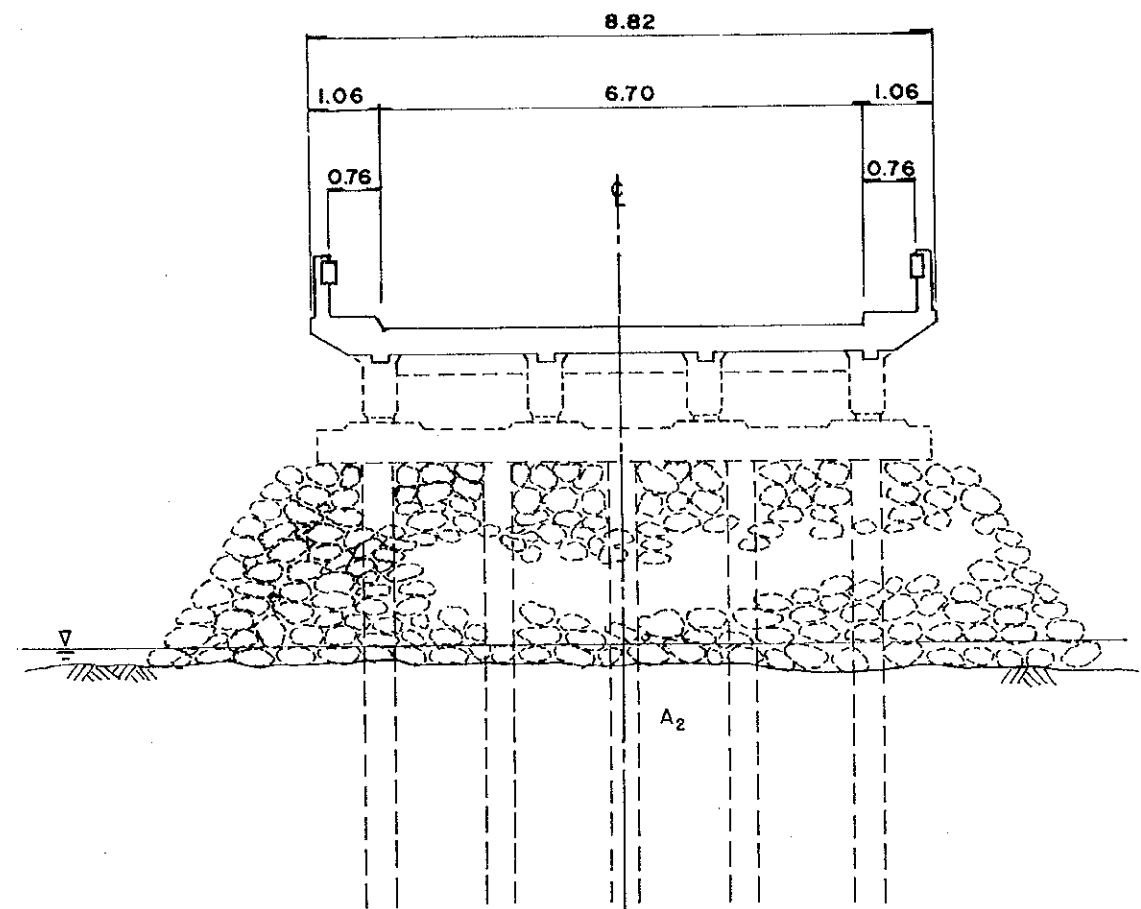
PLAN
SCALE: 1:200



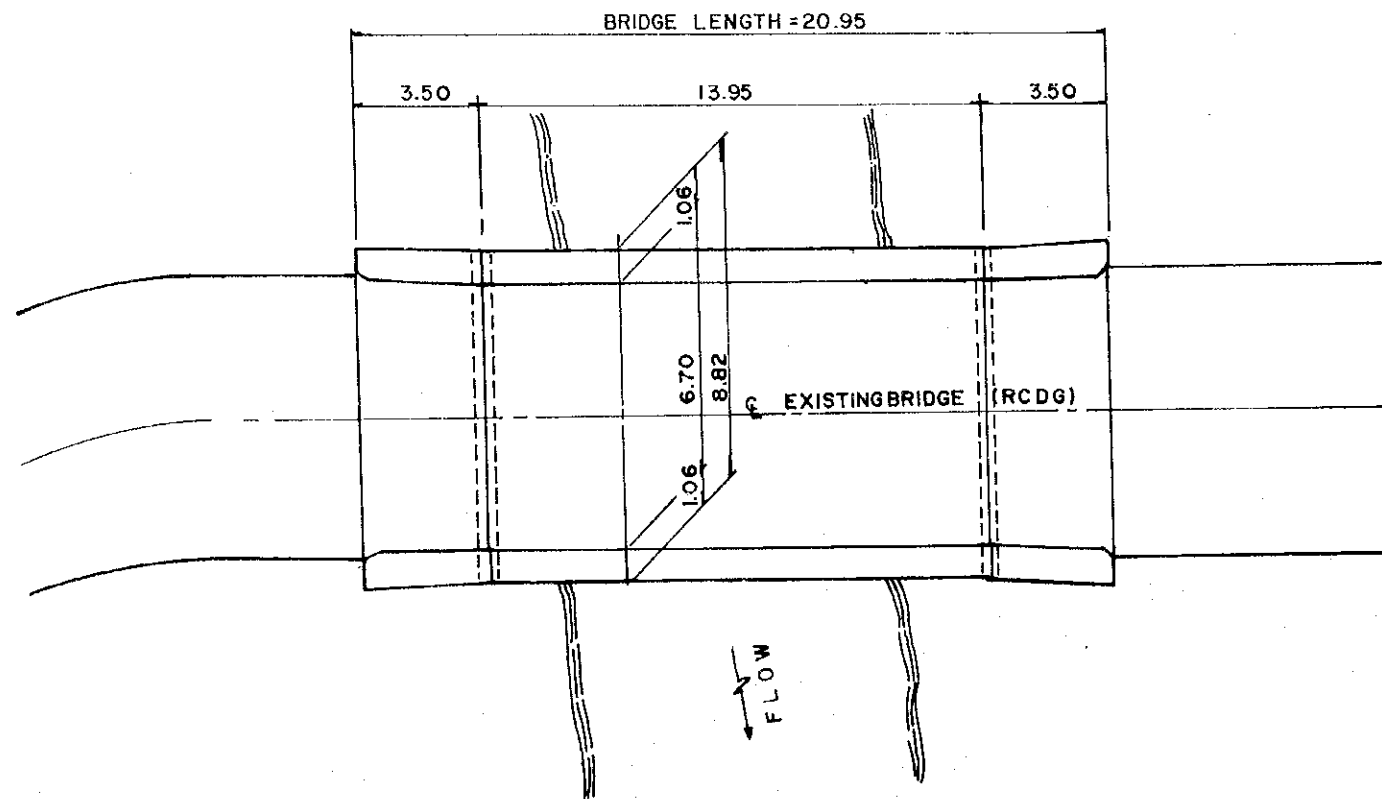
PROFILE
SCALE: 1:200



CROSS SECTION
SCALE 1:100
(RECONSTRUCT DECK SLAB)

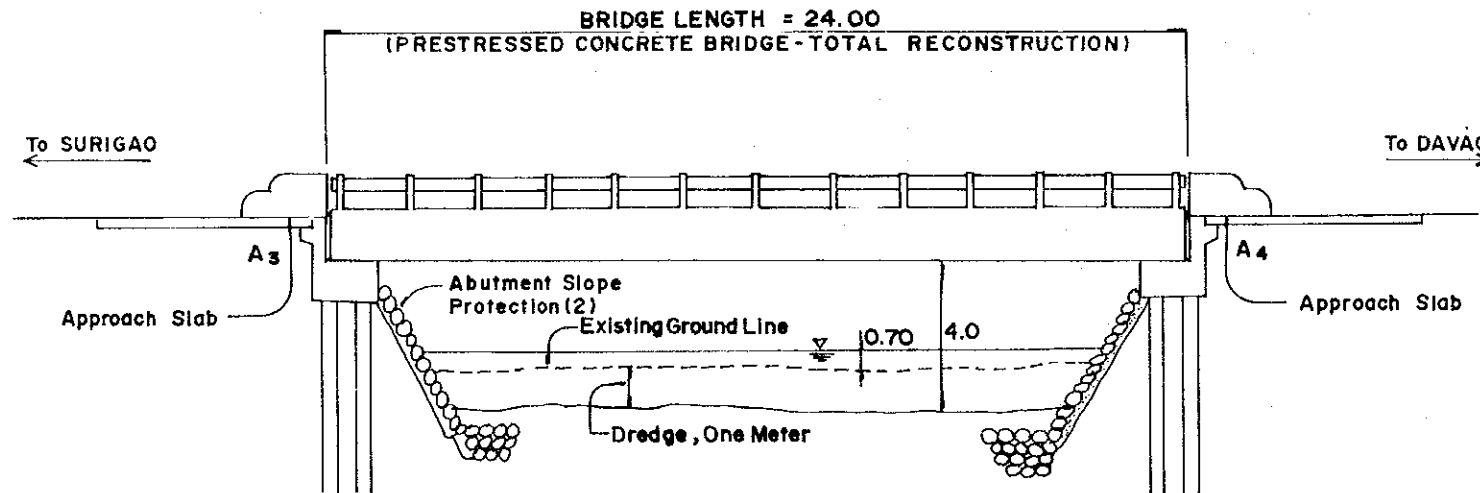


PLAN
SCALE: 1:200

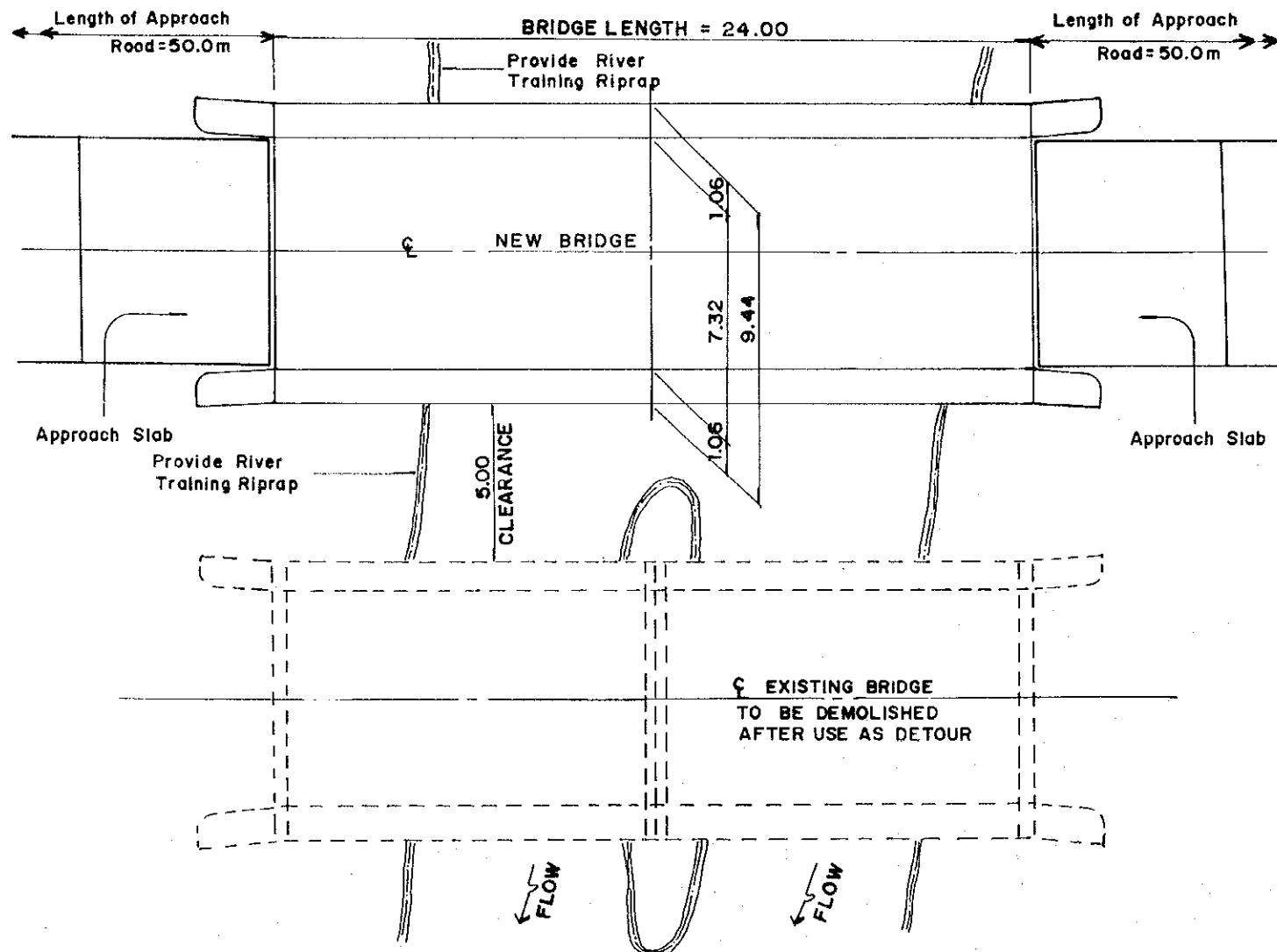


DETOUR BRIDGE : TEMPORARY ONE-LANE

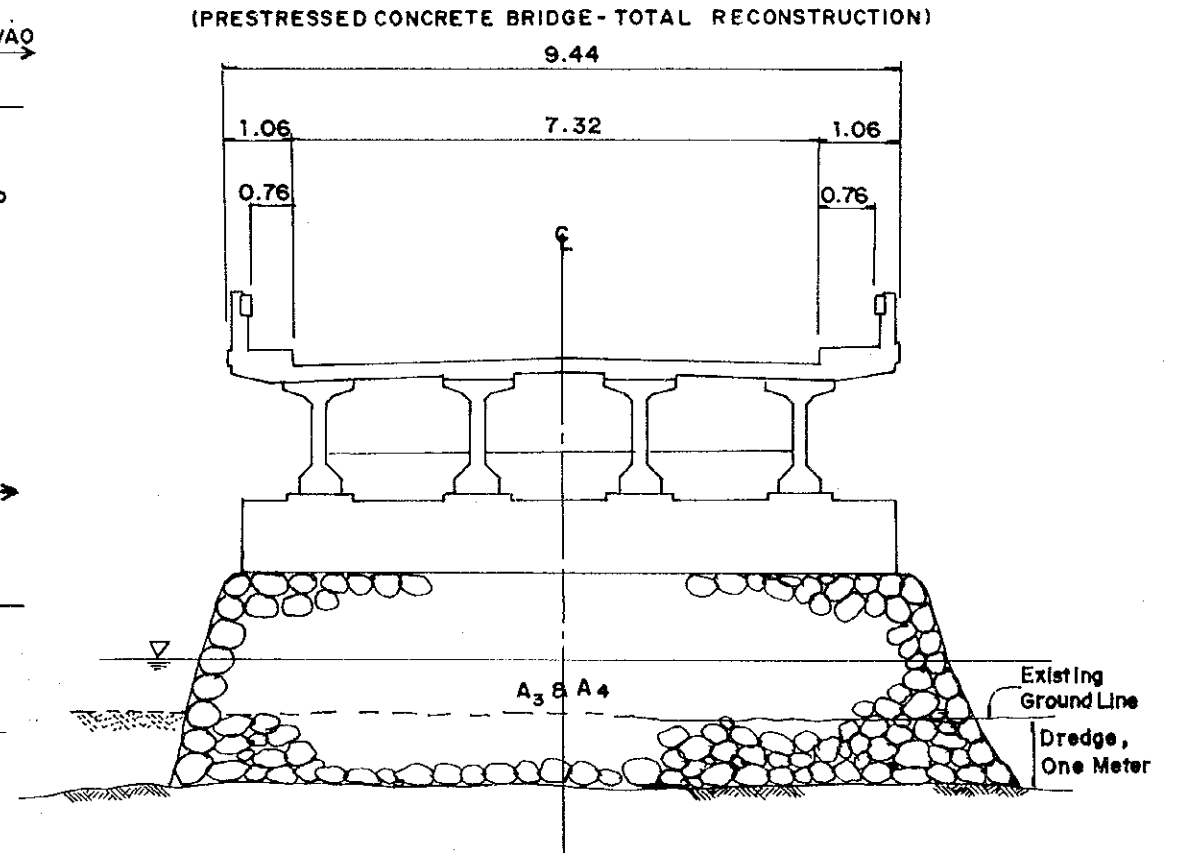
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PLAN
SCALE 1:200

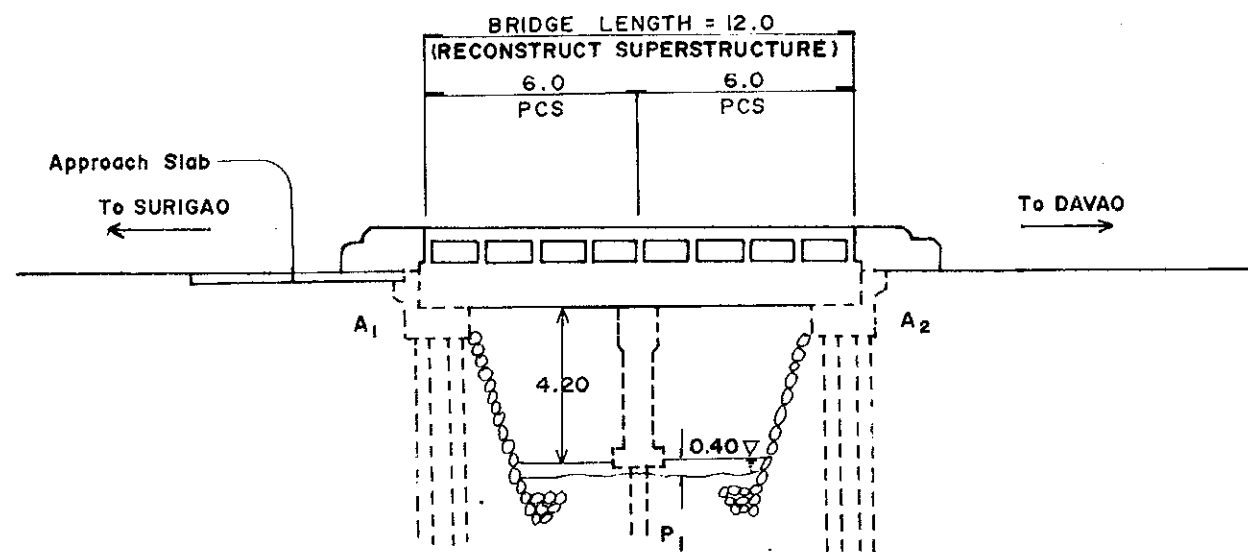


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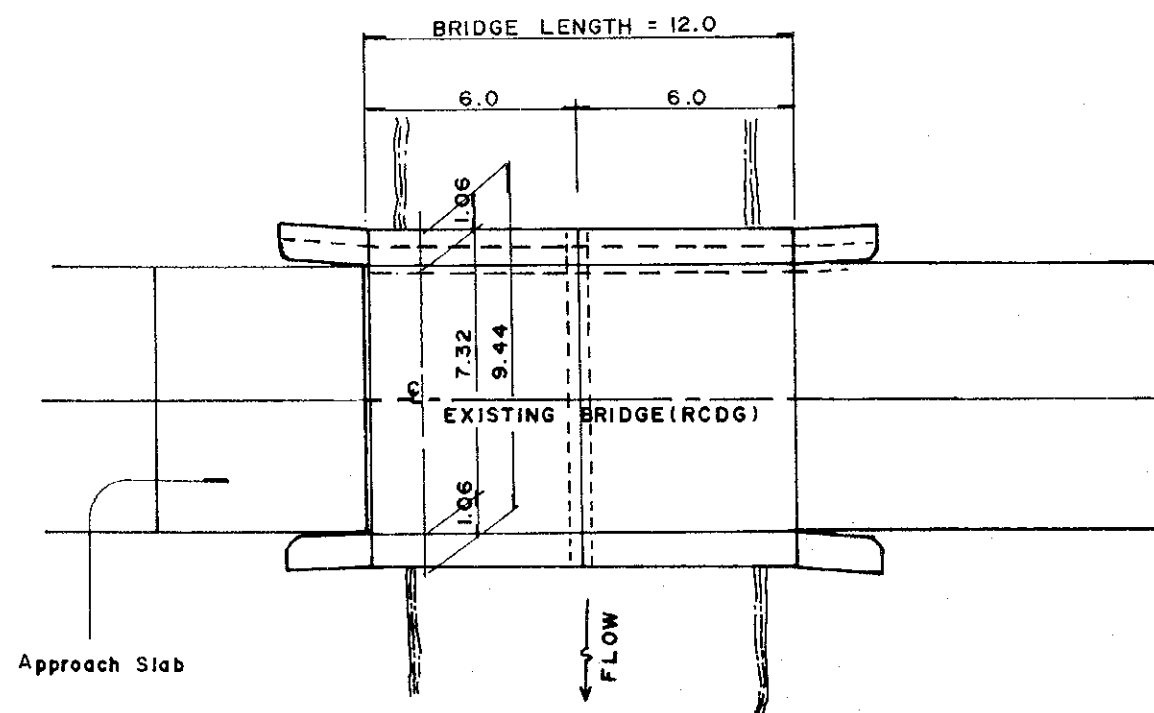


DETOUR BRIDGE : EXISTING BRIDGE

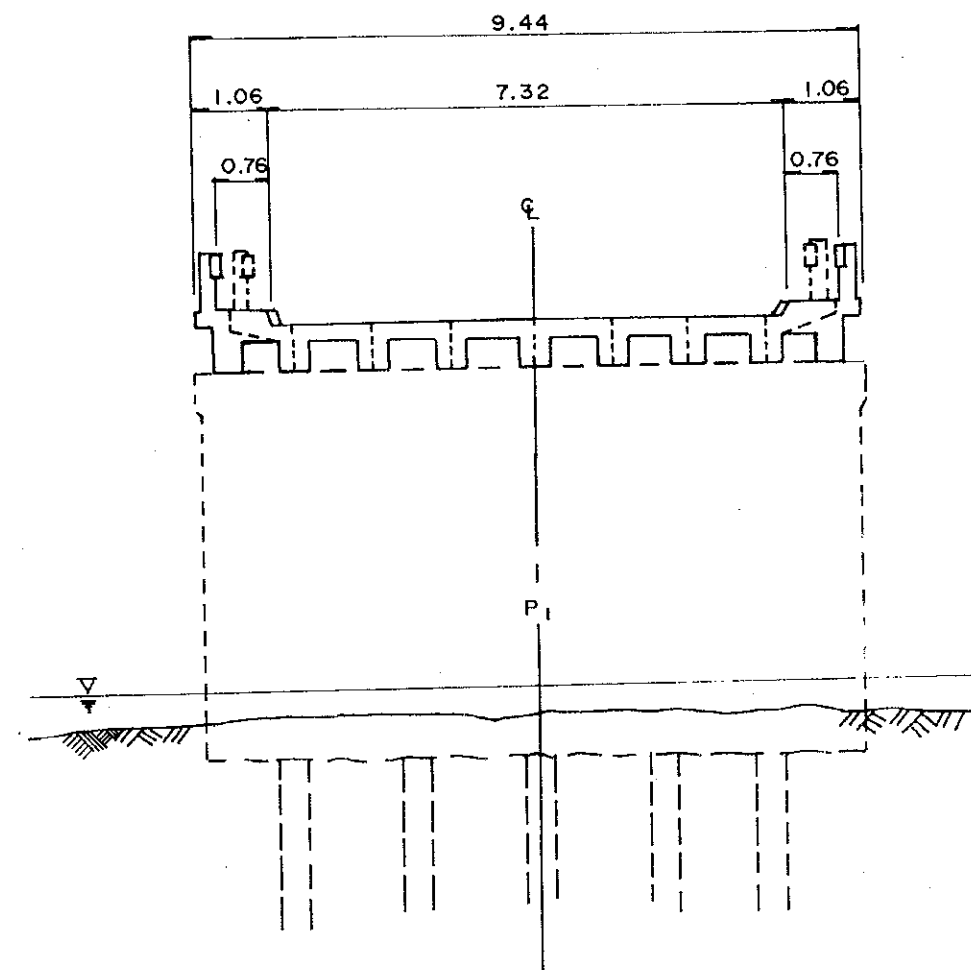
PROFILE
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P L A N
SCALE 1:200

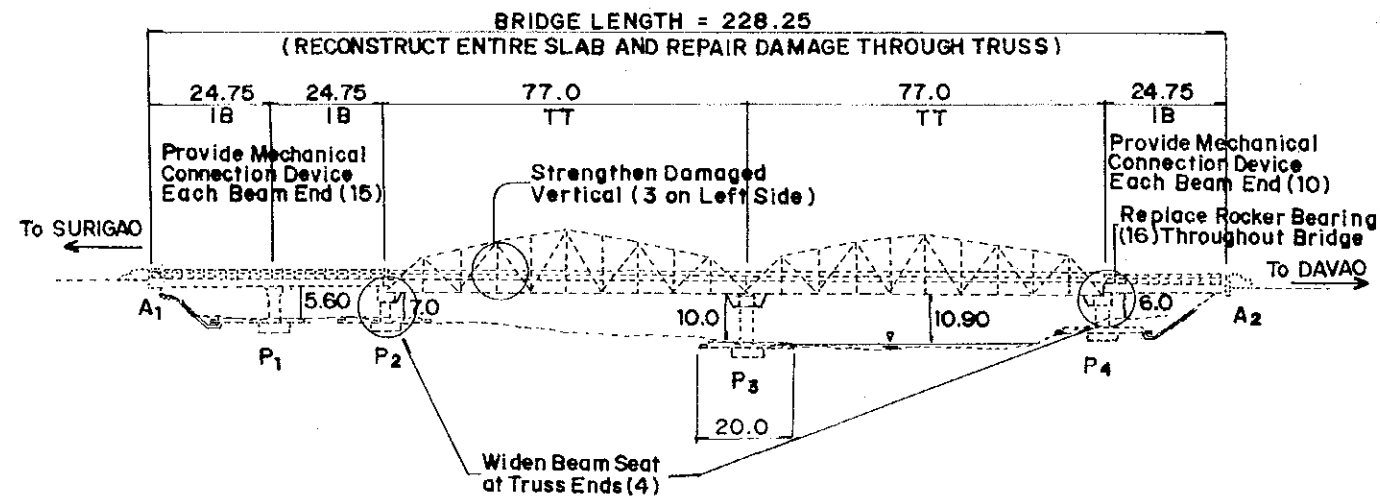


CROSS SECTION
SCALE 1:100
(RECONSTRUCT SUPERSTRUCTURE)

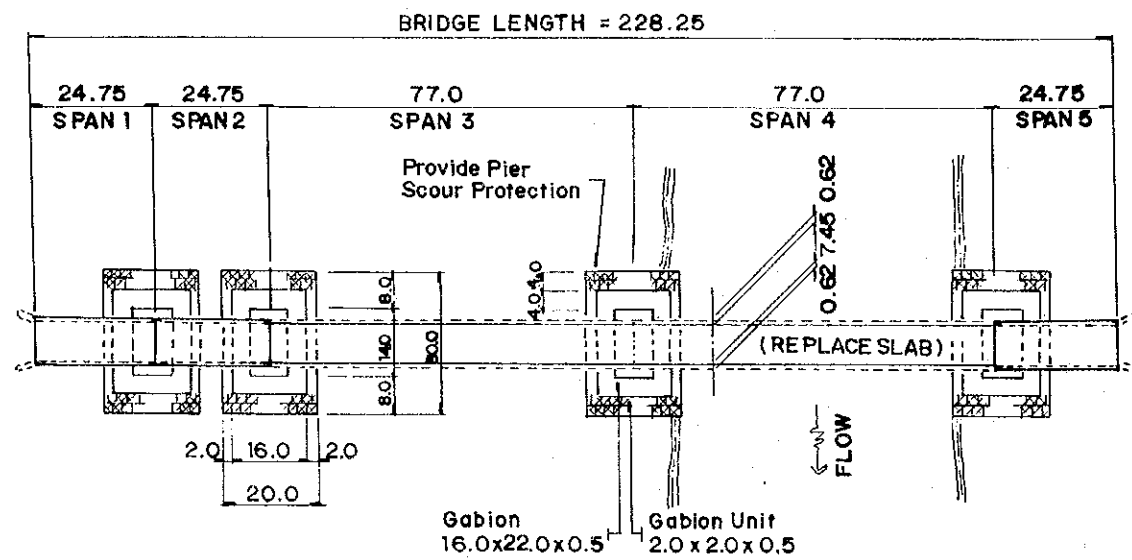


DETOUR BRIDGE: USE ONE - LANE EXISTING BRIDGE
AND STAGE CONSTRUCTION

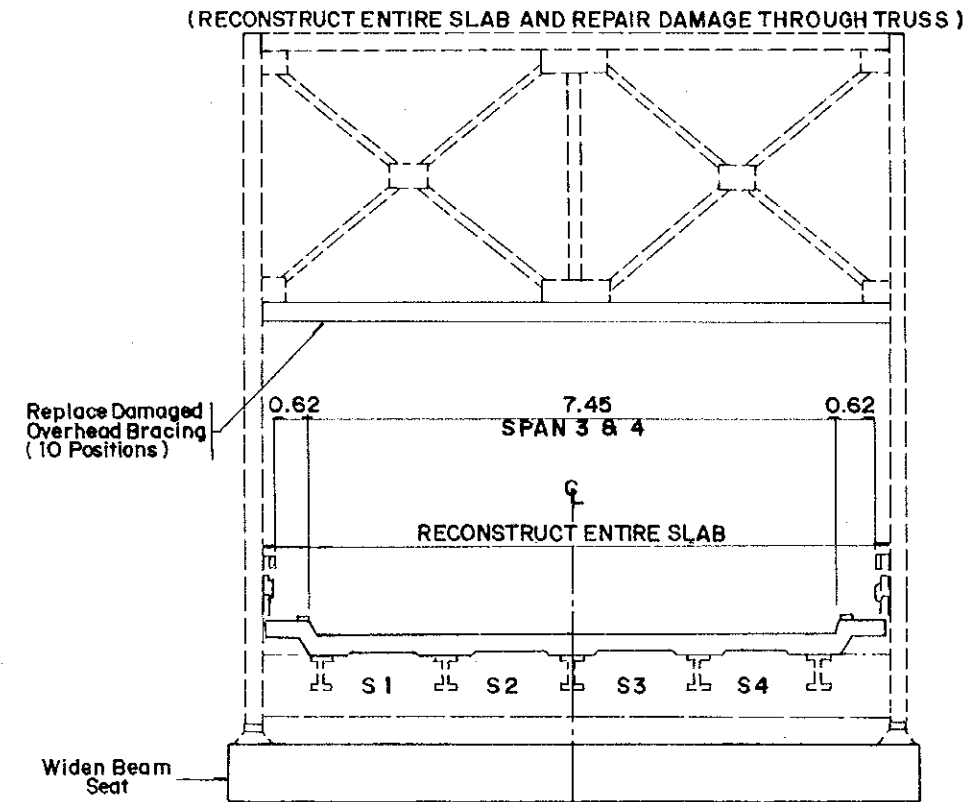
PROFILE
SCALE 1:1500



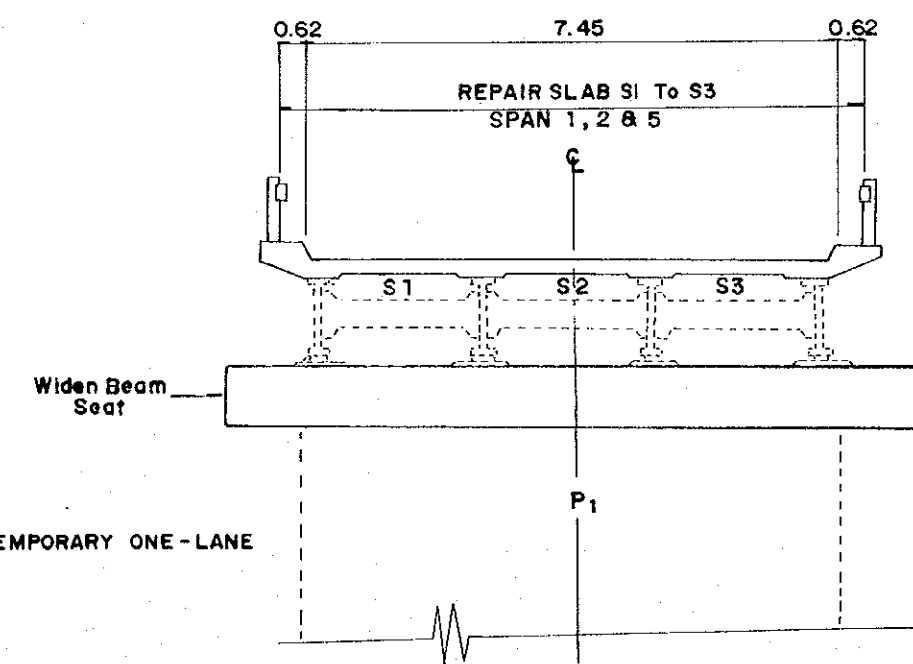
P L A N
SCALE 1:1500



CROSS SECTION
SCALE 1:100

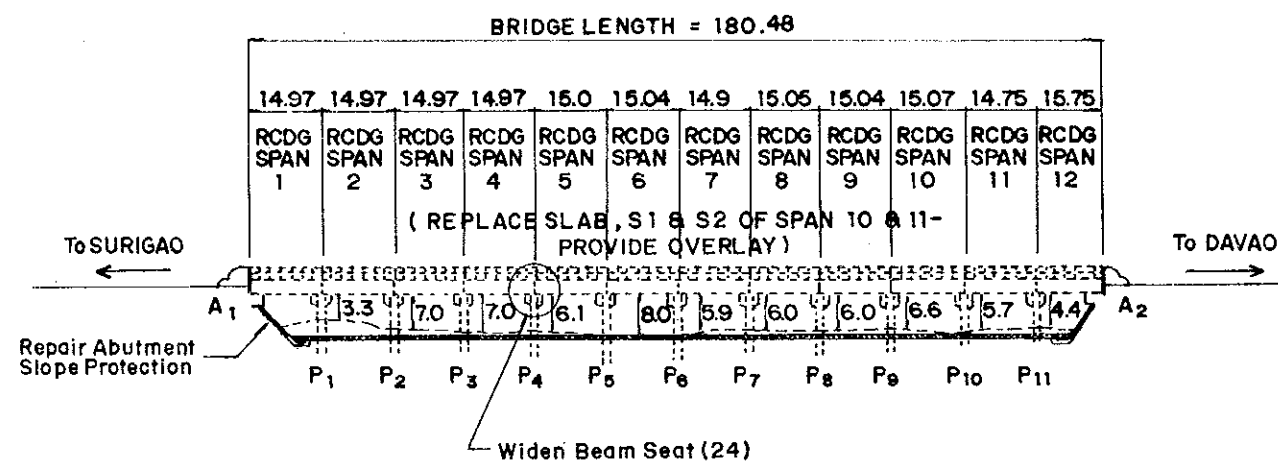


CROSS SECTION
SCALE 1:100

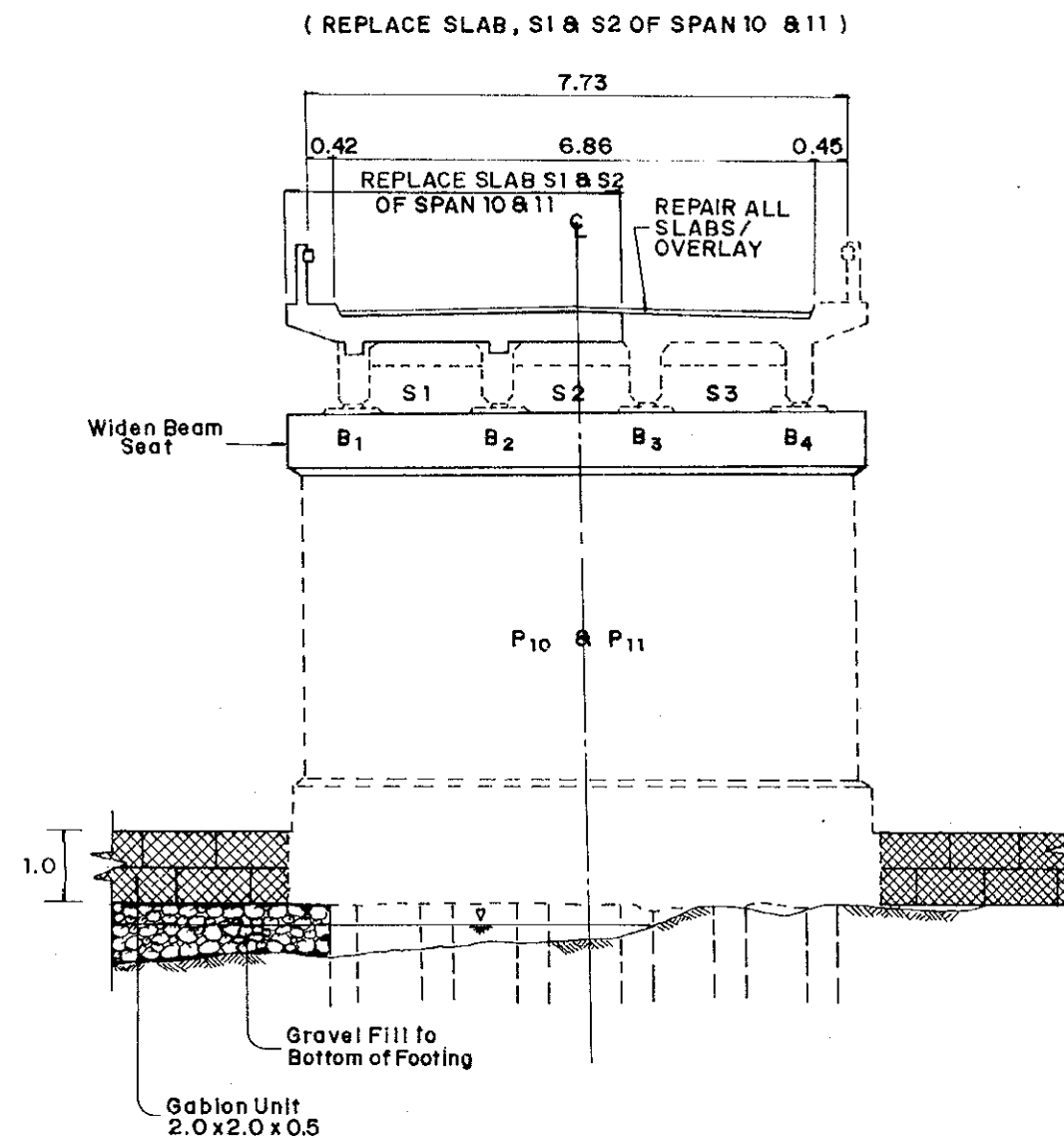


DETOUR BRIDGE: TEMPORARY ONE-LANE

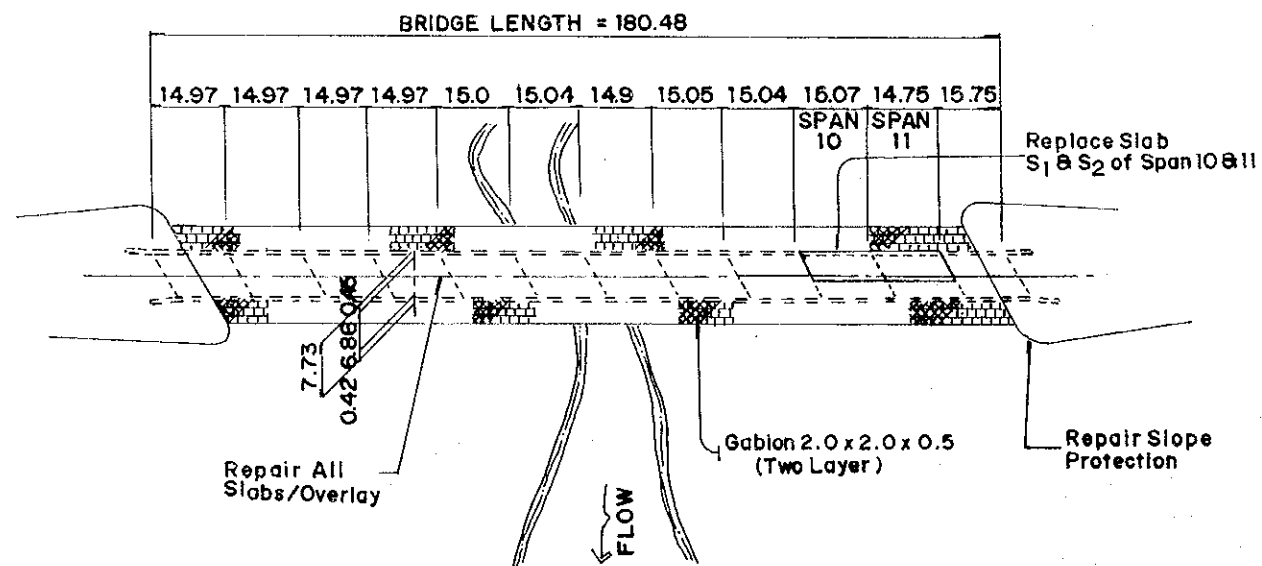
PROFILE
SCALE 1:1500



CROSS SECTION
SCALE 1:100

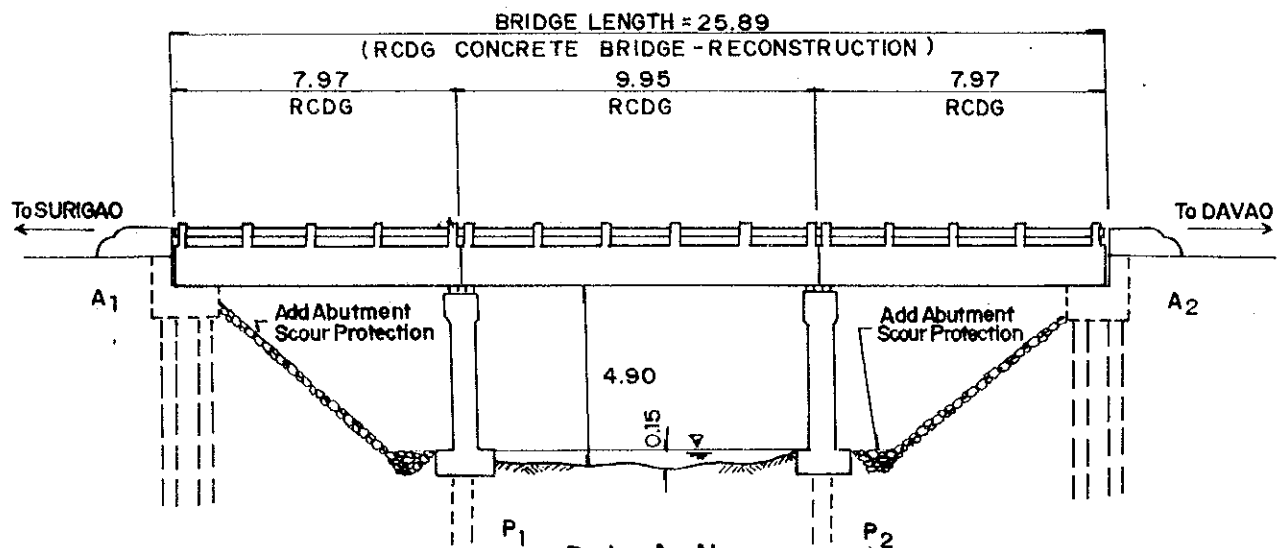


P L A N
SCALE 1:1500

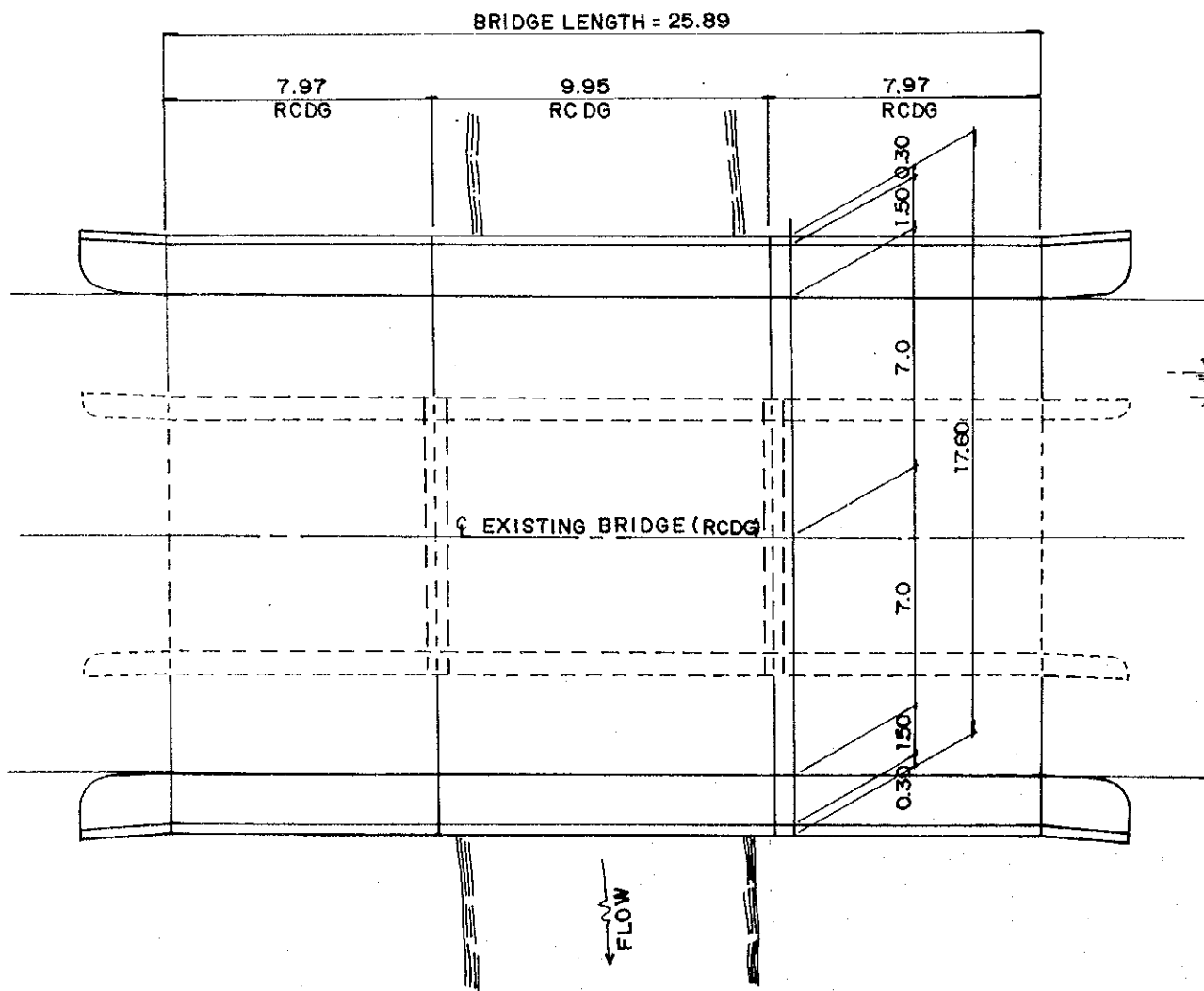


DETOUR BRIDGE : USE ONE-LANE EXISTING BRIDGE AND STAGE CONSTRUCTION

PROFILE
SCALE 1:200

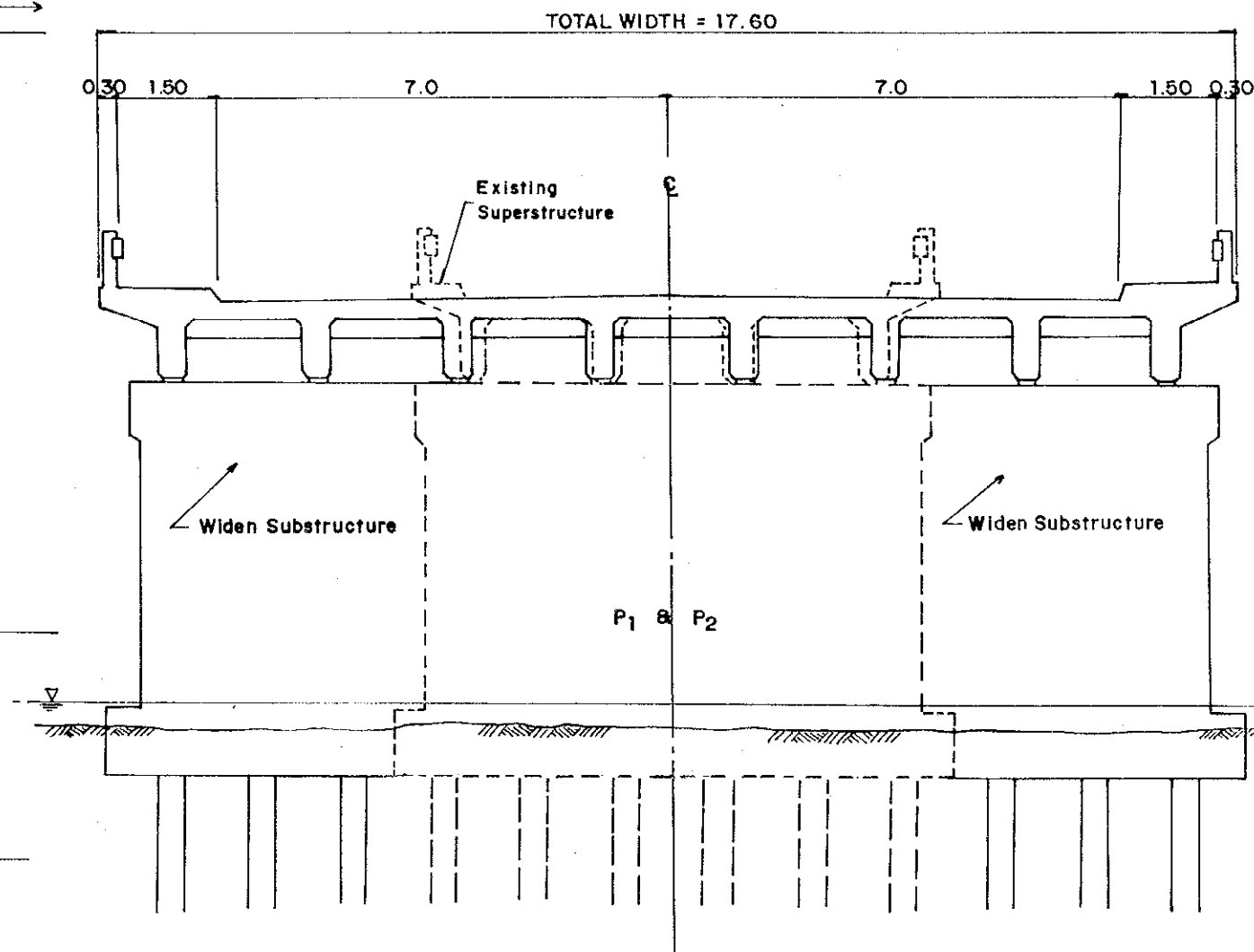


PLAN
SCALE 1:200



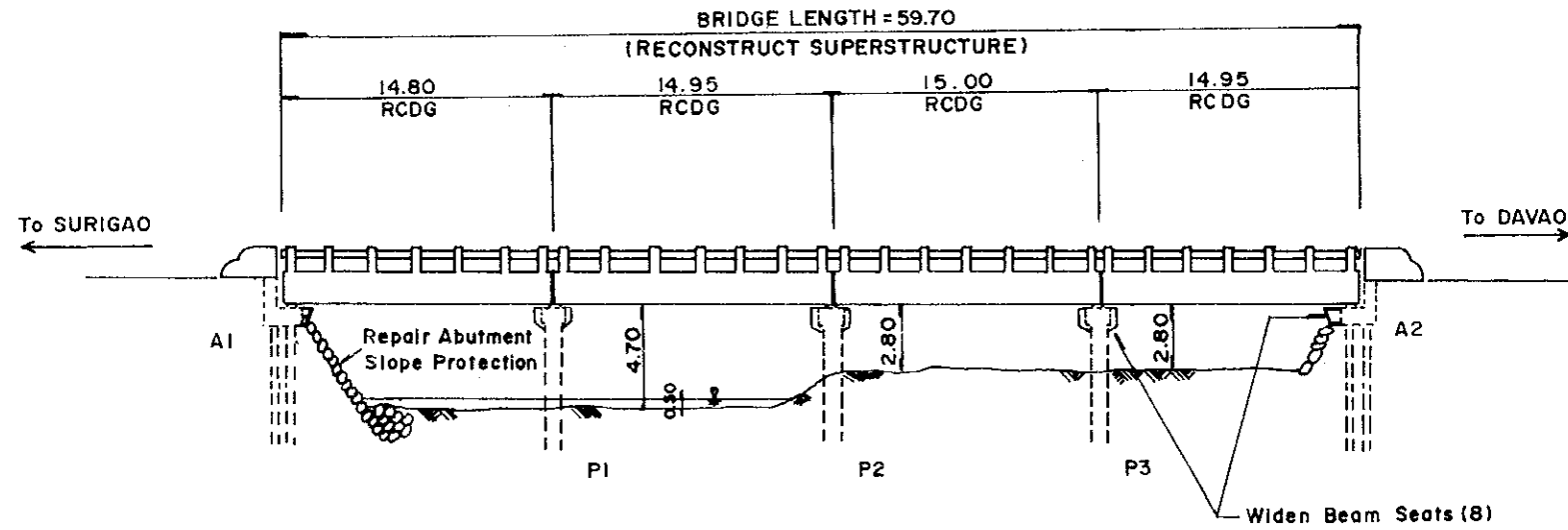
CROSS SECTION
SCALE 1:100

(RECONSTRUCT SUPERSTRUCTURE AND WIDEN SUBSTRUCTURE)

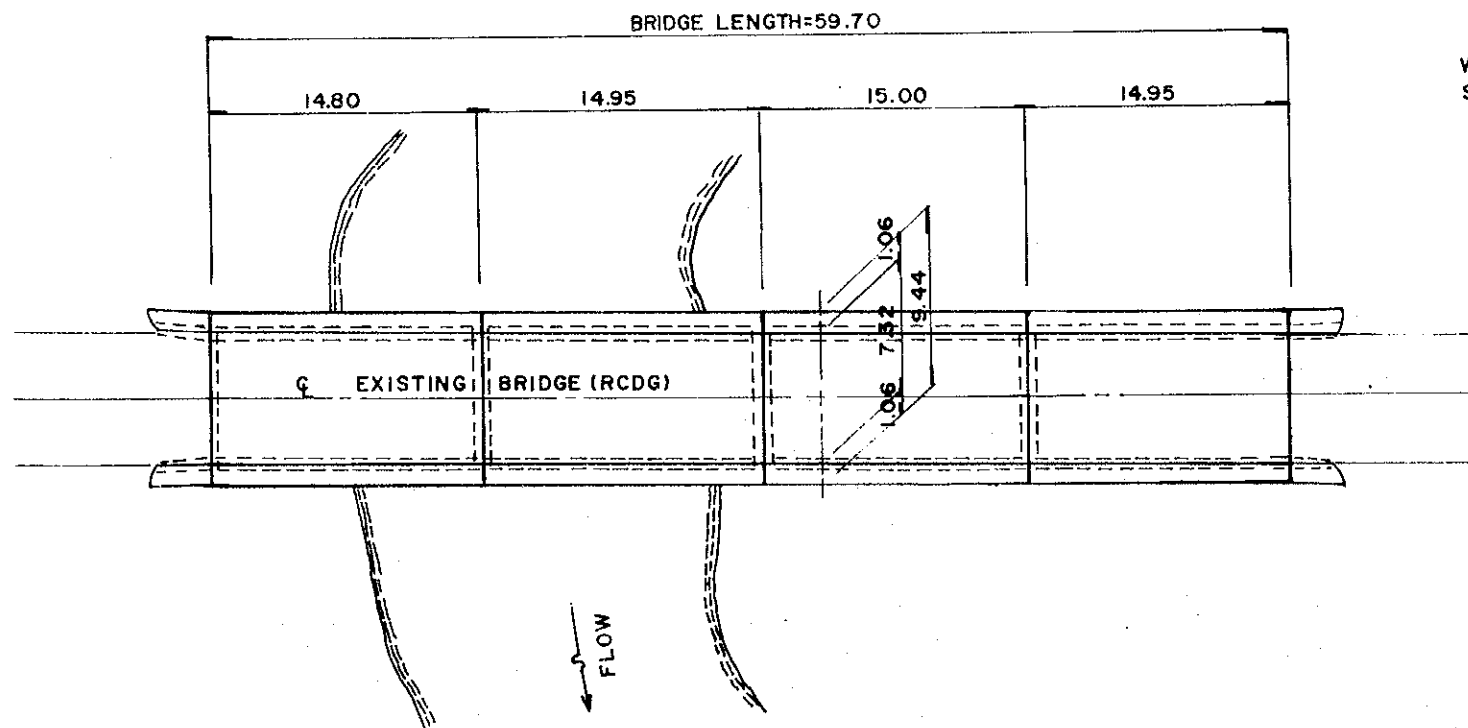


DETOUR BRIDGE: USE ONE-LANE EXISTING BRIDGE
AND STAGE CONSTRUCTION

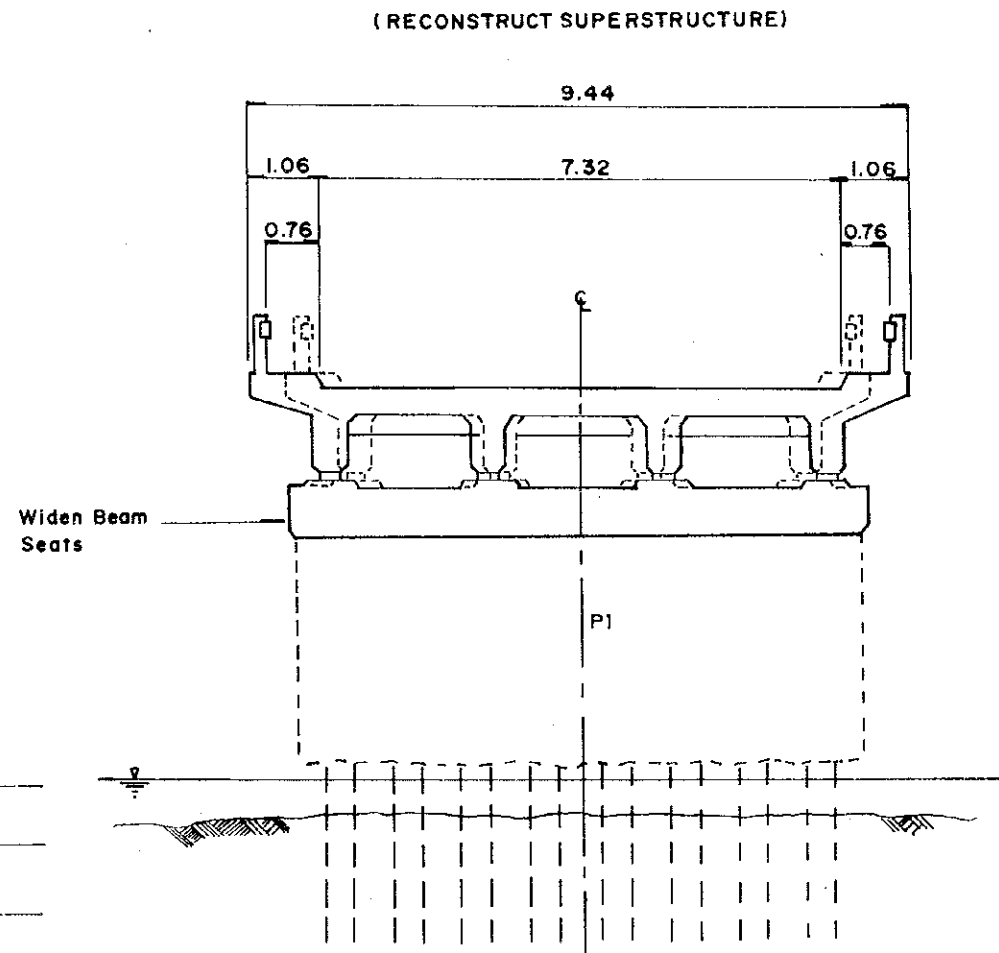
PROFILE
SCALE 1:400



PLAN
SCALE 1:400

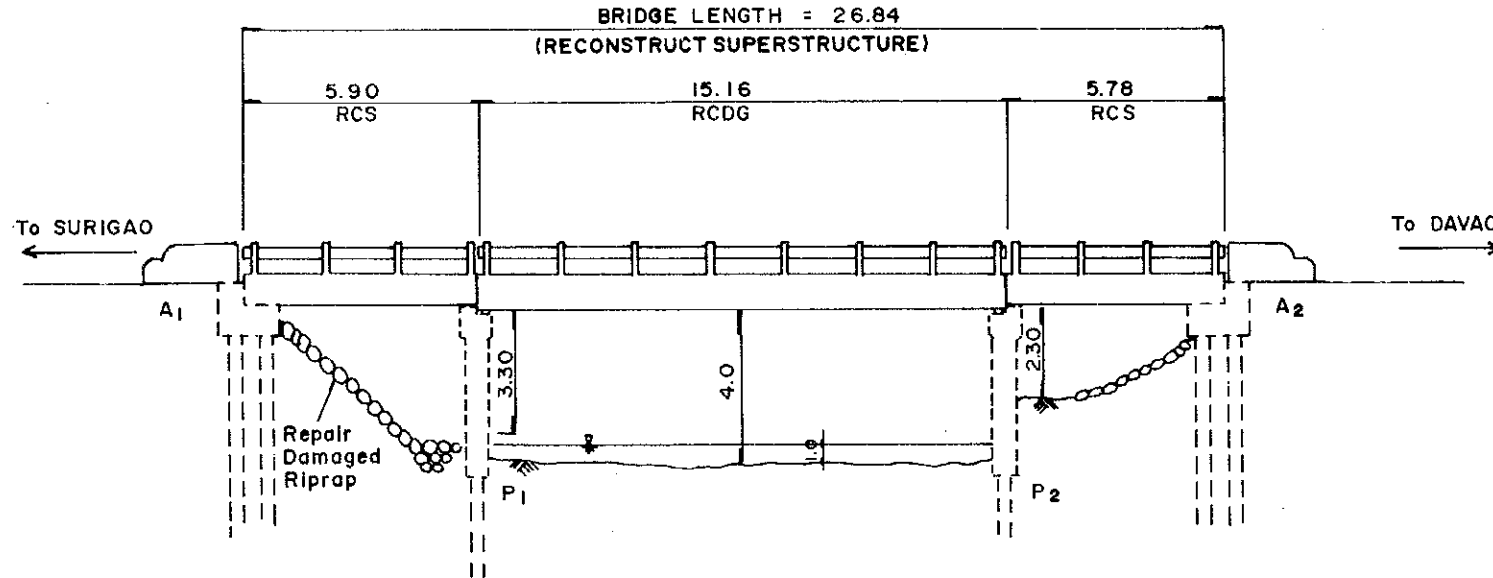


CROSS SECTION
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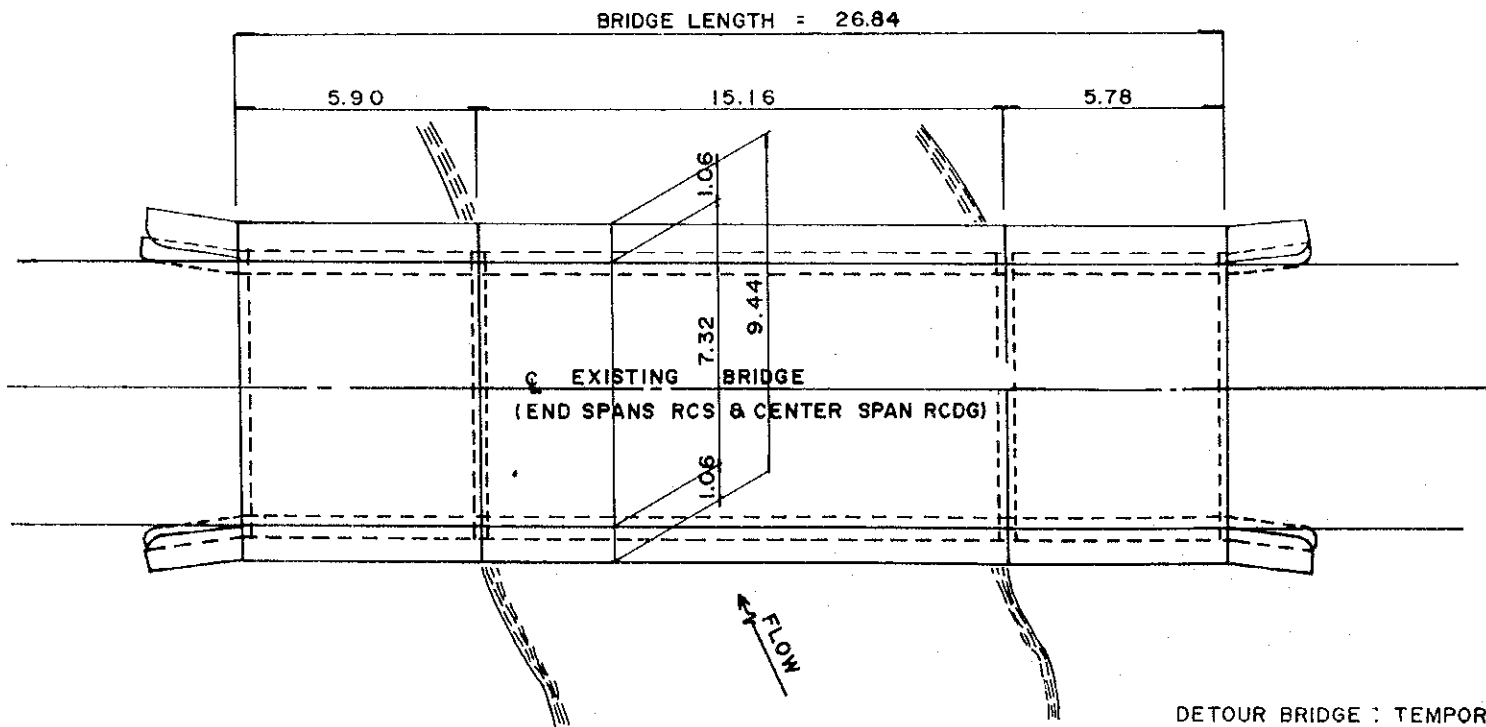


DETOUR BRIDGE: TEMPORARY ONE-LANE

PROFILE
SCALE: 1:200

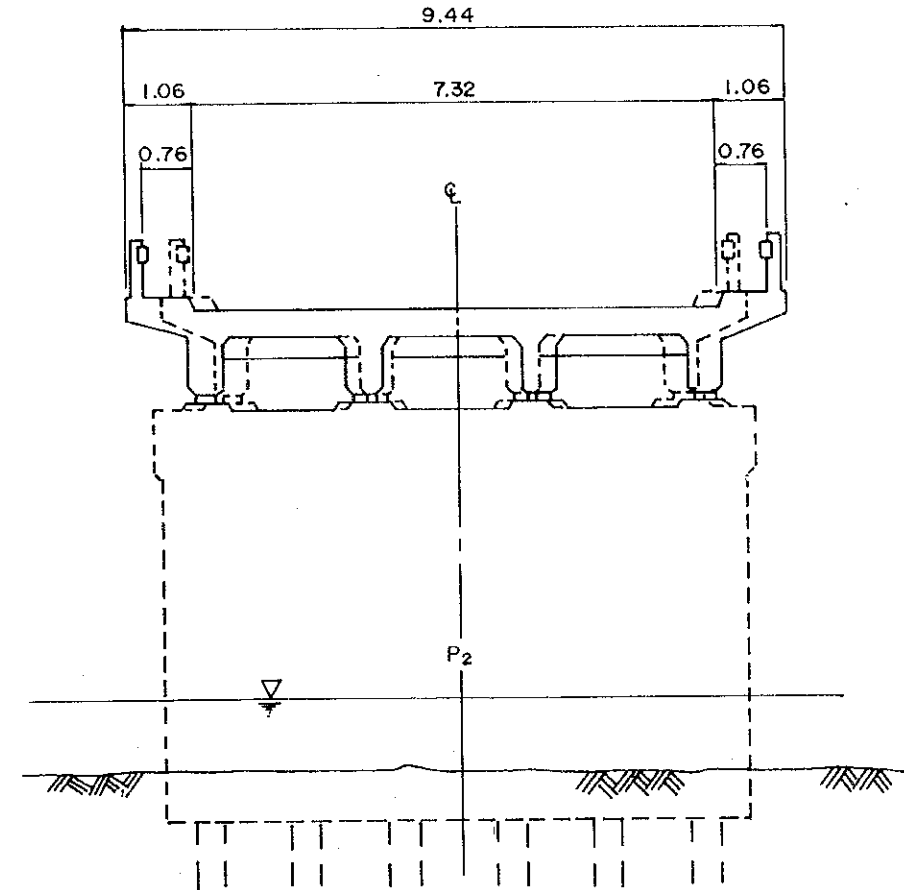


PLAN
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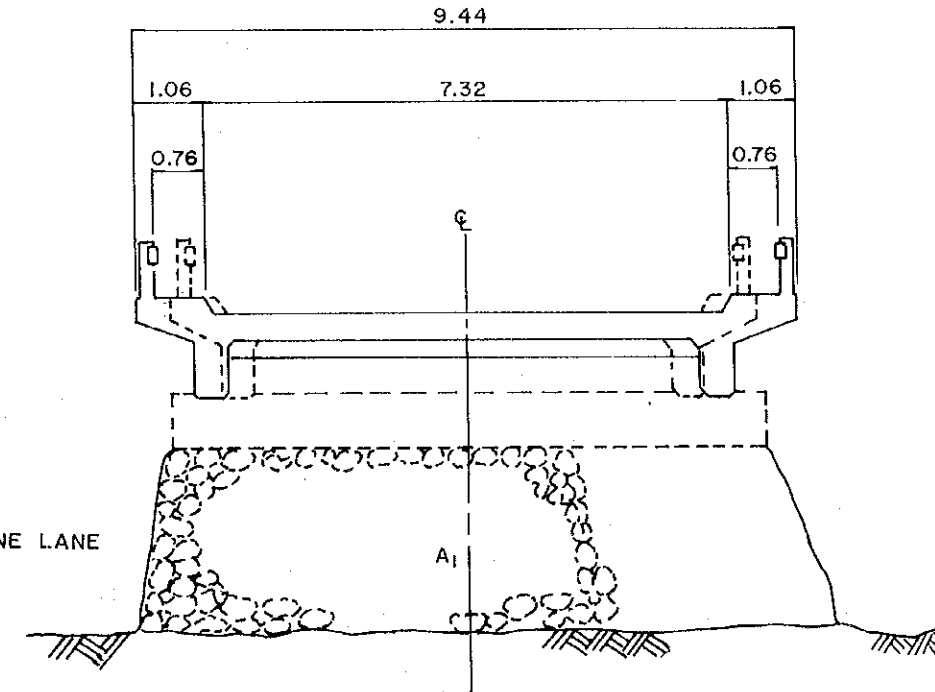


DETOUR BRIDGE : TEMPORARY ONE LANE

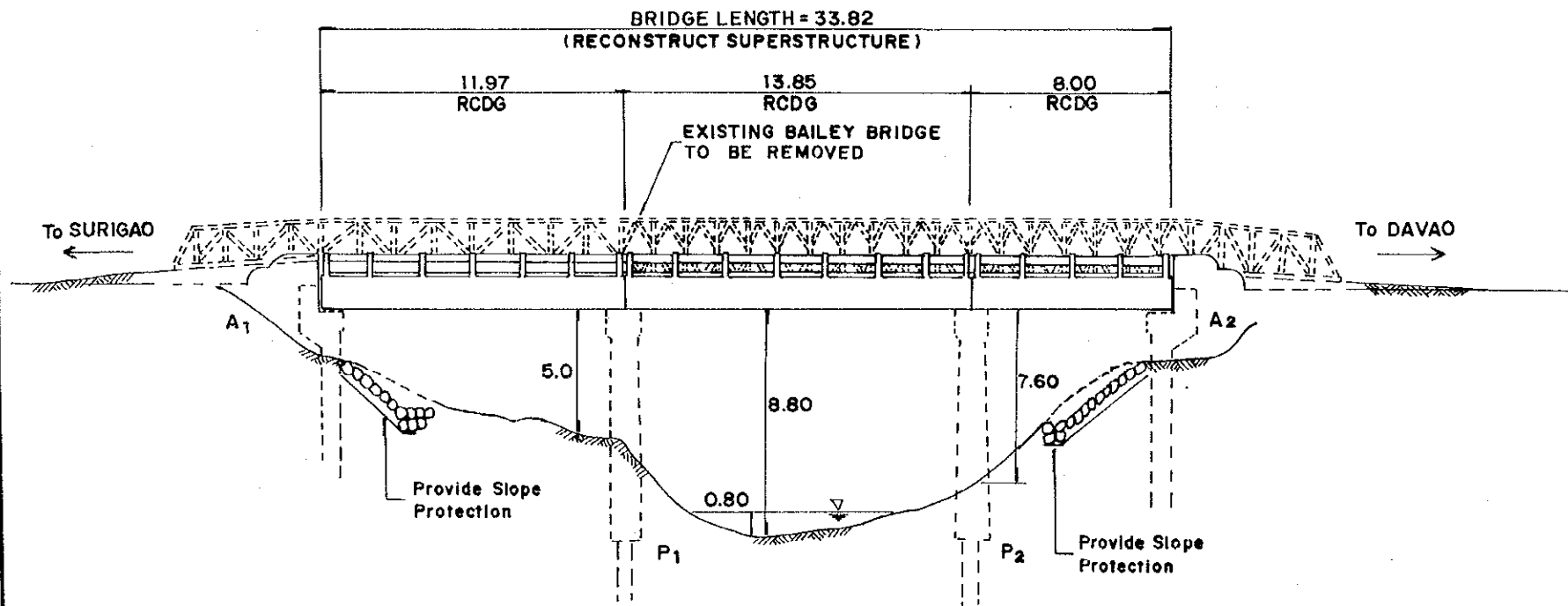
CROSS SECTION
SCALE 1:100
(RECONSTRUCT SUPERSTRUCTURE)



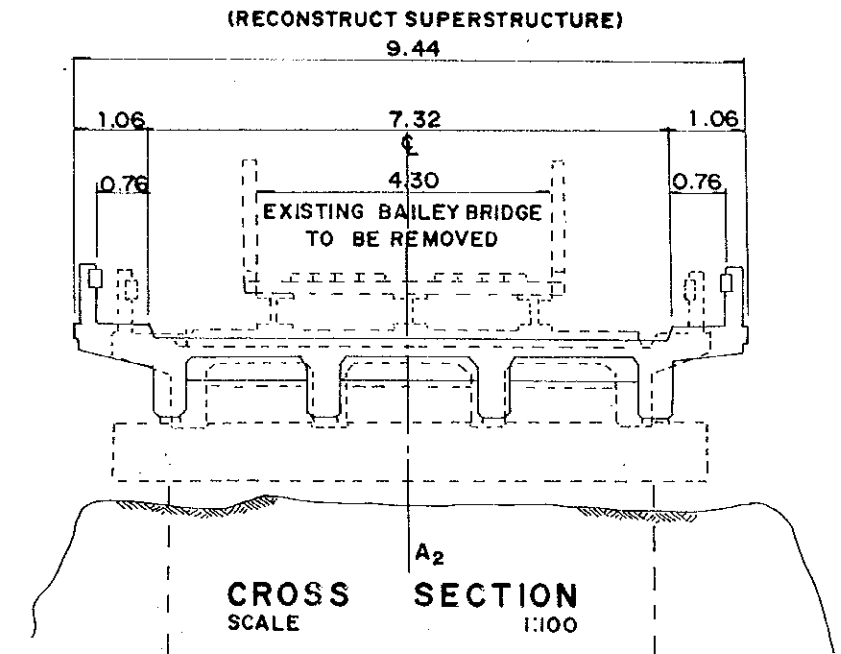
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SCALE 1:100
(RECONSTRUCT SUPERSTRUCTURE)



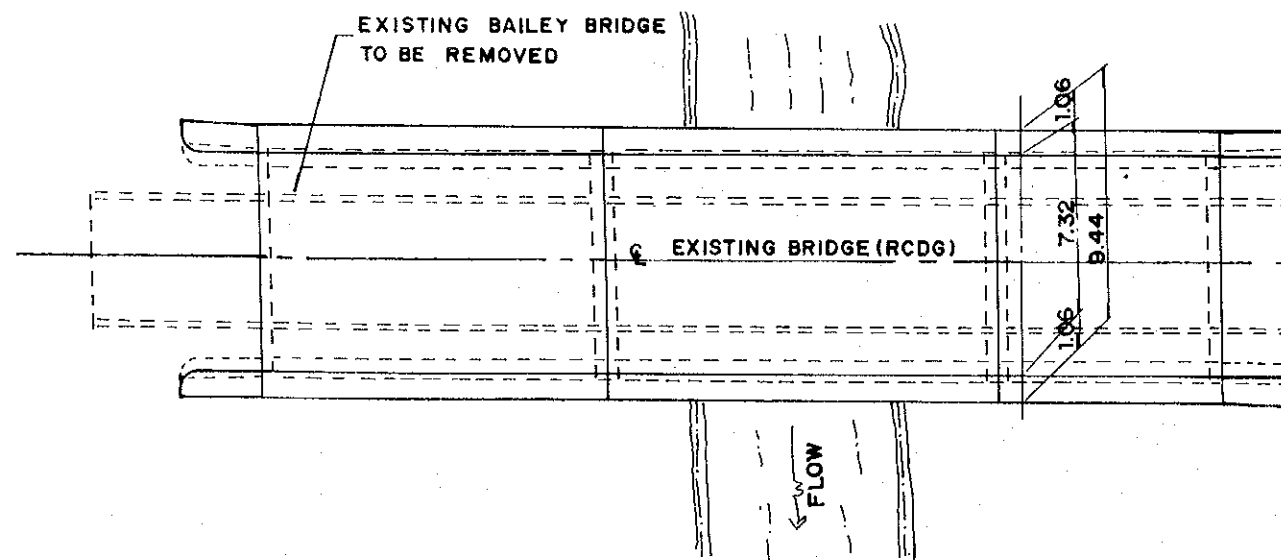
PROFILE
SCALE 1:250



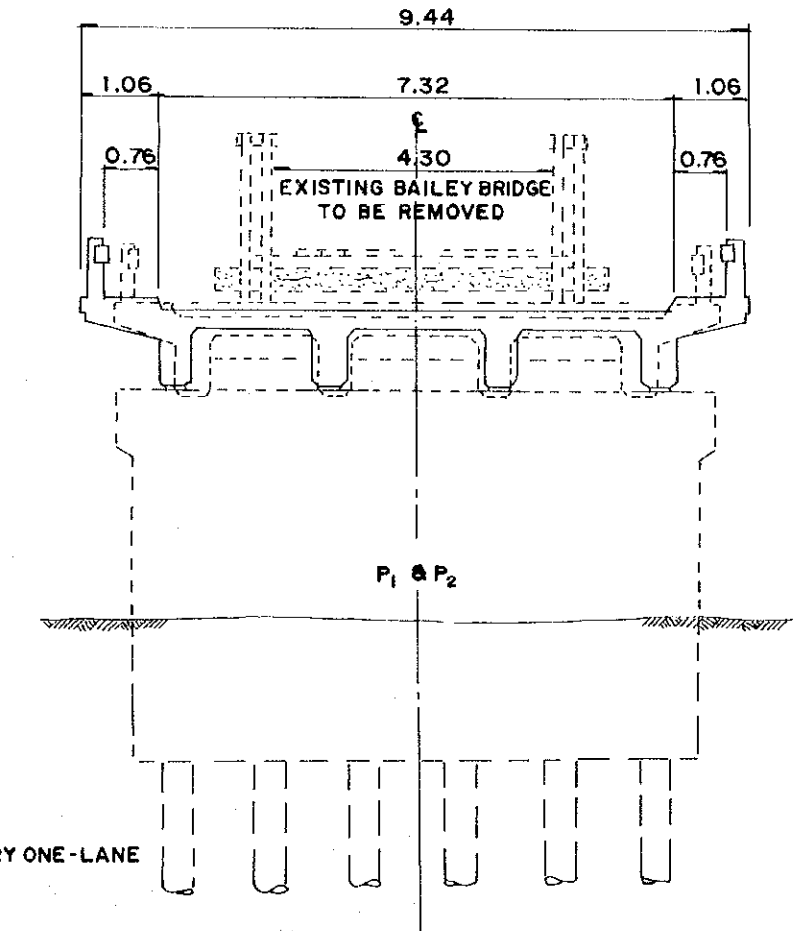
CROSS SECTION
SCALE: 1:100



PLAN
SCALE: 1:250

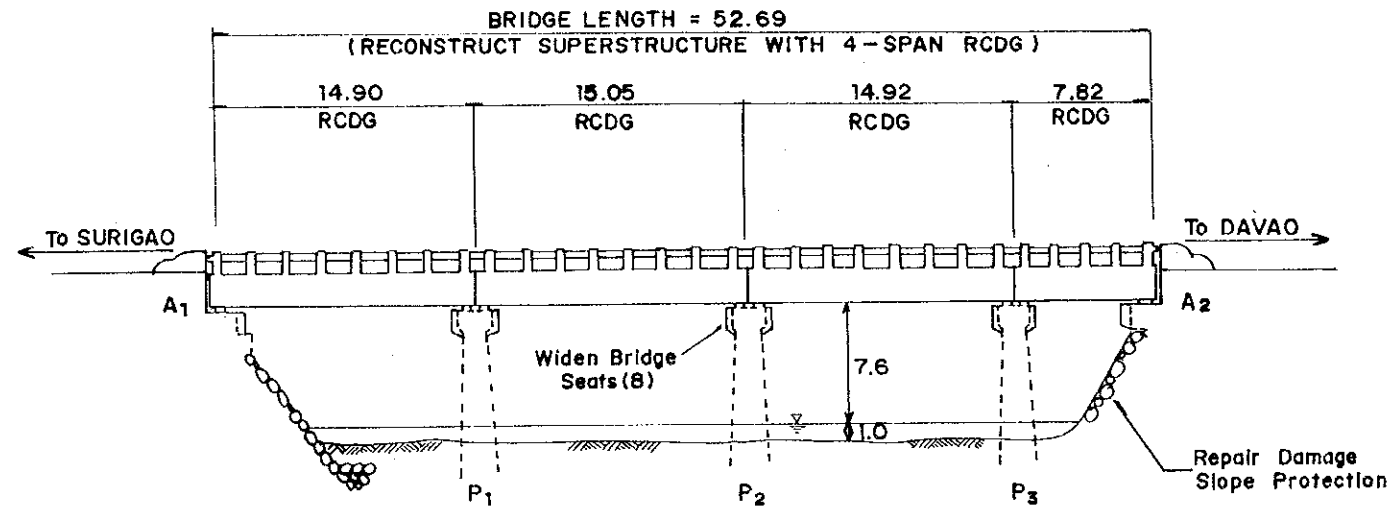


(RECONSTRUCT SUPERSTRUCTURE)

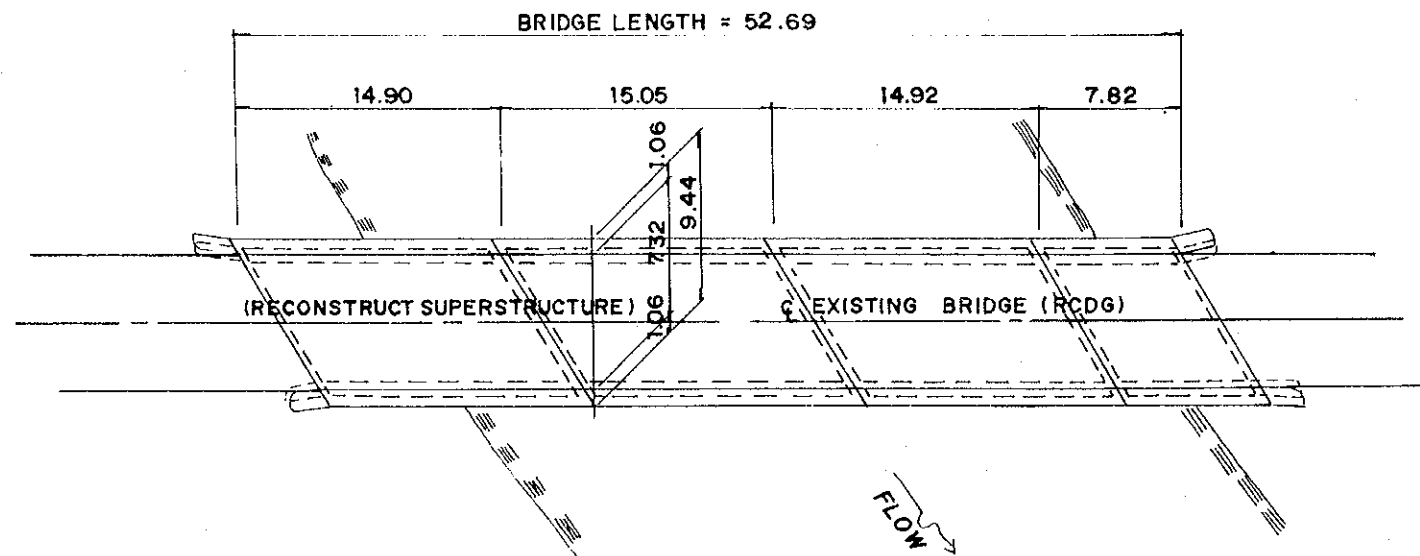


DETOUR BRIDGE : TEMPORARY ONE-LANE

PROFILE
SCALE 1:400

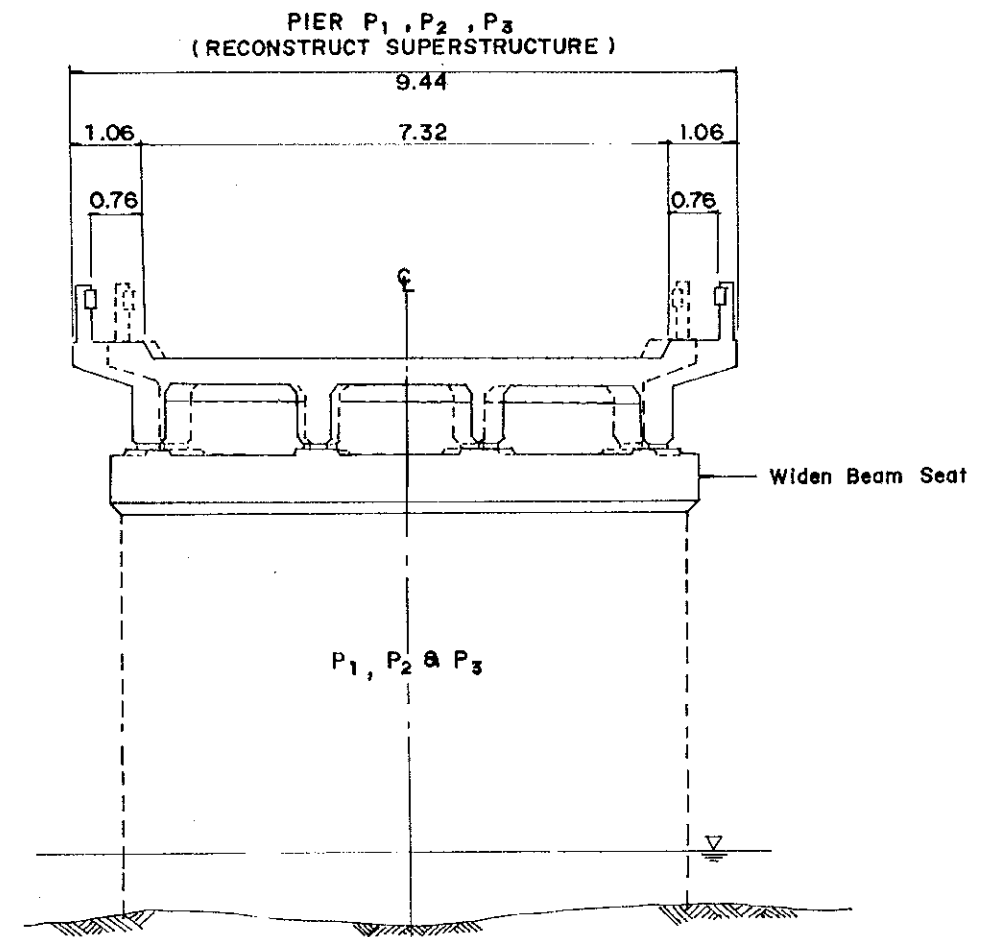


PLAN
SCALE 1:400

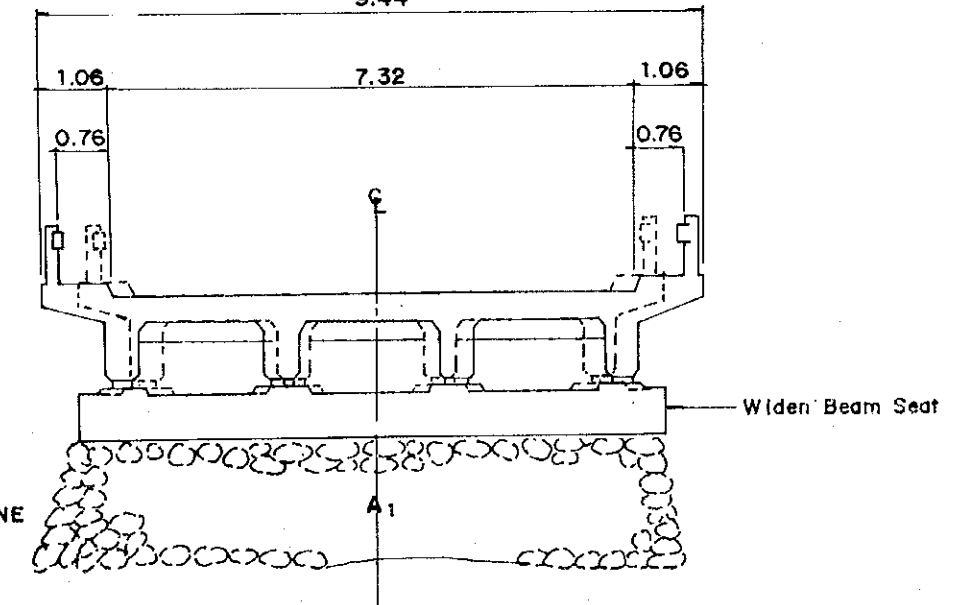


DETOUR BRIDGE: TEMPORARY ONE-LANE

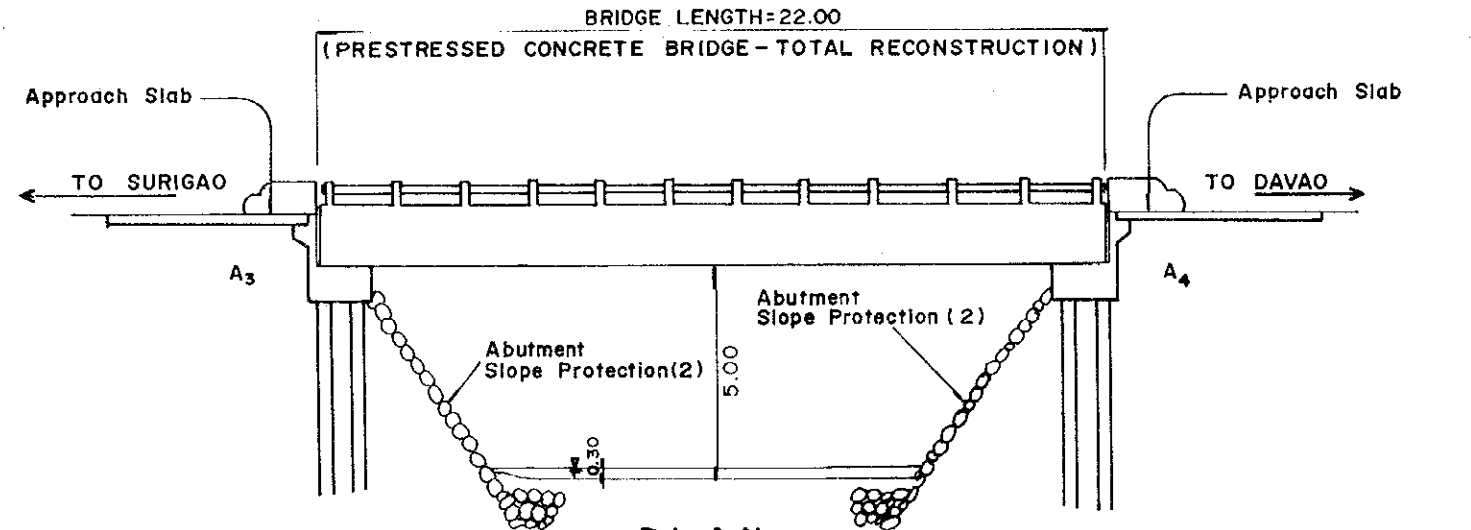
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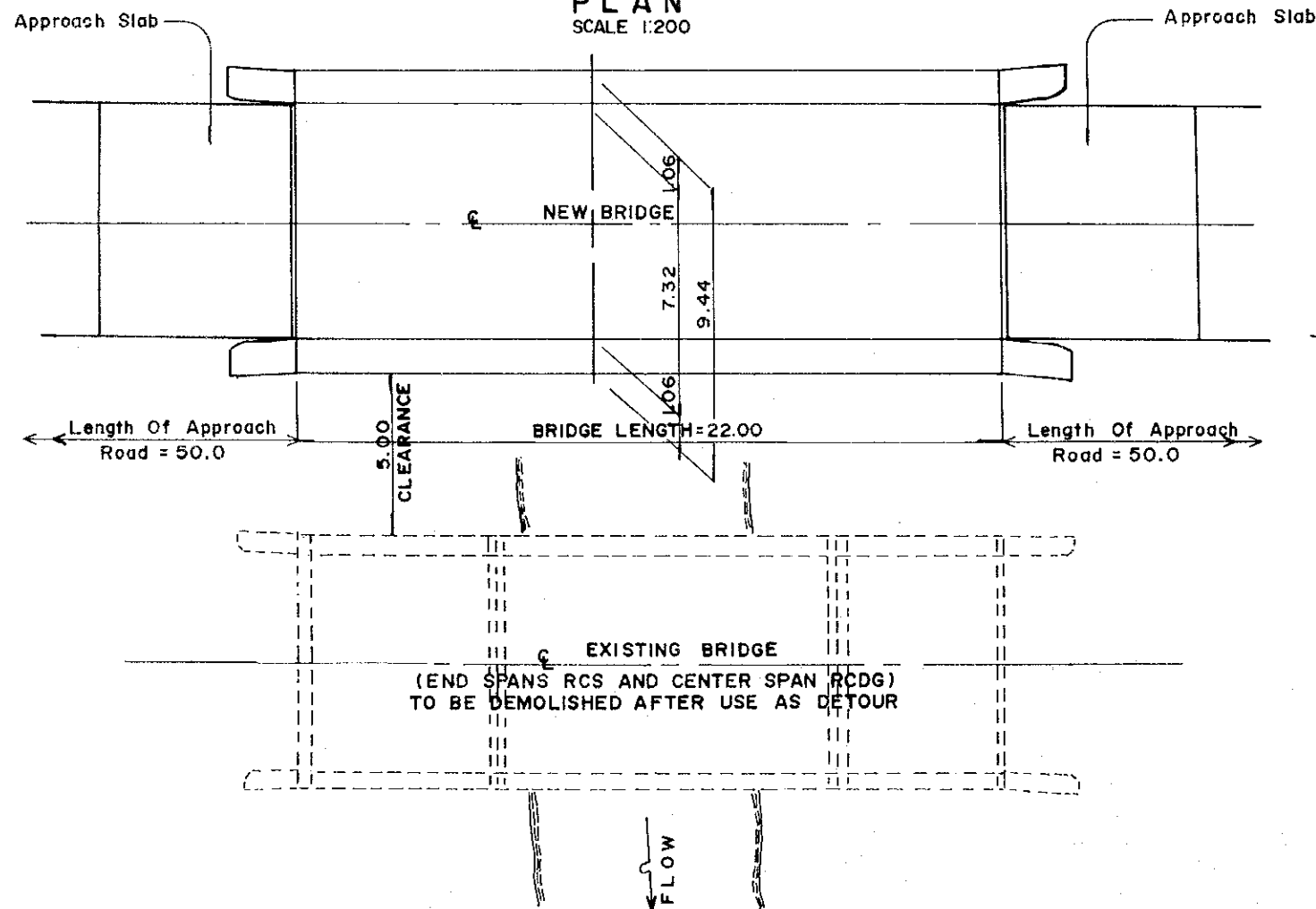
CROSS SECTION
SCALE 1:100
(RECONSTRUCT SUPERSTRUCTURE)



PROFILE
SCALE 1:200

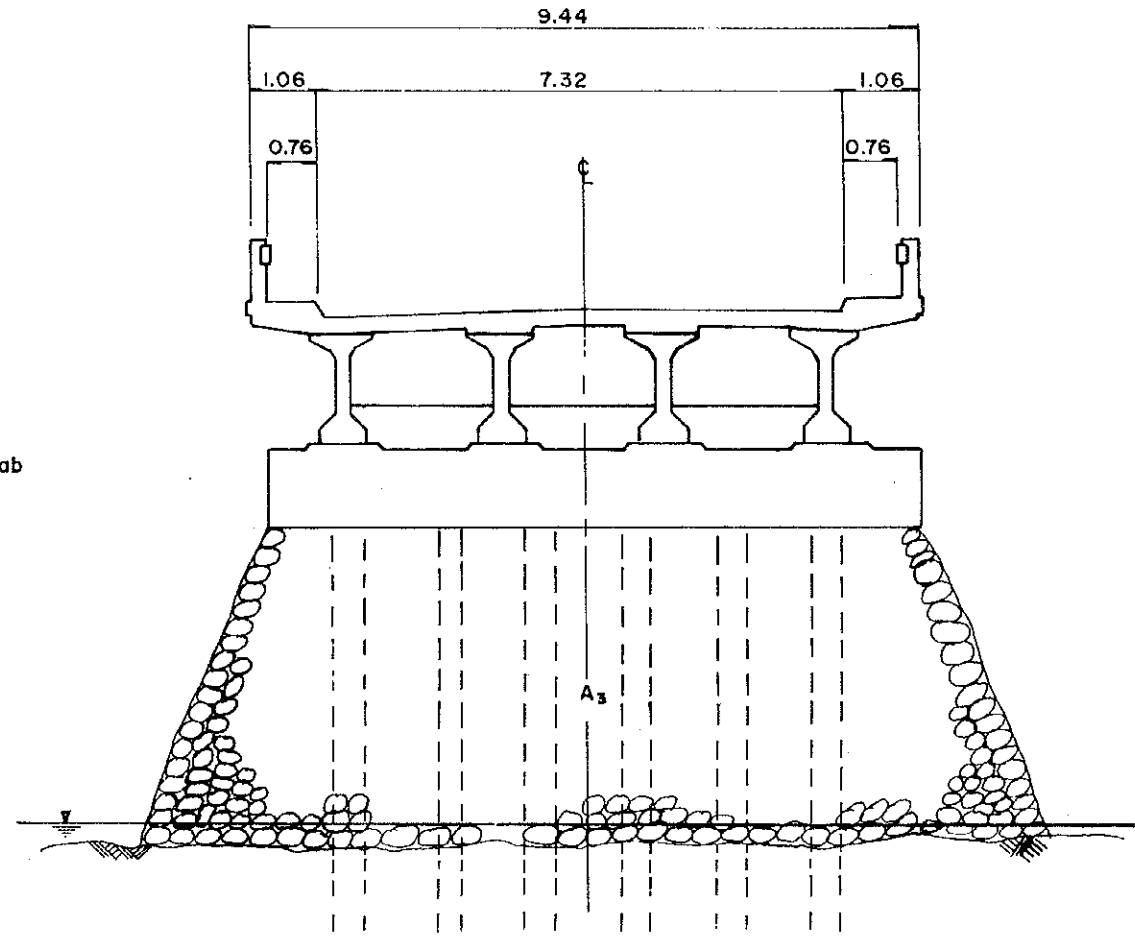


PLAN
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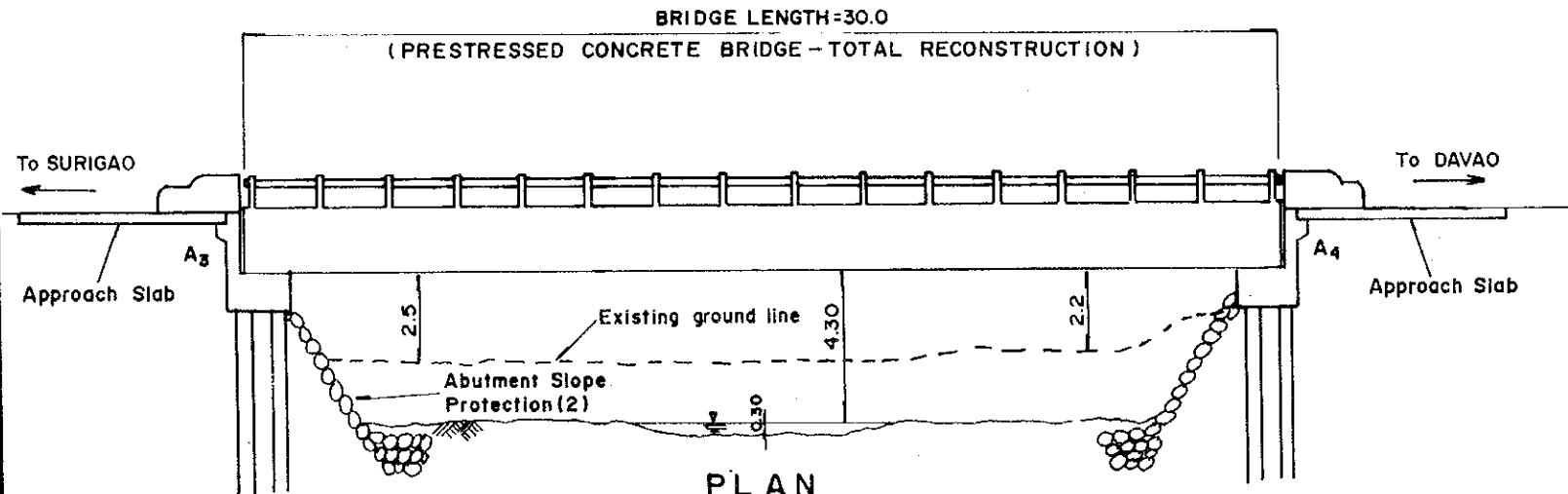
CROSS SECTION
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(PRESTRESSED CONCRETE BRIDGE - TOTAL RECONSTRUCTION)

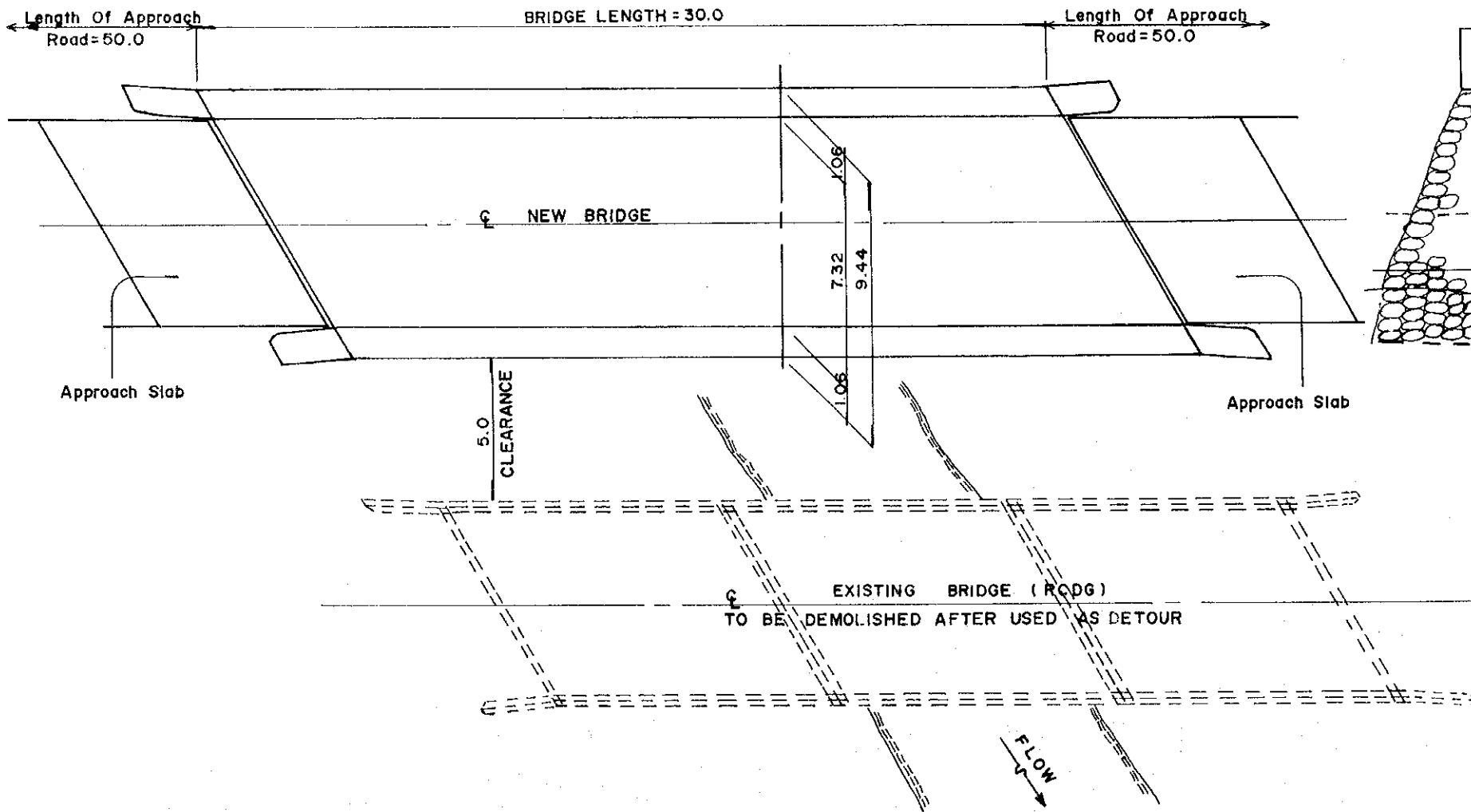
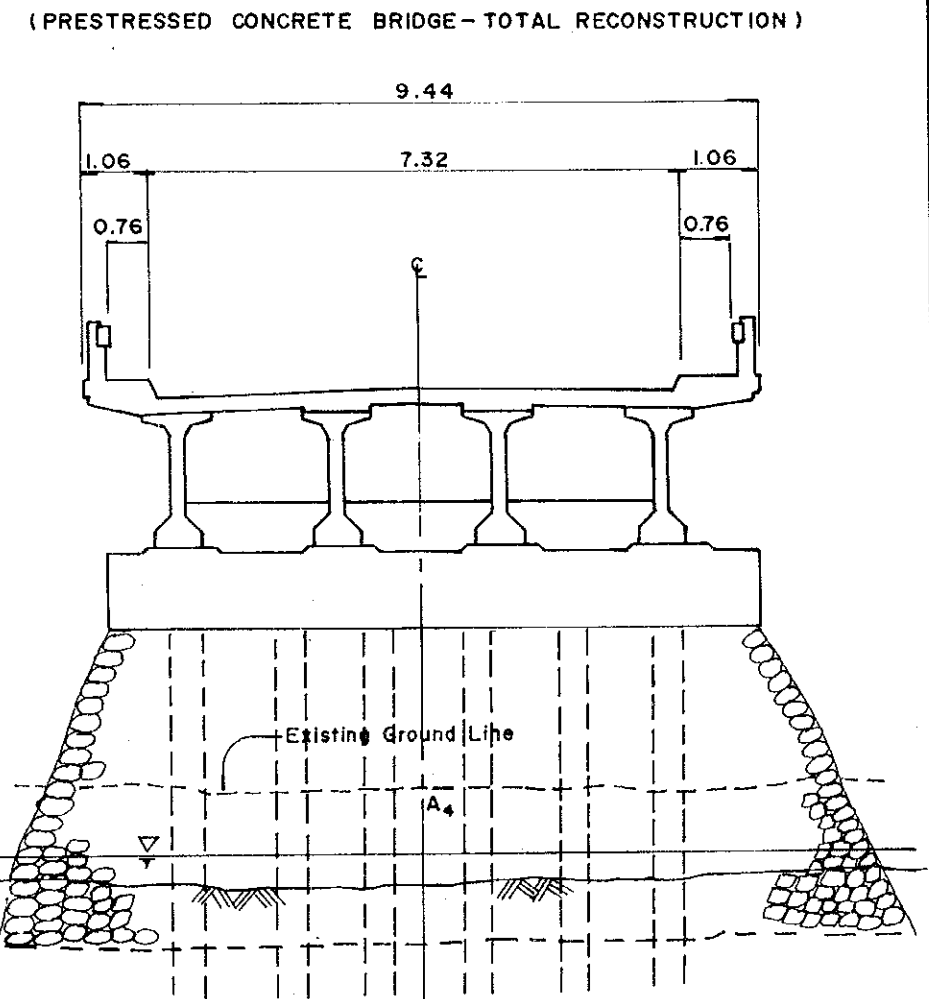


DETOUR BRIDGE : EXISTING BRIDGE

PROFILE
SCALE 1:200

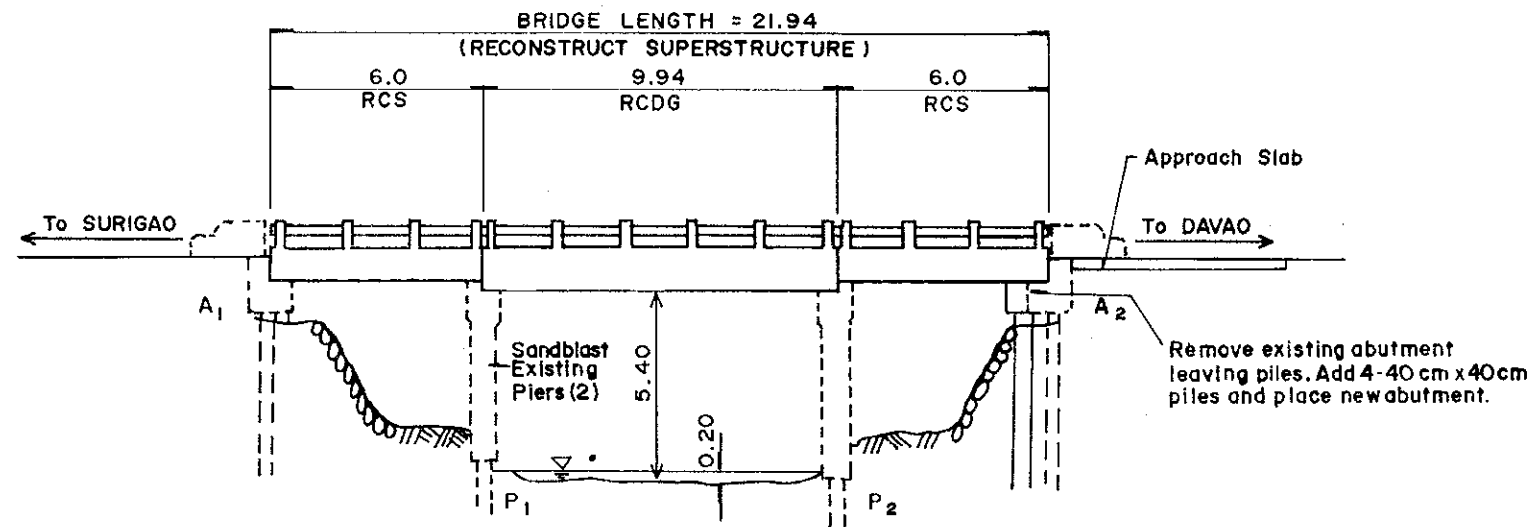


CROSS SECTION
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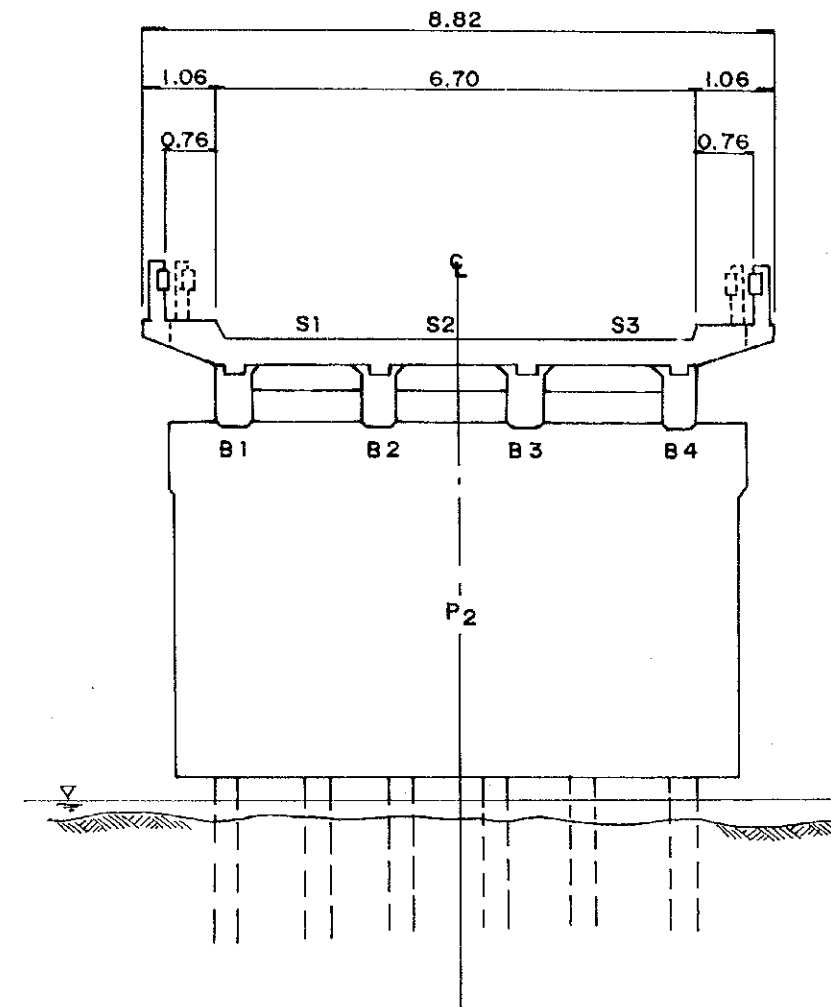


DETOUR BRIDGE: EXISTING BRIDGE

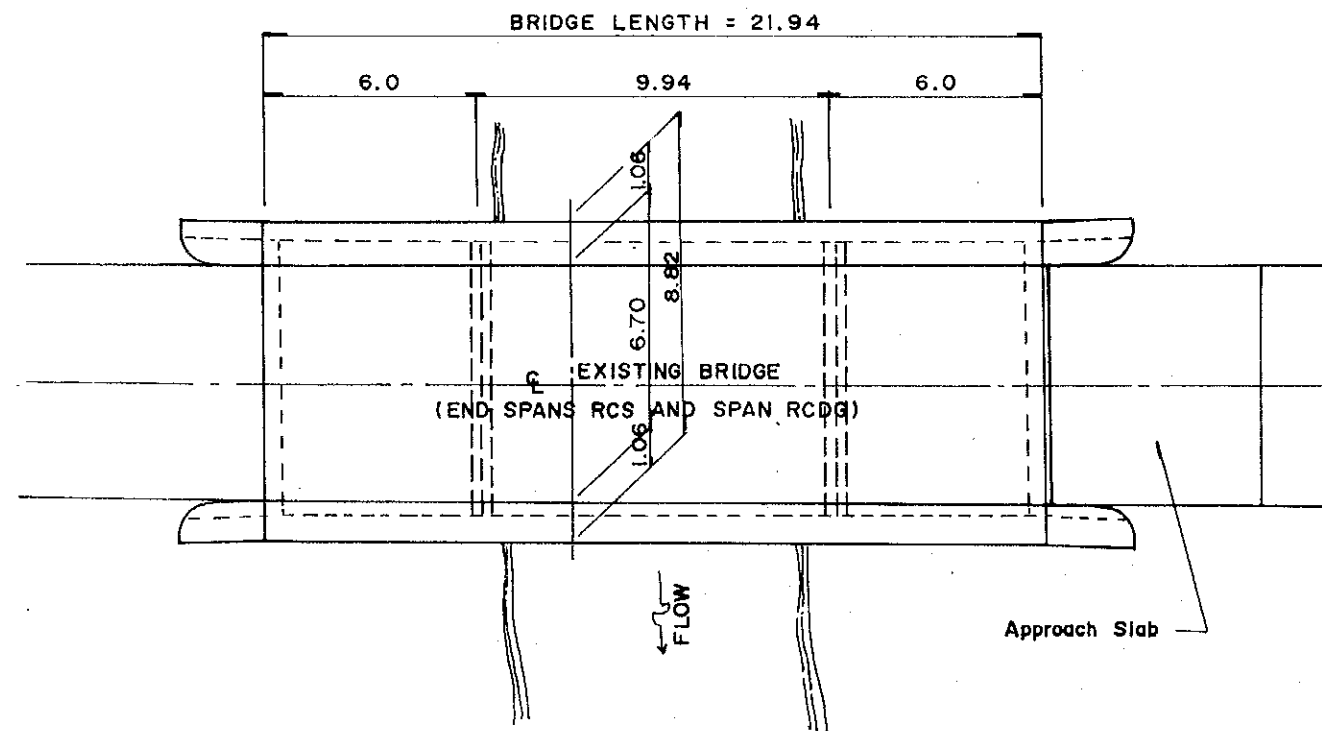
PROFILE
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CROSS SECTION
SCALE 1:100
(RECONSTRUCT SUPERSTRUCTURE)

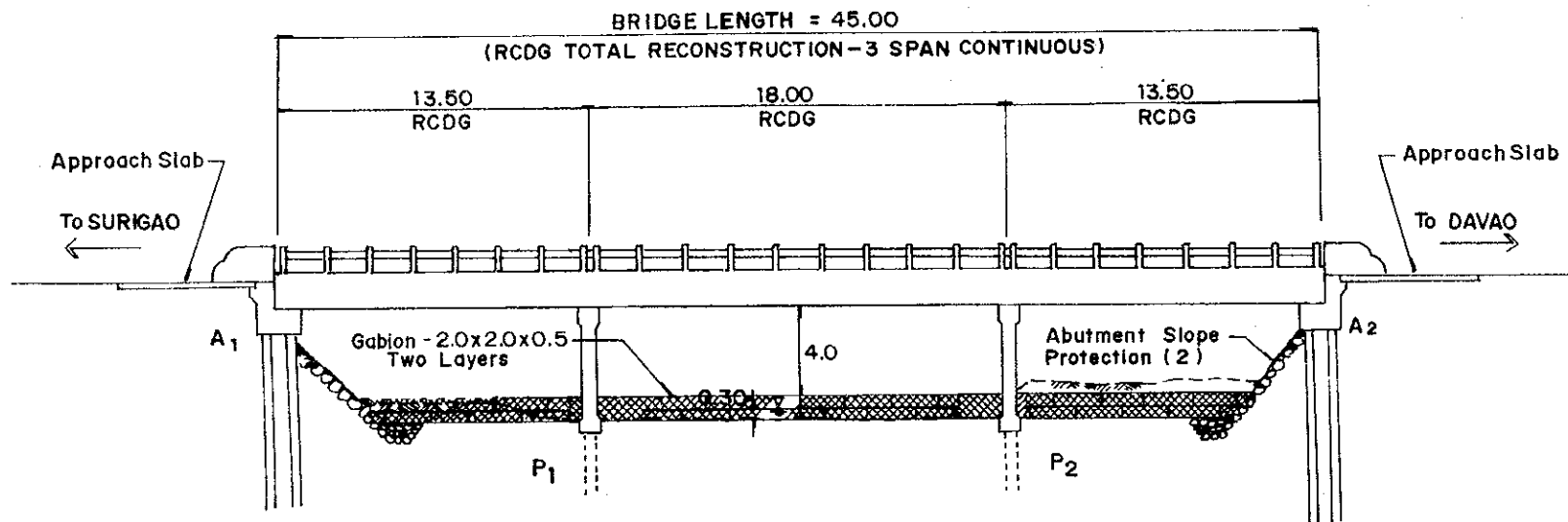


PLAN
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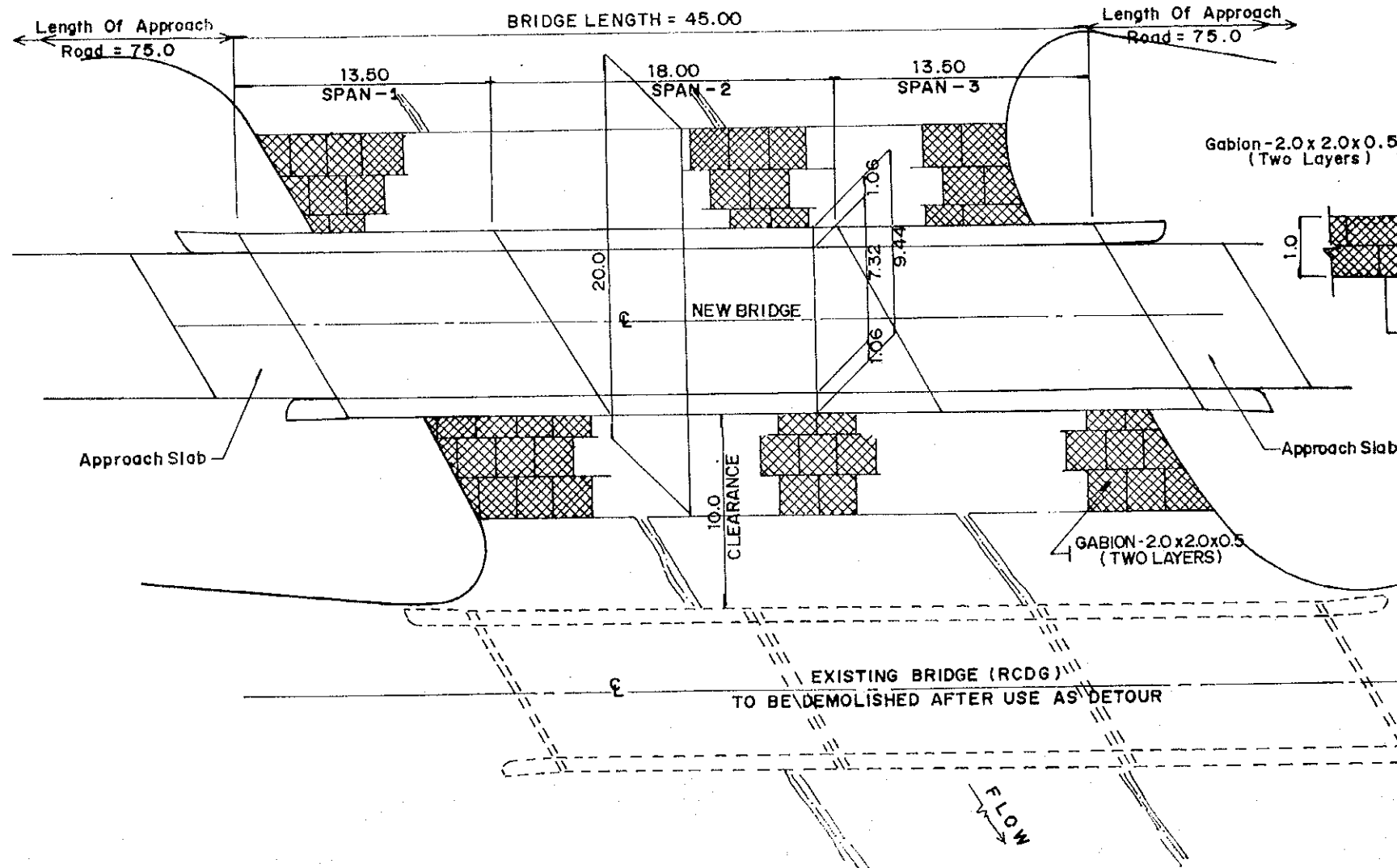


DETOUR BRIDGE : TEMPORARY ONE-LANE

PROFILE
SCALE 1:300

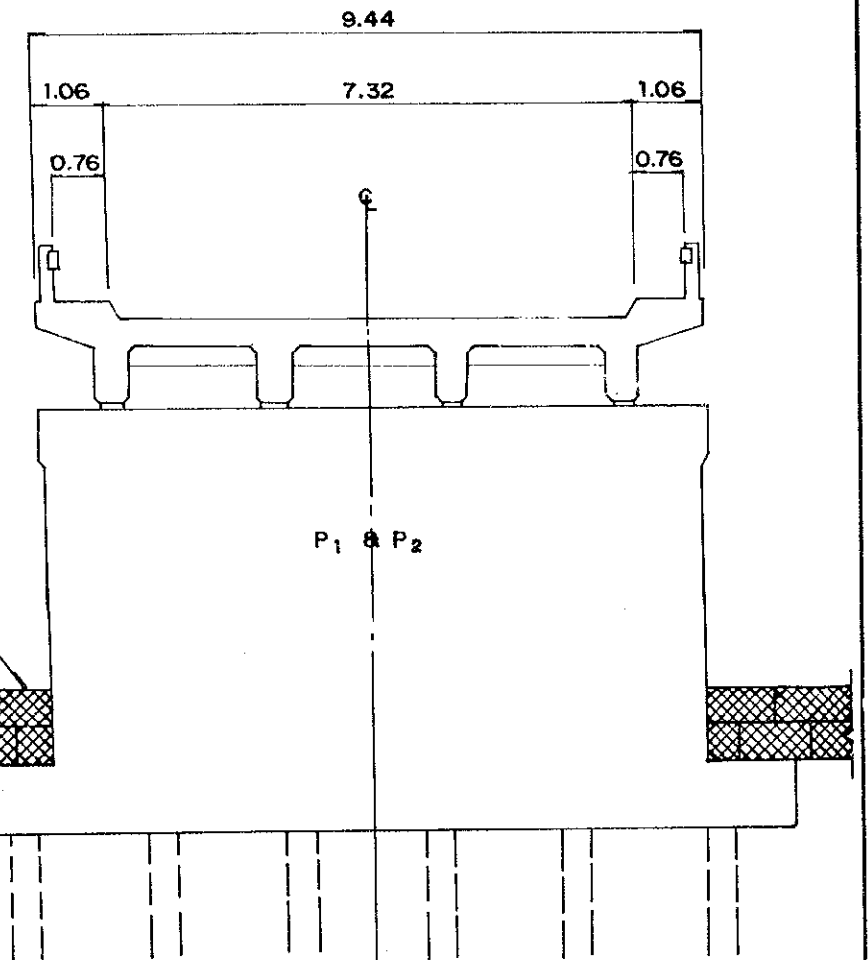


PLAN
SCALE 1:300



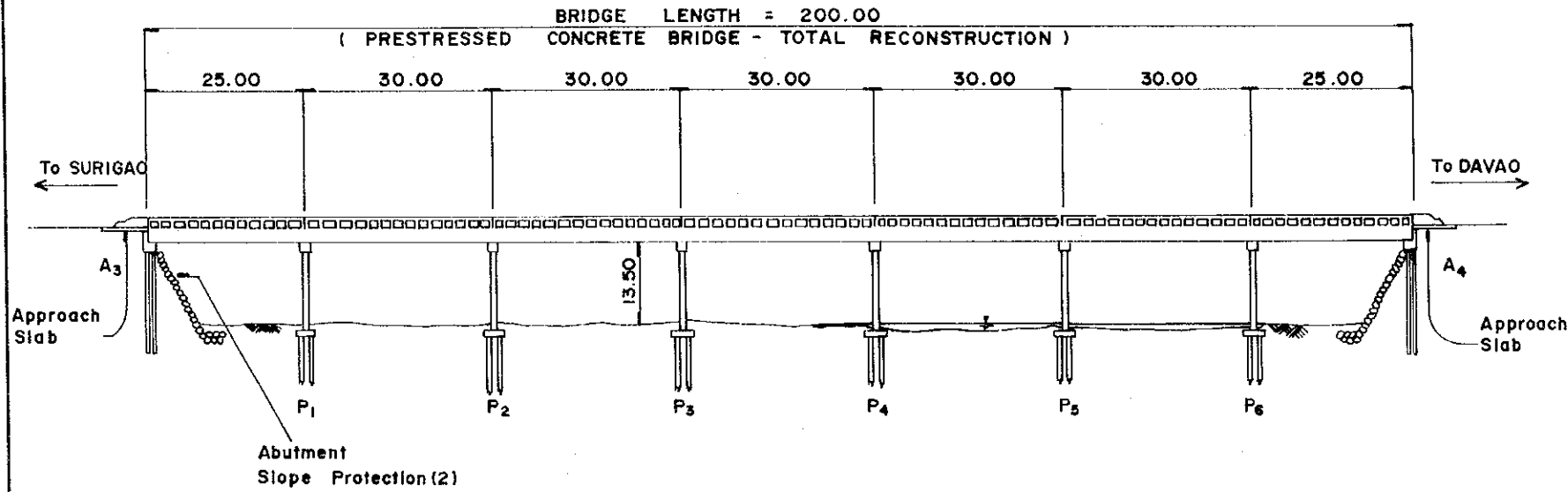
CROSS SECTION
SCALE 1:100

(RCDG TOTAL RECONSTRUCTION - 3 SPAN CONTINUOUS)

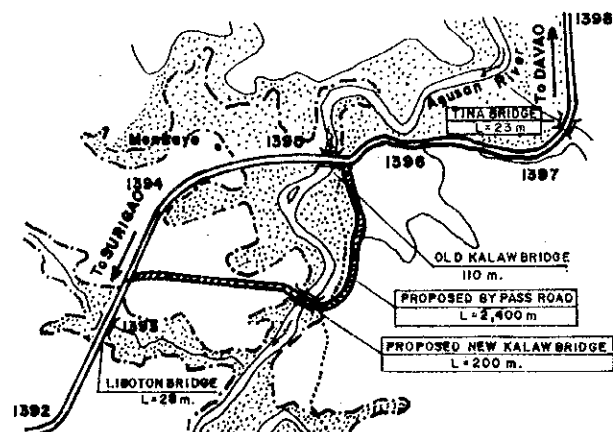
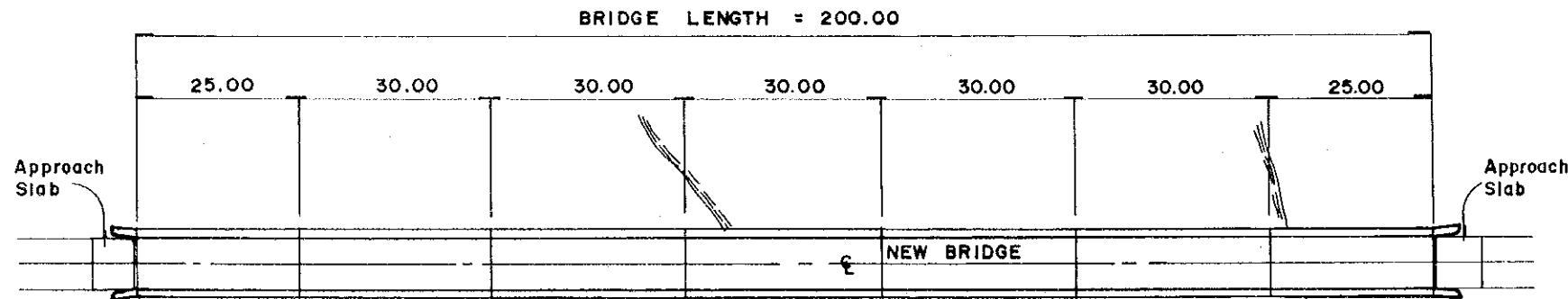


DETOUR BRIDGE : EXISTING BRIDGE

PROFILE
SCALE 1:1000



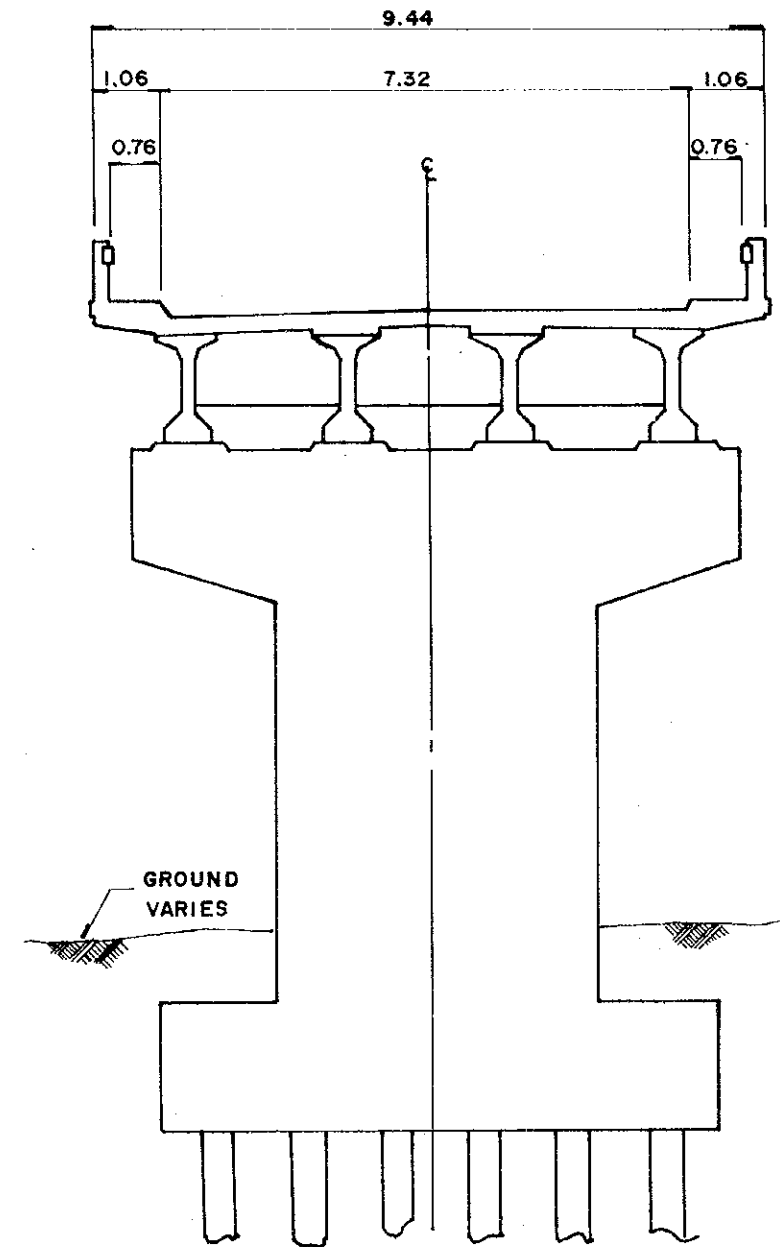
PLAN
SCALE 1:1000



LOCATION PLAN

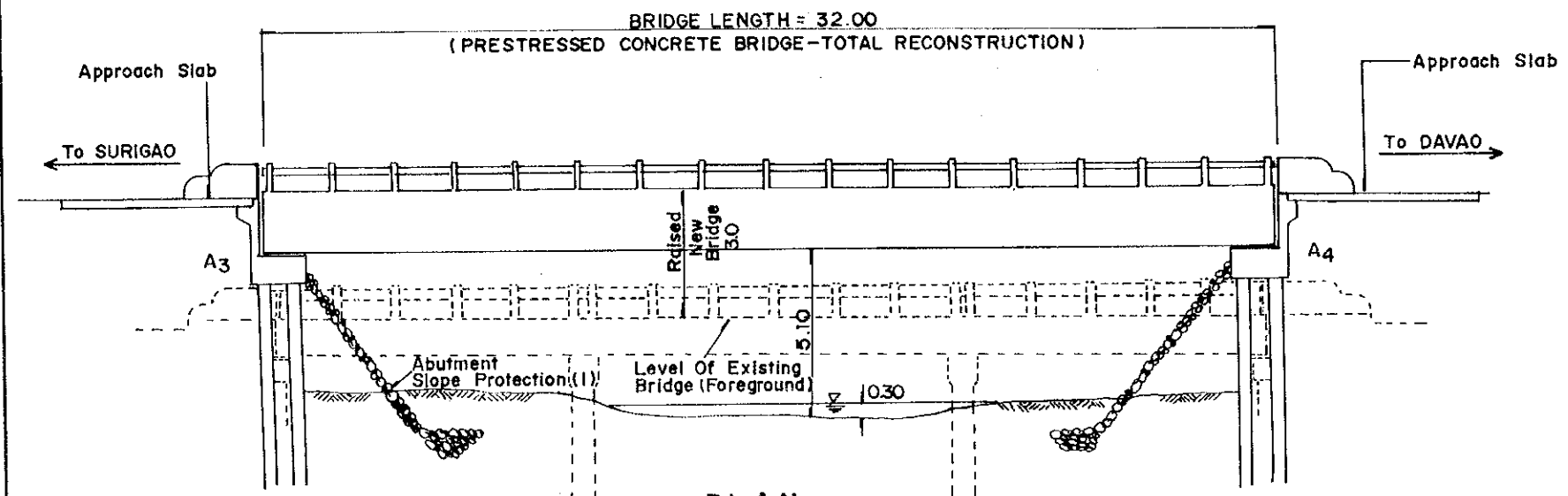
CROSS SECTION
SCALE 1:100

(PRESTRESSED CONCRETE BRIDGE - TOTAL RECONSTRUCTION)

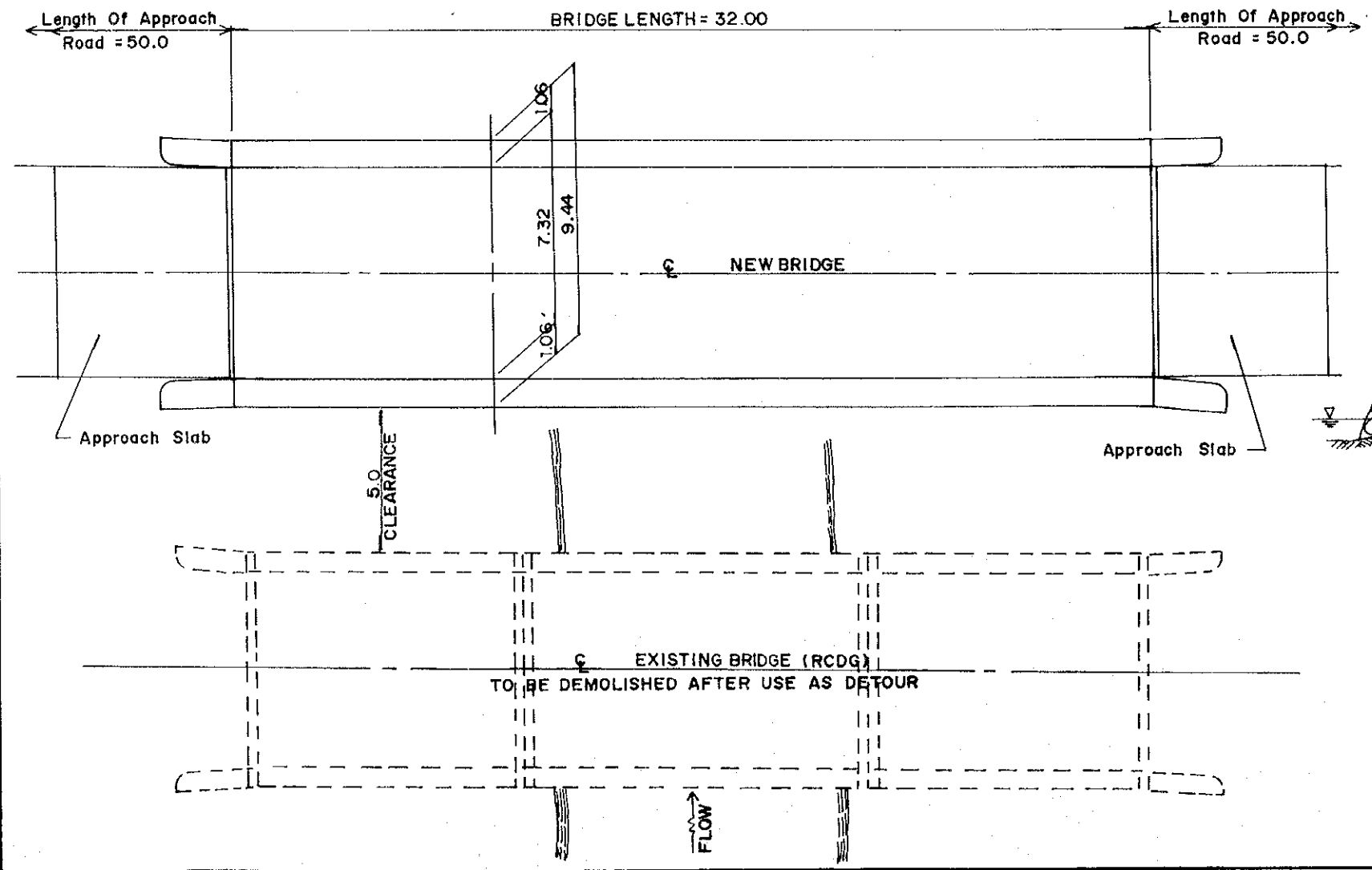


DETOUR BRIDGE: EXISTING BRIDGE

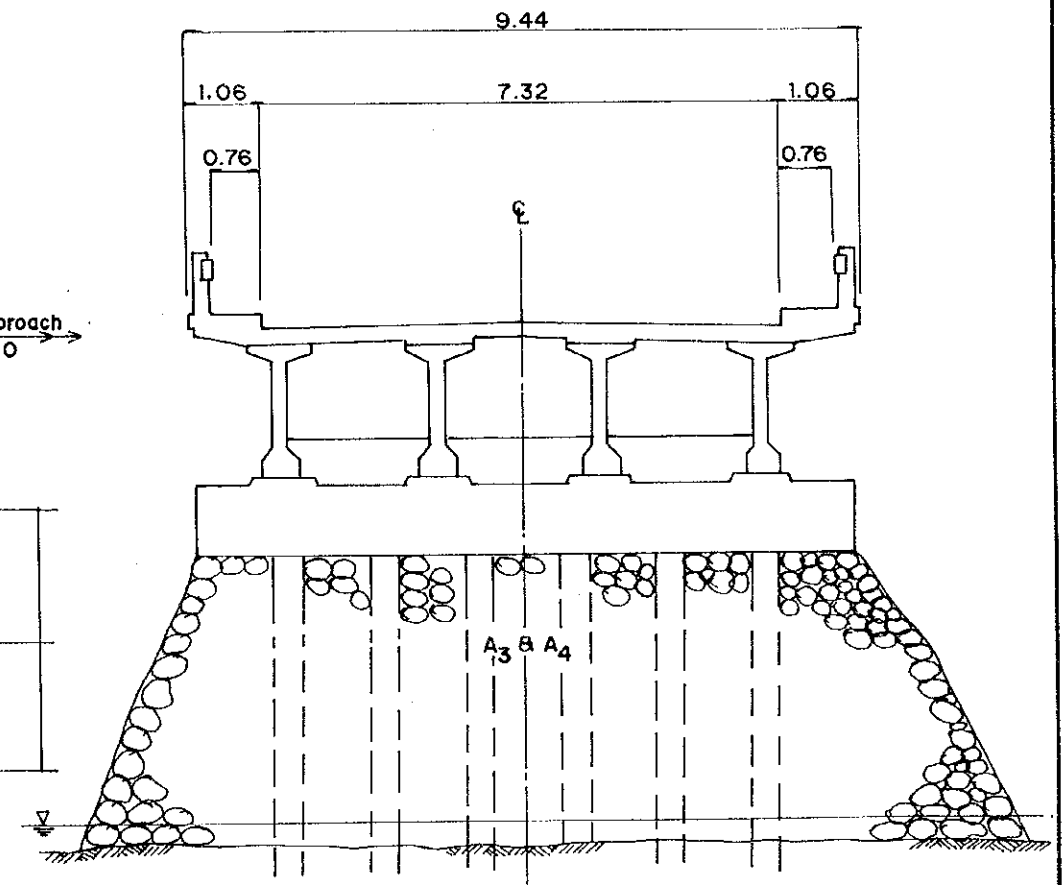
PROFILE
SCALE 1:200



PLAN
SCALE 1:200

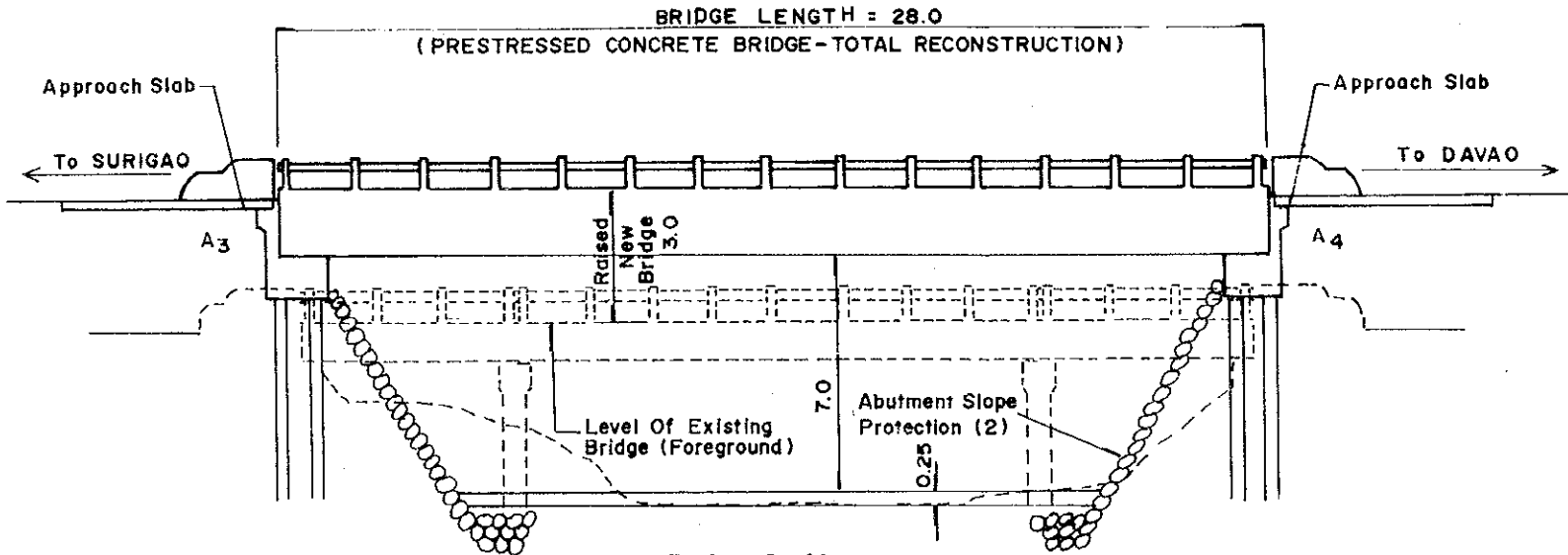


CROSS SECTION
SCALE 1:100
(PRESTRESSED CONCRETE BRIDGE-TOTAL RECONSTRUCTION)

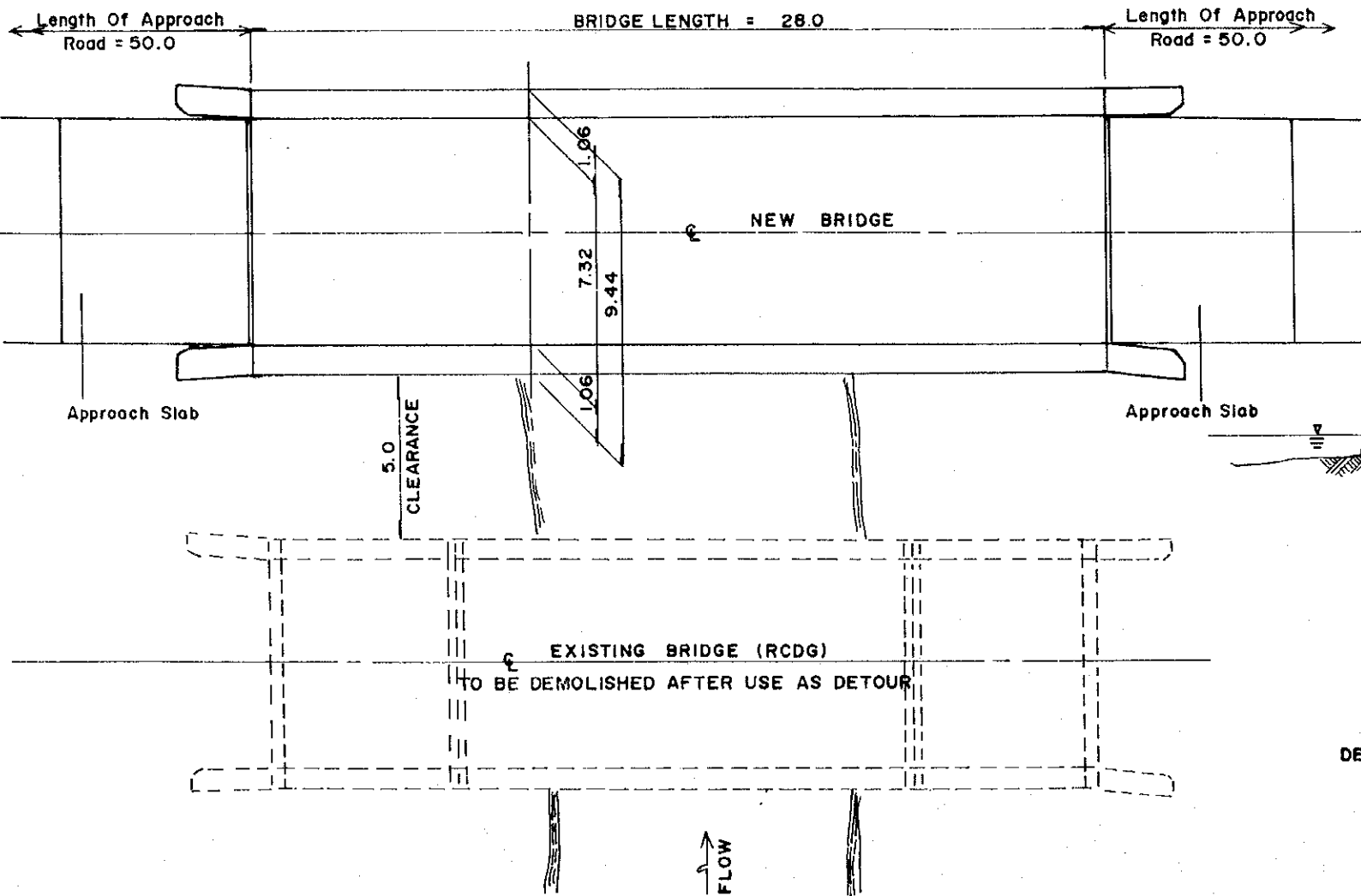


DETOUR BRIDGE: EXISTING BRIDGE

PROFILE
SCALE 1:200

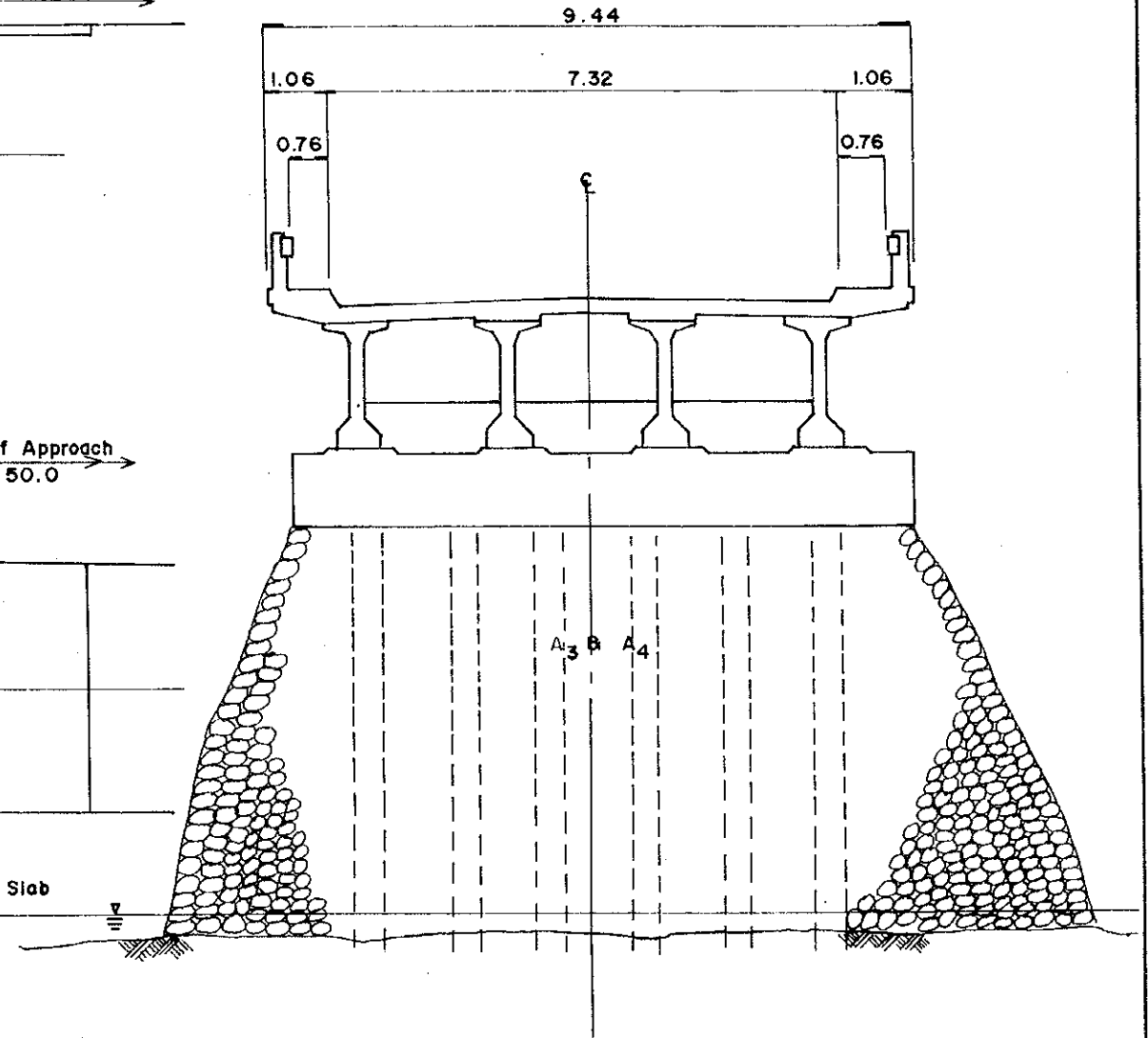


PLAN
SCALE 1:200



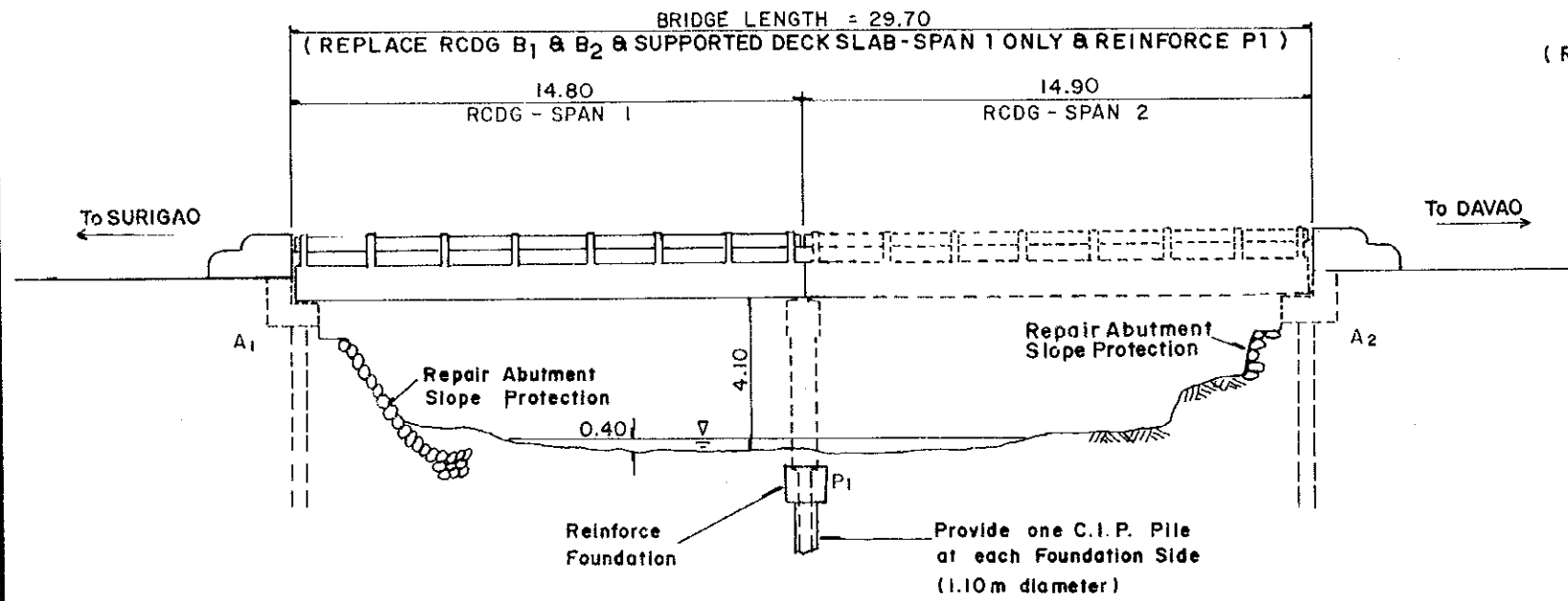
CROSS SECTION
SCALE 1:100

(PRESTRESSED CONCRETE BRIDGE-TOTAL RECONSTRUCTION)

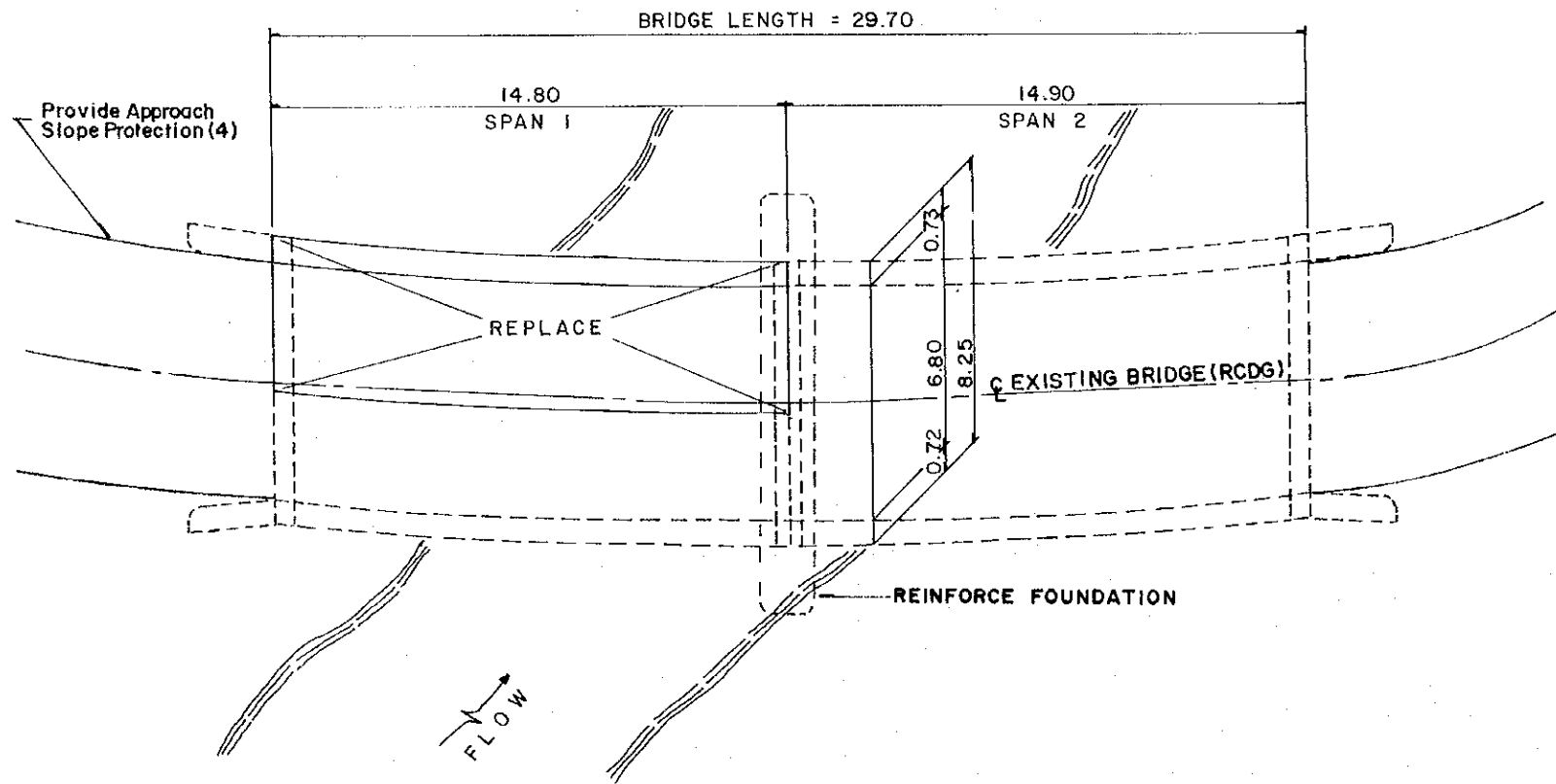


DETOUR BRIDGE : EXISTING BRIDGE

PROFILE
SCALE: 1:200

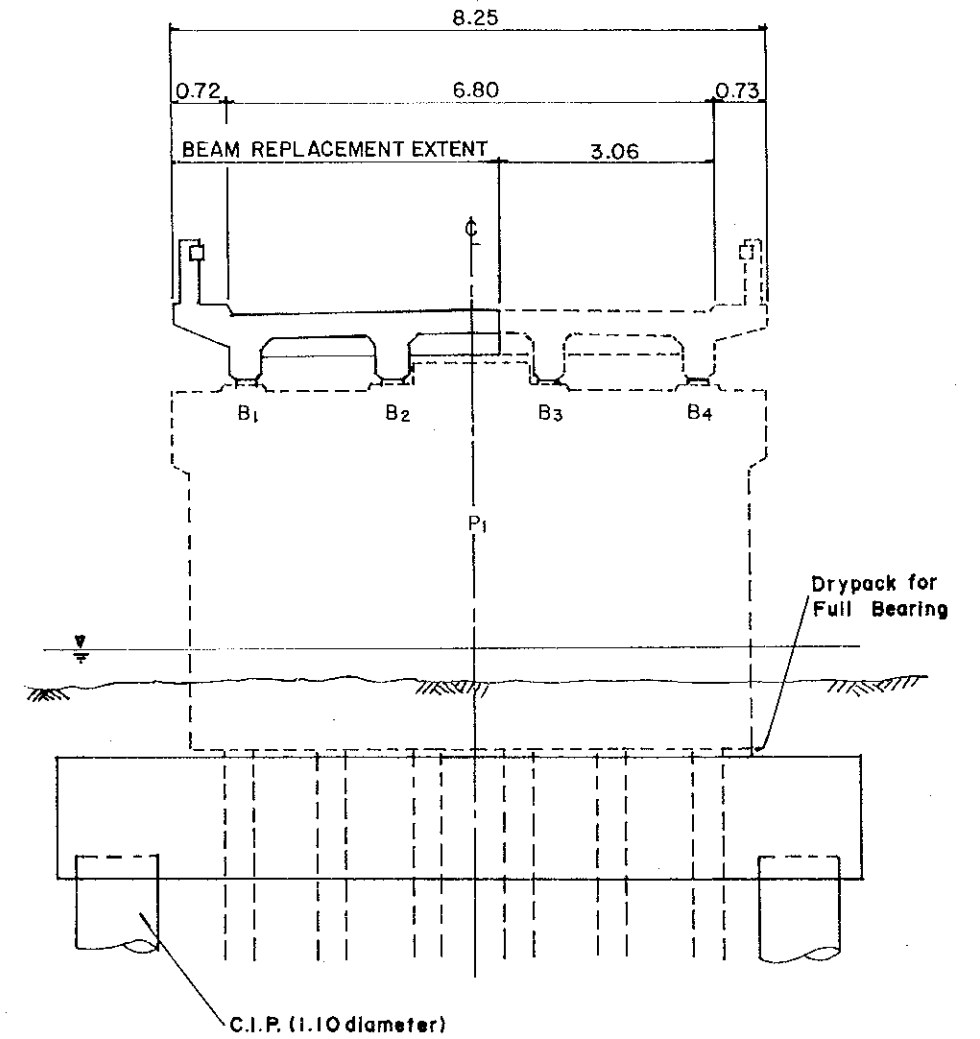


P L A N
SCALE: 1:200



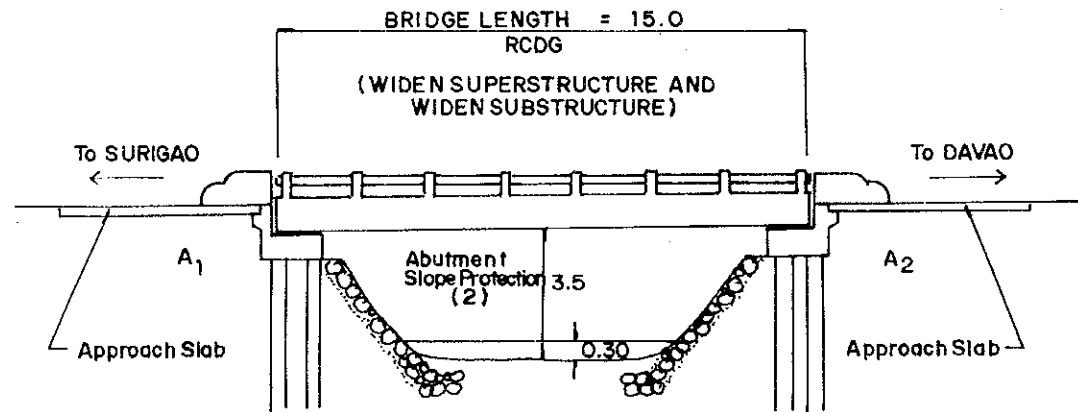
CROSS SECTION
SCALE: 1:100

(REPLACE RCDG B₁ & B₂ & SUPPORTED DECK SLAB - SPAN 1 ONLY & REINFORCE P₁)

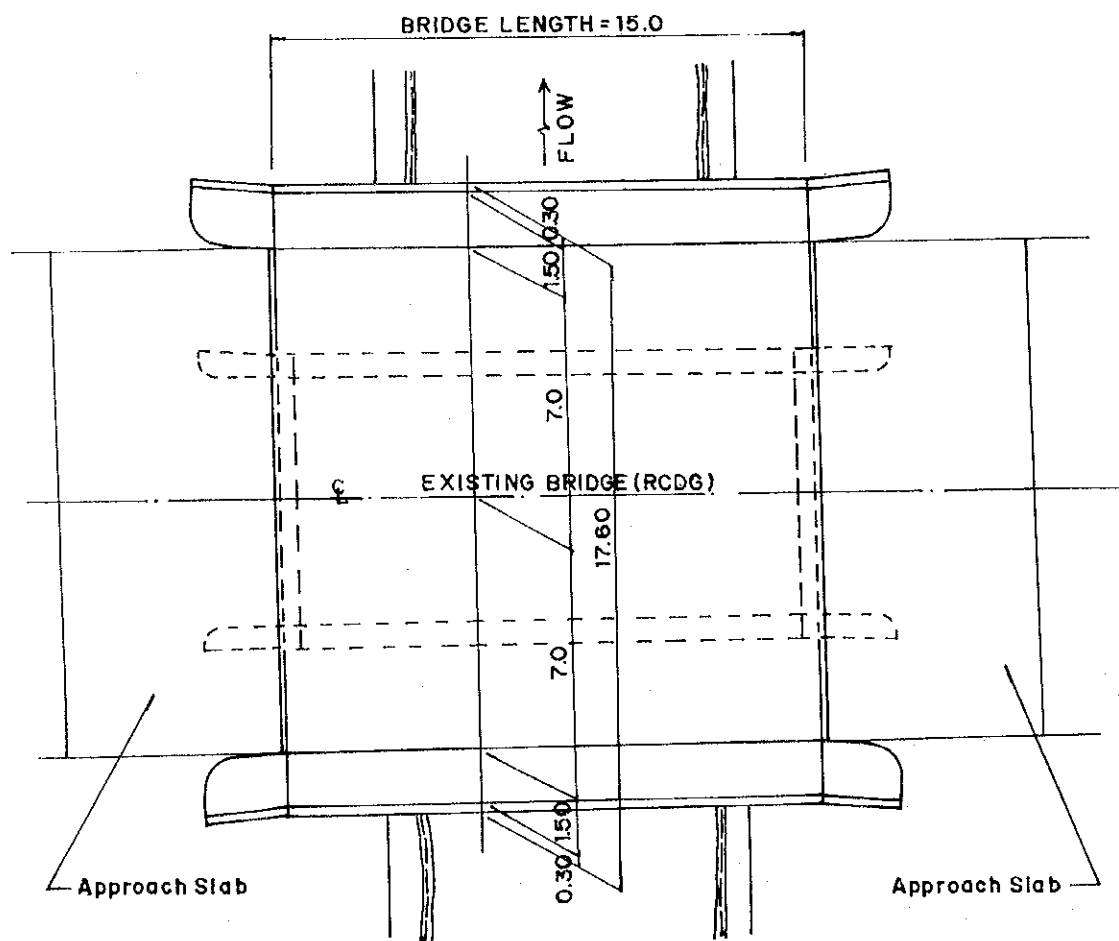


DETOUR BRIDGE : USE EXISTING BRIDGE
AND STAGE CONSTRUCTION

PROFILE
SCALE 1:200

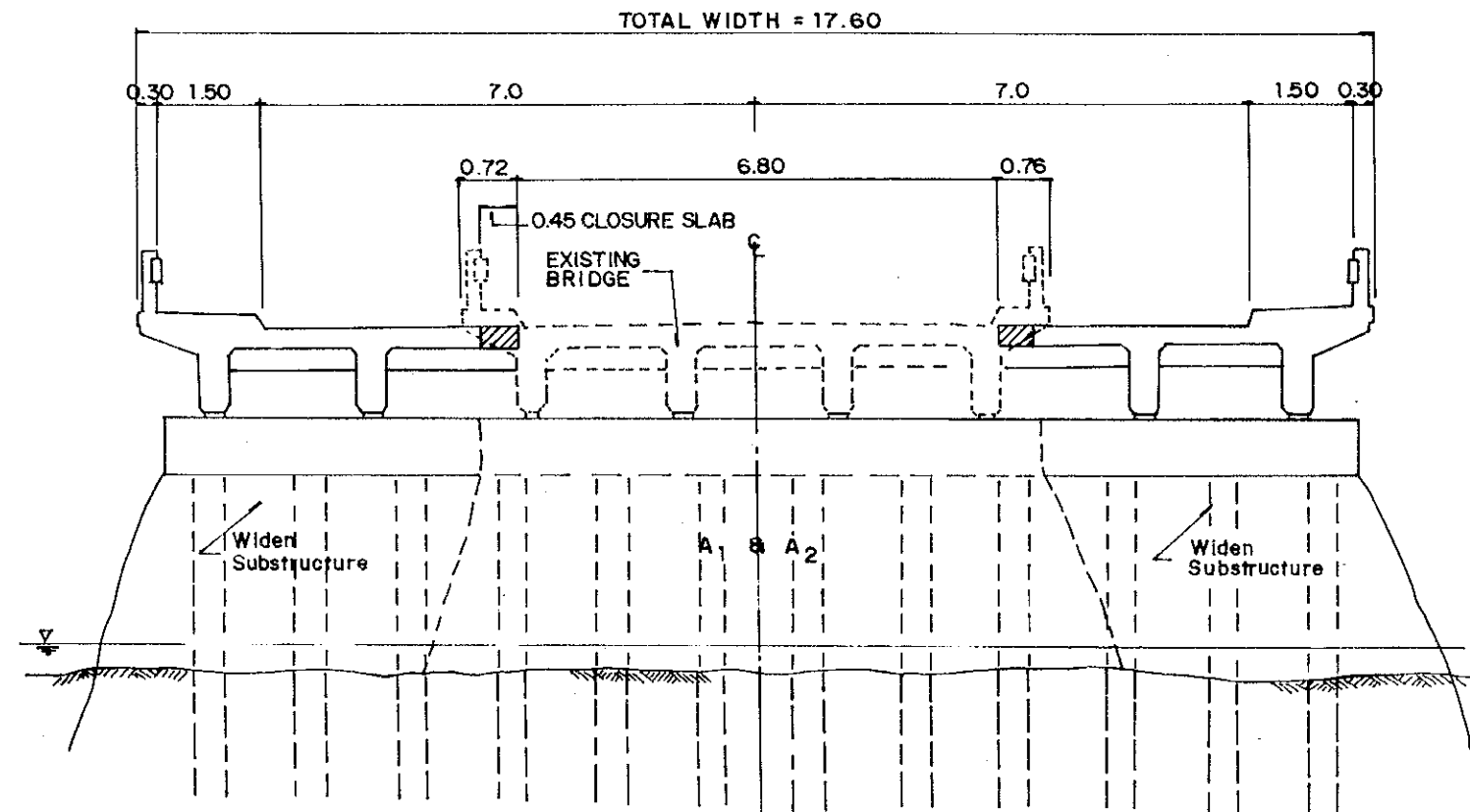


PLAN
SCALE 1:200



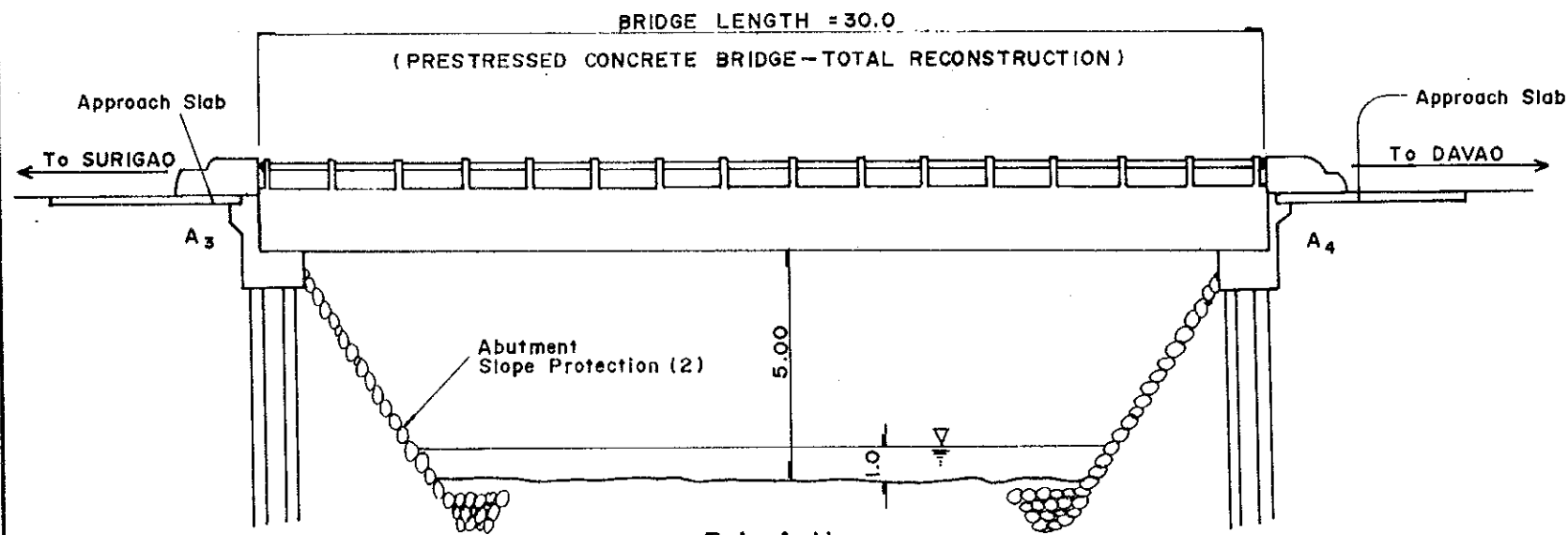
CROSS SECTION
SCALE 1:100

(WIDEN SUPERSTRUCTURE AND WIDEN SUBSTRUCTURE)

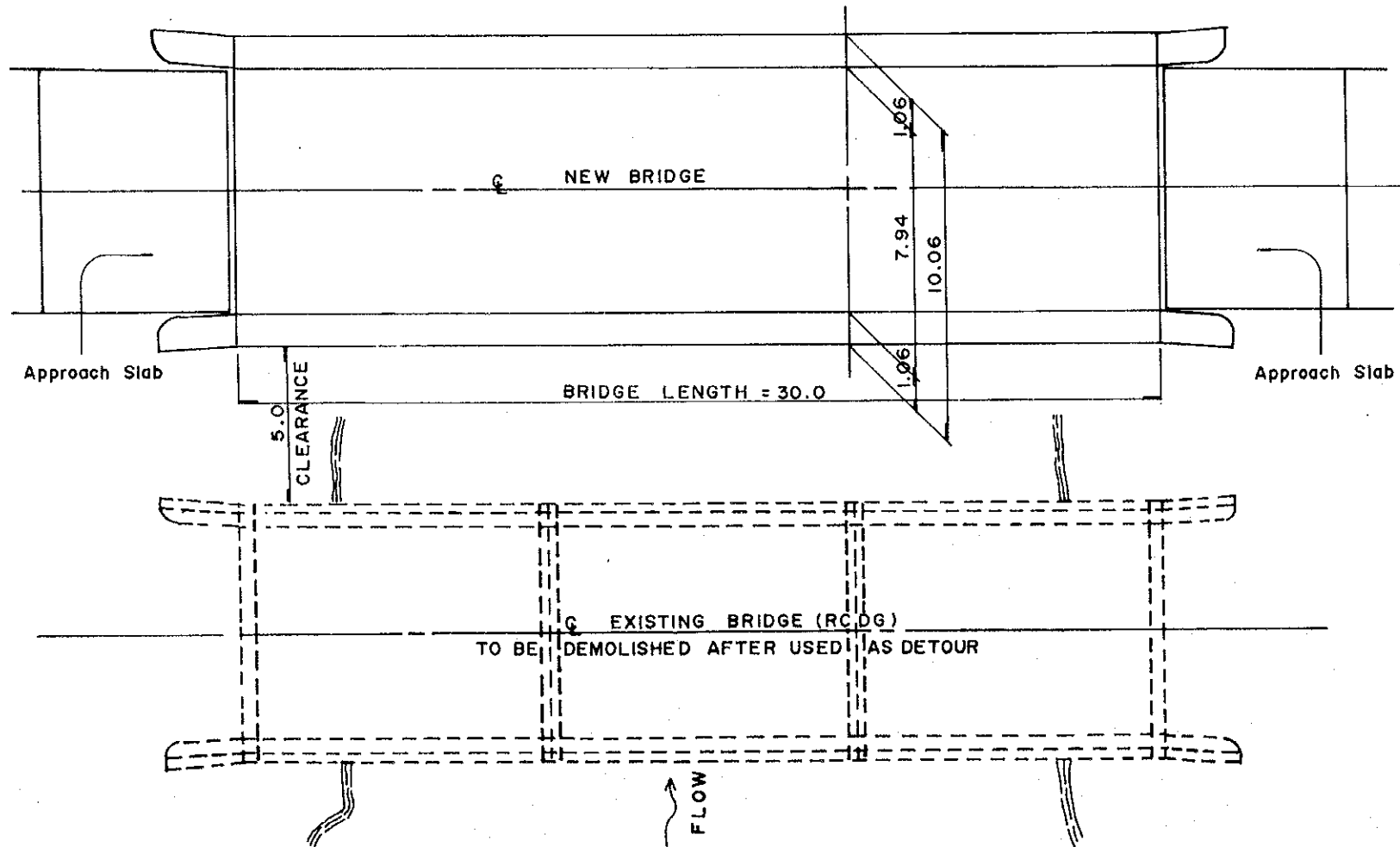


DETOUR BRIDGE : EXISTING BRIDGE

PROFILE
SCALE 1:200

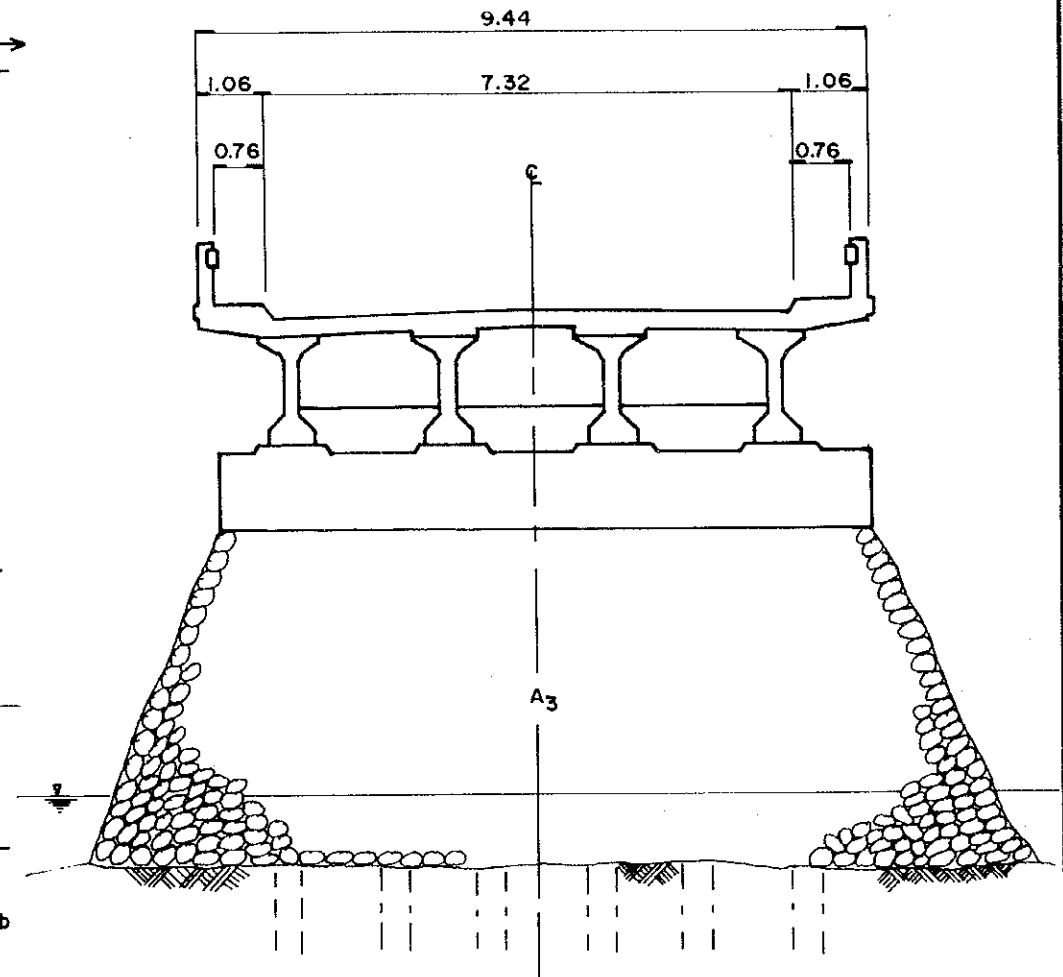


PLAN
SCALE 1:200



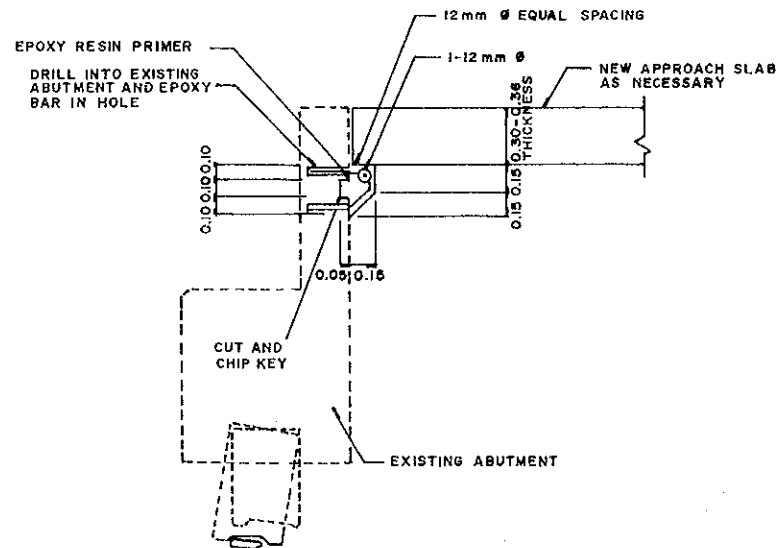
CROSS SECTION
SCALE 1:100

(PRESTRESSED CONCRETE BRIDGE - TOTAL RECONSTRUCTION)

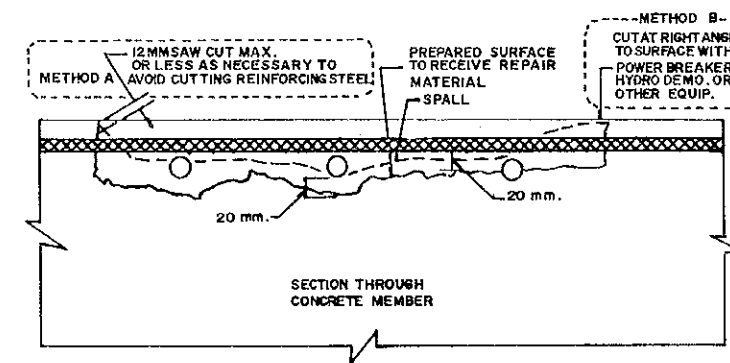
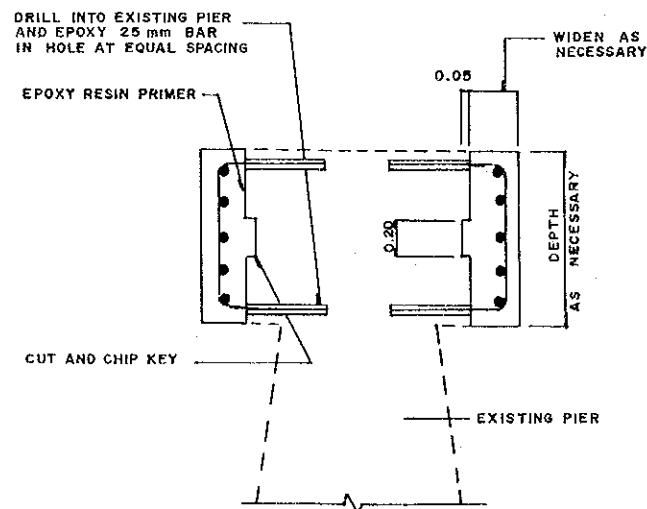


DETOUR BRIDGE: EXISTING BRIDGE

NEW APPROACH SLAB



WIDEN PIER COPING
(ABUTMENT, SIMILAR)

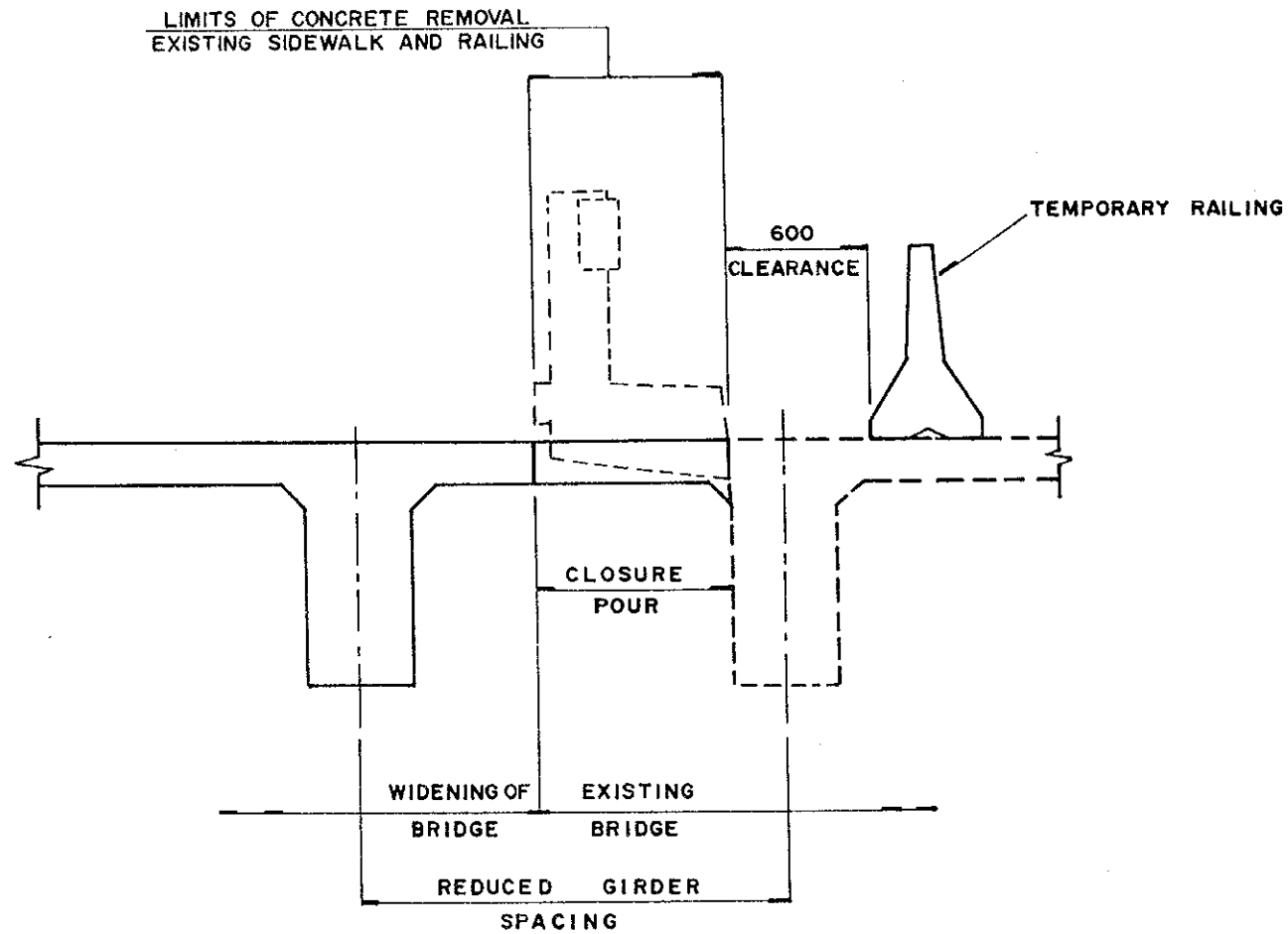


SURFACE REMOVAL TO REPAIR SPALL

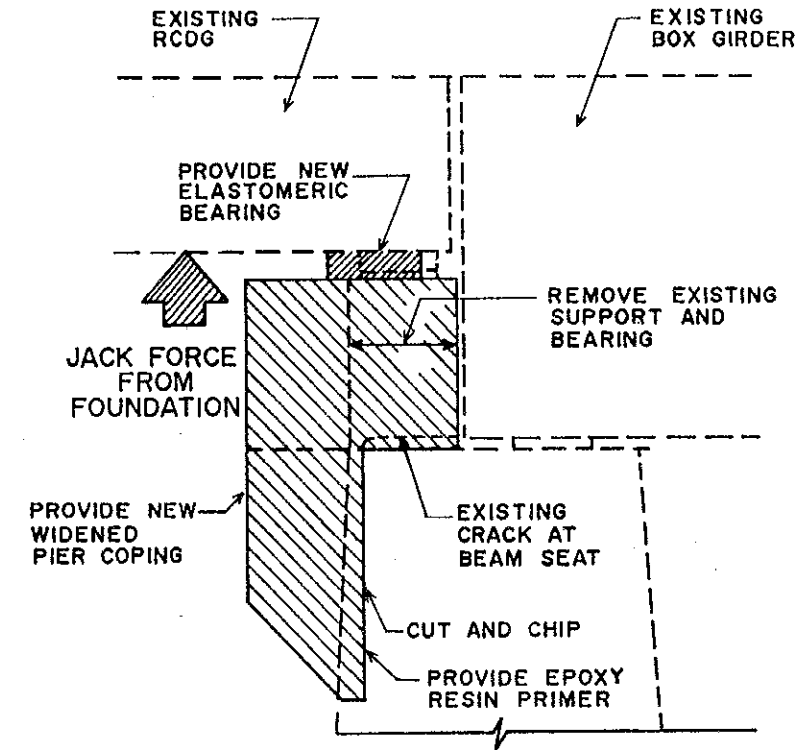
PROCEDURE :

1. REMOVE DETERIORATED CONCRETE ABOVE CORRODED BAR. REMOVE A MINIMUM OF 20 MM. CLEARANCE BELOW CORRODED BAR. THIS REMOVAL BELOW THE BAR WILL ALLOW BAR CLEANING, FULL BAR CIRCUMFERENCE BONDING TO SURROUNDING CONCRETE AND SECURING THE PATCH STRUCTURALLY.
2. CONCRETE REMOVAL SHALL PROCEED UNTIL THE BARS ARE UNCORRODED.
3. IF THE TOP OF THE BAR IS UNCORRODED, CARE SHALL BE TAKEN NOT TO DAMAGE BARS BOND SURROUNDING CONCRETE. IF BOND BETWEEN BAR AND CONCRETE IS BROKEN, THEN UNDERCUT THE BAR A MINIMUM OF 20 MM.
4. ANY LOOSE BARS SHALL BE SECURED IN PLACE BY TYING TO OTHER SECURED BARS.
5. IF BAR HAS LOST MORE THAN 25% OF ITS CROSS SECTION THE REPAIR METHOD SHALL BE :
 - A.) COMPLETE BAR REPLACEMENT
 - B.) ADDITION OF EXTRA BAR BY MECHANICAL SPLICE OR PLACING BAR PARALLEL TO AND APPROXIMATELY 20MM FROM EXISTING BAR.

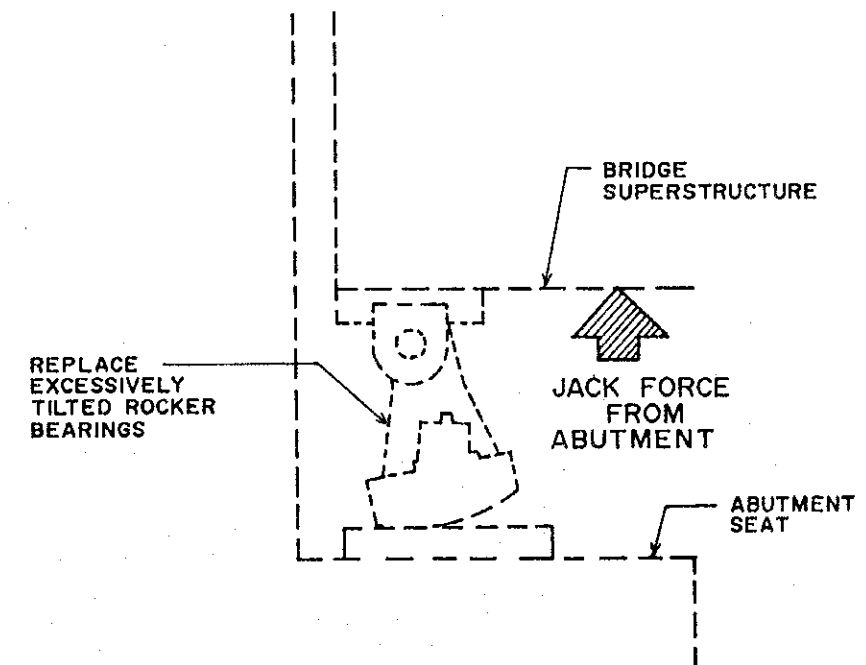
WIDEN EXISTING BRIDGE
SCALE 1:30



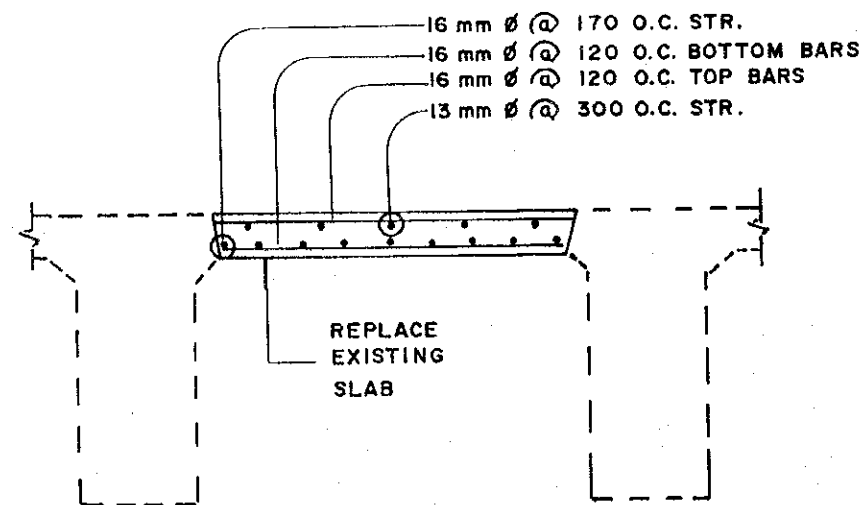
REPAIR BEAM SEAT
SCALE : NONE

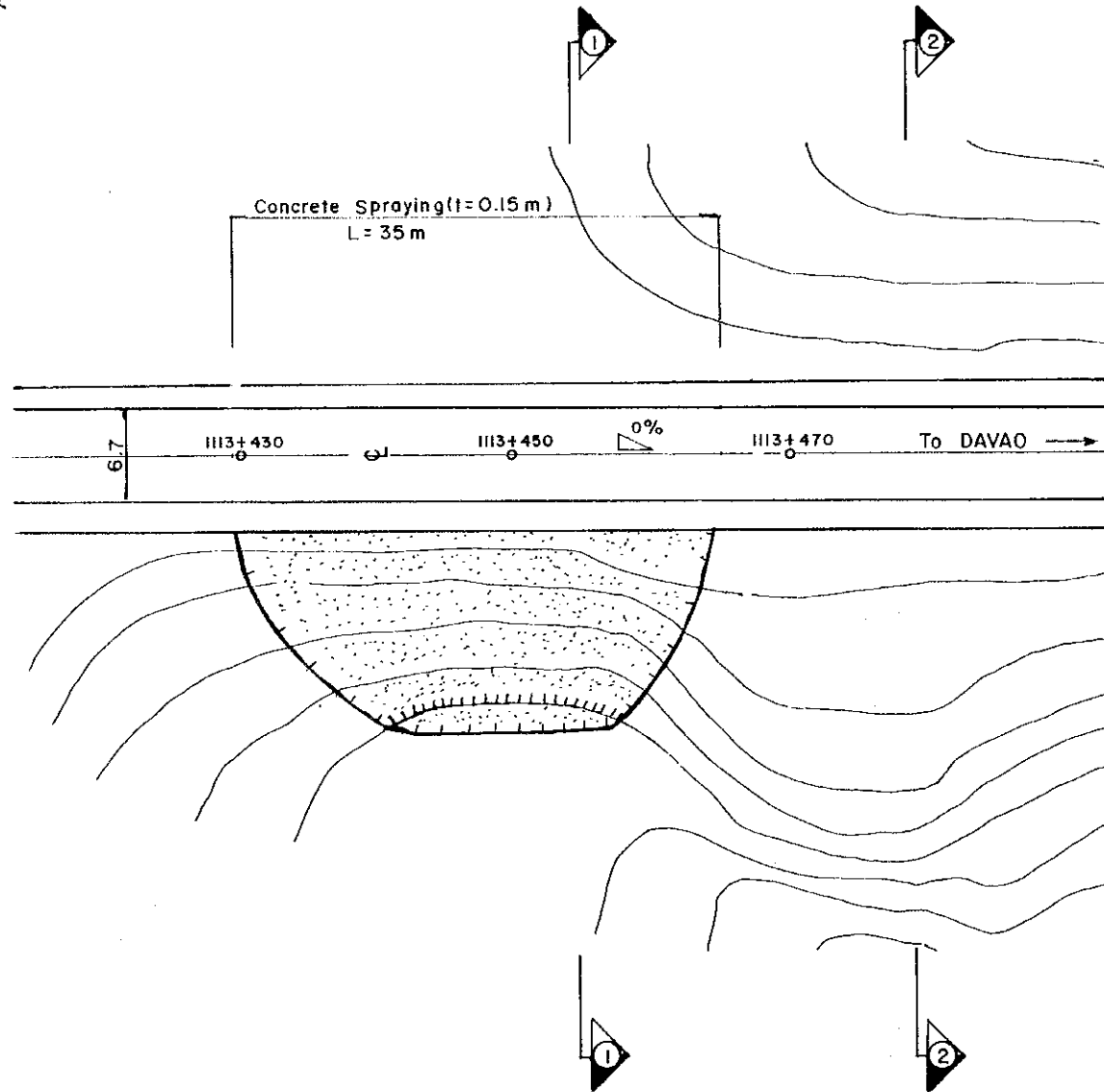


**REPLACE ABUTMENT
ROCKER BEARING**
SCALE : NONE

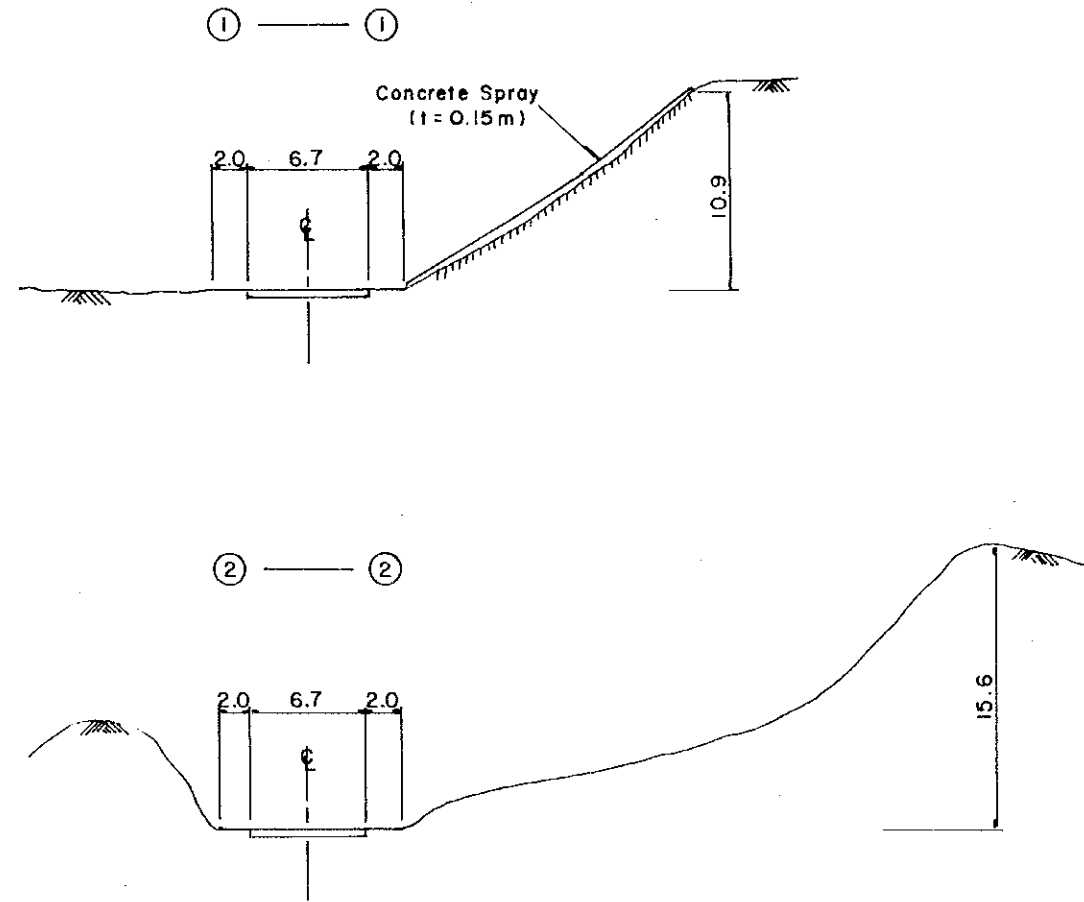


**REPLACEMENT OF DECK SLAB
CROSS SECTION**
SCALE 1:30





P L A N



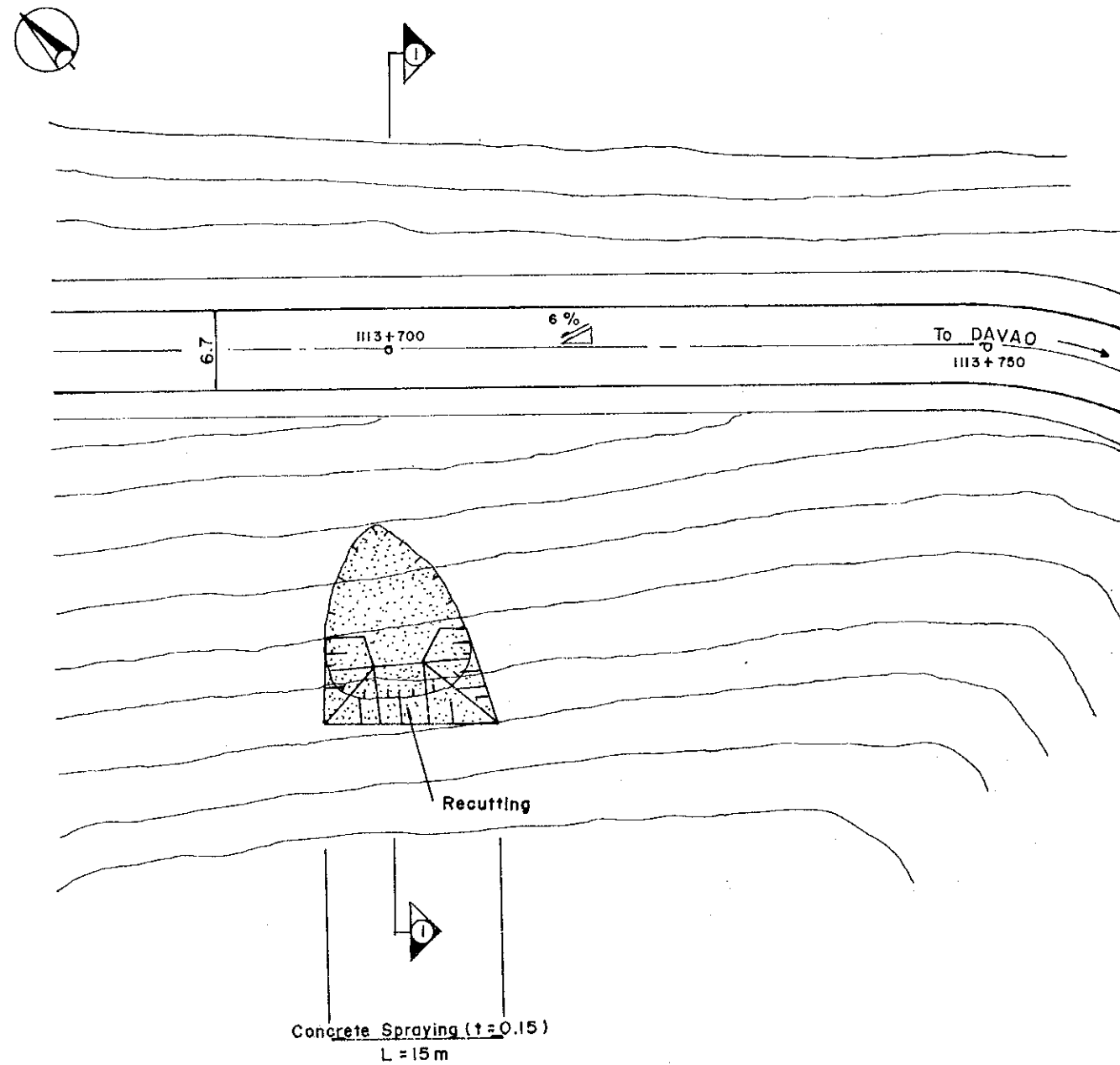
CROSS SECTION
SCALE 1:400

Cause of Disaster:

- 1) Failure in layer of severely weathered andesite.
- 2) Infiltration of water into cracks which precipitated weathering of andesite.

SUMMARY OF QUANTITY

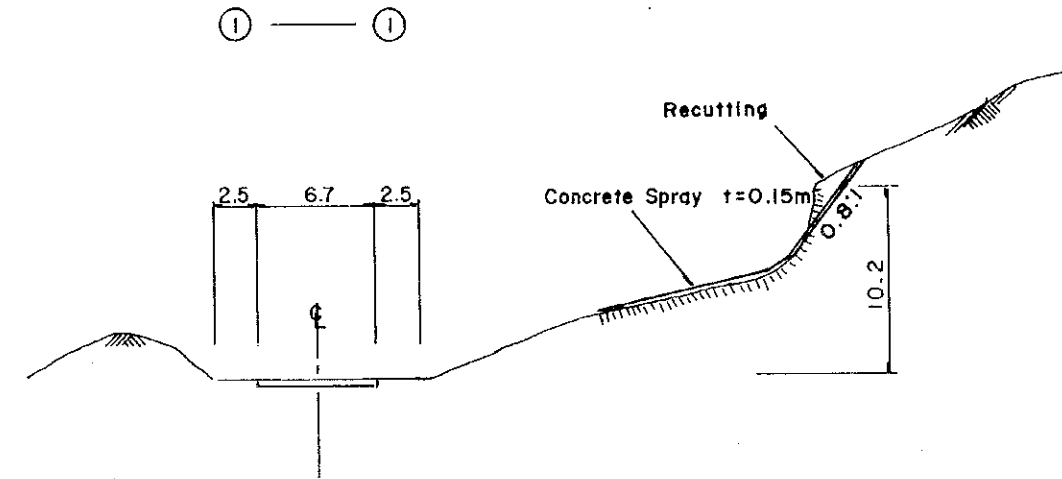
TYPE OF WORK		UNIT	TOTAL
5-20	CONCRETE SPRAYING	SQ. M	850



P L A N

Cause of Disaster:

- 1) Failure in layer of severely weathered andesite.
- 2) Infiltration of water into cracks which induced wedge-shaped failures.



CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-2	RECURTING OF SOFT ROCK	CU.M	60
5-20	CONCRETE SPRAYING (t=0.15)	SQ.M	160

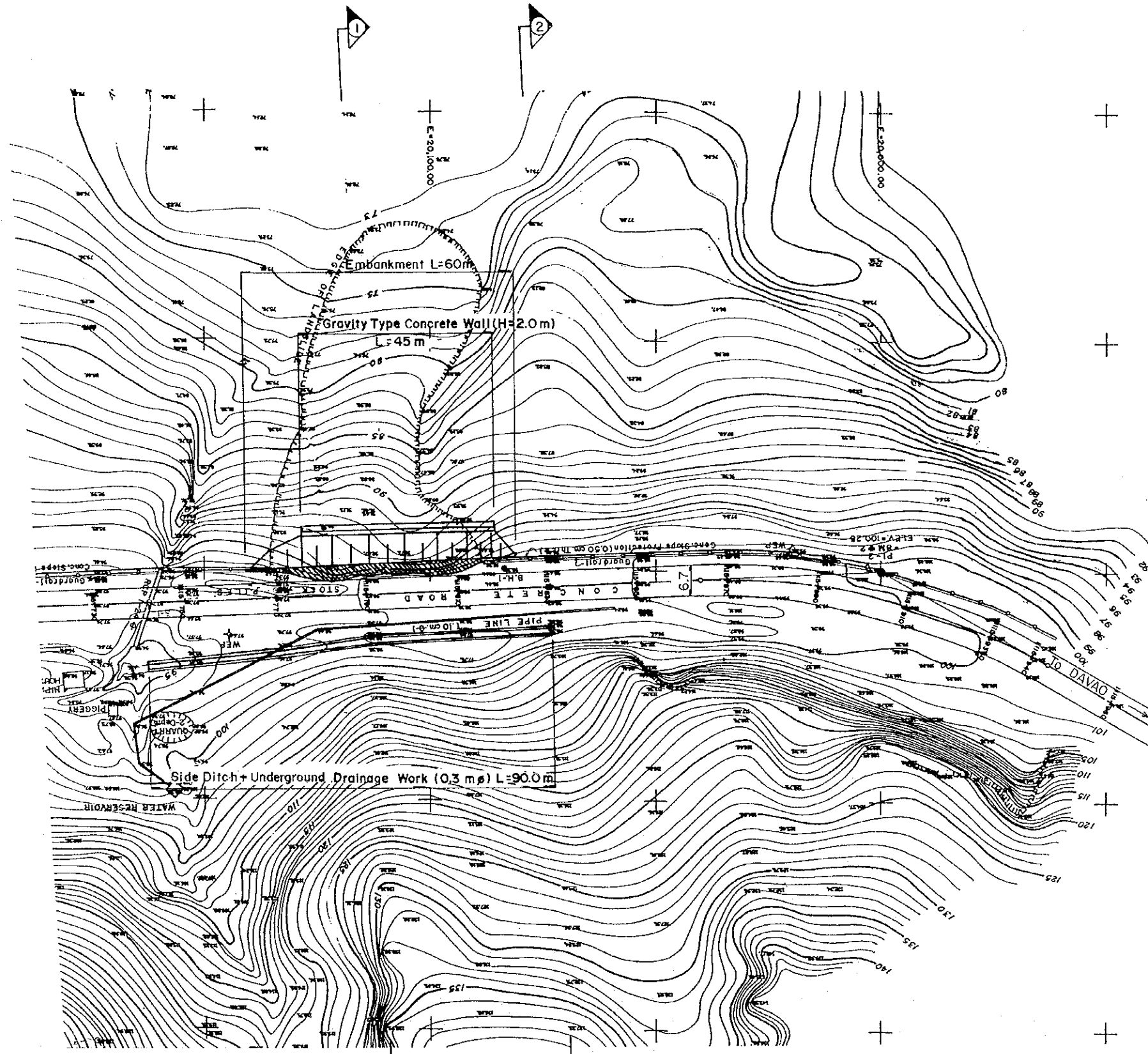
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

SLOPE NO. : 1-03
TYPE OF DISASTER :

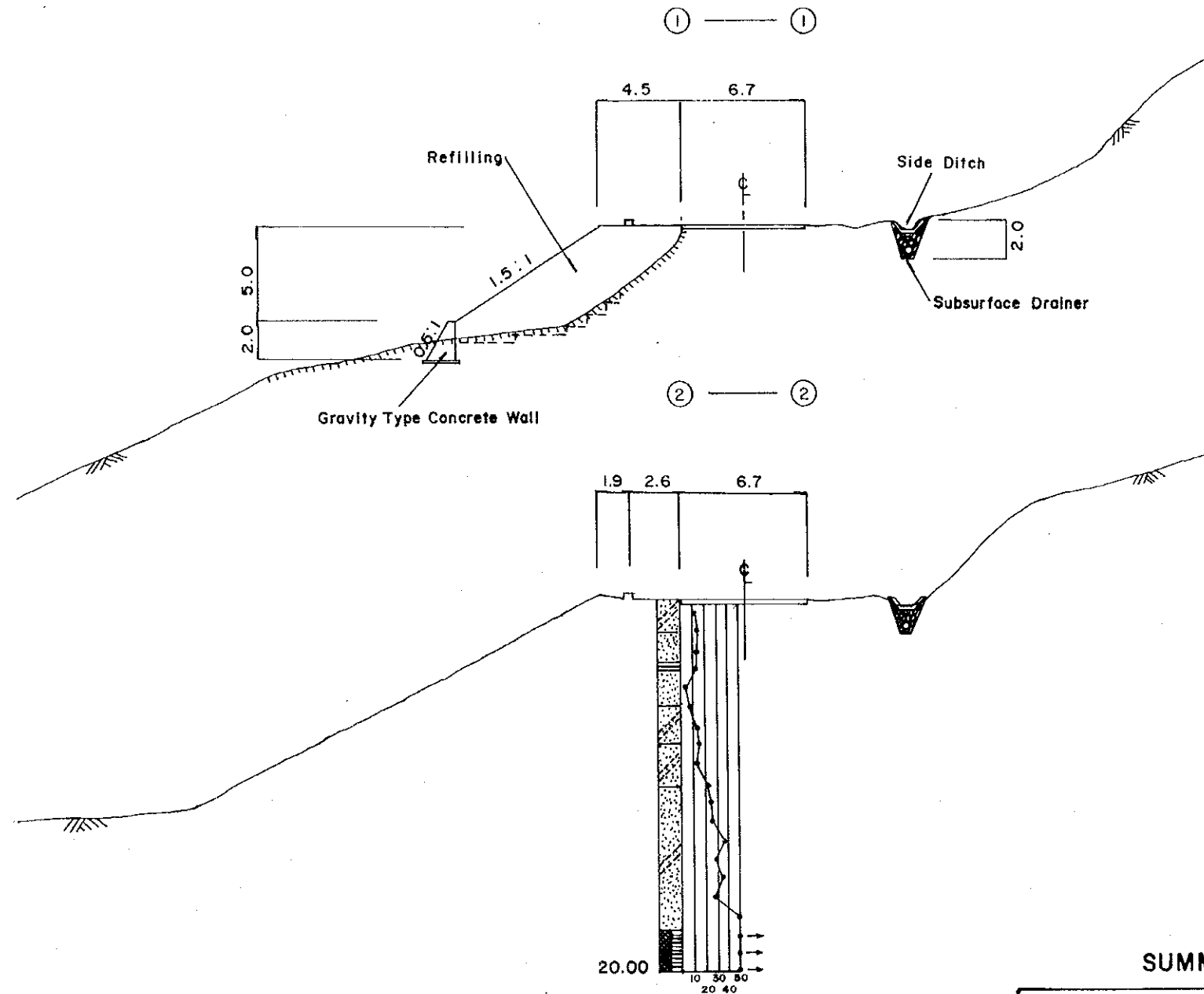
STATION : 1115 + 800
EMBANKMENT SLOPE FAILURE

SCALE
1:1000

DRAWING NO.
S-3(1/2)



PLAN
SCALE 1:1000



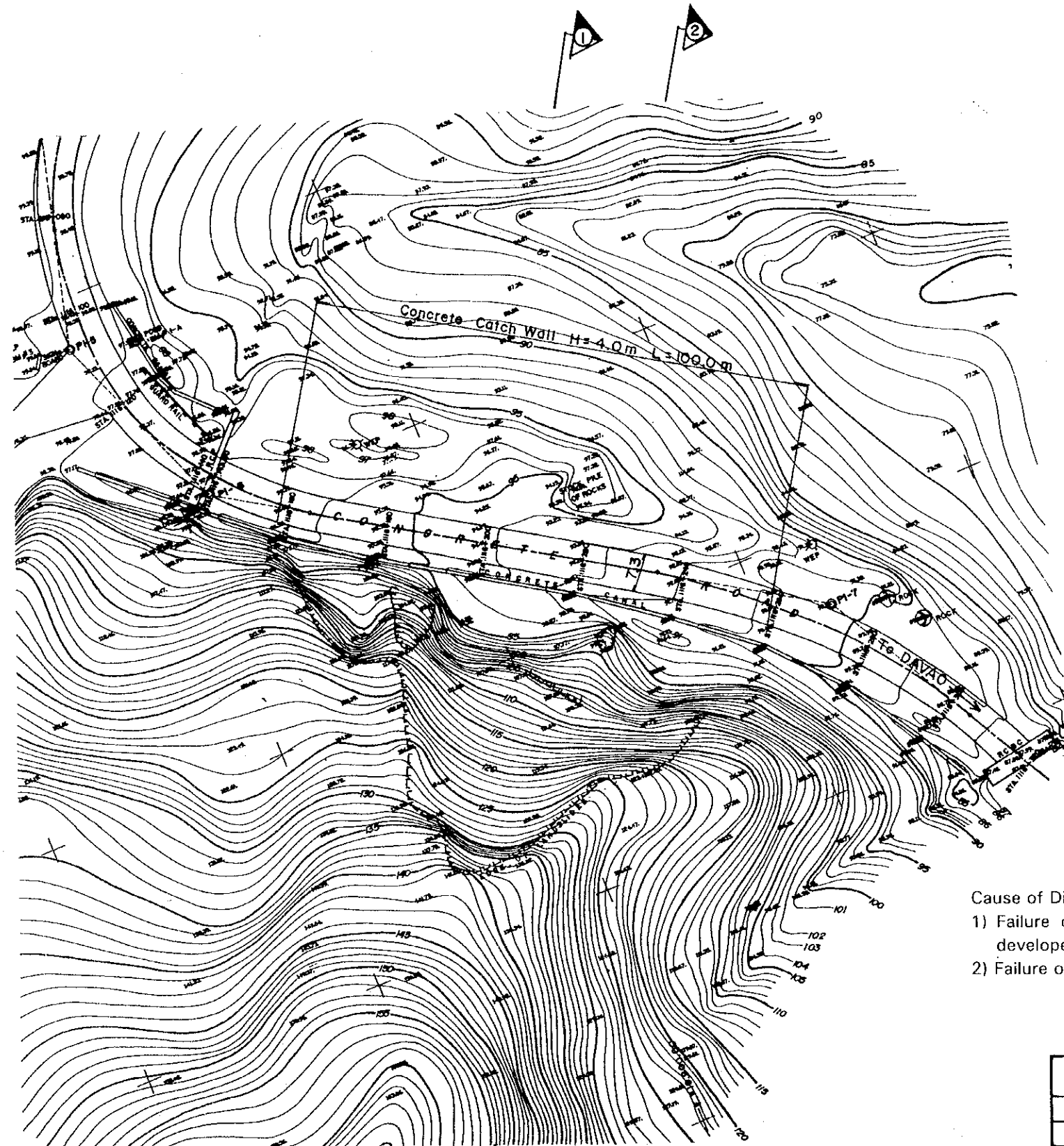
CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU. M	1,340
5-14	GRAVITY TYPE CONCRETE WALL	CU. M	81
5-44	SUBSURFACE DRAINER	L. M	90
5-4	STRUCTURAL EXCAVATION	CU. M	148
5-8	FOUNDATION FILL	CU. M	88

Cause of Disaster:

- 1) Infiltration of water into boundary surface between the inclined ground and embankment.
- 2) Effect of ground water.
- 3) Embankment slope with an unstable grade.



Cause of Disaster:

- 1) Failure of surface layer along cracks in sandstone which have been developed in the direction towards road.
- 2) Failure of large slope with a steep grade.

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-25	CONCRETE CATCH WALL	CU.M	560
5-4	STRUCTURAL EXCAVATION	CU.M	225
5-6	FOUNDATION FILL	CU.M	111

PLAN
SCALE 1:1000



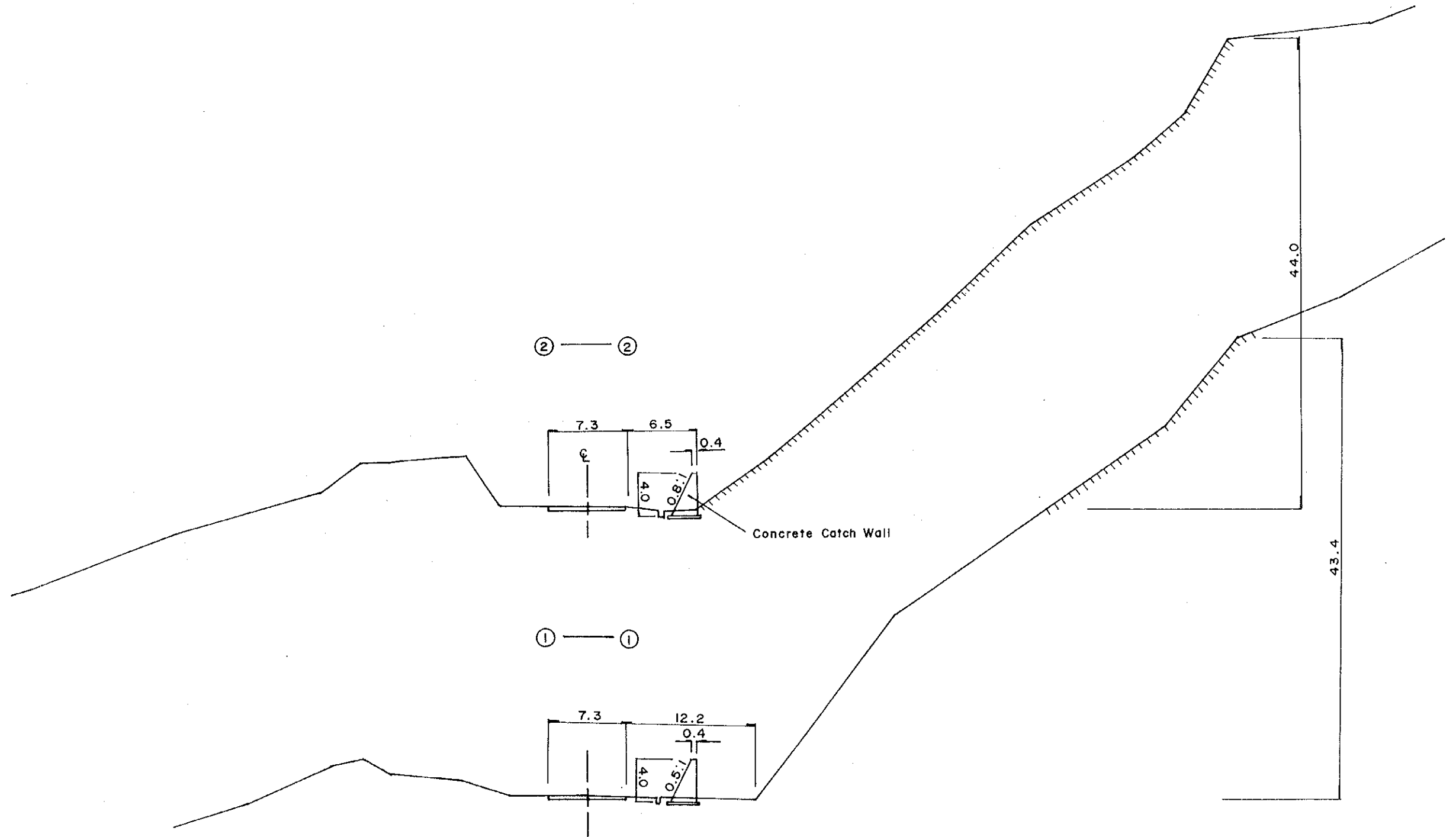
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

SLOPE NO. : 1-04
TYPE OF DISASTER :

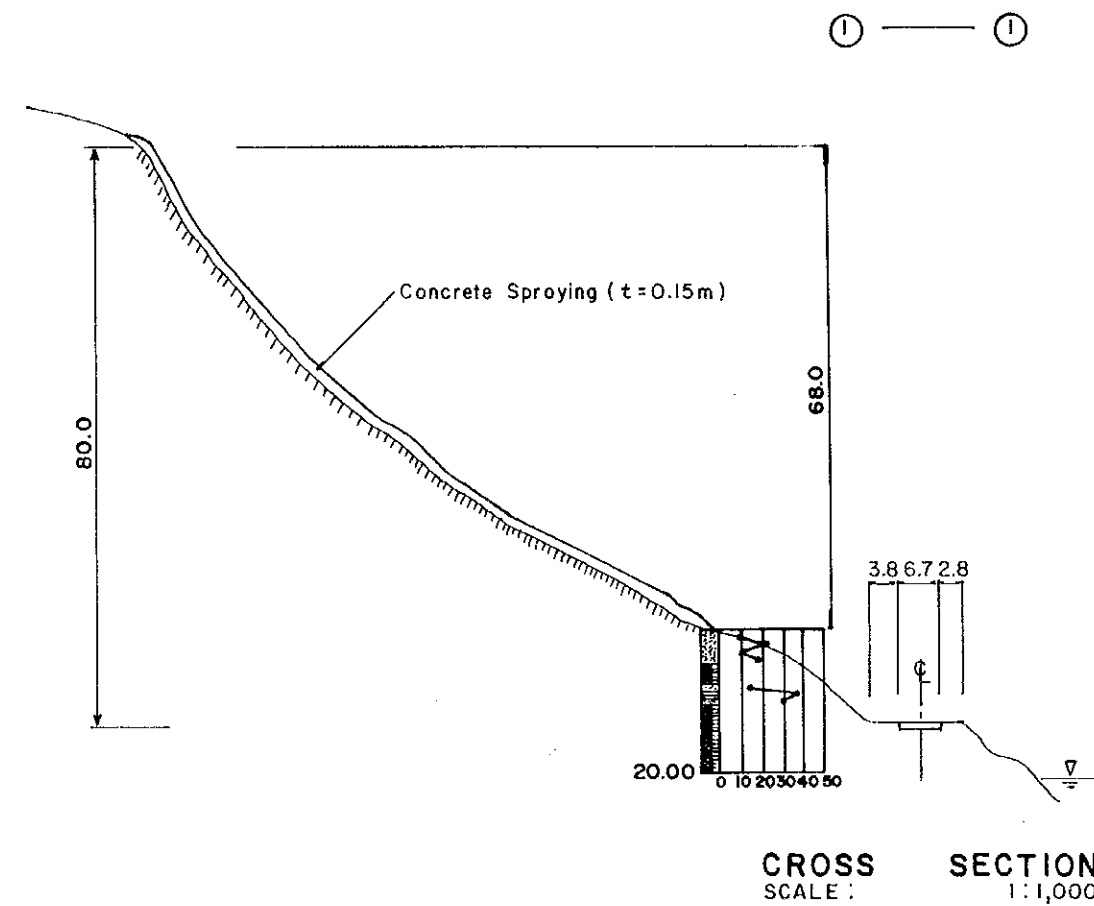
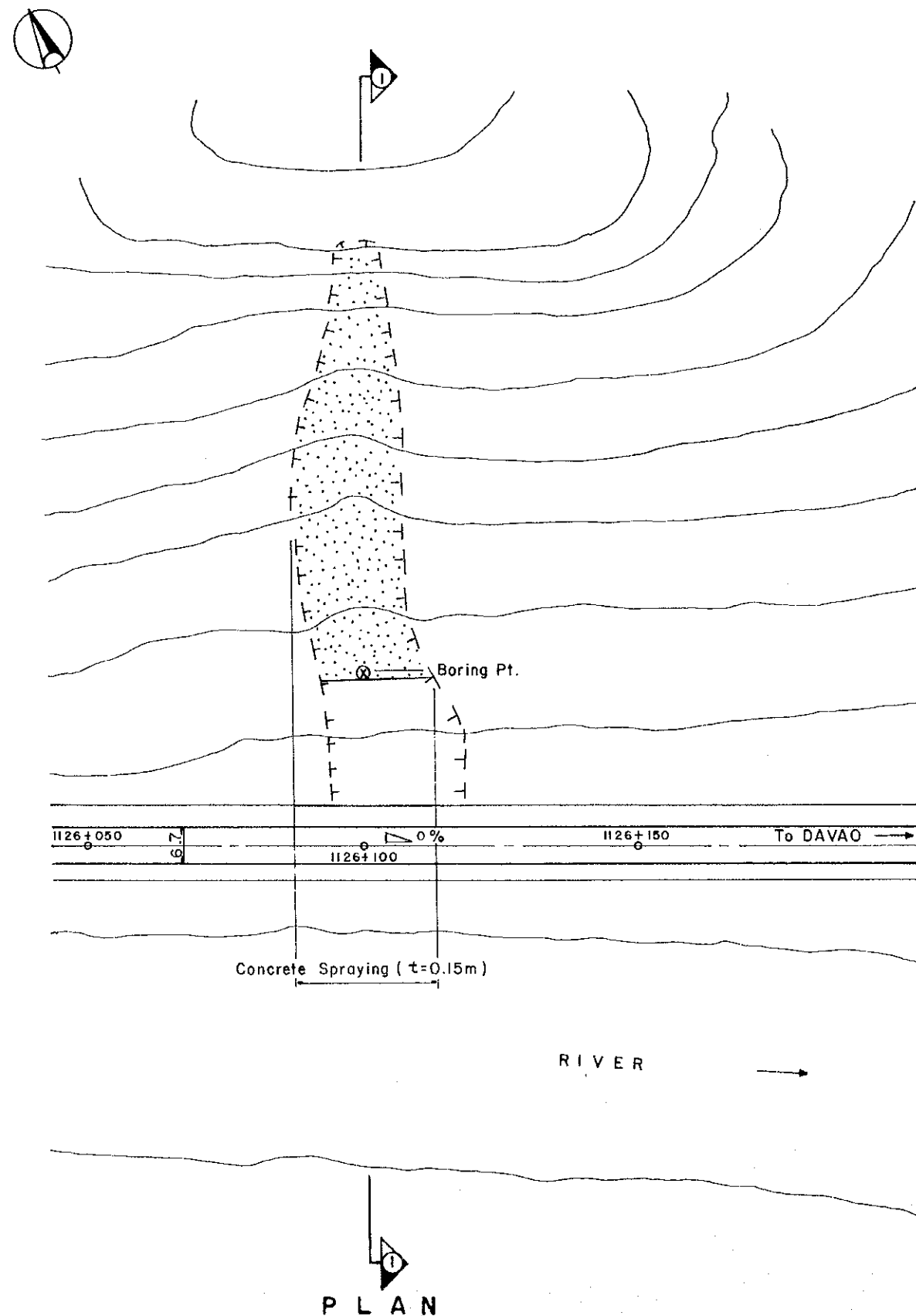
1116+200
CUTSLOPE FAILURE

SCALE
1:400

DRAWING NO.
S-4(2/2)



CROSS SECTION
SCALE 1:400

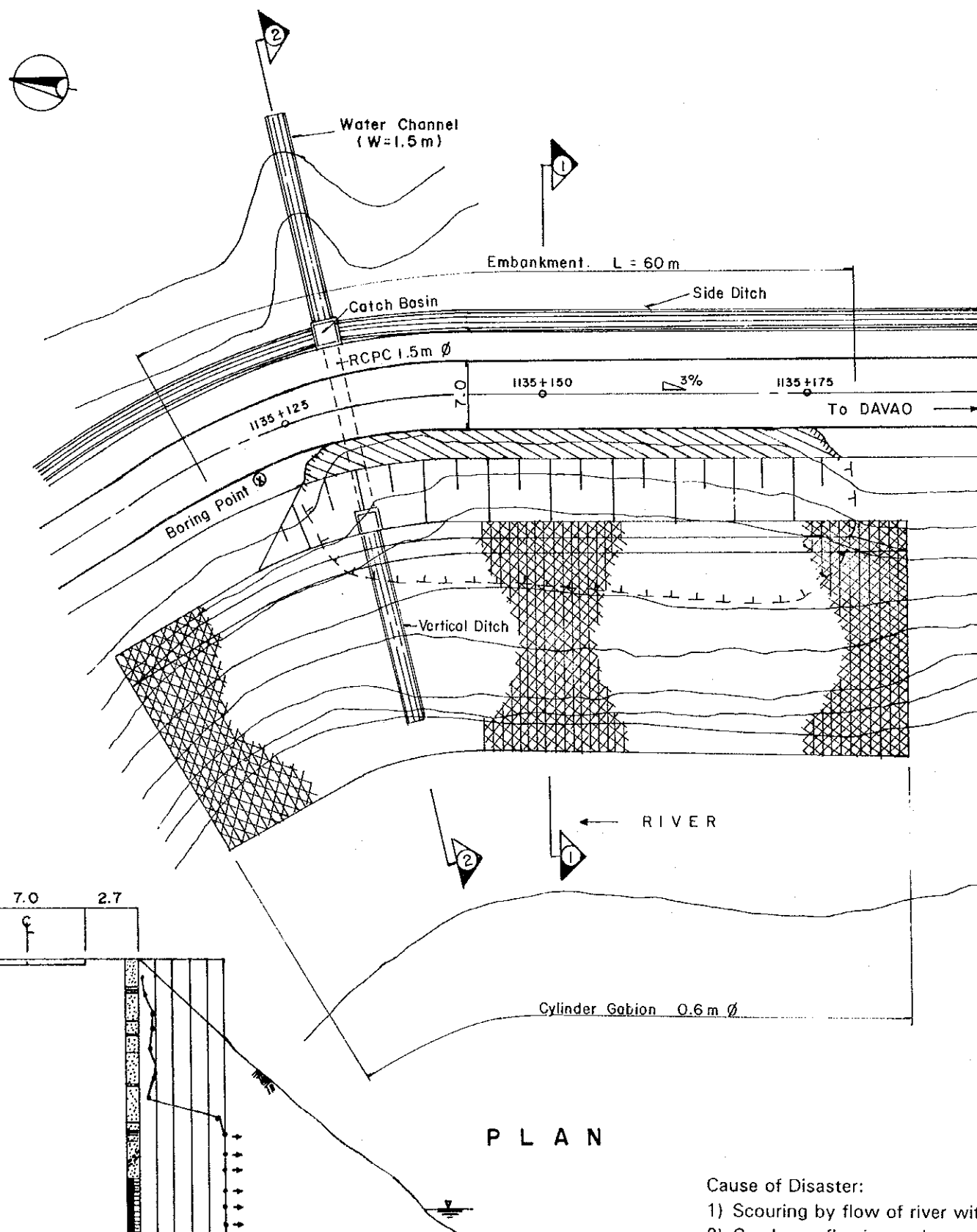


Cause of Disaster:

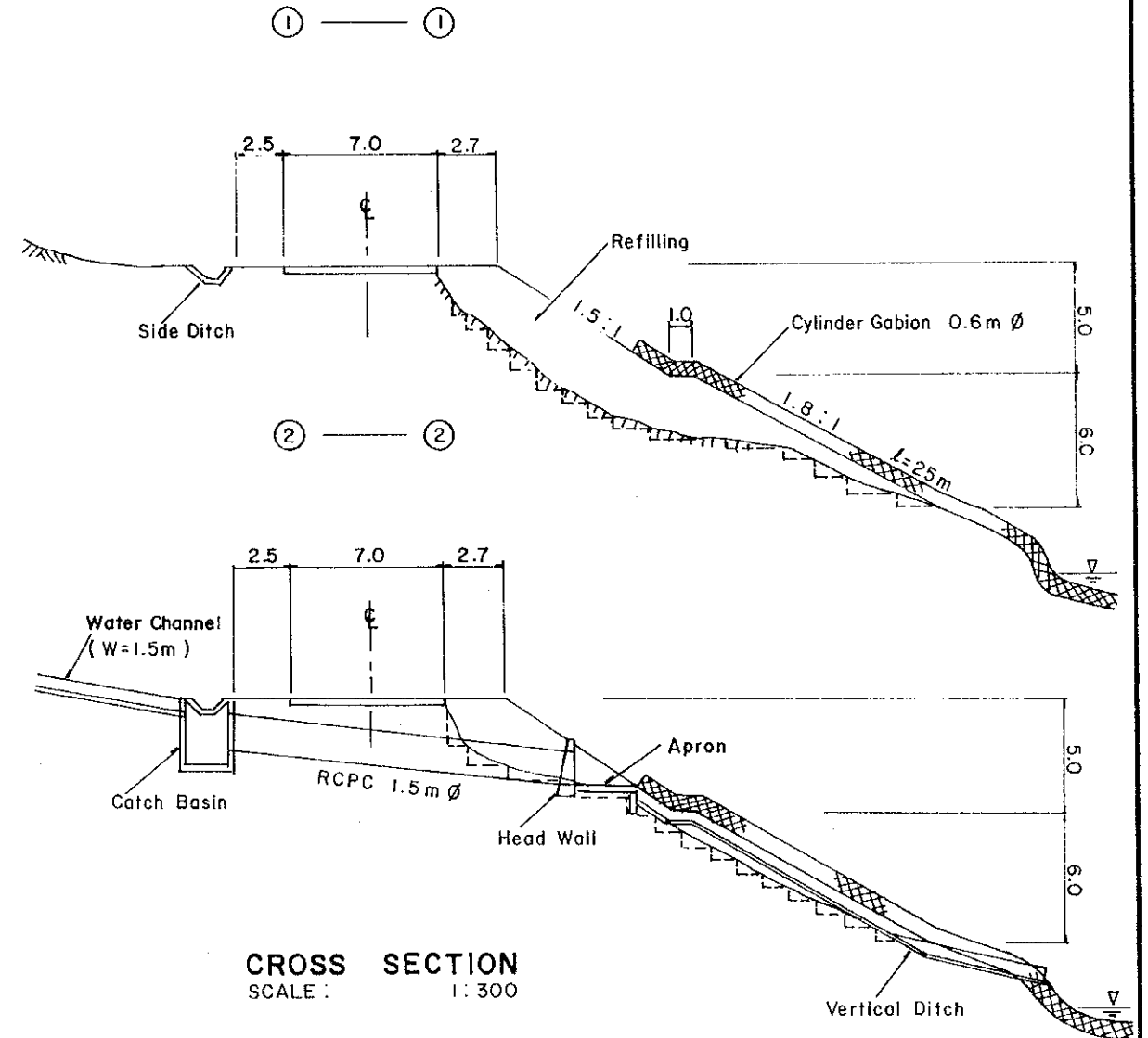
- 1) Surface failure induced by heavy rain in layer of severely weathered granodiorite.

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5 - 20	CONCRETE SPRAYING	SQ.M	1,705



CROSS SECTION (BORING POINT)
SCALE 1:300

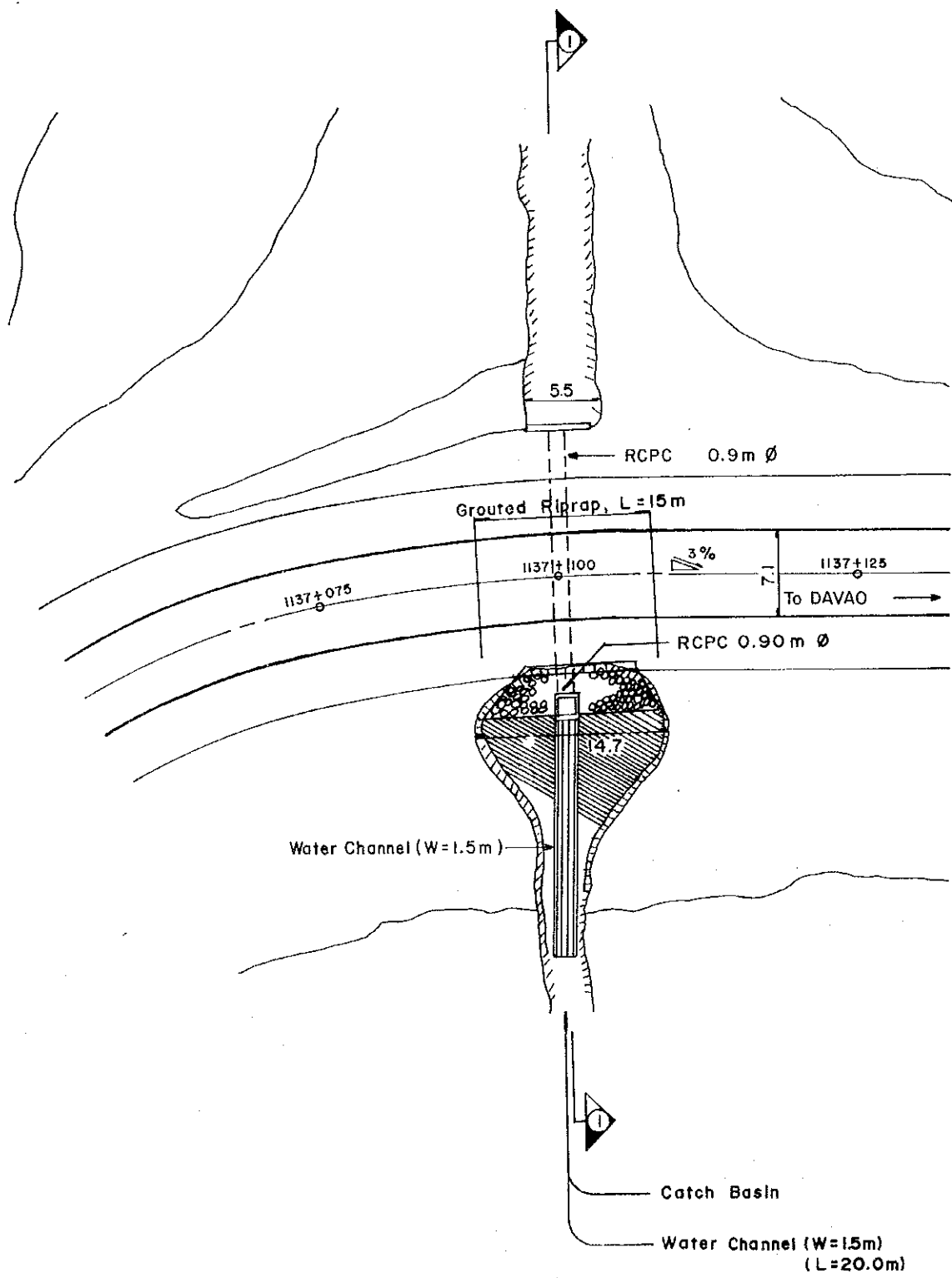


CROSS SECTION
SCALE : 1:300

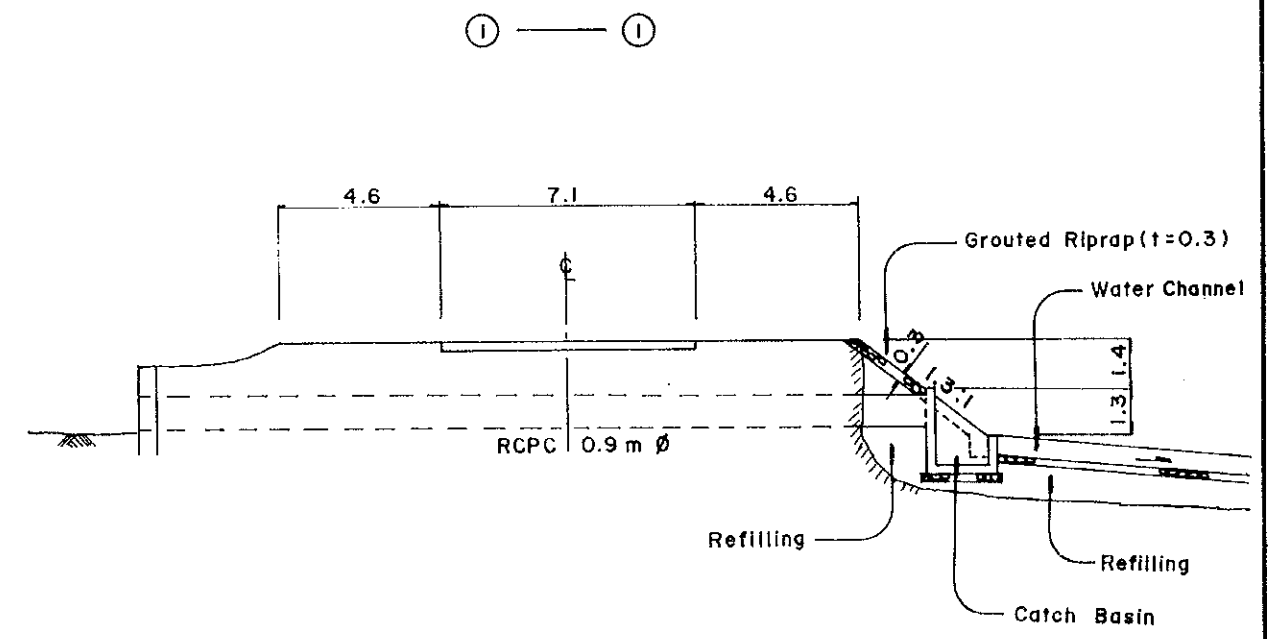
SUMMARY OF QUANTITY

TYPE OF WORK	UNIT	TOTAL
5-5 REFILLING / EMBANKMENT	CU. M.	1922
5-22 CYLINDER GABION (0.6 m Ø)	CU. M.	860
5-33 RCPC (1.5 m Ø)	L. M.	16
5-38 CATCH BASIN FOR RCPC 1.5 m Ø	E. M.	1
5-27 VERTICAL DITCH	L. M.	20
5-28 WATER CHANNEL (W=1.5m)	L. M.	20
5-41 HEAD WALL FOR RCPC 1.5 m Ø	E. A.	1
5-4 STRUCTURAL EXCAVATION	CU. M.	117
5-8 FOUNDATION FILL	CU. M.	90

Cause of Disaster:
1) Scouring by flow of river with flood stage.
2) Creek overflowing and scouring the embankment.



P L A N

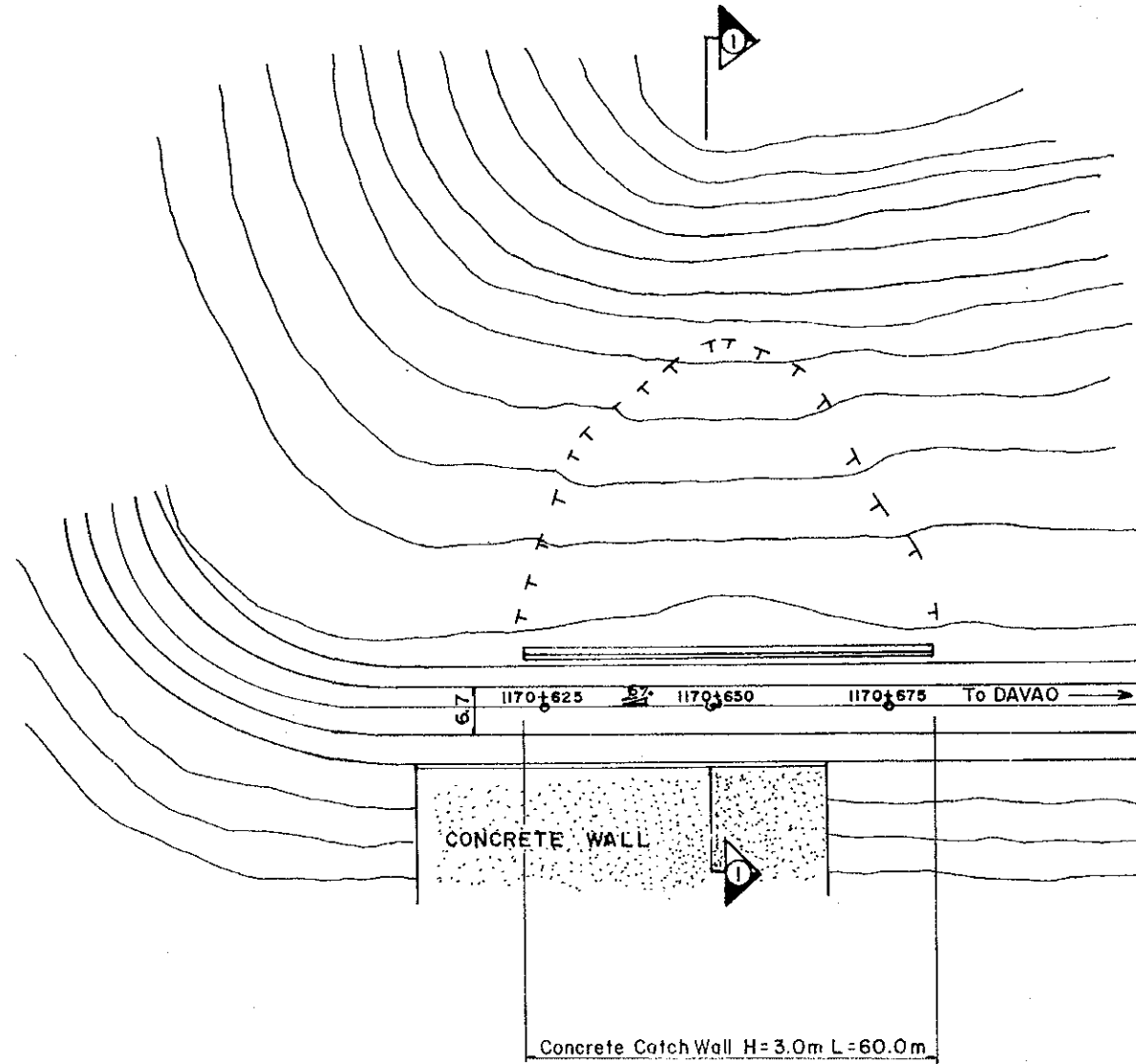


CROSS SECTION
SCALE 1:200

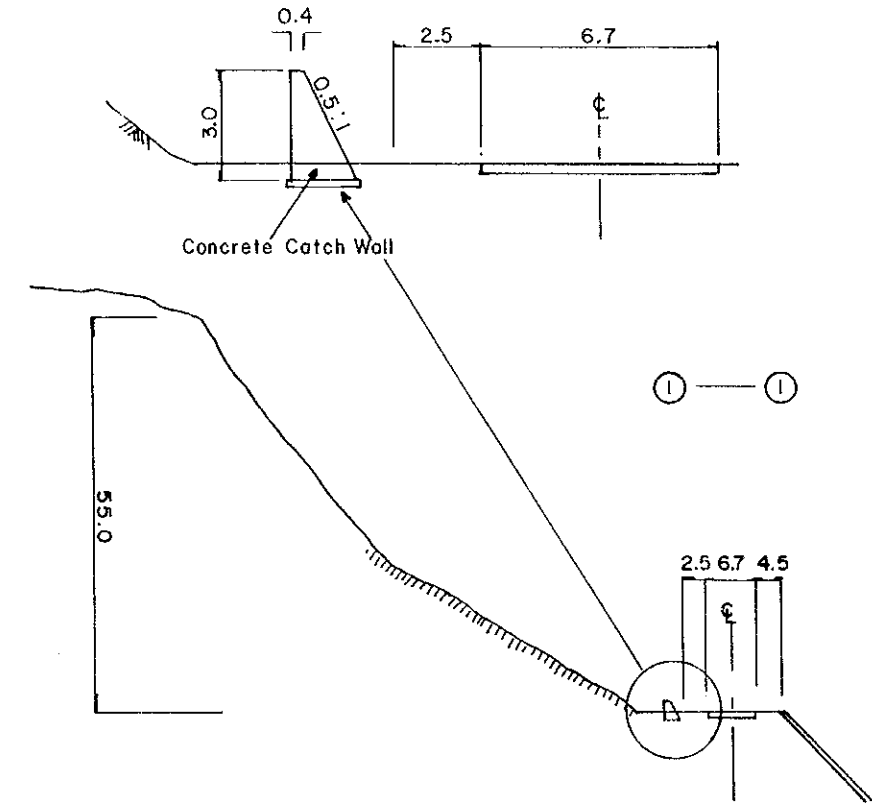
SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	223
5-19	GROUTED RIPRAP	CU.M	21
5-31	RCPC 0.90 m Ø	L. M.	2
5-37	CATCH BASIN FOR RCPC 0.90 m Ø	E. A.	1
5-28	WATER CHANNEL (W=1.5m)	L. M.	20

- Cause of Disaster:
- 1) Erosion at the foot of slope by pond water.
 - 2) Inadequate out-let facility of pipe culvert.
 - 3) Embankment slope with an unstable grade.



P L A N

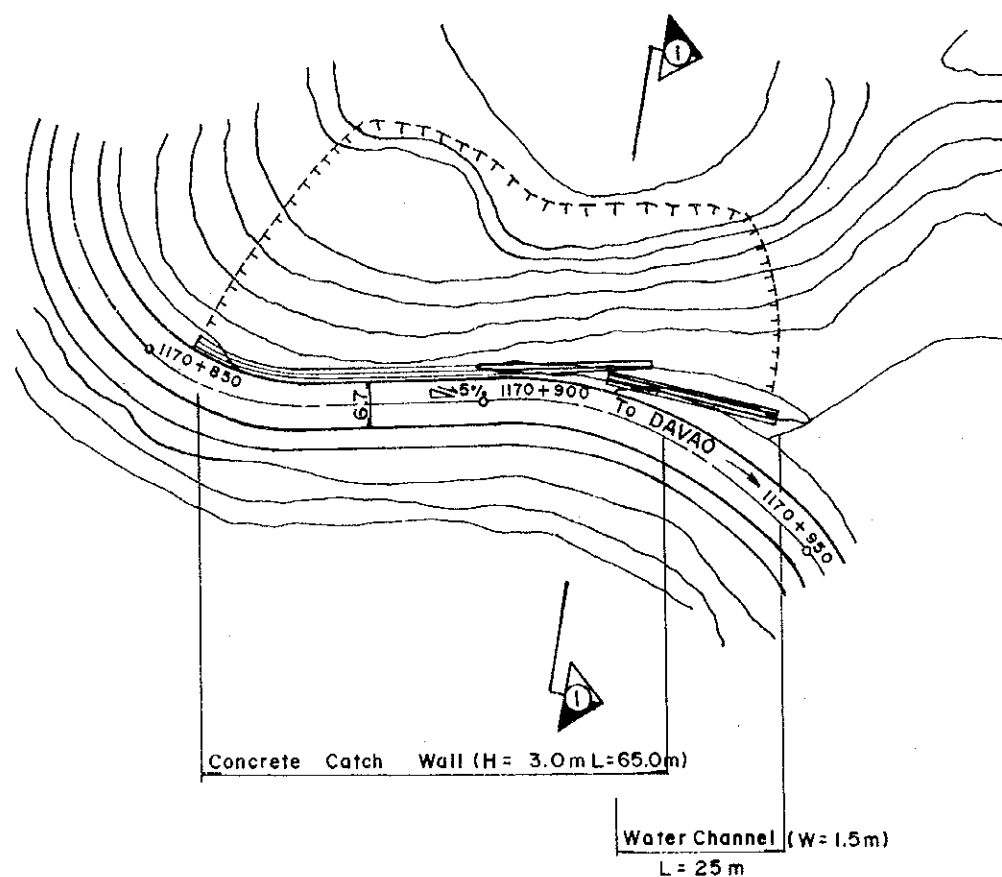


CROSS SECTION
SCALE: 1:1000

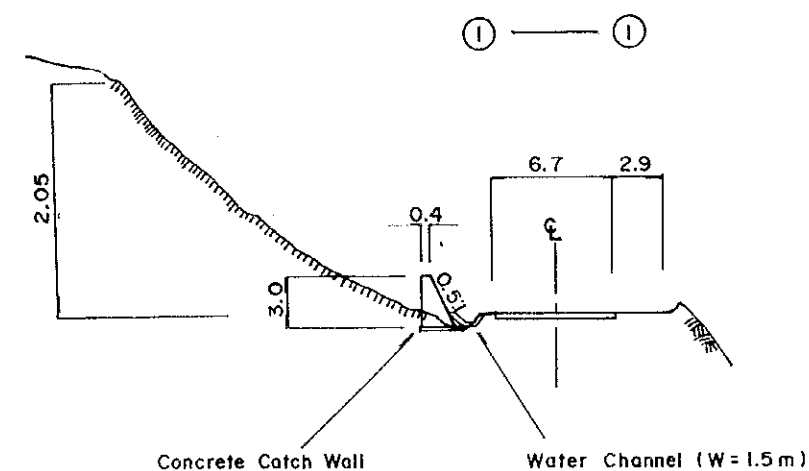
Cause of Disaster:
1) Failure due to exfoliation of limestone.

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-25	CONCRETE CATCH WALL	CU.M	207
5-4	STRUCTURAL EXCAVATION	CU.M	114
5-8	FOUNDATION FILL	CU.M	62



P L A N



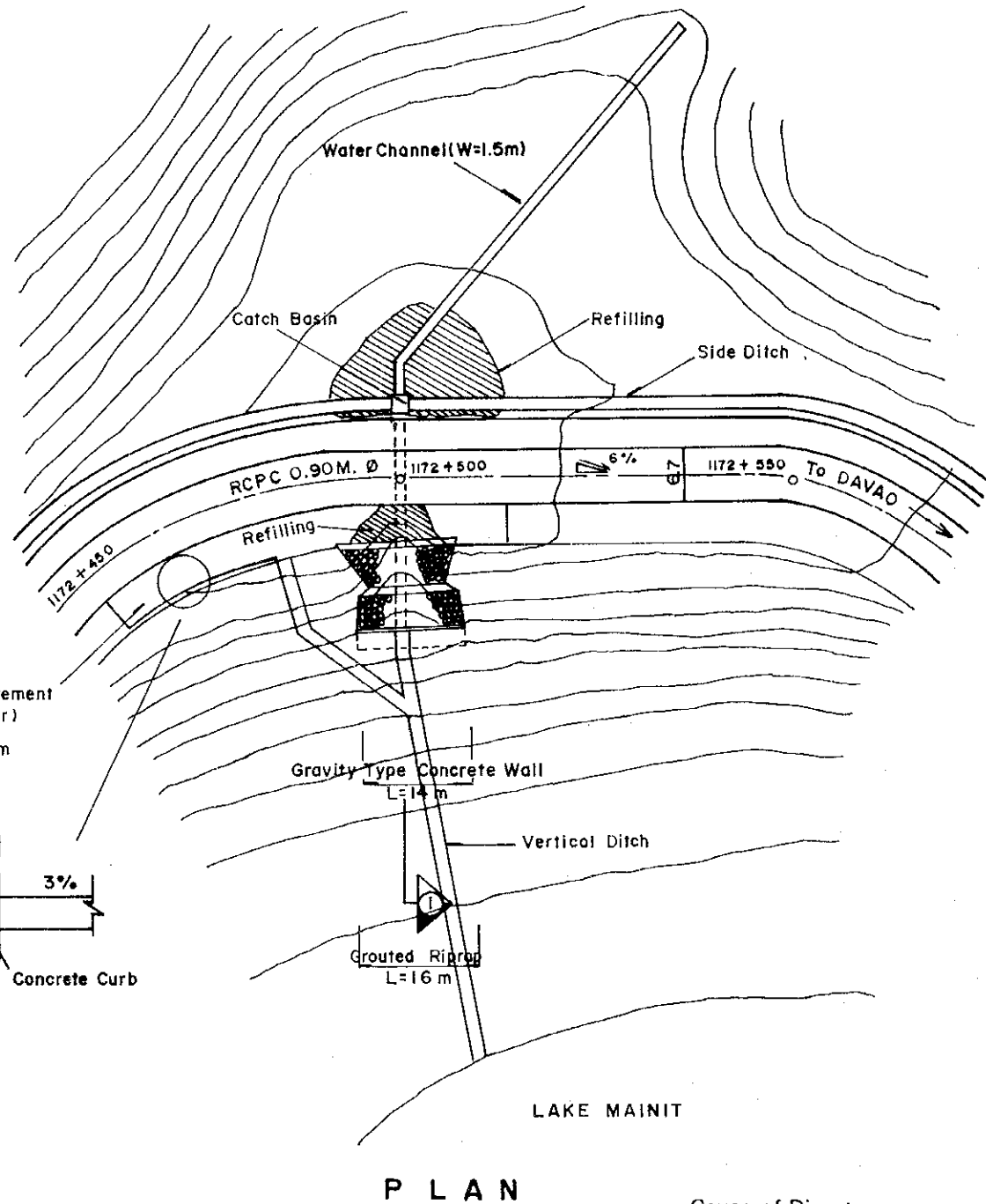
CROSS SECTION
SCALE : 1:400

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-25	CONCRETE CATCH WALL	CU. M	224
5-28	WATER CHANNEL (W=1.5m)	L. M	25
5-4	STRUCTURAL EXCAVATION	CU. M	123
5-8	FOUNDATION FILL	CU. M	67

Cause of Disaster:

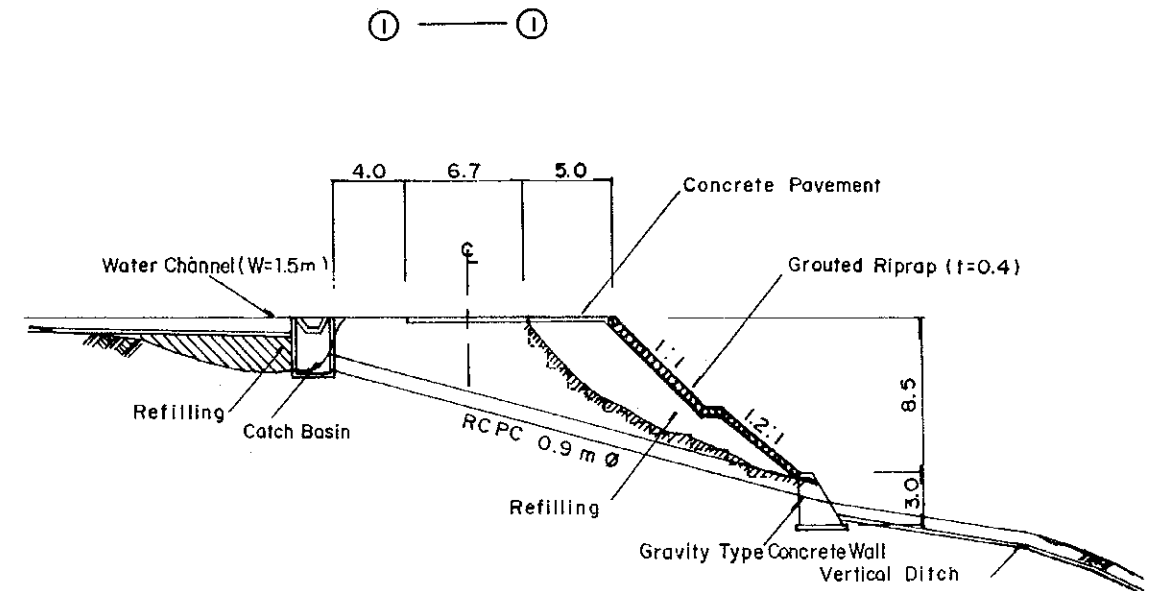
- 1) Failure due to lateralization: Rain wash of surface layer composed of laterite.



P L A N

Cause of Disaster:

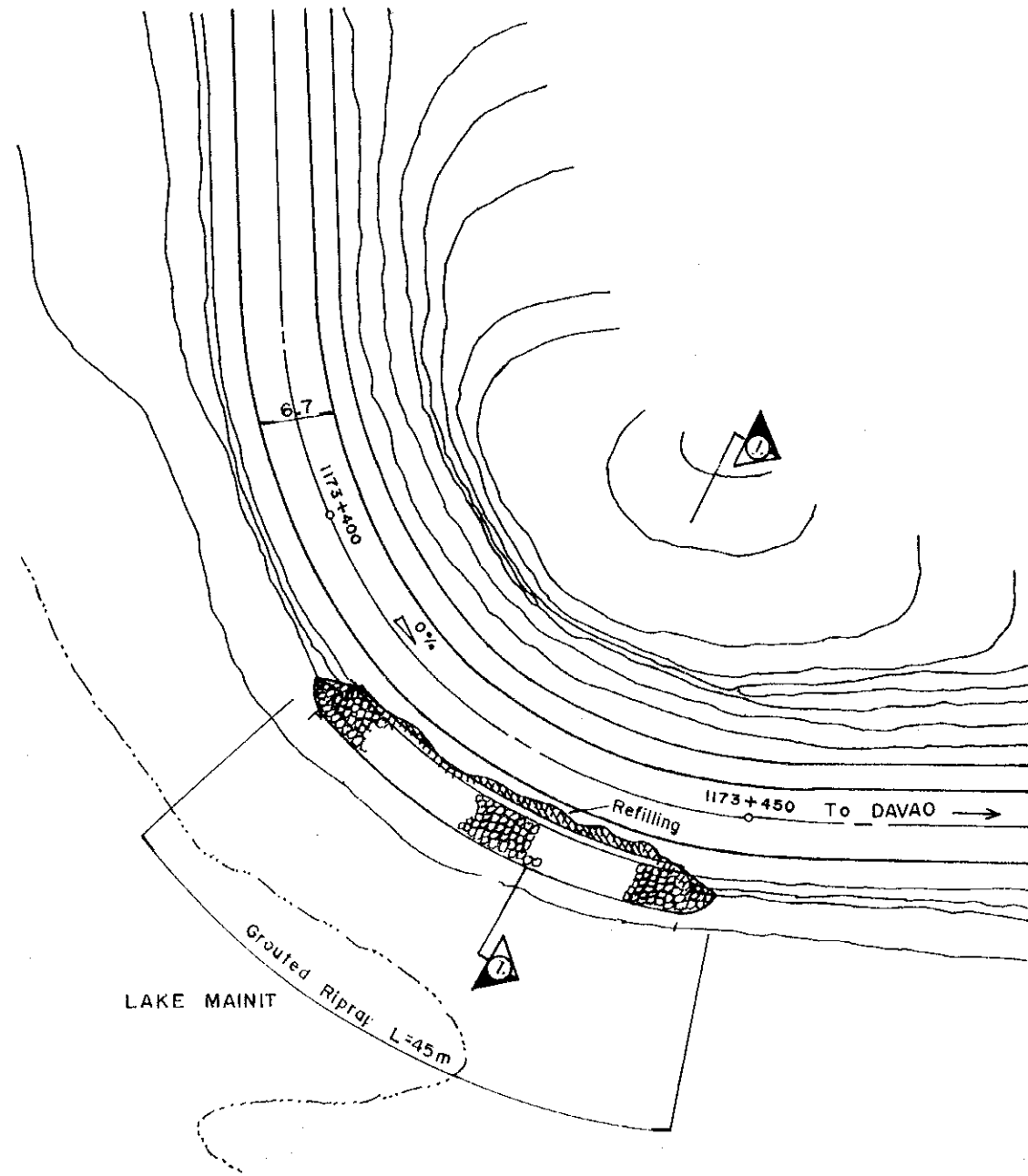
- 1) Insufficient compaction of embankment.
- 2) Creek which overflowed and scoured the embankment.
- 3) Embankment slope with an unstable grade.



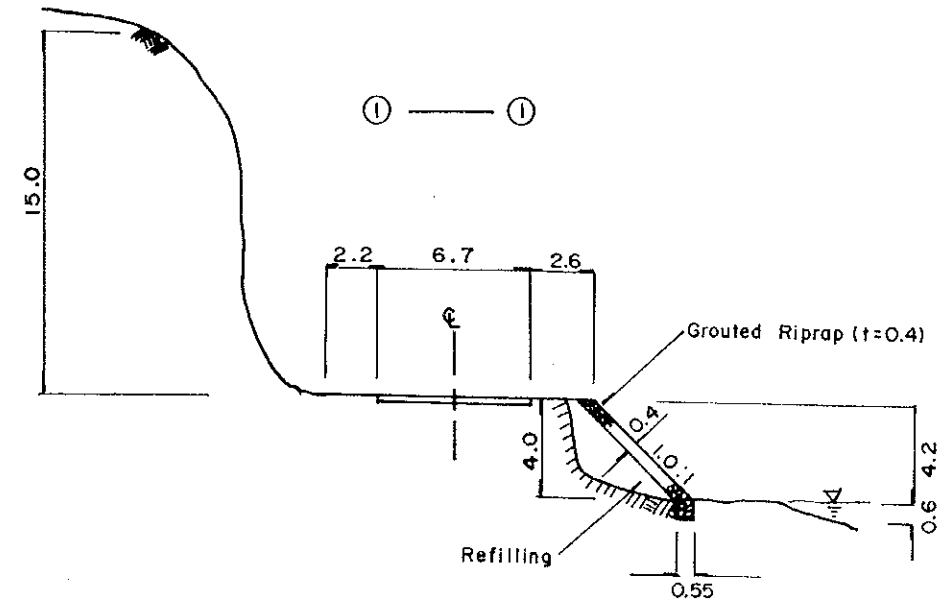
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	772
5-19	GROUTED RIPRAP	CU.M	68
5-14	GRAVITY TYPE CONCRETE WALL	CU.M	59
5-28	WATER CHANNEL (W=1.5)	L.M	60
5-27	VERTICAL DITCH	L.M	80
5-37	CATCH BASIN FOR RCPC 0.9m Ø	E.A	1
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ.M	250
5-4	STRUCTURAL EXCAVATION	CU.M	102
5-8	FOUNDATION FILL	CU.M	58
5-45	CONCRETE CURB	L.M	30



P L A N



CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING/ EMBANKMENT	CU. M	285
5-19	GROUTED RIPRAP	CU. M	108

Cause of Disaster:

- 1) Erosion by water of lake with flood stage.

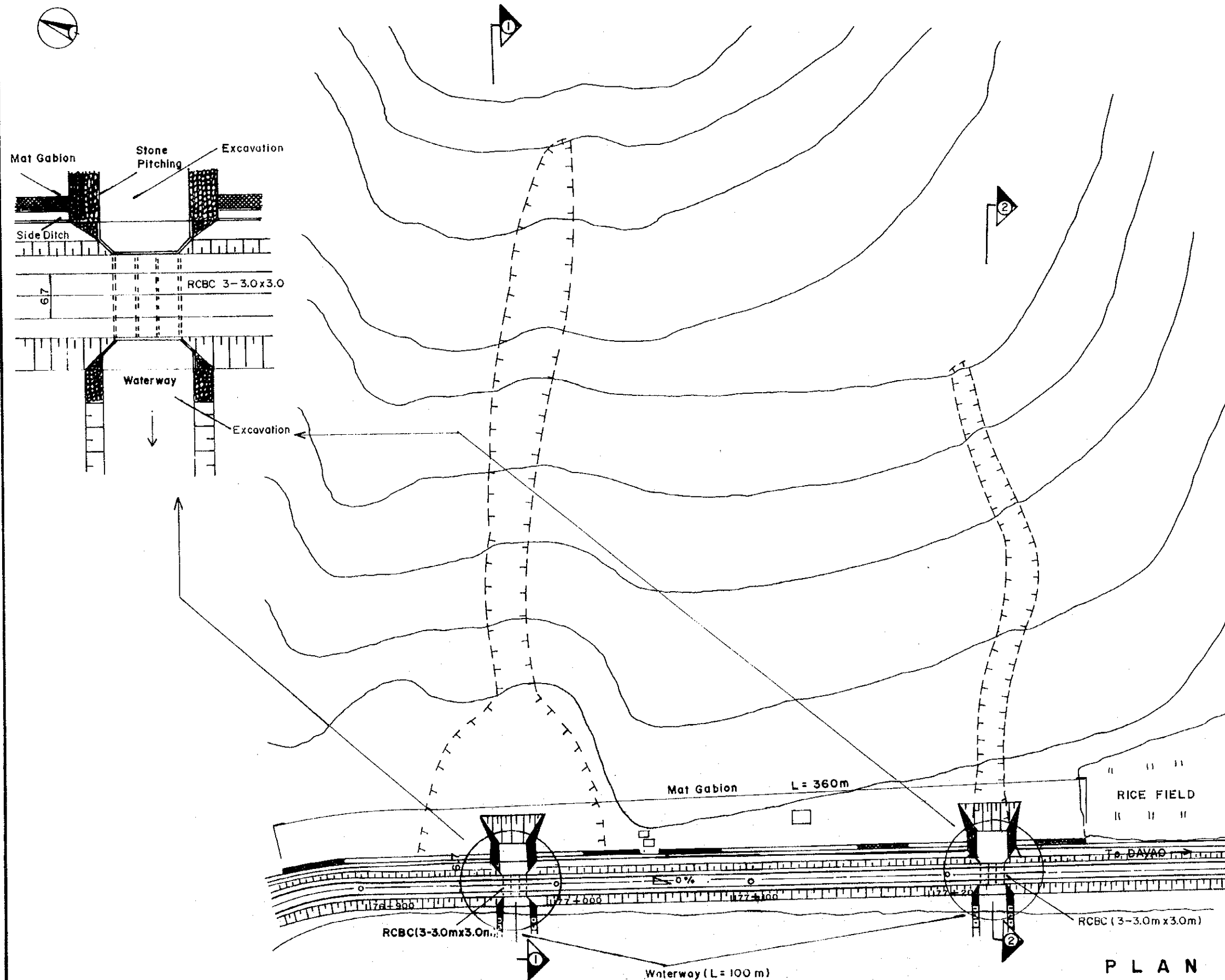
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

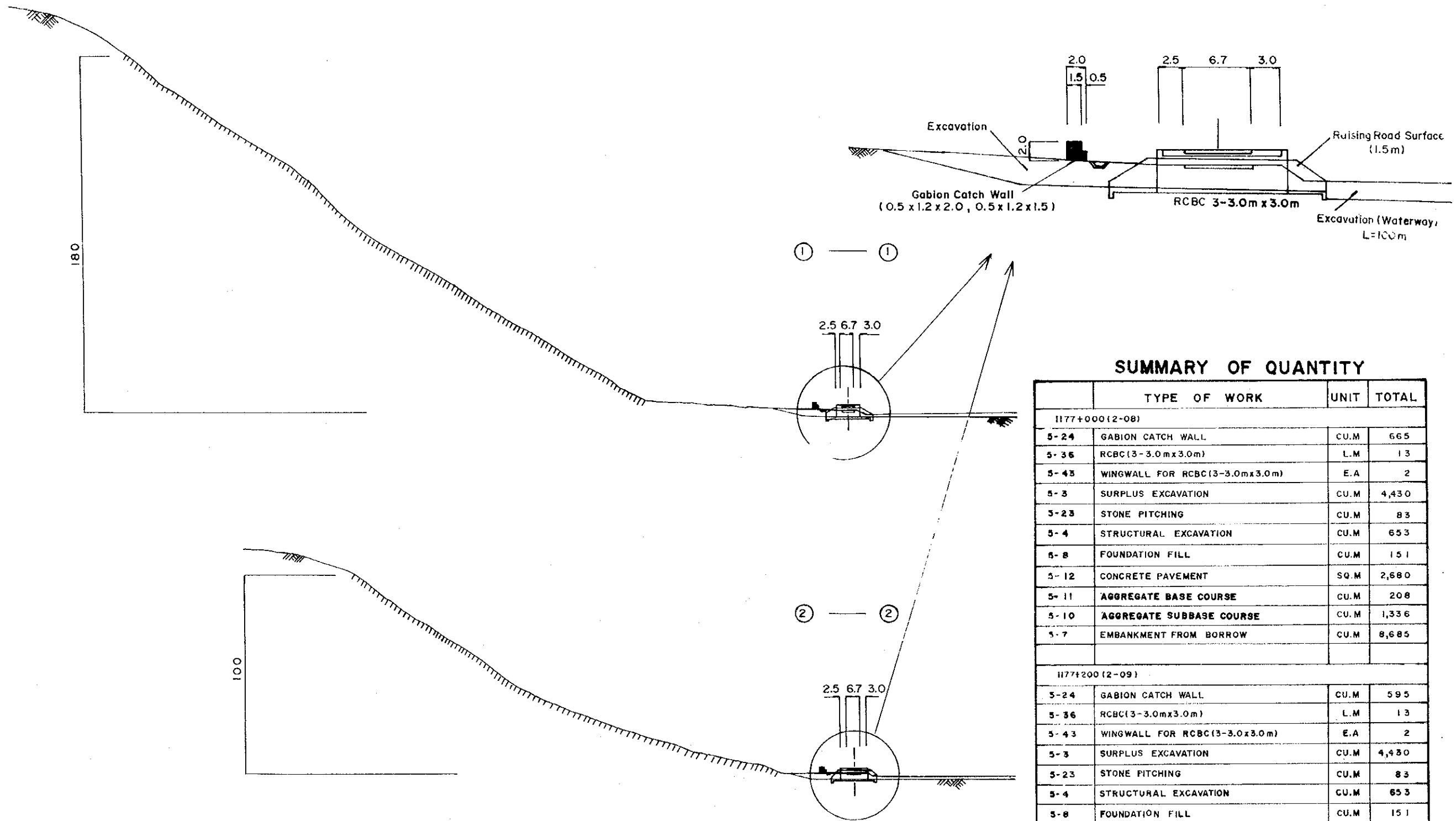
SLOPE NO. : 2-08, 2-09
TYPE OF DISASTER

STATION : 1177+000, 1177+200
DEBRIS FLOW

SCALE
NOT TO SCALE

DRAWING NO.
S-12(1/2)





SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
1177+000 (2-08)			
5-24	GABION CATCH WALL	CU.M	665
5-36	RCBC (3-3.0m x 3.0m)	L.M	13
5-43	WINGWALL FOR RCBC (3-3.0m x 3.0m)	E.A	2
5-3	SURPLUS EXCAVATION	CU.M	4,430
5-23	STONE PITCHING	CU.M	83
5-4	STRUCTURAL EXCAVATION	CU.M	653
5-8	FOUNDATION FILL	CU.M	151
5-12	CONCRETE PAVEMENT	SQ.M	2,680
5-11	AGGREGATE BASE COURSE	CU.M	208
5-10	AGGREGATE SUBBASE COURSE	CU.M	1,336
5-7	EMBANKMENT FROM BORROW	CU.M	8,685
1177+200 (2-09)			
5-24	GABION CATCH WALL	CU.M	595
5-36	RCBC (3-3.0m x 3.0m)	L.M	13
5-43	WINGWALL FOR RCBC (3-3.0m x 3.0m)	E.A	2
5-3	SURPLUS EXCAVATION	CU.M	4,430
5-23	STONE PITCHING	CU.M	83
5-4	STRUCTURAL EXCAVATION	CU.M	653
5-8	FOUNDATION FILL	CU.M	151
5-12	CONCRETE PAVEMENT	SQ.M	1,340
5-11	AGGREGATE BASE COURSE	CU.M	104
5-10	AGGREGATE SUBBASE COURSE	CU.M	668
5-7	EMBANKMENT FROM BORROW	CU.M	4,342

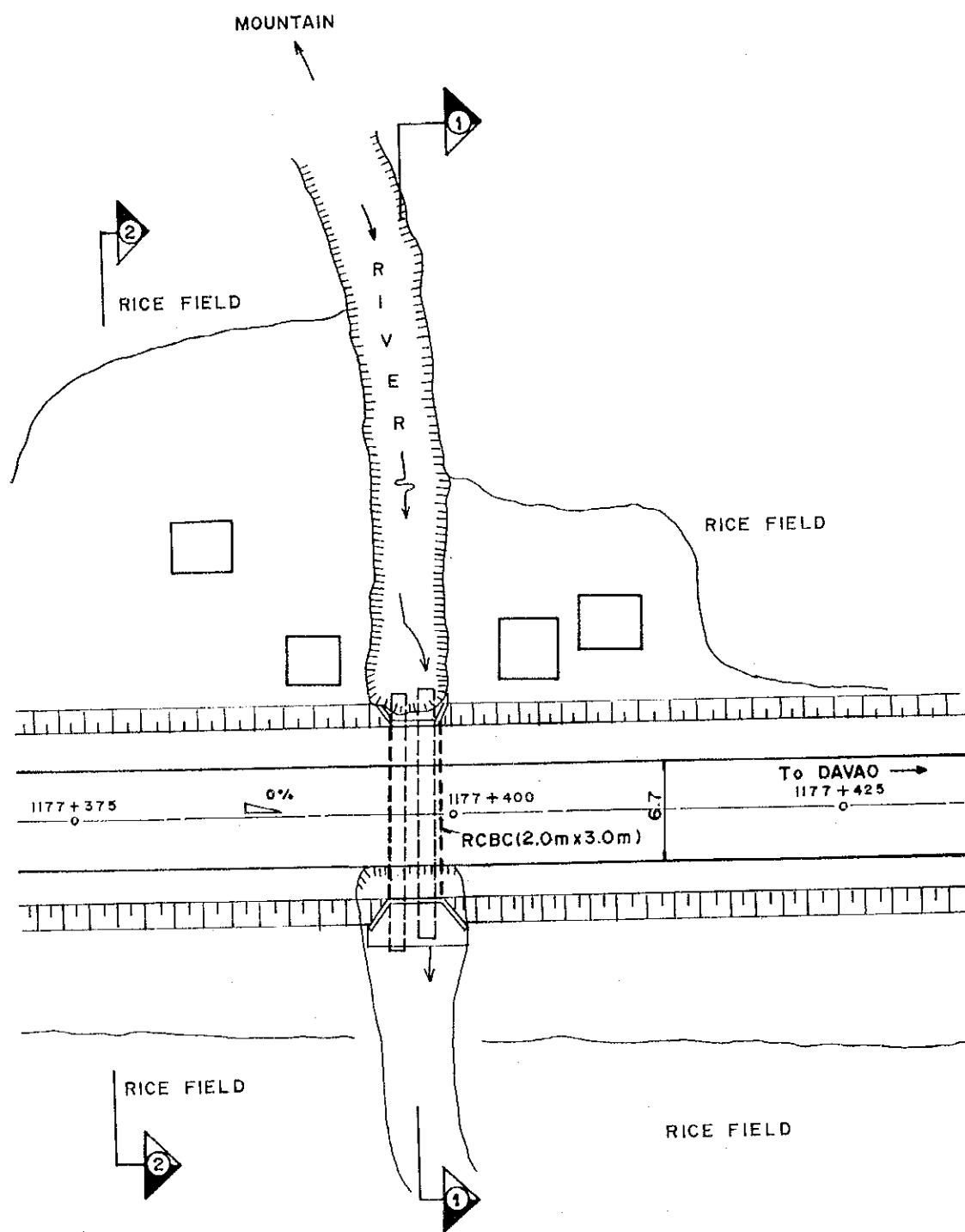
CROSS SECTION
SCALE 1:2000

Cause of Disaster:

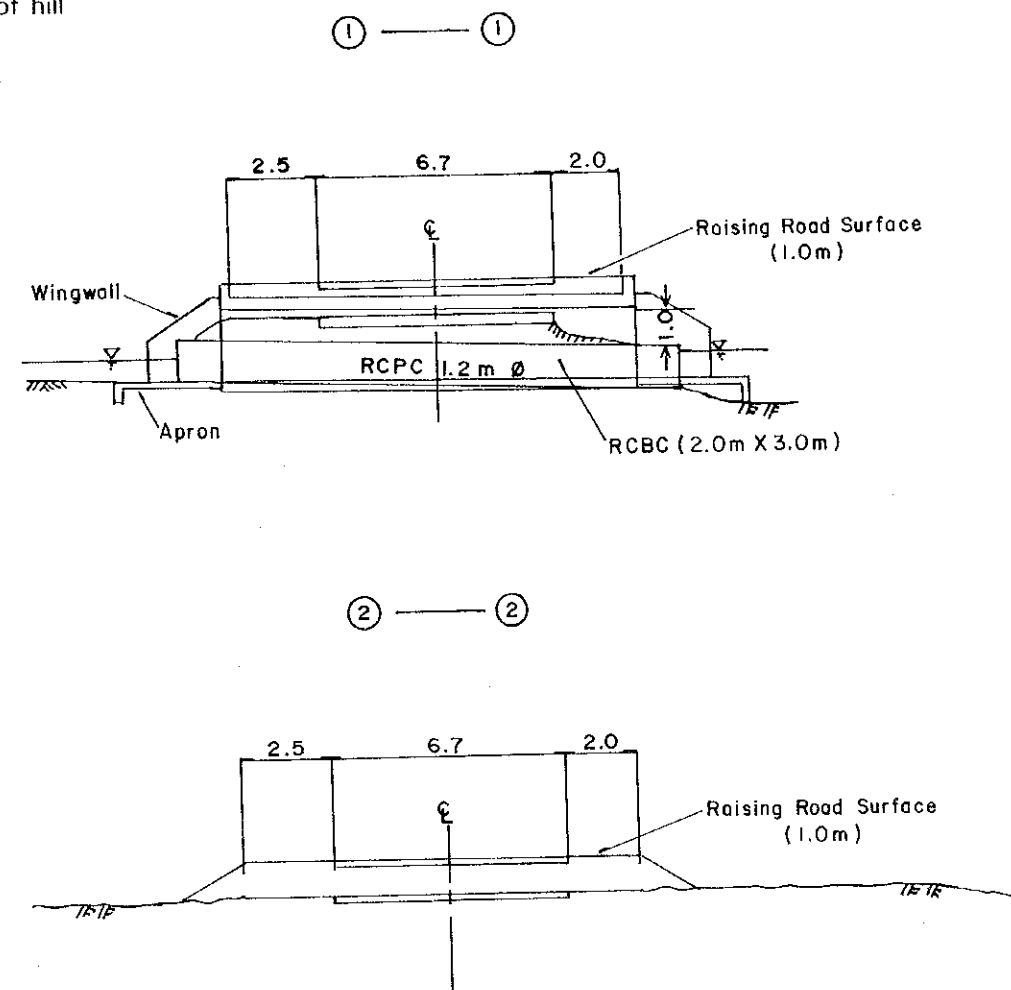
- 1) Flow of debris supplied by slope failures, deposited on the side of hill and flashed down by heavy rain.

Cause of Disaster:

- 1) Flow of debris supplied by slope failures, deposited on the side of hill and flashed down by heavy rain.
- 2) Insufficient drainage capacity of pipe culvert and poor maintenance.



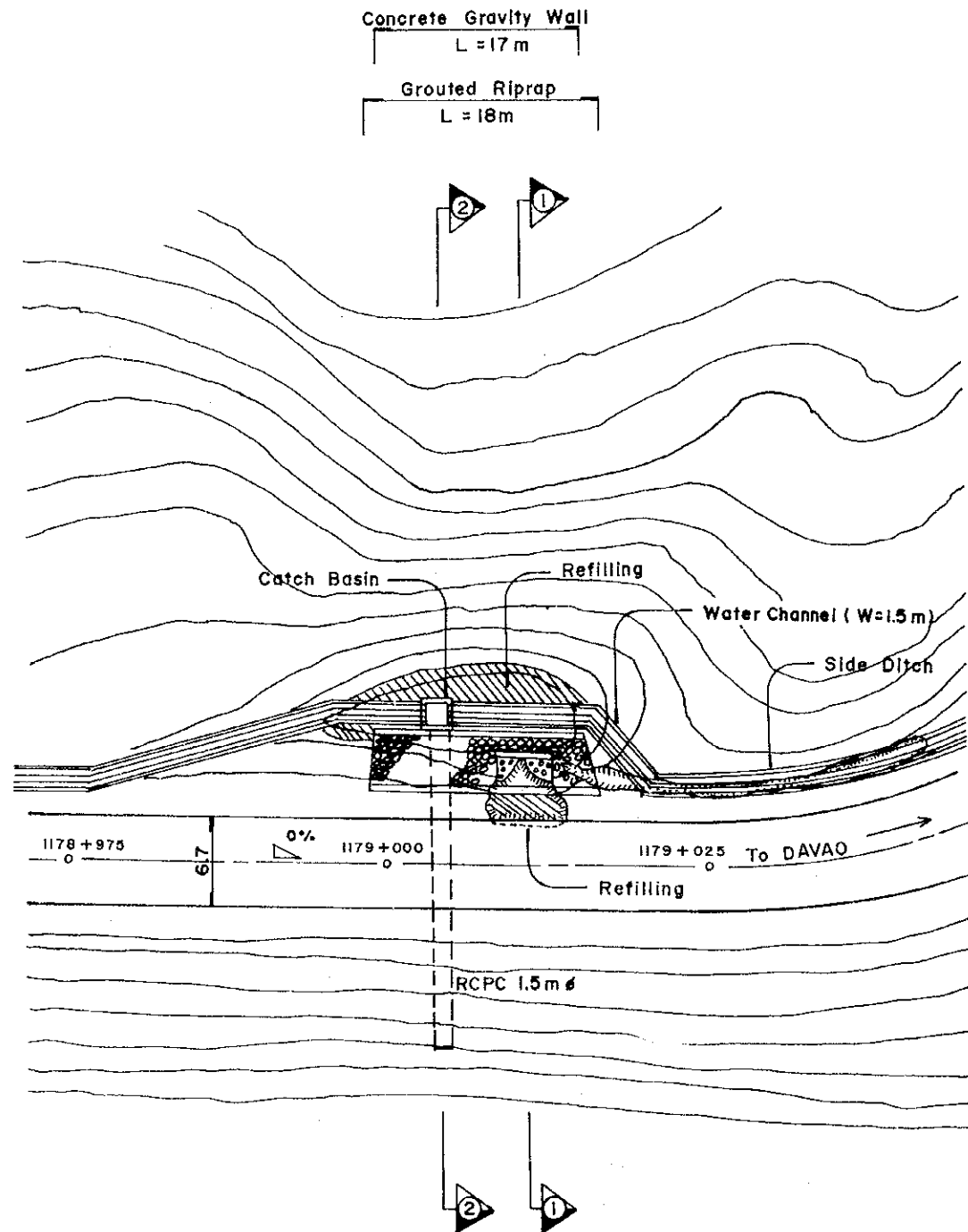
P L A N



CROSS SECTION
SCALE 1:200

SUMMARY OF QUANTITY

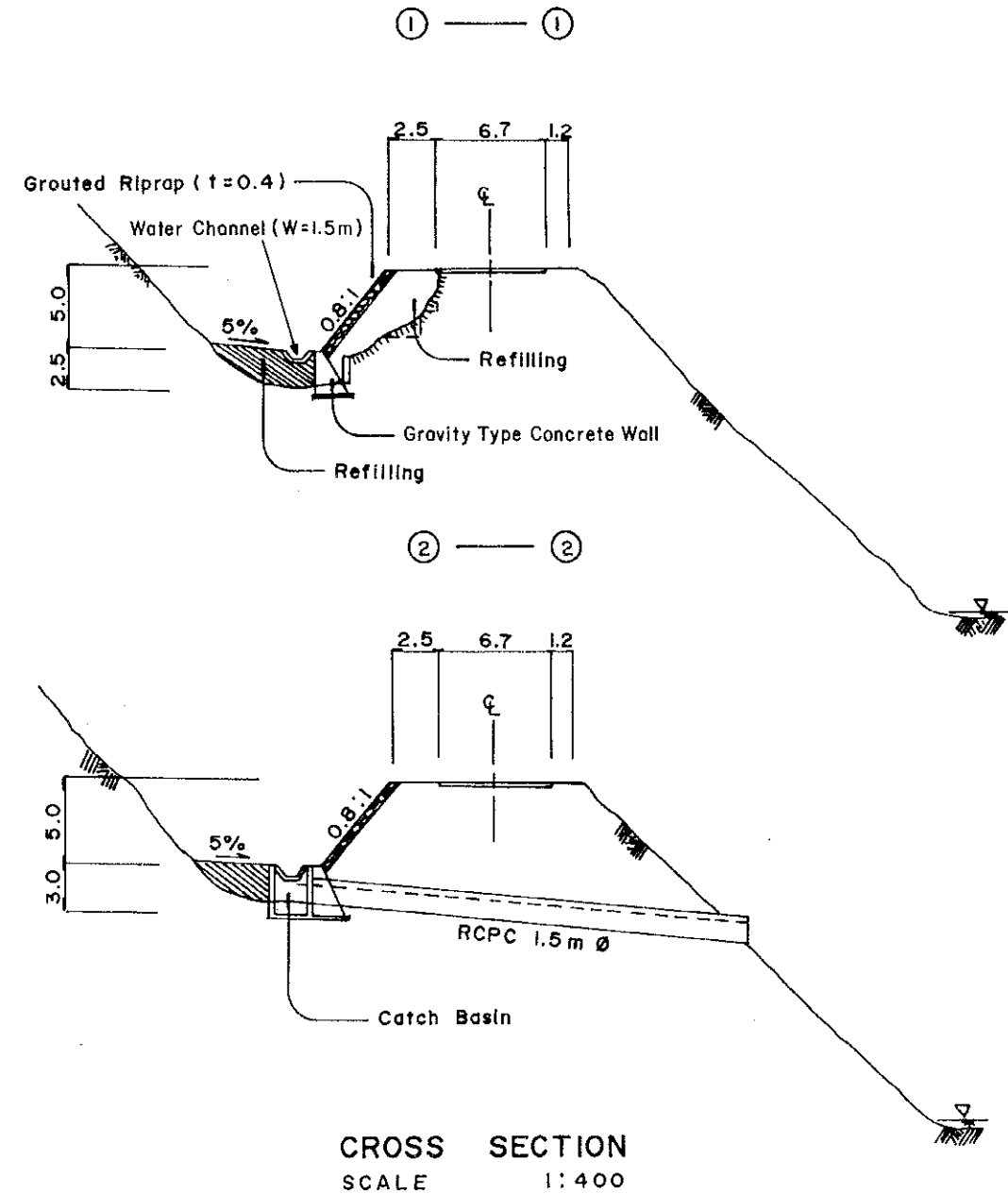
	TYPE OF WORK	UNIT	TOTAL
5-35	RCBC (2.0 x 3.0 m.)	L.M	12
5-42	WING WALL FOR RCBC (2.0 x 3.0 m.)	E.A	2
5-4	STRUCTURAL EXCAVATION	CU.M	131
5-8	FOUNDATION FILL	CU.M	19
5-12	CONCRETE PAVEMENT	SQ.M	2,010
5-11	AGGREGATE BASE COURSE	CU.M	156
5-10	AGGREGATE SUBBASE COURSE	CU.M	1,002
5-7	EMBANKMENT FROM BORROW	CU.M	3,138



P L A N

Cause of Disaster:

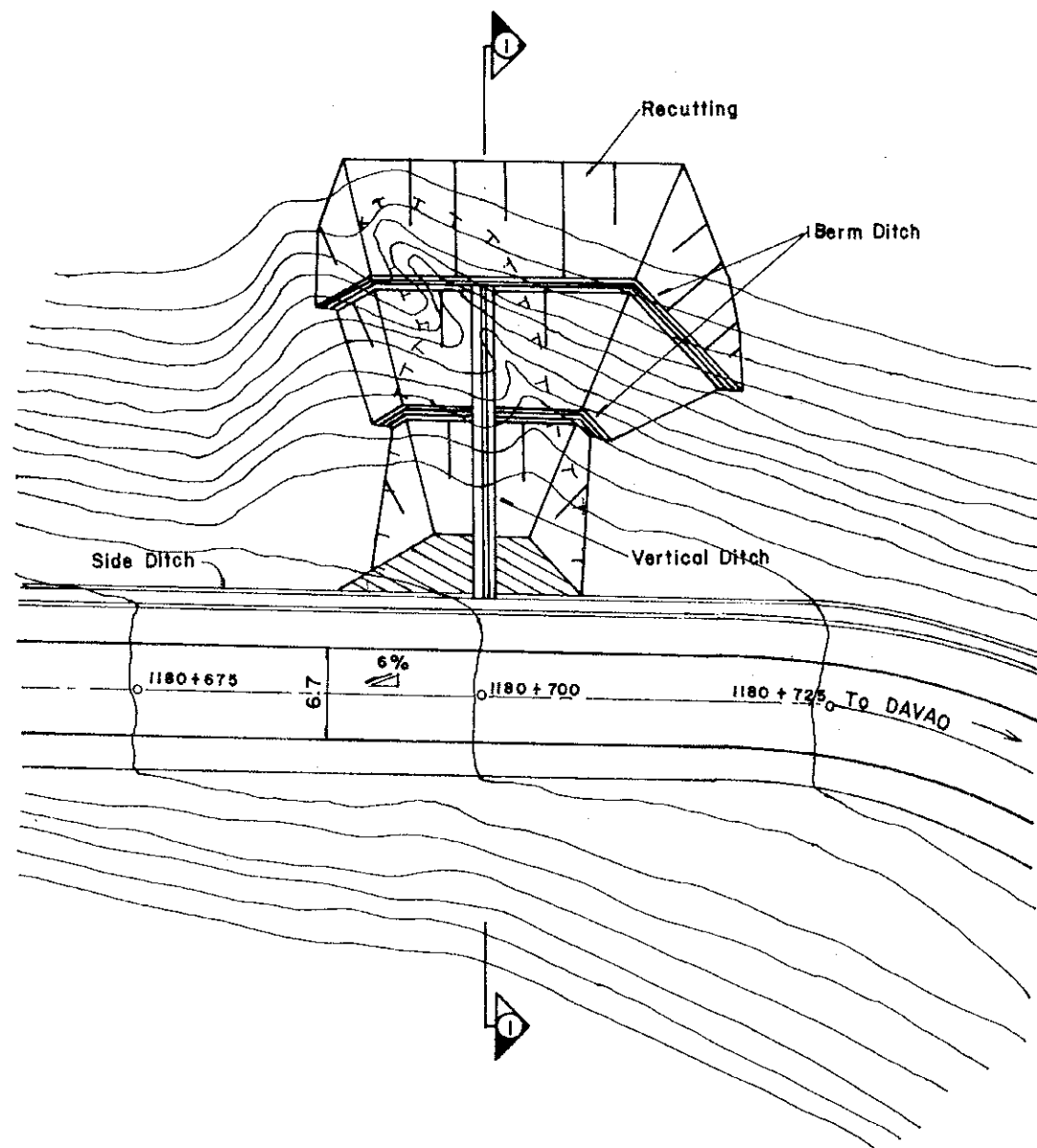
- 1) Effect of ground water.
- 2) Infiltration of water into boundary surface between the inclined ground and embankment.
- 3) Insufficient drainage capacity of pipe culvert.



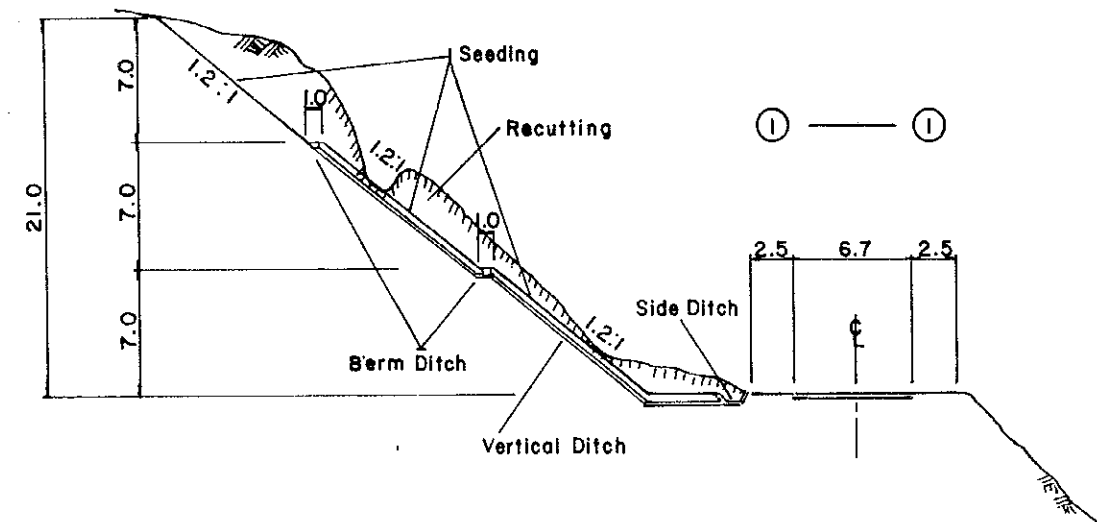
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	330
5-19	GROUTED RIPRAP	CU.M	48
5-14	GRAVITY TYPE CONCRETE WALL	CU.M	49
5-28	WATER CHANNEL (W=1.5 m)	L. M.	48
5-38	CATCH BASIN FOR RCPC (1.5m Ø)	E. A.	1
5-33	RCPC (1.5m Ø)	L. M.	26
5-4	STRUCTURAL EXCAVATION	CU.M	563
5-8	FOUNDATION FILL	CU.M	522



P L A N



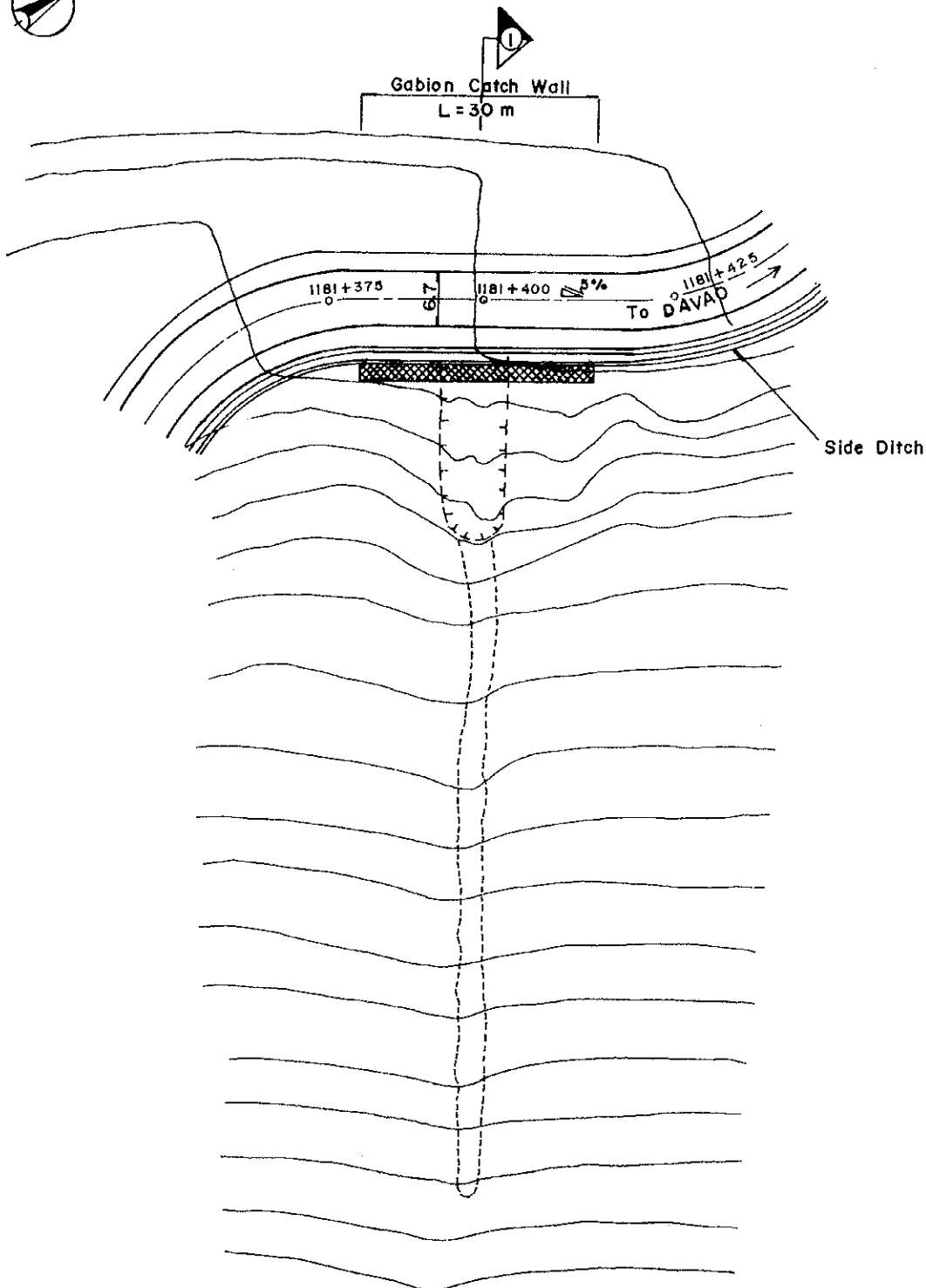
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

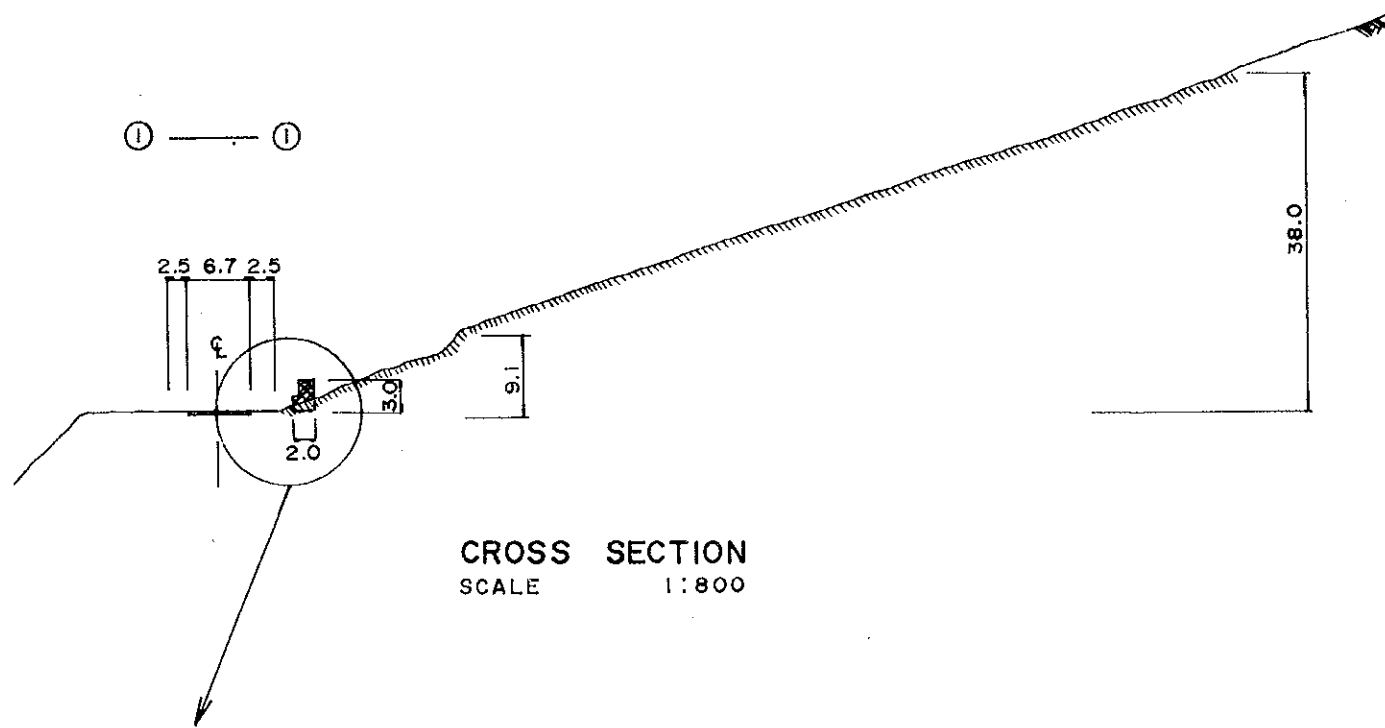
TYPE OF WORK		UNIT	TOTAL
5-2	RECURTING OF SOFT ROCK	CU. M	2,100
5-18	VEGETATION (SEEDING)	SQ. M	726
5-30	BERM DITCH	L. M	49
5-27	VERTICAL DITCH	L. M	39

Cause of Disaster:

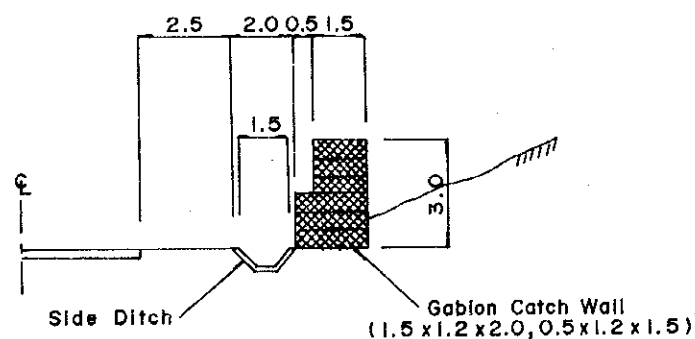
- 1) Surface failure of granite which has been severely weathered by rain.



P L A N



CROSS SECTION
SCALE 1:800

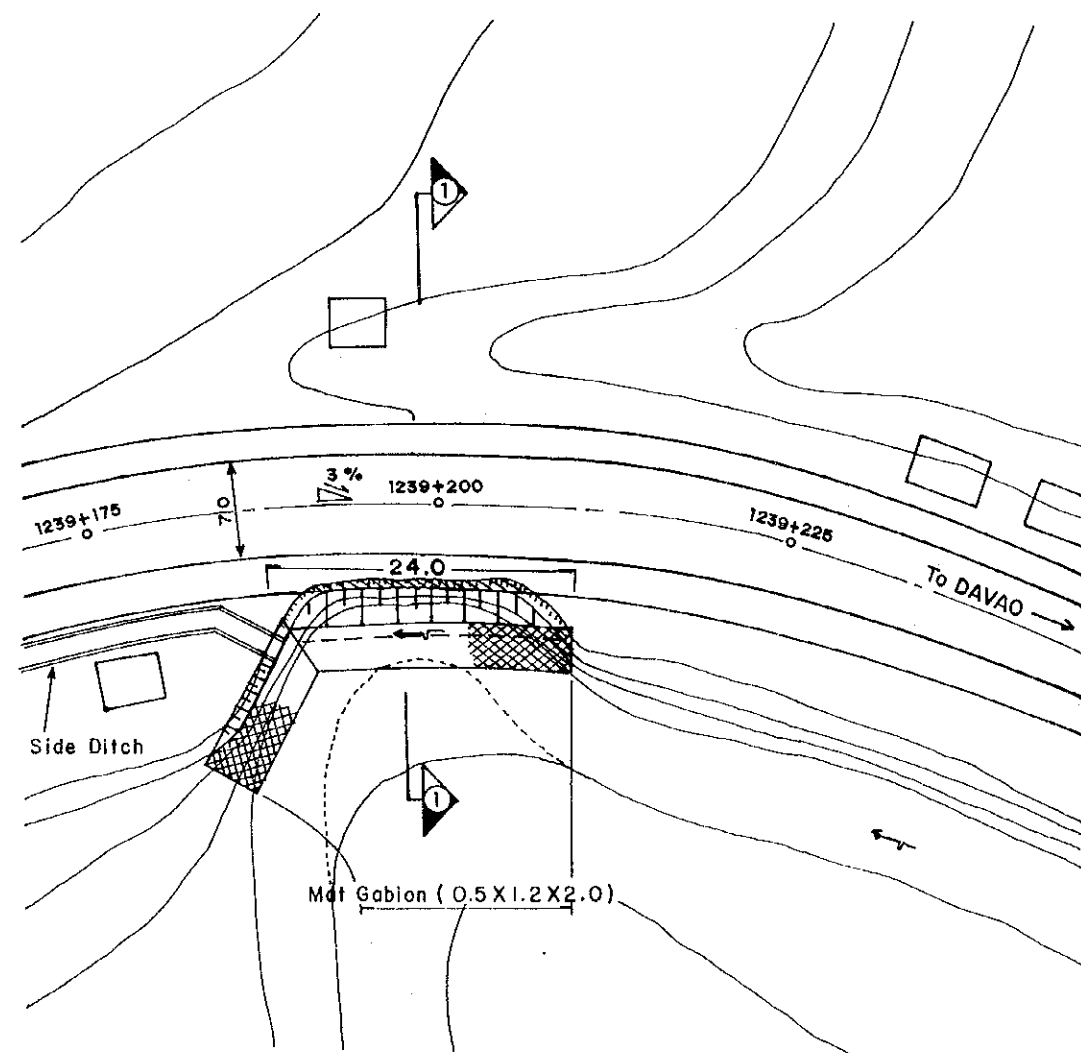


SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-24	GABION CATCH WALL	CU.M	158

Cause of Disaster:

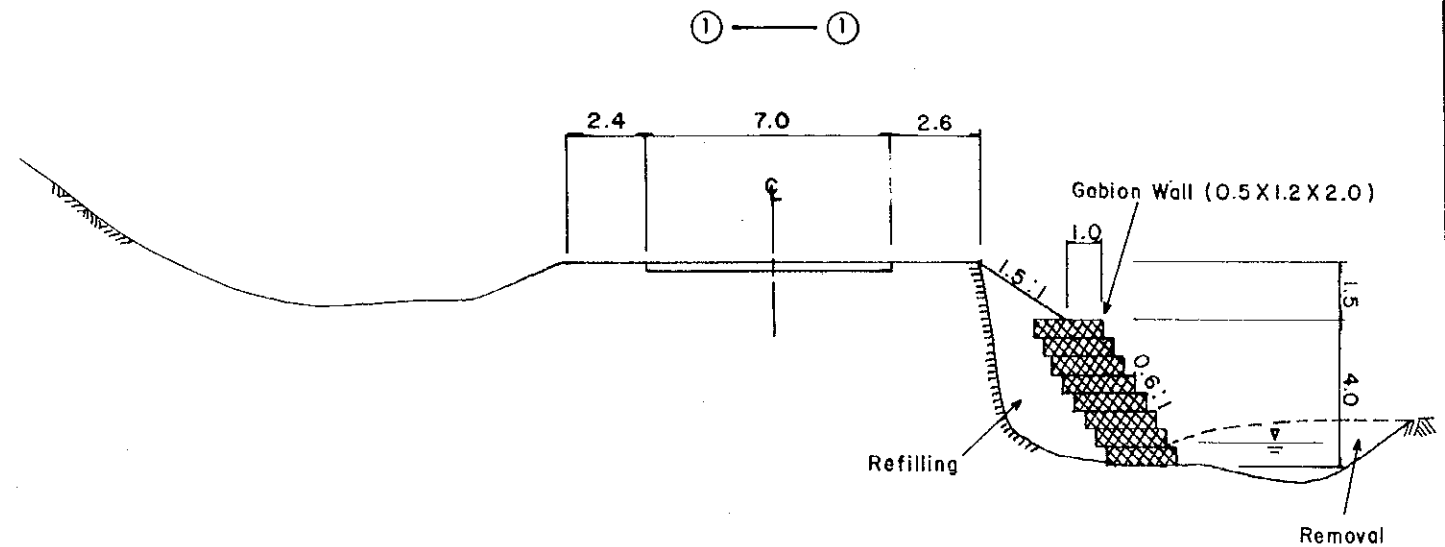
- 1) Flow of debris supplied by slope failures, deposited on the side of hill and flashed down by heavy rain.



P L A N

Cause of Disaster:

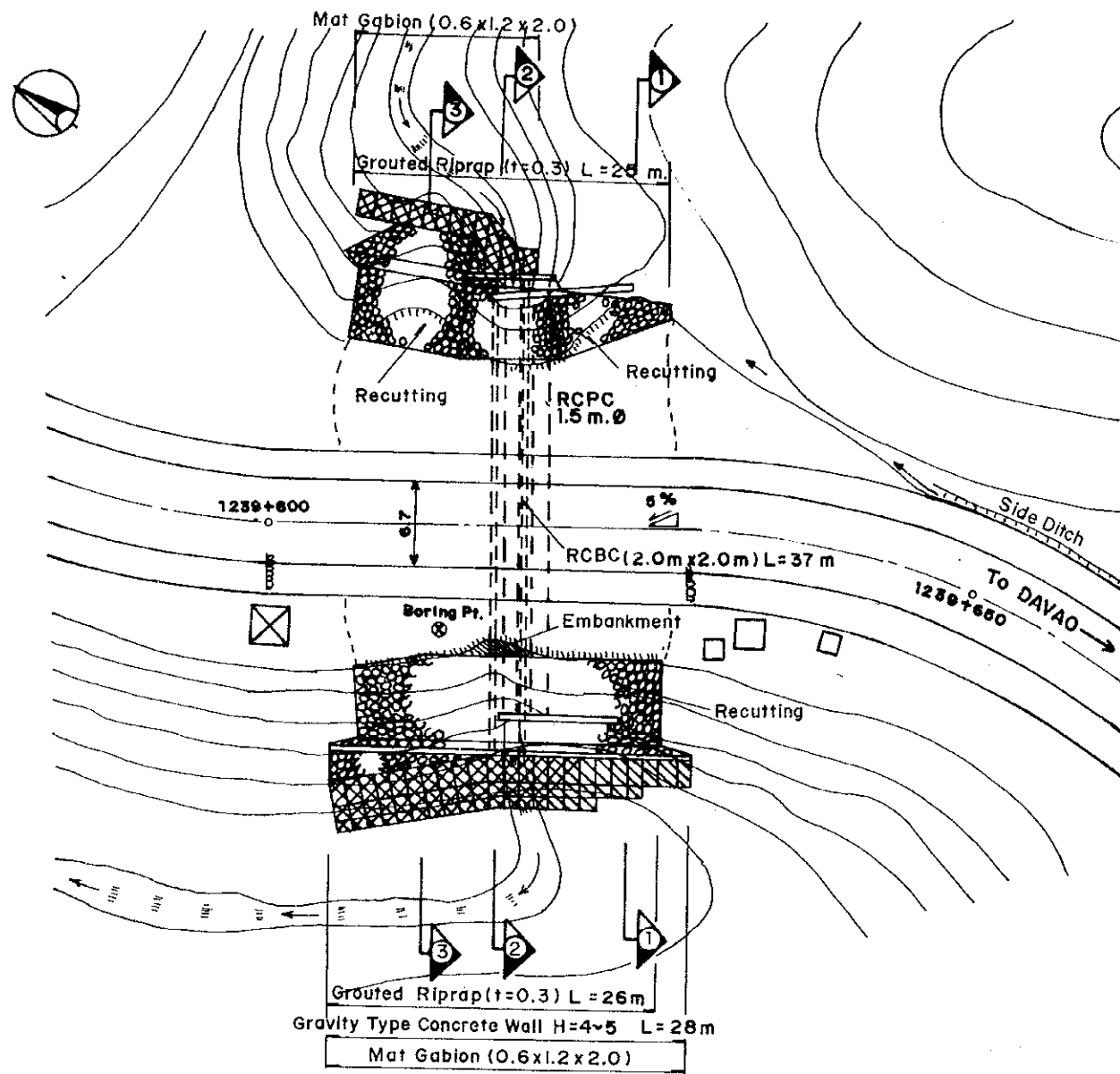
- 1) Scouring by flow of river with flood stage.
- 2) Erosion due to concentrated surface water on the curved portion of road.
- 3) Embankment slope with an unstable grade.



CROSS SECTION
SCALE: 1:200

SUMMARY OF QUANTITY

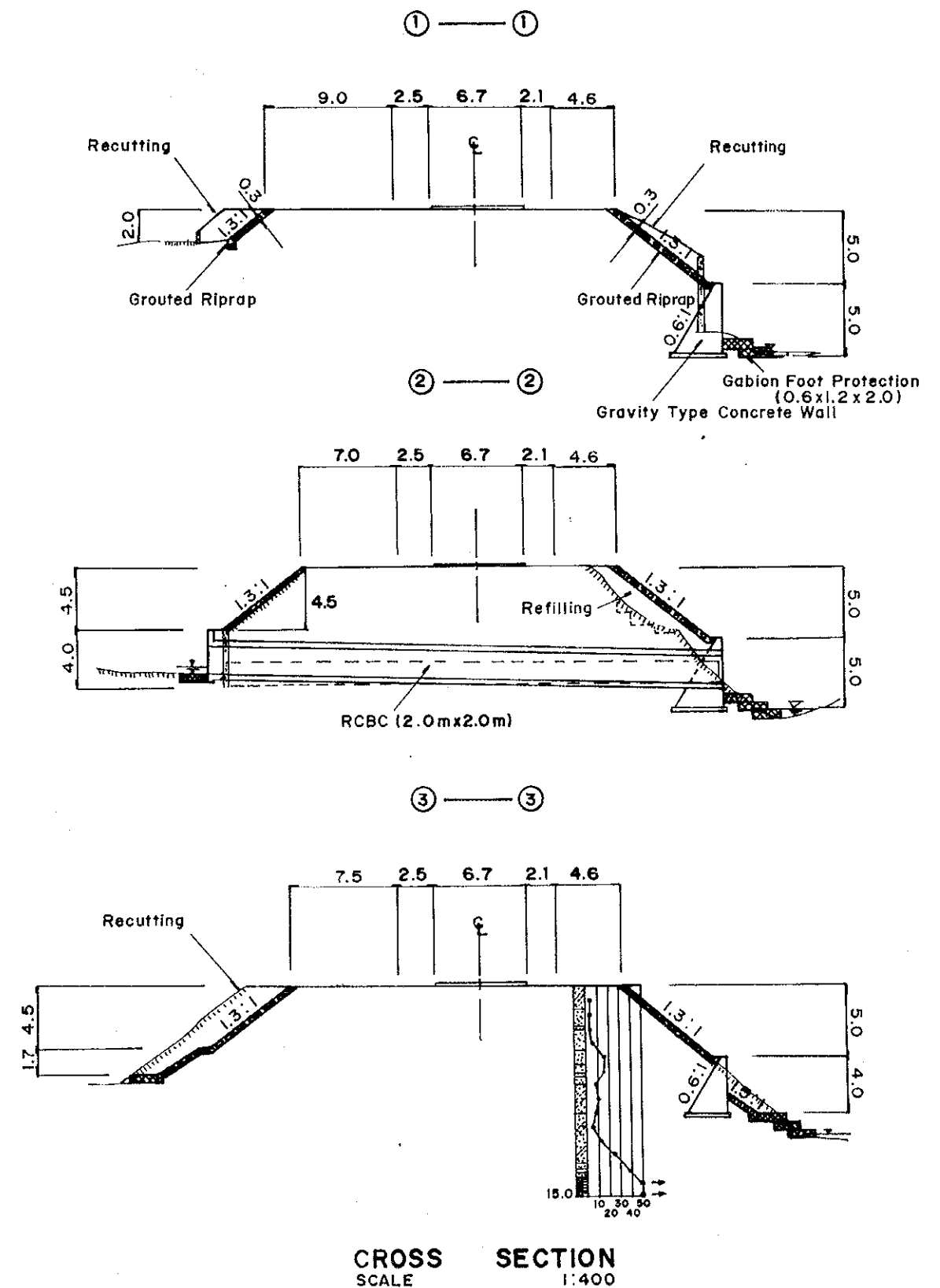
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING/EMBANKMENT	CU.M	125
5-17	GABION WALL	CU.M	240
5-4	STRUCTURAL EXCAVATION	CU.M	58



P L A N

SUMMARY OF QUANTITY

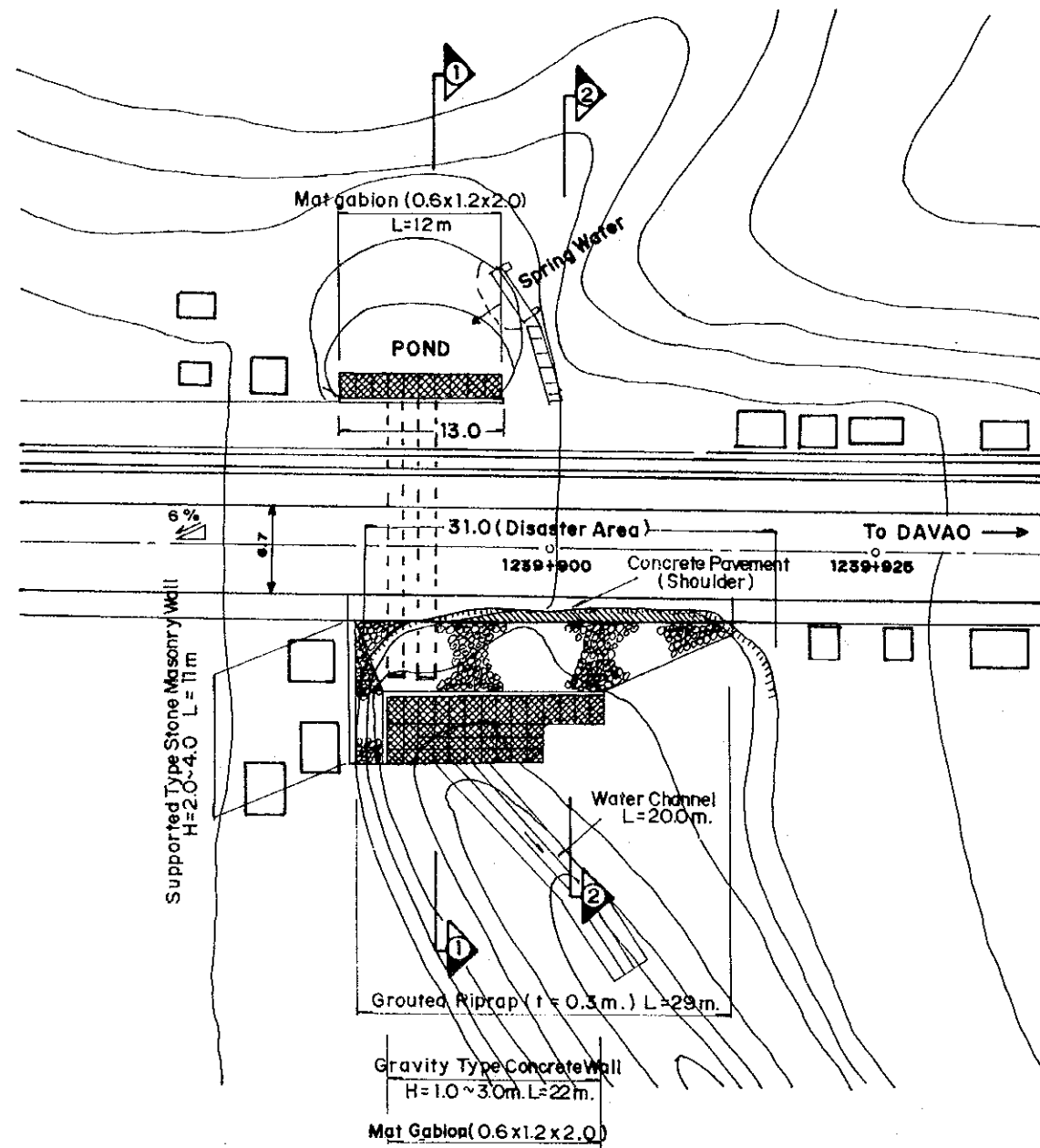
TYPE OF WORK	UNIT	TOTAL
5 - 5 REFFILLING / EMBANKMENT	CU. M.	60
5 - 1 RECUTTING OF SOIL	CU. M.	177
5 - 19 GROUTED RIPRAP	CU. M.	120
5 - 14 GRAVITY TYPE CONCRETE WALL	CU. M.	221
5 - 26 GABION FOOT PROTECTION	CU. M.	105
5 - 34 RCBC (2.0m x 2.0m)	L. M.	37
5 - 4 STRUCTURAL EXCAVATION	CU. M.	450
5 - 8 FOUNDATION FILL	CU. M.	220



CROSS SECTION
SCALE 1:400

Cause of Disaster:

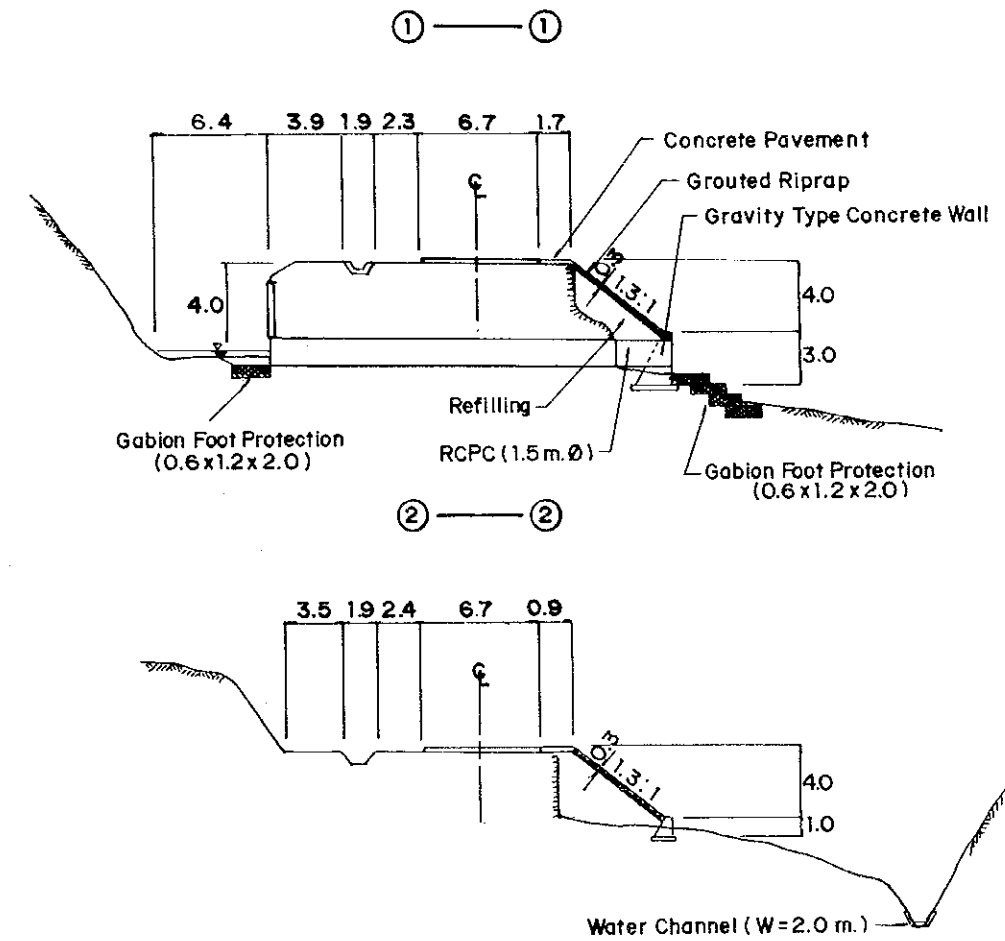
- 1) Risen pore water pressure in embankment due to infiltration of surface water.
- 2) Insufficient drainage capacity of pipe culvert and poor maintenance.



P L A N

Cause of Disaster:

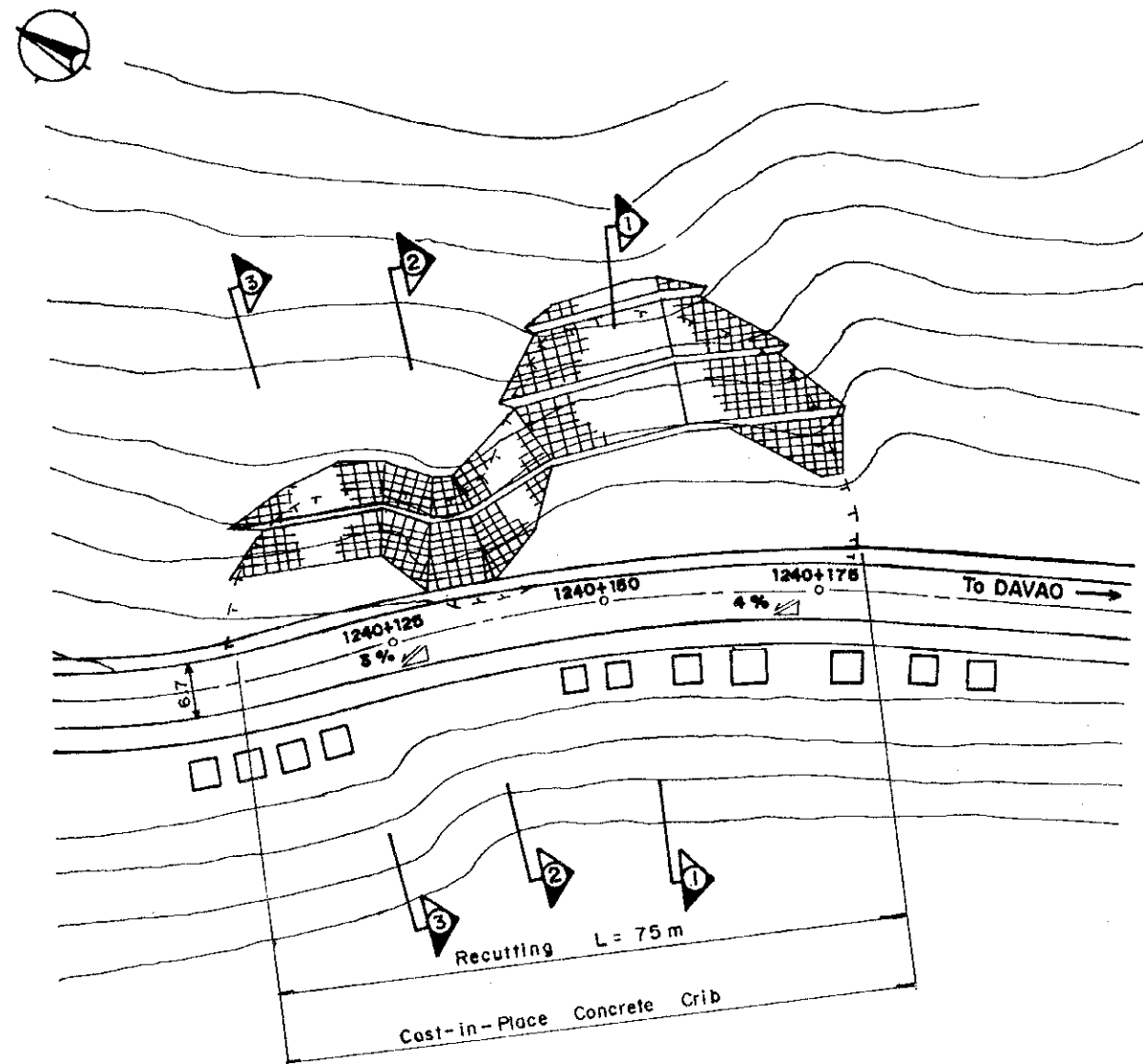
- 1) Inadequate out-let facility of pipe culvert.



CROSS SECTION
SCALE: 1:400

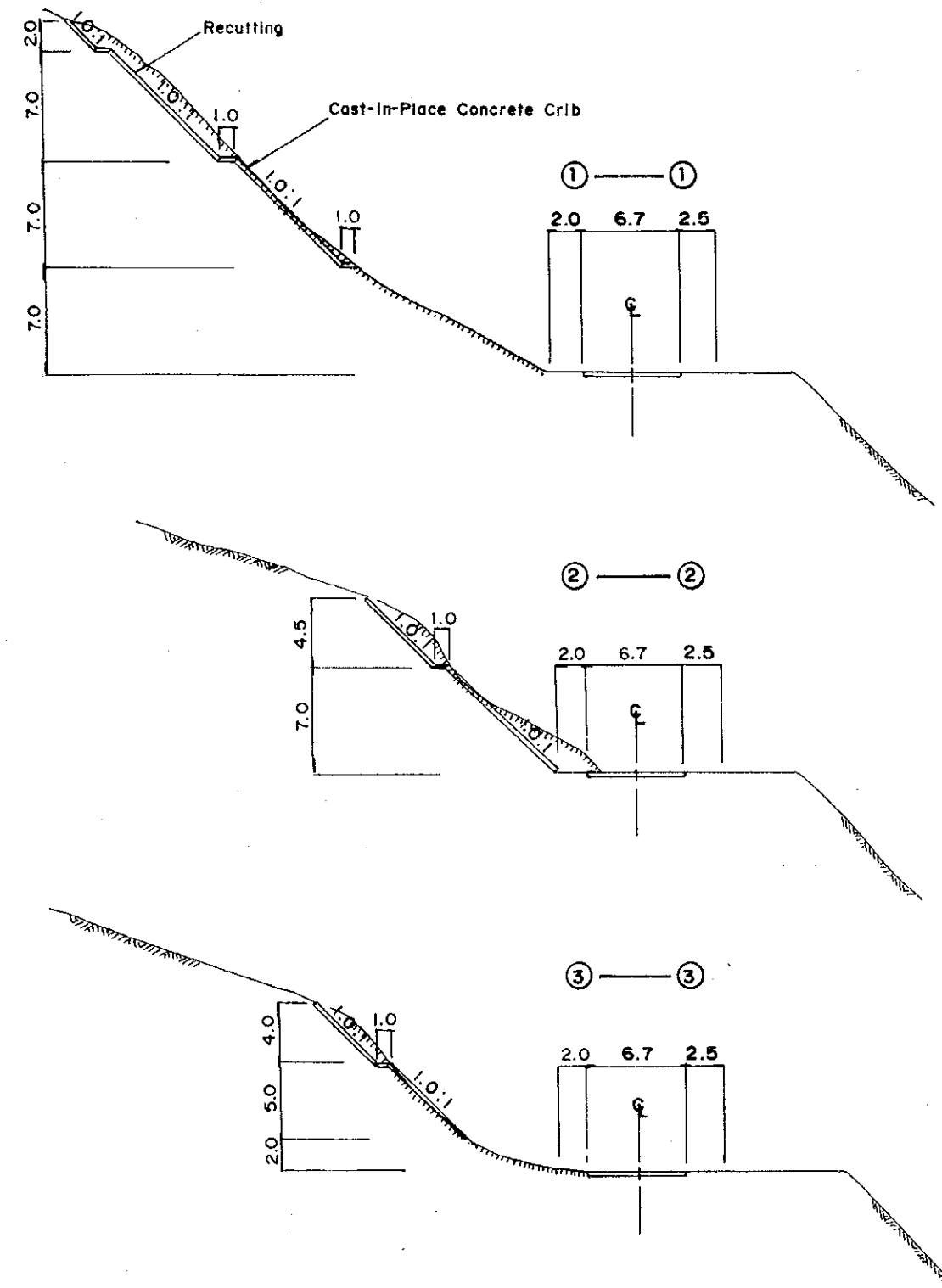
SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	209
5-19	GRouted RIPRAP	CU.M	50
5-14	GRAVITY TYPE CONCRETE WALL	CU.M	44
5-16	SUPPORTED TYPE STONE MASONRY WALL	CU.M	23
5-26	GABION FOOT PROTECTION	CU.M	75
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ.M	56
5-33	RCPC (1.5m.Ø)	L.M	6
5-29	WATER CHANNEL (W=2.0m.)	L.M	20
5-4	STRUCTURAL EXCAVATION	CU.M	66
5-8	FOUNDATION FILL	CU.M	20



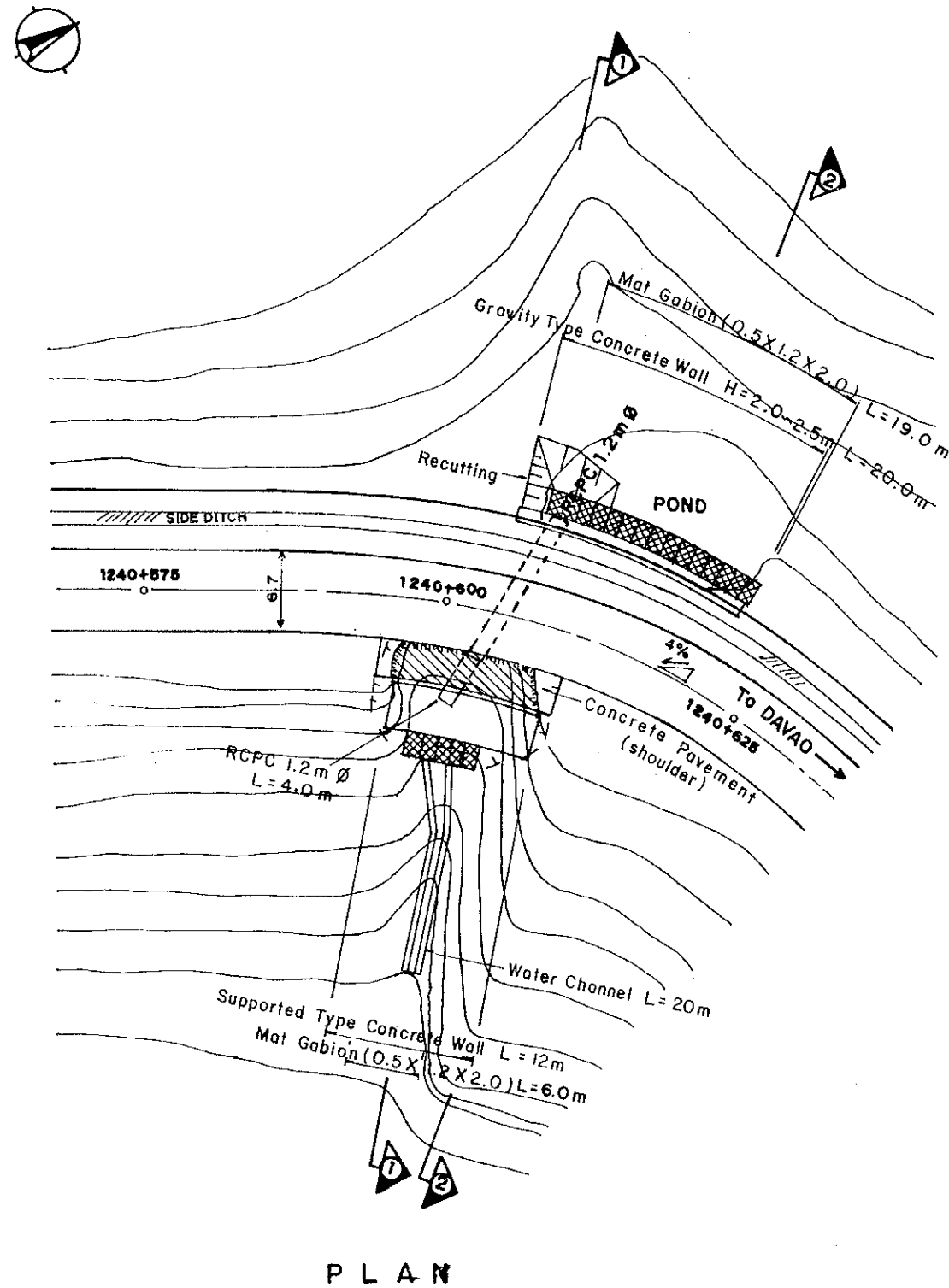
SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-2	RECUTTING OF SOFT ROCK	CU. M	1,020
5-21	CAST-IN-PLACE CONCRETE CRIB	SQ. M	1,290

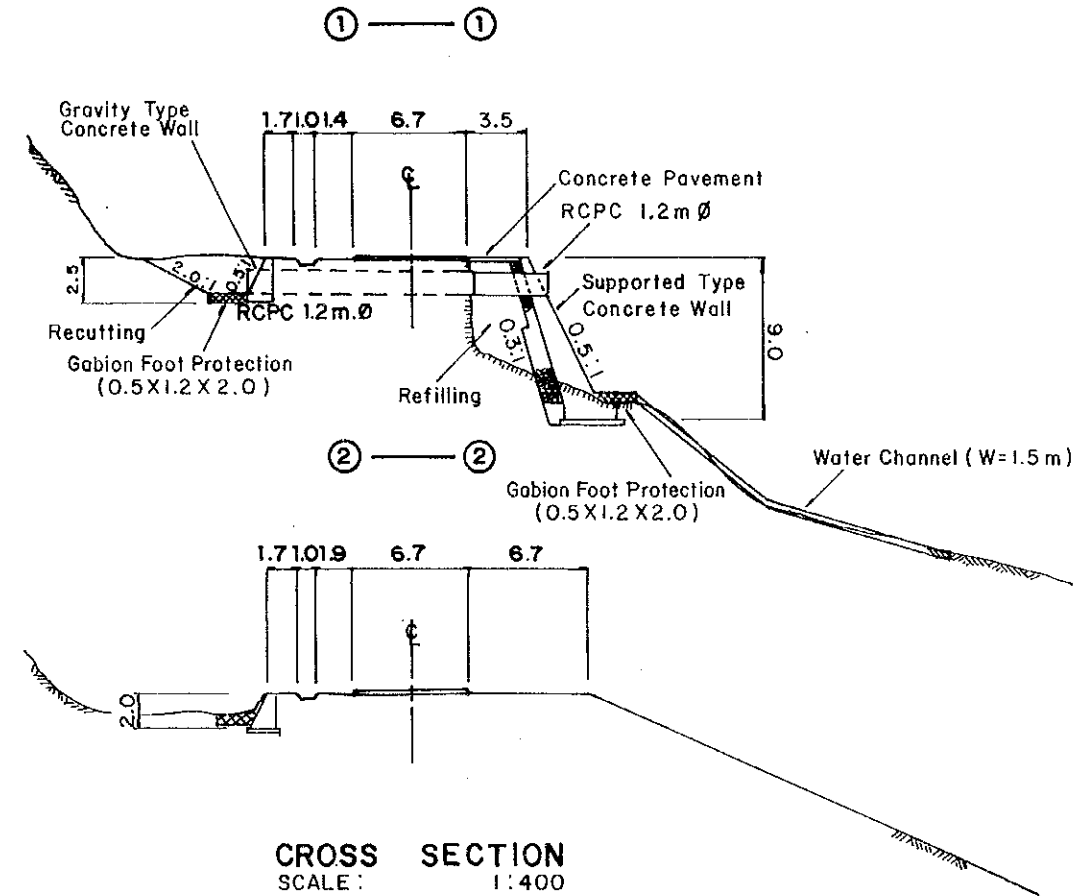


Cause of Disaster:

- 1) Surface failure induced by rain in layer of severely weathered mudstone.



PLAN



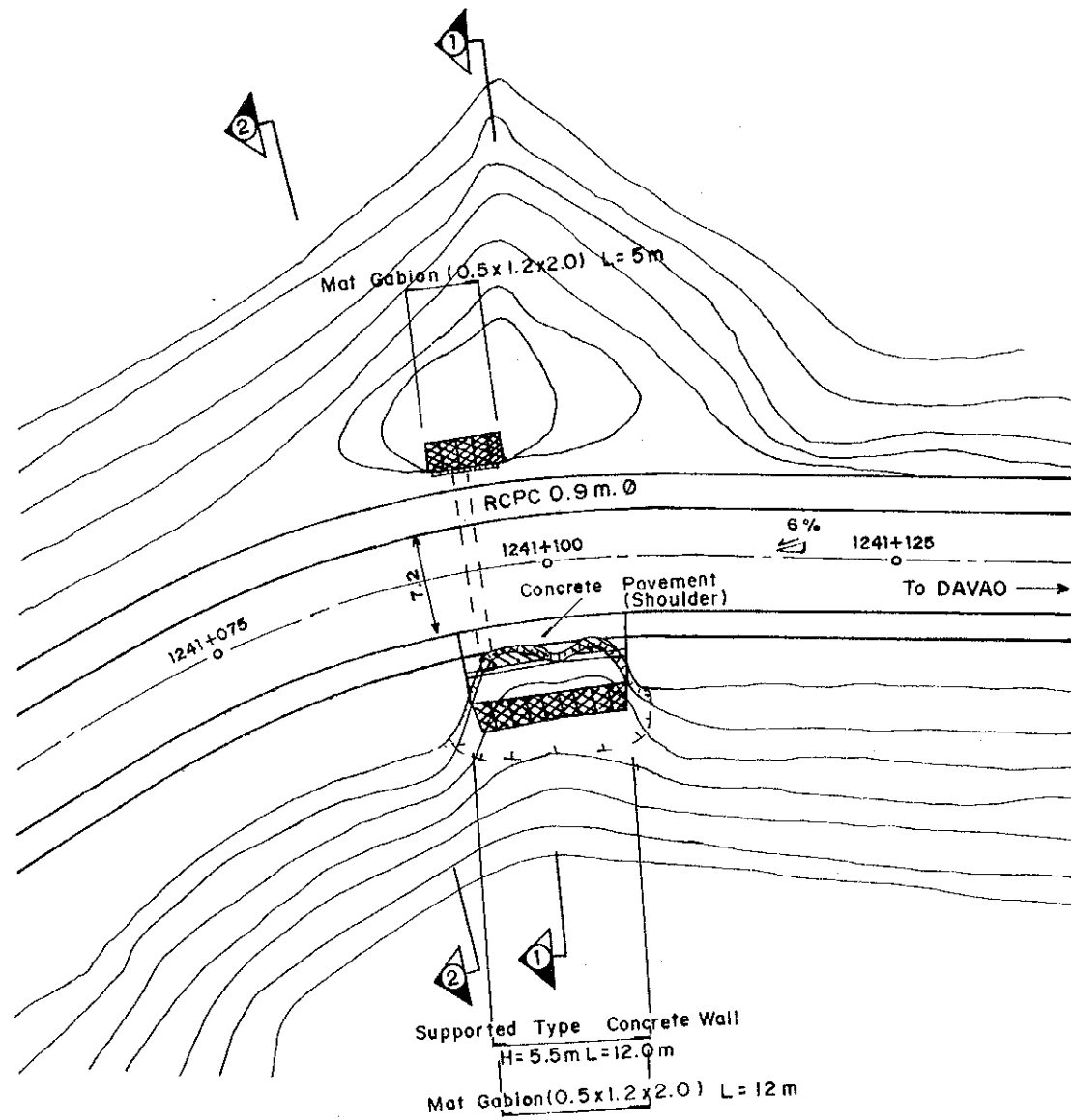
CROSS SECTION
SCALE: 1:400

SUMMARY OF QUANTITY

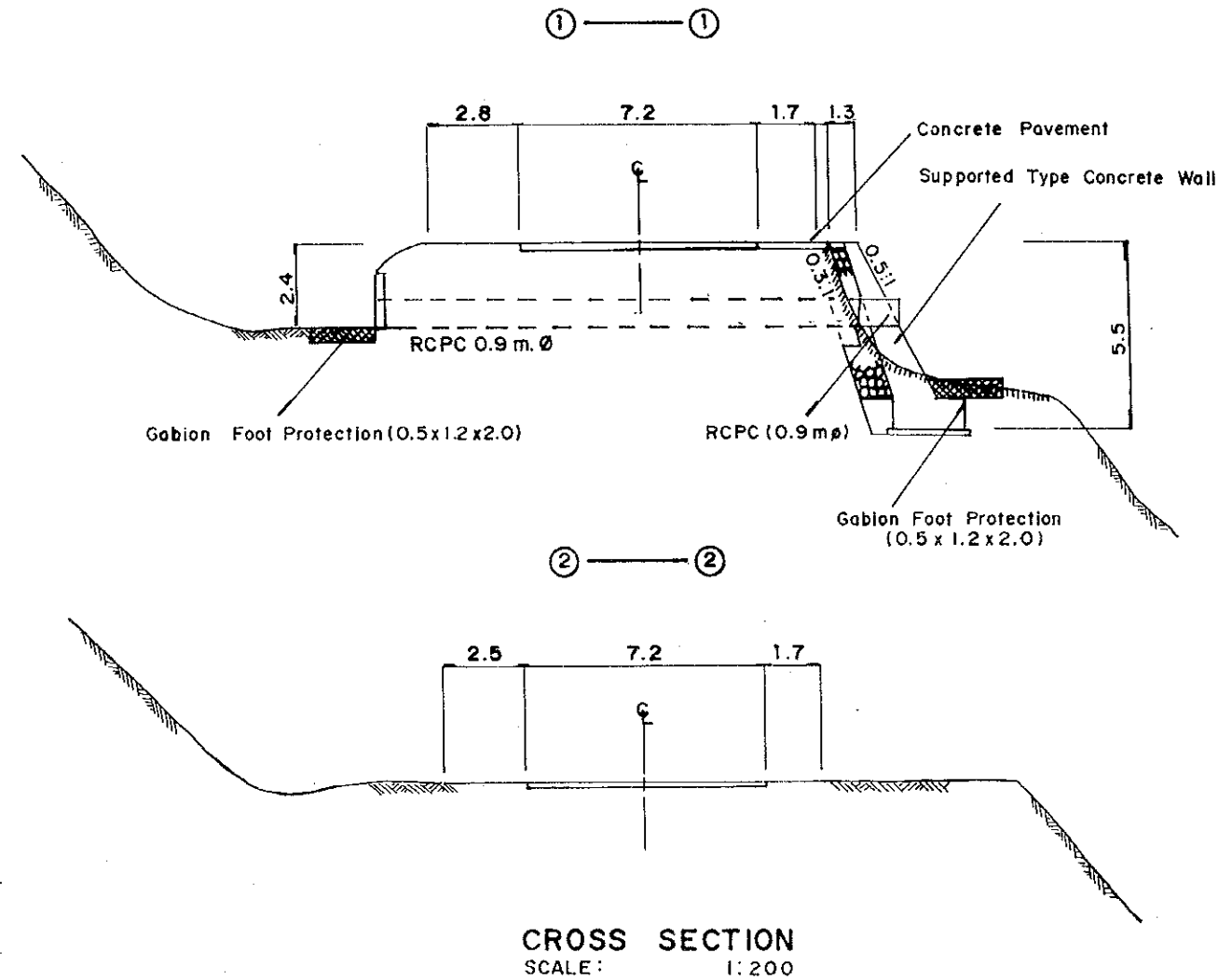
	TYPE OF WORK	UNIT	TOTAL
5-3	SURPLUS EXCAVATION	CU. M.	45
5-5	REFILLING/EMBANKMENT	CU. M.	127
5-14	GRAVITY TYPE CONCRETE WALL	CU. M.	43
5-15	SUPPORTED TYPE CONCRETE WALL	CU. M.	151
5-26	GABION FOOT PROTECTION	CU. M.	25
3-32	RCPC (1.2m Ø)	L. M.	4
5-13	CONCRETE PAVEMENT (Shoulder)	SQ. M.	46
5-28	WATER CHANNEL (W=1.5m)	L. M.	20
5-4	STRUCTURAL EXCAVATION	CU. M.	120
5-8	FOUNDATION FILL	CU. M.	30
5-6	REFILLING OF BACKFILL MATERIAL	CU. M.	54

Cause of Disaster:

- 1) Insufficient drainage capacity of pipe culvert.
- 2) Erosion due to concentrated surface water on the curved portion of road.



P L A N



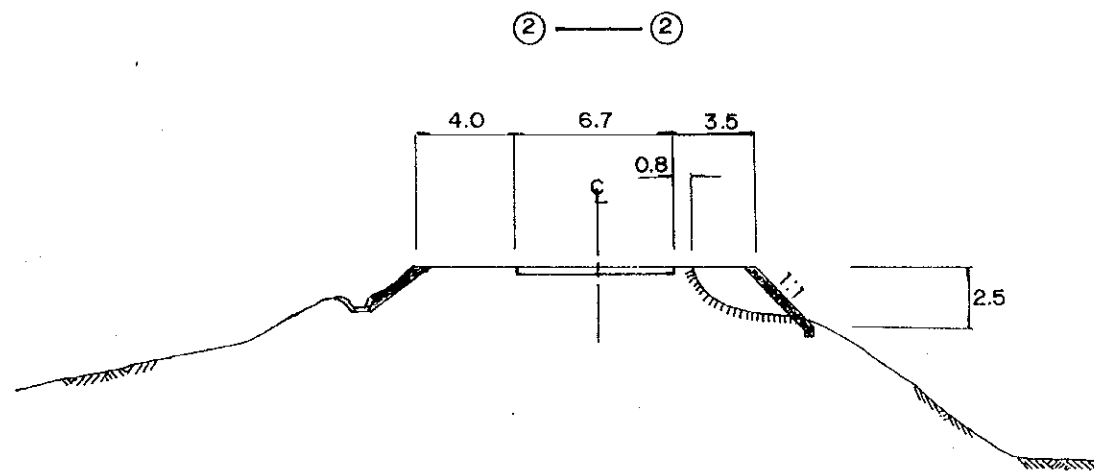
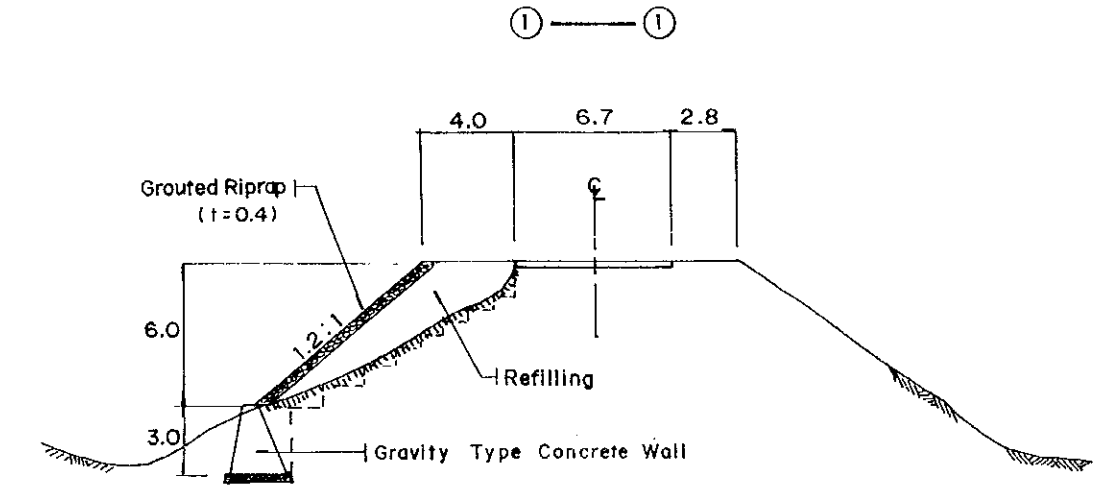
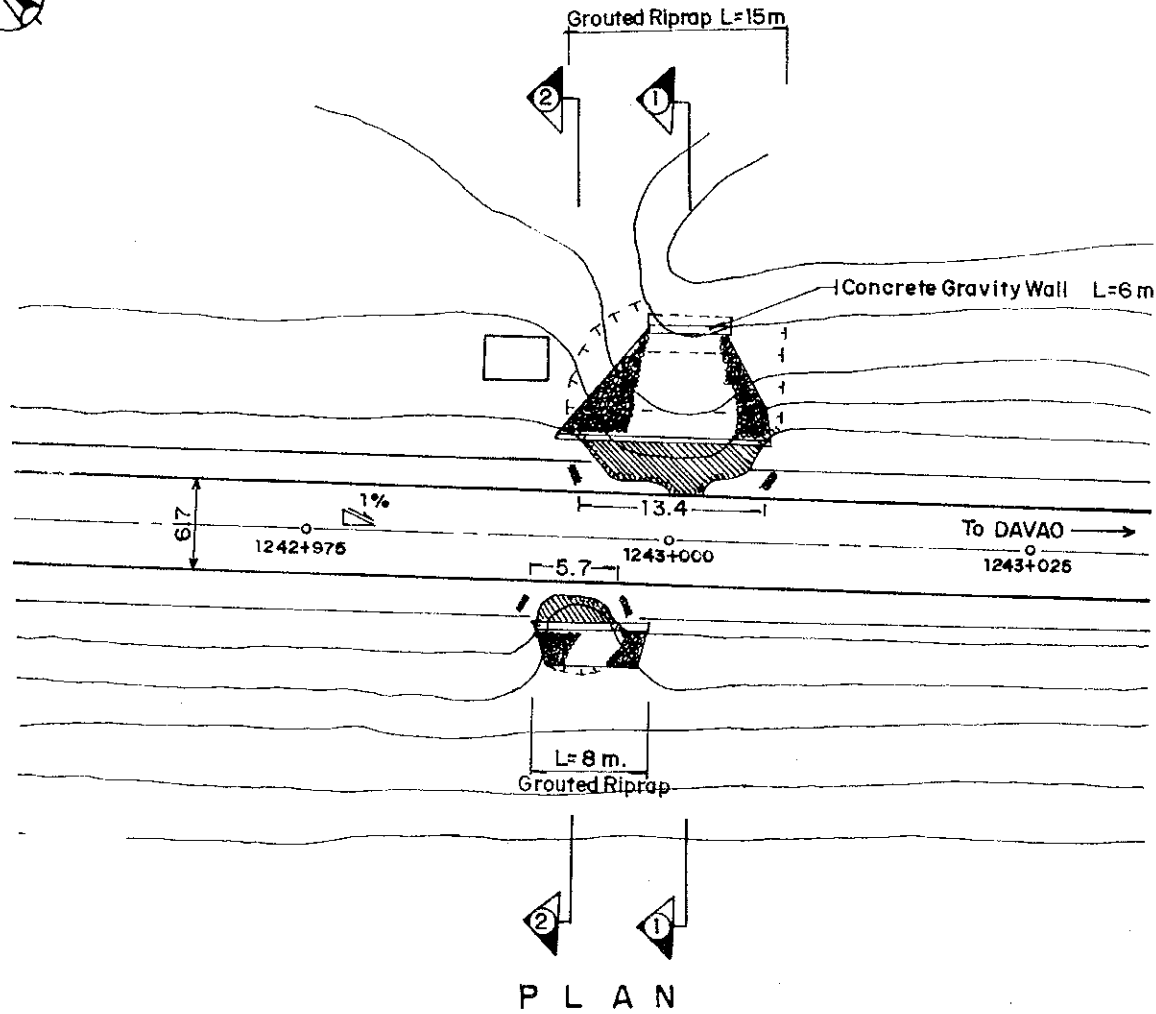
CROSS SECTION
SCALE: 1:200

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-15	SUPPORTED TYPE CONCRETE WALL	CU. M	70
5-26	GABION FOOT PROTECTION	CU. M	17
5-31	RCPC (0.9 m Ø)	L. M	2
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ. M	31
5-4	STRUCTURAL EXCAVATION	CU. M	90
5-6	REFILLING OF BACKFILL MATERIAL	CU. M	26

Cause of Disaster:

- 1) Insufficient drainage capacity of pipe culvert.
- 2) Erosion due to concentrated surface water on the curved portion of road.

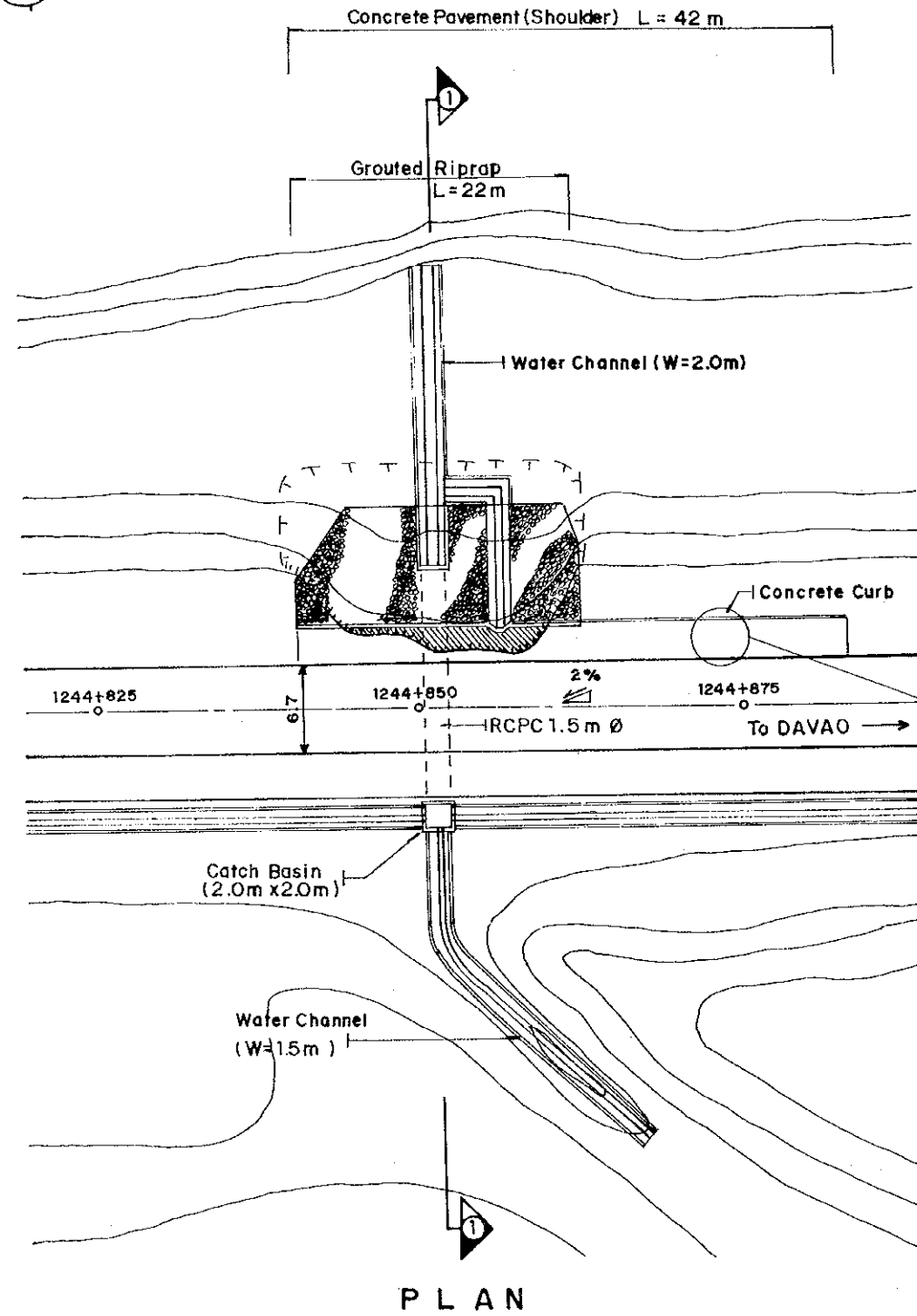


CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

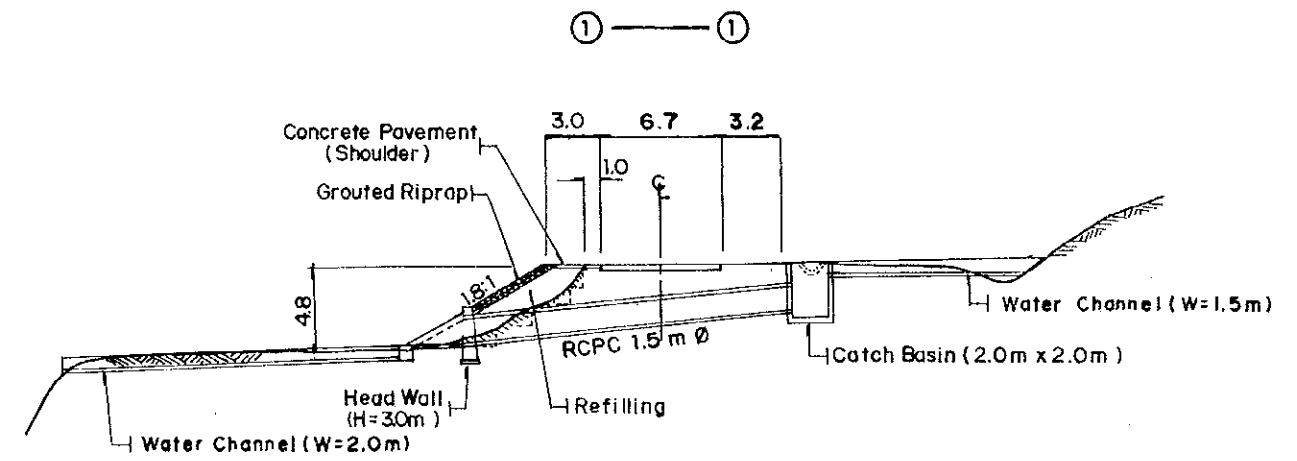
TYPE OF WORK	UNIT	TOTAL
5-5 REFILLING / EMBANKMENT	CU.M	316
5-19 GROUDED RIPRAP	CU.M	50
5-14 GRAVITY TYPE CONCRETE WALL	CU.M	27
5-4 STRUCTURAL EXCAVATION	CU.M	53
5-8 FOUNDATION FILL	CU.M	30

Cause of Disaster:
1) Insufficient compaction of embankment.



PLAN

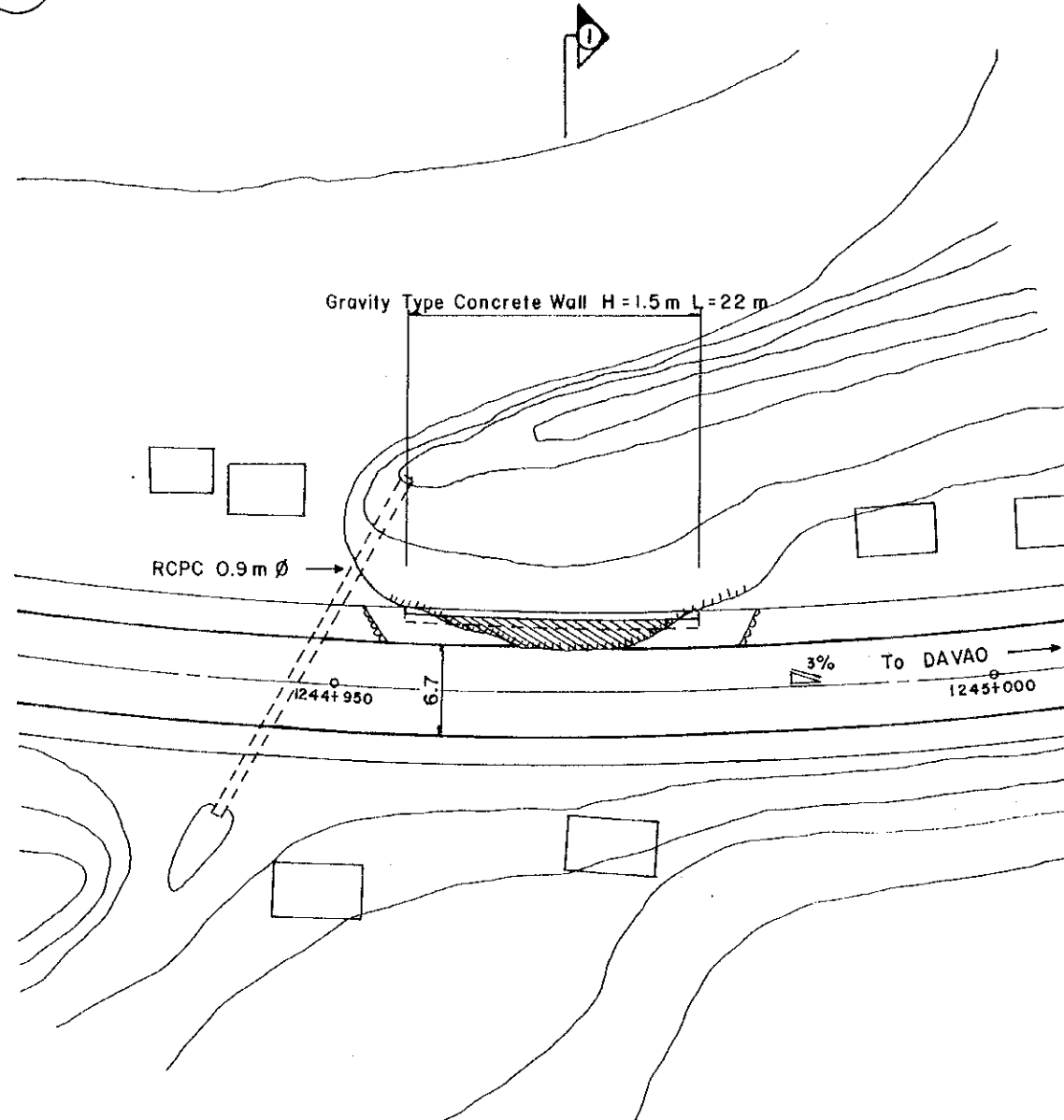
Cause of Disaster:
1) Water drained from hill side and stream of creek which overflowed and scoured the embankment.



CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

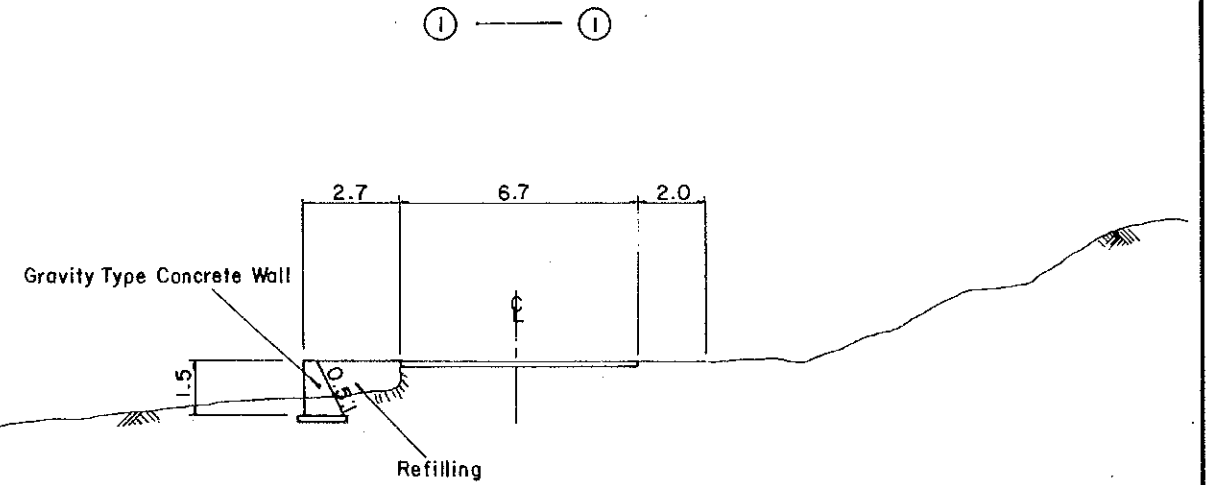
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING/ EMBANKMENT	CU.M	331
5-19	GROUTED RIPRAP	CU.M	55
5-33	RCPC (1.5m Ø)	L.M	18
5-41	HEAD WALL FOR RCPC 1.5m Ø	E.A	1
5-38	CATCH BASIN FOR RCPC 1.5m Ø	E.A	1
5-28	WATER CHANNEL (W=1.5m)	L.M	30
5-29	WATER CHANNEL (W=2.0m)	L.M	23
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ.M	126
5-4	STRUCTURAL EXCAVATION	CU.M	190
5-8	FOUNDATION FILL	CU.M	150
5-45	CONCRETE CURB	L.M	42



P L A N

Cause of Disaster:

- 1) Scouring by water which was drained from valley and road surface and concentrated on the slope due to the geometric formation of road.



CROSS SECTION
SCALE: 1:200

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING/EMBANKMENT	CU.M.	23
5-14	GRAVITY TYPE CONCRETE WALL	CU.M.	26
5-4	STRUCTURAL EXCAVATION	CU.M.	33
5-8	FOUNDATION FILL	CU.M.	20

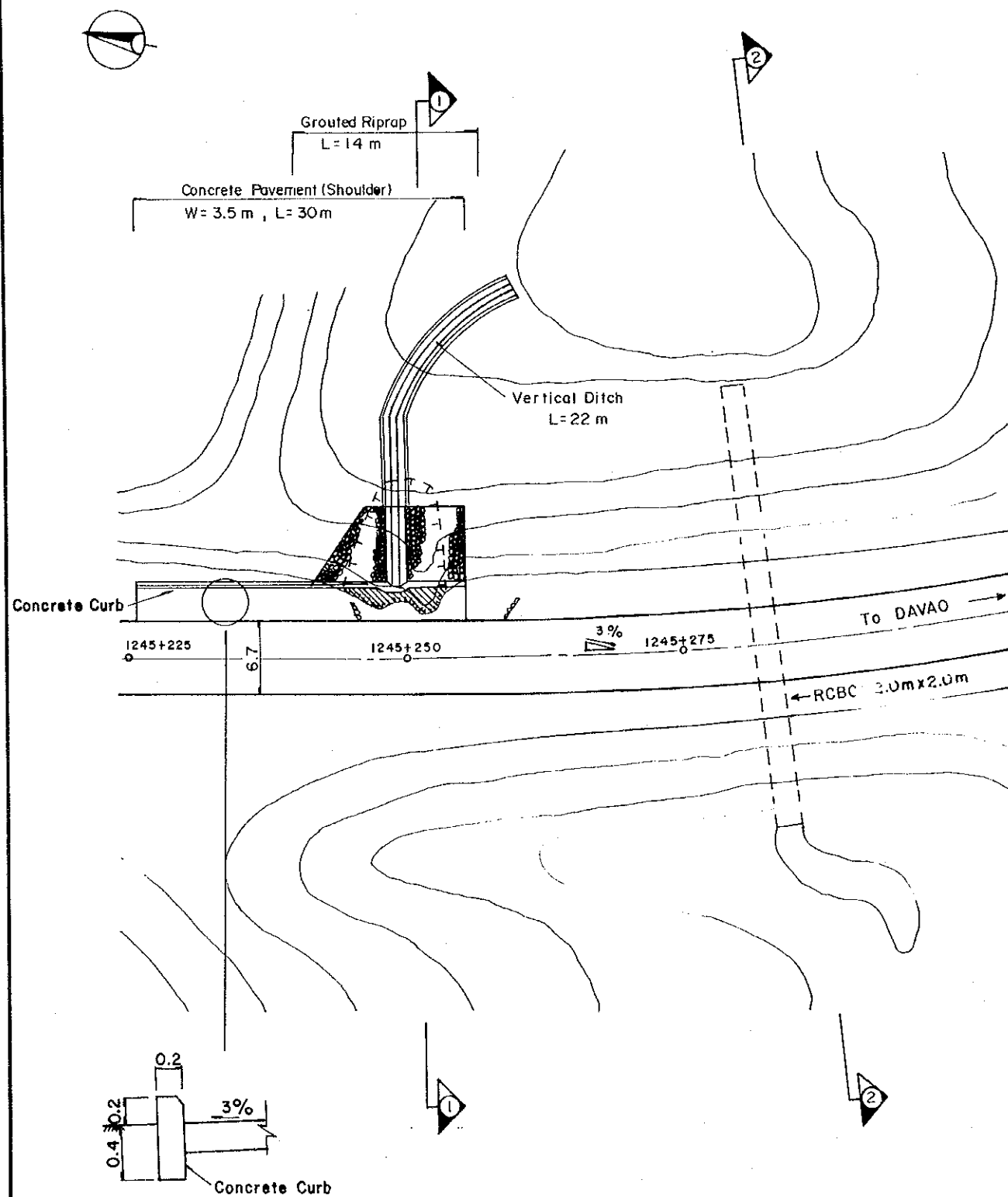
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

SLOPE NO.: 4-05
TYPE OF DISASTER:

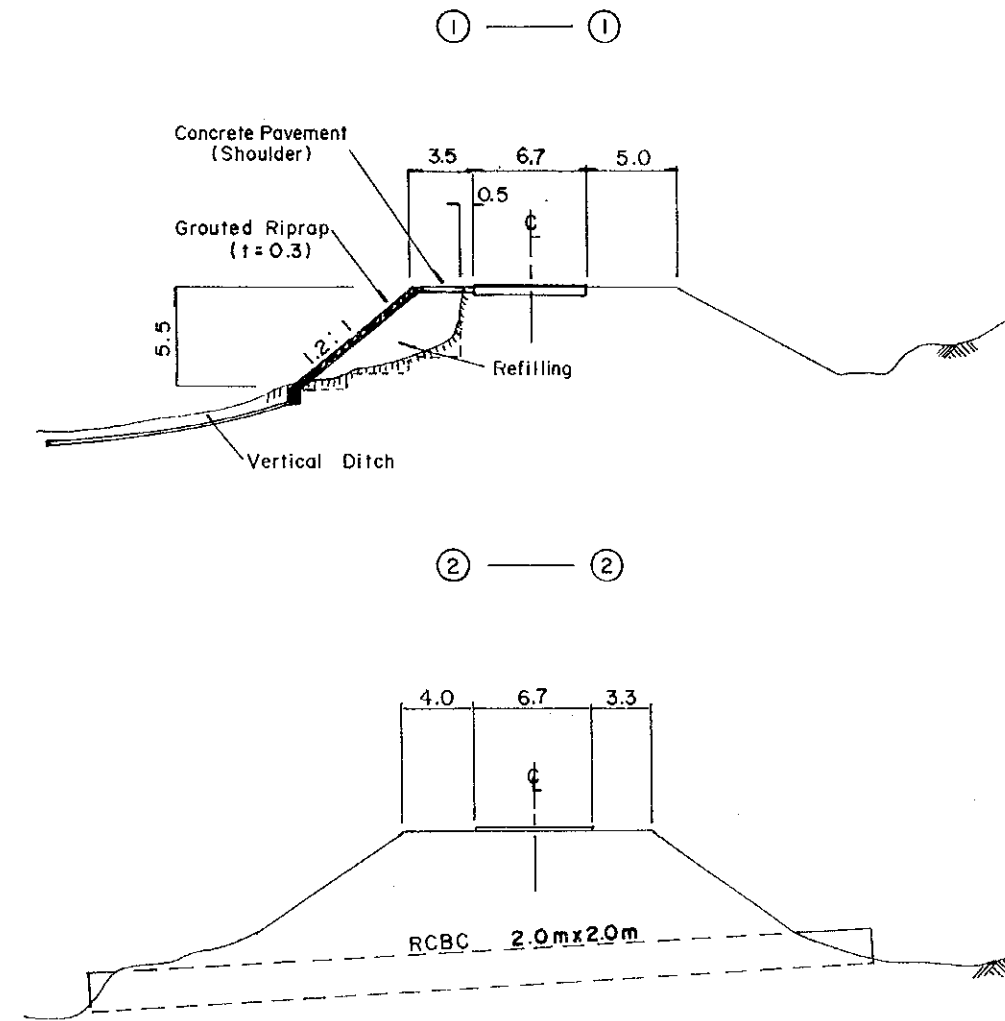
STATION: 1245+250
EMBANKMENT SLOPE FAILURE

SCALE
NOT TO SCALE

DRAWING NO.
S-26



PLAN



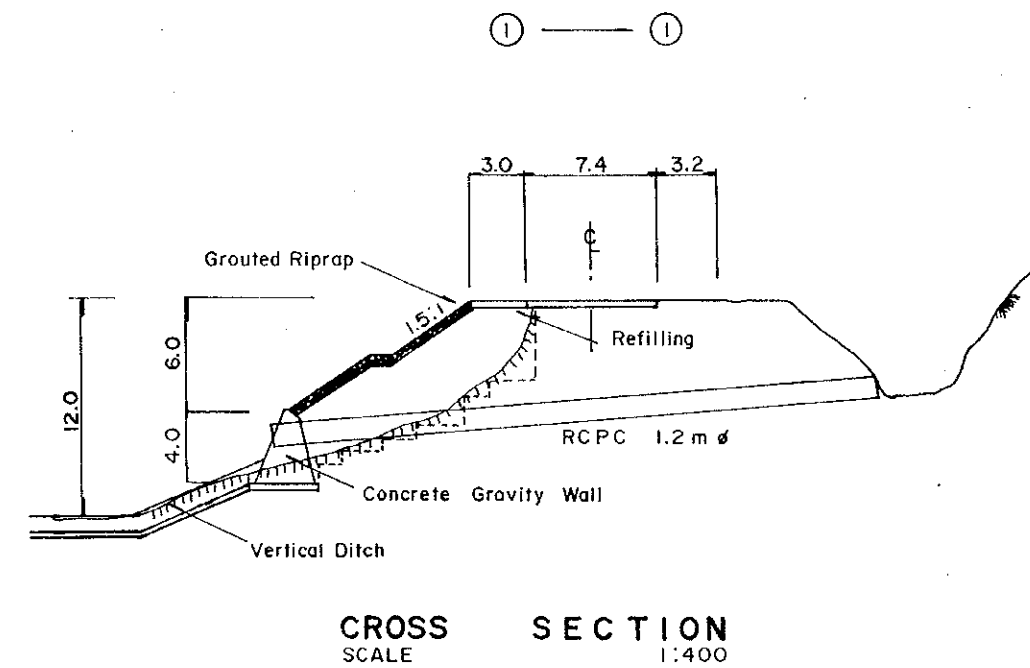
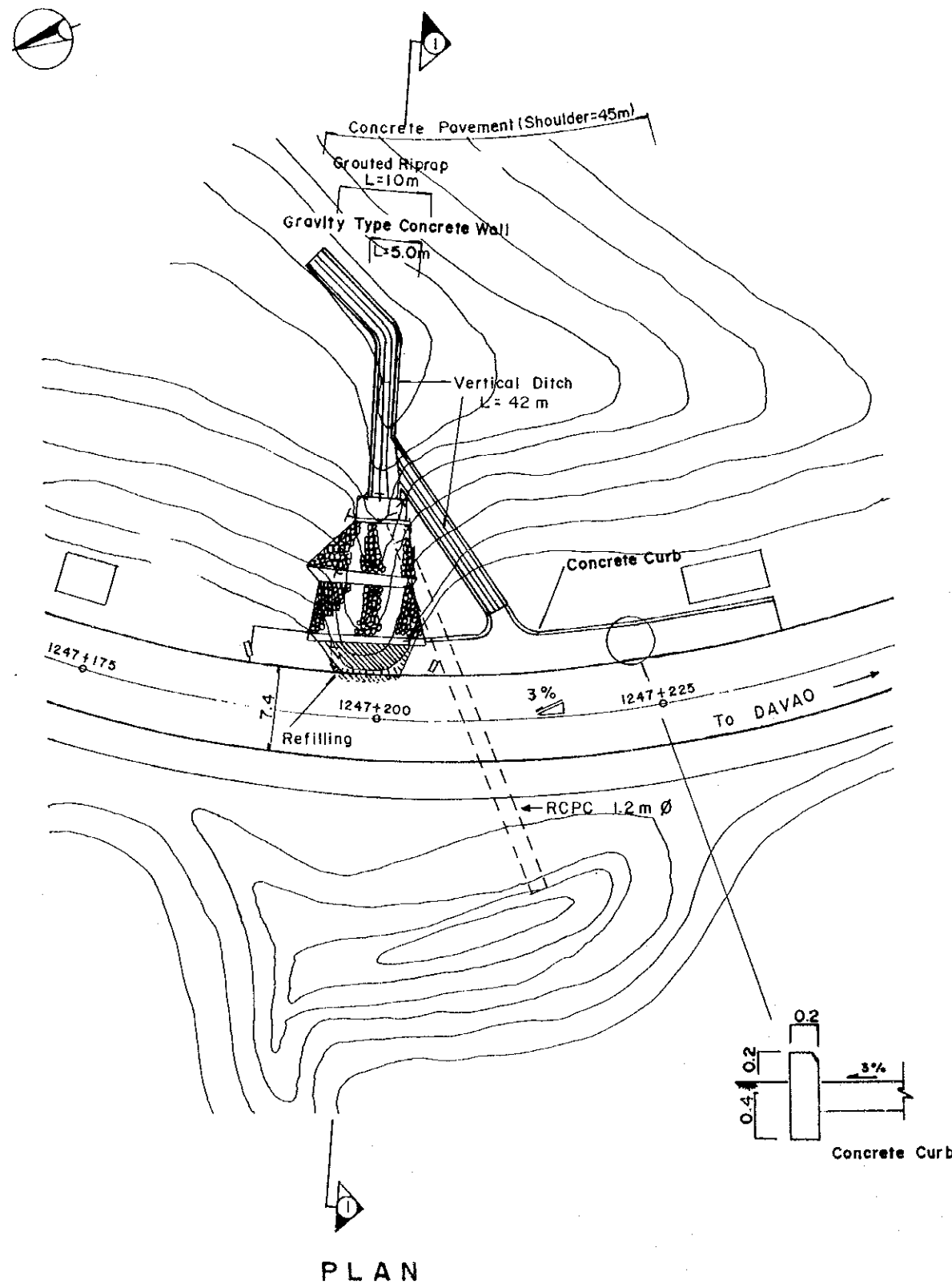
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING/ EMBANKMENT	CU.M	239
5-19	GROUTED RIPRAP	CU.M	44
5-27	VERTICAL DITCH	L.M	22
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ.M	105
5-45	CONCRETE CURB	L.M	23

Cause of Disaster:

- 1) Scouring by water which was drained from hill side and road surface and concentrated on the slope due to the geometric formation of road.
- 2) Embankment slope with an unstable grade.

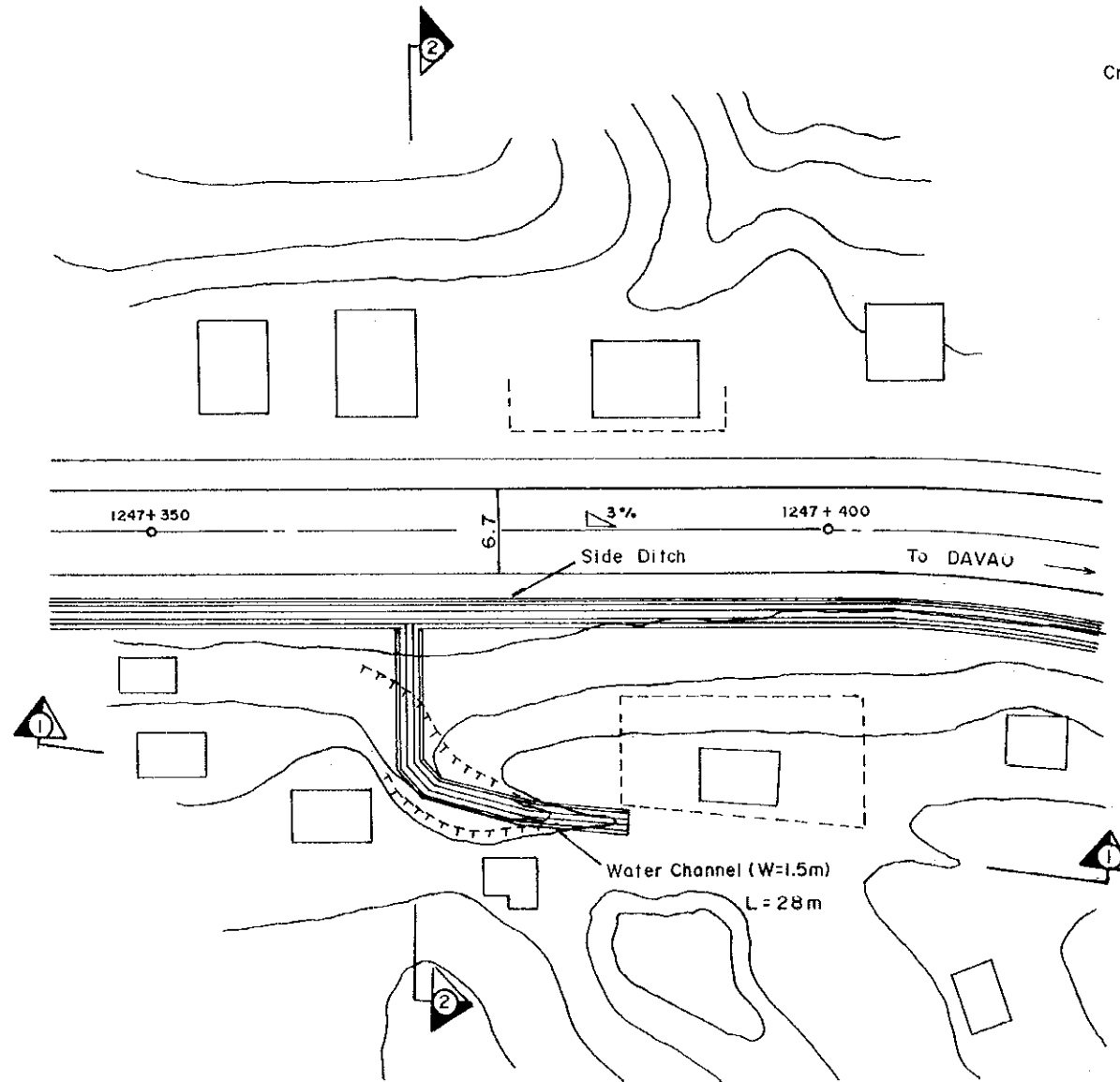


SUMMARY OF QUANTITY

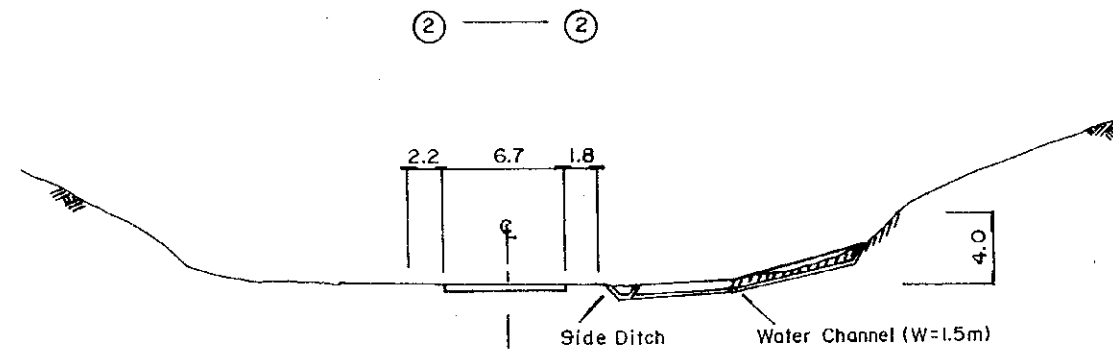
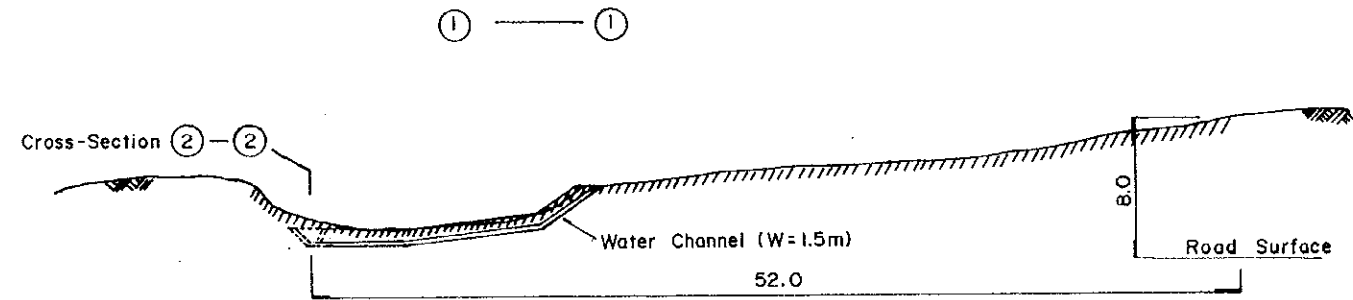
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU. M	431
5-19	GROUTED RIPRAP	CU. M	30
5-14	GRAVITY TYPE CONCRETE WALL	CU. M	37
5-27	VERTICAL DITCH	L. M	42
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ. M	135
5-4	STRUCTURAL EXCAVATION	CU. M	33
5-8	FOUNDATION FILL	CU. M	11
5-45	CONCRETE CURB	L. M	35

Cause of Disaster:

- 1) Erosion due to concentrated surface water on the curved portion of road.



P L A N



CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
S-28	WATER CHANNEL (W=1.5m)	L.M	28

Cause of Disaster:

- 1) Flow of debris supplied by slope failures, deposited on the side of hill and flashed down by heavy rain.

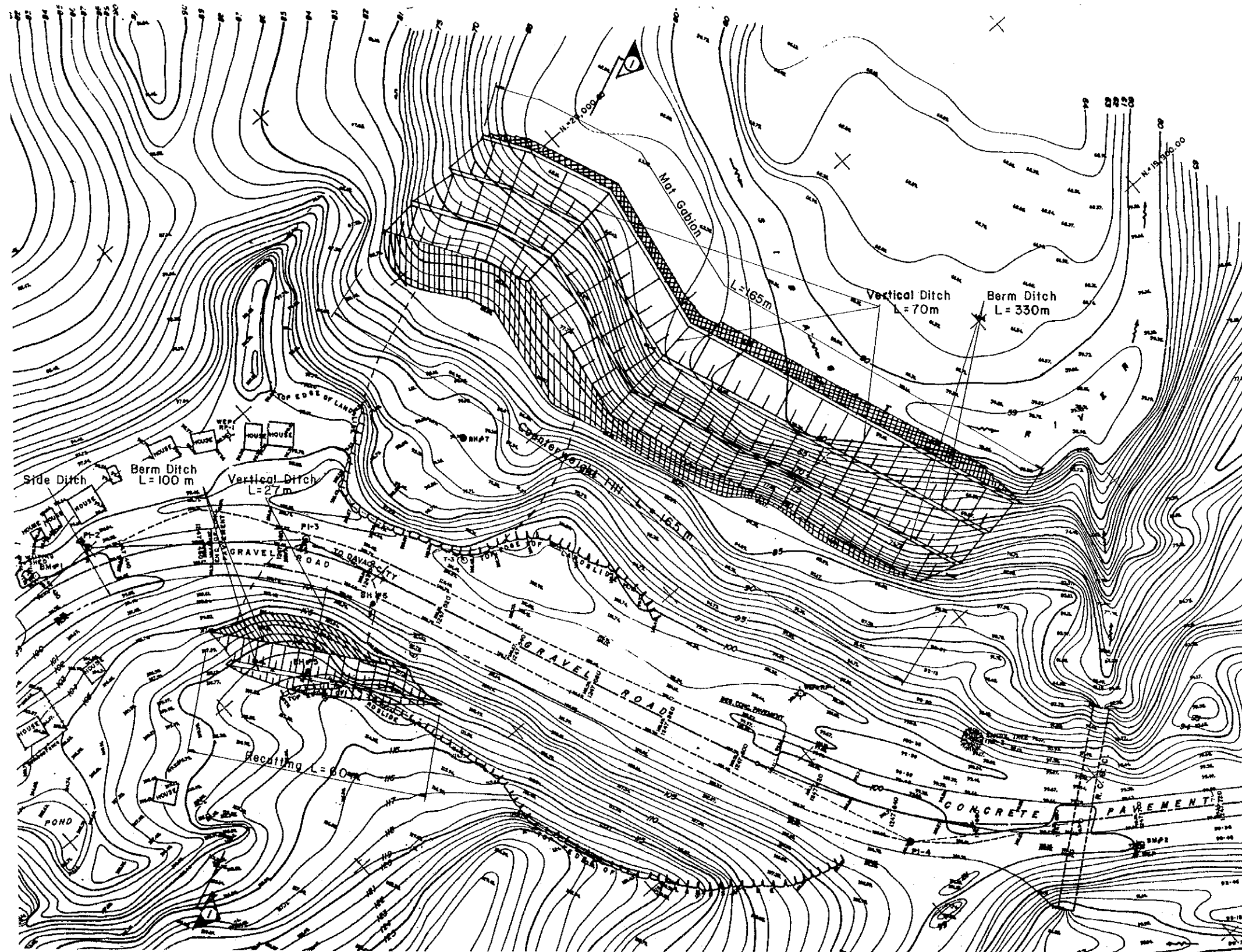
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

SLOPE NO. 4-08
TYPE OF DISASTER : LAND SLIDE

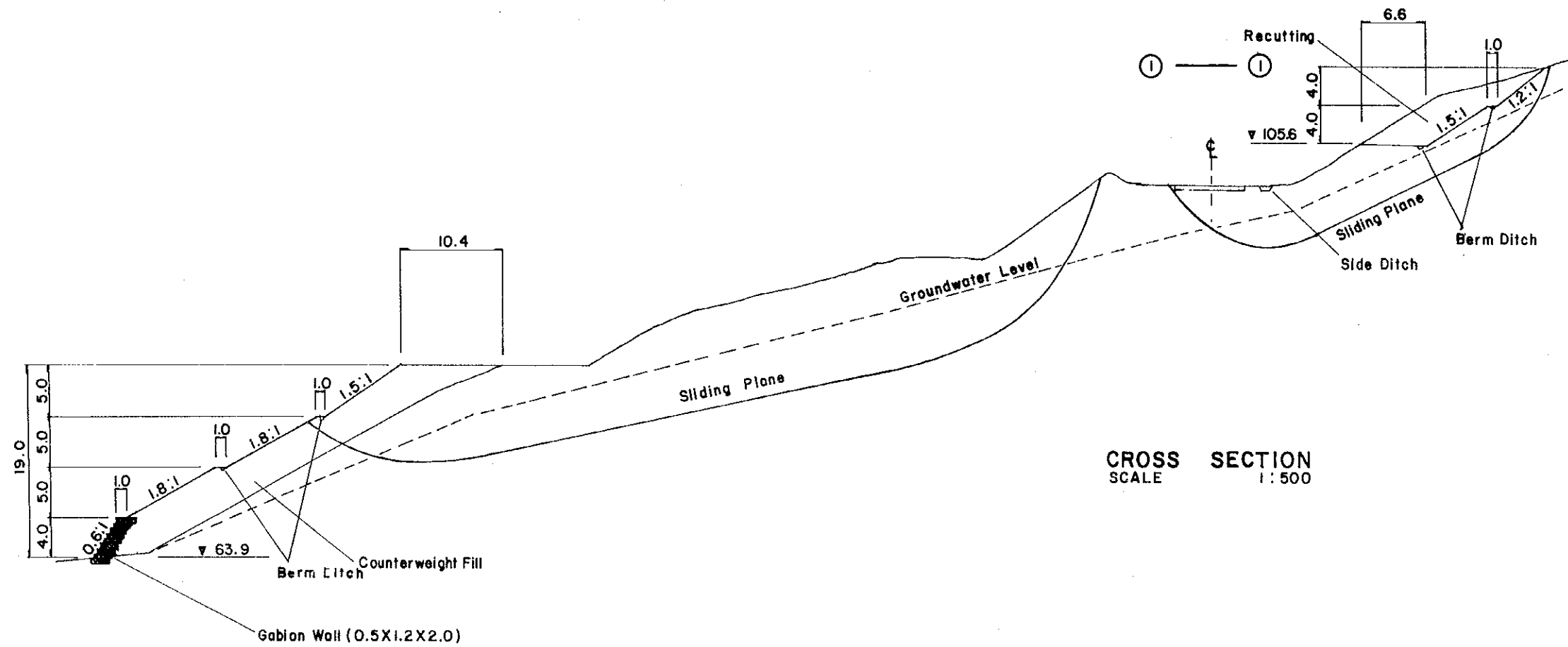
STATION : 1247+500
LAND SLIDE

SCALE.
1 : 1,000

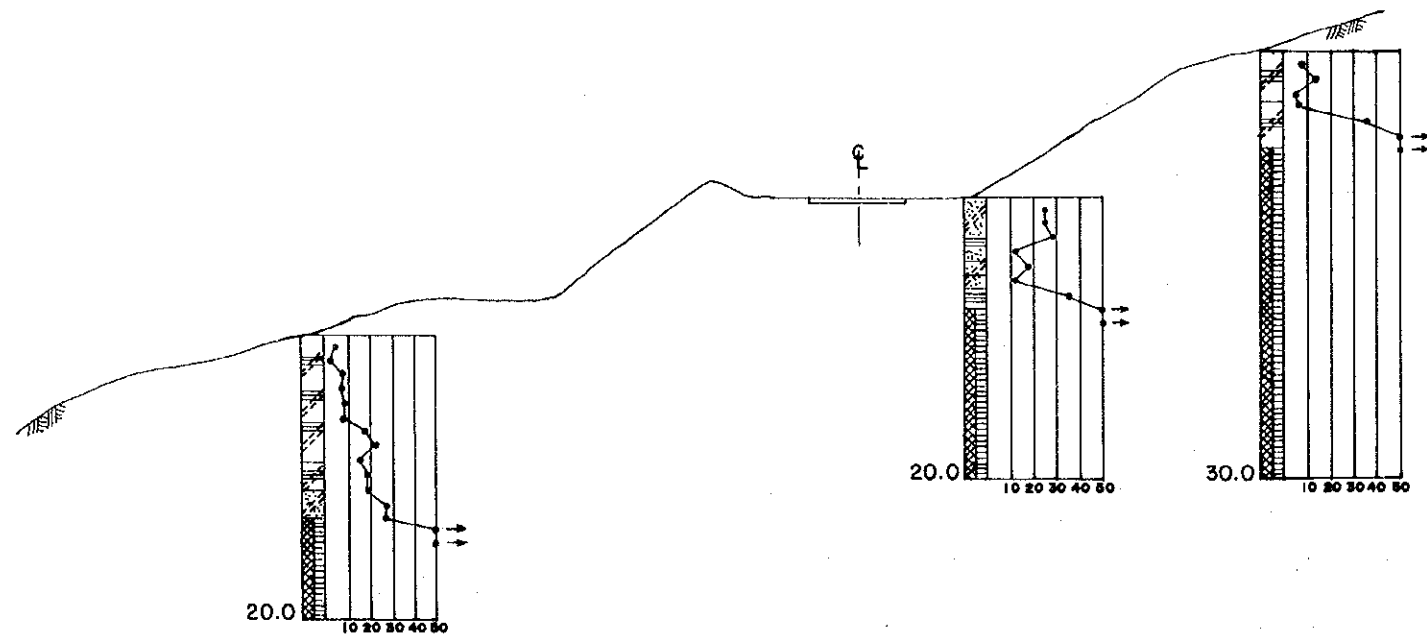
DRAWING NO.
S-29(1/2)



P L A N
SCALE 1:1000



CROSS SECTION
SCALE 1:500



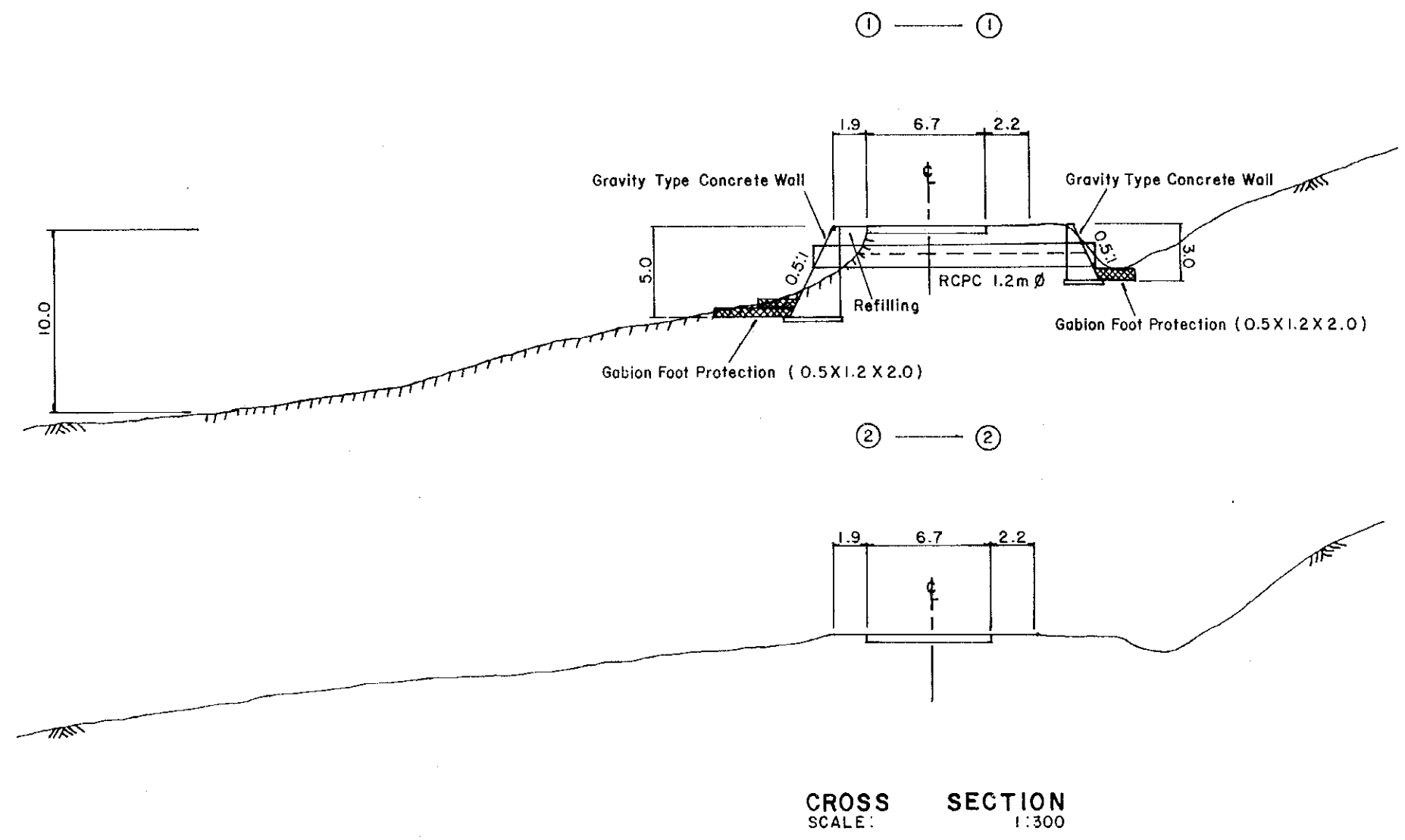
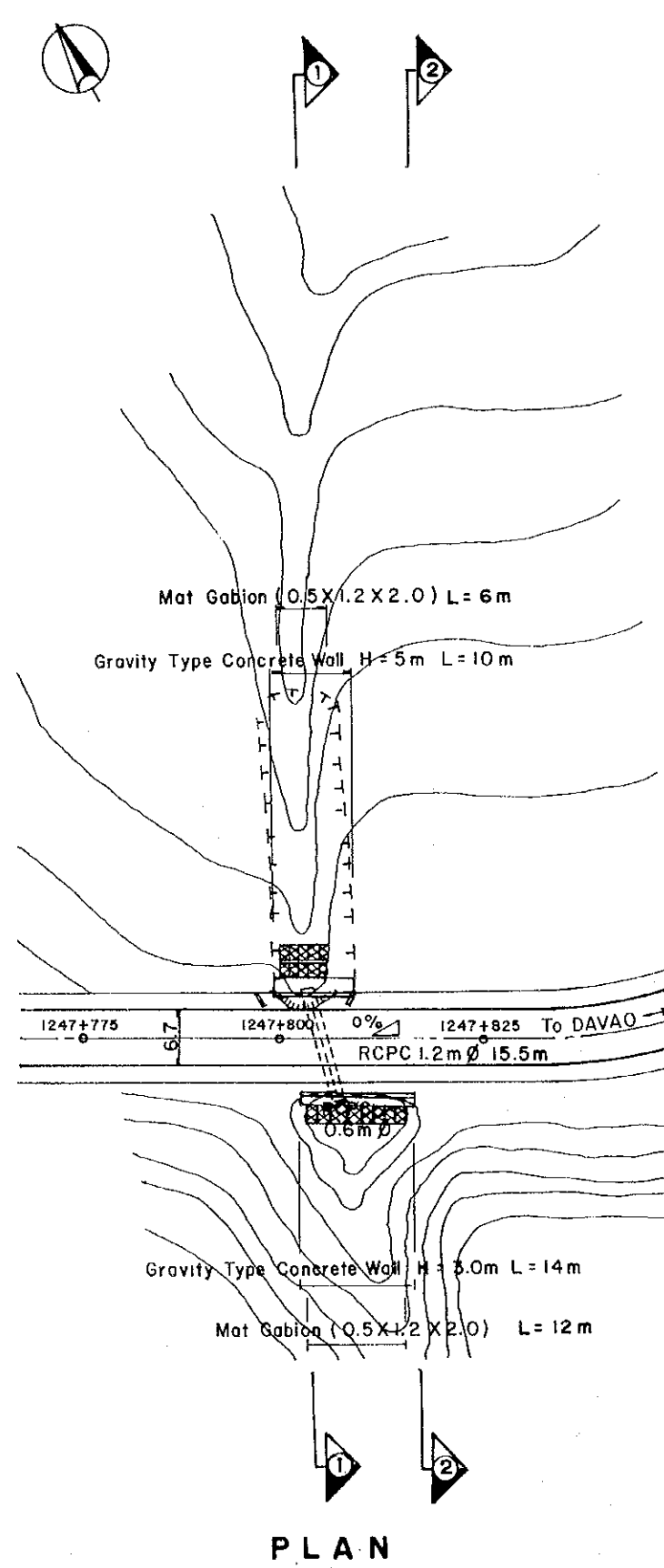
CROSS SECTION (BORING POINT)
SCALE 1:500

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-2	RECURTING OF SOFT ROCK	CU.M	1,500
5-9	COUNTER WEIGHT FILL	CU.M	26,700
5-17	GABION WALL	CU.M	1,630
5-30	BERM DITCH	L.M	430
5-27	VERTICAL DITCH	L.M	97

Cause of Disaster:

- 1) Movement along sliding plane in cohesive soil layer induced by the raise of groundwater level.



SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING/EMBANKMENT	CU.M.	12
5-14	GRAVITY TYPE CONCRETE WALL	CU.M.	131
5-26	GABION FOOT PROTECTION	CU.M.	30
5-32	RCPC (1.2m Ø)	L.M.	16
3-4	STRUCTURAL EXCAVATION	CU.M.	240
5-8	FOUNDATION FILL	CU.M.	190

Cause of Disaster:
1) Insufficient drainage capacity of pipe culvert.

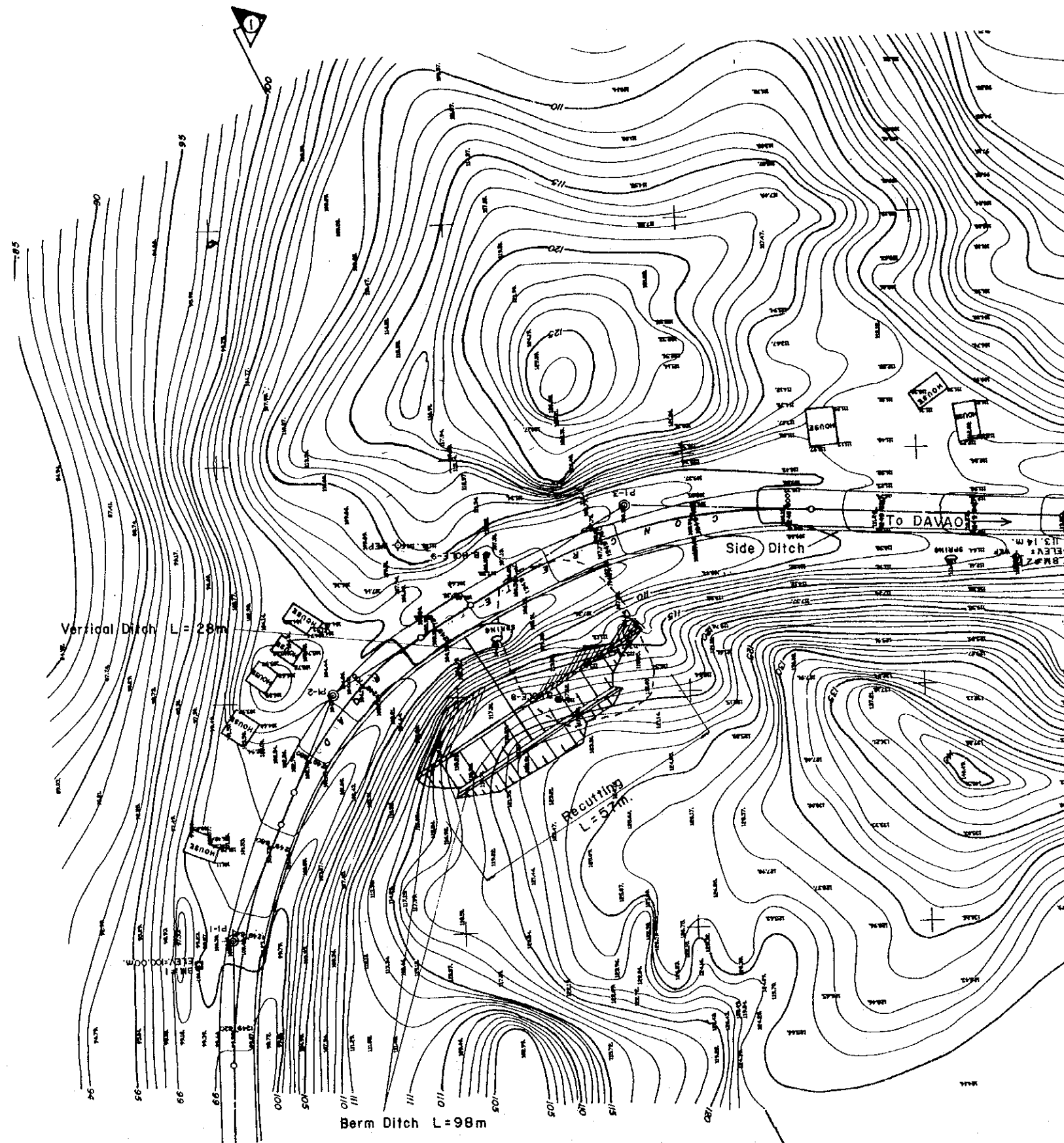
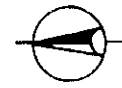
FEASIBILITY STUDY ON PAN-PHILIPPINE HIGHWAY
REHABILITATION PROJECT (MINDANAO SECTION)

SLOPE NO. : 4-10
TYPE OF DISASTER :

STATION : 1249+750
LAND SLIDE

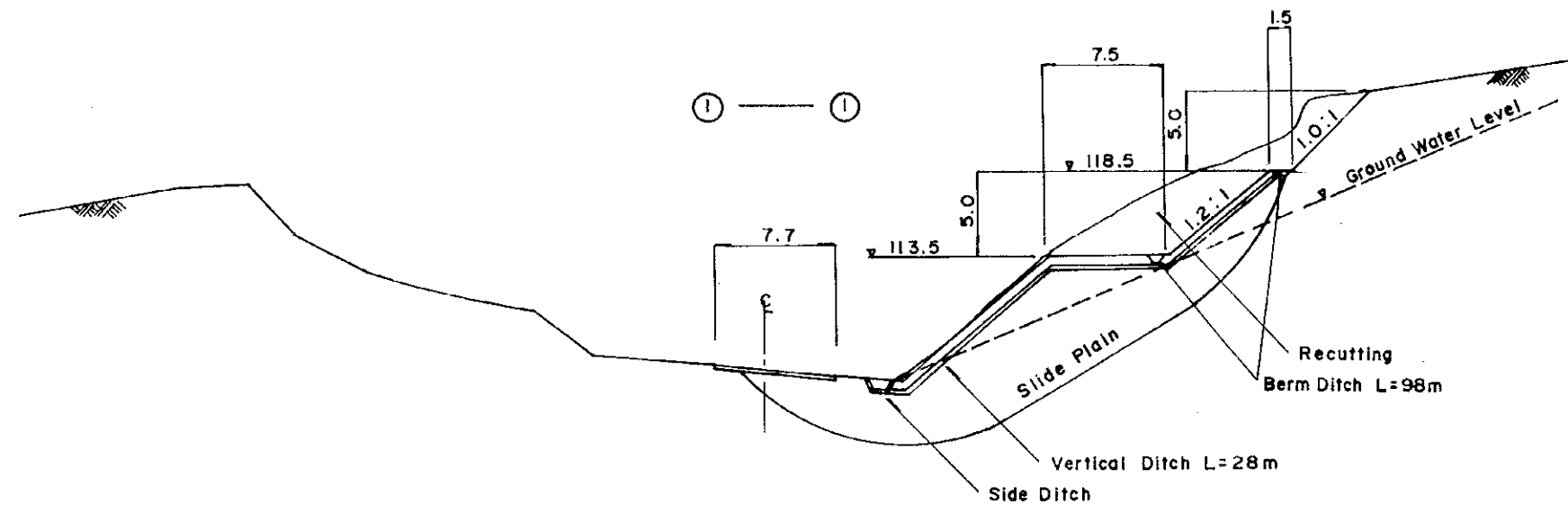
SCALE
1:1000

DRAWING NO.
S-31(1/2)

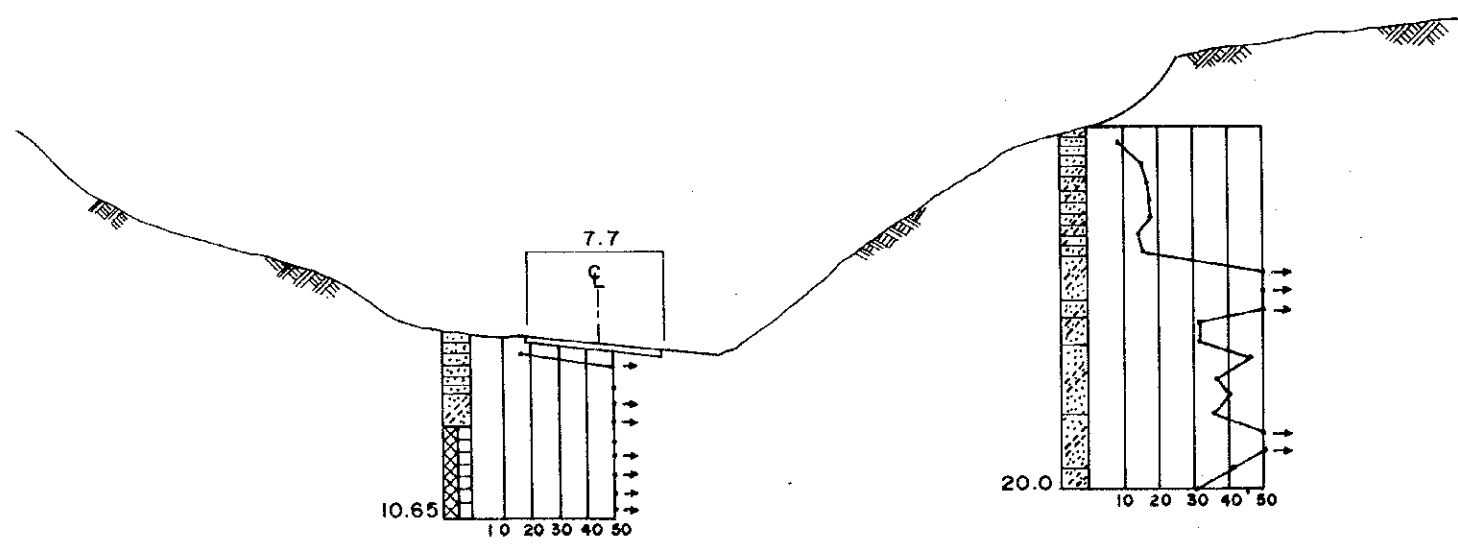


PLAN
SCALE: 1:1000





CROSS SECTION
SCALE: 1:400

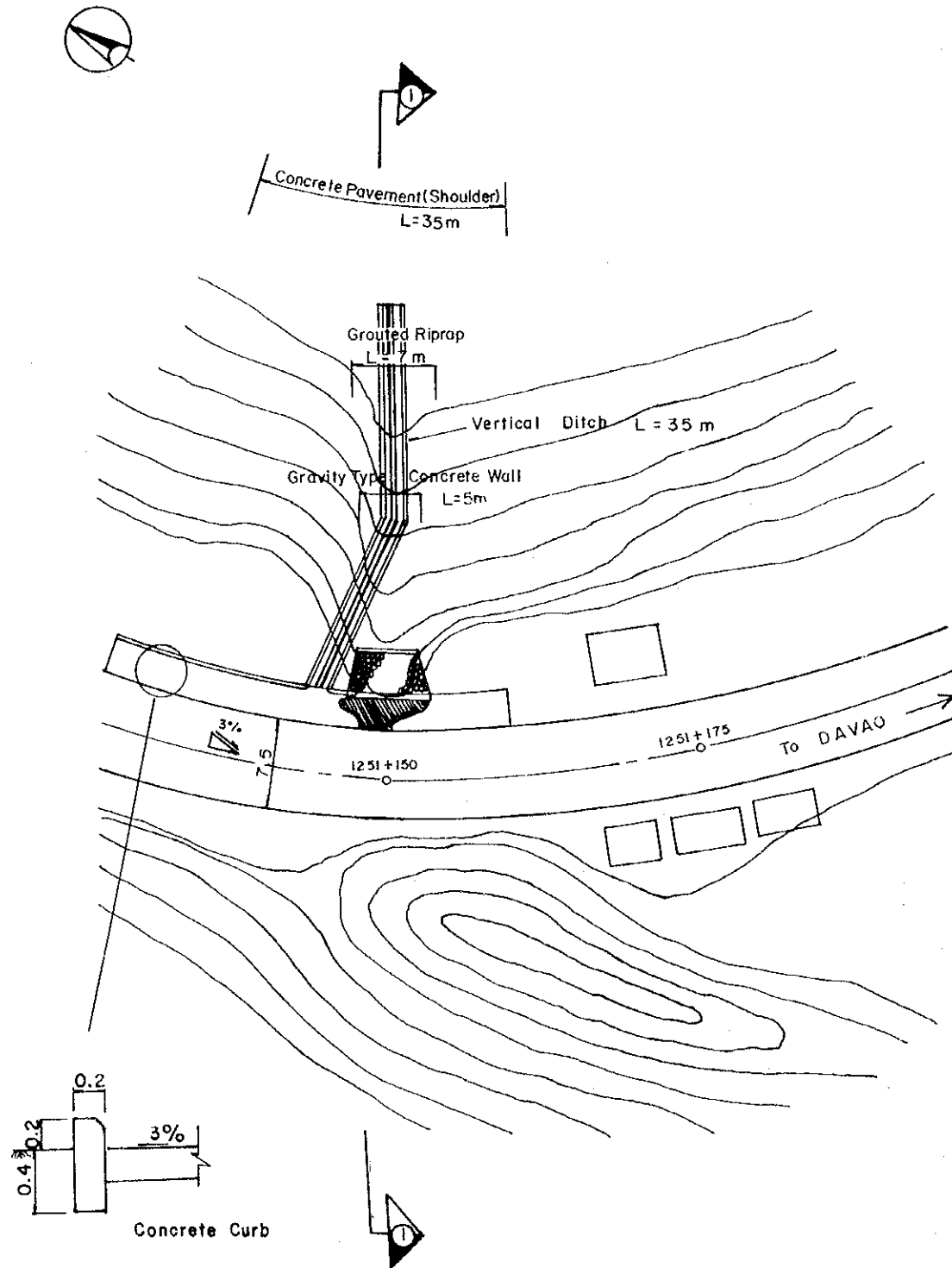


CROSS SECTION (BORING POINT)
SCALE: 1:400

SUMMARY OF QUANTITY

TYPE OF WORK	UNIT	TOTAL
5-2 RECUTTING OF SOFT ROCK	CU.M.	2,170
5-30 BERM DITCH	L.M	98
5-27 VERTICAL DITCH	L.M	28

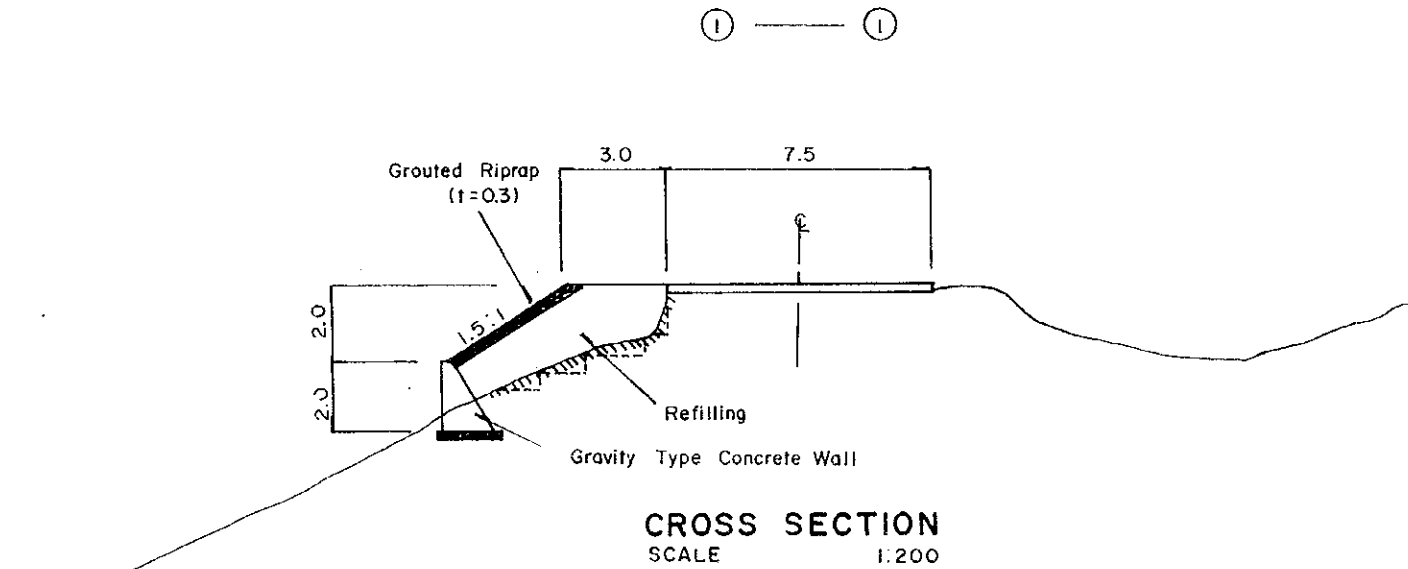
Cause of Disaster:
1) Movement along sliding plane in cohesive soil layer induced by the raise of groundwater level.



P L A N

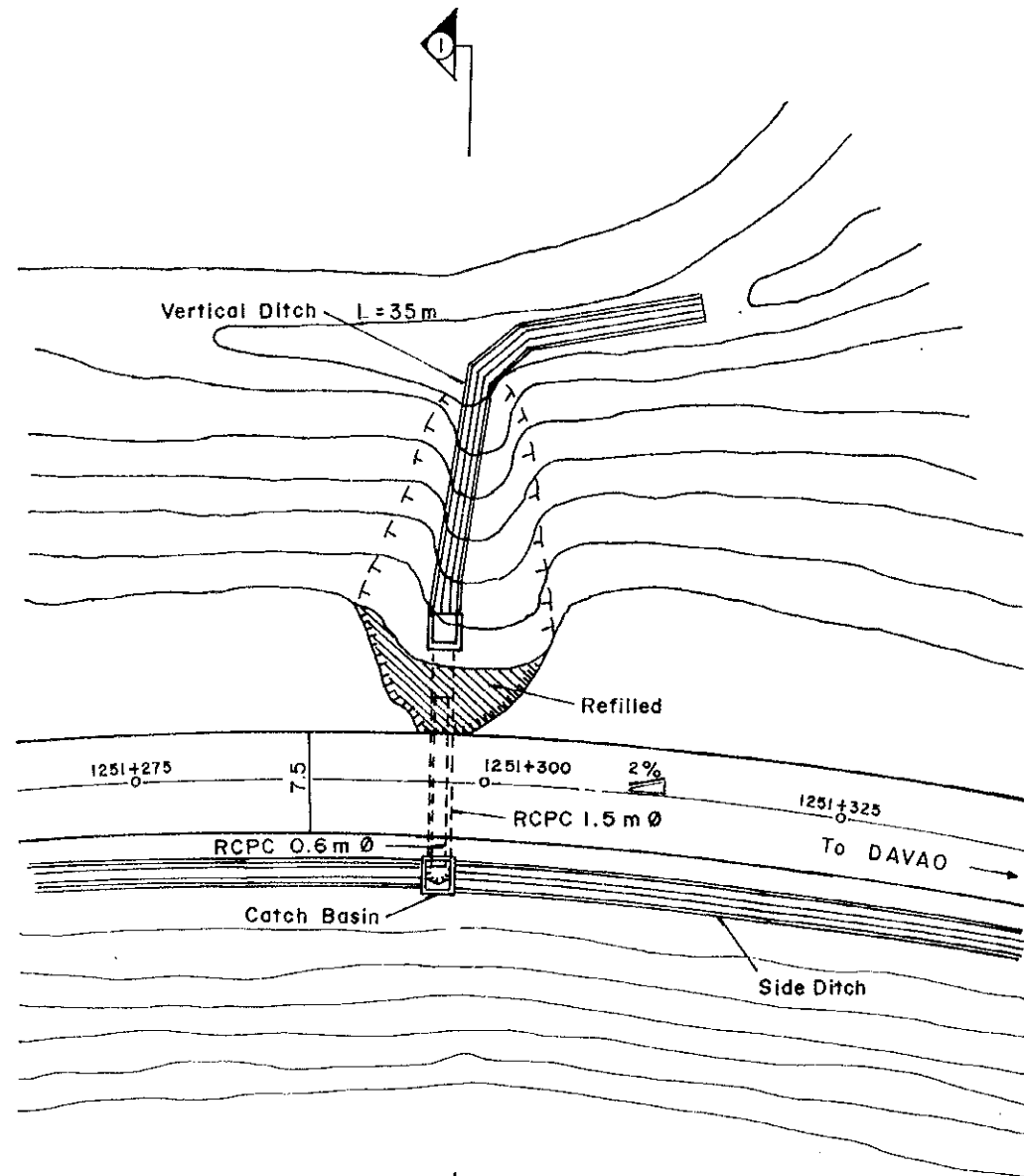
Cause of Disaster:

- 1) Erosion due to concentrated surface water on the curved portion of road.
- 2) Embankment slope with an unstable grade.

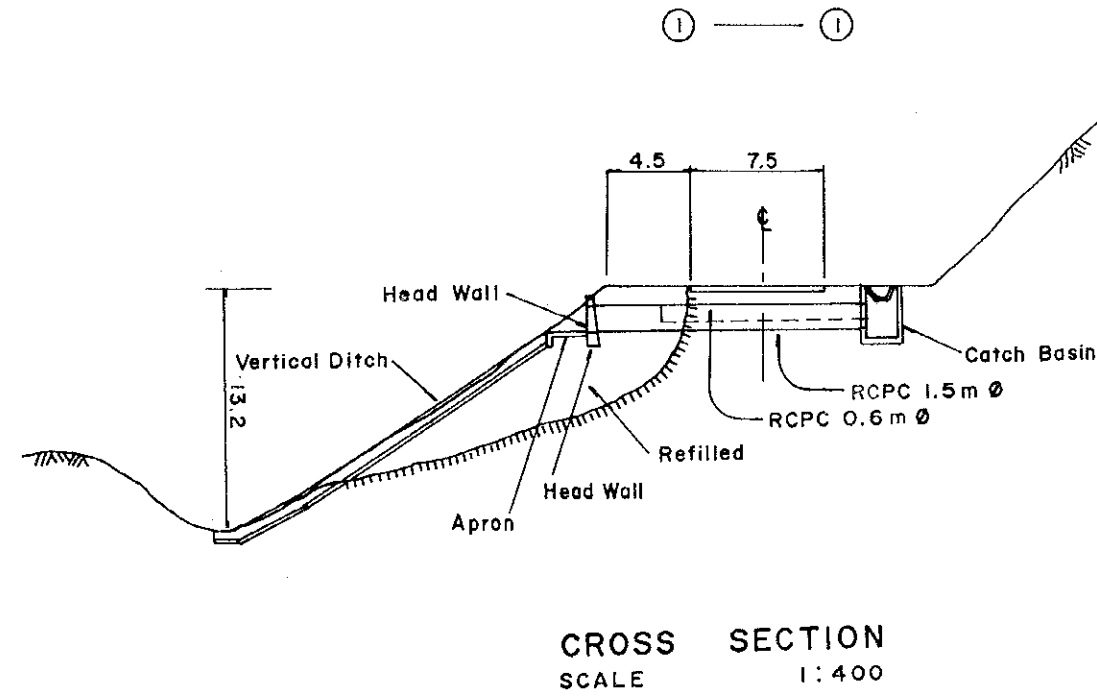


SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	59
5-19	GROUTED RIPRAP	CU.M	8
5-14	GRAVITY TYPE CONCRETE WALL	CU.M	10
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ.M	105
5-27	VERTICAL DITCH	L.M	35
5-4	STRUCTURAL EXCAVATION	CU.M	20
5-8	FOUNDATION FILL	CU.M	11
5-45	CONCRETE CURB	L.M	17



P L A N



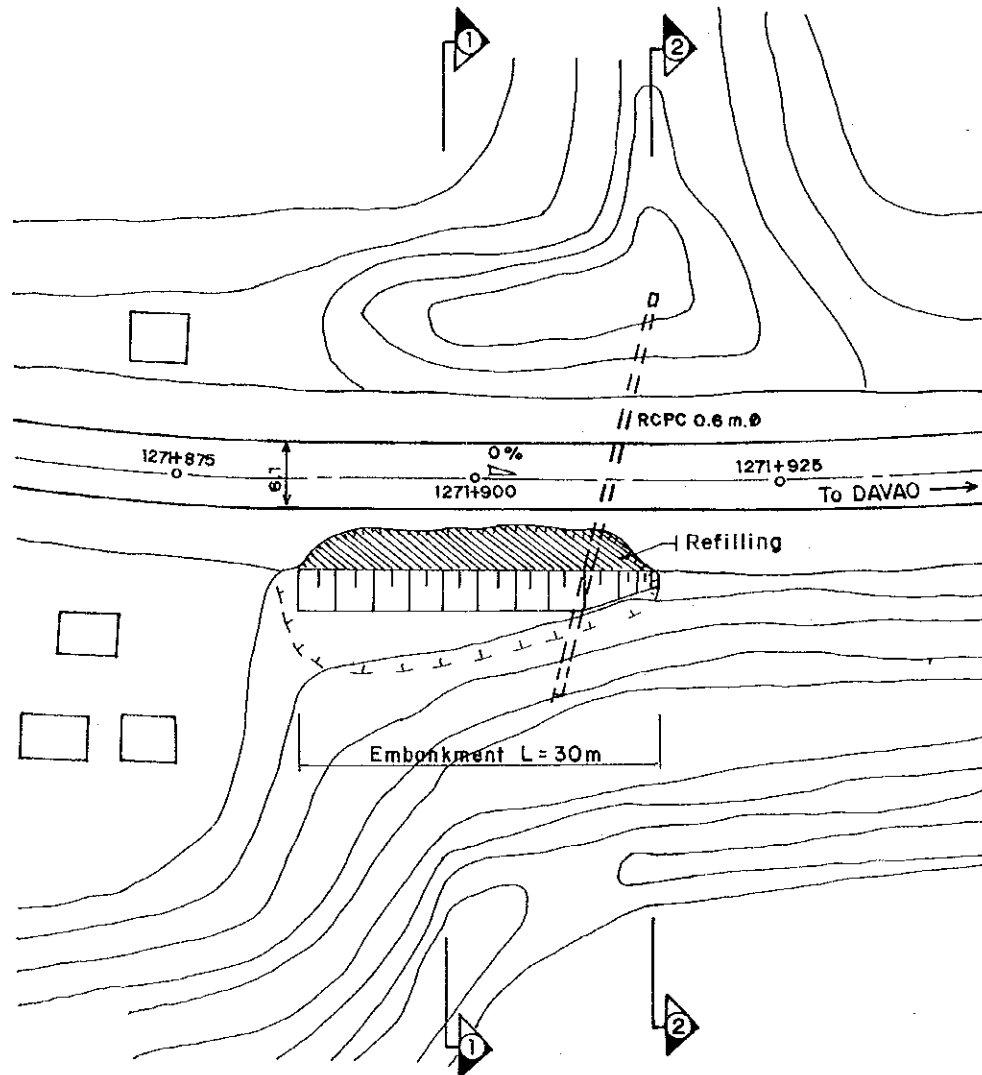
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

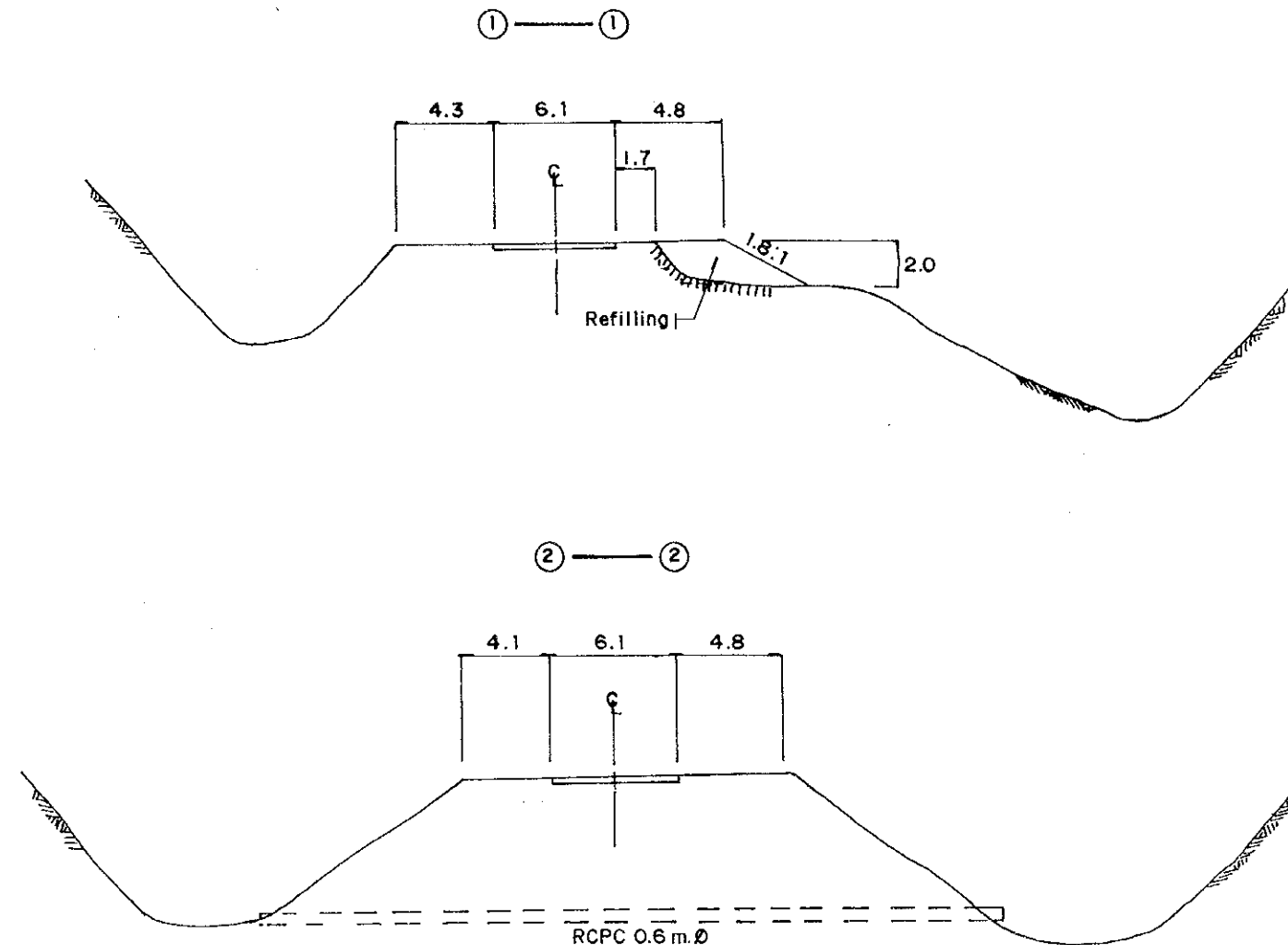
	TYPE OF WORK	UNIT	TOTAL
5-33	RCPC (1.5 m Ø)	L.M.	15
5-36	CATCH BASIN FOR RCPC 1.5 m Ø	E.A.	1
5-27	VERTICAL DITCH	L.M.	35
5-41	HEAD WALL FOR RCPC 1.5 m Ø	E.A.	1
5-4	STRUCTURAL EXCAVATION	CU.M.	116
5-8	FOUNDATION FILL	CU.M.	75

Cause of Disaster:

- 1) Infiltration of water into boundary surface between the inclined ground and embankment.
- 2) Insufficient drainage capacity of pipe culvert.
- 3) Effect of ground water.



P L A N

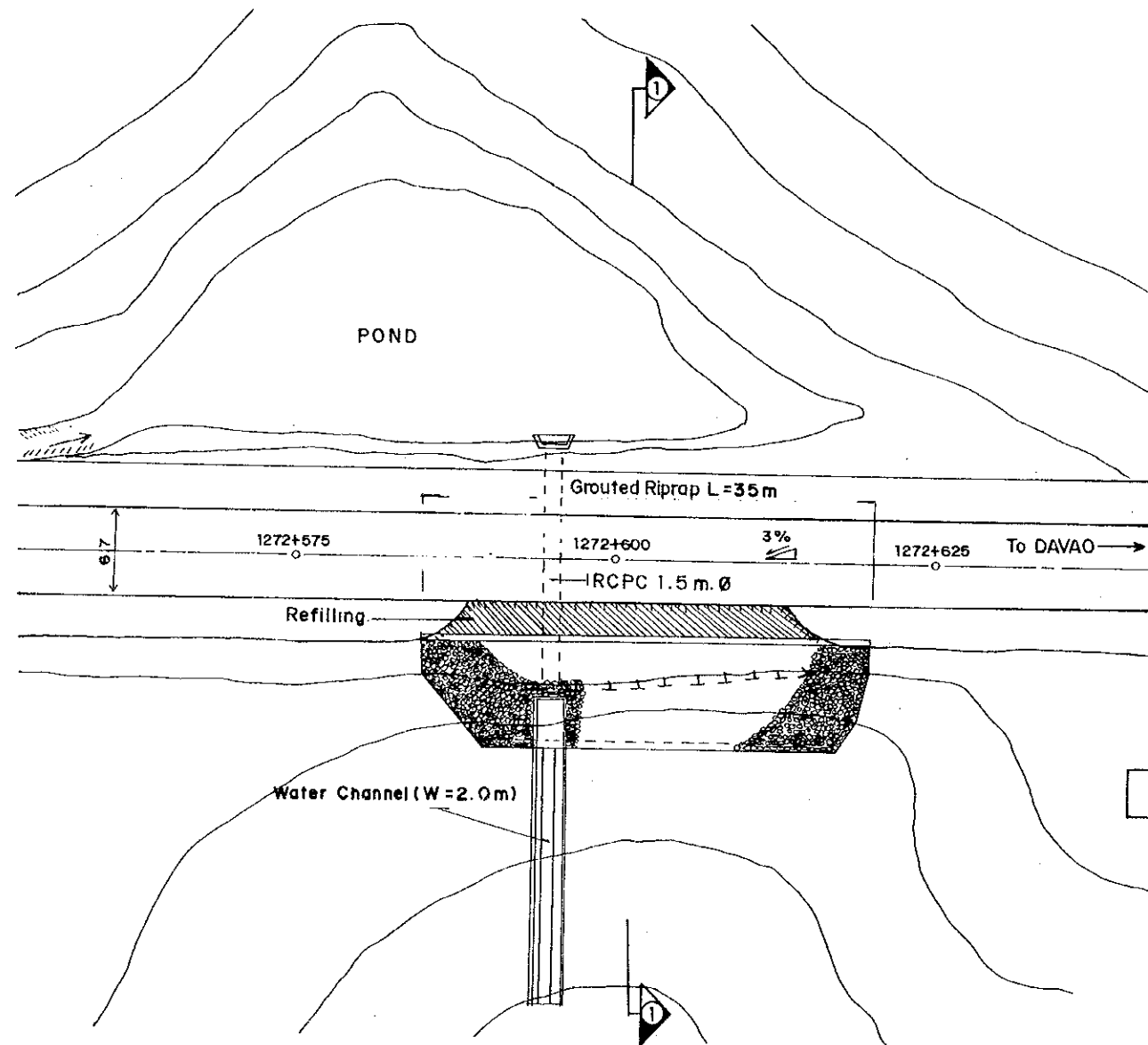


CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU. M	239

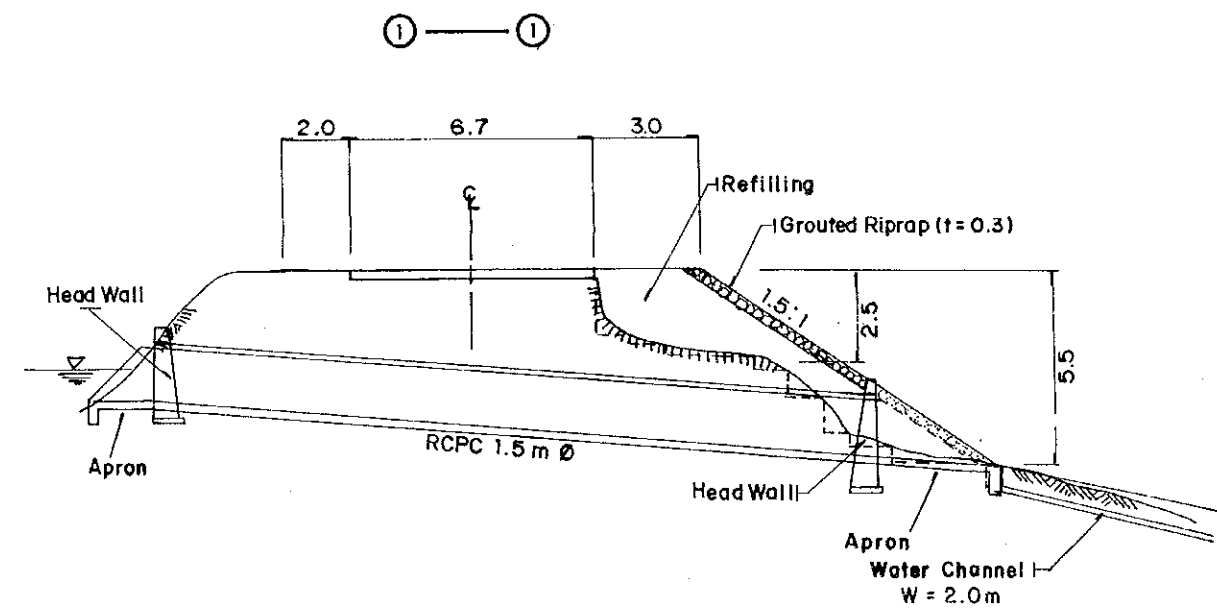
Cause of Disaster:
1) Insufficient compaction of embankment.



P L A N

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Pond which overflowed and scoured the embankment.



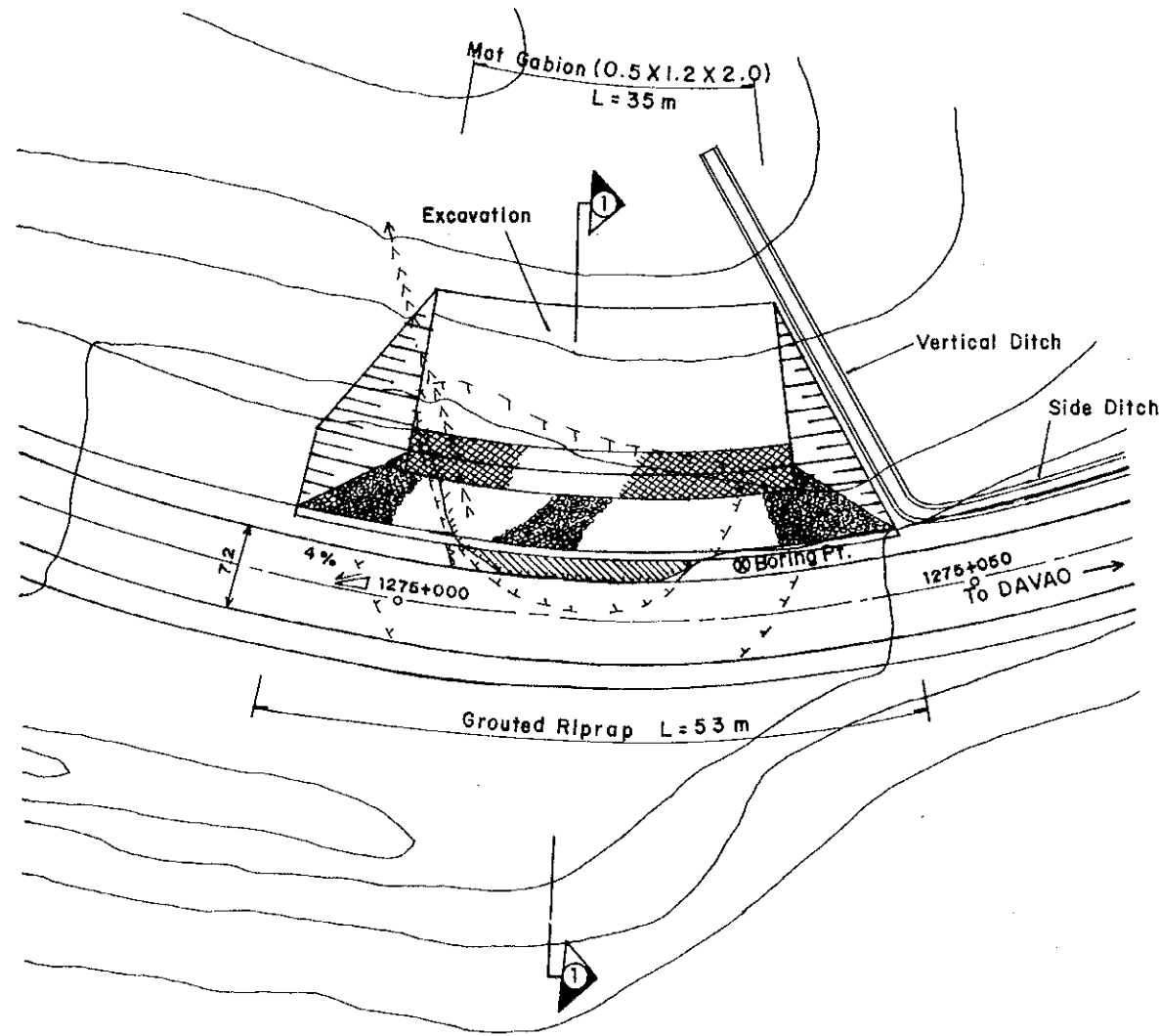
CROSS SECTION
SCALE 1:200

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU. M.	446
5-19	GROUTED RIPRAP	CU. M.	104
5-41	HEAD WALL FOR RCPC 1.5m Ø	E. A.	2
5-38	RCPC (1.5m Ø)	L. M.	20
5-29	WATER CHANNEL (W=2.0m)	L. M.	25
5-4	STRUCTURAL EXCAVATION	CU. M.	230
5-8	FOUNDATION FILL	CU. M.	190



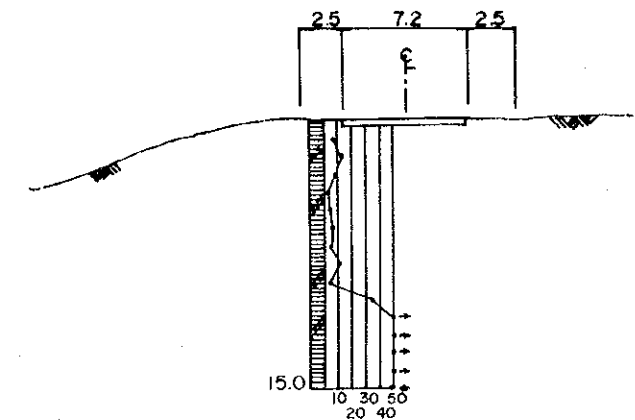
Cause of Disaster:
1) Settlement of embankment caused by consolidation of soft ground.



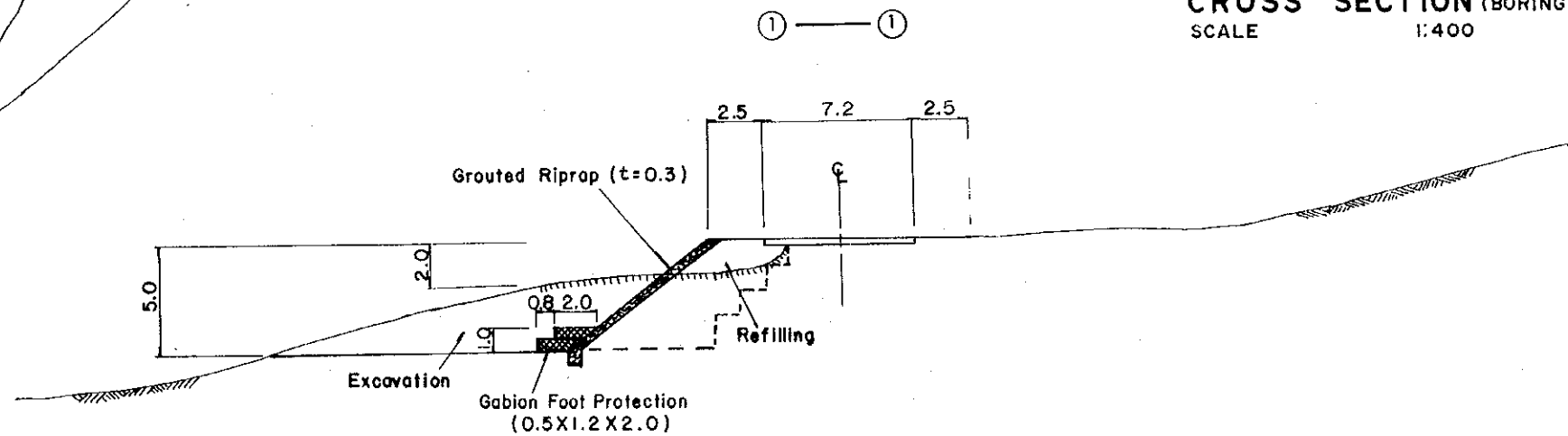
PLAN

SUMMARY OF QUANTITY

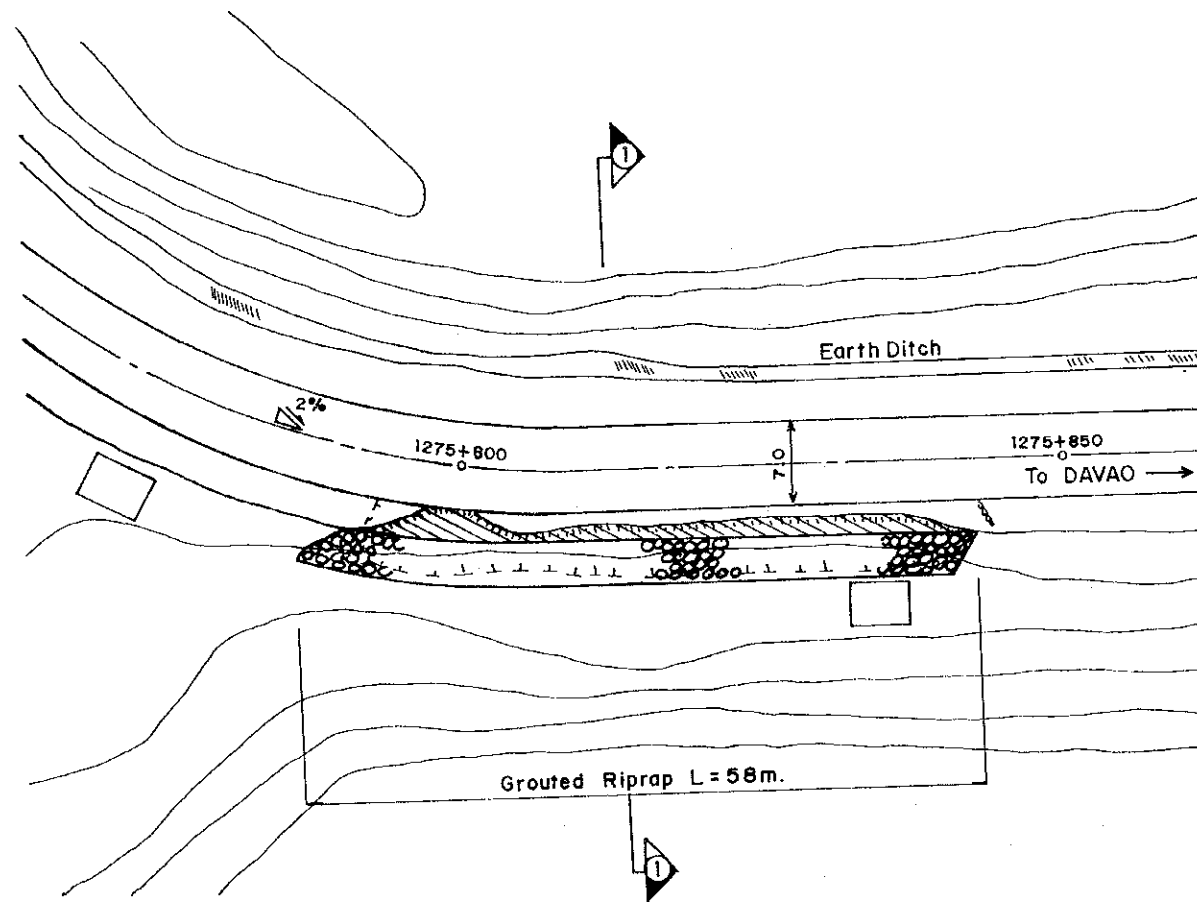
	TYPE OF WORK	UNIT	TOTAL
5-3	SURPLUS EXCAVATION	CU.M.	1,980
5-5	REFILLING/EMBANKMENT	CU.M.	875
5-19	GROUTED RIPRAP	CU.M.	123
5-26	GABION FOOT PROTECTION	CU.M.	70
5-27	VERTICAL DITCH	L.M.	40



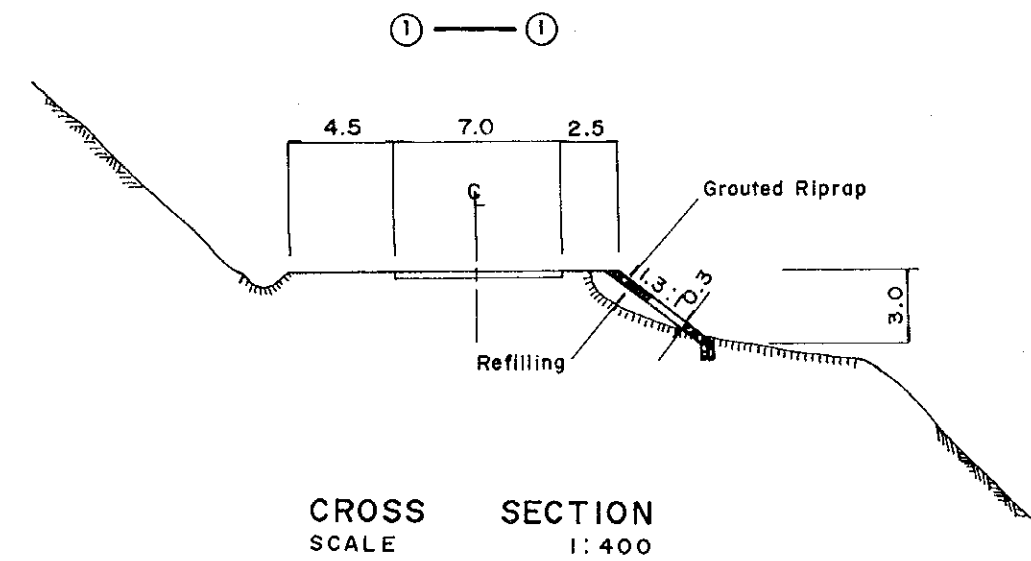
CROSS SECTION (BORING POINT)
SCALE 1:400



CROSS SECTION
SCALE 1:400



P L A N



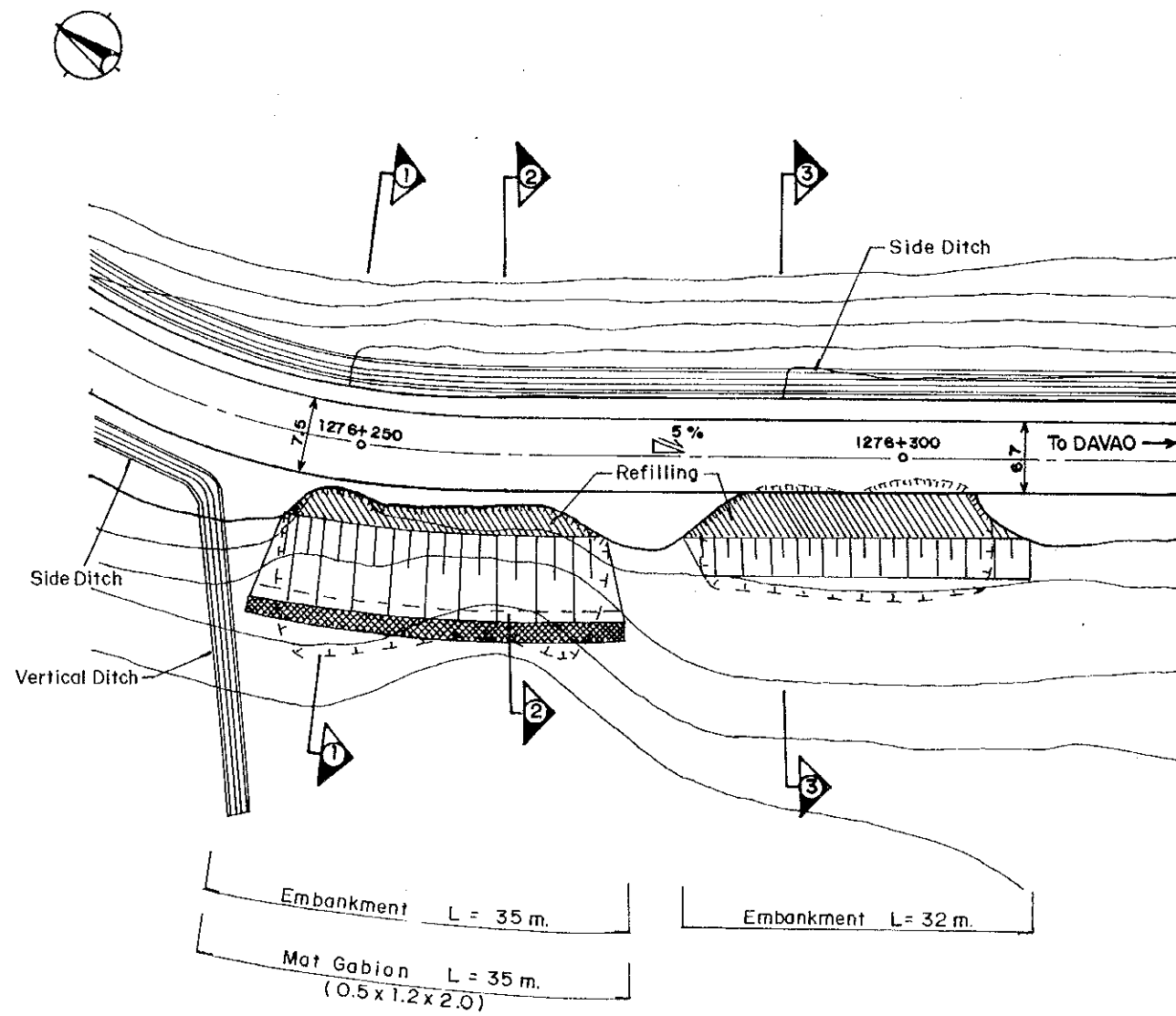
CROSS SECTION
SCALE 1:400

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M.	135
5-19	GRouted RIPRAP	CU.M.	99

Cause of Disaster:

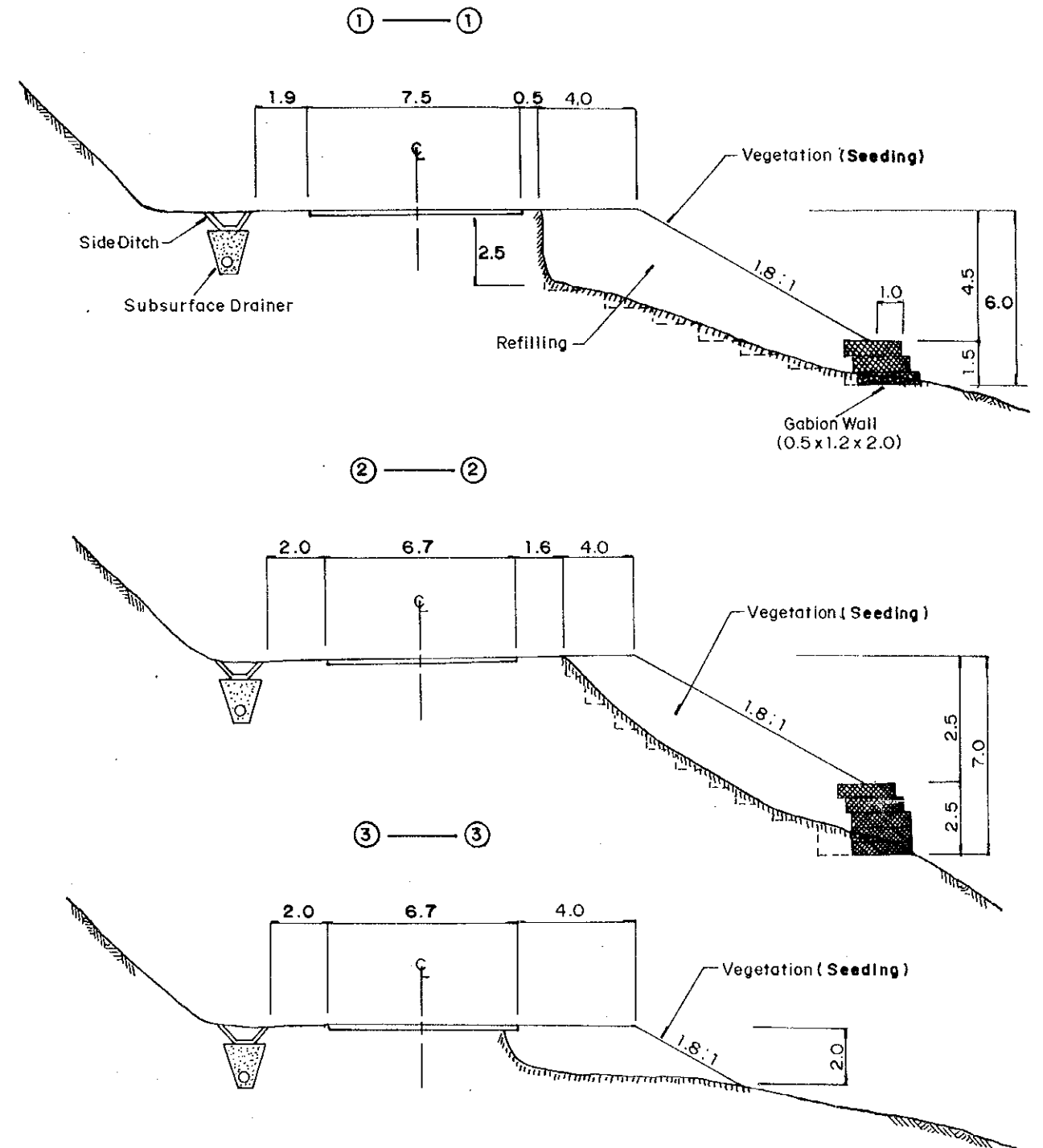
- 1) Infiltration of water into boundary surface between the inclined ground and embankment.
- 2) Effect of ground water.



P L A N

SUMMARY OF QUANTITY

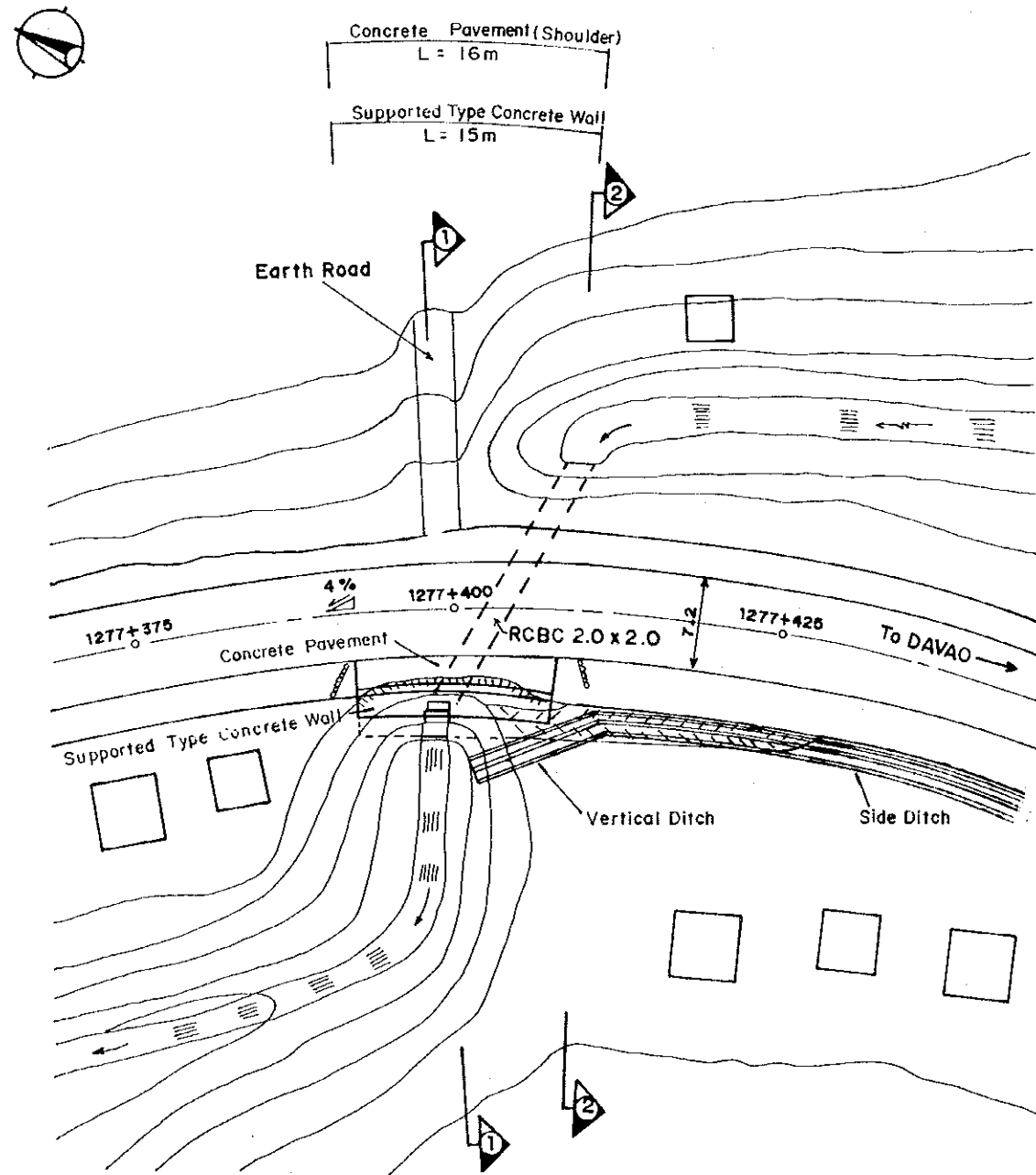
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	1,067
5-17	GABION WALL	CU.M	110
5-18	VEGETATION (SEEDING)	SQ.M	319
5-44	SUBSURFACE DRAINER	L.M	100



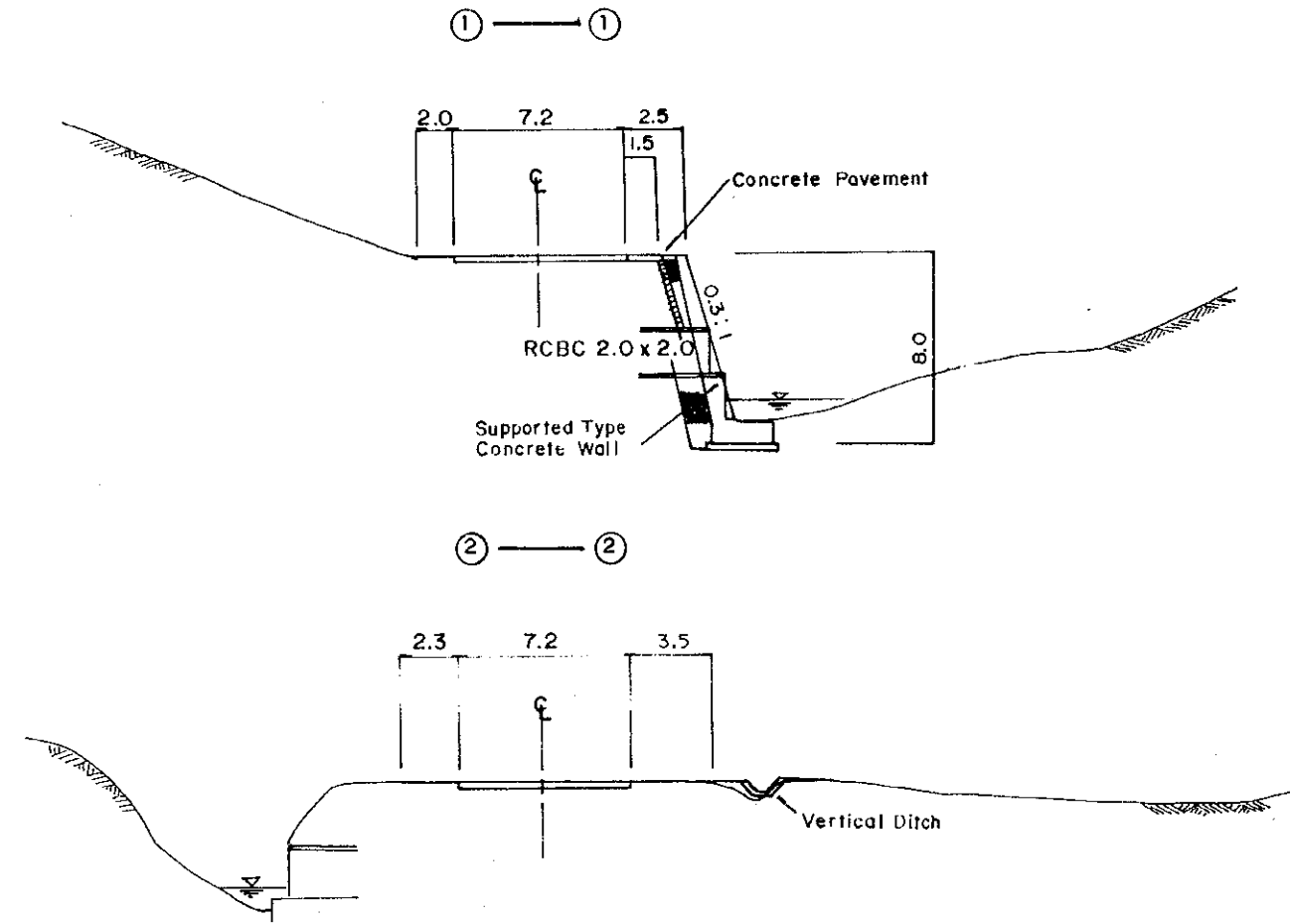
CROSS SECTION
SCALE 1:200

Cause of Disaster:

- 1) Infiltration of water into boundary surface between the ground and embankment.
- 2) Effect of ground water.



P L A N



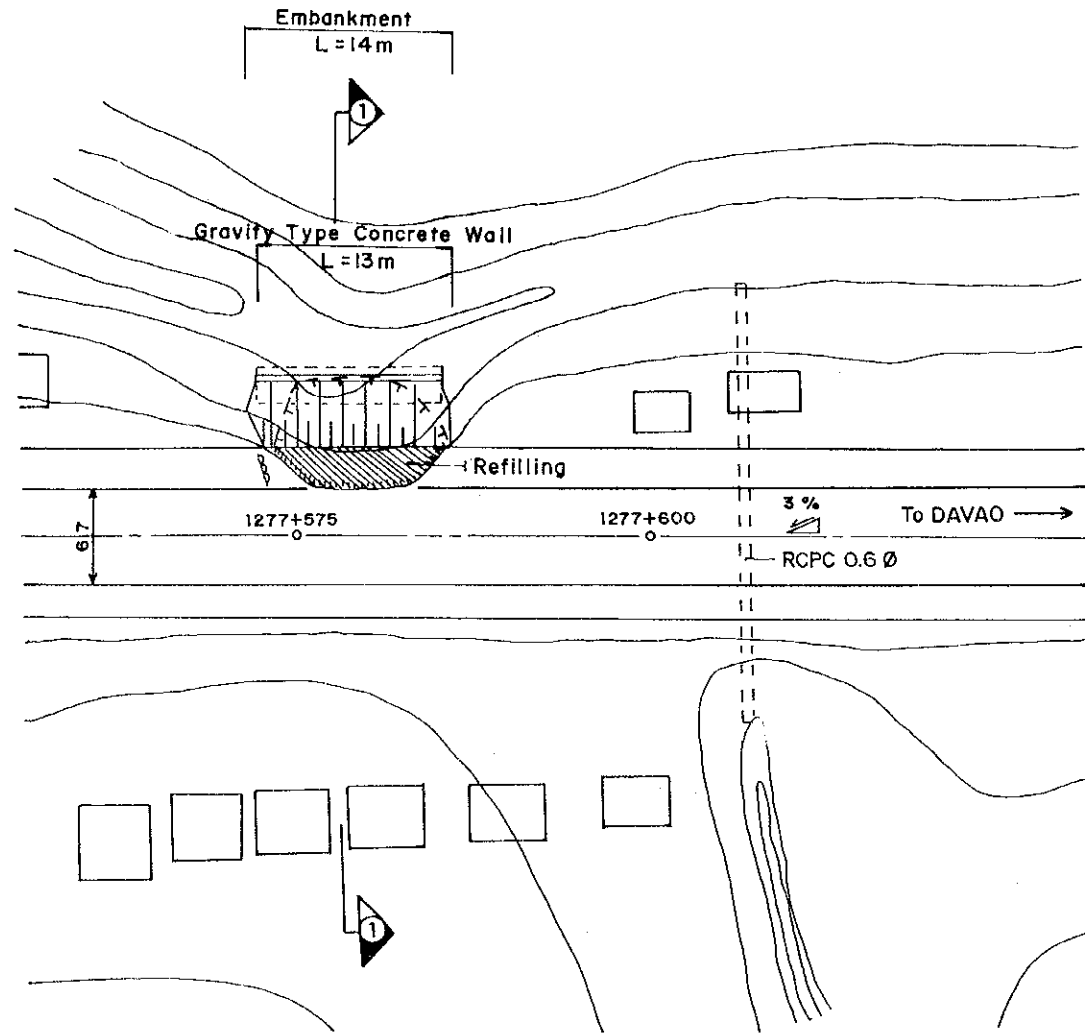
CROSS SECTION
SCALE 1:300

Cause of Disaster:

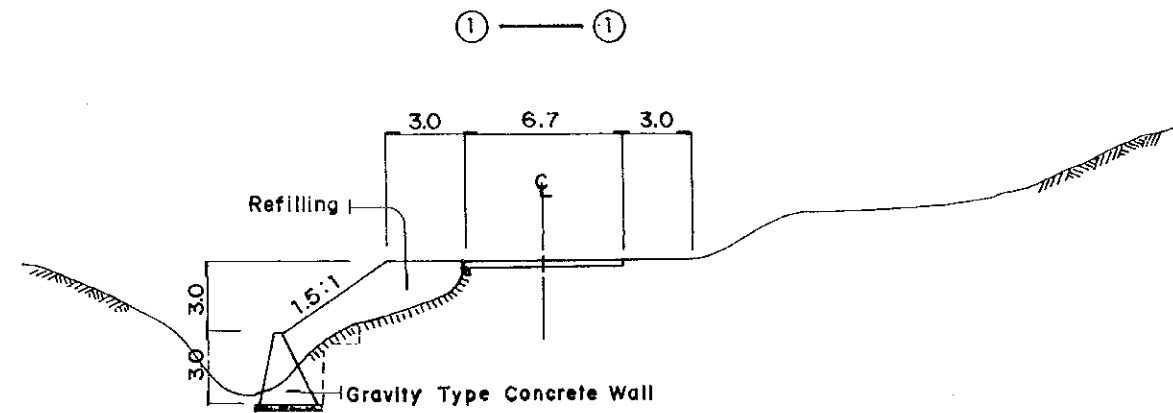
- 1) Insufficient compaction of embankment.
- 2) Erosion due to concentrated surface water on the curved portion of road.
- 3) Embankment slope with an unstable grade.

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-15	SUPPORTED TYPE CONCRETE WALL	CU. M	116
5-13	CONCRETE PAVEMENT (SHOULDER)	SQ. M	48
5-27	VERTICAL DITCH	L. M	11
5-4	STRUCTURAL EXCAVATION	CU. M	210
5-6	FILLING OF BACKFILL MATERIAL	CU. M	68



P L A N



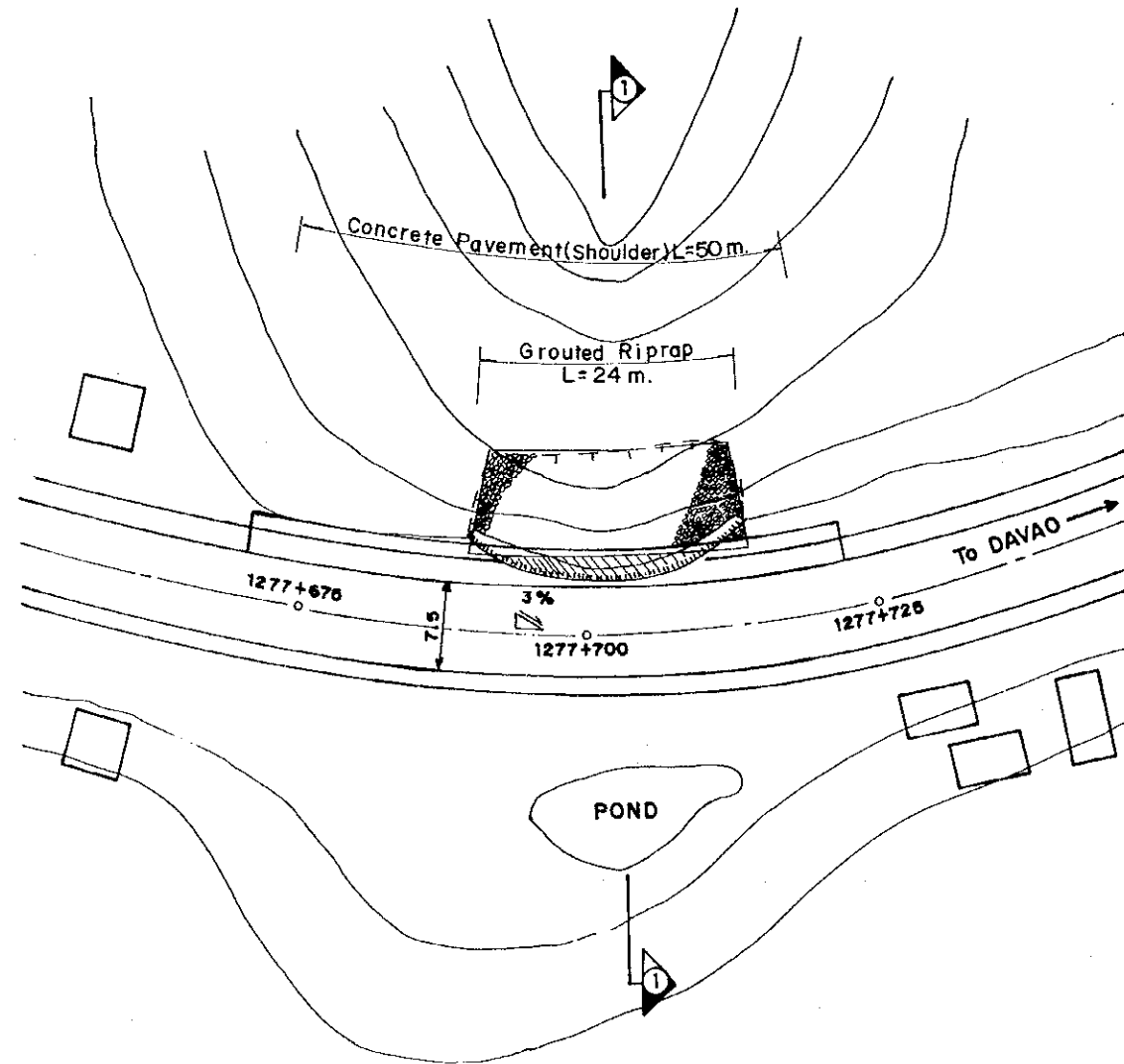
CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

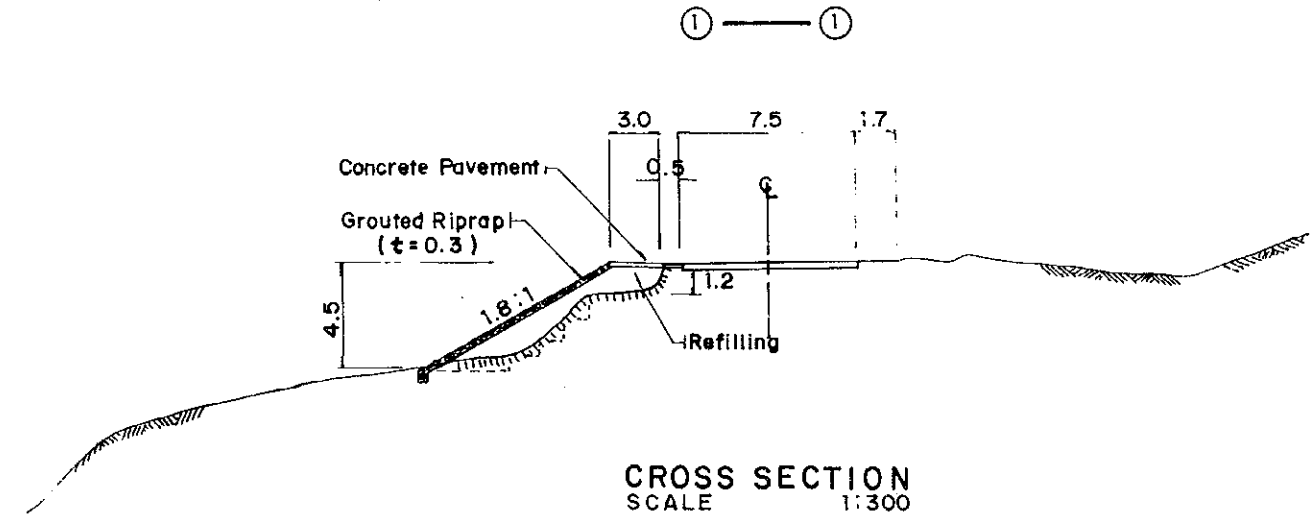
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M.	162
5-14	GRAVITY TYPE CONCRETE WALL	CU.M.	59
5-4	STRUCTURAL EXCAVATION	CU.M.	80
5-8	FOUNDATION FILL	CU.M.	25

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.



P L A N

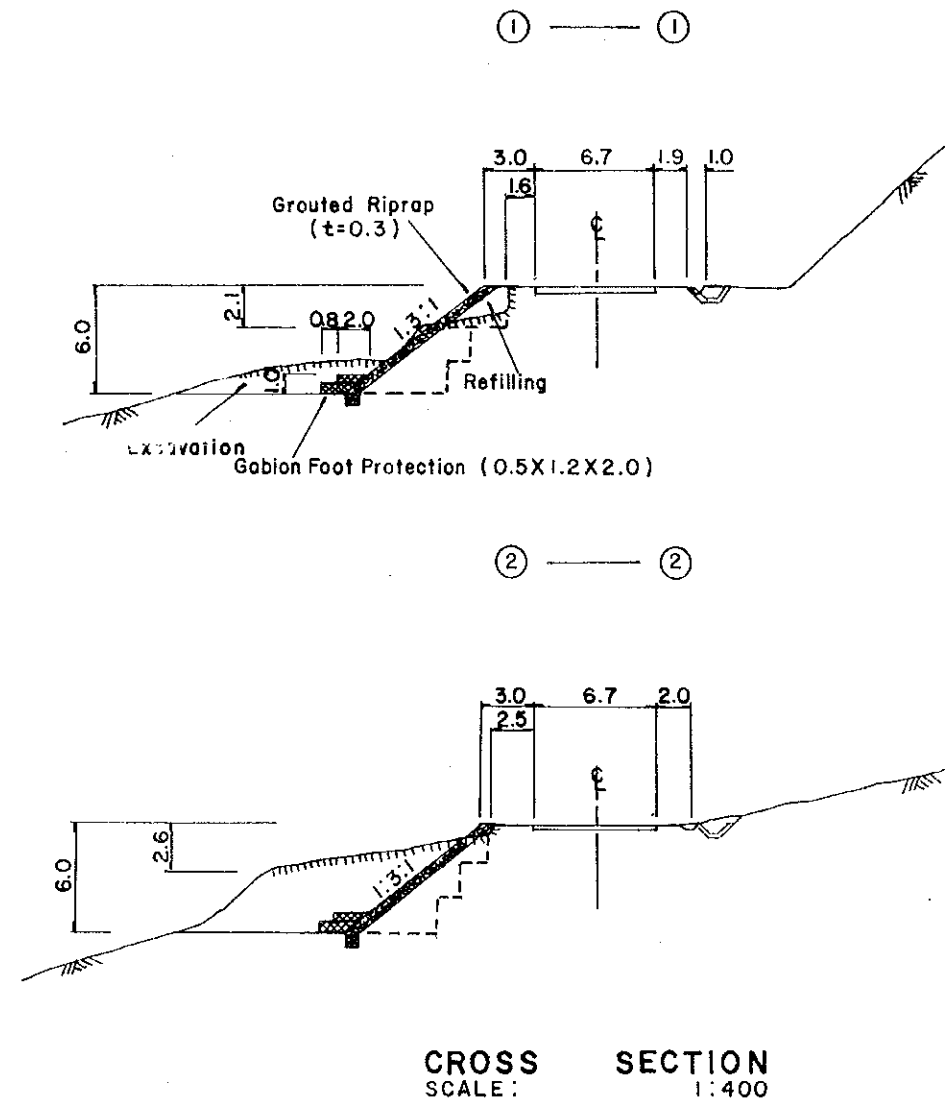
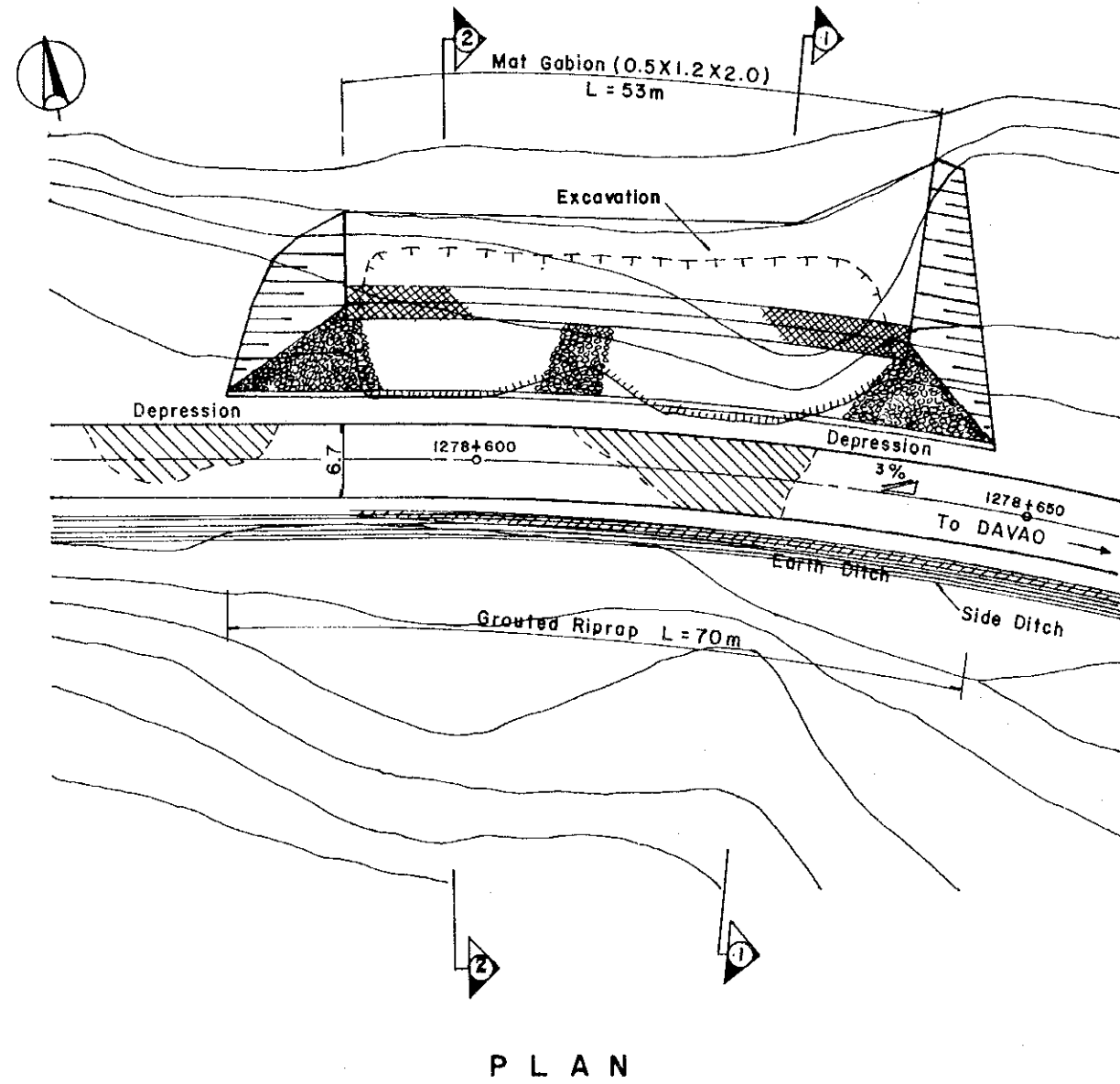


SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING/EMBANKMENT	CU. M.	292
5-19	GROUTED RIPRAP	CU. M.	75
5-13	CONCRETE PAVEMENT (Shoulder)	SQ. M.	150

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Erosion due to concentrated surface water on the curved portion of road
- 3) Embankment slope with an unstable grade.

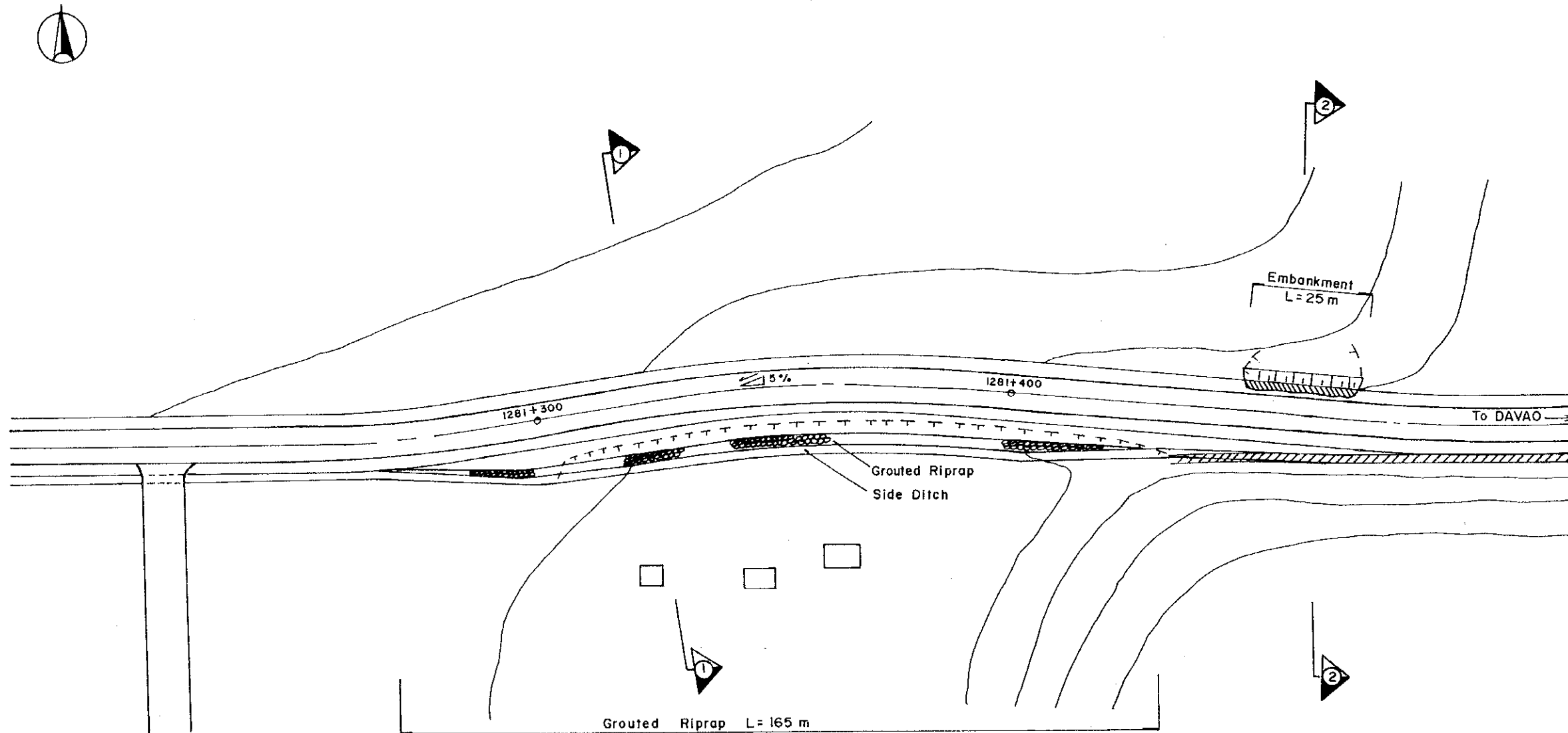


SUMMARY OF QUANTITY

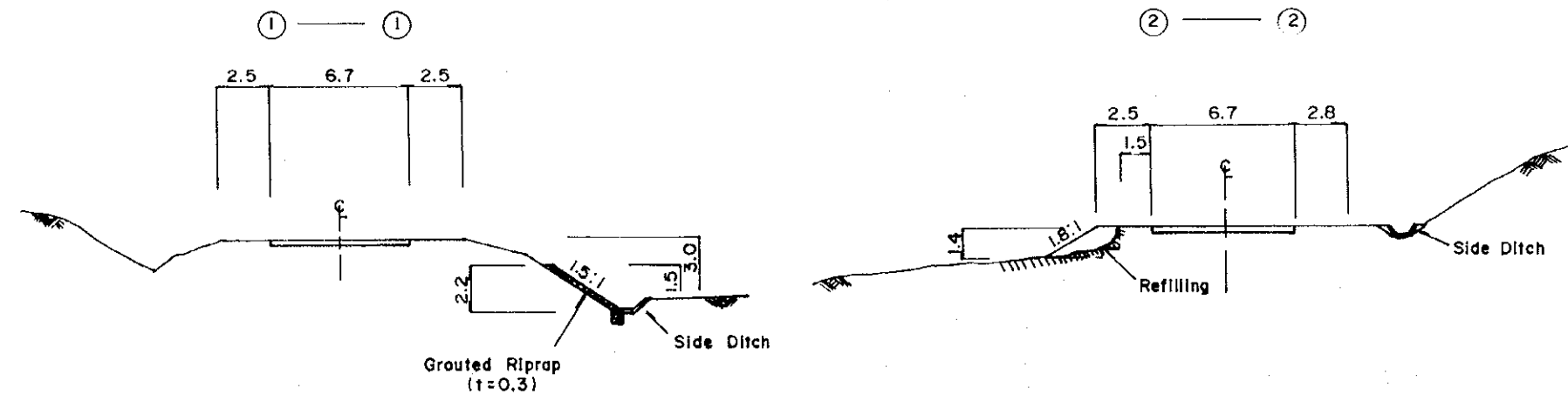
TYPE OF WORK		UNIT	TOTAL
5-3	SURPLUS EXCAVATION	CU. M.	2,200
5-5	REFILLING/EMBANKMENT	CU. M.	470
5-19	GROUTED RIPRAP	CU. M.	207
5-26	GABION FOOT PROTECTION	CU. M.	106

Cause of Disaster:

- 1) Settlement of embankment caused by consolidation of soft ground.
- 2) Infiltration of water into boundary surface between the ground and embankment.
- 3) Risen pore water pressure in embankment due to infiltration of surface water.



P L A N



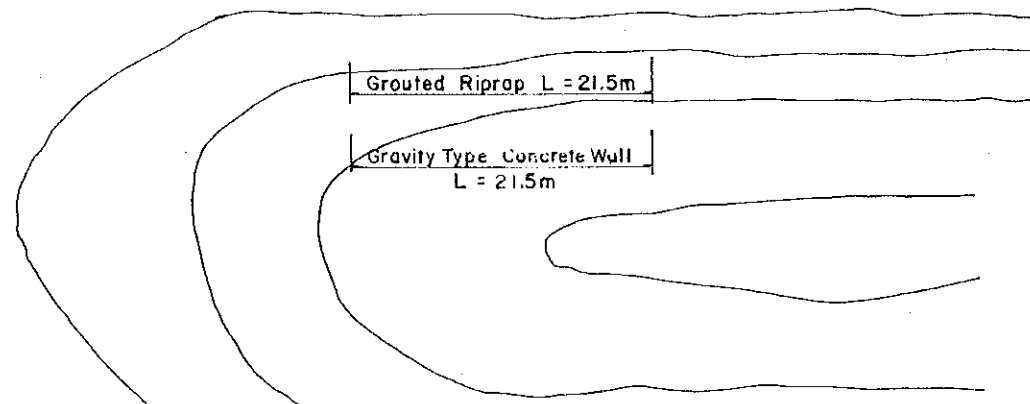
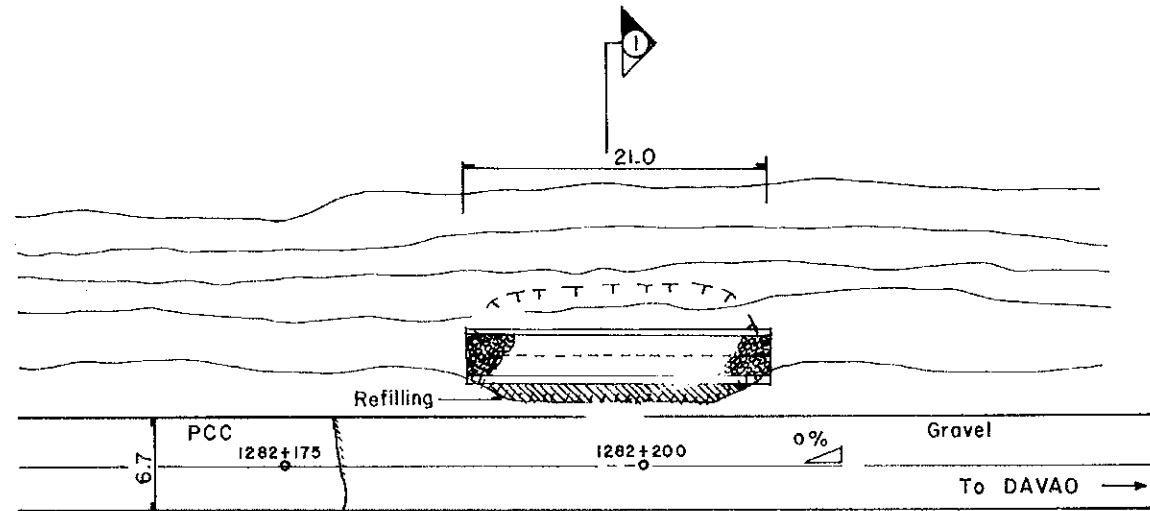
CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

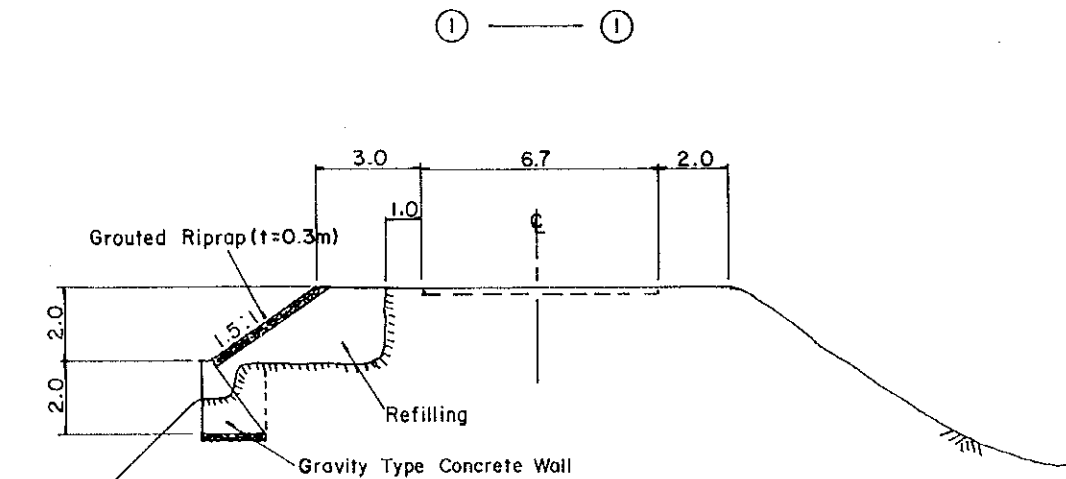
TYPE OF WORK	UNIT	TOTAL
4-22 (1281+320)		
5-19 GROUTED RIPRAP	CU.M	201
4-23 (1281+463)		
5-5 REFILLING / EMBANKMENT	CU.M	62

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.



P L A N



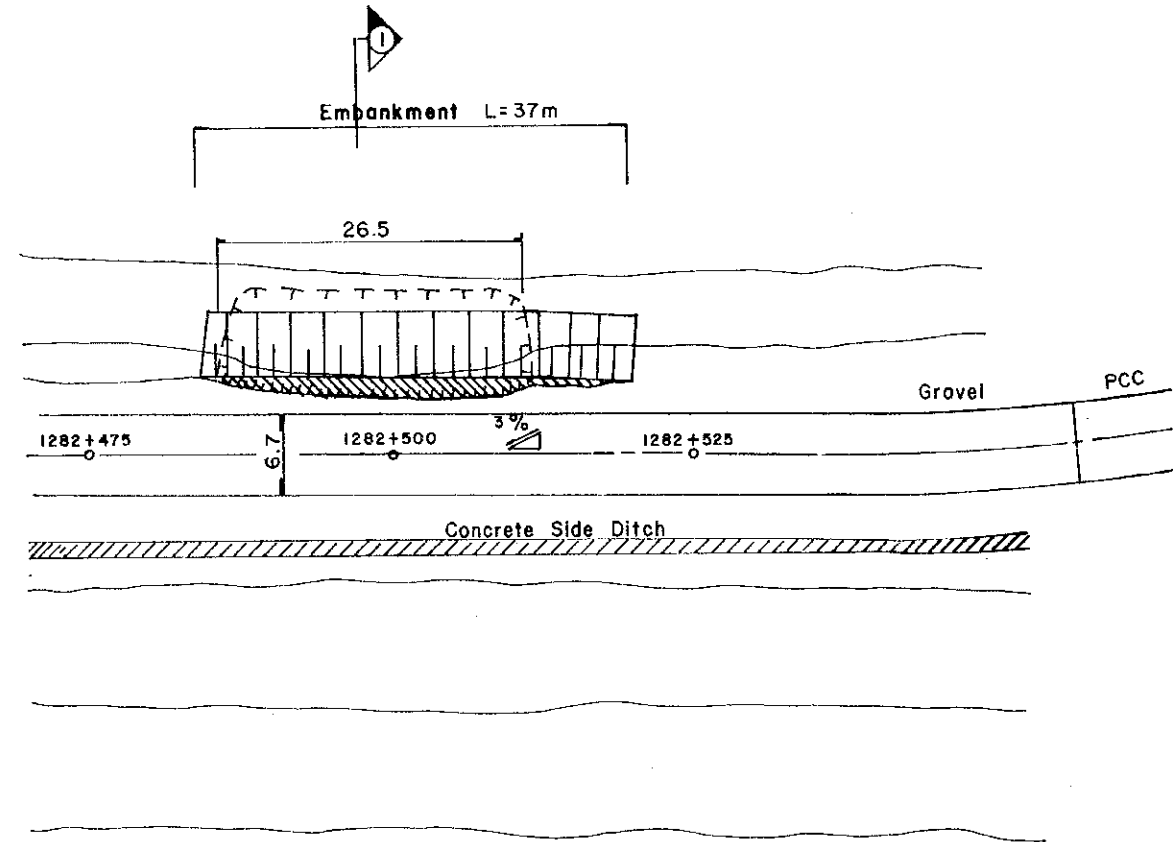
CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

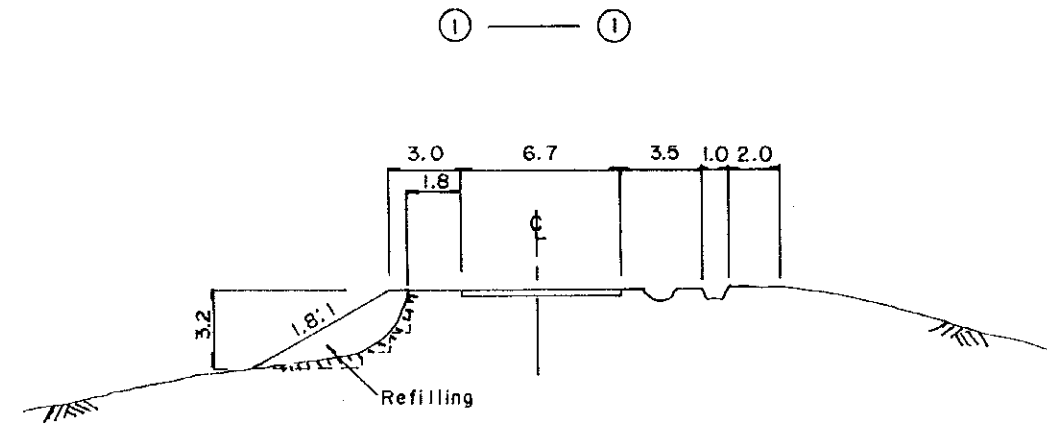
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M	130
5-19	GROUTED RIPRAP	CU.M	23
5-14	GRAVITY TYPE CONCRETE WALL	CU.M	43
5-4	STRUCTURAL EXCAVATION	CU.M	80
5-8	FOUNDATION FILL	CU.M	40

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.



P L A N



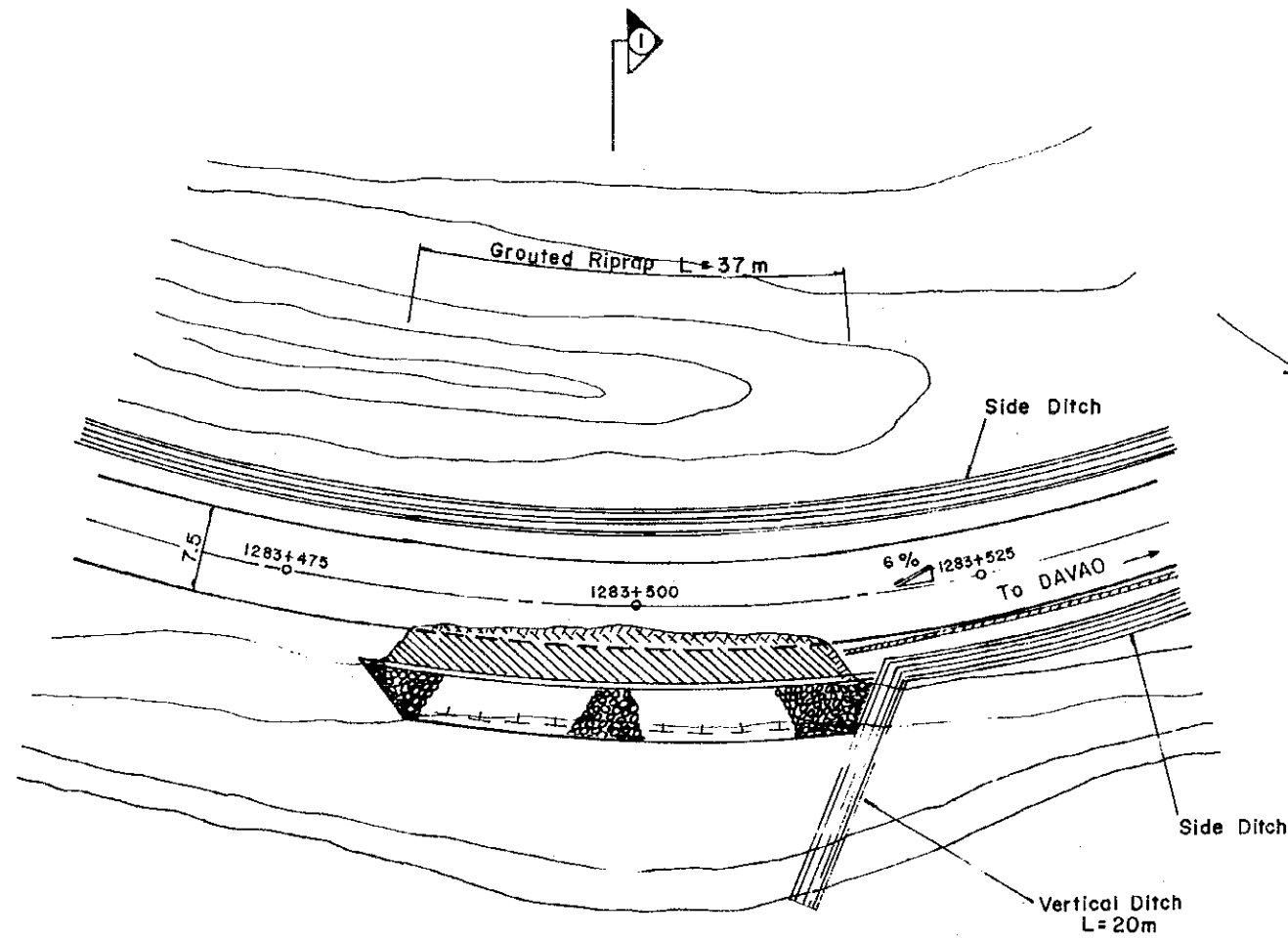
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SUMMARY OF QUANTITY

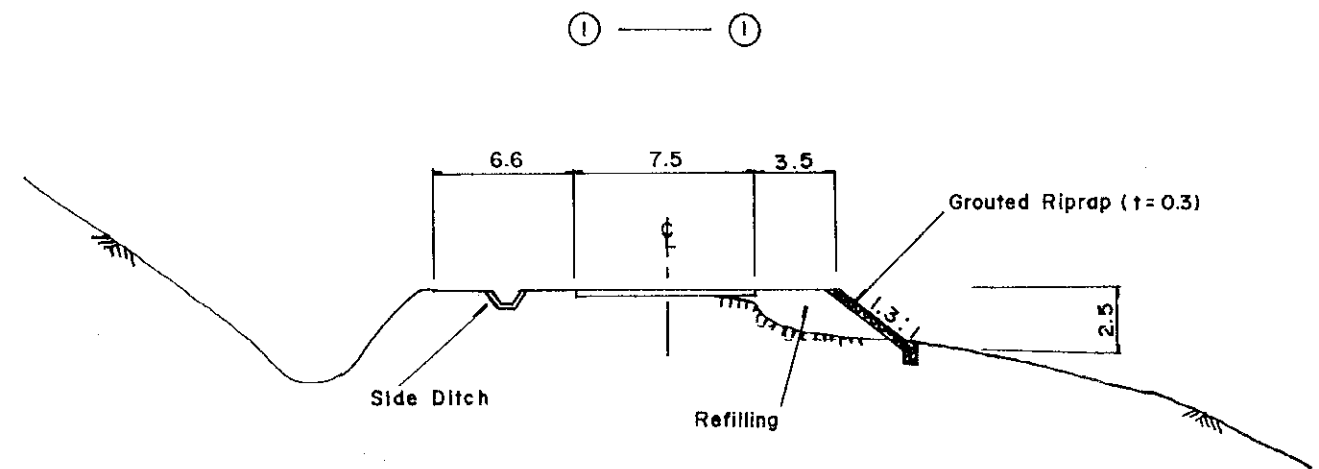
TYPE OF WORK		UNIT	TOTAL
S-5	REFILLING / EMBANKMENT	CU.M	348

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.



P L A N



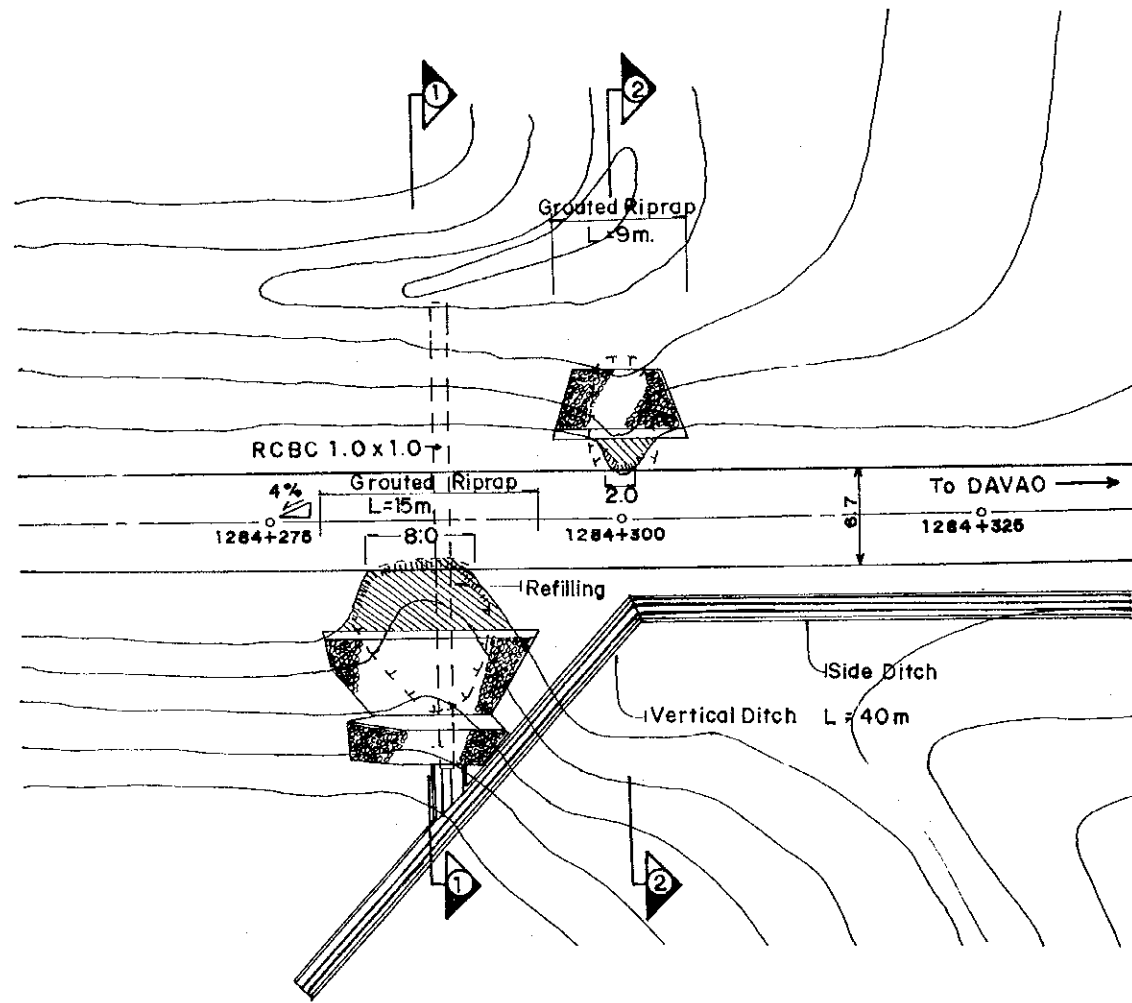
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SUMMARY OF QUANTITY

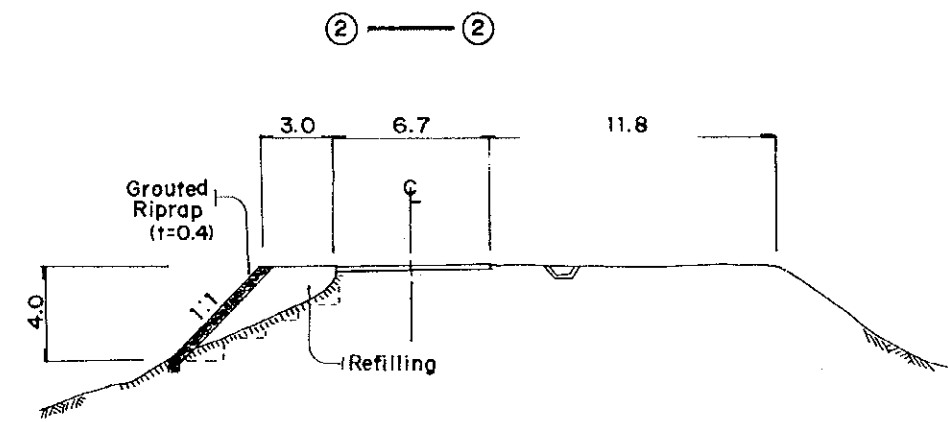
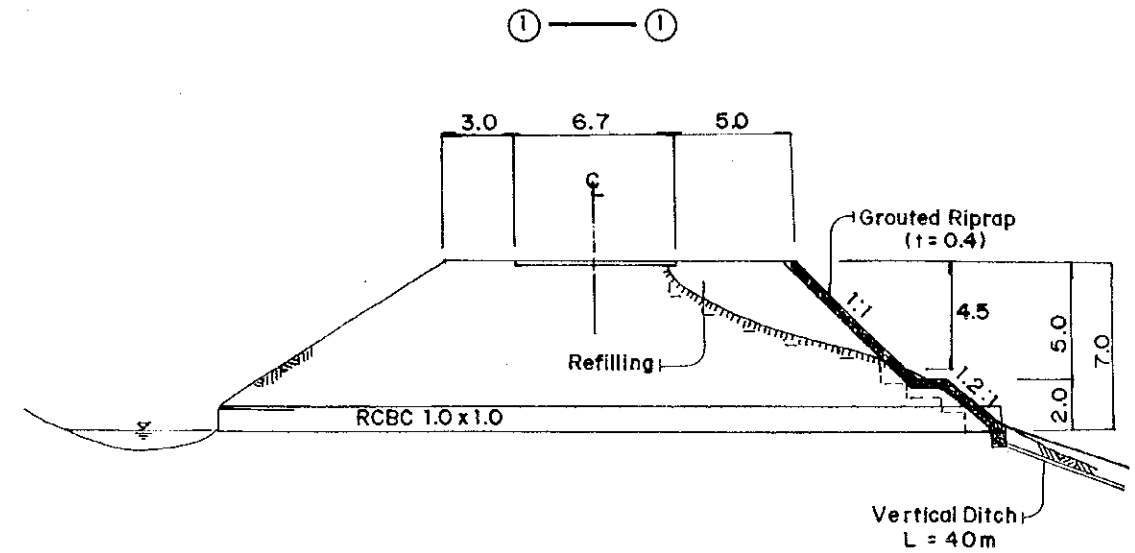
	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING/EMBANKMENT	CU.M	289
5-19	GROUTED RIPRAP	CU.M	53
5-27	VERTICAL DITCH	L.M	20

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.



PLAN



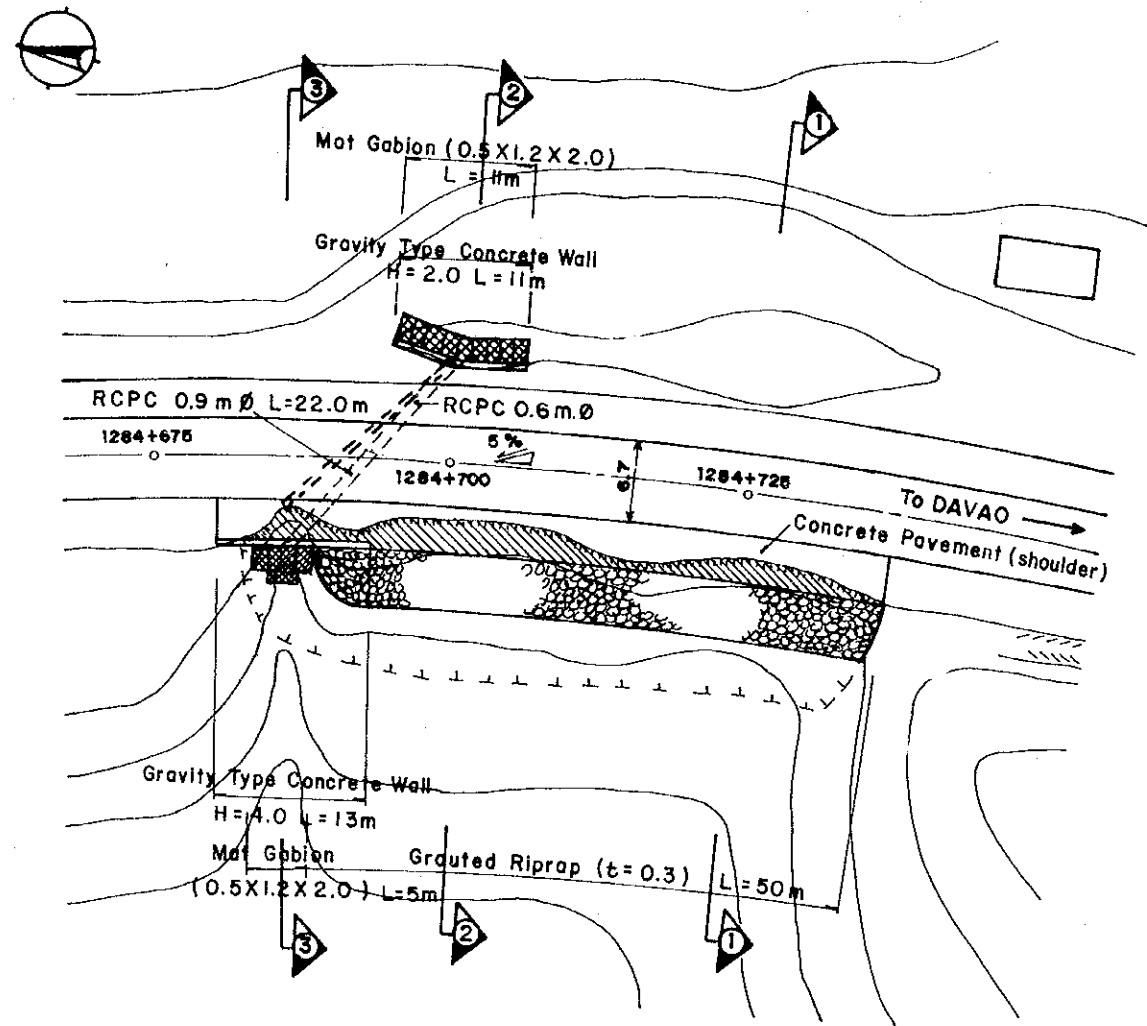
CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

TYPE OF WORK		UNIT	TOTAL
5-5	REFILLING/ EMBANKMENT	CU. M	296
5-19	GROUTED RIPRAP	CU. M	80
5-27	VERTICAL DITCH	CU. M	40

Cause of Disaster:

- 1) Risen pore water pressure in embankment due to infiltration of surface water.
- 2) Embankment slope with an unstable grade.



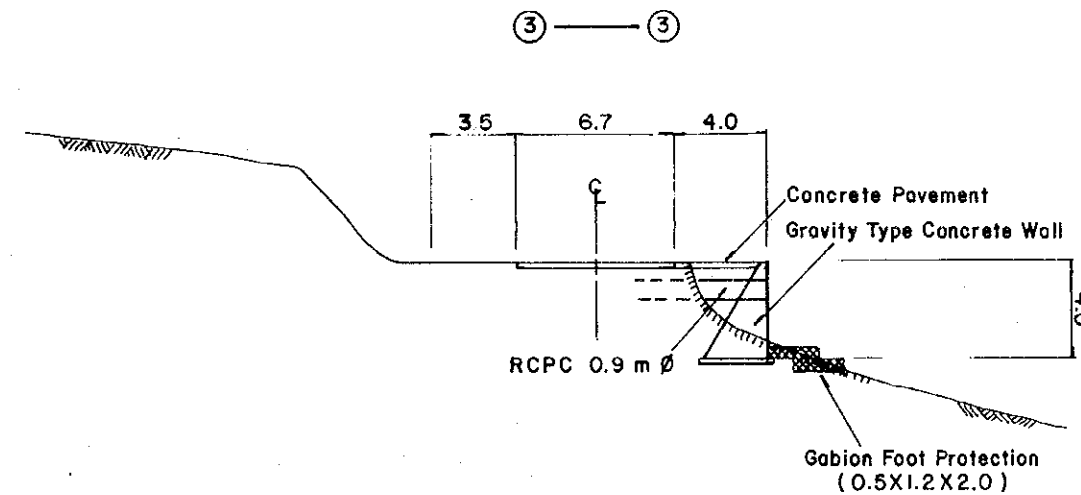
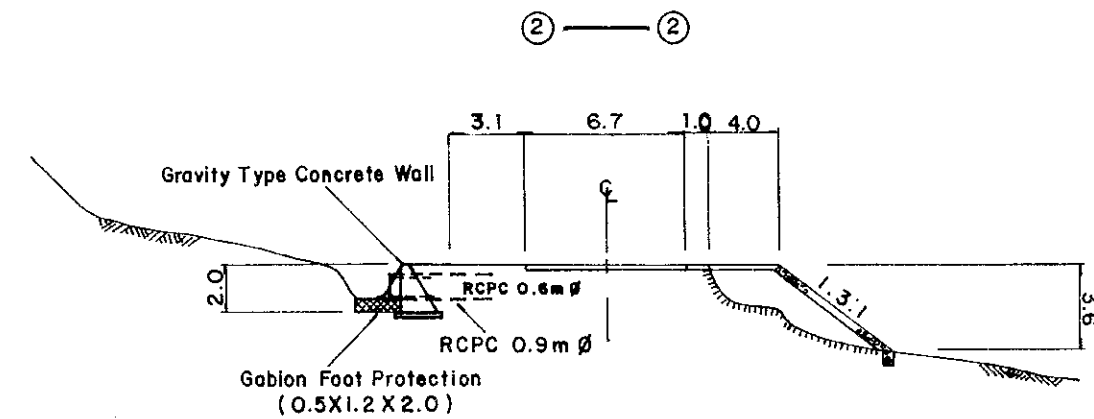
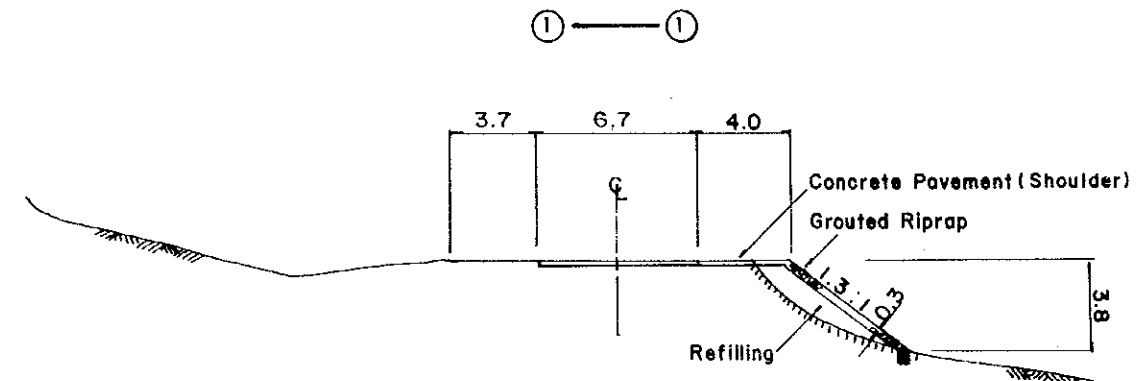
P L A N

SUMMARY OF QUANTITY

	TYPE OF WORK	UNIT	TOTAL
5-5	REFILLING / EMBANKMENT	CU.M.	238
5-19	GROUTED RIPRAP	CU.M.	70
5-14	GRAVITY TYPE CONCRETE WALL	CU.M.	105
5-26	GABION FOOT PROTECTION	CU.M.	18
5-31	RCPC (0.9m Ø)	L.M.	22
5-4	STRUCTURAL EXCAVATION	CU.M.	170
5-8	FOUNDATION FILL	CU.M.	70

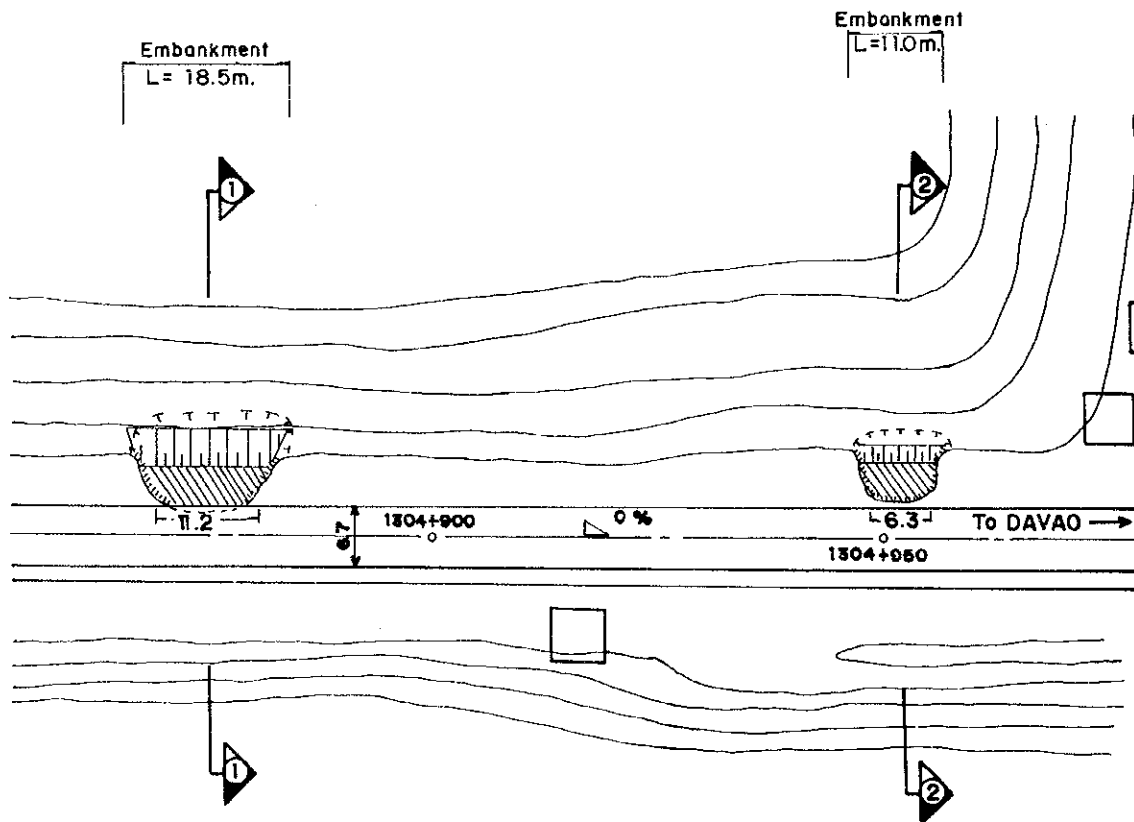
Cause of Disaster:

- 1) Insufficient drainage capacity of pipe culvert.
- 2) Inadequate inlet facility of pipe culvert.

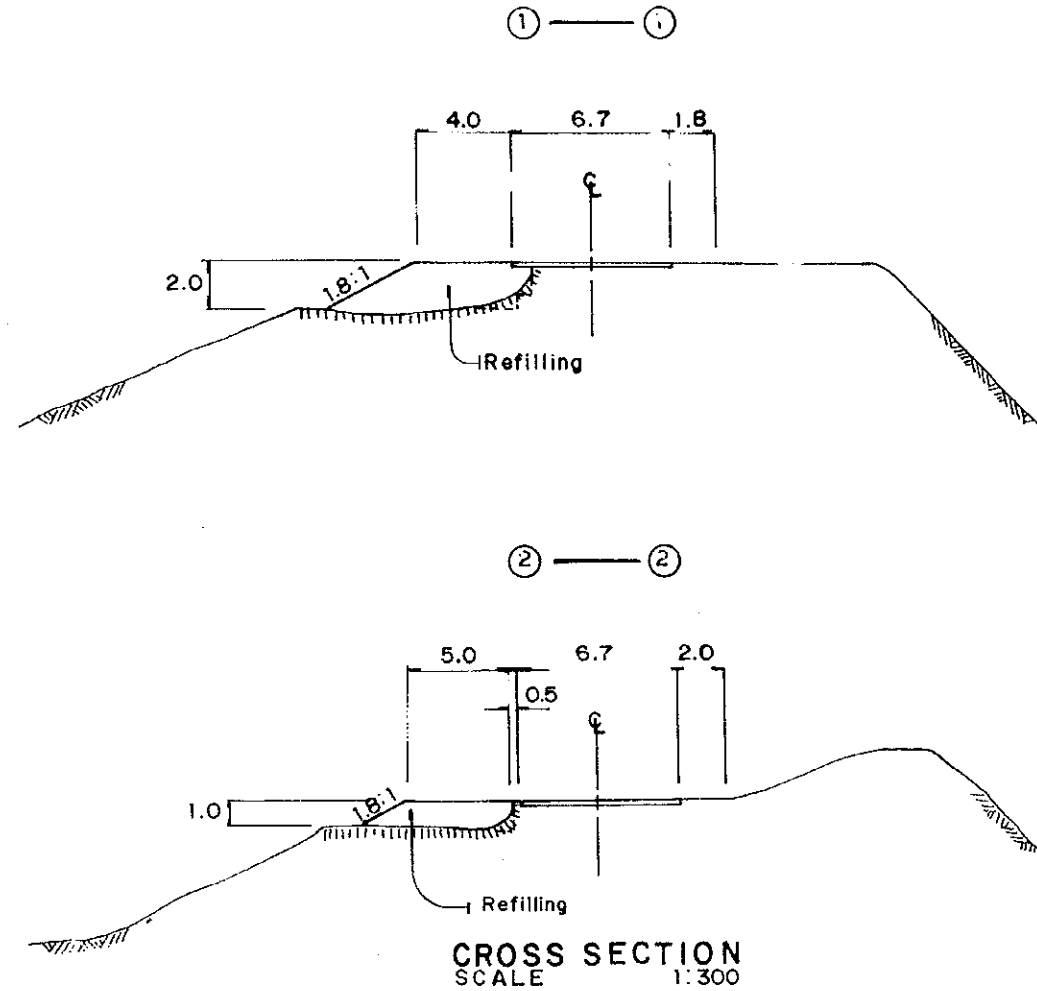


CROSS
SCALE

SECTION
1:400



PLAN



CROSS SECTION
SCALE 1:300

SUMMARY OF QUANTITY

TYPE OF WORK	UNIT	TOTAL
4 - 30 (1304 + 875)		
5 - 5 REFILLING / EMBANKMENT	CU. M	180
4 - 31 (1304 + 952)		
5 - 5 REFILLING / EMBANKMENT	CU. M	51

Cause of Disaster:

- 1) Insufficient compaction of embankment.
- 2) Embankment slope with an unstable grade.