Appendix A-7.2 Economic Comparison of Route 7A, 7B and 7C

(Million Rp.)

	Route 7A	Route 7B	Route 7C
(A) Project Costs (Initial Investment) (1992 price)			
(A-1) Financial Costs			
a) Initial Cost			
Construction, Enginnering, & etc	68,761	78,555	82,928
Land Acquisition	37,991	35,883	38,111
Total	106,752	114,638	121,039
b) Whole including Maint.	266,200	270,418	247,896
(A-2) Economic Costs			
a) Initial Cost			
Construction, Enginnering, & etc	62,510	71,595	75,389
Land Acquisition	37,991	35,883	38,111
Total	100,501	107,478	113,500
b) Whole including Maint.	245,454	249,097	228,825
(B) Direct Economic Benefit (1992 price)			
1997 VOC Saving	7,423	7,387	7,470
1997 Time Saving	713	864	842
1997 Total	8,136	8,251	8,312
2010 VOC Saving	43,089	49,342	51,352
2010 Time Saving	5,380	7,569	7,693
2010 Total	48,469	56,912	59,045
(C) Indirect Economic Benefit (1992 price)			
1997	4,214	7,428	8,213
2010	17,910	31,567	34,905
(D) Present Value discounted at 15%			
(D-1) Whole Costs including Maint.	79,459	98,241	99,751
(D-2) Direct Benefit	112,163	128,670	132,916
(D-3) Indirect Benefit	41,871	73,800	81,603
(E) Economic Efficiency (Direct Benefit)			
EIRR	18.8%	18.3%	18.4%
NPV at discount rate of 15%	32,704	30,430	33,165
B/C at discount rate of 15%	1.4	1.3	1.3
(F) Economic Efficiency (Indirect Benefit)			
EIRR	8.5%	11.3%	12.5%
NPV at discount rate of 15%	-37,589	-24,441	-18,148
B/C at discount rate of 15%	0.5	0.8	0.8
(G) Economic Efficiency (Total of Direct and Indirect Benefits)			
EIRR	23.0%	25.1%	25.4%
NPV at discount rate of 15%	74,574	104,231	114,768
B/C at discount rate of 15%	1.9	2.1	2.1

Note: EIRR : Economic Internal Rate of Return
NPV : Net Present Value
B/C : Benefit Cost Ratio

Appendix A-7.3 Economic Comparison of Section 1 to 7

(1) Traffic Volume by Section (Vehicle / day Basis)

	Section 1	Section 2	Section3	Section 4	Section 5	Section 6	Section 7 (7C)
(1) Road Length (Km)	522	205	201	264	276	249	189
(2) Present Traffic Volume (Vehicle / Day) (Source: 1991 National O/D)	Medan 14,400 Tebing Tinggi 5,100 Kisaran 2,800 Rantau Prapat 1,600 Dumai	Dumai 6,500 Pakan Baru	Pakan Baru 600 Rengat	Rengat 1,100 Jambi	Jambi 1,400 Palembang	Palembang 3,100 Kayu Agung (No Data) Menggala	(Existing Road) Menggala 6,000 B. Lampung 2,800 Bakahuni
(3) Estimated Traffic Volume (2010) (Vehicle / Day) Case of Individual Development	Medan 21,500 Tebing Tinggi 10,500 Rantau Prapat 7,600 Dumai	Dumai 18,400 Pakan Baru	Pakan Baru 5,000 Rengat	Rengat 4,800 Seberida 5,400 Merlung 9,400 Jambi	Jambi 11,700 Palembang	Palembang 17,800 Kayu Agung 7,100 Menggala	(Existing Road) Menggala 2,300 Terbgi. Besar 25,100 B. Lampung 6,500 Bakauhuni (7C) Menggala 7,000 Bakauhuni
(4) Estimated Traffic Volume (2010) (Vehicle / Day) Case of Whole Sections Development	Medan 22,000 Tebing Tinggi 17,000 Rantau Prapat 9,000 Dumai	Dumai 19,000 Pakan Baru	Pakan Baru 7,000 Rengat	Rengat 7,000 Seberida 7,000 Merlung 11,000 Jambi	Jambi 14,000 Palembang	Palembang 19,000 Kayu Agung 10,000 Menggala	Menggala 3,100 Terbgi. Besar 26,200 B. Lampung 5,600 Bakauhuni (7C) Menggala 9,000 Bakauhuni
(5) Project Cost (Financial) (Initial Cost) (Million Rp.)	213,805	77,120	85,121	131,876	108,843	113,971	121,039
(6) Project Cost per Km (Initial Cost : Million Rp.)	409.5	376.2	423.5	499.5	394.3	457.7	640.4

(2) Traffic Volume by Section (PCU / day Basis)

	Section 1	Section 2	Section3	Section 4	Section 5	Section 6	Section 7(7C)
(1) Road Length (Km)	522	205	201	264	276	249	189
(2) Present Traffic Volume (PCU / Day) (Source: 1991 National O/D)	Medan 21,300 Tebing Tinggi 7,500 Kisaran 4,100 Rantau Prapat 2,400 Dumai	Dumai 10,200 Pakan Baru	Pakan Baru 900 Rengat	Rengat 1,800 Jambi	Jambi 2,100 Palembang	Palembang 5,100 Kayu Agung (No Data) Menggala	(Existing Road) Menggala 9,200 B. Lampung 4,300 Bakauhuni
(3) Estimated Traffic Volume (2010) (PCU / Day) Case of Individual Development	Medan 36,000 Tebing Tinggi 17,500 Rantau Prapat 12,700 Dumai	Dumai 32,000 Pakan Baru	Pakan Baru 9,400 Rengat	Rengat 8,600 Seberida 9,500 Merlung 16,700 Jambi	Jambi 19,600 Palembang	Palembang 34,200 Kayu Agung 13,600 Menggala	(Existing Road) Menggala 3,600 Terbgi. Besar 40,200 B. Lampung 10,500 Bakauhuni (7C) Menggala 15,300 Bakauhuni
(4) Estimated Traffic Volume (2010) (PCU / Day) Case of Whole Sections Development	Medan 37,000 Tebing Tinggi 28,000 Rantau Prapat 14,000 Dumai	Dumai 33,000 Pakan Baru	Pakan Baru 12,000 Rengat	Rengat 12,000 Seberida 12,000 Merlung 19,000 Jambi	Jambi 23,000 Palembang	Palembang 36,000 Kayu Agung 18,000 Menggala	Menggala 5,000 Terbgi. Besar 42,000 B. Lampung 9,000 Bakauhuni (7C) Menggala 18,000 Bakauhuni
(5) Project Cost (Financial) (Initial Cost) (Million Rp.)	213,805	77,120	85,121	131,876	108,843	113,971	121,039
(6) Project Cost per Km (Initial Cost : Million Rp.)	409.5	376.2	423.5	499.5	394.3	457.7	640.4

(3) Economic Comparison by Section

(Million Rp.)

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7
(A) Project Costs (Initial Investment) (1992 price)							
(A-1) Financial Costs							
a) Initial Cost							
Construction, Enginnering, & etc	164,370	55,031	72,209	107,616	97,755	89,782	82,928
Land Acquisition	49,435	22,089	12,912	24,260	11,088	24,189	38,111
Total	213,805	77,120	85,121	131,876	108,843	113,971	121,039
b) Whole including Maint.	565,644	219,654	221,493	309,073	305,582	284,245	247,896
(A-2) Economic Costs							
a) Initial Cost							
Construction, Enginnering, & etc	149,427	50,028	65,645	97,833	88,868	81,620	75,389
Land Acquisition	49,435	22,089	12,912	24,260	11,088	24,189	38,111
Total	198,862	72,117	78,557	122,093	99,956	105,809	113,500
b) Whole including Maint.	518,716	201,694	202,531	283,181	278,810	260,604	228,825
(B) Direct Economic Benefit (1992 price)							
1997 VOC Saving	6,353	6,782	2,728	5,135	10,857	10,318	7,470
Time Saving	737	679	367	732	760	919	842
Total	7,090	7,461	3,095	5,867	11,618	11,237	8,312
2010 VOC Saving	41,148	9,340	11,036	27,776	35,142	44,679	51,352
Time Saving	5,536	1,665	1,779	4,013	2,824	4,491	7,693
Total	46,684	11,005	12,815	31,789	37,965	49,170	59,045
(C) Present Value discounted at 15%							
(C-1) Whole Costs including Maint.	156,874	56,827	62,687	98,447	80,653	85,321	99,751
(C-2) Benefit	106,295	38,529	31,851	74,799	100,060	120,725	132,916
(D) Economic Efficiency							
EIRR	11.3%	10.2%	8.4%	12.2%	17.6%	19.1%	18.4%
NPV at discount rate of 15%	-50,578	-18,298	-30,836	-23,648	19,408	35,404	33,165
B/C at discount rate of 15%	0.7	0.7	0.5	0.8	1.2	1.4	1.3

Note: EIRR : Economic Internal Rate of Return
NPV : Net Present Value
B/C : Benefit Cost Ratio

Section 7 : Route 7C

Appendix A-7.4 Estimation of Indirect Economic Impact of the East Coast Highway

In order to evaluate indirect economic impacts of the East Coast Highway, and effect of the reduced access time to the national development centers of Medan and Palembang is considered to enhance the economic productivity of the regions.

A model equation, therefore, is established to explain the relationship between the access time and the economic productivity as shown below:

$$L_nY_1 = aL_nT_1 + bL_nT_2 + c$$

where,

Y_1	:	Per capita GRDP
T_1	:	Travel (access) time to Medan city
T_2	:	Travel (access) time to Palembang city
a,b,c	:	Parameters

The parameters, a and b, attached to the respective variables of T_1 and T_2 imply elasticity that reflects a percentage change in productivity by that in travel time (reduced access time).

Because, the elasticity (e) is defined as follows:

$$e_1 = \left| \frac{\Delta Y_1}{Y_1} / \frac{\Delta T_1}{T_1} \right| = \left| \frac{\alpha Y_1}{\alpha T_1} / \frac{Y_1}{T_1} \right| = a$$

$$e_2 = \left| \frac{\Delta Y_1}{Y_1} / \frac{\Delta T_2}{T_2} \right| = \left| \frac{\alpha Y_1}{\alpha T_2} / \frac{Y_1}{T_2} \right| = b$$

Accordingly, a unit of reduced access time (aT_1) will bring about the increase in productivity ($aY_1 = a * Y_1/T_1$).

Per capita GRDP of the Sumatra provinces were obtained from the statistical data, and travel time between the national development center (Medan or Palembang) and the respective provincial capitals were based on the present road network and conditions. Using these data, the model equation was established as follows:

$$L_nY_1 = 15.03104 - 0.57003\,L_nT_1 - 0.13598\,L_nT_2 \quad (R^2 = 0.90)$$

where,

Y_1	=	Per Capita GRDP of Province 1 (Rp. 1,000 at 1983 constant price)
T_1	=	Travel time to Medan from capital city of Province 1 (hour)
T_2	=	Travel time to Palembang from capital city of Province 1 (hour)

The parameters were estimated to be negative values for a and b, and positive value for c. This means that the reduction of travel time to Medan and Palembang brings about an increase in the per capita GRDP of Province 1.

Consequently, the whole completion of the East Coast Highway in 2005 is estimated to contribute to the Sumatra's GRDP increase in 2010 by 554,027 million Rupiah at 1992 price in terms of added value basis.

Also for 1997, estimation of the contribution amount was made as below:

- Assuming the partial development of Section 6 and 7 (Bakauhuni - Palembang) in 1997 based on the staged construction schedule, travel times (T1 and T2) for 1997 were estimated.

- Then, the staged construction of the East Coast Highway in 1997 is estimated to contribute to Sumatra's GRDP increase in 1997 by 14,410 million Rupiah at 1992 price in terms of added value basis.

Appendix A-8.1 Economic Analysis for Pre-Feasibility Study Section

(Million Rp.)

		Section 4	Section 6	Section 7
(A) Project Costs (Initial Investment) (1992 price)				
	(A-1) Financial Costs			
	a) Initial Cost			
	Construction, Enginnering, & etc	106,754	76,525	87,129
	Land Acquisition	20,008	13,746	38,066
	Total	126,762	90,271	125,195
	b) Whole including Maint.	297,944	213,119	252,052
	(A-2) Economic Costs			
	a) Initial Cost			
	Construction, Enginnering, & etc	97,049	69,568	79,208
	Land Acquisition	20,008	13,746	38,066
	Total	117,057	83,314	117,274
	b) Whole including Maint.	272,677	194,994	232,599

			Section 4	Section 6	Section 7
(B) Direct Economic Benefit (1992 price)					
	1997	VOC Saving	5,124	9,871	7,470
		Time Saving	730	807	842
		Total	5,854	10,678	8,312
	2010	VOC Saving	27,562	40,111	51,352
		Time Saving	3,971	3,797	7,693
		Total	31,534	43,908	59,045

		Section 4	Section 6	Section 7
(C) Present Value discounted at 15%				
	(C-1) Whole Costs including Maint.	94,603	67,659	102,621
	(C-2) Direct Benefit	74,278	109,304	132,916

		Section 4	Section 6	Section 7
(D) Economic Efficiency (Direct Benefit)				
	EIRR	12.5%	20.9%	18.0%
	NPV at discount rate of 15%	-20,325	41,646	30,295
	B/C at discount rate of 15%	0.8	1.6	1.3

Note: EIRR : Economic Internal Rate of Return
NPV : Net Present Value
B/C : Benefit Cost Ratio

Section 7 : Route 7C

Appendix A-9.1 Analysis Data of Soil Investigation

Table 1 Soil Section and Invariable Soil Value for Design

EXAMINED LOCATION STA. WAY MESUSI BRIDGE

DEPTH (m)	DIVISION OF SOIL	THICKNESS OF SOIL H (m)	DEPTH OF CENTRAL STRATUM (m)	N-VALUE	WET UNIT WEIGHT γ_t (t/m^3)	COHESION OF THE INITIAL CONDITION Co (t/m^2)	MODULUS OF DEFOR-MATION E_{50} (t/m^2)	THE RATE OF STRENGTH INCREASE m	YIELD STRESS Py (t/m^2)	REMARK
1.00	Ac 1	1.00	0.50	0	1.400	0.6	8.3	0.3	2.40	1.00 ▽
10.00	Ac 2	9.00	5.50	0	0.400	0.6	8.3	0.3	2.40	
15.00	As 1	5.00	12.50	9 ~ 37	0.800	—	—	—	—	ø = 30°

FIG 1 RELATIVE CHART FOR LOADING TIME AND SETTLEMENT VALUE
WAY MESUJI BRIDGE $H_E = 2.00^M$

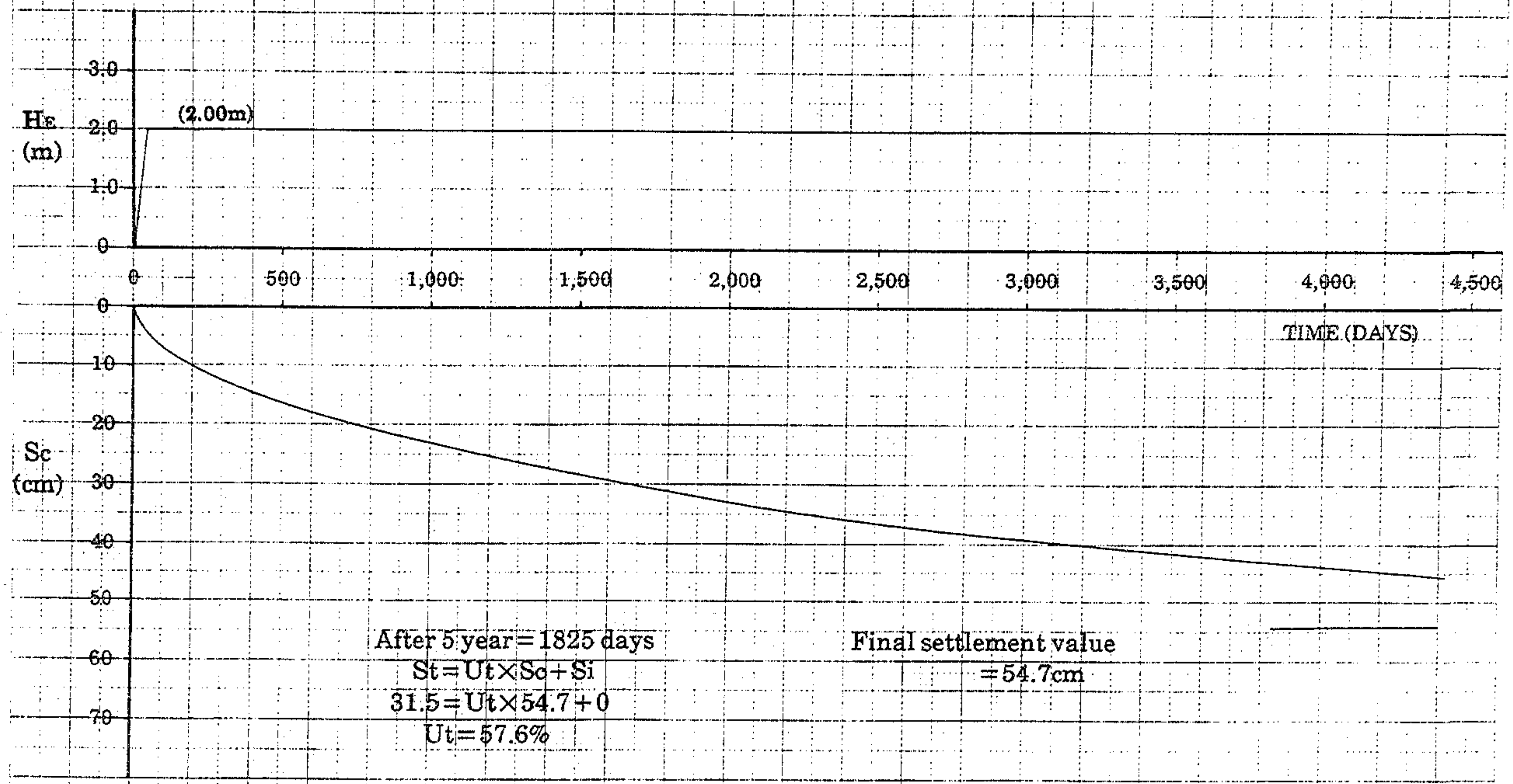


FIG 2 RELATIVE CHART FOR LOADING TIME AND SETTLEMENT VALUE
WAY MESUJI BRIDGE $H_E = 3.00^M$

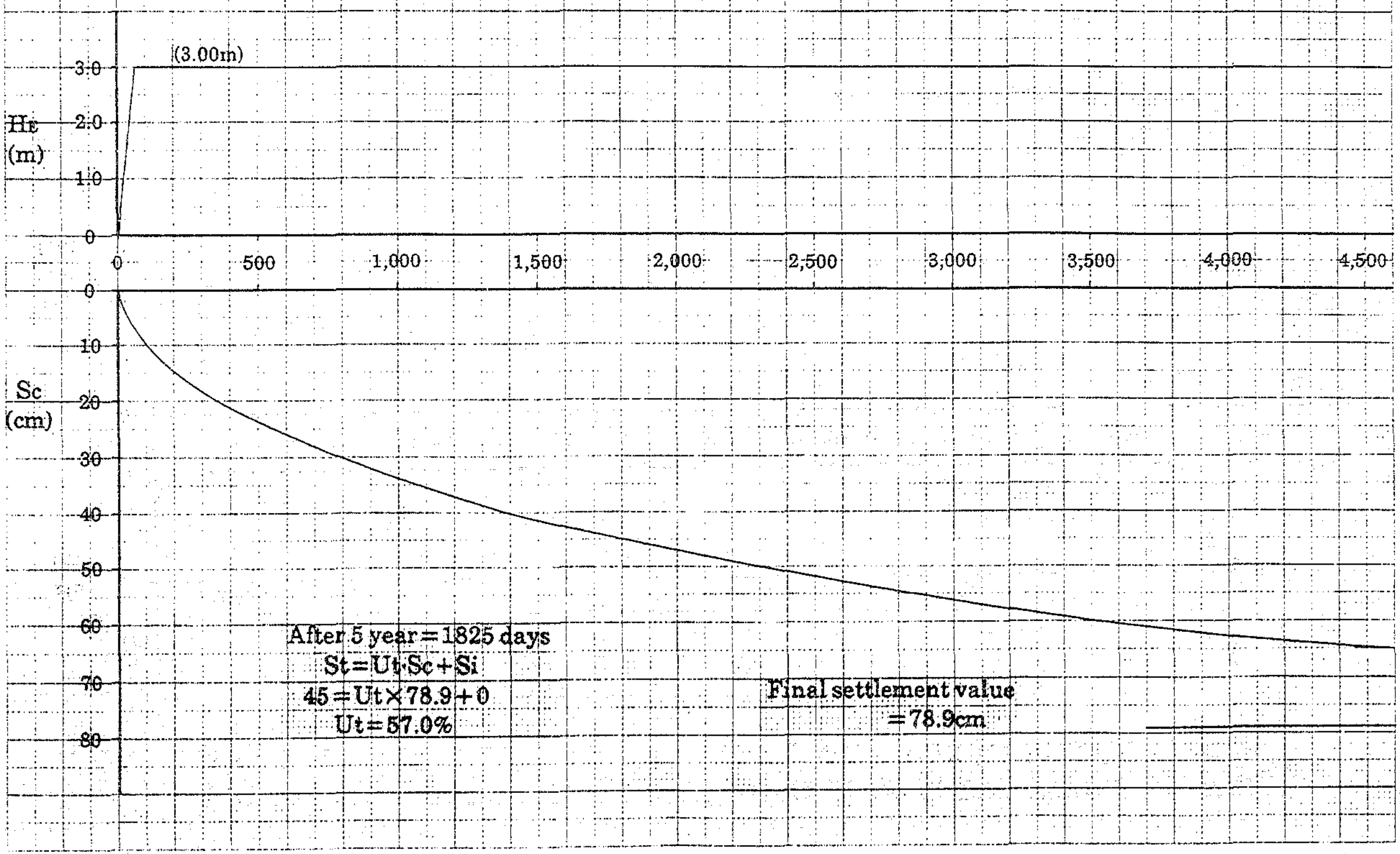
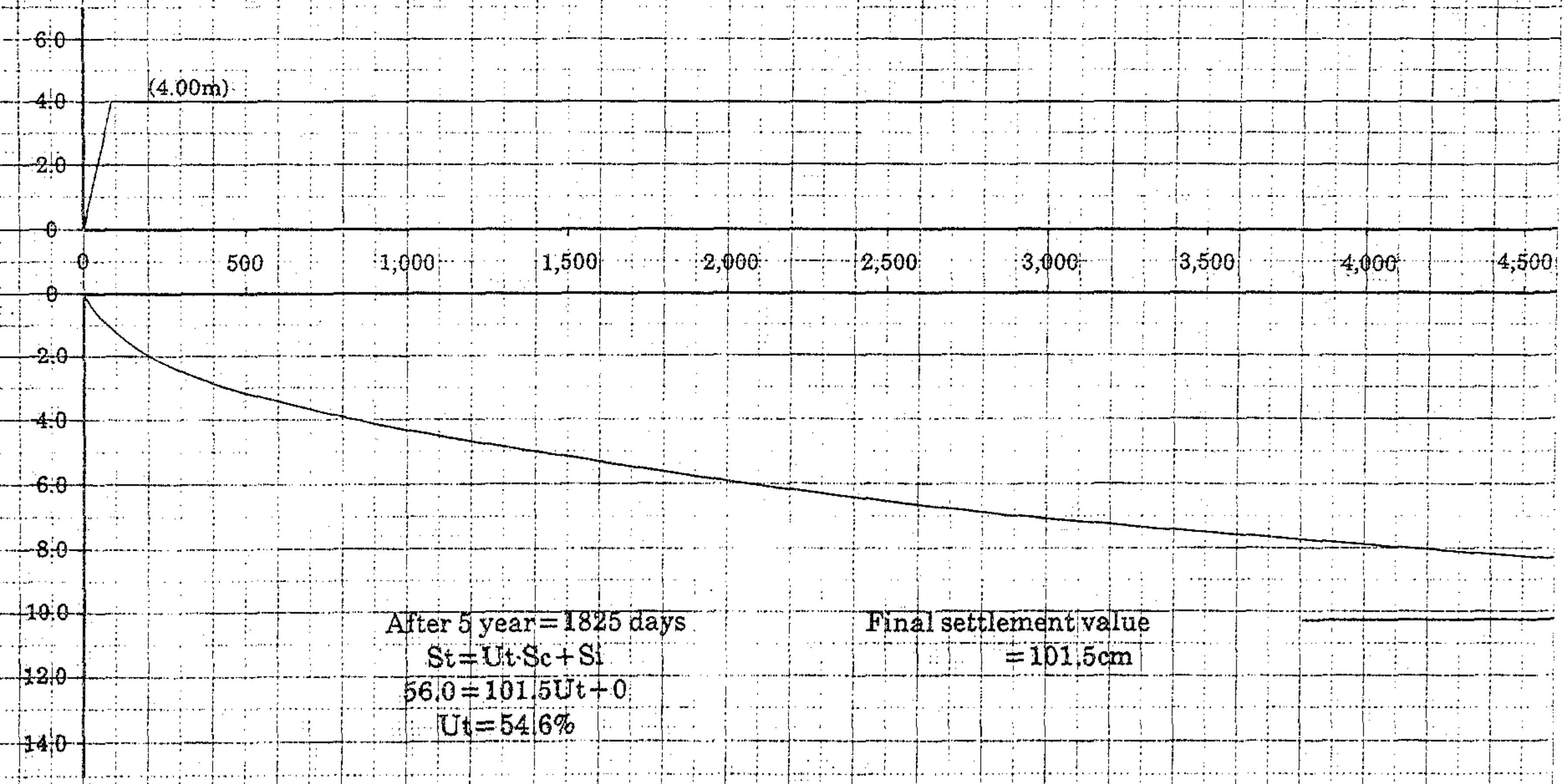


FIG. 3 RELATIVE CHART FOR LOADING TIME AND SETTLEMENT VALUE
WAY MESUJI BRIDGE $H_E = 4.00^M$



CALCULATION OF INITIAL PRESSURE

SOIL No.	SOIL	THICKNESS OF SOIL	WET UNIT WEIGHT	CALCULATION OF INITIAL PRESSURE	INITIAL PRESSURE
1	Ac1	1.000	1.400	0.000+0.5(0.000 * 0.000 + 1.000 * 1.400)	0.700
2	Ac2	9.000	0.400	0.700+0.5(1.000 * 1.400 + 9.000 * 0.400)	3.200

INTENSITY OF DISTRIBUTED LOAD q=H/rt= 2.00* 1.800 3.60

SOIL No.	SOIL	DEPTH FROM CENTRAL SOIL STRUTA	a/Z a= 2.000	b/Z b= 4.500	I	DP	Po	Po+DP
1	Ac1	0.500	4.000	9.000	0.500	3.600	0.700	4.300
2	Ac2	5.500	0.364	0.818	0.407	2.933	3.200	6.133

SUBSIDED VALUE FOR CONSOLIDATION AND COEFFICIENT OF CONSOLIDATTION

SOIL No.	SOIL	THICKNESS OF SOIL	Po	DP	Po+DP	e0	e1	Sc	DP/2	Po+DP/2	Cv
1	Ac1	1.0000	0.7000	3.6000	4.3000	2.3850	2.1150	0.0798	1.8000	2.5000	44
2	Ac2	9.0000	3.2000	2.9332	6.1332	2.1800	2.0150	0.4670	1.4666	4.6666	36

TYPICAL COEFFICIENT OF CONSOLIDATION AND DISTANCE OF DRAINAGE

SOIL No	SOIL	THICKNESS OF SOIL	Cv	Cv'	H'	CONDITION OF DRAINAGE	DISTANCE OF DRAINAGE
1	Ac1	100.00	44.00	44.00	1094.99	2Side	547.49
2	Ac2	900.00	36.00				

SUBSIDED TIME FOR CONSOLIDATION BY MOMENTARY EMBANKMENT

U (%)	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	95.00	100.00
Tv	0.008	0.031	0.071	0.126	0.196	0.287	0.403	0.567	0.848	1.130	infinite

EXPRESSION t=Tv.d^2/C'v=Tv. 547.49^2/ 44.00=6812.49

t (days)	54.50	211.19	483.69	858.37	1335.25	1955.18	2745.43	3862.68	5776.99	7698.11	
Sc.U (cm)	5.47	10.93	16.40	21.87	27.34	32.80	38.27	43.74	49.21	51.94	54.67

*APPENDIX

CALCULATION OF CONVERTIBLE SOIL THICKNESS

100.00 *SQR(44.00 / 44.00) + 900.00 *SQR(44.00 / 36.00)

CALCULATION OF INITIAL PRESSURE

SOIL No.	SOIL	THICKNESS OF SOIL	WET UNIT WEIGHT	CALCULATION OF INITIAL PRESSURE	INITIAL PRESSURE
1	Ac1	1.000	1.400	0.000+0.5(0.000 * 0.000 + 1.000 * 1.400)	0.700
2	Ac2	9.000	0.400	0.700+0.5(1.000 * 1.400 + 9.000 * 0.400)	3.200

INTENSITY OF DISTRIBUTED LOAD q=H/rt= 3.00* 1.800 5.40

SOIL No.	SOIL	DEPTH FROM CENTRAL SOIL STRUTA	a/Z a= 3.000	b/Z b= 4.500	I	DP	Po	Po+DP
1	Ac1	0.500	6.000	9.000	0.500	5.400	0.700	6.100
2	Ac2	5.500	0.545	0.818	0.419	4.526	3.200	7.726

SUBSIDED VALUE FOR CONSOLIDATION AND COEFFICIENT OF CONSOLIDATTION

SOIL No.	SOIL	THICKNESS OF SOIL	Po	DP	Po+DP	e0	e1	Sc	DP/2	Po+DP/2	Cv
1	Ac1	1.0000	0.7000	5.4000	6.1000	2.3850	2.0150	0.1093	2.7000	3.4000	40
2	Ac2	9.0000	3.2000	4.5259	7.7259	2.1800	1.9400	0.6792	2.2629	5.4629	35

TYPICAL COEFFICIENT OF CONSOLIDATION AND DISTANCE OF DRAINAGE

SOIL No	SOIL	THICKNESS OF SOIL	Cv	Cv'	H'	CONDITION OF DRAINAGE	DISTANCE OF DRAINAGE
1	Ac1	100.00	40.00	40.00	1062.14	2Side	531.07
2	Ac2	900.00	35.00				

SUBSIDED TIME FOR CONSOLIDATION BY MOMENTARY EMBANKMENT

U (%)	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	95.00	100.00
Tv	0.008	0.031	0.071	0.126	0.196	0.287	0.403	0.567	0.848	1.130	infinite

EXPRESSION t=Tv.d^2/C'v=Tv. 531.07^2/ 40.00=7050.89

t (days)	56.41	218.58	500.61	888.41	1381.97	2023.61	2841.51	3997.85	5979.16	7967.51	
Sc.U (cm)	7.89	15.77	23.66	31.54	39.43	47.31	55.20	63.08	70.97	74.91	78.86

*APPENDIX

CALCULATION OF CONVERTIBLE SOIL THICKNESS

100.00 *SQR(40.00 / 40.00) + 900.00 *SQR(40.00 / 35.00)

CALCULATION OF INITIAL PRESSURE

SOIL No.	SOIL	THICKNESS OF SOIL	WET UNIT WEIGHT	CALCULATION OF INITIAL PRESSURE	INITIAL PRESSURE
1	Ac1	1.000	1.400	0.000+0.5(0.000 * 0.000 + 1.000 * 1.400)	0.700
2	Ac2	9.000	0.400	0.700+0.5(1.000 * 1.400 + 9.000 * 0.400)	3.200

INTENSITY OF DISTRIBUTED LOAD q=H/rt= 4.00* 1.800 7.20

SOIL No.	SOIL	DEPTH FROM CENTRAL SOIL STRUTA	a/Z a= 4.000	b/Z b= 4.500	I	DP	Po	Po+DP
1	Ac1	0.500	8.000	9.000	0.500	7.200	0.700	7.900
2	Ac2	5.500	0.727	0.818	0.428	6.170	3.200	9.370

SUBSIDED VALUE FOR CONSOLIDATION AND COEFFICIENT OF CONSOLIDATTION

SOIL No.	SOIL	THICKNESS OF SOIL	Po	DP	Po+DP	e0	e1	Sc	DP/2	Po+DP/2	Cv
1	Ac1	1.0000	0.7000	7.2000	7.9000	2.3850	1.9350	0.1329	3.6000	4.3000	37
2	Ac2	9.0000	3.2000	6.1701	9.3701	2.1800	1.8650	0.8915	3.0850	6.2850	33

TYPICAL COEFFICIENT OF CONSOLIDATION AND DISTANCE OF DRAINAGE

SOIL No	SOIL	THICKNESS OF SOIL	Cv	Cv'	H'	CONDITION OF DRAINAGE	DISTANCE OF DRAINAGE
1	Ac1	100.00	37.00	37.00	1052.99	2Side	526.49
2	Ac2	900.00	33.00				

SUBSIDED TIME FOR CONSOLIDATION BY MOMENTARY EMBANKMENT

U (%)	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	95.00	100.00
Tv	0.008	0.031	0.071	0.126	0.196	0.287	0.403	0.567	0.848	1.130	infinite

EXPRESSION t=Tv.d^2/C'v=Tv. 526.49²/ 37.00=7491.75

t (days)	59.93	232.24	531.91	943.96	1468.38	2150.13	3019.17	4247.82	6353.00	8465.68	
Sc.U (cm)	10.24	20.49	30.73	40.98	51.22	61.47	71.71	81.96	92.20	97.32	102.45

*APPENDIX

CALCULATION OF CONVERTIBLE SOIL THICKNESS

100.00 *SQR(37.00 / 37.00) + 900.00 *SQR(37.00 / 33.00)

EXAMINED
LOCATION. STA.

SUBSIDED VALUE FOR CONSOLIDATION OF *Sand drain*
INITIAL EMBANKMENT to AND AFTER EMBANKMENT

EH = ______ cm SPEED OF EB. U_H = ______ cm/day LET ALONE PERIOD $\Delta t = t_2 - t_0$ = ______ days

$t_0 = EH/U_H$ = ______ days $t_2 = t_0 + \Delta t$ = ______ day

Dc = ______ cm dw = ______ cm de = 1.13 Dc = ______ cm

SOIL No.	SOIL	Sf	C'v	d	$t_0 \rightarrow t'_0 = \frac{t_0}{2}$ = ______ days				$t_2 \rightarrow t'_2 = t_2 - t'_0$ = ______ days			
					$Tt_0 = Tt'_0 = \frac{t'_0 \cdot C'v}{d^2}$	$Ut_0 = Ut'_0$	$St_0 = \frac{Ut'_0}{100} \cdot Sf$	$Srt_0 = Sf - St_0$	$Tt_2 = Tt'_2 = \frac{t'_2 \cdot C'v}{d^2}$	$Ut_2 = Ut'_2$	$St_2 = \frac{Ut'_2}{100} \cdot Sf$	$Srt_2 = Sf - St_2$
		(cm)	(cm/day)	(cm)		(%)	(cm)	(cm)		(%)	(cm)	(cm)
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

INCREASE OF COHESION (INITIAL EMBANKMENT)

$$Pt = Po + \frac{U}{100} \cdot \Delta P$$

$Pt \leqq Py$ $C = Co$

$Pt > Py$ $C = Co + m(Pt - Py) = Co + m\left(Po + \frac{U}{100} \cdot \Delta P - Py\right)$

	SOIL No.	SOIL	Co (t/m^2)	Py (t/m^2)	Po (t/m^2)	ΔP (t/m^2)	U (%)	$\frac{U}{100} \cdot \Delta P$ (t/m^2)	Pt (t/m^2)	Pt - Py (t/m^2)	m	m(Pt - Py) (t/m^2)	C (t/m^2)	
He= 4m	1	Ac1	0.60	2.40	0.700	7.200	54.6	3.931	4.631	2.231	0.3	0.669	1.269	He= 4m
	2	Ac2	0.60	2.40	3.200	6.170	54.6	3.369	6.569	4.169	0.3	1.251	1.851	
	3													
He= 3m	4	Ac1	0.60	2.40	0.700	5.400	57.0	3.078	3.778	1.378	0.3	0.413	1.013	He= 3m
	5	Ac2	0.60	2.40	3.200	4.526	57.0	2.580	5.780	3.380	0.3	1.039	1.614	
	6													
He= 2m'	7	Ac1	0.60	2.40	0.700	3.600	57.6	2.074	2.774	0.374	0.3	0.112	0.712	He= 2m
	8	Ac2	0.60	2.40	3.200	2.993	57.6	1.724	4.924	2.524	0.3	0.757	1.357	
	9													
	10													

*** INPUT DATA DUMP LIST ***

```
                   1         2         3         4         5         6         7
        8
234567890 1234567890123456789012345678901234567890123456789012345678901234567890
     1  TITLE     Way Musuji Bridge in east coast of Sumatra  HE=2m
     2  METHO              2
     3  PRINT              1         1         0         1    1.400
     4  POINT    1      .000    15.000
     5  POINT    2    27.000    15.000
     6  POINT    3    30.000    17.000
     7  POINT    4    50.000    17.000
     8  POINT    5    50.000    15.000
     9  POINT    6    30.000    15.000
    10  POINT    7      .000    14.000
    11  POINT    8    27.000    14.000
    12  POINT    9    30.000    14.000
    13  POINT   10    50.000    14.000
    14  POINT   11      .000     5.000
    15  POINT   12    27.000     5.000
    16  POINT   13    30.000     5.000
    17  POINT   14    50.000     5.000
    18  POINT   15      .000      .000
    19  POINT   16    50.000      .000
    20  BLOCK    1  2  3  4  5  6
    21  BLOCK    2  1  2  8  7
    22  BLOCK    3  2  6  9  8
    23  BLOCK    4  6  5 10  9
    24  BLOCK    5  7  8 12 11
    25  BLOCK    6  8  9 13 12
    26  BLOCK    7  9 10 14 13
    27  BLOCK    8 11 12 13 14 16 15
    28  NATUR    1     1.800     1.900      .000      .000     2.000    10.000
    29  NATUR    2     1.400     1.500      .000      .000      .600      .000
    30  NATUR    3     1.400     1.500      .000      .000      .656      .000
    31  NATUR    4     1.400     1.500      .000      .000      .712      .000
    32  NATUR    5     1.400     1.500      .000      .000      .600      .000
    33  NATUR    6     1.400     1.500      .000      .000      .979      .000
    34  NATUR    7     1.400     1.500      .000      .000     1.357      .000
    35  NATUR    8     1.800     1.900      .000      .000      .000    30.000
    36  WATER    2      .000    14.000    50.000    14.000
    37  VOIDP          1.000
    38  CIRCL         25.000    31.000     2.000         0      .500
    39                18.000    24.000     2.000         0     2.000
    40                12.000     2.000     2.000         1
    41  END
                   1         2         3         4         5         6         7
        8
234567890 1234567890123456789012345678901234567890123456789012345678901234567890
```

Way Musuji Bridge in east coast of Sumatra HE=2m

***** MINIMUM SAFTY FACTOR DETAIL LIST *****

X	Y	R	RESISTING MOMENT	SLIDING MOMENT	SAFTY FACTOR
25.00	24.00	18.00	685.56	443.93	1.544
	22.00	16.00	577.20	371.60	1.553
	20.00	14.00	474.54	300.11	1.581
	18.00	12.00	373.21	228.08	1.636
27.00	24.00	18.00	711.99	461.86	1.542
	22.00	16.00	595.99	389.98	1.528
	20.00	14.00	494.97	317.87	1.557
	18.00	8.00	167.30	102.07	1.639
29.00	24.00	18.00	738.17	465.58	1.586
	22.00	16.00	619.13	393.93	1.572
	20.00	14.00	515.04	321.35	1.603
	18.00	10.00	285.72	170.63	1.675
31.00	24.00	18.00	764.43	454.86	1.681
	22.00	16.00	654.09	383.03	1.708
	20.00	14.00	535.22	310.80	1.722
	18.00	12.00	438.72	238.91	1.836

Way Musuji Bridge in east coast of Sumatra HE=2m

***** MINIMUM SAFTY FACTOR LIST *****

Y \ X =	25.00	27.00	29.00	31.00
24.00	1.544 (18.00)	1.542 (18.00)	1.586 (18.00)	1.681 (18.00)
22.00	1.553 (16.00)	1.528 (16.00)	1.572 (16.00)	1.708 (16.00)
20.00	1.581 (14.00)	1.557 (14.00)	1.603 (14.00)	1.722 (14.00)
18.00	1.636 (12.00)	1.639 (8.00)	1.675 (10.00)	1.836 (12.00)

MINIMUM SAFTY FACTOR = 1.528

XC = 27.00 RESISTING MOMENT = 595.99
YC = 22.00 SLIDING MOMENT = 389.98
R = 16.00

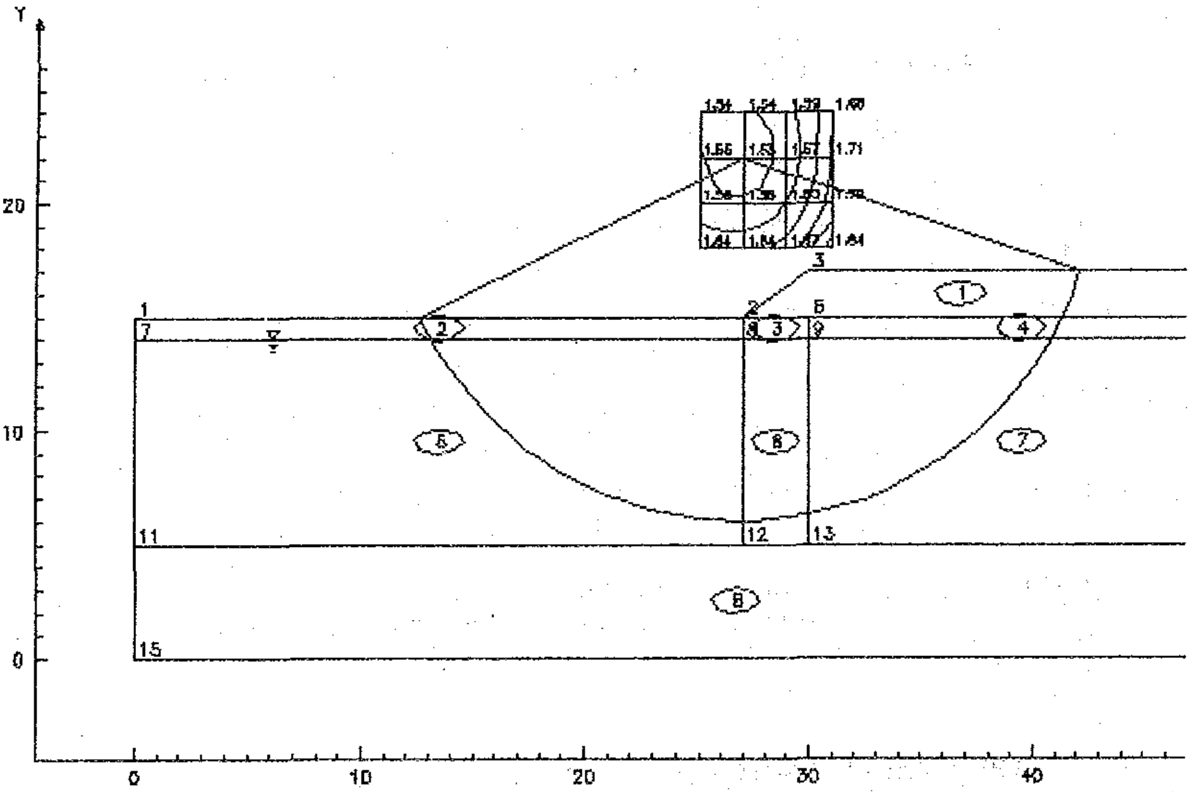
	X (M)	Y (M)	R (M)	FS	MR (T.M/M)	NS (T.M/M)
1	27.00	22.00	16.00	1.528	595.98	389.98

* SOIL CONDITION & SEISMIC COEFFICIENT

	GAMMAT (T/M^3)	GAMMAS (T/M^3)	GAMMA (T/M^3)	PHAI	C0 (T/M^2)	K	Y0 (M)	KH	KV
1	1.800	1.900		10.00	2.000	0.000	0.0		
2	1.400	1.500		0.00	0.600	0.000	0.0		
3	1.400	1.500		0.00	0.656	0.000	0.0		
4	1.400	1.500		0.00	0.712	0.000	0.0		
5	1.400	1.500		0.00	0.600	0.000	0.0		
6	1.400	1.500		0.00	0.979	0.000	0.0		
7	1.400	1.500		0.00	1.357	0.000	0.0		
8	1.800	1.900		30.00	0.000	0.000	0.0		

* C = C0 + K (Y0−Y)

Way Musuji Bridge in east coast of Sumatra HE=2m



*** INPUT DATA DUMP LIST ***

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         8
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234567890
TITLE     Way Musuji Bridge in east coast of Sumatra  HE=3m
METHO              2
PRINT              1         1         0         1     1.400
POINT     1     .000    15.000
POINT     2   27.000    15.000
POINT     3   31.500    18.000
POINT     4   60.000    18.000
POINT     5   60.000    15.000
POINT     6   31.500    15.000
POINT     7     .000    14.000
POINT     8   27.000    14.000
POINT     9   31.500    14.000
POINT    10   60.000    14.000
POINT    11     .000     5.000
POINT    12   27.000     5.000
POINT    13   31.500     5.000
POINT    14   60.000     5.000
POINT    15     .000      .000
POINT    16   60.000      .000
BLOCK     1  2  3  4  5  6
BLOCK     2  1  2  8  7
BLOCK     3  2  6  9  8
BLOCK     4  6  5 10  9
BLOCK     5  7  8 12 11
BLOCK     6  8  9 13 12
BLOCK     7  9 10 14 13
BLOCK     8 11 12 13 14 16 15
NATUR     1    1.800     1.900      .000      .000     2.000    10.000
NATUR     2    1.400     1.500      .000      .000      .600      .000
NATUR     3    1.400     1.500      .000      .000      .806      .000
NATUR     4    1.400     1.500      .000      .000     1.013      .000
NATUR     5    1.400     1.500      .000      .000      .600      .000
NATUR     6    1.400     1.500      .000      .000     1.107      .000
NATUR     7    1.400     1.500      .000      .000     1.614      .000
NATUR     8    1.800     1.900      .000      .000      .000    30.000
WATER     2     .000    14.000    60.000    14.000
VOIDP          1.000
CIRCL         24.000    30.000     2.000         0      .500
              21.000    27.000     2.000         0     2.000
              12.000     2.000     2.000         1
END
                   1         2         3         4         5         6         7
         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
234567890
```

Way Musuji Bridge in east coast of Sumatra HE=3m

***** MINIMUM SAFTY FACTOR DETAIL LIST *****

X	Y	R	RESISTING MOMENT	SLIDING MOMENT	SAFTY FACTOR
24.00	27.00	21.00	965.95	812.12	1.189
	25.00	19.00	827.44	698.80	1.184
	23.00	17.00	705.83	585.17	1.206
	21.00	15.00	578.57	471.87	1.226
26.00	27.00	21.00	1008.08	857.64	1.175
	25.00	19.00	865.76	744.10	1.164
	23.00	17.00	740.44	631.35	1.173
	21.00	15.00	615.50	518.22	1.188
28.00	27.00	21.00	1049.55	882.04	1.190
	25.00	19.00	915.00	768.75	1.190
	23.00	17.00	774.13	655.70	1.181
	21.00	15.00	645.25	542.18	1.190
30.00	27.00	21.00	1103.08	885.20	1.246
	25.00	19.00	952.31	771.68	1.234
	23.00	17.00	802.50	657.73	1.220
	21.00	15.00	674.60	544.03	1.240

Way Musuji Bridge in east coast of Sumatra HE=3m

***** MINIMUM SAFTY FACTOR LIST *****

Y \ X =	24.00	26.00	28.00	30.00
27.00	1.189	1.175	1.190	1.246
	(21.00)	(21.00)	(21.00)	(21.00)
25.00	1.184	1.164	1.190	1.234
	(19.00)	(19.00)	(19.00)	(19.00)
23.00	1.206	1.173	1.181	1.220
	(17.00)	(17.00)	(17.00)	(17.00)
21.00	1.226	1.188	1.190	1.240
	(15.00)	(15.00)	(15.00)	(15.00)

MINIMUM SAFTY FACTOR = 1.164

XC = 26.00 RESISTING MOMENT = 865.76
YC = 25.00 SLIDING MOMENT = 744.10
R = 19.00

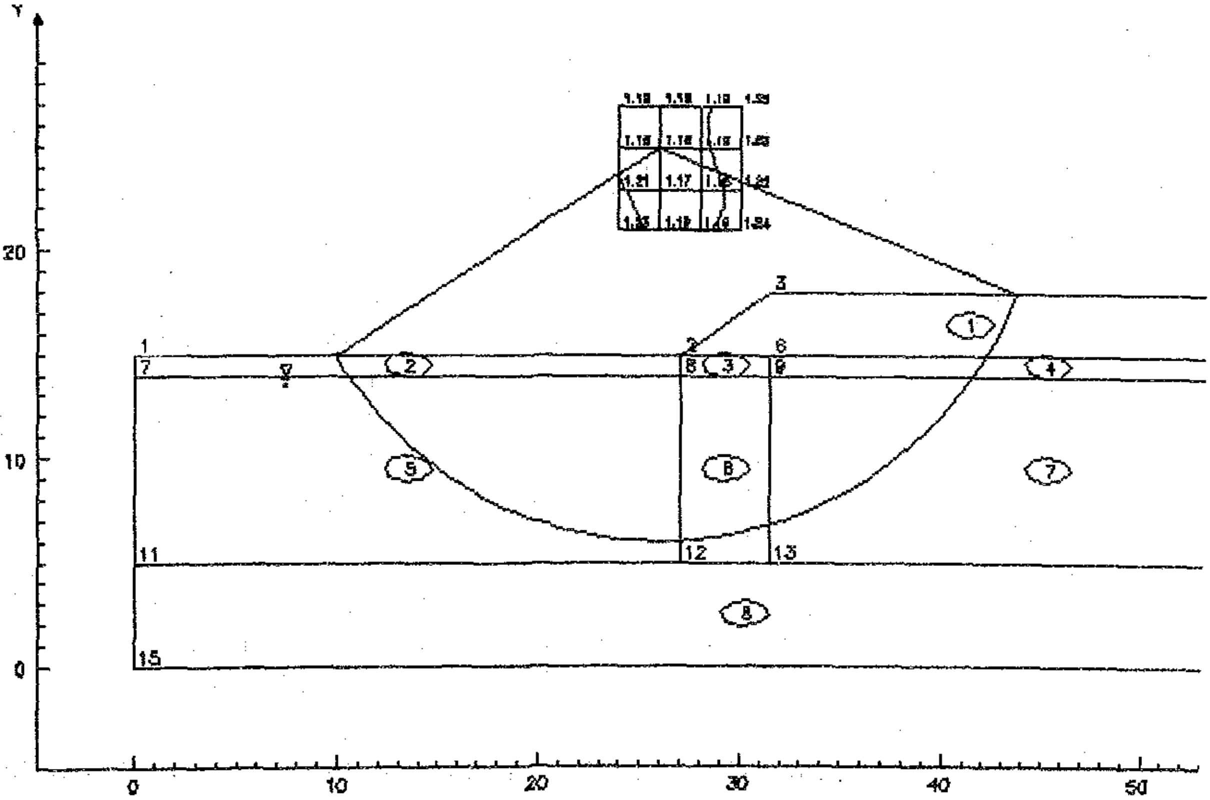
	X (M)	Y (M)	R (M)	FS	MR (T.M/M)	MS (T.M/M)
1	26.00	25.00	18.00	1.164	865.76	744.10

* SOIL CONDITION & SEISMIC COEFFICIENT

	GAMMAT (T/M³)	GAMMAS (T/M³)	GAMMA (T/M³)	PHAI	C0 (T/M²)	K	Y0 (M)	KH	KV
1	1.800	1.900		10.00	2.000	0.000	0.0		
2	1.400	1.500		0.00	0.600	0.000	0.0		
3	1.400	1.500		0.00	0.806	0.000	0.0		
4	1.400	1.500		0.00	1.013	0.000	0.0		
5	1.400	1.500		0.00	0.600	0.000	0.0		
6	1.400	1.500		0.00	1.107	0.000	0.0		
7	1.400	1.500		0.00	1.814	0.000	0.0		
8	1.800	1.900		30.00	0.000	0.000	0.0		

* C = C0 + K (Y0−Y)

Way Musuji Bridge in east coast of Sumatra HE=3m



*** INPUT DATA DUMP LIST ***

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234567890
    1  TITLE      Way Musuji Bridge in east coast of Sumatra  HE=4m
    2  METHO               2
    3  PRINT               1         1         0         1     1.400
    4  POINT    1       .000    15.000
    5  POINT    2     27.000    15.000
    6  POINT    3     33.000    19.000
    7  POINT    4     60.000    19.000
    8  POINT    5     60.000    15.000
    9  POINT    6     33.000    15.000
   10  POINT    7       .000    14.000
   11  POINT    8     27.000    14.000
   12  POINT    9     33.000    14.000
   13  POINT   10     60.000    14.000
   14  POINT   11       .000     5.000
   15  POINT   12     27.000     5.000
   16  POINT   13     33.000     5.000
   17  POINT   14     60.000     5.000
   18  POINT   15       .000      .000
   19  POINT   16     60.000      .000
   20  BLOCK    1  2  3  4  5  6
   21  BLOCK    2  1  2  8  7
   22  BLOCK    3  2  6  9  8
   23  BLOCK    4  6  5 10  9
   24  BLOCK    5  7  8 12 11
   25  BLOCK    6  8  9 13 12
   26  BLOCK    7  9 10 14 13
   27  BLOCK    8 11 12 13 14 16 15
   28  NATUR    1      1.800     1.900      .000      .000     2.000    10.000
   29  NATUR    2      1.400     1.500      .000      .000      .600      .000
   30  NATUR    3      1.400     1.500      .000      .000      .935      .000
   31  NATUR    4      1.400     1.500      .000      .000     1.269      .000
   32  NATUR    5      1.400     1.500      .000      .000      .600      .000
   33  NATUR    6      1.400     1.500      .000      .000     1.226      .000
   34  NATUR    7      1.400     1.500      .000      .000     1.851      .000
   35  NATUR    8      1.800     1.900      .000      .000      .000    30.000
   36  WATER    2       .000    14.000    60.000    14.000
   37  VOIDP           1.000
   38  CIRCL          24.000    30.000     2.000         0      .500
   39                 20.000    26.000     2.000         0     2.000
   40                 12.000     2.000     2.000         1
   41  END
                   1         2         3         4         5         6         7
         8
          1234567890123456789012345678901234567890123456789012345678901234567890
234567890
```

Way Musuji Bridge in east coast of Sumatra HE=4m

***** MINIMUM SAFTY FACTOR DETAIL LIST *****

X	Y	R	RESISTING MOMENT	SLIDING MOMENT	SAFTY FACTOR
24.00	26.00	20.00	993.39	1003.28	.990
	24.00	18.00	841.35	844.51	.996
	22.00	16.00	706.14	686.47	1.029
	20.00	14.00	573.49	527.93	1.086
26.00	26.00	20.00	1045.41	1075.36	.972
	24.00	18.00	888.79	916.70	.970
	22.00	16.00	749.12	758.59	.988
	20.00	14.00	612.26	600.26	1.020
28.00	26.00	20.00	1096.22	1118.61	.980
	24.00	18.00	944.36	960.05	.984
	22.00	16.00	790.40	801.87	.986
	20.00	14.00	648.84	643.71	1.008
30.00	26.00	20.00	1146.47	1133.03	1.012
	24.00	18.00	989.73	974.53	1.016
	22.00	16.00	830.92	816.30	1.018
	20.00	14.00	693.37	658.26	1.053

Way Musuji Bridge in east coast of Sumatra HE=4m

***** MINIMUM SAFTY FACTOR LIST *****

Y \ X =	24.00	26.00	28.00	30.00
26.00	.990 (20.00)	.972 (20.00)	.980 (20.00)	1.012 (20.00)
24.00	.996 (18.00)	.970 (18.00)	.984 (18.00)	1.016 (18.00)
22.00	1.029 (16.00)	.988 (16.00)	.986 (16.00)	1.018 (16.00)
20.00	1.086 (14.00)	1.020 (14.00)	1.008 (14.00)	1.053 (14.00)

MINIMUM SAFTY FACTOR = .970

XC = 26.00 RESISTING MOMENT = 888.79
YC = 24.00 SLIDING MOMENT = 916.70
R = 18.00

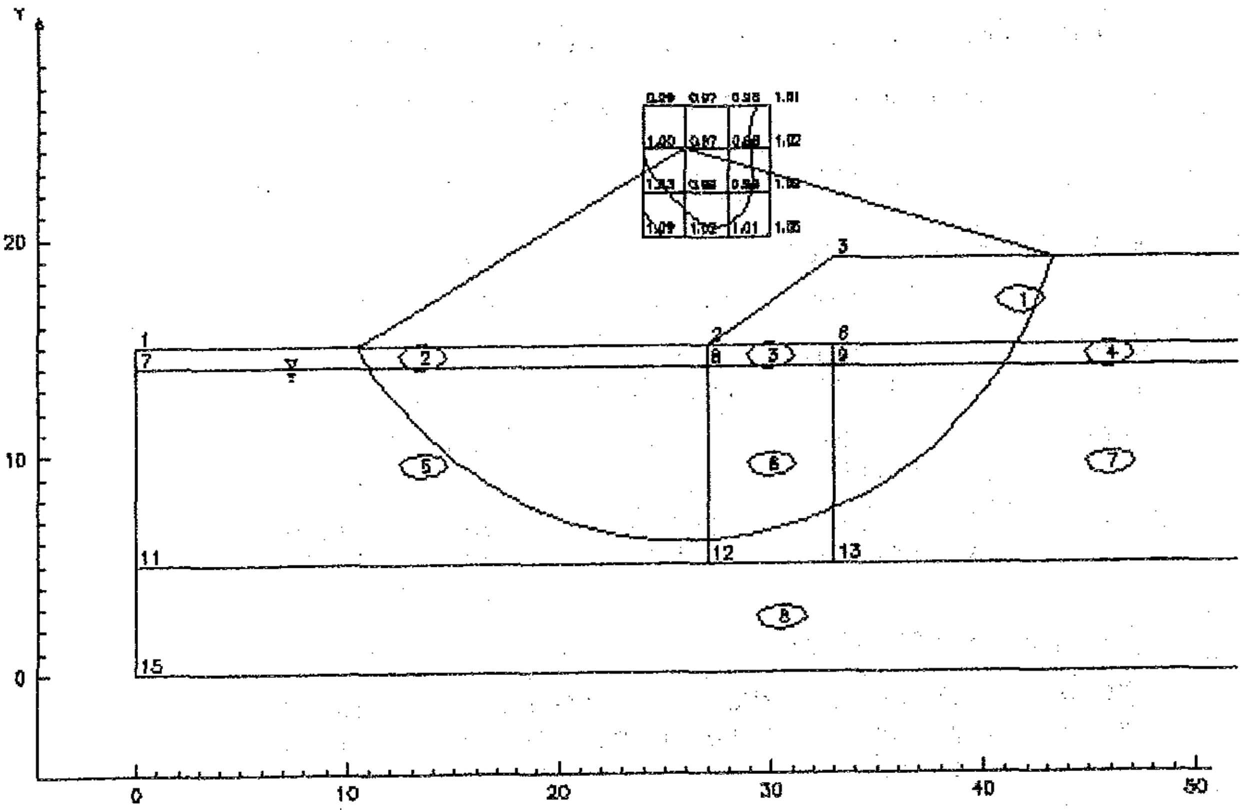
	X (M)	Y (M)	R (M)	FS	MR (T.M/M)	MS (T.M/M)
1	26.00	24.00	18.00	0.970	888.78	916.70

* SOIL CONDITION & SEISMIC COEFFICIENT

	GAMMAT (T/M³)	GAMMAS (T/M³)	GAMMA (T/M³)	PHAI	CO (T/M²)	K	YO (M)	KH	KV
1	1.800	1.900		10.00	2.000	0.000	0.0		
2	1.400	1.500		0.00	0.800	0.000	0.0		
3	1.400	1.500		0.00	0.935	0.000	0.0		
4	1.400	1.500		0.00	1.269	0.000	0.0		
5	1.400	1.500		0.00	0.600	0.000	0.0		
6	1.400	1.500		0.00	1.226	0.000	0.0		
7	1.400	1.500		0.00	1.851	0.000	0.0		
8	1.800	1.900		30.00	0.000	0.000	0.0		

* C = CO + K (YO−Y)

Way Musuji Bridge in east coast of Sumatra HE=4m



*** INPUT DATA DUMP LIST ***

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  1 TITLE     Way Mesuji Bridge in east coast of Sumatra  HE=4m C.Weight
  2 METHO              2
  3 PRINT              1         1         0         1     1.400
  4 POINT   1       .000    15.000
  5 POINT   2     22.000    15.000
  6 POINT   3     25.000    17.000
  7 POINT   4     30.000    17.000
  8 POINT   5     33.000    19.000
  9 POINT   6     60.000    19.000
 10 POINT   7     60.000    15.000
 11 POINT   8     33.000    15.000
 12 POINT   9       .000    14.000
 13 POINT  10     22.000    14.000
 14 POINT  11     33.000    14.000
 15 POINT  12     60.000    14.000
 16 POINT  13       .000     5.000
 17 POINT  14     22.000     5.000
 18 POINT  15     33.000     5.000
 19 POINT  16     60.000     5.000
 20 POINT  17       .000      .000
 21 POINT  18     60.000      .000
 22 BLOCK   1  2  3  4  5  6  7  8
 23 BLOCK   2  1  2 10  9
 24 BLOCK   3  2  8 11 10
 25 BLOCK   4  8  7 12 11
 26 BLOCK   5  9 10 14 13
 27 BLOCK   6 10 11 15 14
 28 BLOCK   7 11 12 16 15
 29 BLOCK   8 13 14 15 16 18 17
 30 NATUR   1      1.800     1.900      .000      .000     2.000    10.000
 31 NATUR   2      1.400     1.500      .000      .000      .600      .000
 32 NATUR   3      1.400     1.500      .000      .000      .935      .000
 33 NATUR   4      1.400     1.500      .000      .000     1.269      .000
 34 NATUR   5      1.400     1.500      .000      .000      .600      .000
 35 NATUR   6      1.400     1.500      .000      .000     1.226      .000
 36 NATUR   7      1.400     1.500      .000      .000     1.851      .000
 37 NATUR   8      1.800     1.900      .000      .000      .000    30.000
 38 WATER   2       .000    14.000    60.000    14.000
 39 VOIDP          1.000
 40 CIRCL         24.000    30.000     2.000         0      .500
 41               20.000    26.000     2.000         0     2.000
 42               12.000     2.000     2.000         1
 43 END
                   1         2         3         4         5         6         7
         8
234567890 1234567890123456789012345678901234567890123456789012345678901234567890123456789 01
```

Way Mesuji Bridge in east coast of Sumatra HE=4m C.Weight

***** MINIMUM SAFTY FACTOR DETAIL LIST *****

X	Y	R	RESISTING MOMENT	SLIDING MOMENT	SAFTY FACTOR
24.00	26.00	20.00	1056.17	1039.28	1.016
	24.00	18.00	897.89	880.51	1.020
	22.00	16.00	756.45	722.47	1.047
	20.00	14.00	617.58	563.93	1.095
26.00	26.00	20.00	1108.35	1075.36	1.031
	24.00	18.00	945.51	916.70	1.031
	22.00	16.00	799.63	758.59	1.054
	20.00	14.00	656.58	600.26	1.094
28.00	26.00	20.00	1159.99	1082.61	1.071
	24.00	18.00	1002.02	924.06	1.084
	22.00	16.00	841.98	765.87	1.099
	20.00	14.00	694.42	607.71	1.143
30.00	26.00	20.00	1211.81	1061.03	1.142
	24.00	18.00	1049.18	902.53	1.162
	22.00	16.00	884.60	744.30	1.188
	20.00	14.00	741.50	586.26	1.265

Way Mesuji Bridge in east coast of Sumatra HE=4m C.Weight

***** MINIMUM SAFTY FACTOR LIST *****

Y \ X =	24.00	26.00	28.00	30.00
26.00	1.016 (20.00)	1.031 (20.00)	1.071 (20.00)	1.142 (20.00)
24.00	1.020 (18.00)	1.031 (18.00)	1.084 (18.00)	1.162 (18.00)
22.00	1.047 (16.00)	1.054 (16.00)	1.099 (16.00)	1.188 (16.00)
20.00	1.095 (14.00)	1.094 (14.00)	1.143 (14.00)	1.265 (14.00)

MINIMUM SAFTY FACTOR = 1.016

XC = 24.00 RESISTING MOMENT = 1056.17
YC = 26.00 SLIDING MOMENT = 1039.28
R = 20.00

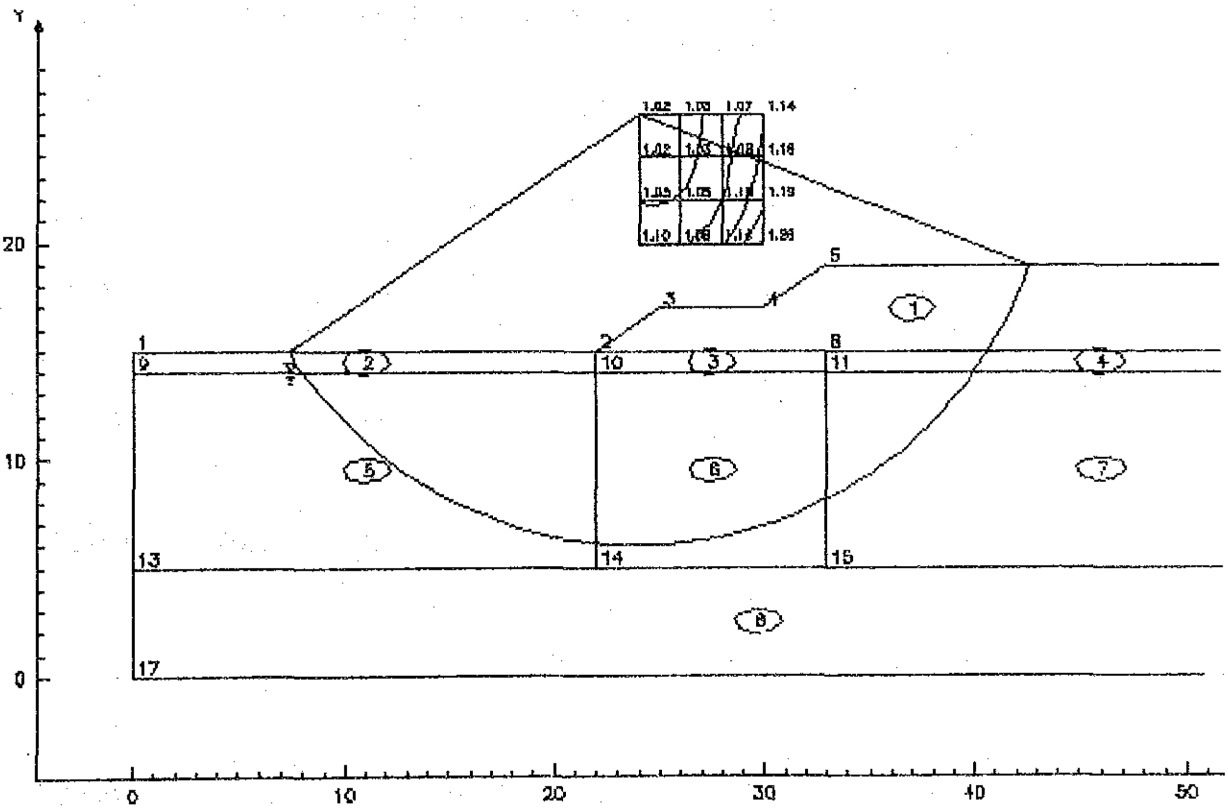
	X (M)	Y (M)	R (M)	FS	MR (T.M/M)	MS (T.M/M)
1	24.00	26.00	20.00	1.016	1056.17	1039.26

* SOIL CONDITION & SEISMIC COEFFICIENT

	GAMMAT (T/M^3)	GAMMAS (T/M^3)	GAMMA (T/M^3)	PHAI	C0 (T/M^2)	K	Y0 (M)	KH	KV
1	1.800	1.900		10.00	2.000	0.000	0.0		
2	1.400	1.500		0.00	0.600	0.000	0.0		
3	1.400	1.500		0.00	0.935	0.000	0.0		
4	1.400	1.500		0.00	1.269	0.000	0.0		
5	1.400	1.500		0.00	0.600	0.000	0.0		
6	1.400	1.500		0.00	1.226	0.000	0.0		
7	1.400	1.500		0.00	1.851	0.000	0.0		
8	1.800	1.900		30.00	0.000	0.000	0.0		

* C = C0 + K (Y0−Y)

Way Mesuji Bridge in east coast of Sumatra HE−4m C.Weight



Appendix A-9.2 Road Inventory (1990)

Link No.	KM Post (Length : Km)	Cross section (m) Carrigeway	Shoulder	Roadbed	Surface Material	IRI
15090-1	PLG 72-80 (8)	4.5	1.5	7.5	Penetration Macadam	8.0
1590-2	PLG 80-175 (93)	3.0	2.0	7.0	Butas/ Penetration Macadam	9.2
17062-1	TBL119-183 (64)	3.0	2.5	8.0	Telford/ Penetration Macadam	11.4
17062-2	TBL183-201 (18)	3.0	2.5	8.0	Telford	12.1

Appendix A-9.3 Road Inventory (1992)

Link No.	KM Post (Length KM)	Cross Section (m) Carriage way	Shoulder	Road Bed	Type	Surface Material	Completed Year
15090-1	PLG72-80 (8)	4.5	1.5	7.5	I	HRS	1992
15090-2	PLG80-105 (23)	6.0	2.0	10.0	II	AC	1991
	PLG105-175 (70)	(4.5)	(1.0)	6.5	III	(AC)	1993*
17062-1	TLB 119-143 (24)	4.5	1.0	6.5	III	AC	1992
	TLB 143-160 (17)	(4.5)	(1.0)	6.5	III	(AC)	1993*
	TLB 160-183 (23)	4.5	1.0	6.5	III	AC	1992
17062-2	TLB 183-201 (18)	(4.5)	(1.0)	6.5	III	AC	1993*
Total	(183)						

Note : * These road sections are under betterment

Appendix A-9.4 Bridge Inventory

In all there are 53 bridges (including those under construction) the study road. They are classified according to size, type, year built, and length in Table (A) through Table (D).

Table (A) Number of Bridges by Carriageway Width

Road Section	< 4,5 m	6.0 m	Total
Kayuagung - Prov Border	-	9 + (9)	9 + (9)
Menggala - Prov Border	2	32 + (1)	34 + (1)
Total	2	41 + (10)	43 + (10)

Table (B) Number of Bridges by Type

Road Section	Reinforced Concrete	Steel Girder	Steel Truss	Total
Kayuagung - Prov Border	6 + (9)	-	3	9 + (9)
Menggala - Prov Border	25 + (1)	7	2	34 + (1)
Total	31 + (10)	7	5	43 + (10)

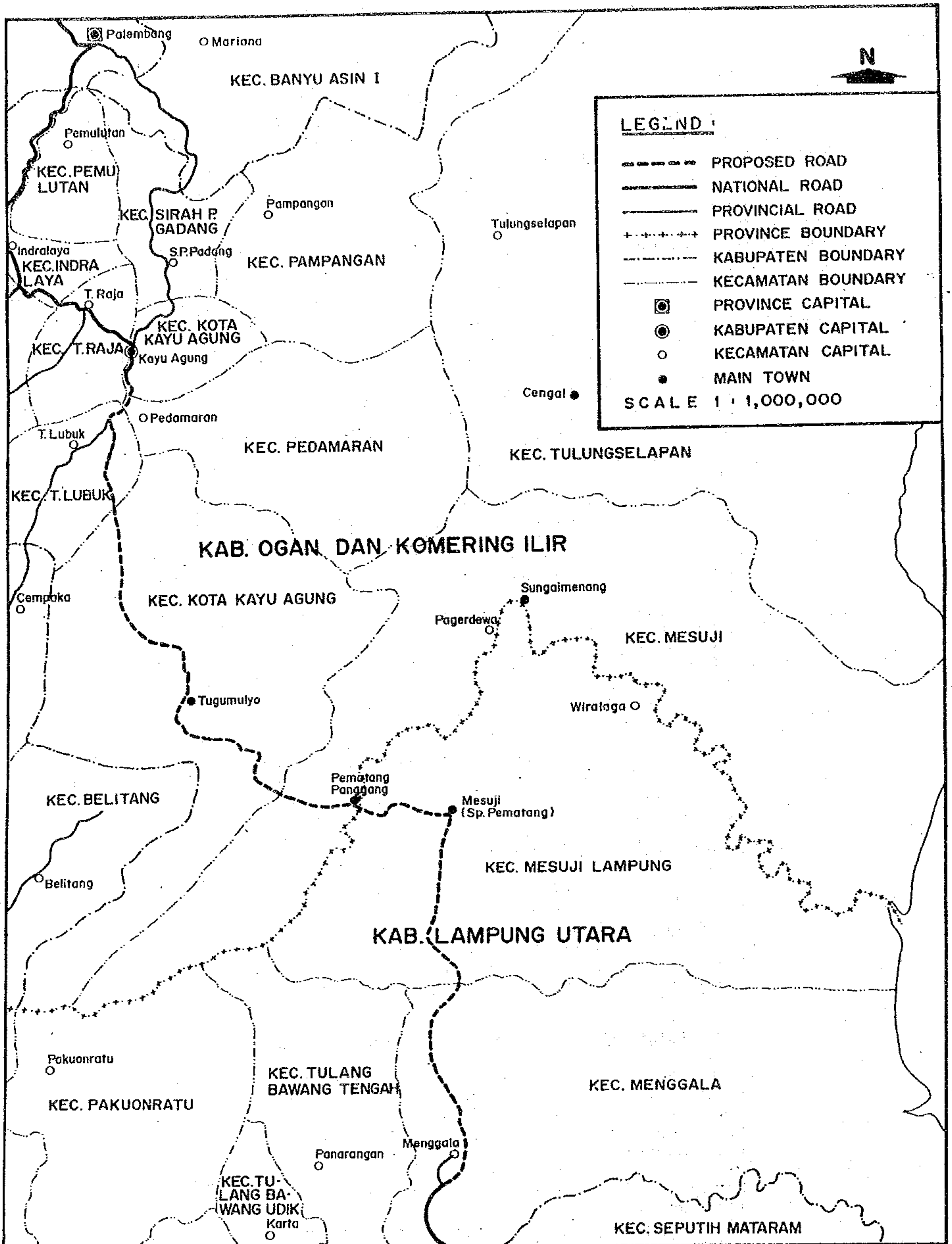
Table (C) Number of Bridges by Length

Road Section	<19m	20 - 49m	50 - 99m	100 - 130m	Total
Kayuagung - Prov Border	4 + (7)	2 + (2)	2	1	9 + (9)
Menggala - Prov Border	31 + (1)	1	-	2	34 + (1)
Total	35 + (8)	3 + (2)	2	3	43 + (10)

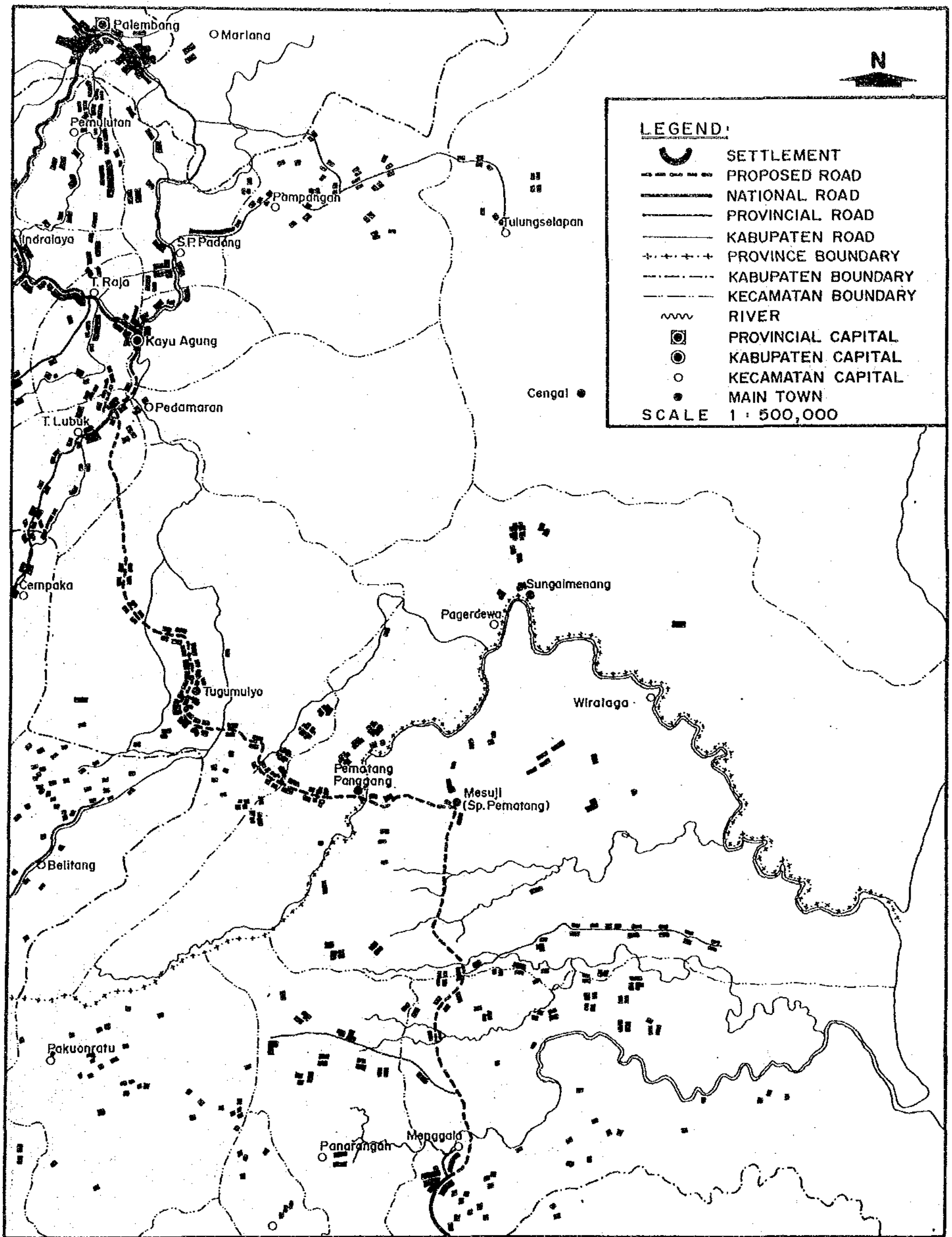
Table (D) Number of Bridges by Year of Construction

Road Section	1980 - 1989	1990 - 1992	Total
Kayuagung - Prov Border	-	9 + (9)	9 + (9)
Menggala - Prov Border	5	29 + (1)	34 + (1)
Total	5	38 + (10)	43 + (10)

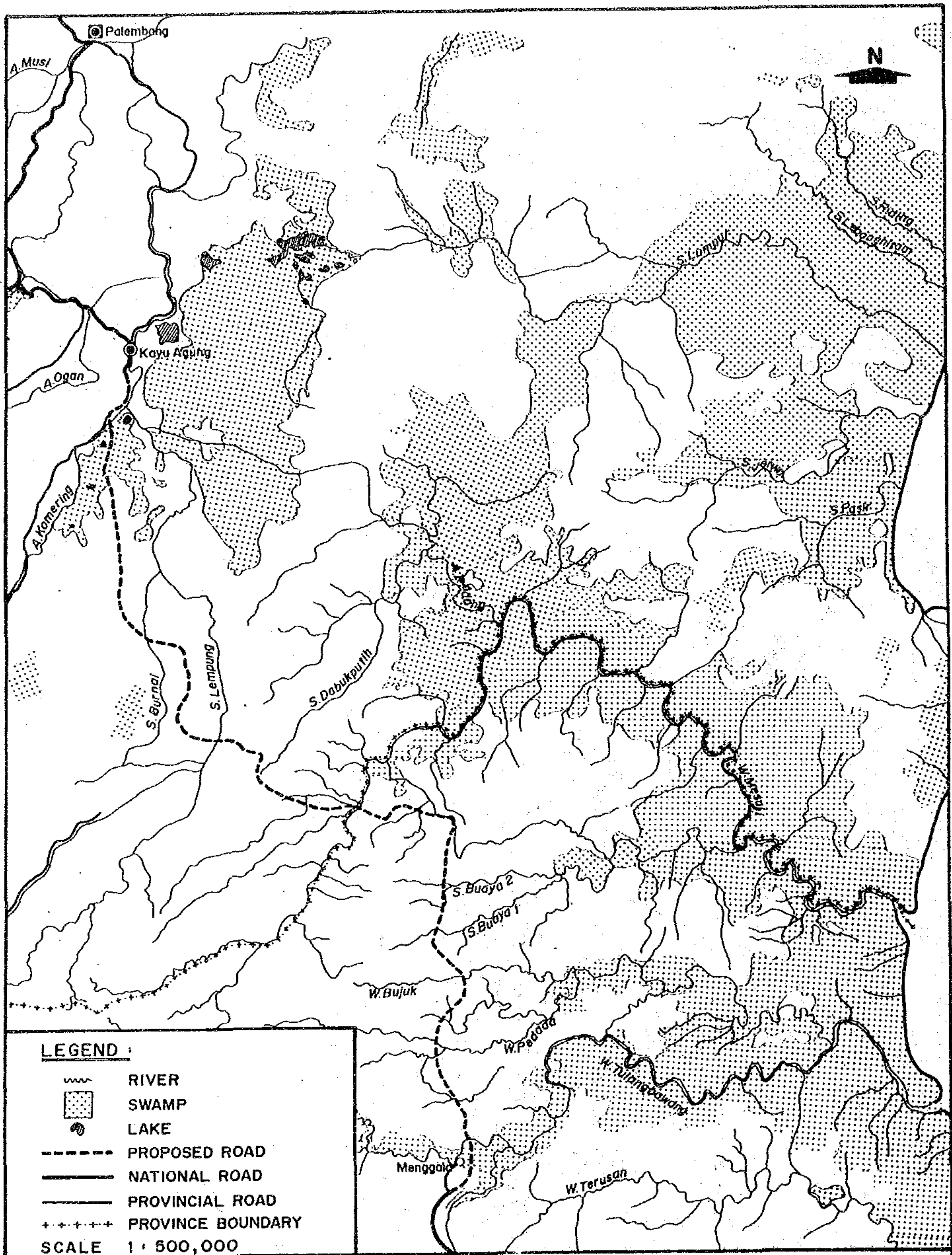
Note : Number in parentheses indicate bridge under construction



COASTAL ROADS IN EAST COAST OF SUMATERA	**Appendix A-9.5 Administration Map in Project Area**



COASTAL ROADS IN EAST COAST OF SUMATERA	**Appendix A-9.6 Settlement Location Map**



COASTAL ROADS
IN
EAST COAST OF SUMATERA

Appendix A-9.7 Swamp Areas in the Project Area

Appendix A-9.8 Economic Project Costs Flows

(Million Rp. at 1992 price)

Year	Construction Costs	Engineering Costs	Land Acquisition	Investment Costs Total	Maintenances (Routine, Periodical, Betterment, etc.)	Maintenance Costts for Without Cases
1994	16,347	4,715	7,441	28,504		
1995	32,693	1,572	7,442	41,707		
1996	32,693	1,572		34,265		
1997					150	101
1998					150	101
1999					150	101
2000					150	101
2001					12,794	8,569
2002					150	101
2003					150	101
2004					150	101
2005					150	101
2006					30,711	20,569
2007					150	101
2008					150	101
2009					150	101
2010					150	101
2011					12,794	8,569
2012					150	101
2013					150	101
2014					150	101
2015					150	101
2016					55,982	37,496
2017					150	101
2018					150	101
2019					150	101
2020					150	101
2021					150	101
Initial Costs Total	81,733	7,859	14,883	104,475		
Costs after Operation	0	0	0	0	115,430	77,323
Grand Total	81,733	7,859	14,883	104,475	115,430	77,323

Note: 1) Construction costs include a countermeasure cost for elephants.
2) Maintenance costs for Without include a routine maintenance cost, periodical maintenance cost, betterment cost, etc.

Appendix A-9.9 Estimated Share Ratio of PCU-Kilometers by Vehicle Type and by Road Section

Year 1997	Vehicle Type					
Road Section	Passenger Car	Light Truck	Heavy Truck	Small Bus	Large Bus	Total
(East Coast Highway)						
Section 1	17.4%	39.7%	21.4%	6.0%	15.5%	100.0%
Section 2	12.5%	49.5%	19.9%	5.5%	12.6%	100.0%
Section 3	9.6%	33.2%	32.2%	2.3%	22.7%	100.0%
Section 4	10.7%	32.5%	27.4%	5.5%	23.9%	100.0%
Section 5	13.0%	33.9%	20.3%	10.3%	22.5%	100.0%
Section 6	8.3%	35.5%	34.7%	1.9%	19.6%	100.0%
Section 7 (Existing Road)	15.1%	52.6%	12.5%	10.1%	9.7%	100.0%
Section 7 (7B and 7C)	4.7%	29.7%	49.6%	0.1%	15.9%	100.0%
(Rest of East Coast Highway)						
Local Road	14.1%	65.3%	1.5%	9.9%	9.2%	100.0%
Collector Road	15.1%	44.7%	8.5%	13.0%	18.7%	100.0%
Arterial Road	15.9%	46.9%	8.6%	12.9%	15.7%	100.0%

Year 2010	Vehicle Type					
Road Section	Passenger Car	Light Truck	Heavy Truck	Small Bus	Large Bus	Total
(East Coast Highway)						
Section 1	18.4%	37.8%	22.7%	6.9%	14.2%	100.0%
Section 2	11.8%	44.4%	23.3%	8.5%	12.0%	100.0%
Section 3	12.2%	34.7%	27.6%	3.2%	22.3%	100.0%
Section 4	13.1%	34.8%	21.7%	7.6%	22.8%	100.0%
Section 5	15.0%	30.6%	15.7%	14.4%	24.3%	100.0%
Section 6	10.0%	36.9%	30.3%	2.3%	20.5%	100.0%
Section 7 (Existing Road)	14.1%	48.2%	14.4%	13.1%	10.2%	100.0%
Section 7 (7B and 7C)	5.2%	29.7%	47.0%	0.2%	17.9%	100.0%
(Rest of East Coast Highway)						
Local Road	16.3%	60.1%	1.3%	10.4%	11.9%	100.0%
Collector Road	16.5%	41.5%	8.8%	16.6%	16.6%	100.0%
Arterial Road	16.4%	43.2%	9.9%	16.9%	13.6%	100.0%

(Note) : Based on the share ratio of PCU-kilometers by vehicle type estimated in the traffic assignment process.

Appendix A-9.10 Estimation of Unit Vehicle Time Cost

(A) Per Capita GRDP at Current Price excluding Oil & Gas (Rp.1,000)

Province	1983	1984	1985	1986	1987	1988	Average Annual Growth Ratio '83-'88	Estimated 1992
Aceh	423	465	523	567	635	701	10.63%	1,050
Sumatera Utara	368	446	475	520	634	736	14.87%	1,281
Sumatera Barat	346	398	439	494	577	656	13.65%	1,094
Riau	401	468	503	538	607	680	11.14%	1,038
Jambi	298	339	370	393	446	490	10.46%	729
Sumatera Selatan	484	528	576	621	705	773	9.82%	1,124
Bengklu	305	339	388	464	532	585	13.91%	985
Lampung	198	219	233	292	341	379	13.87%	637
Sumatra Average	353	400	438	486	560	625	12.11%	987

Source: Statistik Indonesia 1990

(B) Assumption on Annual Working Hour

Monthly Working Hour	170	(Hours)
Annual Working Hour	2,040	(Hours)

(C) Per Capita GRDP / Workinh Hour

484 (Rp./hour)

(D) Trip Purpose Composition in Sumatra Area

	(1) Car Passengers			(2) Bus Passengers		
	Purpose	Factor	Total	Purpose	Factor	Total
Business	27.0%	100.0%	131	9.5%	100.0%	46
Recreation	9.3%		0	8.3%		0
Visit Families	44.7%		0	50.4%		0
Work	12.4%	100.0%	60	11.4%	100.0%	55
School	1.6%		0	8.5%		0
Shopping	2.2%		0	2.8%		0
Others	2.8%		0	7.4%		0
Unknown	0.0%		0	1.7%		0
	100.0%		191	100.0%		101

Source: Data of Trip Purpose ...1991 National O/D Survey

(E) Occupancy Rate of Vehicle in Sumatra Area

Car	3.0	(Persons)
Small Bus	7.1	
Large Bus	34.8	

Source: 1991 National O/D Survey

(F) Estimation of Unit Vehicle Time Cost

Car	573	(Rp./Hour)
Small Bus	717	
Large Bus	3515