

KINGDOM OF THAILAND
MINISTRY OF TRANSPORT AND COMMUNICATIONS
DEPARTMENT OF HIGHWAYS

ROAD DEVELOPMENT STUDY IN THE CENTRAL REGION

FEASIBILITY STUDY

FINAL REPORT
ROUTE REPORT
(VOLUME II-3)

MARCH 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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**SUMMARY OF FEASIBILITY STUDY
FOR ROAD DEVELOPMENT STUDY IN THE CENTRAL REGION OF THAILAND**

STUDY PROJECT							MAJOR CONSTRUCTION WORK QUANTITIES			PROJECT COST (1000 Baht)	IRR (%)	REMARKS
NO.	ORIGIN - DESTINATION	LOCATION	JURISDICTION UNDER :	LENGTH (km)	PROPOSED ROAD CLASS	PROJECTED AADT IN 2000	EXCAVATION & EMBANKMENT (1000 m ³)	PAVEMENT AC or PCC Thickness (cm)	BRIDGE Accumulative Length (m)			
(ML-PROJECTS)**												
ML-1	Chon Buri Bypass	Chon Buri	DOH (Rt.3)	13.6	PD	23,000-30,000	312	PCC : 30.0	520	348,000	36.5	3-Grade Separated Intersections
ML-2	H.Pattaya - A.Satthahip	Chon Buri	DOH (Rt.3)	27.3	PD	11,000-13,000	768	AC : 5.0	218	225,000	22.2	
ML-3	A.Satthahip - C.Rayong	Chon Buri/ Rayong	DOH (Rt.3)	44.6	PD	9,000-12,000	1,010	AC : 10.0	210	418,000	25.6	
ML-4	A.Klaeng - C.Chanthaburi	Rayong/ Chanthaburi	DOH (Rt.3, Rt.316)	61.9	PD/SD	14,000-18,000	1,762	AC : 10.0	872	694,000	19.7	
ML-5	Chon Buri-Pattaya New Highway	Chon Buri	DOH ((Rt.36))	50.3	PD/P1 FD	26,000/7,000 21,000	2,417	PCC : 28.0 (24 km) 23.0 (18 km) 25.0 (8 km)	1,252	1,105,000	30.6	2-Grade Separated Intersections
ML-7	A.Min Buri - C.Chachoengsao	Bangkok - Chachoengsao	DOH (Rt.304)	40.9	SD	11,000-14,000	1,389	AC : 10.0	1,909	754,000	21.9	
ML-9	Bangkok - Chon Buri New Highway	Bangkok/ Samut Prakarn/ Chachoengsao/ Chon Buri	DOH ((Rt.36))	81.7	PD	17,000-40,000	5,973 ^{L1}	AC : 10.0 (66 km) PCC : 28.0 (16 km)	6,522 ^{L2}	3,570,000	39.6	4-Grade Separated Intersections and 1-Junction ^{L1} includes sand mat volume ^{L2} 3,261 m (one-way) x 2
Sub - total				320.3								
(IH-PROJECTS)*												
IH-1	A.Bang Len - B.Bang Noi Nai	Nakhon Phathom	PWD	18.7	F4	600-1,000	80	AC : 5.0	37	50,000	26.7	
IH-2	B.Nong Pru - A.Lao Khwan	Kanchanaburi	DOH (Rt.3306)	35.9	F4	500-600	230	DBST	-	47,000	28.1	
IH-11	B.Channa Soot - A.Pho Thong	Sing Buri/ Ang Thong	RID	40.7	F2	500-2,000	234	AC : 7.5	27	140,000	23.9	
IH-12	A.Pho Thong - A.Sena	Ang Thong/ Ayutthaya	RID	51.0	F2	1,000-1,600	575	AC : 10.0	88	246,000	15.1	New Construction : 1.7 km
IH-13	A.Bang Pa-In - C.Ayutthaya	Ayutthaya	DOH (Rt.3059)	17.8	F2	1,500	160	AC : 10.0	-	81,000	21.7	
IH-14	A.Wang Noi - A.Thanyaburi	Ayutthaya/ Phatum Thani	Rural Municipality (Partly of DOH Rt.3189)	25.6	F3	900-1,000	276	AC : 10.0	140	137,000	22.9	New Construction : 5.0 km
IH-15	B.Khlong Luang - A.Min Buri	Phatum Thani/ Bangkok	Rural Municipality	24.7	F2/F1	2,500/5,200	147	AC : 10.0	72	116,000	32.5	North Section : F2-Class South Section : F1-Class
IH-16	A.Lam Luk Ka - B.Khlong 16	Phatum Thani/ Nakhon Nayok	DOH (Rt.3312)	20.8	F3	600-1,200	180	AC : 5.0	337	119,000	19.9	
IH-17	A.Lat Krabang - B.Khlong Thua Thua	Bangkok/ Samut Prakarn/ Chachoengsao	PWD	19.2	F2	400-2,100	208	AC : 7.5	65	98,000	27.7	
IH-22	J.R. 304 - A.Bang Nam Prieo	Bangkok/ Chachoengsao	Rural Municipality	15.9	F3	1,100	192	AC : 7.5	225	96,000	23.7	New Construction : 5.0 km
IH-23	J.R. 32 - J.R. 3022	Ayutthaya	DOH (Rt.3267)	26.9	F1	4,000-6,000	124	PCC : 23.0	-	164,000	21.5	
Sub - total				297.2								
(RH-PROJECTS)***												
RH-2	Rt.225 Link 0100	Nakhon Sawan	DOH	39.5	S2		-	AC : 5.0	-	53,000	74.2	
RH-3	Rt.325 Link 0200	Samut Songkram	DOH	17.9	S2		-	AC : 5.0	-	24,000	150.1	
RH-5	Rt.344 Link 0200	Chon Buri	DOH	39.3	S1		-	AC : 5.0	-	42,000	147.1	
Sub - total				96.2								
Grand Total				713.7								

* Improvement Projects of Existing Roads
 ** Multi-Lanes Highway Construction Projects. ML-5 and ML-9 are New Construction Projects
 *** Pavement Rehabilitation Projects

FEASIBILITY STUDY PHASE I

STUDY ROUTES

Project No.	Changwat	Division	Route No.	Origin - Destination
ML-1	Chon Buri	Chachoengsao	3	Chon Buri Bypass
ML-2	Chon Buri	Chachoengsao	3	Pattaya - A. Sattahip
ML-4	Rayong Chanthaburi	Chachoengsao	3/316	A. Klaeng - C. Chanthaburi
ML-5	Chon Buri	Chachoengsao	New Route	Chon Buri - Pattaya New Highway (incl. Access Road to Laem Chabang)
ML-7	Bangkok Chachoengsao	Chachoengsao	304	A. Min Buri - C. Chachoengsao
IM-23	Ayutthaya	Bangkok	3267	J.R. 32 - J.R. 3022



LEGEND:





-  PROJECT ROUTE
-  NATIONAL HIGHWAY
-  PROVINCIAL ROADS
-  CHANGWAT

TABLE OF CONTENTS

- SUMMARY

1. GENERAL

2. TRAFFIC FORECAST

- o Base Traffic Volumes
- o Traffic Growth Rates
- o Future Traffic Volumes

3. ENGINEERING

- 3.1 Materials and Boring Results
- 3.2 Preliminary Design
- 3.3 Quantities and Construction and Road Maintenance Costs

4. BENEFITS

- o VOC Savings
- o Time Savings
- o Total Benefits

5. ECONOMIC EVALUATION

- o Cost and Benefit Statement

6. DRAWINGS

PROJECT ML - 1

Changwat : Chon Buri

Chon Buri Bypass

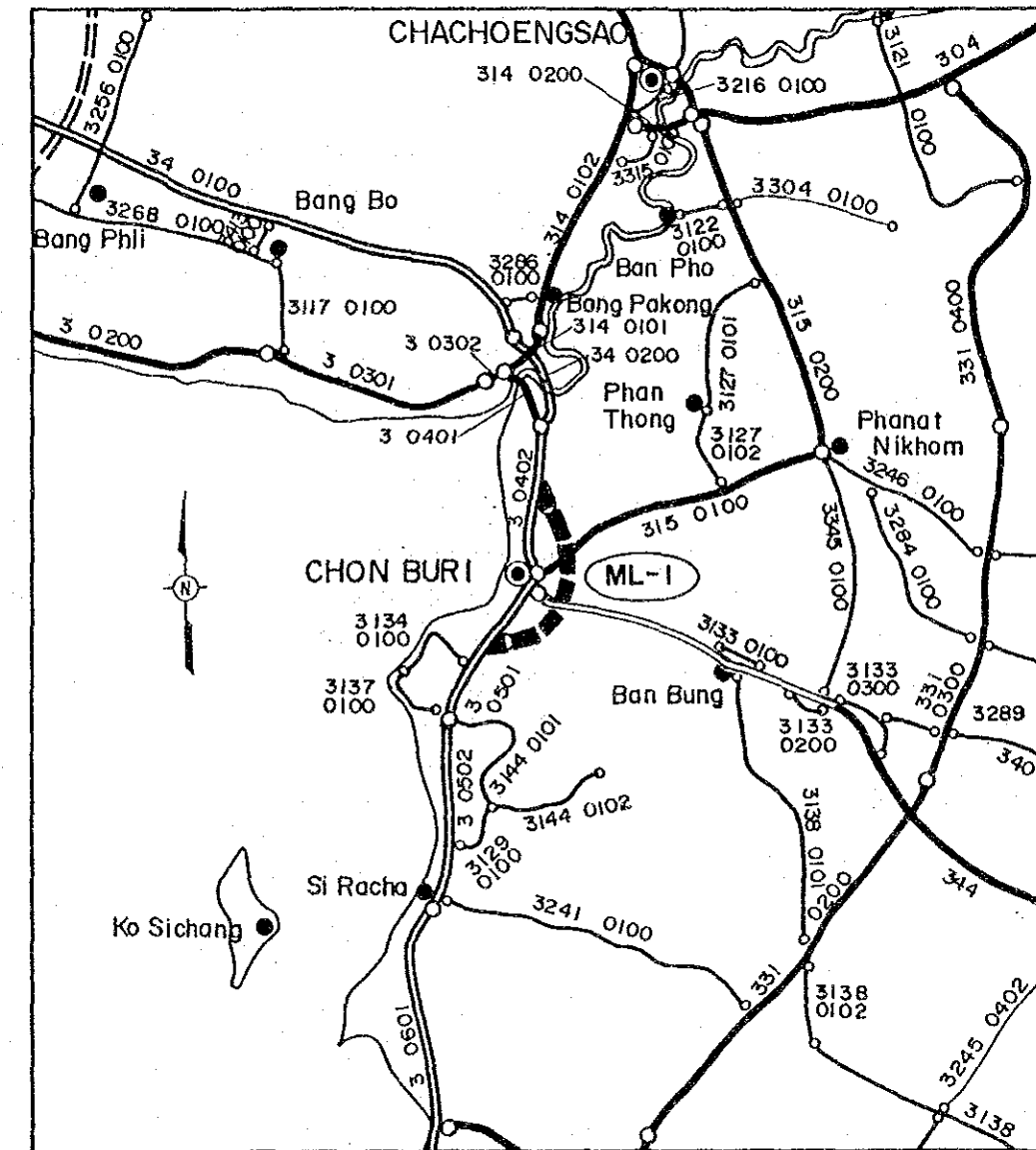
Length : 13.60 km

SUMMARY

PROJECT ML-1

ITEM	DESCRIPTION
Changwat	Chon Buri
Origin	Chon Buri Bypass
Destination	" " "
Route No.	Rt. 3
Project Length	13.60 km
Standard	
- Existing	P1
- Proposed	PD
Traffic	
- Base	12,141 ~ 15,555
- 2000	22,400 ~ 30,100
- 2008	37,400 ~ 58,300
Pavement Type	
- Existing	AC pavement
- Proposed	PCC pavement (30 cm thick concrete slab)
Bridges	
- New Construction	3 sites, 520 m
- Replacement	—
Intersection	
- Trumpet Type	1 each
- Partial Cloverleaf Type	2 each
- Channelization	—
Construction Costs	
- Financial	347,856,000 Baht
- Economic	317,675,000 Baht
Economic Evaluation	
- IRR	36.5% (30.8%)
- B/C	5.54 (4.40)

LOCATION OF PROJECT ROUTE



SCALE
0 10 Km.

LEGEND :

- PROJECT ROUTE
- DIVIDED HIGHWAYS
- NATIONAL HIGHWAYS
- PROVINCIAL HIGHWAYS
- PROVINCIAL HIGHWAYS (Unpaved)
- CHANGWAT, AMPHOE

() opening year of 1992

1. GENERAL

Project ML-1 is to upgrade the Chon Buri Bypass with a total length of 13.60 km.

The existing Chon Buri Bypass starts at a signalized intersection on Route 3 on the approach to the Chon Buri built-up area, runs in a semi-circular alignment on the eastern fringe of the city, and ends at a partially grade-separated intersection with Route 3. In between the two ends it intersects with five roads, of which two are major national highways (Routes 315 and 344).

The terrain is generally flat. Land use along the road is still mostly agricultural with coconut plantations, paddy and cassava fields being dominant. The alignments, both horizontal and vertical, are good. There are no sharp curves. The present cross section follows the P1 standards with a 7.0 m carriageway width and 2.5 m wide shoulders. Because all heavy vehicle traffic is prohibited from passing through Chon Buri on Route 3, the existing two-lane road is at times saturated with heavy vehicle traffic, causing all vehicles to move at the pace of the slowest moving heavy vehicle. At present, therefore, light vehicles normally do not take the Bypass, resulting in congestion in the city of Chon Buri.

The condition of the existing asphaltic surface is generally fair to poor.

The existing right-of-way width of 60 m is sufficient to accommodate an additional two-lane carriageway. The proposed project is the construction of an additional two-lane carriageway with concrete pavement running parallel to the existing road at a distance of 20 m inside the existing circular route. Three intersections, at the beginning, at Route 315 and at Route 344, were designed as grade separations due to the expected heavy turning movements.

Upon completion, the widened multilane Chon Buri Bypass will be a properly functioning bypass.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

Project Code	Section	Year	Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-1	3-0403-N	1988	985	1229	134	261	2921	1330	8896	14771
	3-0403-E	1988	1303	1381	372	135	3263	1375	9029	15555
	3-0403-S	1988	2043	1078	555	151	3141	919	6297	12141
	3-0403-s	1988	2043	1078	555	151	3141	919	6297	12141
	Average	-	1594	1192	404	175	3117	1136	7630	13652

Traffic Growth Rate

(Unit: Percent)

Project	Section	Period	MC	PC	LB	HB	LT	MT	HT
ML-1	3-0403-N	-1993	7.83	8.65	7.95	7.31	7.07	6.91	6.02
	3-0403-E	1994-2000	6.82	6.97	7.90	6.75	5.73	6.16	5.95
	3-0403-S	2000-2008	6.21	6.59	7.00	5.76	5.10	5.08	4.94
	3-0403-s								

Diverted Traffic from Route 3 to Chon Buri Bypass

(Unit: Vehicles/Day)

Year	MC	PC	LB	HB	LT	MT	HT	Total
1992	0	0	0	0	0	0	0	0
1994	0	881	68	245	1143	73	38	2448
2000	0	0	0	0	0	0	0	0
2008	0	3279	512	1234	8054	536	299	13914

Future Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT
ML-1	3-0403-N	1992	1344	2379	182	348	3887	2705	14194	23695
		1994	1534	3654	279	641	5489	2972	15831	28866
		2000	2279	1468	216	299	4832	3457	18033	28305
		2008	3690	5642	883	1702	15248	5496	26519	55490
	3-0403-E	1992	1779	2594	505	180	4343	2764	14362	24748
		1994	2030	3900	656	450	5998	3038	16020	30062
		2000	3015	1836	311	16	5544	3551	18300	30058
		2008	4882	6255	1905	1259	16308	5636	26911	58274
	3-0403-S	1992	2788	2165	754	201	4180	2164	10908	20372
		1994	3181	3409	946	475	5816	2363	12143	25152
		2000	4726	1101	1269	52	5290	2585	12816	23113
		2008	7653	5030	2692	1315	15929	4200	18846	48012
	3-0403-s	1992	2055	3078	1164	1742	4210	977	7307	18478
		1994	2337	4235	1421	2048	5784	1178	8293	22959
		2000	3433	2066	1536	1554	6076	1271	9922	22425
		2008	5522	4021	2801	2225	11222	2067	15103	37439
Average		1992	2554	651	618	4155	2153	11693	21823	
		1994	2271	3800	826	904	5772	2388	13072	26760
		2000	3363	1618	958	480	5436	2716	14768	25975
		2008	5437	5237	2070	1625	14677	4350	21845	49804

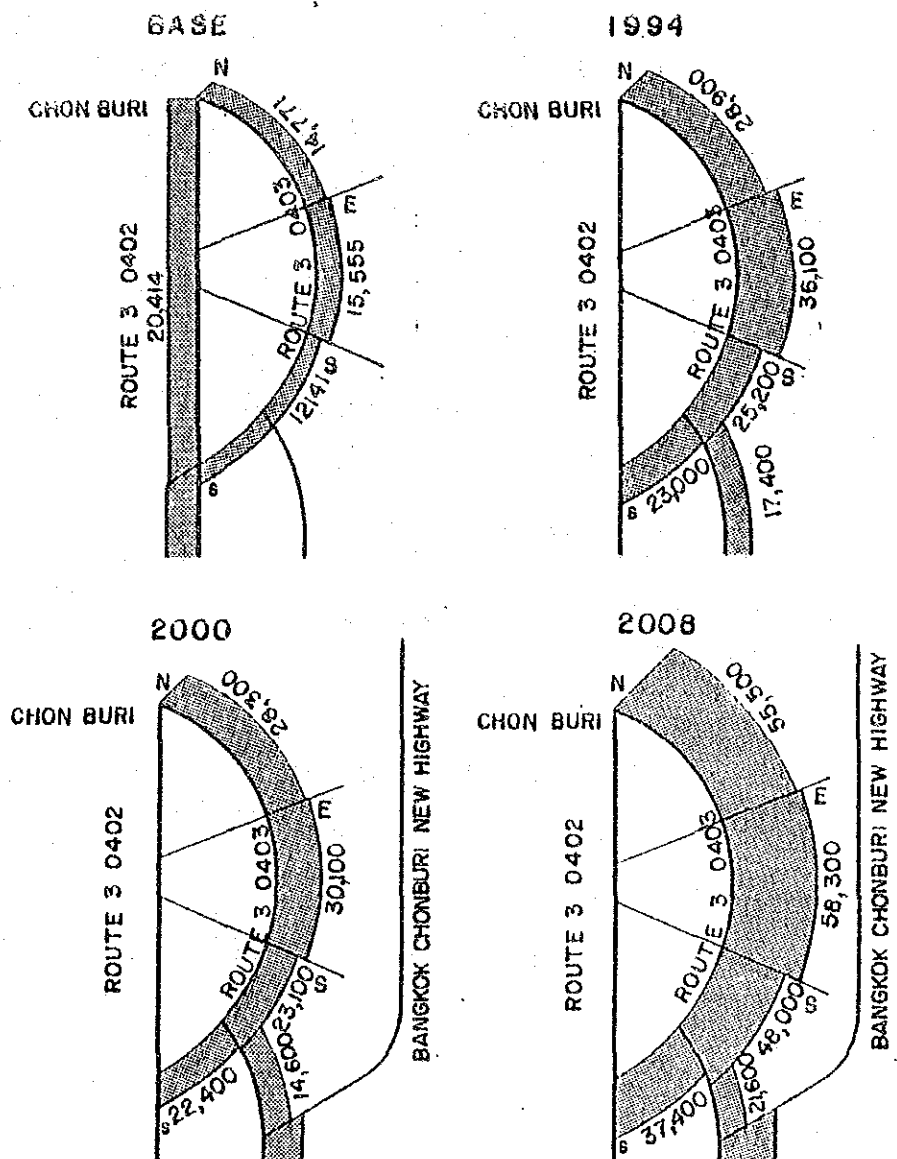
Note. N:North section E:East section S:Upper south section
s:Lower south section

Traffic Volumes Generated from Industrial Estates

(Unit: Vehicles/Day)

Project Name	Year	MC	PC	LB	HB	LT	MT	HT	CT	Total
LAEM CHABANG	1992		639				432	746	1279	3096
	1994		782				461	798	1564	3605
	2000		424				516	977	0	1917
	2008		623				705	1338	0	2666
MAP TA PHUT	1992		0				523	922		1445
	1994		0				566	981		1547
	2000		0				651	1234		1885
	2008		0				851	1612		2463

Note. CT: Container Truck



UNIT: VEHICLE / DAY

3. ENGINEERING

3.1 Materials and Boring Results

(1) Materials

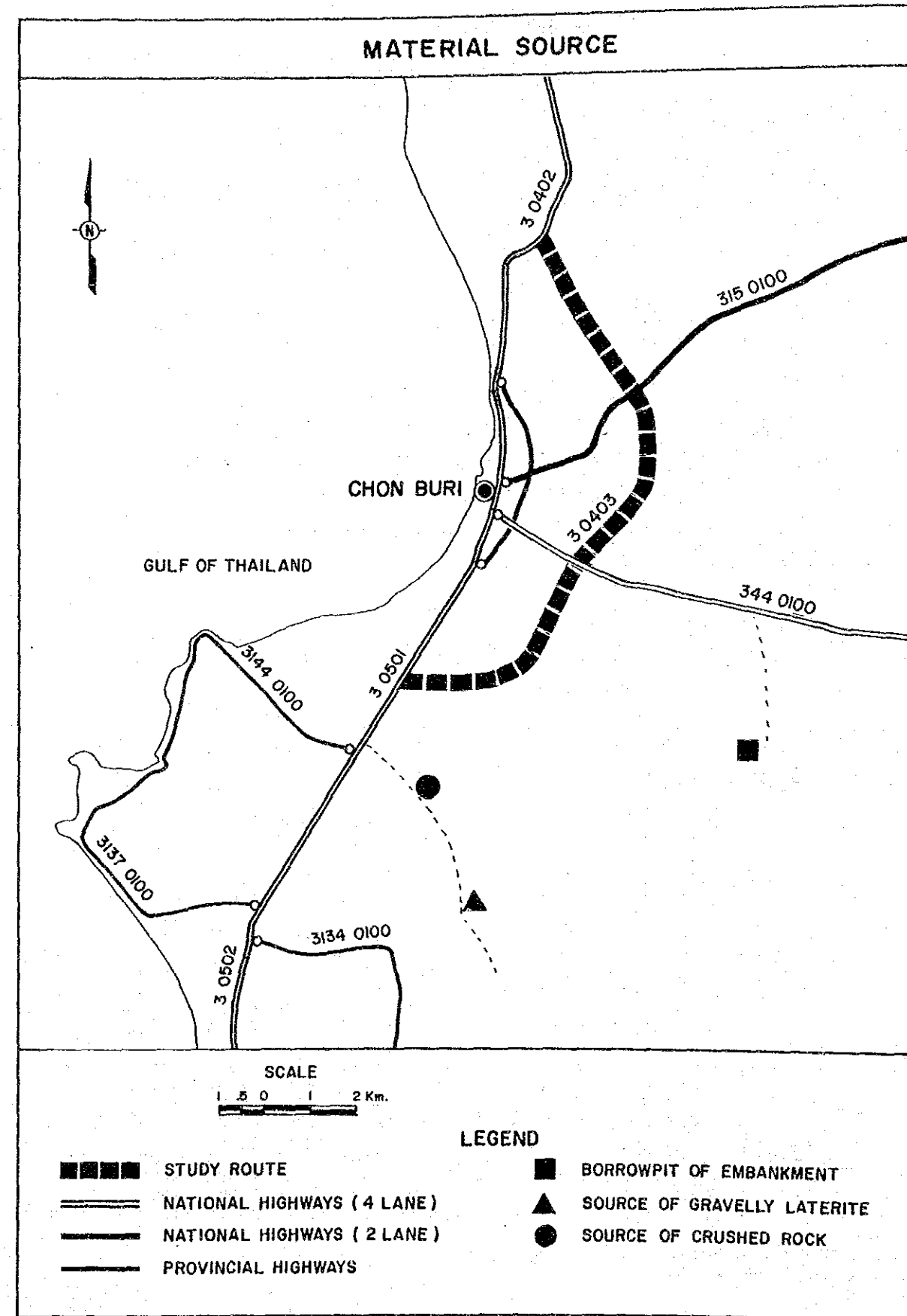
DESCRIPTION OF MATERIAL SOURCES

Material	Source	Description of Sample	Estimated Quantity cu.m.	Hauling Distance (km)
Soil	Route 344 Km 7+00 Right Side 3.0 Km	Silty Sand	Plentiful	17.00
Laterite	Route 3144 Km 4+950 Left Side 1.0 Km	Gravelly Laterite	75,000	17.00
Crushed Rock	Route 3 Km 99+150 Left Side 2.1 Km	Lime Stone	Plentiful	17.00

RESULTS OF LABORATORY TESTS

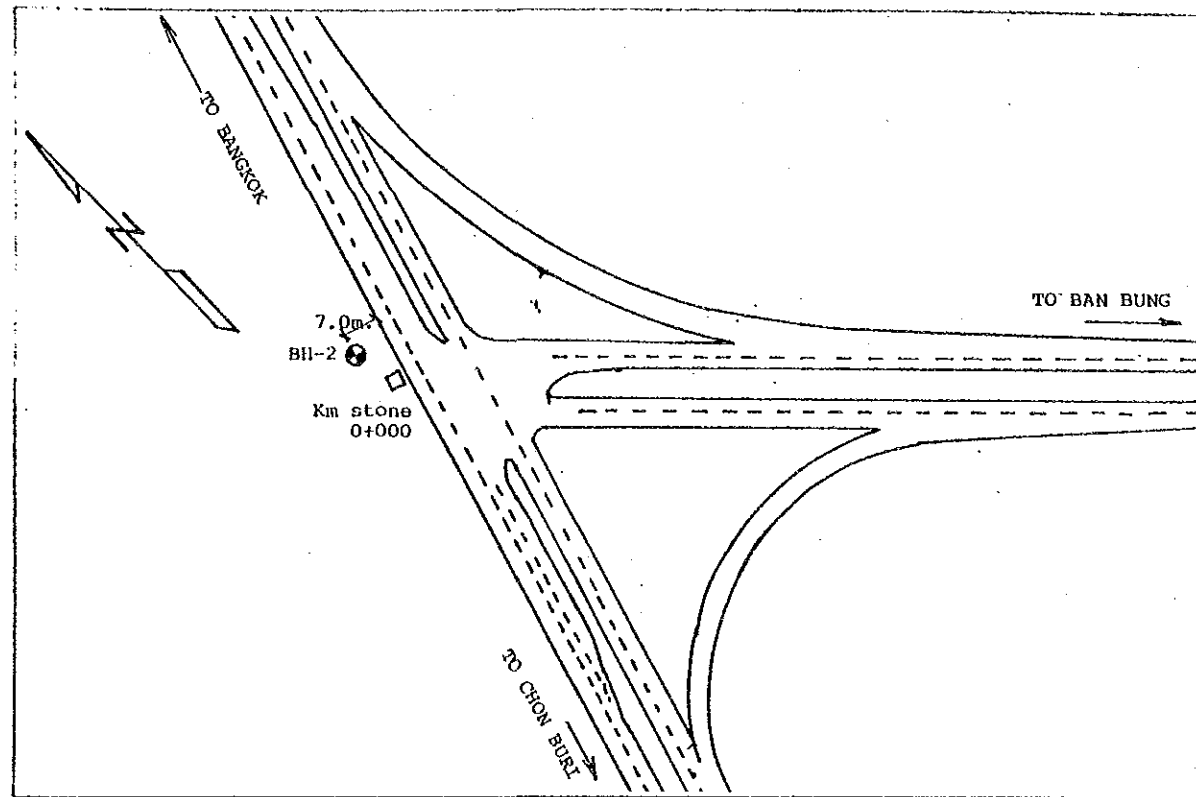
	Sieve Analysis % Passing								Plasticity		Comp.		
									LL	PI	Opt. 95%	Lab. C.B.R. 95%	Swell %
	50.0	25.0	19.0	9.5	#4	#10	#40	#200			gm/cc		
Soil			100	99.4	98.8	88.2	23.1		-NP-		1.962	80	-
Laterite	100	97.5	82.6	55.9	41.0	29.1	19.6	33.5	9.93	7.1	2.190	43	0.76
Crushed Rock	-	-	-	-	-	-	-	-	-	-	-	>80	-

Note: Abrasion test result of Crushed Rock 31.2 %

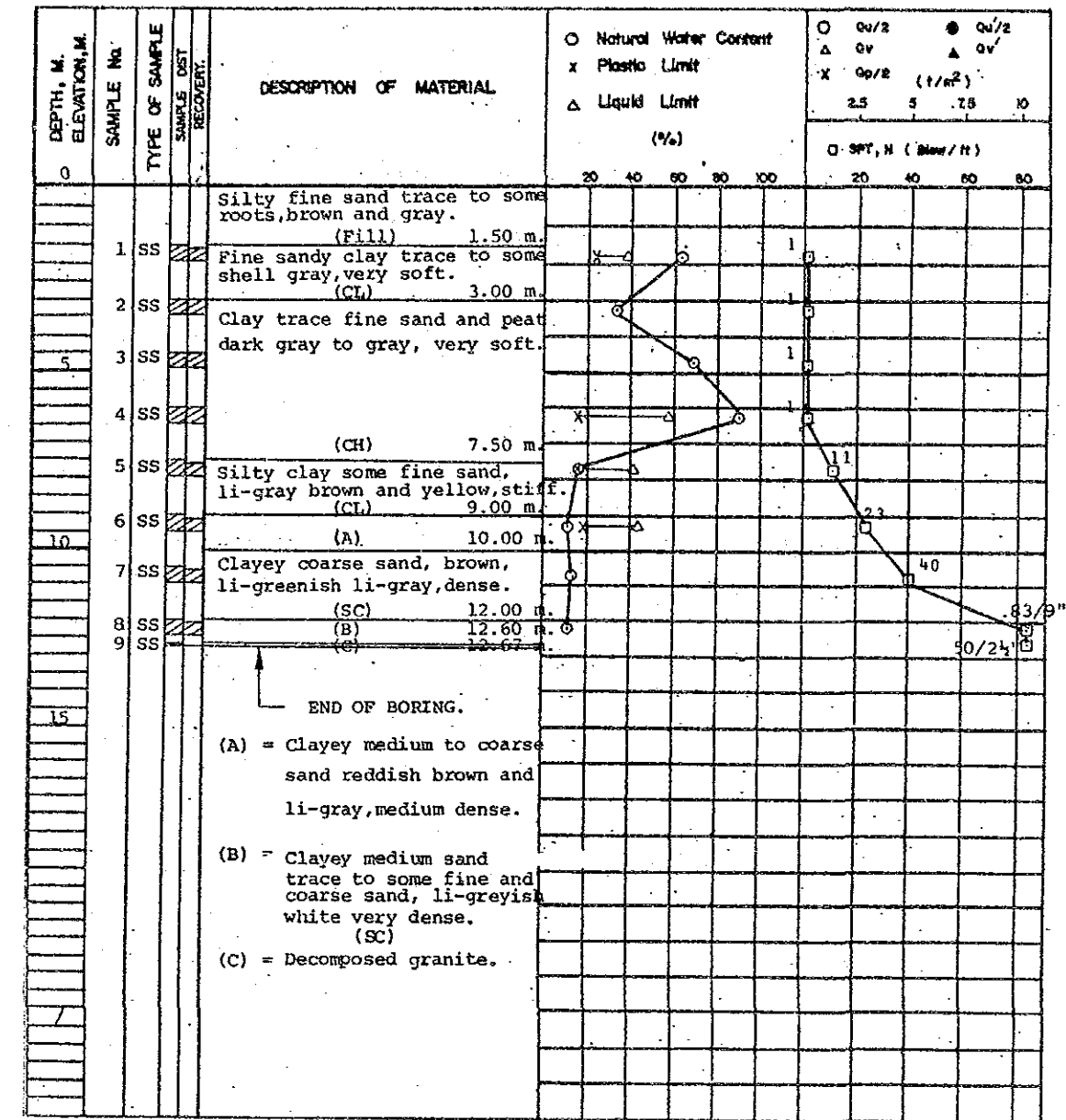


(2) Boring Results

BOREHOLE LOCATION



BORING LOG



SUMMARY OF TEST RESULTS

SAMPLE No.	DEPTH M.		WATER CONTENT %	ATTERBERG LIMIT %			WET UNIT WEIGHT γ_{m^3}	SIEVE ANALYSIS % FINER					CLASSIFICATION	UNDRAINED SHEAR STRENGTH γ_{m^2}				STANDARD PENETRATION (N)
	FROM	TO		LL	PL	PI		No. 3/8"	No. 4	No. 10	No. 40	No. 200		UNCONFINED SHEAR		FIELD VANE SHEAR		
														Q _{u2}	Q _{u/2}	Q _v	Q _{v'}	
SS-1	1.50	1.95	62.1	39.4	22.9	16.5	1.63		100	97	90	74	CL					1
SS-2	3.00	3.45	32.2										CH					1
SS-3	4.50	4.95	68.5										CH					1
SS-4	6.00	6.45	90.2	58.0	16.0	42.0	1.50		100	99	93		CH					1
SS-5	7.50	7.95	17.0	41.4	17.1	24.3	2.13	100	99	97	92	68	CL				8.5	11
SS-6	9.00	9.45	10.0	43.2	17.7	25.5	2.19		100	77	52	42	SC				13.5	23
SS-7	10.50	10.95	11.4										SC					40
SS-8	12.00	12.36	10.7						99	94	79	42	30	SC				83/9"
SS-9	12.60	12.57		-No	Recovery-									Decomposed granite				50/24

3.2 Preliminary Design

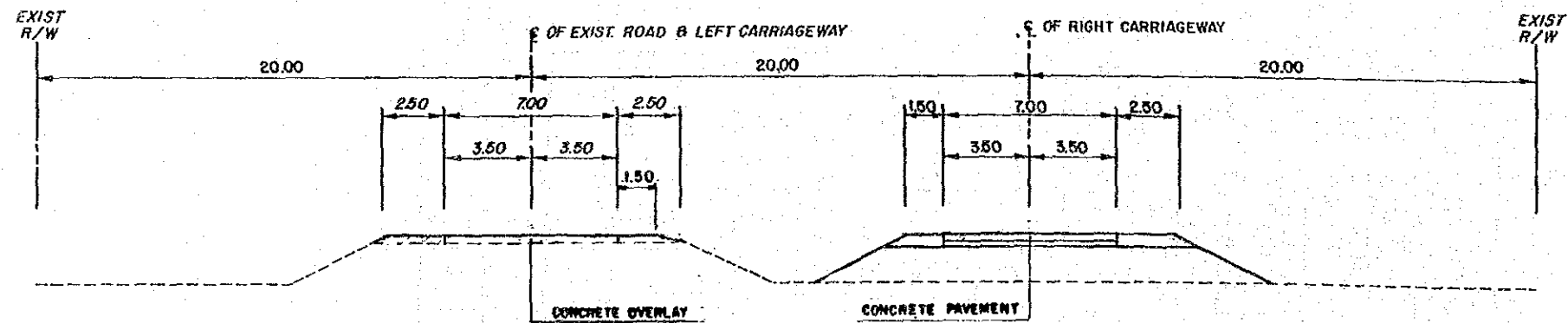
(1) Geometric Design Criteria

Design Standard : PD

Design Speed : 80-100 km/h

Geometric Design Criteria

Description	Design Speed (km/h)		
	100	90	80
Minimum Radius & Curvature (m)	360	280	210
Minimum Stopping Sight Distance (m)	160	140	115
Maximum Gradient (%)	6	7	8

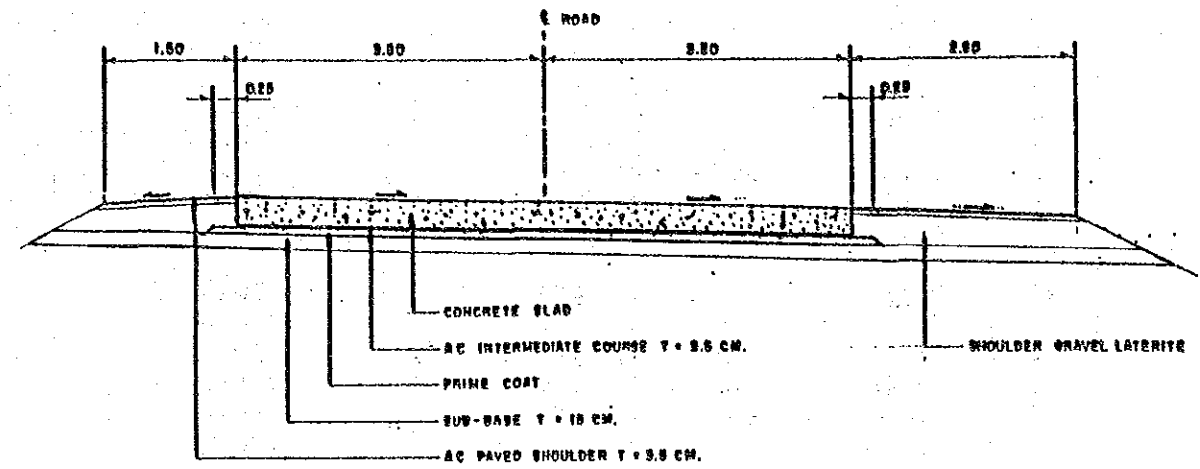


TYPICAL CROSS SECTION (ROUTE ML-1)

(2) Pavement Design

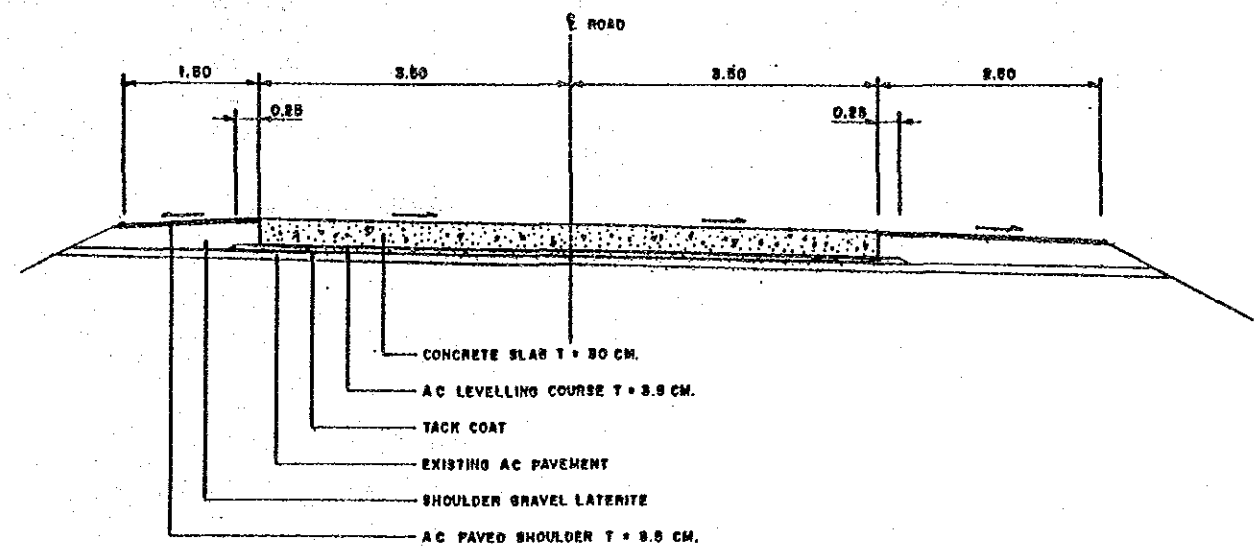
Pavement for New Construction Lane

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10 (20 years)	Thickness of Pavement Structure (cm)
8.0	145,978	Slab 30 Intermediate AC Layer 3.5 Subbase 15



Initial Overlay for Existing Lane

Type of Overlay	Design CBR	Cumulative of ESA W18 x 10 (20 years)	Required D or SN	FRL * D _{xeff} or SN _{xeff}	Overlay Dol or SNol	Thickness (cm)
PCC	28.2	145,998	D = 30 cm	-	D = 30 cm	30



(3) Culverts

No.	CHAINAGE	EXISTING CULVERT	NEW CULVERT	
			LT ROADWAY	RT ROADWAY
1	0+397	RCP 1 - Ø.80X33	REMAIN	RCP 1 - Ø.80X20
2	1+230	RCP 1 - Ø.80X18	REMAIN	RCP 1 - Ø.80X18
3	1+425	RCP 1 - Ø.80X16	REMAIN	RCP 1 - Ø.80X16
4	1+855	RCP 2 - Ø1.0X20	REMAIN	RCP 2 - Ø1.0X20
5	2+320	RCP 1 - Ø.80X16	REMAIN	RCP 1 - Ø.80X16
6	2+686	RCP 2 - Ø1.0X20	REMAIN	RCP 2 - Ø1.0X20
7	3+302	BOX 1 - 2.4X2.4X16	REMAIN	BOX 1 2.4X2.4X16
8	4+149	RCP 2 - Ø1.0X48	REMAIN	EXTEND 2X10 = 20 M
9	4+400	RCP 1 - Ø1.0X44	REMAIN	EXTEND = 14 M
10	4+443	RCP 1 - Ø1.0X38	REMAIN	RCP 1 - Ø1.0X20
11	5+123	RCP 2 - Ø1.2X23	REMAIN	RCP 2 - Ø1.2X21
12	6+172	RCP 2 - Ø1.0X22	REMAIN	RCP 2 - Ø1.0X20
13	6+221	RCP 2 - Ø1.2X22	REMAIN	RCP 2 - Ø1.2X20
14	7+295	RCP 1 - Ø1.0X18	REMAIN	RCP 1 - Ø1.0X18
15	7+375	RCP 1 - Ø1.0X20	REMAIN	RCP 1 - Ø1.0X20
16	8+420	BOX 2 - 2.1X1.8X16	REMAIN	BOX 2 - 2.1X1.8X16
17	9+100	RCP 1 - Ø1.0X35	REMAIN	RCP 1 - Ø1.0X21
18	9+505	RCP 2 - Ø.80X16	REMAIN	RCP 2 - Ø.80X19
19	9+679	BOX 2 - 1.5X1.2X13.5	REMAIN	BOX 2 - 1.5X1.2X13.5
20	9+902	RCP 2 - Ø1.2X18	REMAIN	RCP 2 - Ø1.2X20
21	10+098	RCP 2 - Ø1.2X18	REMAIN	RCP 2 - Ø1.2X20
22	10+472	RCP 1 - Ø1.2X23	REMAIN	RCP 1 - Ø1.2X21
23	11+060	BOX 2 - 1.8X1.5X14.5	REMAIN	BOX 2 - 1.8X1.5X14.5
24	11+150	RCP 2 - Ø1.0X20	REMAIN	RCP 2 - Ø1.0X20
25	11+700	RCP 1 - Ø1.0X20	REMAIN	RCP 1 - Ø1.0X19
26	12+230	RCP 1 - Ø.80X18	REMAIN	RCP 1 - Ø.80X18
27	12+491	RCP 1 - Ø.80X16	REMAIN	RCP 1 - Ø.80X18
28	12+977	RCP 2 - Ø.80X19	REMAIN	RCP 2 - Ø.80X19
29	13+080	RCP 1 - Ø1.0X18	REMAIN	RCP 1 - Ø1.0X18
30	13+250	RCP 1 - Ø.80X18	REMAIN	RCP 1 - Ø.80X18
31	13+791	RCP 1 - Ø1.2X45	REMAIN	REMAIN
32	ROAD CONNECTIONS ≈ 14 LOCATIONS			

(4) Bridges

NO.	STATION	EXISTING RC BRIDGE	PROPOSED RC BRIDGE
1.	0 + 000 (Grade Separation)	11.00x97.00	PC I GIRDER
		11.00x58.00	STEEL I GIRDER
		11.00x175.00	STEEL I GIRDER
2.	4 + 242 (Grade Separation)	11.00x50.00	PC I GIRDER
3.	8 + 848 (Grade Separation)	2 x 11.00x70.00	PC BOX GIRDER

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS (Project ML-1 Length = 13.60 km)

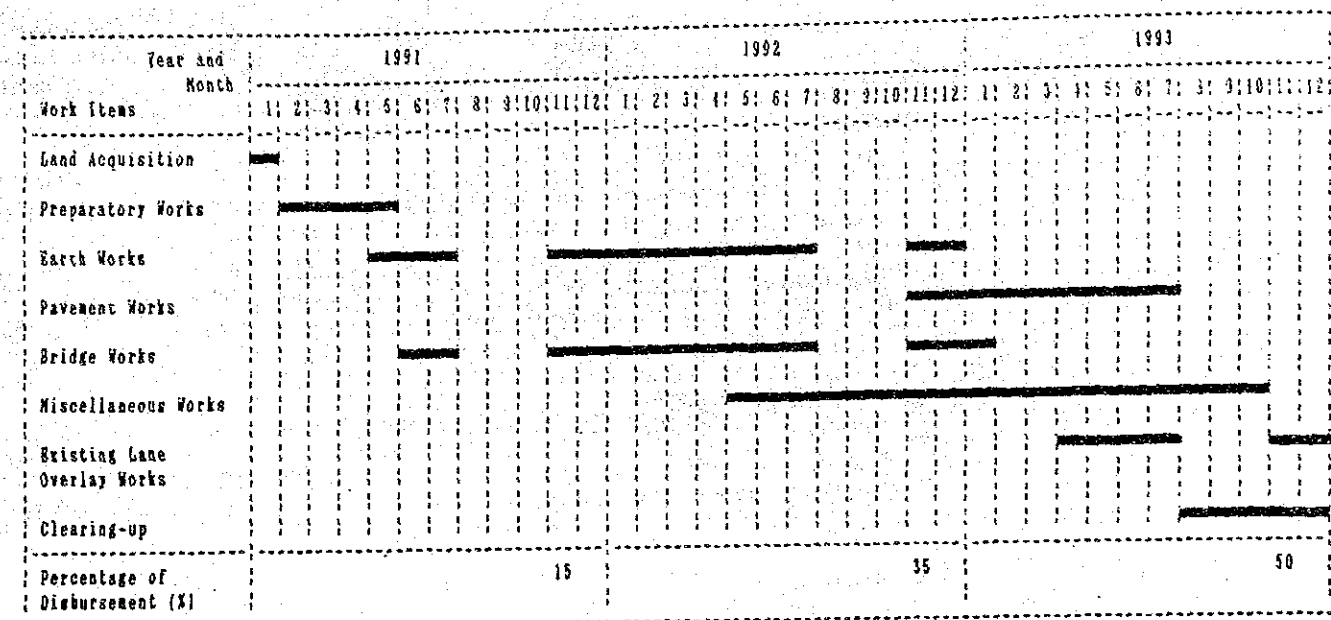
Item	Unit	Financial Unit Rate Baht	Quantity	Financial Total Cost 1000 Baht	Economic Cost		Residual Value		
					%	1000 Baht	%	1000 Baht	
EARTHWORK									
Clearing & Grubbing	ha	10,000	69	690	85	587	90	528	
Roadway Excavation (Unclassified)	m ³	18	15,000	270	84	227	90	204	
Roadway Excavation (Classified)	m ³	38	1,000	38	84	32	90	29	
Embankment (Common)	m ³	33	12,000	396	86	341	90	307	
Embankment (Borrow)	m ³	77	284,000	21,868	86	18,806	90	16,926	
Removal of Existing Structure	each	60,000	-	-	84	-	90	-	
Sub Total				23,262		19,992		17,994	
SUBBASE and BASE COURSES									
Subbase	m ³	141	23,650	3,335	83	2,768	50	1,384	
Aggregate base	m ³	257	-	-	84	-	50	-	
Shoulder (Soil Aggregate)	m ³	166	51,000	8,466	83	7,027	50	3,513	
Sub Total				11,801		9,795		4,897	
SURFACE COURSES									
Asphaltic Prime Coat	m ²	11	166,200	1,828	93	1,700	50	850	
Asphaltic Tack Coat	m ²	5	95,250	476	93	443	50	221	
Double Bituminous Surface Treatment	m ²	31	-	-	91	-	50	-	
Asphalt Concrete Surfacing	ton	890	32,750	29,148	90	26,233	50	13,116	
Portland Cement Concrete Pavement	m ³	1,574	67,200	105,773	90	95,196	50	47,598	
Sub Total				137,225		123,571		61,785	
STRUCTURES (Equivalent)									
RC Pipe Culvert (D=1.00 m)	m	1,800	778	1,400	88	1,232	50	616	
RC Box Culvert (2-2.40x 2.40 m)	m	9,000	30	270	90	243	50	122	
RC Bridge (W=11.0 m)	m	64,000	-	-	87	-	50	-	
PC Bridge (W=11.0 m)	m	91,000	520	47,320	87	41,168	50	20,584	
Bearing Unit	m ²	2,200	480	1,056	87	919	50	459	
Sub Total				50,046		43,562		21,781	
Total (a)				222,334		196,921		106,457	
Miscellaneous Work ((a) x 7%)				1s	15,563	87	13,540	0	0
CONTRACT AMOUNT (b)				237,897		210,460		106,457	
PHYSICAL CONTINGENCIES ((b) x 10%) (c)				1s	23,790		21,046		10,646
ENGINEERING AND SUPERVISION (((b) + (c)) x 10%) (d)				1s	26,169	100	26,169	0	0
LAND ACQUISITION (Average) (e)				ha	2,500,000	24	60,000	100	60,000
PROJECT COST ((b) + (c) + (d) + (e))					347,856		317,675		177,103
AVERAGE COST PER KM					25,578				

(2). Road Maintenance Costs

(Unit : Baht/Year)

	Without Project	With Project
Existing	344,716	-
1994	367,697	419,176
2008	367,697	660,334

3.4 Construction Schedule



4. BENEFITS

ROAD CONDITIONS

(unit : km)

Section	Without Project									With Project				
	Road Length	Paved				Laterite				No. of Narrow Bridge	No. of Wooden Bridge	Road Paved Length	No. of	
		Good	Fair	Fair	Poor	Good	Fair	Poor	Narrow Bridge				Wooden Bridge	
		Good /Fair	Fair /Poor											
3-403-N	4.2	-	-	-	4.2	-	-	-	-	-	4.2	4.2	-	-
3-403-E	4.6	-	-	-	4.6	-	-	-	-	-	4.6	4.6	-	-
3-403-S	2.8	-	-	2.8	-	-	-	-	-	-	2.8	2.8	-	-
3-403-s	2.2	-	-	2.2	-	-	-	-	-	-	2.2	2.2	-	-

VOC AND TIME SAVINGS

(1000 BAHT)

Year	VOC Savings			Time Savings			Total Savings		
	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total	Normal Traffic	Induced Traffic	Total
1994	77,362	-	77,362	52,542	-	52,542	129,904	-	129,904
2000	239,797	-	239,797	103,234	-	103,234	343,031	-	343,031
2008	404,206	-	404,206	137,475	-	137,475	541,681	-	541,681

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT

(1000 BAHT)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1991	98,651				0	138,598	0
1992	90,186				0	113,129	0
1993	128,838				0	144,299	0
1994		77,362	52,542	(43)	129,861	0	115,947
1995		104,434	60,991	(58)	165,367	0	131,830
1996		131,507	69,440	(73)	200,874	0	142,978
1997		158,579	77,888	(88)	236,379	0	150,223
1998		185,652	86,337	(103)	271,886	0	154,275
1999		212,724	94,785	(118)	307,391	0	155,734
2000		239,797	103,234	(133)	342,898	0	155,110
2001		260,348	107,514	(148)	367,714	0	148,514
2002		280,899	111,794	(163)	392,530	0	141,550
2003		301,450	116,074	(178)	417,346	0	134,374
2004		322,001	120,354	(193)	442,162	0	127,111
2005		342,552	124,635	(208)	466,979	0	119,862
2006		363,104	128,915	(223)	491,796	0	112,707
2007		383,655	133,195	(238)	516,612	0	105,709
2008	(177,103)	404,206	137,475	(248)	541,433	(36,239)	98,918
TOTAL	140,572	3,768,270	1,525,173	(2,215)	5,291,228	359,787	1,994,842

NET PRESENT VALUE : 1,635,055
 BENEFIT COST RATIO : 5.54
 INTERNAL RATE OF RETURN : 36.5%
 FIRST YEAR RATE OF RETURN : 29.3%

COST AND BENEFIT STATEMENT






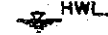
(1000 BAHT)

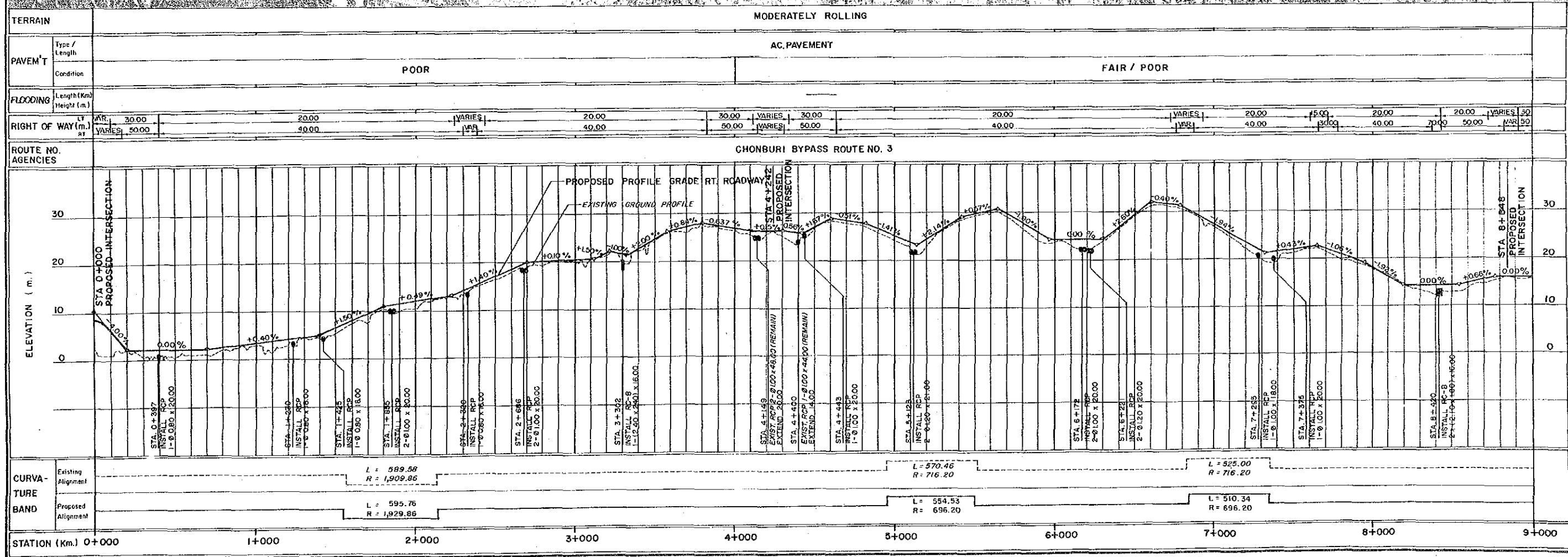
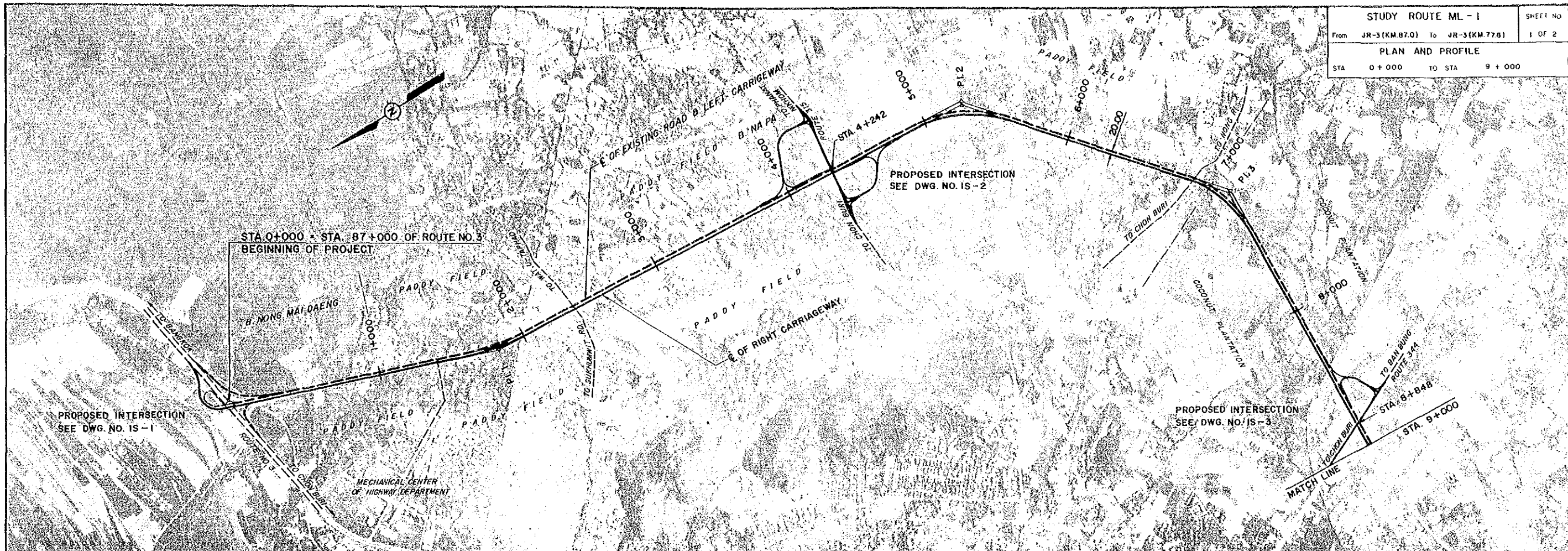
YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1989	98,651				0	173,857	0
1990	90,186				0	141,909	0
1991	128,838				0	181,008	0
1992		44,755	34,958	(13)	79,700	0	89,264
1993		61,058	43,750	(28)	104,780	0	104,780
1994		77,362	52,542	(43)	129,861	0	115,947
1995		104,434	60,991	(58)	165,367	0	131,830
1996		131,507	69,440	(73)	200,874	0	142,978
1997		158,579	77,888	(88)	236,379	0	150,223
1998		185,652	86,337	(103)	271,886	0	154,275
1999		212,724	94,785	(118)	307,391	0	155,734
2000		239,797	103,234	(133)	342,898	0	155,110
2001		260,348	107,514	(148)	367,714	0	148,514
2002		280,899	111,794	(163)	392,530	0	141,550
2003		301,450	116,074	(178)	417,346	0	134,374
2004		322,001	120,354	(193)	442,162	0	127,111
2005		342,552	124,635	(208)	466,979	0	119,862
2006	(177,103)	363,104	128,915	(223)	491,796	(45,458)	112,707
TOTAL	140,572	3,086,222	1,333,211	(1,770)	4,417,663	451,316	1,984,259

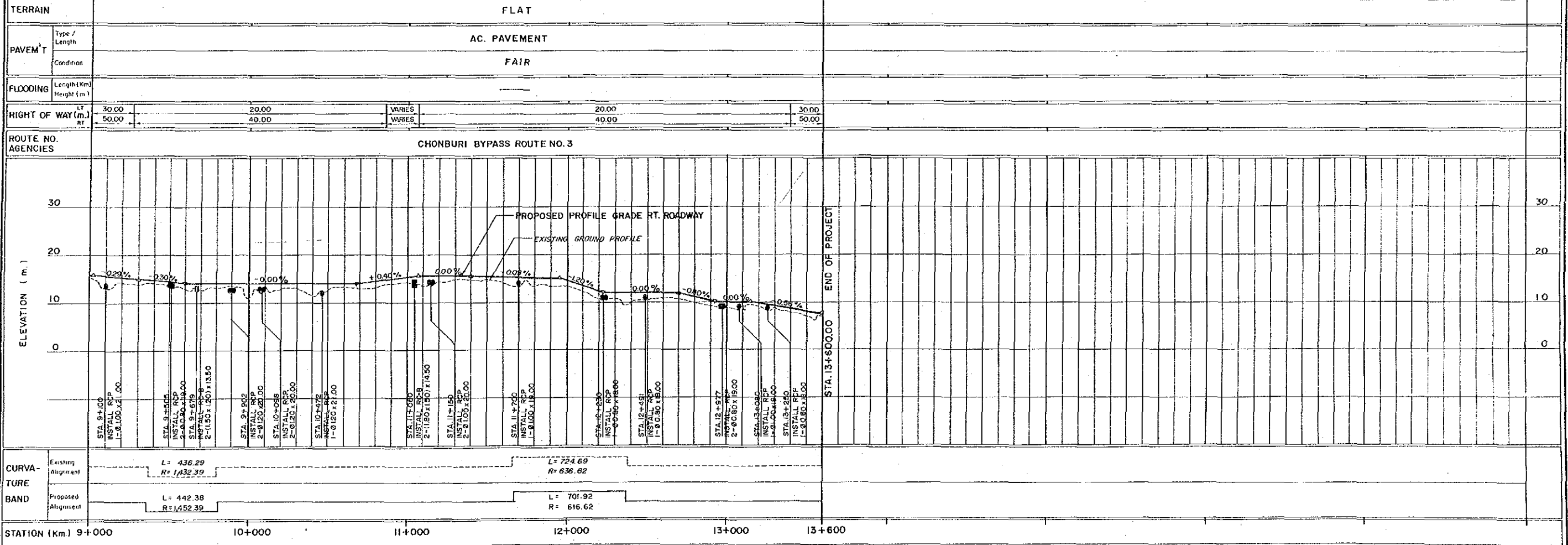
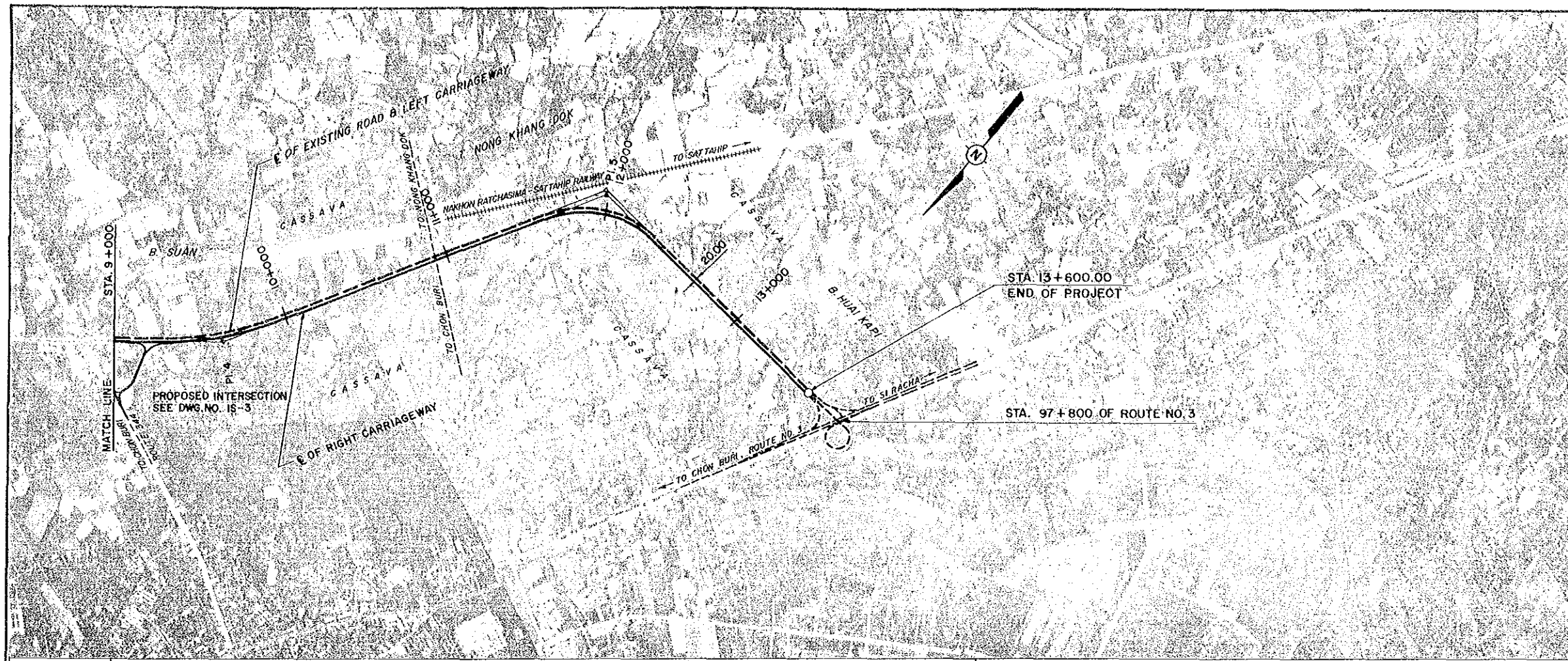
NET PRESENT VALUE : 1,532,943
 BENEFIT COST RATIO : 4.40
 INTERNAL RATE OF RETURN : 30.8%
 FIRST YEAR RATE OF RETURN : 18.0%

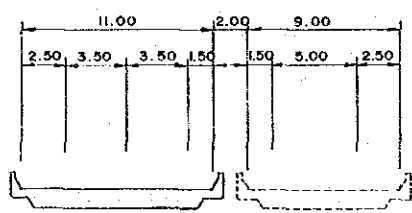
6. DRAWINGS

ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

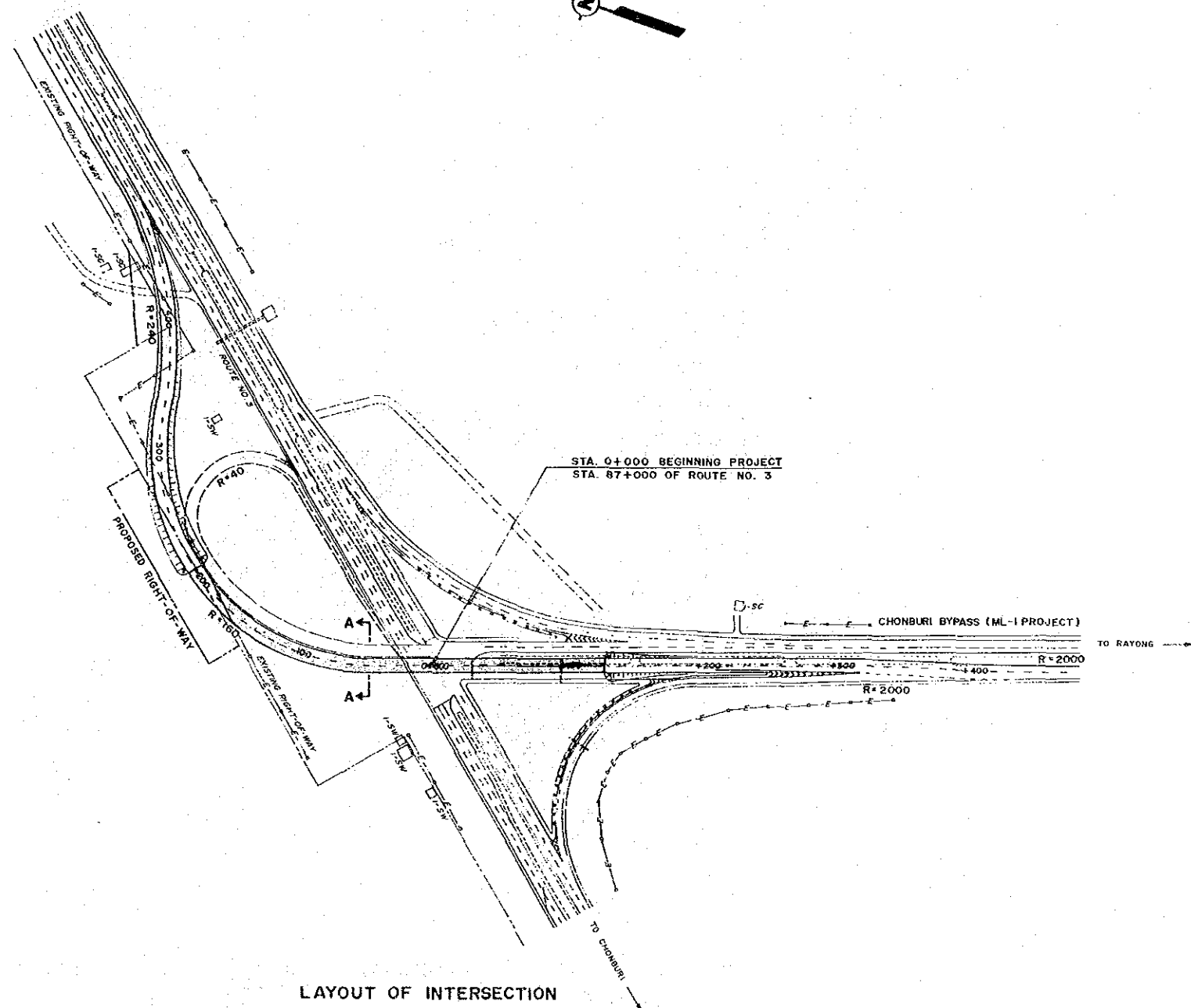
	NEW CONSTRUCTION SECTION OF STUDY ROUTE
	IMPROVEMENT SECTION OF STUDY ROUTE
	BRIDGE (PROPOSED, EXISTING)
	BOX CULVERT (PROPOSED, EXISTING)
	PIPE CULVERT (PROPOSED, EXISTING)
	HIGH WATER LEVEL
HWY	HIGHWAY
PI	POINT OF HORIZONTAL INTERSECTION
NO. or #	NUMBER
Δ	DEFLECTION ANGLE
R	RADIUS OF CURVATURE
T	TANGENT LENGTH
L	LENGTH OF CURVE
RT	RIGHT
LT	LEFT
EXIST.	EXISTING
EXTD.	EXTEND
RC-P-n- $\phi a \times l$	PIPE CULVERT, n (ROW), ϕa (DIAMETER, m), l (LENGTH, m)
RC-B-n-a $\times b \times l$	BOX CULVERT, n (NO. OF CELLS), a $\times b \times l$ (CLEAR SPAN \times DEPTH \times LENGTH, m)
BR-T-a $\times l - n$	TIMBER BRIDGE, a $\times l$ (WIDTH \times LENGTH, m), n (NO. OF SPANS)
BR-RC-a $\times l - n$	CONCRETE BRIDGE, a $\times l$ (ROADWAY WIDTH \times LENGTH, m) n (NO. OF SPANS)



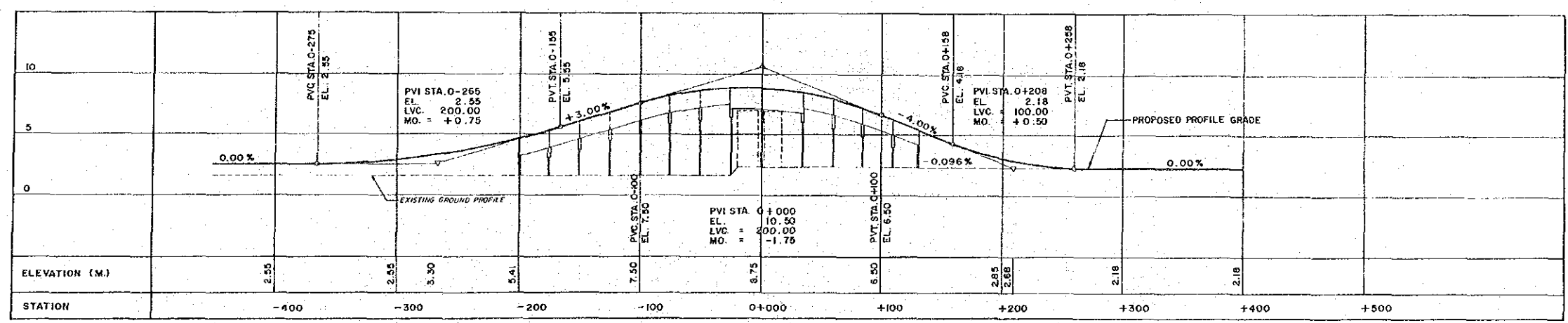




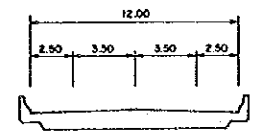
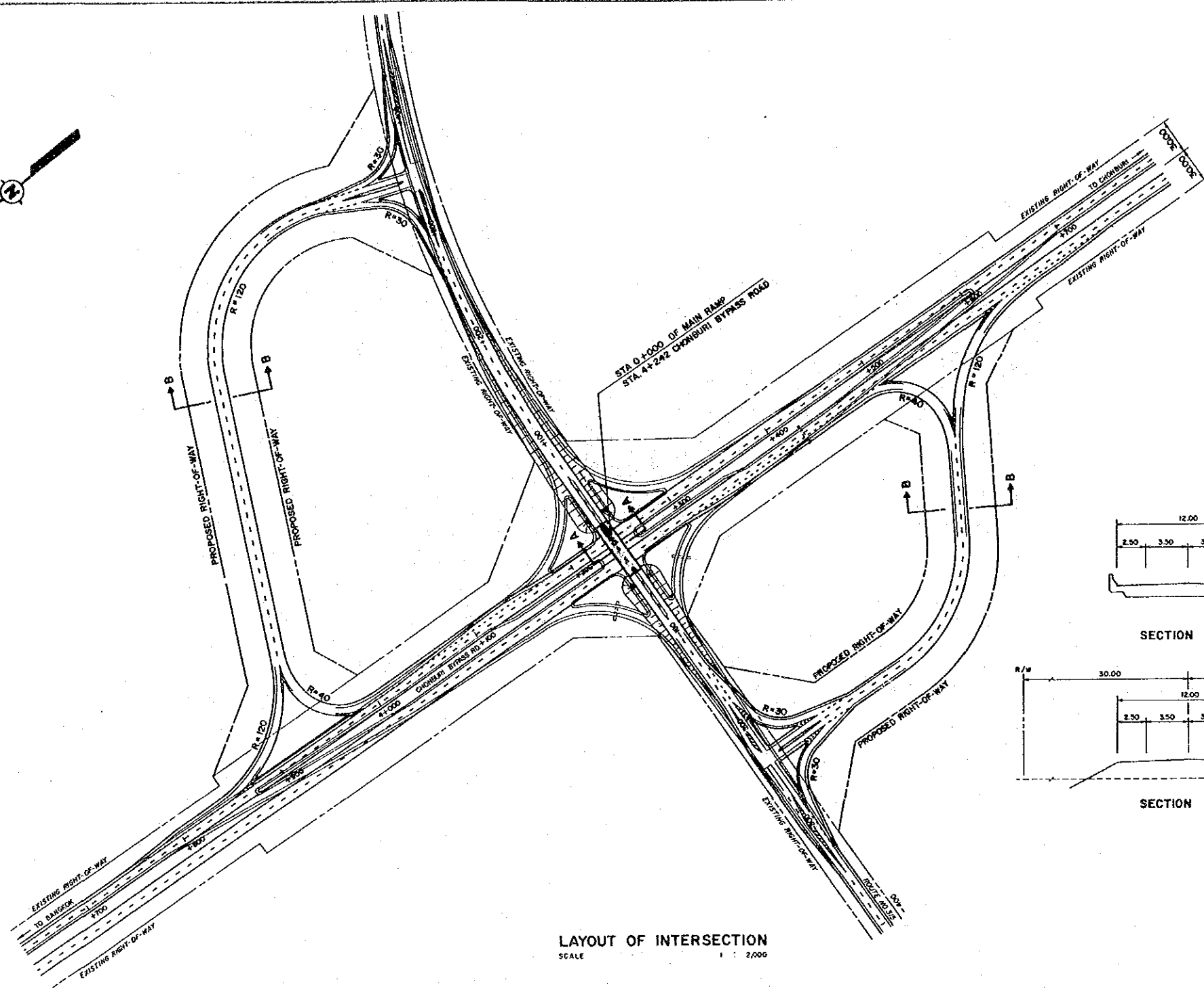
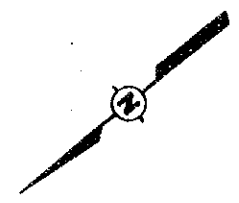
SECTION A-A



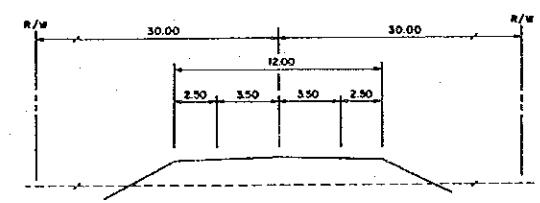
LAYOUT OF INTERSECTION
 SCALE 1:2,000



PROFILE OF MAIN RAMP
 SCALES HORIZ. 1:2,000 VERT. 1:200

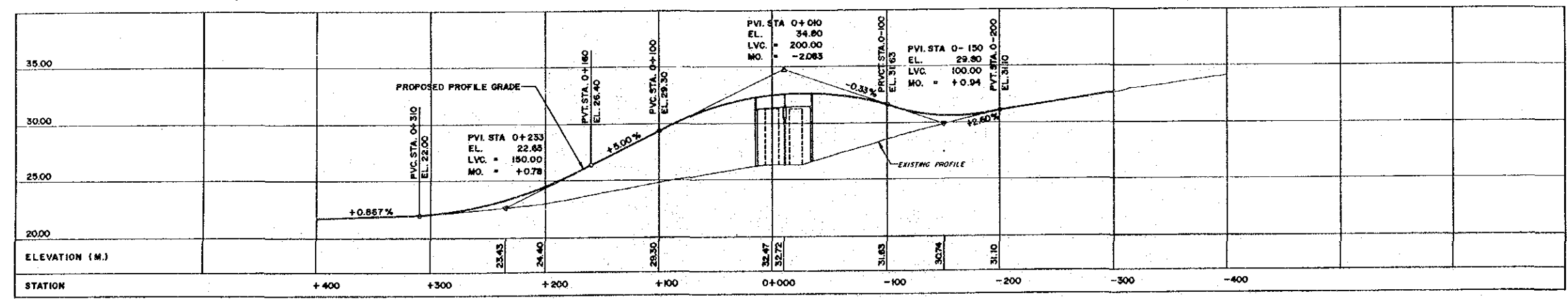


SECTION A-A

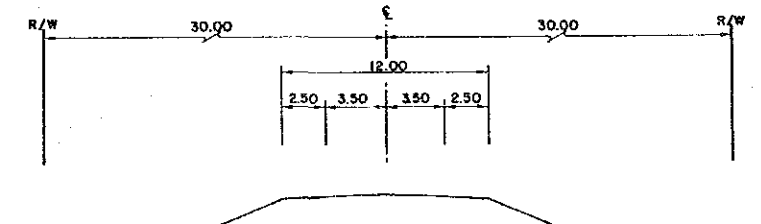
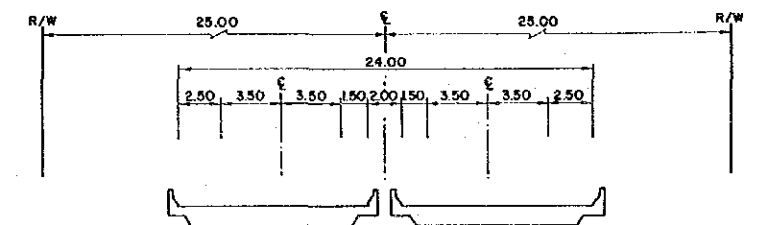
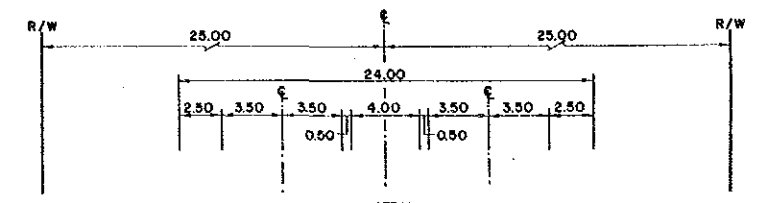
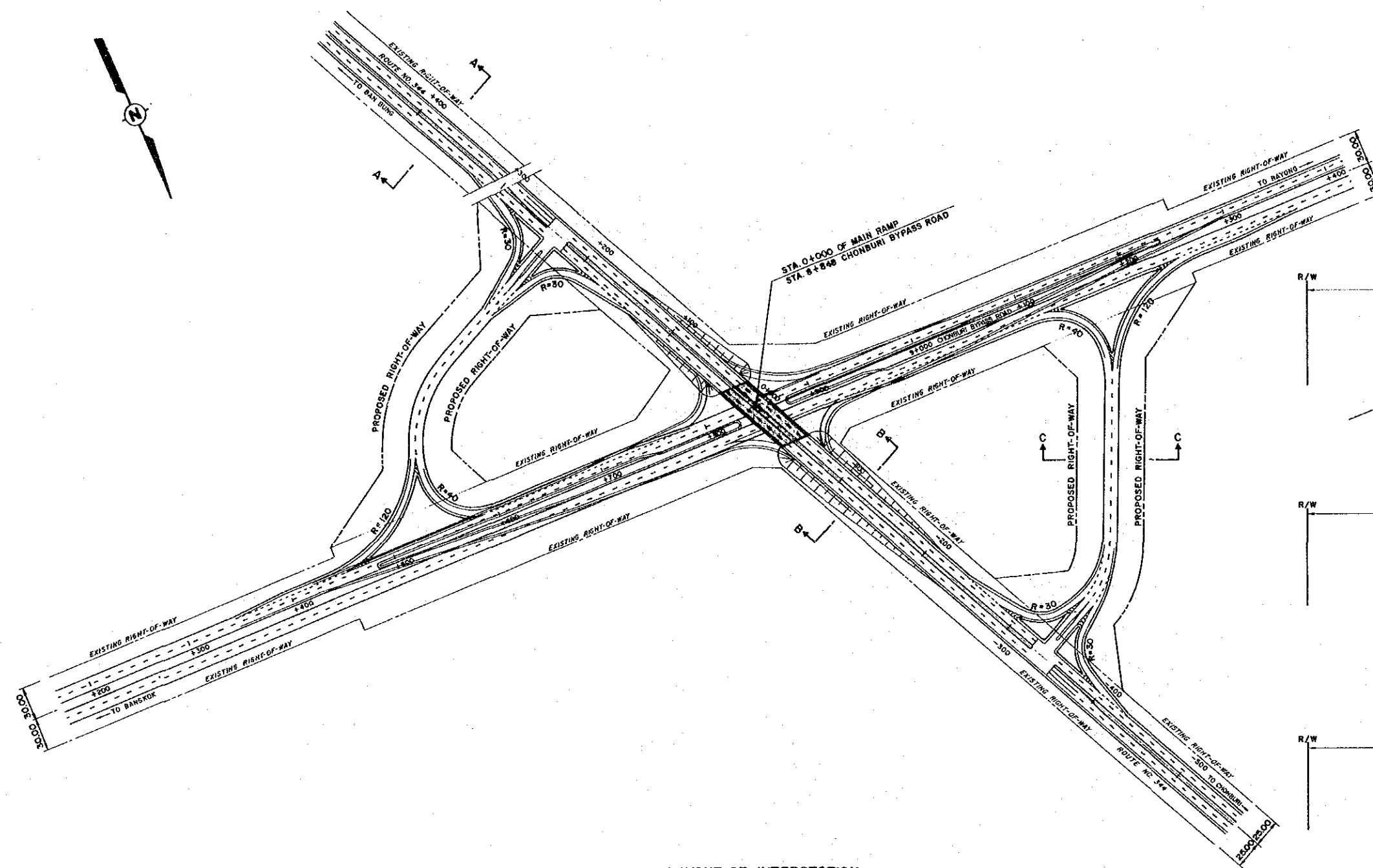


SECTION B-B

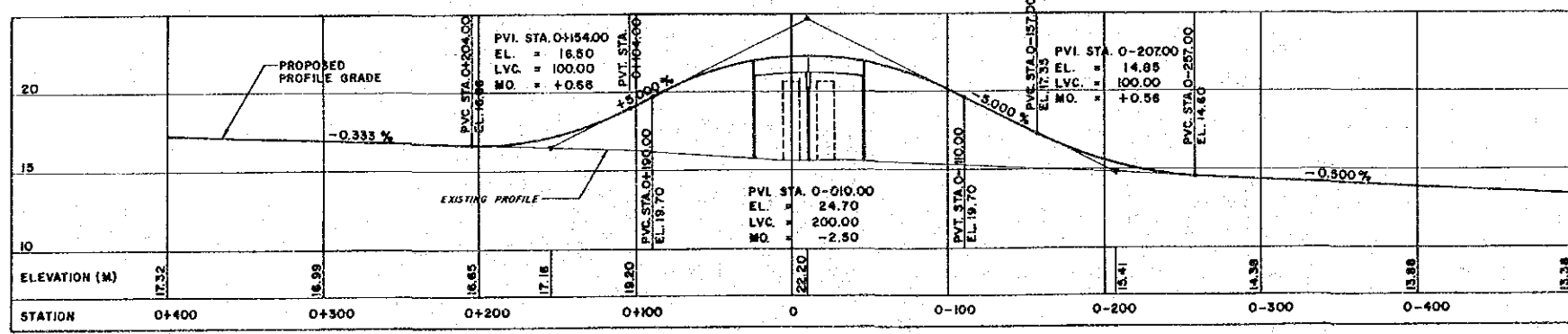
LAYOUT OF INTERSECTION
 SCALE 1 : 2,000



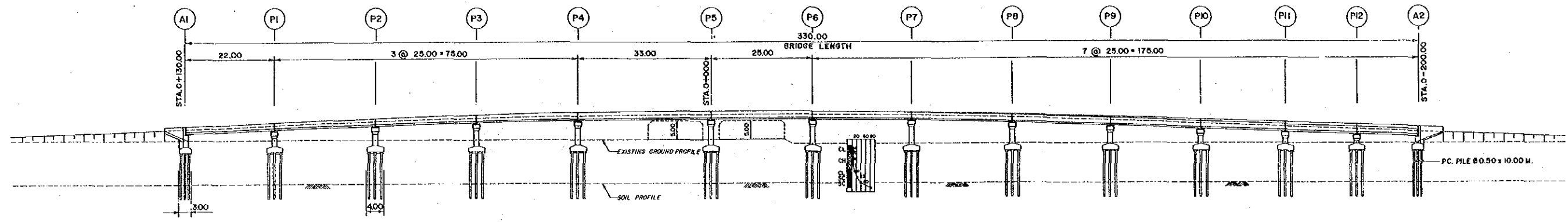
PROFILE OF MAIN RAMP
 SCALES HORIZ 1 : 2,000 VERT 1 : 200



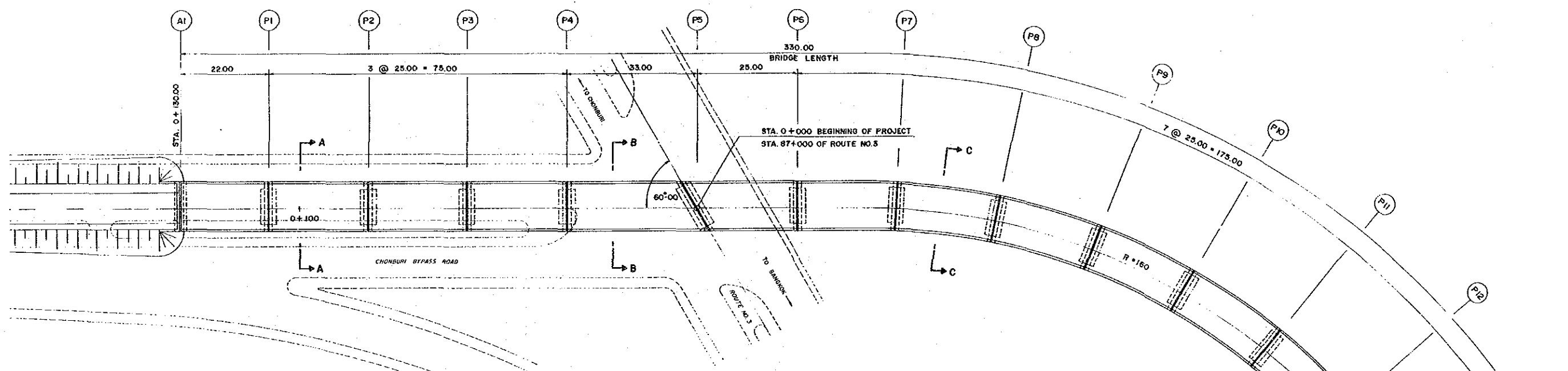
LAYOUT OF INTERSECTION
 SCALE 1:2,000



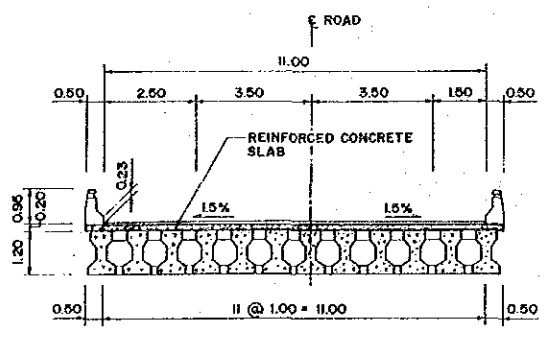
PROFILE OF MAIN RAMP
 SCALES HORIZ 1:2,000, VERT 1:200



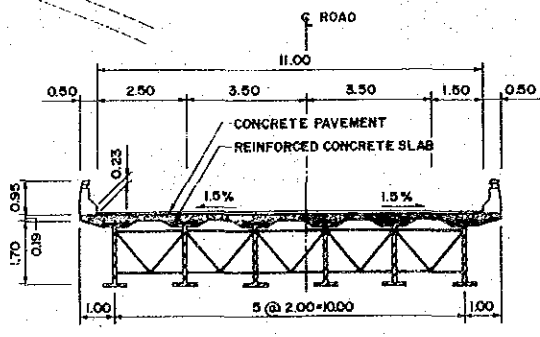
GENERAL ELEVATION
 SCALE 1 : 500



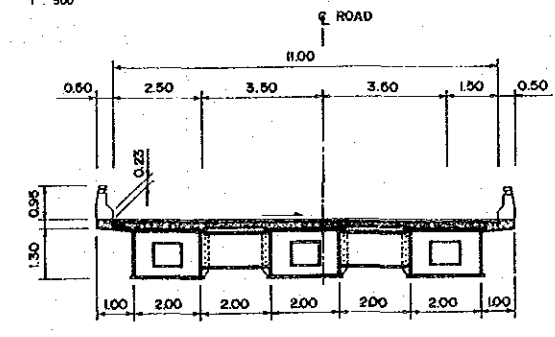
GENERAL PLAN
 SCALE 1 : 500



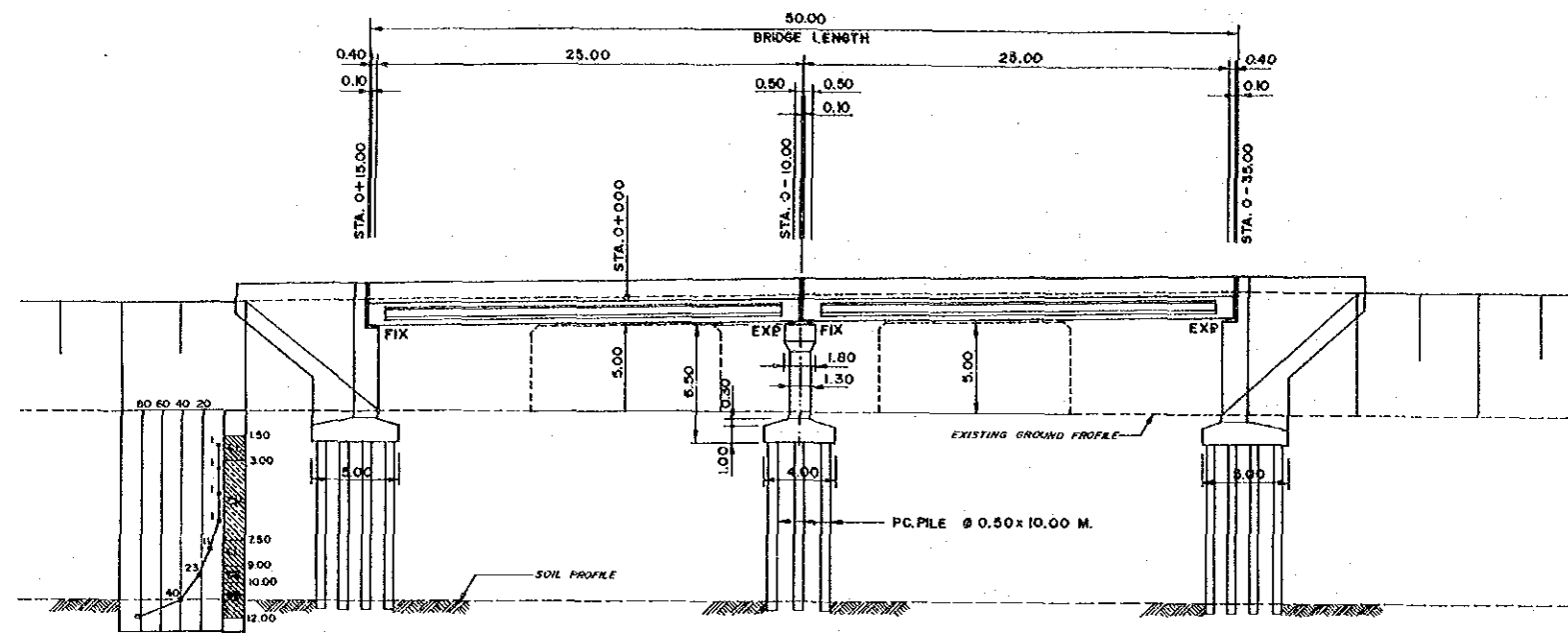
SECTION A - A
 SCALE 1 : 100



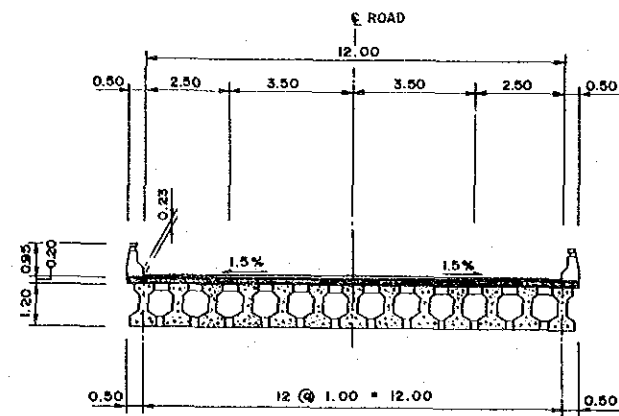
SECTION B - B
 SCALE 1 : 100



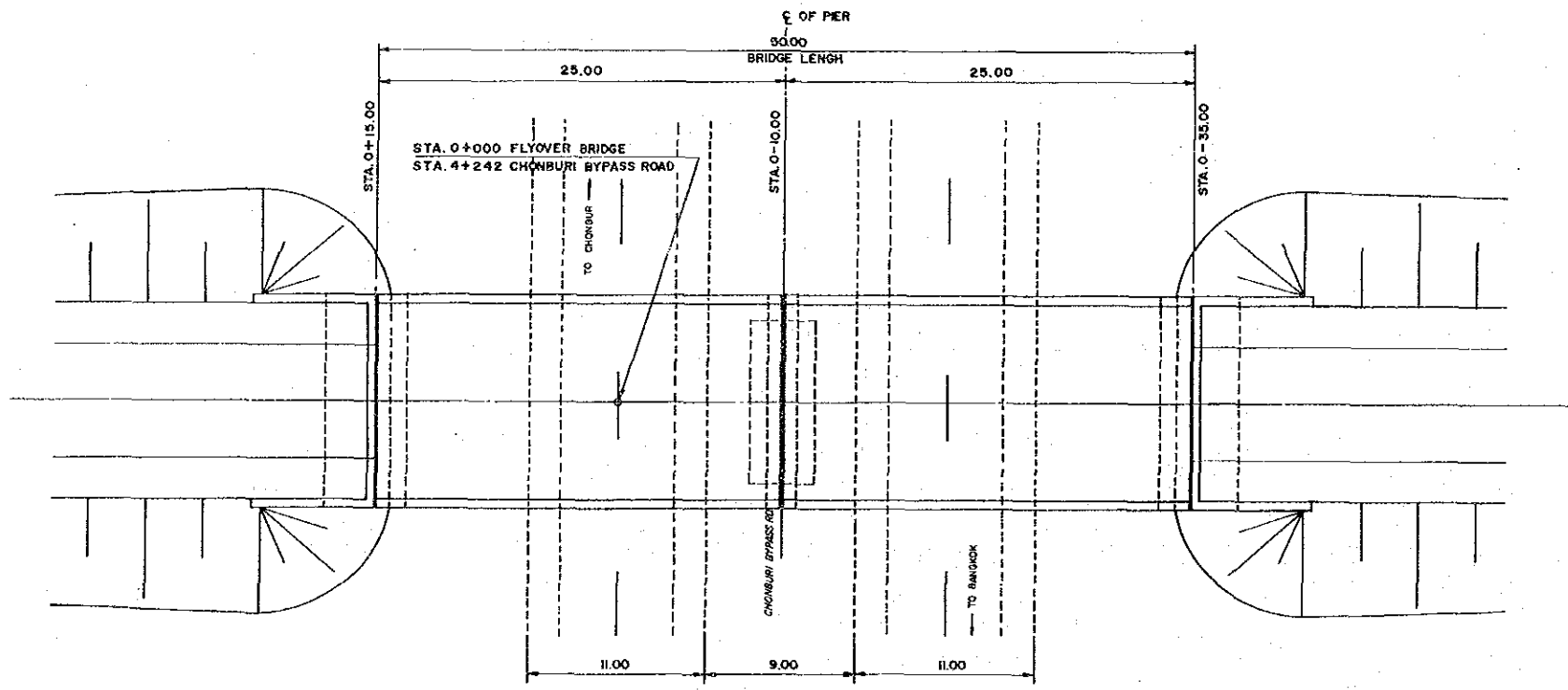
SECTION C - C
 SCALE 1 : 100



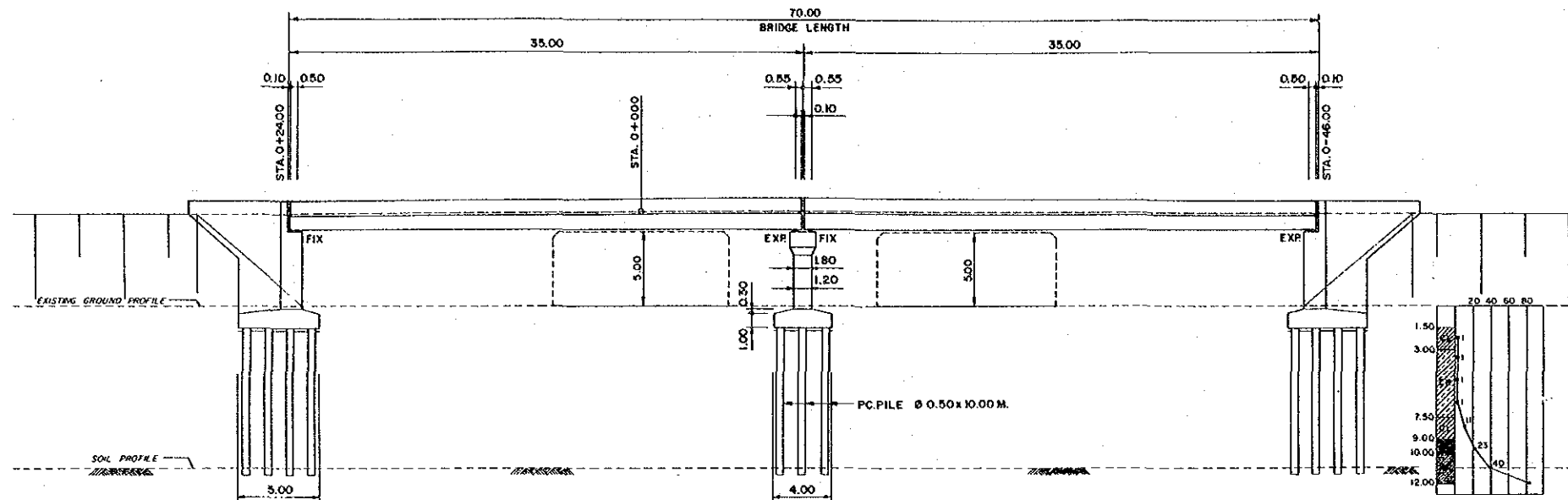
GENERAL ELEVATION
SCALE 1:200



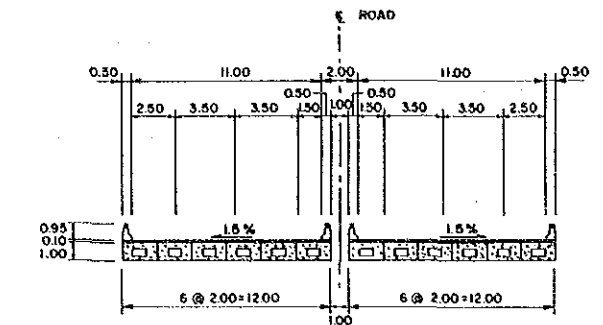
SUPERSTRUCTURE CROSS SECTION
SCALE 1:100



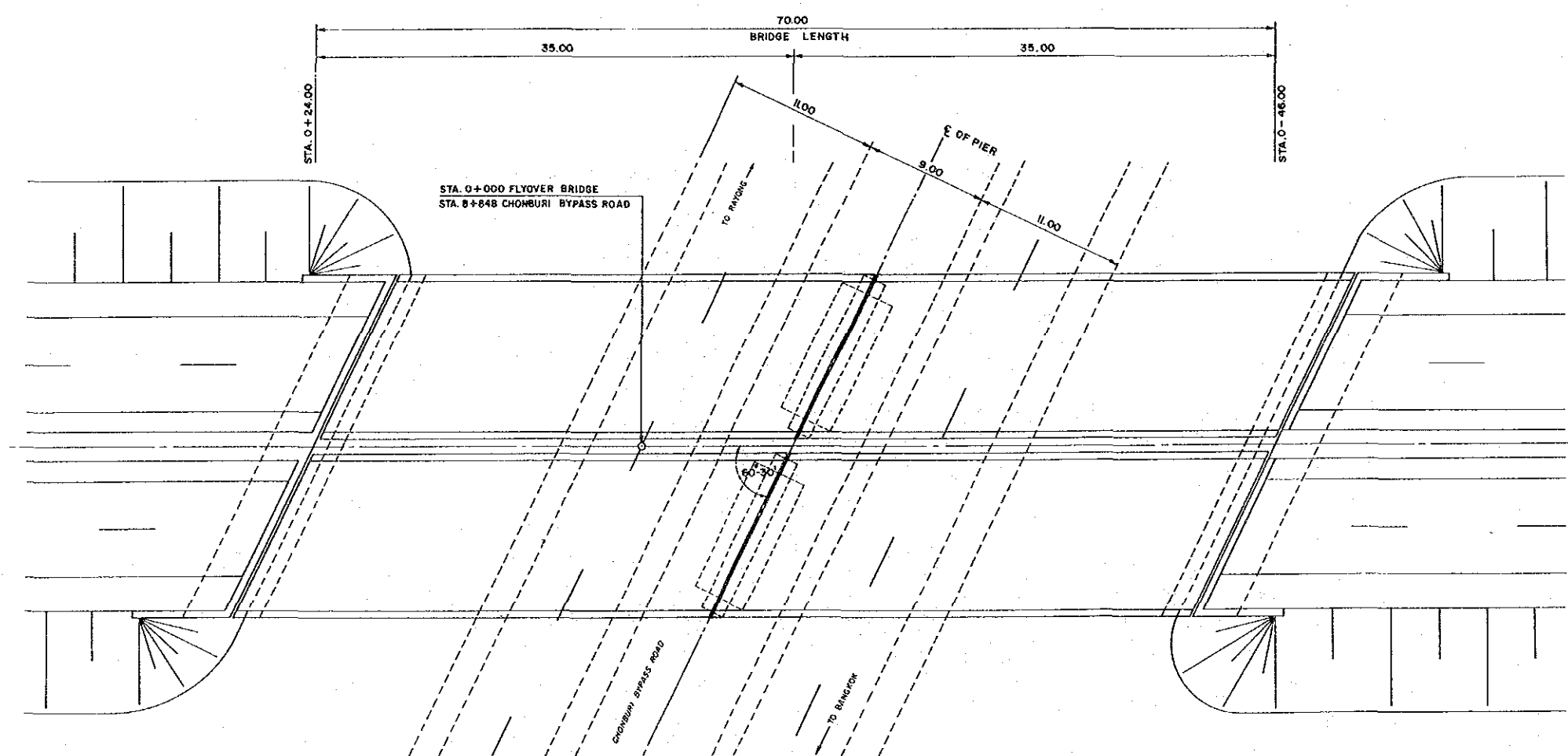
GENERAL PLAN
SCALE 1:200



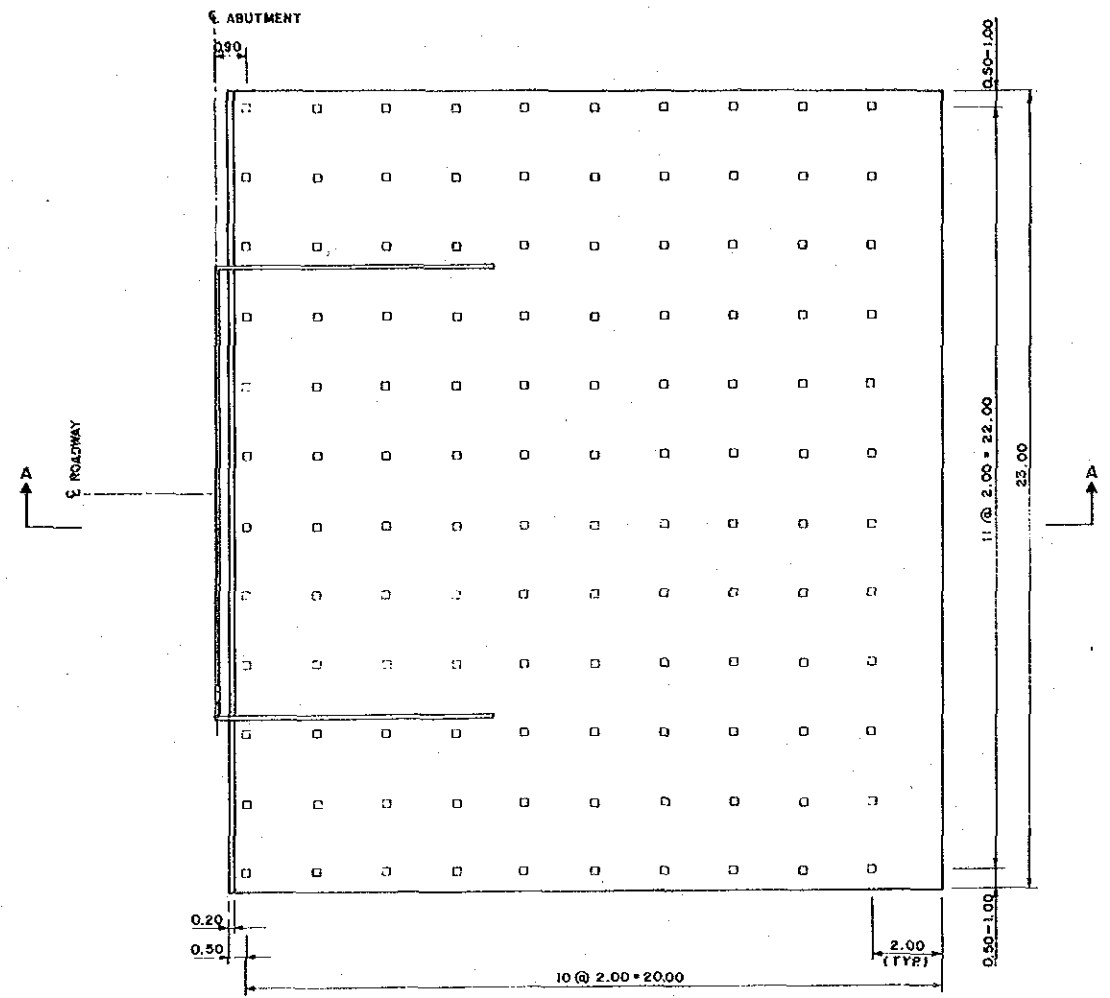
GENERAL ELEVATION
SCALE 1 : 200



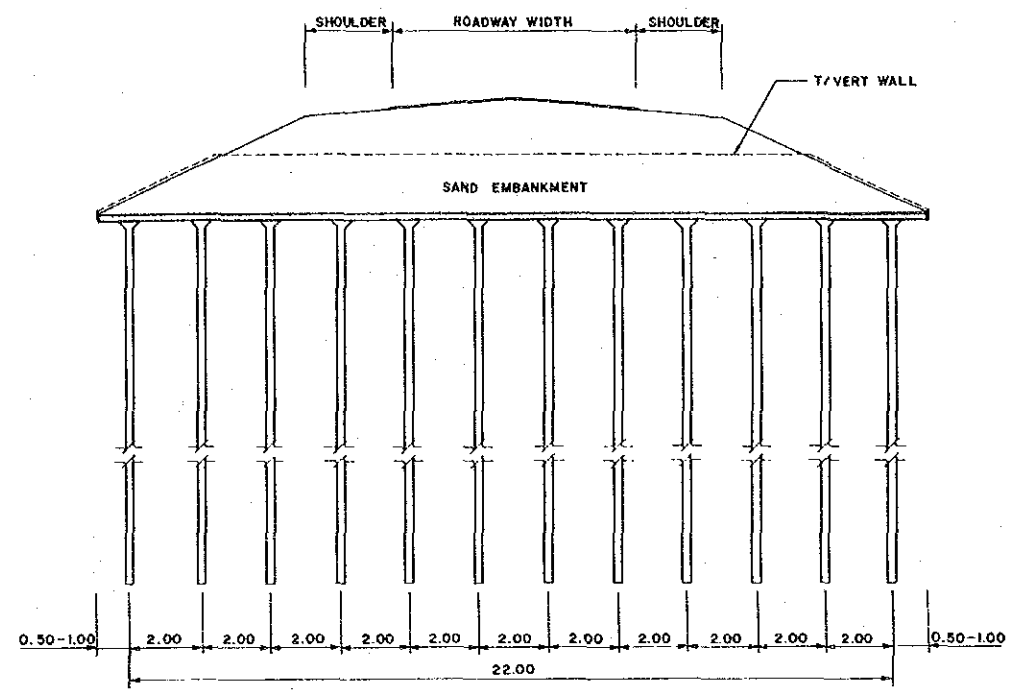
SUPERSTRUCTURE CROSS SECTION
SCALE 1 : 200



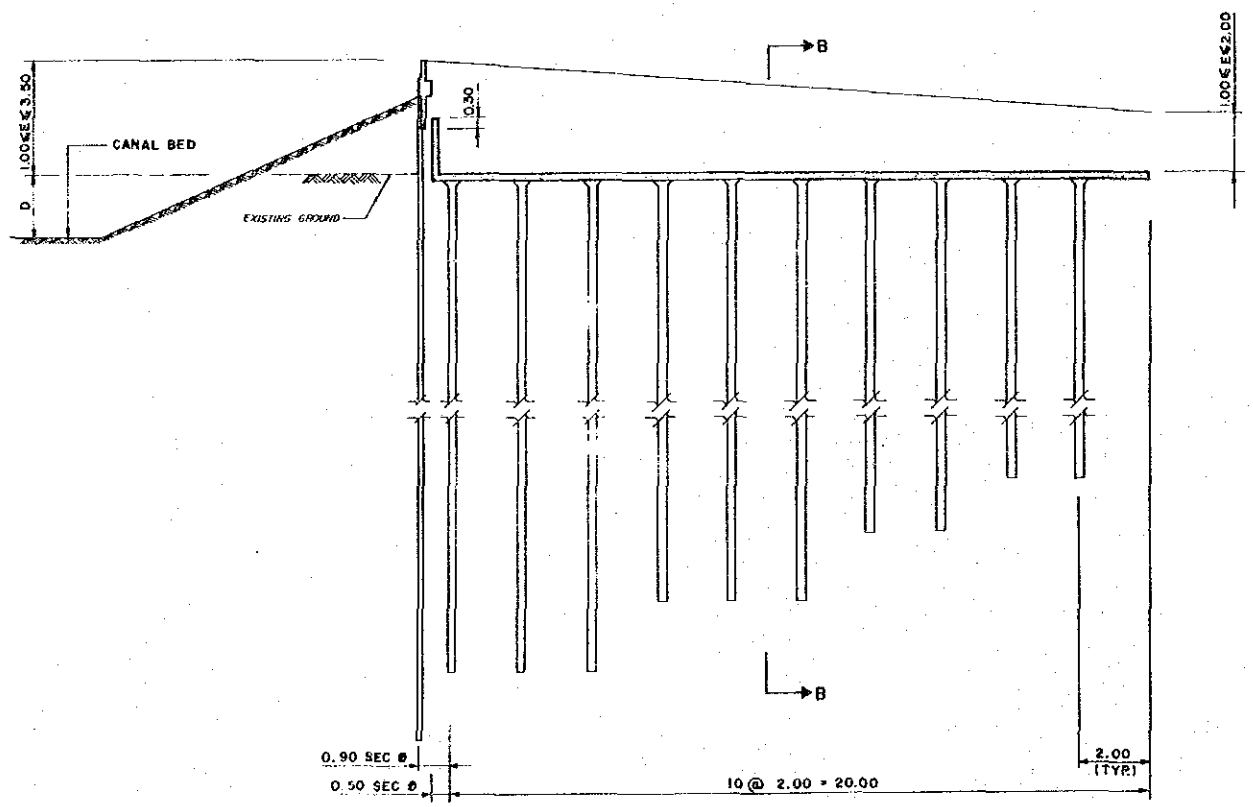
GENERAL PLAN
SCALE 1 : 200



PILING PLAN FOR NON-SKEW BRIDGE
SCALE 1 : 100



SECTION B-B
SCALE 1 : 100



SECTION A-A
SCALE 1 : 100

PROJECT ML - 2

Changwat : Chon Buri

Pattaya - A. Sattahip

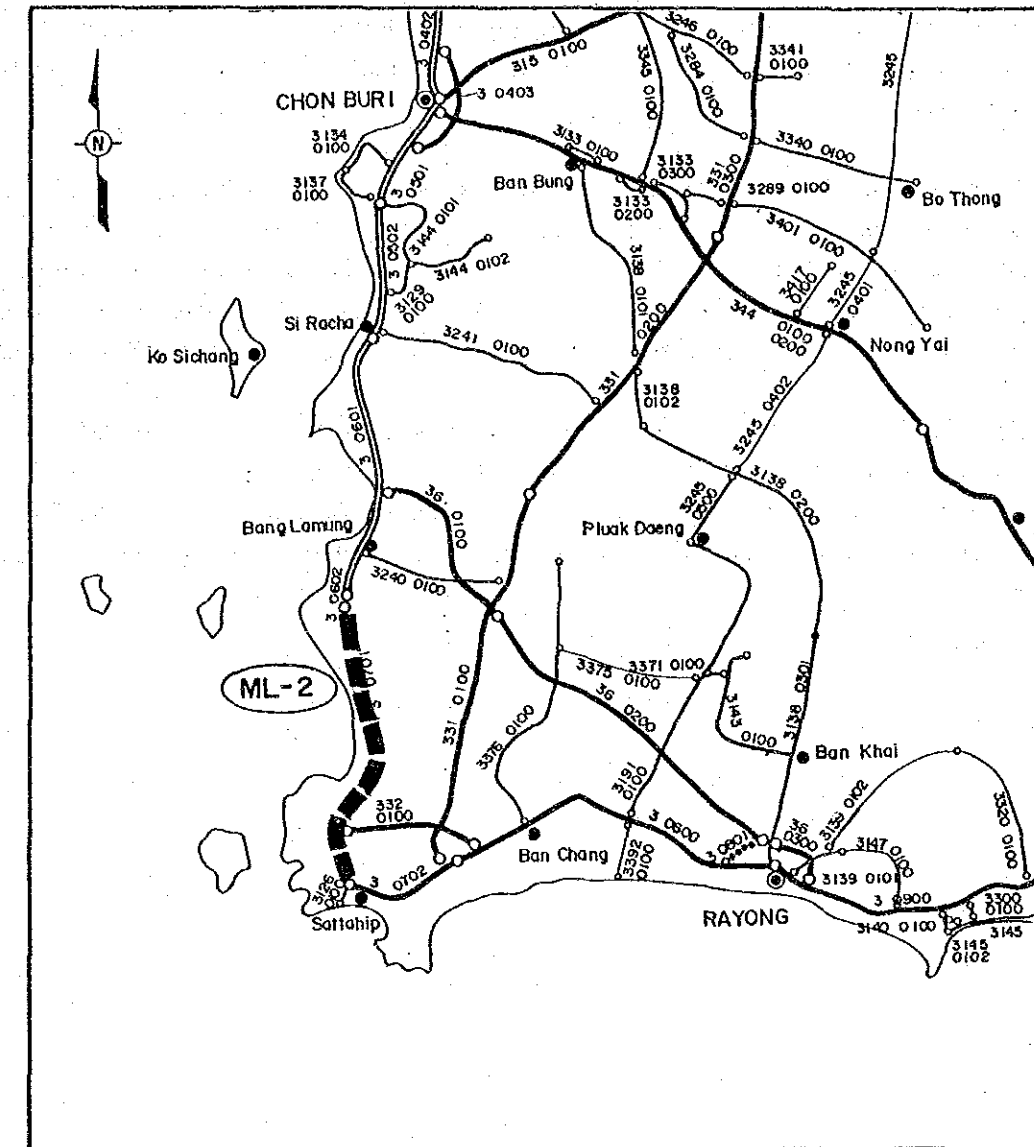
Length : 27.27 km

SUMMARY

PROJECT ML-2

ITEM	DESCRIPTION
Changwat	Chon Buri
Origin	M. Pattaya
Destination	A. Sattahip
Route No.	Rt. 3
Project Length	27.27 km
Standard	
- Existing	P1 ~ P3
- Proposed	PD
Traffic	
- Base	4,958 ~ 6,700
- 2000	11,200 ~ 12,900
- 2008	16,600 ~ 18,700
Pavement Type	
- Existing	AC pavement
- Proposed	AC pavement (10 cm thick surface)
Bridges	
- New Construction	5 sites, 109 m
- Replacement	5 sites, 109 m
Intersection	—
Construction Costs	
- Financial	224,503,000 Baht
- Economic	197,763,000 Baht
Economic Evaluation	
- IRR	22.2%
- B/C	2.25

LOCATION OF PROJECT ROUTE



SCALE
5 0 10km.

LEGEND :

- ▬▬▬▬▬ .PROJECT ROUTE
- ▬▬▬▬▬ DIVIDED HIGHWAYS
- ▬▬▬▬▬ NATIONAL HIGHWAYS
- ▬▬▬▬▬ PROVINCIAL HIGHWAYS
- ▬▬▬▬▬ PROVINCIAL HIGHWAYS (Unpaved)
- , ● CHANGWAT, AMPHOE

1. GENERAL

Project ML-2 is to upgrade a part of Route 3 from Muang Pattaya to Amphoe Sattahip with a total length of 27.3 km.

The terrain is flat to slightly rolling and land along the road is used mostly for cassava field but residential and other structures are not infrequent. This two-lane section has asphalt concrete surfacing and its condition is generally poor. Because of extensive resort development up to Ban Saray in recent years, traffic has been increasing with particularly heavy traffic on weekends.

There are a number of factors which assure a traffic increase in the future. The industrial complex under construction in Map Ta Phut will inevitably induce expansion of the area between Map Ta Phut and Sattahip. The U Tapao airport is planned to become a commercial airport. Expansion of Sattahip port activities are also planned. It is therefore imperative to improve this section at least in time for the full operation of the Map Ta Phut Complex.

Therefore, minor widening and overlay of the existing road and the construction of an additional two-lane carriageway are proposed. The new carriageway runs parallel to the existing road on the sea side for the first six km and on the hill side for the remainder. The proposed design calls for asphaltic pavement and overlay, replacement of five narrow bridges, and a realignment at Km 154.

2. TRAFFIC FORECAST

Base Traffic Volume

(Unit: Vehicles/Day)

Project Code	Section	Year	Traffic Volume							ADT
			MC	PC	LB	HB	LT	MT	HT	
ML-2	3-158KM	1986	2467	1748	1740	308	870	201	91	4958
	3-175KM	1988	3676	1078	2348	508	2356	301	109	6700
	Average	-	3072	1413	2044	408	1613	251	100	5829

Traffic Growth Rate

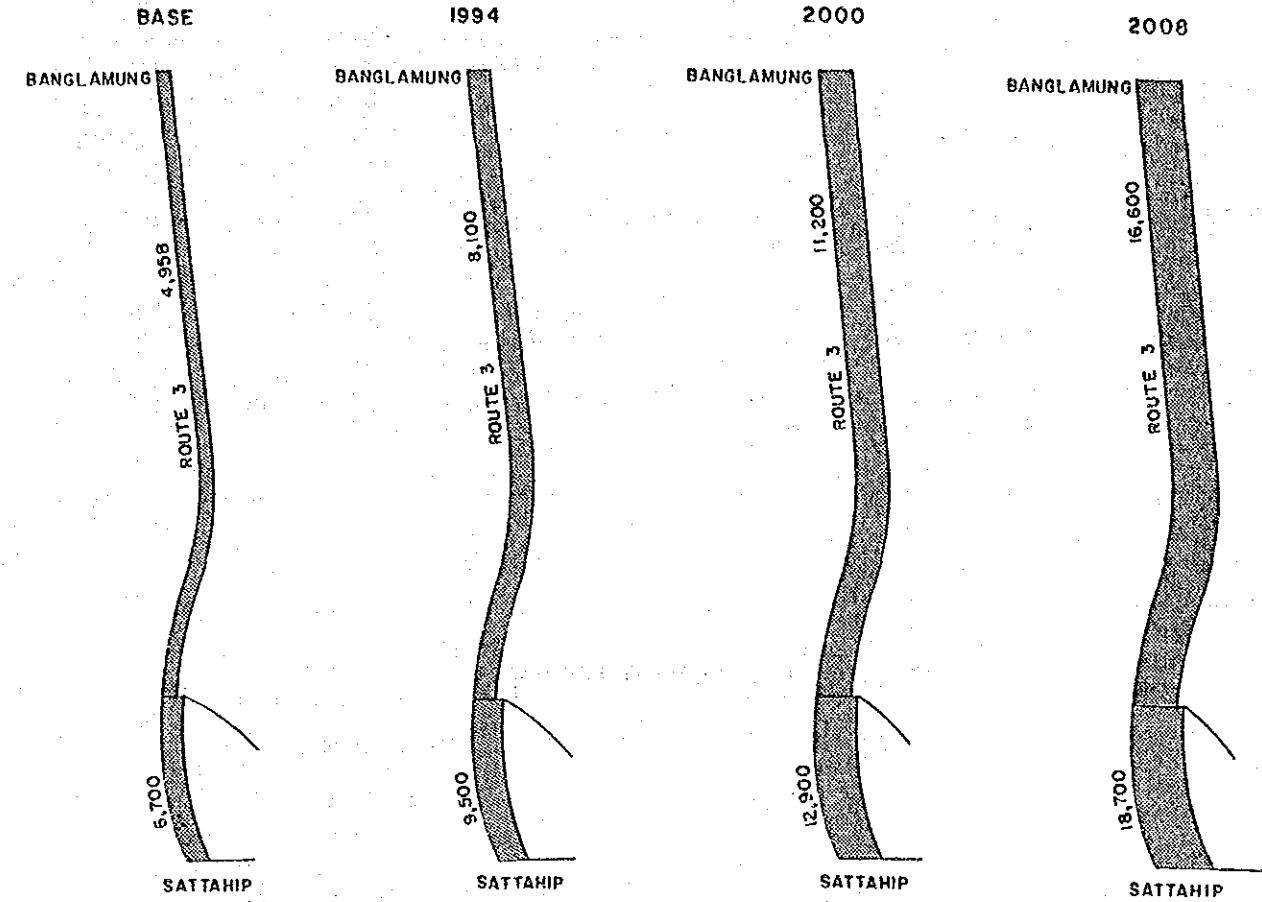
(Unit: Percent)

Project	Section	Period	MC	PC	LB	HB	LT	MT	HT
ML-2	3-175KM	-1993	6.44	6.70	6.88	6.29	5.01	6.19	6.99
		1994 -2000	5.57	5.61	6.52	5.40	3.49	4.70	5.11
		2000 -2008	5.04	5.60	5.03	5.04	3.82	4.58	4.26

Future Traffic Volume

(Unit: Vehicles/Day)

Project	Section	Year	MC	PC	LB	HB	LT	MT	HT	ADT
ML-2	3-158KM	1994	4032	2906	2953	497	1268	320	153	8097
		2000	5581	4033	4313	682	1557	422	207	11214
		2008	8271	6236	6387	1011	2102	604	289	16629
ML-2	3-175KM	1994	5302	1575	3489	726	3113	425	161	9489
		2000	7339	2185	5096	996	3824	560	217	12878
		2008	10876	3379	7546	1476	5161	801	303	18666
ML-2	Average	1994	4667	2241	3221	612	2191	373	157	8793
		2000	6460	3109	4705	839	2691	491	212	12046
		2008	9574	4808	6967	1244	3632	703	296	17648



Project ML-2

UNIT : VEHICLE / DAY

3. ENGINEERING

3.1 Materials and Boring Results

(1) Materials

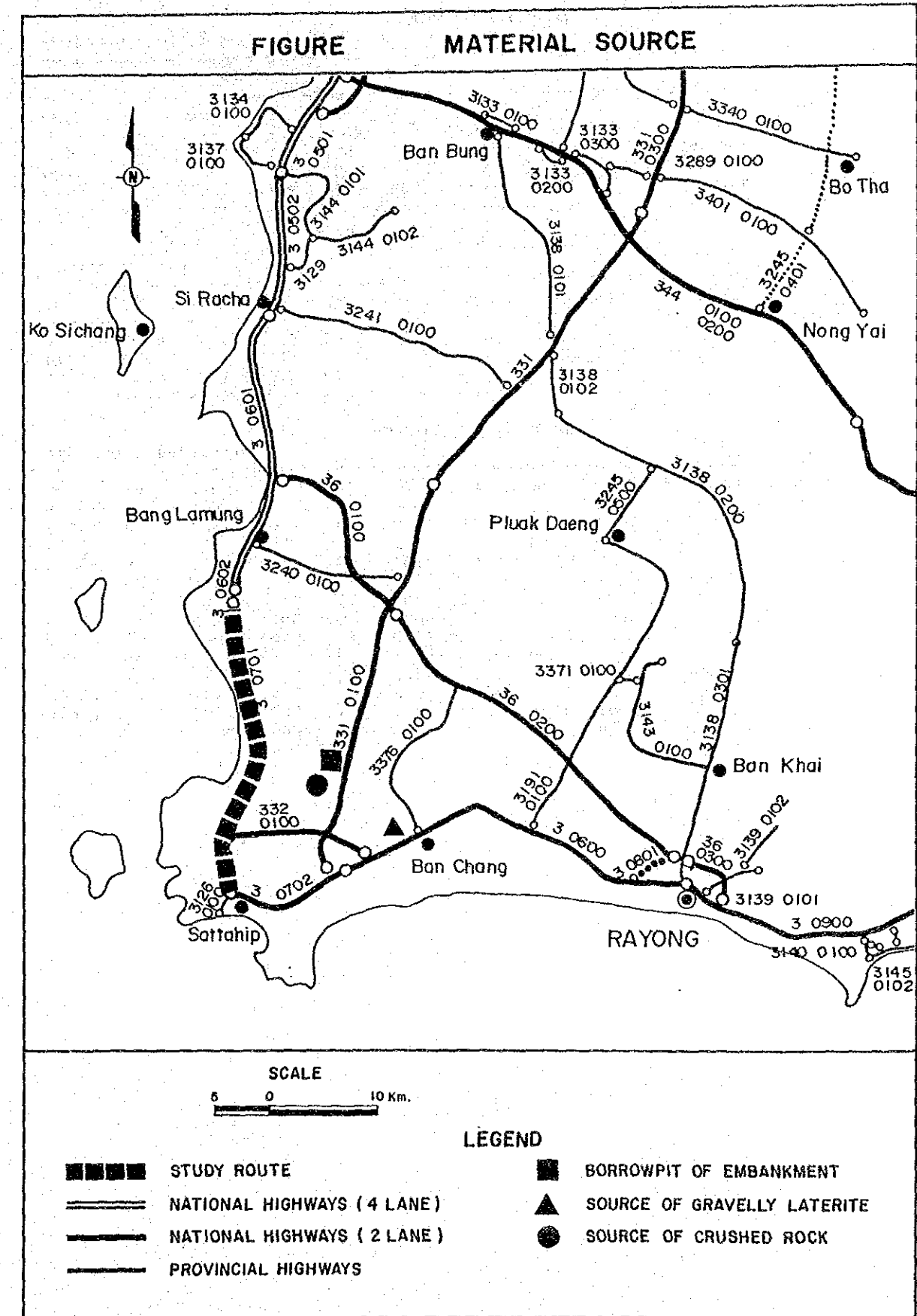
DESCRIPTION OF MATERIAL SOURCES

Material	Source	Description of Sample	Estimated Quantity cu.m.	Hauling Distance (km)
Soil	Route 331 Km 13+500 Left Side 0.2 Km	Silty Sand	Plentiful	27.00
Laterite	Route 3 Km 194+700 Left Side 3 Km	Gravelly Laterite	85,000	28.00
Crushed Rock	Route 332 Km 9+000 Right Side 5.0 Km	Lime Stone	Plentiful	21.00

RESULTS OF LABORATORY TESTS

	Sieve Analysis % Passing							Plasticity		Comp. DH-T Stand.		Lab. C.B.R.		
	50.0	25.0	19.0	9.5	#4	#10	#40	#200	LL	PT	Opt. 95%	ga/cc	CBR 95%	Swell %
Soil	100	99.1	88.9	83.6	74.9	64.6	36.2	-NP-	7.7	2.045	11.4	-	-	
Laterite	100	93.1	77.1	50.9	25.9	16.6	12.5	24.8	8.8	7.4	2.126	37	-	
Crushed Rock	-	-	-	-	-	-	-	-	-	-	-	-	>80	

Note: Abrasion test result of Crushed Rock 23.2 %



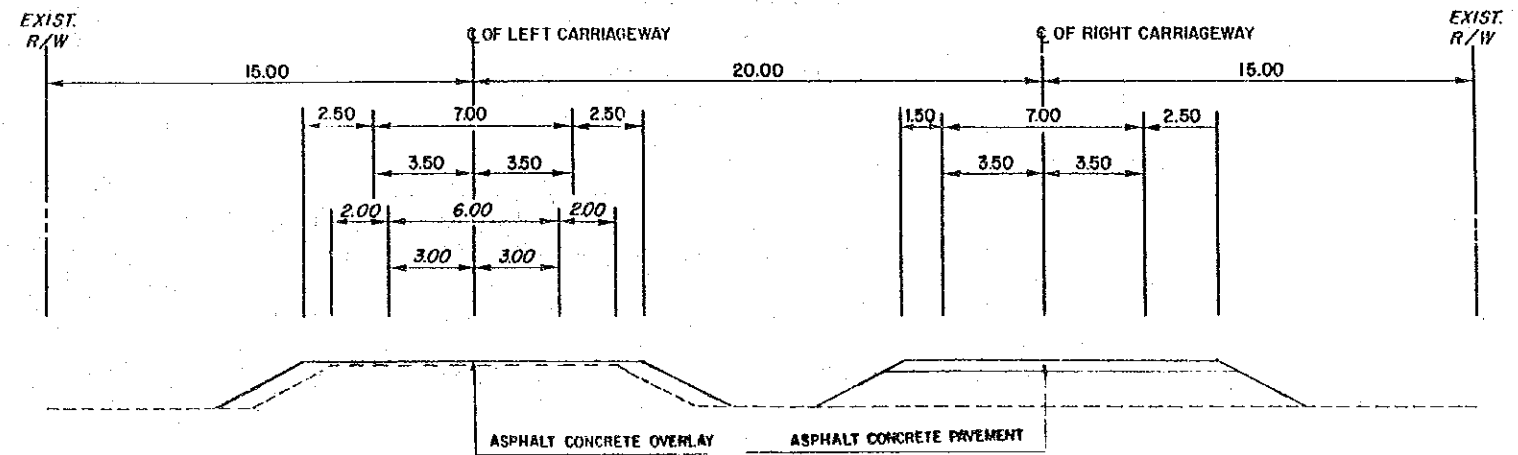
3.2 Preliminary Design

(1) Geometric Design Criteria

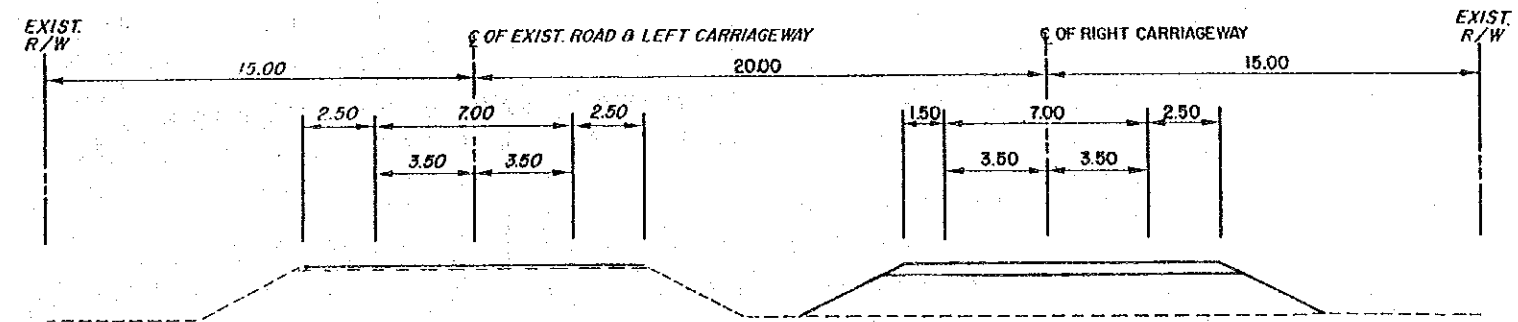
Design Standard : PD
 Design Speed : 80-100 km/h

Geometric Design Criteria

Description	Design Speed (km/h)		
	100	90	80
Minimum Radius & Curvature (m)	360	280	210
Minimum Stopping Sight Distance (m)	160	140	115
Maximum Gradient (%)	6	7	8



CARRIAGEWAY WIDENING (LT) & NEW CONSTRUCTION (RT)



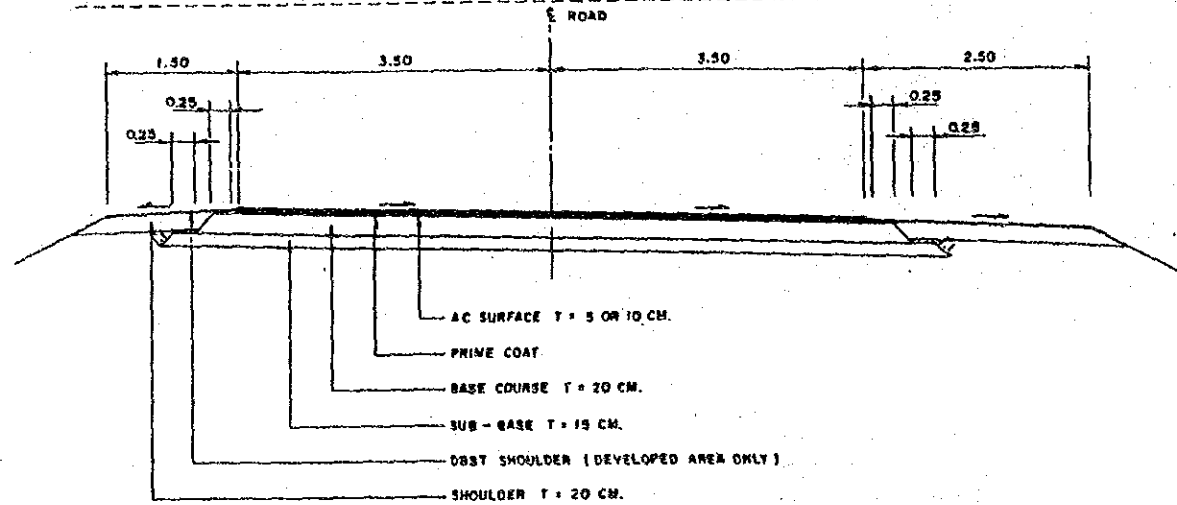
NEW CONSTRUCTION (RT)

TYPICAL CROSS SECTION (ROUTE ML-2)

(2) Pavement Design

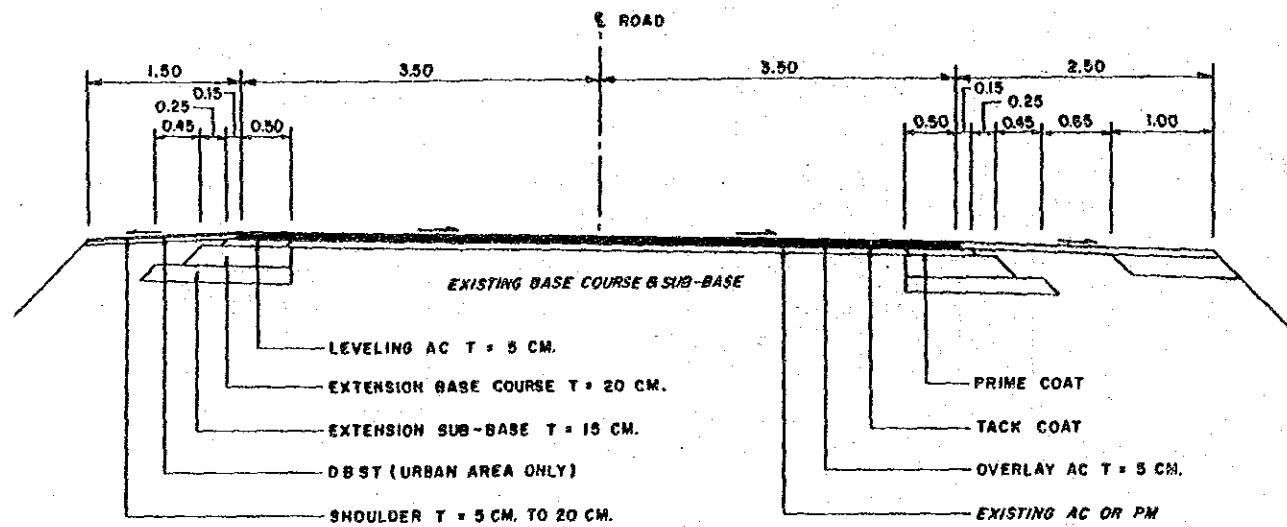
Pavement for New Construction Lane

Design CBR of Subgrade	Cumulative No. of ESA W18 x 10 (10 years)	Thickness of Pavement Structure (cm)	
11.4	1,709	Surface 10 Base 20 Subbase 15	SN = 2.3



Initial Overlay for Existing Lane

Type of Overlay	Design CBR	Cumulative of ESA W18 x 10 (20 years)	Required D or SN	FRL * D _{xeff} or SN _{xeff}	Overlay D _{ol} or SN _{ol}	Thickness (cm)
AC	10.5	1,709	2.30	1.05	1.25	7.0



(3) Culverts

No.	CHAINAGE	EXISTING CULVERT	NEW CULVERT	
			LT ROADWAY	RT ROADWAY
1	147+825	RCP 1 - Ø.60X22	REMAIN	-
2	148+315	RCP 1 - Ø.80X22	BOX 1 - Ø1.8X1.8X13	BOX 1 - Ø1.8X1.8X13
3	149+560	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
4	150+450	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X20	RCP 1 - Ø1.0X20
5	150+620	BOX 2 - 1.0X3.0X10	BOX 1 - 1.8X1.8X13	BOX 1 - 1.8X1.8X13
6	150+800	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X20	RCP 1 - Ø1.0X20
7	151+800	RCP 2 - Ø.60X10	RCP 2 - Ø1.0X21	RCP 2 - Ø1.0X21
8	152+445	RCP 1 - Ø.60X10	RCP 3 - Ø1.0X21	RCP 3 - Ø1.0X21
9	154+500	-	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
10	154+800	-	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
11	155+750	-	RCP 1 - Ø1.0X19	RCP 1 - Ø1.0X19
12	157+600	RCP 2 - Ø.80X10	EXTEND 2X10 = 20 M	RCP 2 - Ø.80X20
13	157+910	RCP 1 - Ø.60X11	RCP 1 - Ø1.0X22	RCP 1 - Ø1.0X22
14	158+405	RCP 2 - Ø.60X12	RCP 1 - Ø1.0X22	RCP 1 - Ø1.0X22
15	160+750	RCP 2 - Ø1.0X10	EXTEND & ADD = 28 M	RCP 2 - Ø1.0X19
16	161+900	-	RCP 1 - Ø.80X18	RCP 1 - Ø.80X18
17	162+800	-	RCP 2 - Ø.80X14	RCP 2 - Ø.80X14
18	164+880	RCP 2 - Ø.80X10 RCP 1 - Ø.60X10	EXTEND & ADD = 64 M	RCP 4 - Ø.80X21
19	165+515	RCP 1 - Ø.60X10	RCP 2 - Ø1.0X21	RCP 2 - Ø1.0X21
20	165+960	RCP 2 - Ø.60X9	RCP 2 - Ø.80X20	RCP 2 - Ø.80X20
21	166+217	RCP 1 - Ø.80X10	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
22	167+040	RCP 2 - Ø.80X11	RCP 2 - Ø1.0X21	RCP 2 - Ø1.0X21
23	168+147	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
24	169+380	RCP 1 - Ø.80X12	EXTEND = 9 M	RCP 1 - Ø.80X21
25	169+525	RCP 1 - Ø.80X10	EXTEND = 11 M	RCP 1 - Ø.80X21
26	169+905	RCP 2 - Ø.80X9	EXTEND 2X16 = 32 M	RCP 2 - Ø.80X25
27	169+993	RCP 1 - Ø.80X11	EXTEND = 11 M	RCP 1 - Ø.80X22
28	170+035	RCP 1 - Ø.80X10	EXTEND = 12 M	RCP 1 - Ø.80X22
29	170+240	RCP 1 - Ø.80X10	EXTEND = 12 M	RCP 1 - Ø.80X22
30	170+586	RCP 2 - Ø.80X10	EXTEND 2X11 = 22 M	RCP 2 - Ø.80X21
31	171+305	RCP 1 - Ø1.0X10	BOX 2 1.8X1.8X13	BOX 2 1.8X1.8X13
32	171+855	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X19	RCP 1 - Ø1.0X19
33	172+005	RCP 1 - Ø.80X34	REMAIN	RCP 1 - Ø.80X22
34	172+485	RCP 1 - Ø.80X10	RCP 2 - Ø1.0X21	RCP 2 - Ø1.0X21
35	173+980	RCP 1 - Ø.80X8	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
36	174+170	RCP 1 - Ø.60X10	RCP 1 - Ø1.0X21	RCP 1 - Ø1.0X21
37	174+550	RCP 1 - Ø.60X10	RCP 1 - Ø.80X19	RCP 1 - Ø.80X19
38	174+875	RCP 1 - Ø.60X9	RCP 1 - Ø.80X20	RCP 1 - Ø.80X20
39	175+100	RCP 2 - Ø.60X14	RCP 2 - Ø1.0X20	RCP 2 - Ø1.0X20
40	SIDE DRAIN AT ROAD CONNECTION S ~ 30 LOCATIONS		for Ø.60 = 20X10 = 200 for Ø.80 = 10x11 = 110 for Ø1.0 = 11x12 = 132	
41	MEDIAN DRAIN ~ 5 LOCATIONS		RCP 1 Ø.60X22 = 22X5	
			TOTAL	

(4) Bridges

NO.	STATION	EXISTING RC BRIDGE	PROPOSED RC BRIDGE
1	154+170	6.50X18.00 SLAB TYPE	DUAL 11.00X30.00 SLAB TYPE
2	156+395	6.50X12.00 SLAB TYPE	DUAL 11.00X24.00 SLAB TYPE
3	158+245	6.50X18.00 SLAB TYPE	DUAL 11.00X24.00 SLAB TYPE
4	158+570	6.50X12.00 SLAB TYPE	DUAL 11.00X18.00 SLAB TYPE
5	168+010	6.50X 6.00 SLAB TYPE	DUAL 11.00X13.00 GIRDER TYPE

Note: All existing bridges shall be removed.

3.3 Quantities and Construction and Road Maintenance Costs

(1) CONSTRUCTION QUANTITIES AND COSTS

(Project ML-2 Length = 27.27 km)

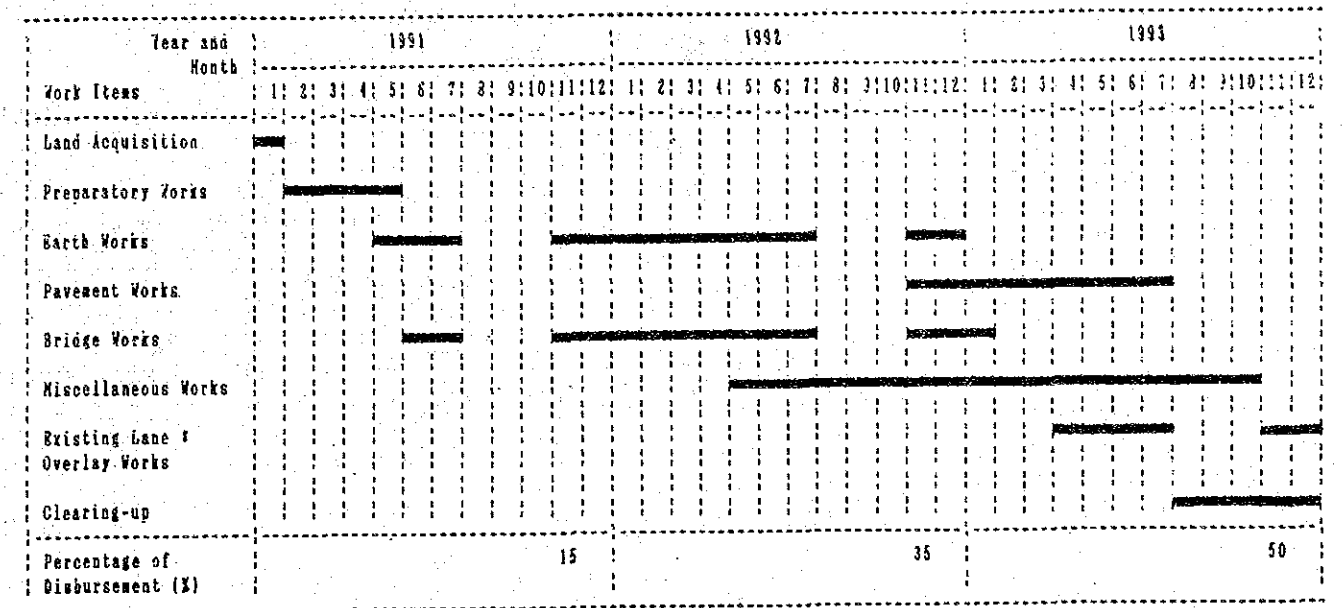
Item	Unit	Financial Unit Rate Baht	Quantity	Financial Total Cost 1000 Baht	Economic Cost		Residual Value		
					%	1000 Baht	%	1000 Baht	
EARTHWORK									
Clearing & Grubbing	ha	10,000	68	680	85	578	90	520	
Roadway Excavation (Unclassified)	m ³	18	16,000	288	84	242	90	218	
Roadway Excavation (Classified)	m ³	38	-	-	84	-	90	-	
Embankment (Common)	m ³	33	10,000	330	86	284	90	255	
Embankment (Borrow)	m ³	110	742,000	81,620	86	70,193	90	63,174	
Removal of Existing Structure	each	60,000	5	300	84	252	90	227	
Sub Total				83,218		71,549		64,394	
SUBBASE and BASE COURSES									
Subbase	m ³	163	40,750	6,642	83	5,513	50	2,757	
Aggregate base	m ³	278	48,600	13,511	84	11,349	50	5,675	
Shoulder (Soil Aggregate)	m ³	190	29,400	5,586	83	4,636	50	2,318	
Sub Total				25,739		21,499		10,750	
SURFACE COURSES									
Asphaltic Prime Coat	m ²	11	218,600	2,405	93	2,236	50	1,118	
Asphaltic Tack Coat	m ²	5	190,500	953	93	886	50	443	
Double Bituminous Surface Treatment	m ²	32	25,500	816	91	743	50	371	
Asphalt Concrete Surfacing	ton	896	47,500	42,560	90	38,304	50	19,152	
Portland Cement Concrete Pavement	m ³	1,589	-	-	90	-	50	-	
Sub Total				46,733		42,169		21,084	
STRUCTURES (Equivalent)									
RC Pipe Culvert (D=1.00 m)	m	1,800	2,060	3,708	88	3,263	50	1,632	
RC Box Culvert (2-2.40x 2.40 m)	m	9,000	30	270	90	243	50	122	
RC Bridge (W=11.0 m)	m	63,000	218	13,734	87	11,949	50	5,974	
PC Bridge (W=11.0 m)	m	86,000	-	-	87	-	50	-	
Bearing Unit	m ²	2,200	-	-	87	-	50	-	
Sub Total				17,712		15,455		7,728	
Total (a)				173,402		150,671		103,956	
Miscellaneous Work ((a) x 7%)				1s	12,138	87	10,560	0	0
CONTRACT AMOUNT (b)				185,540		161,231		103,956	
PHYSICAL CONTINGENCIES ((b) x 10%) (c)				1s	18,554		16,123		10,396
ENGINEERING AND SUPERVISION (((b) + (c)) x 10%) (d)				1s	20,409	100	20,409	0	0
LAND ACQUISITION (Average) (e)				ha	-	100	-	100	-
PROJECT COST ((b) + (c) + (d) + (e))					224,503		197,763		114,352
AVERAGE COST PER KM					8,233				

(2) Road Maintenance Costs

(Unit : Baht/Year)

	Without Project	With Project
Existing	488,433	-
1994	643,953	734,980
2008	714,228	1,276,398

3.4 Construction Schedule



4. BENEFITS

ROAD CONDITIONS

(unit : km)

Without Project											With Project			
Section	Road Length	Paved				Laterite			NO. of Narrow Bridge	NO. of Wooden Bridge	Road Paved Length	NO. of Narrow Bridge	NO. of Wooden Bridge	
		Good	Fair	Fair	Poor	Good	Fair	Poor						
3-158	21.0	-	-	-	21.0	-	-	-	-	-	21.0	21.0	-	-
3-175	6.2	-	-	-	6.2	-	-	-	-	-	6.2	6.2	-	-

BENEFITS

(1000 BAHT)

Year	VOC Savings			Time Savings			Total Savings		
	Nomal Traffic	Induced Traffic	Total	Nomal Traffic	Induced Traffic	Total	Nomal Traffic	Induced Traffic	Total
1994	28,259	-	28,259	16,493	-	16,493	44,752	-	44,752
2000	39,535	-	39,535	24,871	-	24,871	64,406	-	64,406
2008	89,418	-	89,418	88,961	-	88,961	178,379	-	178,379

5. ECONOMIC EVALUATION

COST AND BENEFIT STATEMENT







(1000 BAHT)

YEAR	COST		BENEFITS			DISCOUNTED(12%)	
	CONST. COST	VOC SAVING	TIME SAVING	MAINT. SAVING	TOTAL	COST	BENEFIT
1991	29,664				0	41,676	0
1992	69,217				0	86,826	0
1993	98,881				0	110,747	0
1994		28,259	16,493	(77)	44,675	0	39,888
1995		30,138	17,889	(106)	47,921	0	38,202
1996		32,017	19,285	(134)	51,168	0	36,420
1997		33,897	20,682	(163)	54,416	0	34,582
1998		35,776	22,078	(192)	57,662	0	32,719
1999		37,655	23,475	(220)	60,910	0	30,859
2000		39,535	24,871	(249)	64,157	0	29,021
2001		45,770	32,882	(278)	78,374	0	31,654
2002		52,005	40,893	(306)	92,592	0	33,390
2003		58,241	48,905	(335)	106,811	0	34,390
2004	35,887	64,476	56,916	(363)	121,029	11,555	34,793
2005		70,712	64,927	(392)	135,247	0	34,715
2006		76,947	72,938	(421)	149,464	0	34,253
2007		83,182	80,949	(449)	163,682	0	33,493
2008	(114,352)	89,418	88,961	(478)	177,901	(23,399)	32,502
TOTAL	119,297	778,028	632,144	(4,163)	1,406,009	227,405	510,881

NET PRESENT VALUE : 283,476
 BENEFIT COST RATIO : 2.25
 INTERNAL RATE OF RETURN : 22.2%
 FIRST YEAR RATE OF RETURN : 16.7%

6. DRAWINGS

ABBREVIATIONS and SYMBOLS for PLAN and PROFILE

	NEW CONSTRUCTION SECTION OF STUDY ROUTE
	IMPROVEMENT SECTION OF STUDY ROUTE
	BRIDGE (PROPOSED, EXISTING)
	BOX CULVERT (PROPOSED, EXISTING)
	PIPE CULVERT (PROPOSED, EXISTING)
	HIGH WATER LEVEL

HWY	HIGHWAY
PI	POINT OF HORIZONTAL INTERSECTION
NO. or #	NUMBER
Δ	DEFLECTION ANGLE
R	RADIUS OF CURVATURE
T	TANGENT LENGTH
L	LENGTH OF CURVE
RT	RIGHT
LT	LEFT
EXIST.	EXISTING
EXTD.	EXTEND

RC-P-n- ϕ a x l	PIPE CULVERT, n (ROW), ϕ a (DIAMETER, m), l (LENGTH, m)
RC-B-n-a x b x l	BOX CULVERT, n (NO. OF CELLS), a x b x l (CLEAR SPAN x DEPTH x LENGTH, m)
BR-T-a x l - n	TIMBER BRIDGE, a x l (WIDTH x LENGTH, m), n (NO. OF SPANS)
BR-RC-a x l - n	CONCRETE BRIDGE, a x l (ROADWAY WIDTH x LENGTH, m) n (NO. OF SPANS)

