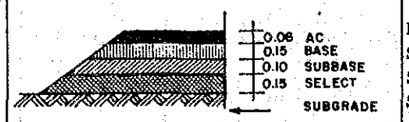
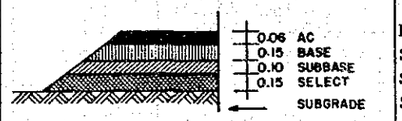
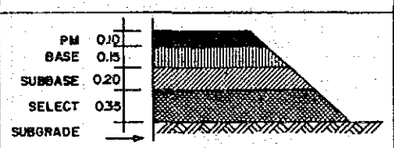
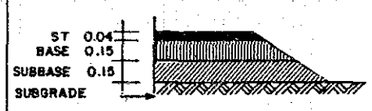
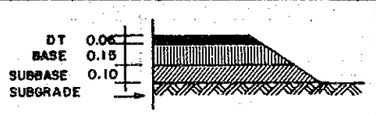
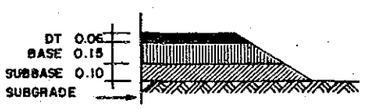
APPENDIX 4.2.4 RESULTS OF FIELD CBR AND LABORATORY SOIL TESTS

Result of CBR Test

ROUTE NO.	SURFACE TYPE	SECTION	PAVEMENT STRUCTURE	FIELD DENSITY (gm/cc)		W (%)	FIELD CBR (%)	MOLD CBR % AT CORRESPONDING FIELD DENSITY	Wo (mm)	δ (mm)	R (m)
RT - 224	AC	11 + 500 ℄ 2.00 M LT		BASE SUBBASE SELECT SUBGRADE	2.215 2.316 2.295 1.777	0.59 1.43 1.59 2.29	55.6 49.7 49.7 14.5	42.0 55.7 57.0 11.9	0.449	0.142	217
RT - 224	AC	16 + 000 ℄ 2.00 M LT		BASE SUBBASE SELECT SUBGRADE	2.075 2.328 2.246 1.936	0.62 1.37 2.55 3.49	19.1 28.8 36.7 20.5	28.0 33.3 30.7 20.2	0.508	0.152	208
RH - 5	PM	21 + 500 ℄ 2.00 M LT		BASE SUBBASE SELECT SUBGRADE	2.063 2.223 2.116 1.995	10.10 1.59 6.39 6.59	35.8 53.6 22.8 20.9	53.5 49.3 40.3 22.0	0.372	0.101	325
RH - 5	PM	36 + 200 ℄ 2.00 M LT		BASE SUBBASE SELECT SUBGRADE	2.027 2.298 2.297 2.000	9.50 4.20 4.35 6.29	30.8 18.9 11.9 20.5	50.8 50.0 28.2 22.7	0.819	0.197	174
RH - 12	DT/ST	492 + 600 ℄ 2.50 M RT		BASE SUBBASE SUBGRADE	2.320 2.261 2.093	6.44 6.13 7.70	43.7 43.1 24.2	65.6 75.3 26.0	0.485	0.154	199
RH - 12	DT/ST	493 + 450 ℄ 2.00 M LT		BASE SUBBASE SELECT SUBGRADE	2.295 2.302 2.229 2.101	7.47 7.78 7.79 9.73	58.6 27.8 26.8 21.2	62.2 71.5 41.0 15.2	0.680	0.176	190
RH - 25	DT/ST	9 + 450 ℄ 1.40 M LT		BASE SUBBASE SUBGRADE	2.259 2.174 2.000	3.56 6.13 3.61	54.6 52.6 29.8	76.0 58.3 29.7	0.297	0.101	294
RH - 25	DT/ST	11 + 950 ℄ 1.40 M LT		BASE SUBBASE SUBGRADE	2.031 2.220 2.064	5.43 3.16 6.79	47.7 39.7 31.8	42.0 62.0 25.7	0.419	0.116	280

where, r = distance from center point (cm)
Wo = center deflection (cm)
Wr = deflection at point r (cm)
δ = W - Wr
R = radius of curvature of deflection (m)

Result of Soil Test (Subgrade)

No.	Route No.	Surface Type	Section	HRB Classi-fication	Sieve Analysis % Passing								Plasticity		Comp. DH-T.....		Lab. C.B.R.		Specific Gravity Test
					50	25	19	9.5	#4	#10	#40	#200	LL.	PI.	Opt. Mc.%	γd (gm/cc)	C.B.R.	Swell (%)	
1	RT - 224	AC	11+000 RT 2.80m	A-1-b			100.0	87.4	72.8	61.5	35.5	18.3	N-P		7.6	2.068	9.8	-	2.64
2	RT - 224	AC	18+000 LT 2.00m	A-1-b			100.0	87.3	72.1	60.7	33.5	15.3	N-P		7.1	2.093	8.3	-	2.73
3	RH - 21	AC	124+000 RT 5.50m	A-4				100.0	94.8	93.0	81.8	39.6	32.00	7.94	9.3	1.967	10.0	-	2.66
4	RH - 21	AC	129+000 RT 5.30m	A-2-4					100.0	99.0	93.6	32.2	N-P		8.2	2.012	11.9	-	2.53
5	RH - 22	PM	3+000 RT 2.35m	A-4				100.0	98.8	98.2	97.6	37.6	N-P		10.9	1.799	4.2	-	2.56
6	RH - 22	PM	6+000 LT 2.30m	A-4				100.0	96.2	94.0	91.6	45.0	N-P		7.8	2.001	4.9	0.35	2.74
7	RH - 5	PM	25+000 RT 2.80m	A-2-4			100.0	82.0	56.2	42.1	34.6	27.4	32.2	9.1	10.3	2.008	4.40	0.09	2.62
8	RH - 5	PM	32+000 LT 2.20m	A-2-4			100.0	82.7	61.6	50.1	42.4	27.7	25.8	7.1	9.6	2.011	6.0	0.09	2.65
9	RH - 12	DT/ST	490+000 RT 2.30m	A-4			100.0	96.8	89.2	80.6	77.2	36.6	21.7	9.7	10.6	1.955	2.85	1.80	2.74
10	RH - 12	DT/ST	496+000 LT 2.60m	A-4				100.0	96.6	90.0	85.6	47.6	20.8	6.0	11.7	1.905	2.20	0.22	2.60
11	RH - 16	DT/ST	10+000 RT 2.50m	A-4				100.0	97.8	94.6	91.2	79.0	20.5	7.1	11.3	1.843	3.55	1.30	2.68
12	RH - 16	DT/ST	16+000 LT 2.60m	A-7-6			100.0	96.4	93.4	89.4	85.4	73.4	61.0	39.5	19.3	1.681	2.85	0.60	2.76
13	RH - 25	DT/ST	8+000 RT 2.20m	A-4				100.0	97.2	93.0	86.6	49.6	33.0	8.59	9.2	1.947	11.0	0.13	2.71
14	RH - 25	DT/ST	15+000 LT 2.00m	A-4				100.0	99.6	97.4	91.2	54.4	32.60	7.76	11.4	1.958	11.3	0.11	2.54
15	RH - 27	DT/ST	9+000 RT 2.20m	A-4				100.0	95.4	88.6	82.0	64.0	28.5	9.0	11.2	1.869	5.25	3.74	2.86
16	RH - 27	DT/ST	17+000 LT 1.90m	A-6				100.0	98.4	94.8	91.2	64.2	34.9	12.8	13.6	1.852	2.50	2.86	2.78

Result of Soil Test (Subbase)

No.	Route No.	Surface Type	Section	HRB Classi-fication	Sieve Analysis % Passing								Plasticity		Comp. DH-T.....		Lab. C.B.R.		Remarks
					50	25	19	9.5	#4	#10	#40	#200	LL.	PI.	Opt. Mc.%	γd (gm/cc)	C.B.R.	Swell (%)	
1	RT - 224	AC	11+000 RT 2.80m			100	92.4	77.0	61.0	40.1	24.0	11.8			8.0	2.226	21.2	0.4	
2	RT - 224	AC	18+000 LT 2.00m			100	95.6	83.9	72.4	63.8	46.8	17.8			8.0	2.237	21.4	0.3	
3	RH - 21	AC	124+000 RT 5.50m			100	86.8	72.4	58.1	42.5	32.2	19.1			9.3	2.162	16.8	0.6	
4	RH - 21	AC	129+000 RT 5.30m		100	93.8	88.8	83.2	68.2	43.9	32.9	23.7			10.2	2.081	16.2	0.3	
5	RH - 22	PM	3+000 RT 2.35m		100	98.8	96.6	81.6	66.2	44.7	36.3	25.0			8.4	2.187	13.0	0.2	
6	RH - 22	PM	6+000 LT 2.30m		100	98.7	96.5	82.5	66.0	44.5	37.1	28.2			8.0	2.180	10.0	0.1	
7	RH - 5	PM	25+000 RT 2.80m		100	93.1	85.7	79.9	62.6	46.3	34.4	16.7			11.1	2.167	12.0	0.3	
8	RH - 5	PM	32+000 LT 2.20m		100	90.1	82.3	76.3	53.7	44.1	36.1	15.3			11.7	2.210	18.6	0.4	
9	RH - 12	DT/ST	490+000 RT 2.30m		100	96.5	93.3	80.6	67.1	44.9	34.2	22.3			8.1	2.185	22.0	0.2	
10	RH - 12	DT/ST	496+000 LT 2.60m			100	96.6	79.7	67.3	48.0	41.7	27.9			7.9	2.209	12.6	0.2	
11	RH - 16	DT/ST	10+000 RT 2.50m		100	97.7	89.4	81.3	63.6	50.8	39.1	23.0			8.8	2.239	13.6	0.4	
12	RH - 16	DT/ST	16+000 LT 2.60m				100	94.6	41.5	28.4	20.5	15.0			7.4	2.195	16.5	0.1	
13	RH - 25	DT/ST	8+000 RT 2.20m			100	99.6	90.4	69.4	43.2	29.3	16.9			11.5	2.124	18.0	0.4	
14	RH - 25	DT/ST	15+000 LT 2.00m				100	96.3	75.6	43.7	32.8	24.2			12.6	2.094	15.0	0.3	
15	RH - 27	DT/ST	9+000 RT 2.20m		100	96.4	92.0	87.6	75.0	59.3	50.4	43.9			10.2	2.187	11.1	0.2	
16	RH - 27	DT/ST	17+000 LT 1.90m																

Result of Soil Test (Base)

No.	Route No.	Surface Type	Section	HRB Classi-fication	Sieve Analysis % Passing								Plasticity		Comp. DH-T.....		Lab. C.B.R.		Remarks
					50	25	19	9.5	#4	#10	#40	#200	LL.	PI.	Opt. Mc.%	γd (gm/cc)	C.B.R.	Swell (%)	
1	RT - 224	AC	11+000 RT 2.80m	A-1-a	100	90.4	75.6	43.2	23.8	13.3	6.3	4.1	N - P		7.6	2.260	74.2	-	
2	RT - 224	AC	18+000 LT 2.00m	A-1-a	100	81.7	65.3	35.8	13.7	9.1	4.5	2.5	N - P		7.6	2.243	79.0	-	
3	RH - 21	AC	124+000 RT 5.50m	A-1-a	100	68.9	55.1	38.4	29.3	21.1	11.0	6.2	N - P		5.8	2.319	80.3	-	
4	RH - 21	AC	129+000 RT 5.30m	A-1-a	100	75.5	67.4	52.7	41.5	27.6	11.5	5.7	N - P		6.7	2.316	188.0	-	
5	RH - 22	PM	3+000 RT 2.35m	A-1-a	100	78.6	65.1	47.2	37.0	27.7	21.2	11.4	N - P		5.1	2.279	88.6	-	
6	RH - 22	PM	6+000 LT 2.30m	A-1-a	100	93.2	80.1	54.7	37.8	23.8	11.7	7.9	N - P		6.1	2.290	82.0	-	
7	RH - 5	PM	25+000 RT 2.80m	A-1-a	100	93.1	85.4	62.7	38.9	14.9	4.3	1.8	N - P		9.3	1.936	58.5	-	
8	RH - 5	PM	32+000 LT 2.20m																
9	RH - 12	DT/ST	490+000 RT 2.30m	A-1-a	100	85.5	73.9	46.8	33.7	21.9	11.0	7.8	N - P		5.1	2.307	115.0	-	
10	RH - 12	DT/ST	496+000 LT 2.60m	A-1-a	100	95.6	83.7	56.0	42.4	28.9	20.0	12.5	N - P		7.0	2.286	90.0	-	
11	RH - 16	DT/ST	10+000 RT 2.50m	A-1-a	100	80.2	70.9	53.9	43.2	26.7	13.5	8.8	N - P		6.5	2.306	117.0	-	
12	RH - 16	DT/ST	16+000 LT 2.60m	A-1-a	100	87.0	71.3	43.6	31.1	17.2	8.4	4.8	N - P		7.0	2.270	92.0	-	
13	RH - 25	DT/ST	8+000 RT 2.20m	A-1-a	100	71.6	57.5	37.6	28.5	21.3	11.0	6.8	N - P		7.5	2.302	74.3	-	
14	RH - 25	DT/ST	15+000 LT 2.00m	A-1-a	100	90.9	74.5	48.7	29.8	21.8	12.8	8.4	N - P		7.6	2.233	89.0	-	
15	RH - 27	DT/ST	9+000 RT 2.20m	A-1-a	100	83.2	70.6	51.4	40.0	26.9	16.0	11.0	N - P		6.7	2.327	126.0	-	
16	RH - 27	DT/ST	17+000 LT 1.90m	A-1-a	100	94.7	87.0	71.8	53.5	29.7	18.3	12.9	N - P		6.5	2.290	110.0	-	

APPENDIX 4.2.5 STIFFNESS OF EXISTING ASPHALT CONCRETE

Route No. Section	Penetration P	Softening Point TRB	Penetration Index P.I.	Cv	Sm (kg/cm^2)	
					CASE 1	CASE 2
RT - 224 11 + 500	22.6	70	1.029	0.887	20500 ($T = 36^oC$)	28100 ($T = 32.2^oC$)
RT - 224 16 + 000	49.6	53	-0.491	0.890	5100 ($T = 36^oC$)	9000 ($T = 32.2^oC$)

(1) PI : Penetration index of bitumen defined in the following equation.

$$\frac{\log 800 - \log P}{T - 25} = \frac{20 - PI}{10 + PI} \times \frac{1}{50}$$

(2) Cv : Concentration of mineral aggregate percent by volume

$$Cv = \frac{\text{Volume of Mineral aggregate}}{\text{Volume of (Mineral aggregate + asphalt)}}$$

(3) Sm : Stiffness of existing asphalt concrete defined by the equation below:

$$Sm = Sb\left(1 + \frac{2.5}{n} \times \frac{Cv}{1 - Cv}\right)^n$$

where,

$$n = 0.83 \log\left(\frac{4 \times 10^5}{Sb}\right)$$

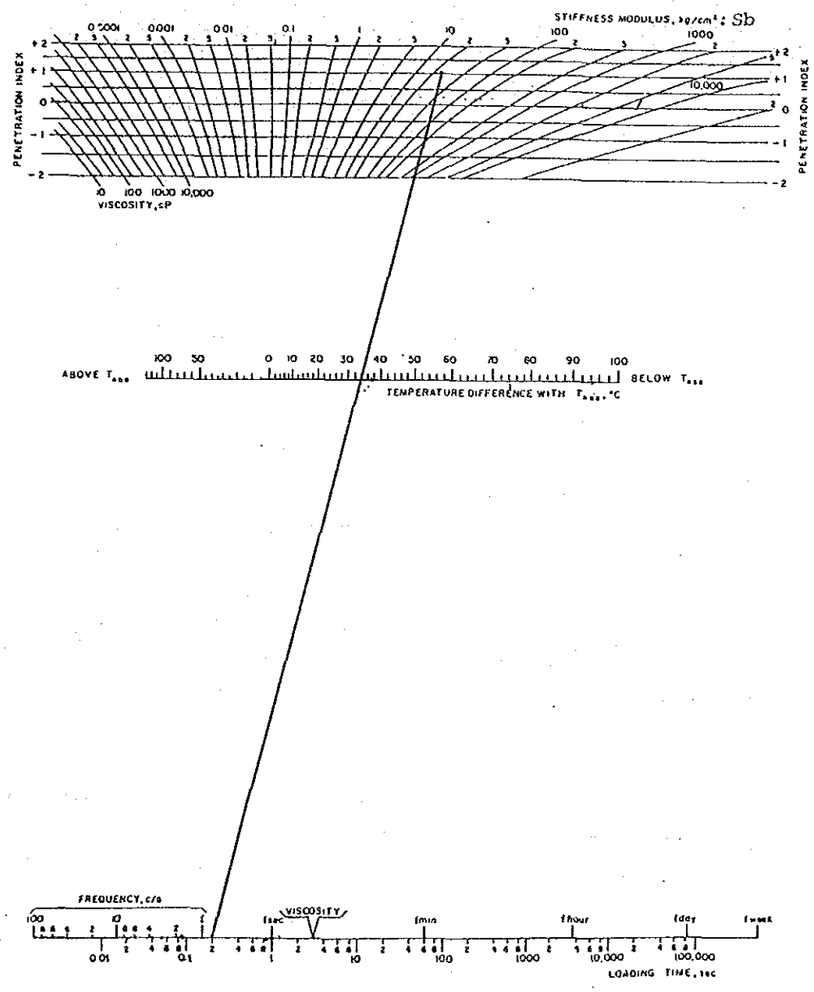
Sb : Stiffness of bitumen
(derived from Figure 1 in assuming the Loading Time = 0.192 second)

Temperature difference = TRB - T

CASE 1: T = pavement temperture

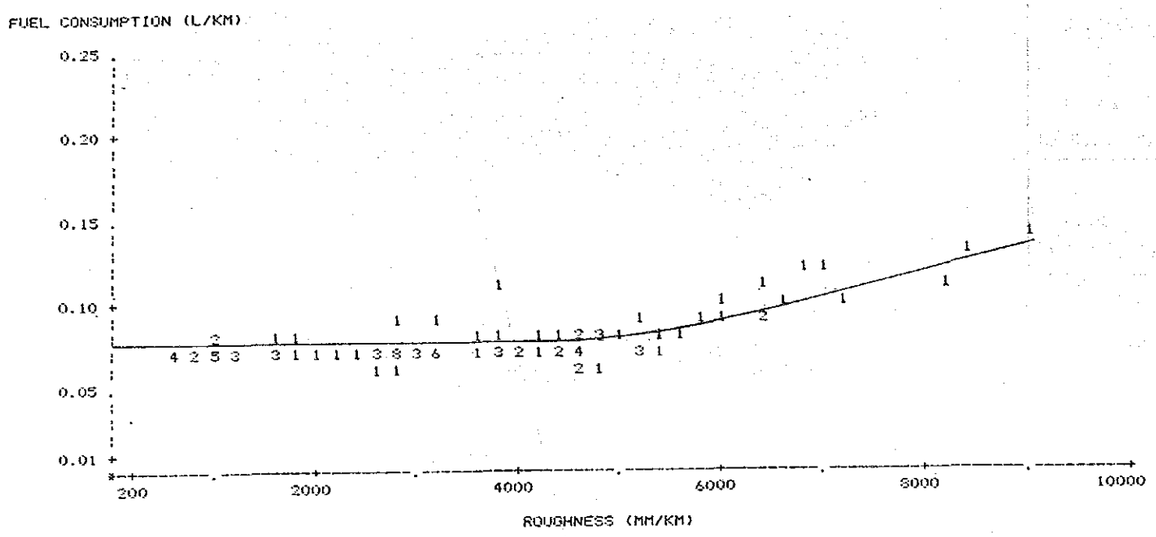
CASE 2: $T = 90^oF$ (32.2^oC)

Figure 1 Graphical Determination of Stiffness



APPENDIX 4.2.6 RESULTS OF FUEL CONSUMPTION SURVEY

FIGURE 1 RELATIONSHIP BETWEEN FUEL CONSUMPTION AND ROUGHNESS



ROUGHNESS < 5500

VARIABLE	AVERAGE	STANDARD DEVIATION
X : ROUGHNESS (MM/KM)	X = 3107	S(X) = 1402
Y : FUEL CONSUMPTION (L/KM)	Y = 0.0758	S(Y) = 0.0075

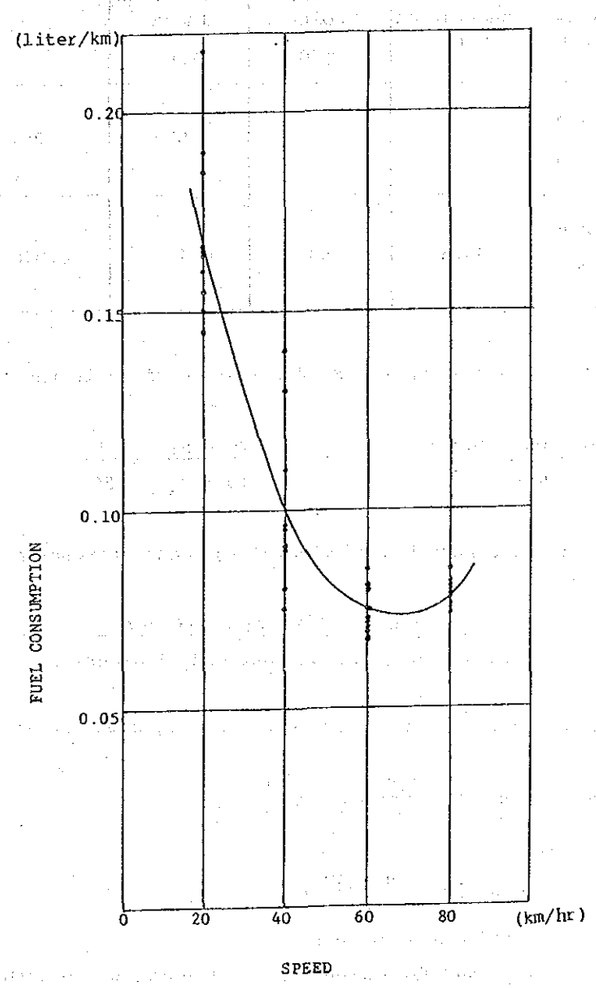
NUMBER OF DATA = 81

ROUGHNESS >= 5500

VARIABLE	AVERAGE	STANDARD DEVIATION
X : ROUGHNESS (MM/KM)	X = 6850	S(X) = 1024
Y : FUEL CONSUMPTION (L/KM)	Y = 0.1064	S(Y) = 0.0162

NUMBER OF DATA = 15

FIGURE 2 FUEL CONSUMPTION RATES AT DIFFERENT SPEEDS



APPENDIX 4.3.1 DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

****
* *
* RT - 224 (224 - 0100) *
* *
****

YEAR OF CONSTRUCTION : 1968

ASSUMED OPENING YEAR : 1969

DESIGN LANE FACTOR : 0.5

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	3.8	5.2
1982 - 1987	3.8	5.2
1988 - 2001	3.8	3.8

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1969	352	187	228	235	181	210	619	1393
1970	366	194	237	248	191	221	649	1457
1971	380	201	246	260	201	233	680	1521
1972	394	209	255	274	211	245	711	1588
1973	534	375	290	354	200	251	741	2004
1974	470	340	279	370	356	302	937	2117
1975	505	310	247	484	285	258	790	2089
1976	503	322	278	502	398	319	995	2322
1977	555	354	336	731	423	321	1080	2720
1978	472	305	392	735	675	321	1388	2900
1979	518	328	342	892	421	370	1133	2871
1980	377	249	304	871	481	294	1079	2576
1981	492	174	437	791	531	369	1337	2794
1982	440	221	451	876	490	390	1331	2868
1983	606	331	552	1016	543	449	1544	3497
1984	629	344	573	1069	571	472	1616	3658
1985	653	357	595	1124	601	497	1693	3827
1986	678	370	617	1183	632	523	1772	4003
1987	703	384	641	1244	665	550	1856	4187
1988	730	399	665	1309	700	579	1944	4382
1989	758	414	690	1359	726	601	2017	4548
1990	787	430	717	1410	754	623	2094	4721
1991	817	446	744	1464	782	647	2173	4900
1992	848	463	772	1520	812	672	2256	5087
1993	880	481	802	1577	843	697	2342	5280
1994	913	499	832	1637	875	724	2431	5480
1995	948	518	864	1700	908	751	2523	5689
1996	984	538	896	1764	943	780	2619	5905
1997	1021	558	930	1831	979	809	2718	6128
1998	1060	579	966	1901	1016	840	2822	6362
1999	1101	601	1003	1973	1055	872	2930	6605
2000	1142	624	1041	2048	1095	905	3041	6855
2001	1186	648	1080	2126	1136	939	3155	7115

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1969	32 (32)	41 (41)	19 (19)	92 (92)
1970	33 (65)	43 (84)	20 (39)	96 (188)
1971	34 (99)	45 (129)	21 (60)	100 (288)
1972	35 (134)	48 (177)	22 (82)	105 (393)
1973	40 (174)	45 (222)	23 (105)	108 (501)
1974	39 (213)	81 (303)	28 (133)	148 (649)
1975	34 (247)	64 (367)	24 (157)	122 (771)
1976	39 (286)	90 (457)	29 (186)	158 (929)
1977	47 (333)	96 (553)	29 (215)	172 (1101)
1978	54 (387)	153 (706)	29 (244)	236 (1337)
1979	47 (434)	95 (801)	34 (278)	176 (1513)
1980	42 (476)	109 (910)	27 (305)	178 (1691)
1981	61 (537)	120 (1030)	34 (339)	215 (1906)
1982	63 (600)	111 (1141)	36 (375)	210 (2116)
1983	77 (677)	123 (1264)	41 (416)	241 (2357)
1984	79 (756)	129 (1393)	43 (459)	251 (2608)
1985	83 (839)	136 (1529)	45 (504)	264 (2872)
1986	86 (925)	143 (1672)	48 (552)	277 (3149)
1987	89 (1014)	150 (1822)	50 (602)	289 (3438)
1988	92 (1106)	158 (1980)	53 (655)	303 (3741)
1989	96 (1202)	164 (2144)	55 (710)	315 (4056)
1990	99 (1301)	171 (2315)	57 (767)	327 (4383)
1991	103 (1404)	177 (2492)	59 (826)	339 (4722)
1992	107 (1511)	184 (2676)	61 (887)	352 (5074)
1993	111 (1622)	191 (2867)	64 (951)	366 (5440)
1994	115 (1737)	198 (3065)	66 (1017)	379 (5819)
1995	120 (1857)	205 (3270)	69 (1086)	394 (6213)
1996	124 (1981)	213 (3483)	71 (1157)	408 (6621)
1997	129 (2110)	222 (3705)	74 (1231)	425 (7046)
1998	134 (2244)	230 (3935)	77 (1308)	441 (7487)
1999	139 (2383)	239 (4174)	80 (1388)	458 (7945)
2000	144 (2527)	248 (4422)	83 (1471)	475 (8420)
2001	150 (2677)	257 (4679)	86 (1557)	493 (8913)

NOTE ; ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 300 DTN = 120

14 YEARS : ITN = 300 DTN = 276

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

RH - 21 (304 - 0904)

YEAR OF CONSTRUCTION : 1968

ASSUMED OPENING YEAR : 1969

DESIGN LANE FACTOR : 0.5

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	3.8	5.2
1982 - 1987	3.8	5.2
1988 - 2001	3.8	3.8

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1969	378	123	137	164	147	267	551	1216
1970	393	128	142	173	155	281	578	1272
1971	408	133	147	182	163	296	606	1329
1972	423	138	153	191	171	311	635	1387
1973	504	192	168	232	179	228	575	1503
1974	475	204	169	310	195	237	601	1590
1975	428	189	201	458	179	198	578	1653
1976	417	238	194	511	215	197	606	1772
1977	417	252	202	578	158	215	575	1822
1978	531	223	261	701	307	402	970	2425
1979	533	155	206	634	278	269	753	2075
1980	385	287	200	499	273	219	692	1863
1981	377	353	201	509	220	261	682	1921
1982	362	304	282	732	280	300	862	2260
1983	375	347	224	676	216	207	647	2045
1984	389	360	233	711	227	218	678	2138
1985	404	374	241	748	239	229	709	2235
1986	419	388	251	787	251	241	743	2337
1987	435	403	260	828	265	254	779	2445
1988	452	418	270	871	278	267	815	2556
1989	469	434	280	904	289	277	846	2653
1990	487	451	291	938	300	287	878	2754
1991	505	468	302	974	311	298	911	2858
1992	525	485	313	1011	323	310	946	2967
1993	545	504	325	1050	335	321	981	3080
1994	565	523	338	1089	348	334	1020	3197
1995	587	543	350	1131	361	346	1057	3318
1996	609	564	364	1174	375	359	1098	3445
1997	632	585	378	1218	389	373	1140	3575
1998	656	607	392	1265	404	387	1183	3711
1999	681	630	407	1313	419	402	1228	3852
2000	707	654	422	1363	435	417	1274	3998
2001	734	679	438	1414	452	433	1323	4150

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1969	19 (19)	33 (33)	24 (24)	76 (76)
1970	20 (39)	35 (68)	26 (50)	81 (157)
1971	20 (59)	37 (105)	27 (77)	84 (241)
1972	21 (80)	39 (144)	28 (105)	88 (329)
1973	23 (103)	41 (185)	21 (126)	85 (414)
1974	23 (126)	44 (229)	22 (148)	89 (503)
1975	28 (154)	41 (270)	18 (166)	87 (590)
1976	27 (181)	49 (319)	18 (184)	94 (684)
1977	28 (209)	36 (355)	20 (204)	84 (768)
1978	36 (245)	69 (424)	37 (241)	142 (910)
1979	29 (274)	63 (487)	25 (266)	117 (1027)
1980	28 (302)	62 (549)	20 (286)	110 (1137)
1981	28 (330)	50 (599)	24 (310)	102 (1239)
1982	39 (369)	63 (662)	27 (337)	129 (1368)
1983	31 (400)	49 (711)	19 (356)	99 (1467)
1984	32 (432)	51 (762)	20 (376)	103 (1570)
1985	33 (465)	54 (816)	21 (397)	108 (1678)
1986	35 (500)	57 (873)	22 (419)	114 (1792)
1987	36 (536)	60 (933)	23 (442)	119 (1911)
1988	37 (573)	63 (996)	24 (466)	124 (2035)
1989	39 (612)	65 (1061)	25 (491)	129 (2164)
1990	40 (652)	68 (1129)	26 (517)	134 (2298)
1991	42 (694)	70 (1199)	27 (544)	139 (2437)
1992	43 (737)	73 (1272)	28 (572)	144 (2581)
1993	45 (782)	76 (1348)	29 (601)	150 (2731)
1994	47 (829)	79 (1427)	30 (631)	156 (2887)
1995	49 (878)	82 (1509)	32 (663)	163 (3050)
1996	50 (928)	85 (1594)	33 (696)	168 (3218)
1997	52 (980)	88 (1682)	34 (730)	174 (3392)
1998	54 (1034)	91 (1773)	35 (765)	180 (3572)
1999	56 (1090)	95 (1868)	37 (802)	188 (3760)
2000	59 (1149)	98 (1966)	38 (840)	195 (3955)
2001	61 (1210)	102 (2068)	40 (880)	203 (4158)

NOTE : ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 125 DTN = 50

14 YEARS : ITN = 125 DTN = 115

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

****
* RH - 22 (2023 - 0100) *
****

YEAR OF CONSTRUCTION : 1973

ASSUMED OPENING YEAR : 1974

DESIGN LANE FACTOR : 0.5

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	6.6	4.5
1982 - 1987	6.6	4.5
1988 - 2001	5.5	3.6

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1972	330	815	70	133	254	115	439	1717
1973	396	857	72	130	418	152	642	2025
1974	434	910	62	144	241	149	452	1940
1975	227	864	62	411	283	121	466	1968
1976	231	890	61	514	282	152	495	2130
1977	247	881	56	507	208	198	462	2097
1978	421	930	56	540	233	255	544	2435
1979	444	933	59	552	244	229	532	2461
1980	469	807	49	510	231	211	491	2277
1981	585	833	51	541	285	246	582	2541
1982	420	437	34	331	180	148	362	1550
1983	485	558	44	736	262	220	526	2305
1984	517	595	47	769	274	230	551	2432
1985	551	634	50	804	286	240	576	2565
1986	588	676	53	840	299	251	603	2707
1987	626	721	57	878	312	262	631	2856
1988	668	768	61	917	326	274	661	3014
1989	704	810	64	950	338	284	686	3150
1990	743	855	67	984	350	294	711	3293
1991	784	902	71	1020	363	305	739	3445
1992	827	952	75	1057	376	316	767	3603
1993	873	1004	79	1095	390	327	796	3768
1994	921	1059	84	1134	404	339	827	3941
1995	971	1117	88	1175	418	351	857	4120
1996	1025	1179	93	1217	433	364	890	4311
1997	1081	1244	98	1261	449	377	924	4510
1998	1140	1312	103	1306	465	390	958	4716
1999	1203	1384	109	1353	482	405	996	4936
2000	1269	1460	115	1402	499	419	1033	5164
2001	1339	1541	121	1453	517	434	1072	5405

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1974	9 (9)	55 (55)	14 (14)	78 (78)
1975	9 (18)	64 (119)	11 (25)	84 (162)
1976	8 (26)	64 (183)	14 (39)	86 (248)
1977	8 (34)	47 (230)	18 (57)	73 (321)
1978	8 (42)	53 (283)	23 (80)	84 (405)
1979	8 (50)	55 (338)	21 (101)	84 (489)
1980	7 (57)	52 (390)	19 (120)	78 (567)
1981	7 (64)	64 (454)	22 (142)	93 (660)
1982	5 (69)	41 (495)	14 (156)	60 (720)
1983	6 (75)	59 (554)	20 (176)	85 (805)
1984	7 (82)	62 (616)	21 (197)	90 (895)
1985	7 (89)	65 (681)	22 (219)	94 (989)
1986	7 (96)	68 (749)	23 (242)	98 (1087)
1987	8 (104)	71 (820)	24 (266)	103 (1190)
1988	8 (112)	74 (894)	25 (291)	107 (1297)
1989	9 (121)	76 (970)	26 (317)	111 (1408)
1990	9 (130)	79 (1049)	27 (344)	115 (1523)
1991	10 (140)	82 (1131)	28 (372)	120 (1643)
1992	10 (150)	85 (1216)	29 (401)	124 (1767)
1993	11 (161)	88 (1304)	30 (431)	129 (1896)
1994	12 (173)	91 (1395)	31 (462)	134 (2030)
1995	12 (185)	95 (1490)	32 (494)	139 (2169)
1996	13 (198)	98 (1588)	33 (527)	144 (2313)
1997	14 (212)	102 (1690)	34 (561)	150 (2463)
1998	14 (226)	105 (1795)	36 (597)	155 (2618)
1999	15 (241)	109 (1904)	37 (634)	161 (2779)
2000	16 (257)	113 (2017)	38 (672)	167 (2946)
2001	17 (274)	117 (2134)	40 (712)	174 (3120)

NOTE ; ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 97 DTN = 38

14 YEARS : ITN = 97 DTN = 87

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

RH - 5 (201 - 0102)

YEAR OF CONSTRUCTION : 1970

ASSUMED OPENING YEAR : 1971

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	4.0	5.0
1982 - 1987	4.0	5.0
1988 - 2001	4.0	4.0

DESIGN LANE FACTOR : 0.5

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1971	99	143	39	70	60	51	150	462
1972	103	149	41	74	63	54	158	484
1973	123	196	43	93	75	68	186	598
1974	172	165	76	82	92	76	244	663
1975	168	226	54	110	141	69	264	768
1976	292	228	66	139	107	52	225	884
1977	312	198	68	202	110	84	262	974
1978	292	228	77	164	138	101	316	1000
1979	407	290	97	125	130	144	371	1193
1980	351	172	121	166	153	154	428	1117
1981	375	152	102	149	137	137	376	1052
1982	425	165	127	207	199	125	451	1248
1983	376	155	124	218	163	140	427	1176
1984	391	161	129	229	171	147	447	1228
1985	407	168	134	240	180	154	468	1283
1986	423	174	139	252	189	162	490	1339
1987	440	181	145	265	198	170	513	1399
1988	457	189	151	278	208	179	538	1462
1989	476	196	157	289	216	186	559	1520
1990	495	204	163	301	225	193	581	1581
1991	515	212	170	313	234	201	605	1645
1992	535	221	176	325	243	209	628	1709
1993	557	229	184	339	253	217	654	1779
1994	579	239	191	352	263	226	680	1850
1995	602	248	199	366	274	235	708	1924
1996	626	258	206	381	285	245	736	2001
1997	651	268	215	396	296	254	765	2080
1998	677	279	223	412	308	264	795	2163
1999	704	290	232	428	320	275	827	2249
2000	732	302	242	445	333	286	861	2340
2001	762	314	251	463	346	298	895	2434

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1971	5 (5)	14 (14)	5 (5)	24 (24)
1972	6 (11)	14 (28)	5 (10)	25 (49)
1973	6 (17)	17 (45)	6 (16)	29 (78)
1974	11 (28)	21 (66)	7 (23)	39 (117)
1975	7 (35)	32 (98)	6 (29)	45 (162)
1976	9 (44)	24 (122)	5 (34)	38 (200)
1977	9 (53)	25 (147)	8 (42)	42 (242)
1978	11 (64)	31 (178)	9 (51)	51 (293)
1979	13 (77)	29 (207)	13 (64)	55 (348)
1980	17 (94)	35 (242)	14 (78)	66 (414)
1981	14 (108)	31 (273)	13 (91)	58 (472)
1982	18 (126)	45 (318)	11 (102)	74 (546)
1983	17 (143)	37 (355)	13 (115)	67 (613)
1984	18 (161)	39 (394)	13 (128)	70 (683)
1985	19 (180)	41 (435)	14 (142)	74 (757)
1986	19 (199)	43 (478)	15 (157)	77 (834)
1987	20 (219)	45 (523)	16 (173)	81 (915)
1988	21 (240)	47 (570)	16 (189)	84 (999)
1989	22 (262)	49 (619)	17 (206)	88 (1087)
1990	23 (285)	51 (670)	18 (224)	92 (1179)
1991	24 (309)	53 (723)	18 (242)	95 (1274)
1992	24 (333)	55 (778)	19 (261)	98 (1372)
1993	26 (359)	57 (835)	20 (281)	103 (1475)
1994	26 (385)	60 (895)	21 (302)	107 (1582)
1995	28 (413)	62 (957)	21 (323)	111 (1693)
1996	29 (442)	64 (1021)	22 (345)	115 (1808)
1997	30 (472)	67 (1088)	23 (368)	120 (1928)
1998	31 (503)	70 (1158)	24 (392)	125 (2053)
1999	32 (535)	72 (1230)	25 (417)	129 (2182)
2000	34 (569)	75 (1305)	26 (443)	135 (2317)
2001	35 (604)	78 (1383)	27 (470)	140 (2457)

NOTE : ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 77 DTN = 31

14 YEARS : ITN = 77 DTN = 71

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

****
* *
* RH - 12 (207 - 0202) *
* *
****

YEAR OF CONSTRUCTION : 1977

ASSUMED OPENING YEAR : 1978

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	4.0	5.0
1982 - 1987	4.0	5.0
1988 - 2001	4.0	4.0

DESIGN LANE FACTOR : 0.5

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1972	24	50	43	20	28	19	90	184
1973	40	70	60	33	29	28	117	260
1974	73	131	147	49	81	35	263	516
1975	41	79	70	33	32	23	125	278
1976	63	72	85	35	33	17	135	305
1977	92	139	126	101	73	51	250	582
1978	109	131	107	97	57	29	193	530
1979	74	78	45	74	29	24	98	324
1980	91	76	56	62	44	19	119	348
1981	127	83	44	88	43	44	131	429
1982	153	94	69	77	43	45	157	481
1983	292	58	70	237	148	144	362	949
1984	304	60	73	249	155	151	379	992
1985	316	63	76	261	163	159	398	1038
1986	328	65	79	274	171	167	417	1084
1987	342	68	82	288	180	175	437	1135
1988	355	71	85	302	189	184	458	1186
1989	369	73	89	315	196	191	476	1233
1990	384	76	92	327	204	199	495	1282
1991	400	79	96	340	212	207	515	1334
1992	416	83	100	354	221	215	536	1389
1993	432	86	104	368	230	224	558	1444
1994	450	89	108	383	239	233	580	1502
1995	468	93	112	398	249	242	603	1562
1996	486	97	117	414	259	252	628	1625
1997	506	100	121	431	269	262	652	1689
1998	526	104	126	448	280	272	678	1756
1999	547	109	131	466	291	283	705	1827
2000	569	113	136	484	302	294	732	1898
2001	592	117	142	504	315	306	763	1976

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1978	15 (15)	13 (13)	3 (3)	31 (31)
1979	6 (21)	7 (20)	2 (5)	15 (46)
1980	8 (29)	10 (30)	2 (7)	20 (66)
1981	6 (35)	10 (40)	4 (11)	20 (86)
1982	10 (45)	10 (50)	4 (15)	24 (110)
1983	10 (55)	33 (83)	13 (28)	56 (166)
1984	10 (65)	35 (118)	14 (42)	59 (225)
1985	11 (76)	37 (155)	15 (57)	63 (288)
1986	11 (87)	39 (194)	15 (72)	65 (353)
1987	11 (98)	41 (235)	16 (88)	68 (421)
1988	12 (110)	43 (278)	17 (105)	72 (493)
1989	12 (122)	44 (322)	17 (122)	73 (566)
1990	13 (135)	46 (368)	18 (140)	77 (643)
1991	13 (148)	48 (416)	19 (159)	80 (723)
1992	14 (162)	50 (466)	20 (179)	84 (807)
1993	14 (176)	52 (518)	20 (199)	86 (893)
1994	15 (191)	54 (572)	21 (220)	90 (983)
1995	16 (207)	56 (628)	22 (242)	94 (1077)
1996	16 (223)	59 (687)	23 (265)	98 (1175)
1997	17 (240)	61 (748)	24 (289)	102 (1277)
1998	17 (257)	63 (811)	25 (314)	105 (1382)
1999	18 (275)	66 (877)	26 (340)	110 (1492)
2000	19 (294)	68 (945)	27 (367)	114 (1606)
2001	20 (314)	71 (1016)	28 (395)	119 (1725)

NOTE : ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 66 DTN = 26

14 YEARS : ITN = 66 DTN = 61

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

RH - 16 (214 - 0100)

YEAR OF CONSTRUCTION : 1963 YEAR OF REHABILITATION : 1976 ASSUMED OPENING YEAR : 1977

DESIGN LANE FACTOR : 0.5

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	3.8	5.2
1982 - 1987	3.8	5.2
1988 - 2001	3.8	3.8

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1972	94	263	17	83	36	12	65	505
1973	103	237	178	102	68	62	308	750
1974	137	269	237	117	118	3	358	881
1975	151	263	205	118	205	6	416	948
1976	130	214	172	138	138	40	350	832
1977	195	373	209	362	166	24	399	1329
1978	337	405	192	329	164	51	407	1478
1979	408	298	104	206	116	75	295	1207
1980	404	293	119	241	134	56	309	1247
1981	400	288	133	275	152	37	322	1285
1982	252	232	129	320	144	39	312	1116
1983	563	258	118	263	98	58	274	1358
1984	584	268	122	277	103	61	286	1415
1985	607	278	127	291	108	64	299	1475
1986	630	289	132	306	114	68	314	1539
1987	654	300	137	322	120	71	328	1604
1988	678	311	142	339	126	75	343	1671
1989	704	323	148	352	131	78	357	1736
1990	731	335	153	365	136	81	370	1801
1991	759	348	159	379	141	84	384	1870
1992	788	361	165	393	147	87	399	1941
1993	817	375	171	408	152	90	413	2013
1994	849	389	178	424	158	93	429	2091
1995	881	404	185	440	164	97	446	2171
1996	914	419	192	457	170	101	463	2253
1997	949	435	199	474	177	105	481	2339
1998	985	451	206	492	183	109	498	2426
1999	1023	469	214	511	190	113	517	2520
2000	1061	486	222	530	198	117	537	2614
2001	1102	505	231	550	205	121	557	2714

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1977	29 (29)	38 (38)	2 (2)	69 (69)
1978	27 (56)	37 (75)	5 (7)	69 (138)
1979	14 (70)	26 (101)	7 (14)	47 (185)
1980	17 (87)	30 (131)	5 (19)	52 (237)
1981	18 (105)	34 (165)	3 (22)	55 (292)
1982	18 (123)	33 (198)	4 (26)	55 (347)
1983	16 (139)	22 (220)	5 (31)	43 (390)
1984	17 (156)	23 (243)	6 (37)	46 (436)
1985	18 (174)	24 (267)	6 (43)	48 (484)
1986	18 (192)	26 (293)	6 (49)	50 (534)
1987	19 (211)	27 (320)	6 (55)	52 (586)
1988	20 (231)	29 (349)	7 (62)	56 (642)
1989	21 (252)	30 (379)	7 (69)	58 (700)
1990	21 (273)	31 (410)	7 (76)	59 (759)
1991	22 (295)	32 (442)	8 (84)	62 (821)
1992	23 (318)	33 (475)	8 (92)	64 (885)
1993	24 (342)	34 (509)	8 (100)	66 (951)
1994	25 (367)	36 (545)	8 (108)	69 (1020)
1995	26 (393)	37 (582)	9 (117)	72 (1092)
1996	27 (420)	38 (620)	9 (126)	74 (1166)
1997	28 (448)	40 (660)	10 (136)	78 (1244)
1998	29 (477)	41 (701)	10 (146)	80 (1324)
1999	30 (507)	43 (744)	10 (156)	83 (1407)
2000	31 (538)	45 (789)	11 (167)	87 (1494)
2001	32 (570)	46 (835)	11 (178)	89 (1583)

NOTE : ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 43 DTN = 17

14 YEARS : ITN = 43 DTN = 40

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

****
* *
* RH - 25 (2071 - 0100) *
* *
****

YEAR OF CONSTRUCTION : 1976

ASSUMED OPENING YEAR : 1977

DESIGN LANE FACTOR : 0.5

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	7.0	5.0
1982 - 1987	7.0	5.0
1988 - 2001	6.0	4.0

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1972	86	21	32	32	31	28	91	230
1973	87	23	33	36	41	30	104	250
1974	107	41	43	62	77	63	183	393
1975	136	135	54	124	106	70	230	625
1976	143	60	53	172	82	63	198	573
1977	120	39	57	269	115	62	234	662
1978	125	39	55	298	162	60	277	739
1979	102	82	63	280	247	65	375	839
1980	127	59	59	332	267	100	426	944
1981	144	46	69	270	152	61	282	742
1982	156	42	69	282	285	139	493	973
1983	151	33	69	348	350	132	551	1083
1984	162	35	74	365	367	139	580	1142
1985	173	38	79	384	386	146	611	1206
1986	185	40	85	403	405	153	643	1271
1987	198	43	90	423	425	160	675	1339
1988	212	46	97	444	447	168	712	1414
1989	224	49	103	462	465	175	743	1478
1990	238	52	109	480	483	182	774	1544
1991	252	55	115	500	502	190	807	1614
1992	267	58	122	520	523	197	842	1687
1993	283	62	130	540	543	205	878	1763
1994	300	66	137	562	565	213	915	1843
1995	318	70	146	584	588	222	956	1928
1996	338	74	154	608	611	231	996	2016
1997	358	78	164	632	636	240	1040	2108
1998	379	83	173	657	661	249	1083	2202
1999	402	88	184	684	688	259	1131	2305
2000	426	93	195	711	715	270	1180	2410
2001	452	99	206	740	744	281	1231	2522

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

YEAR	HB	MT	HT	HV
1977	8 (8)	26 (26)	6 (6)	40 (40)
1978	8 (16)	37 (63)	5 (11)	50 (90)
1979	9 (25)	56 (119)	6 (17)	71 (161)
1980	8 (33)	60 (179)	9 (26)	77 (238)
1981	10 (43)	34 (213)	6 (32)	50 (288)
1982	10 (53)	64 (277)	13 (45)	87 (375)
1983	10 (63)	79 (356)	12 (57)	101 (476)
1984	10 (73)	83 (439)	13 (70)	106 (582)
1985	11 (84)	87 (526)	13 (83)	111 (693)
1986	12 (96)	92 (618)	14 (97)	118 (811)
1987	12 (108)	96 (714)	15 (112)	123 (934)
1988	13 (121)	101 (815)	15 (127)	129 (1063)
1989	14 (135)	105 (920)	16 (143)	135 (1198)
1990	15 (150)	109 (1029)	17 (160)	141 (1339)
1991	16 (166)	114 (1143)	17 (177)	147 (1486)
1992	17 (183)	118 (1261)	18 (195)	153 (1639)
1993	18 (201)	123 (1384)	19 (214)	160 (1799)
1994	19 (220)	128 (1512)	19 (233)	166 (1965)
1995	20 (240)	133 (1645)	20 (253)	173 (2138)
1996	21 (261)	138 (1783)	21 (274)	180 (2318)
1997	23 (284)	144 (1927)	22 (296)	189 (2507)
1998	24 (308)	150 (2077)	23 (319)	197 (2704)
1999	26 (334)	156 (2233)	24 (343)	206 (2910)
2000	27 (361)	162 (2395)	25 (368)	214 (3124)
2001	29 (390)	168 (2563)	26 (394)	223 (3347)

NOTE ; ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 96 DTN = 38

14 YEARS : ITN = 96 DTN = 89

DAILY TRAFFIC VOLUME AND EQUIVALENT STANDARD 8.2 TON AXLE NUMBERS

RH - 27 (2160 - 0100)

YEAR OF CONSTRUCTION : 1974 YEAR OF REHABILITATION : 1977 ASSUMED OPENING YEAR : 1978

TRAFFIC GROWTH RATE

YEAR	PASSENGER	FREIGHT
- 1981	6.6	4.5
1982 - 1987	6.6	4.5
1988 - 2001	5.5	3.6

DESIGN LANE FACTOR : 0.5

ESA CONVERSION FACTOR

HB	MT	HT
0.76	1.24	0.50

DAILY TRAFFIC VOLUME

YEAR	PC	LB	HB	LT	MT	HT	HV	AADT
1972	14	14	24	14	19	10	53	95
1973	14	14	24	14	19	10	53	95
1974	9	9	20	15	16	7	43	76
1975	30	12	29	13	24	5	58	113
1976	44	16	32	28	20	9	61	149
1977	35	22	31	26	53	11	95	178
1978	54	38	30	38	40	20	90	220
1979	66	45	40	55	43	15	98	264
1980	106	37	30	95	56	65	151	389
1981	62	35	29	74	67	25	121	292
1982	59	43	34	91	91	38	163	356
1983	76	71	33	400	115	42	190	737
1984	81	76	35	418	120	44	199	774
1985	86	81	37	437	126	46	209	813
1986	92	86	40	456	131	48	219	853
1987	98	92	43	477	137	50	230	897
1988	105	98	45	498	143	52	240	941
1989	110	103	48	516	148	54	250	979
1990	116	109	51	535	154	56	261	1021
1991	123	115	53	554	159	58	270	1062
1992	130	121	56	574	165	60	281	1106
1993	137	128	59	595	171	62	292	1152
1994	144	135	63	616	177	65	305	1200
1995	152	142	66	638	184	67	317	1249
1996	161	150	70	661	190	69	329	1301
1997	169	158	74	685	197	72	343	1355
1998	179	167	78	710	204	75	357	1413
1999	189	176	82	736	211	77	370	1471
2000	199	186	86	762	219	80	385	1532
2001	210	196	91	789	227	83	401	1596

EQUIVALENT STANDARD 8.2 TON AXLE NUMBER (ESA) [UNIT : X 1000]

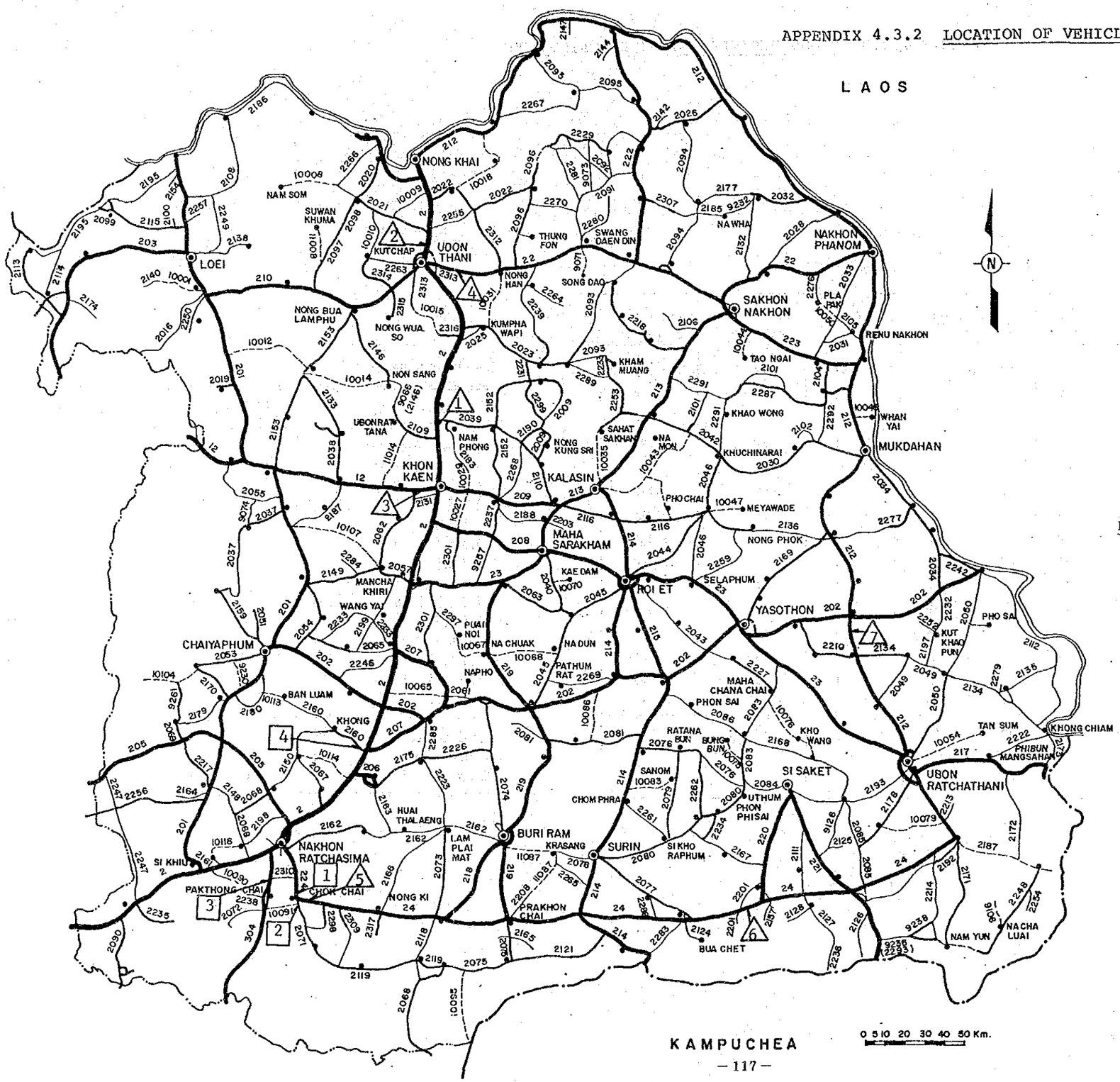
YEAR	HB	MT	HT	HV
1978	4 (4)	9 (9)	2 (2)	15 (15)
1979	6 (10)	10 (19)	1 (3)	17 (32)
1980	4 (14)	13 (32)	6 (9)	23 (55)
1981	4 (18)	15 (47)	2 (11)	21 (76)
1982	5 (23)	21 (68)	3 (14)	29 (105)
1983	5 (28)	26 (94)	4 (18)	35 (140)
1984	5 (33)	27 (121)	4 (22)	36 (176)
1985	5 (38)	29 (150)	4 (26)	38 (214)
1986	6 (44)	30 (180)	4 (30)	40 (254)
1987	6 (50)	31 (211)	5 (35)	42 (296)
1988	6 (56)	32 (243)	5 (40)	43 (339)
1989	7 (63)	33 (276)	5 (45)	45 (384)
1990	7 (70)	35 (311)	5 (50)	47 (431)
1991	7 (77)	36 (347)	5 (55)	48 (479)
1992	8 (85)	37 (384)	5 (60)	50 (529)
1993	8 (93)	39 (423)	6 (66)	53 (582)
1994	9 (102)	40 (463)	6 (72)	55 (637)
1995	9 (111)	42 (505)	6 (78)	57 (694)
1996	10 (121)	43 (548)	6 (84)	59 (753)
1997	10 (131)	45 (593)	7 (91)	62 (815)
1998	11 (142)	46 (639)	7 (98)	64 (879)
1999	11 (153)	48 (687)	7 (105)	66 (945)
2000	12 (165)	50 (737)	7 (112)	69 (1014)
2001	13 (178)	51 (788)	8 (120)	72 (1086)

NOTE ; ( ) = CUMULATION SINCE ASSUMED OPENING YEAR

INITIAL TRAFFIC NUMBER (ITN) & DESIGN TRAFFIC NUMBER (DTN)

7 YEARS : ITN = 32 DTN = 13
14 YEARS : ITN = 32 DTN = 29

APPENDIX 4.3.2 LOCATION OF VEHICLE GROSS WEIGHT SURVEYS



LEGEND

- NATIONAL HIGHWAYS (Paved)
- PROVINCIAL ROADS (Paved)
- PROVINCIAL ROADS (Unpaved)
- RURAL ROADS (Unpaved)
- CHANGWAT
- AMPHOE
- BOUNDARY OF COUNTRY
- BOUNDARY OF PROVINCE
- 2, 2096 HIGHWAYS , ROAD NUMBERS
- △ : Surveyed by DOH (1980)
- □ : Surveyed by JICA TEAM (1984)

Location No.	Route	Km Post
△ 1	2	479 + 0
△ 2	2	572 + 200
△ 3	12	8 + 0
△ 4	22	10 + 800
△ 5	24	6 + 500
△ 6	24	222 + 800
△ 7	212	68 + 800
□ 1	224	23 + 000
□ 2	2071	2 + 000
□ 3	304	121 + 000
□ 4	2160	3 + 000

APPENDIX 4.3.3 GROSS VEHICLE WEIGHT DISTRIBUTION

(6-Wheel Trucks)

Gross Weight (tons)		Location 1/ D1	D2	D3	D4	D5	D6	D7	(1) Total (No.)	Location J1	J2	J3	J4	(2) Total (No.)	(1) + (2) Total (No.)	(1) + (2) Share (%)
3.5- 4.5	4	1							1	25	10	7		42	43	9.287
4.5- 5.5	5	3		5	1				9		1			1	10	2.160
5.5- 6.5	6	3		7	4	1	2		17	1				1	18	3.888
6.5- 7.5	7	9	2	5	8	3	3		30	1				1	31	6.695
7.5- 8.5	8	12	2	3	13	7	2	2	41			1		1	42	9.071
8.5- 9.5	9	11	6	1	13	9	1	2	43	2				2	45	9.719
9.5-10.5	10	13	8	4	15	9	3	2	54	2		1		3	57	12.311
10.5-11.5	11	9	3	5	15	1	3	2	38	1		1	4	6	44	9.503
11.5-12.5	12	5	7	1	13	1	2	2	31	5		11	13	29	60	12.960
12.5-13.5	13	3	5	3	4	4		2	21	6	1	4		11	32	6.911
13.5-14.5	14	4	4	2	10	12	1	3	36	4		2	2	8	44	9.503
14.5-15.5	15	6		2	2	2			12	4		2		6	18	3.888
15.5-16.5	16	2	2	1	2	1			8	2	1	2	2	7	15	3.240
16.5-17.5	17		1		1				2			1		1	3	0.648
17.5-18.5	18									1				1	1	0.216
Total	Loaded	81	40	39	101	50	17	15	343	54	13	32	21	120	463	100
	Loaded +Empty	305	256	274	421	336	64	62	1718	91	36	48	44	219		
Empty	Rate(%)	73	84	86	76	85	73	76	80	41	64	33	52	45		

(HEAVY BUSES)

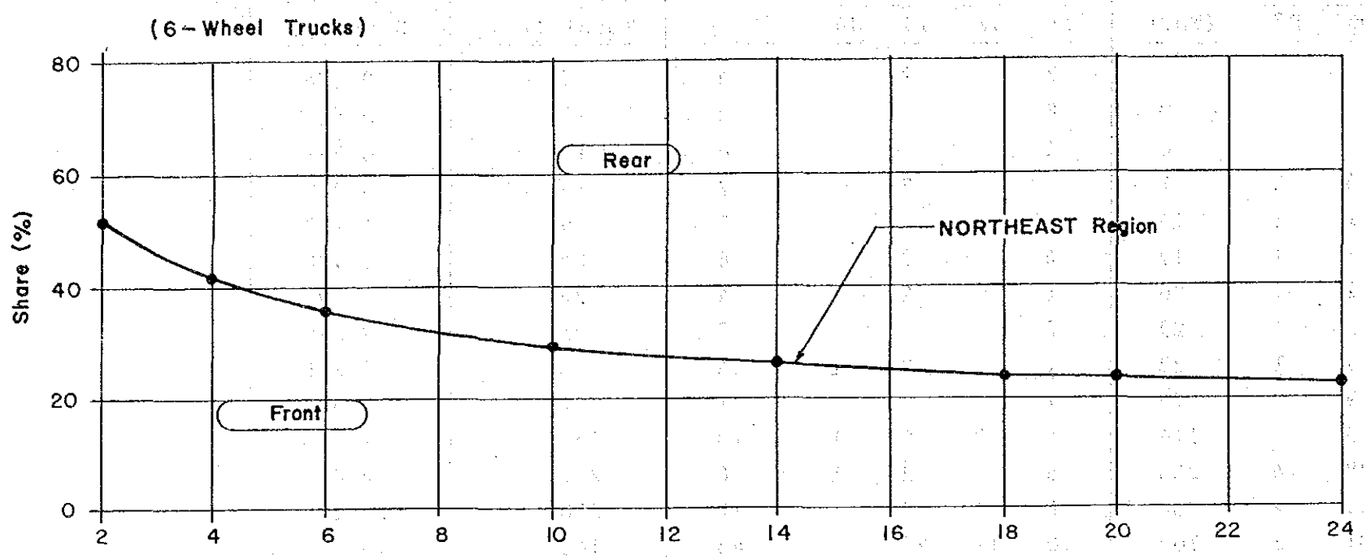
Gross Weight (Tons) Range	Average	LOCATION 1	2	3	4	Total (No.)	Share (%)
1.5-2.5	2						
2.5-3.5	3						
3.5-4.5	4						
4.5-5.5	5						
5.5-6.5	6						
6.5-7.5	7			1		1	0.75%
7.5-8.5	8	20		16		36	26.87%
8.5-9.5	9	25		17		42	31.34%
9.5-10.5	10	17		6	1	24	17.91%
10.5-11.5	11	18		6		24	17.91%
11.5-12.5	12	5		1		6	4.48%
12.5-13.5	13			1		1	0.75%
Total Loaded		85	0	48	1	134	
Loaded+Empty		85	0	48	1	134	
Empty Rate (%)		0%	0%	0%	0%	0%	

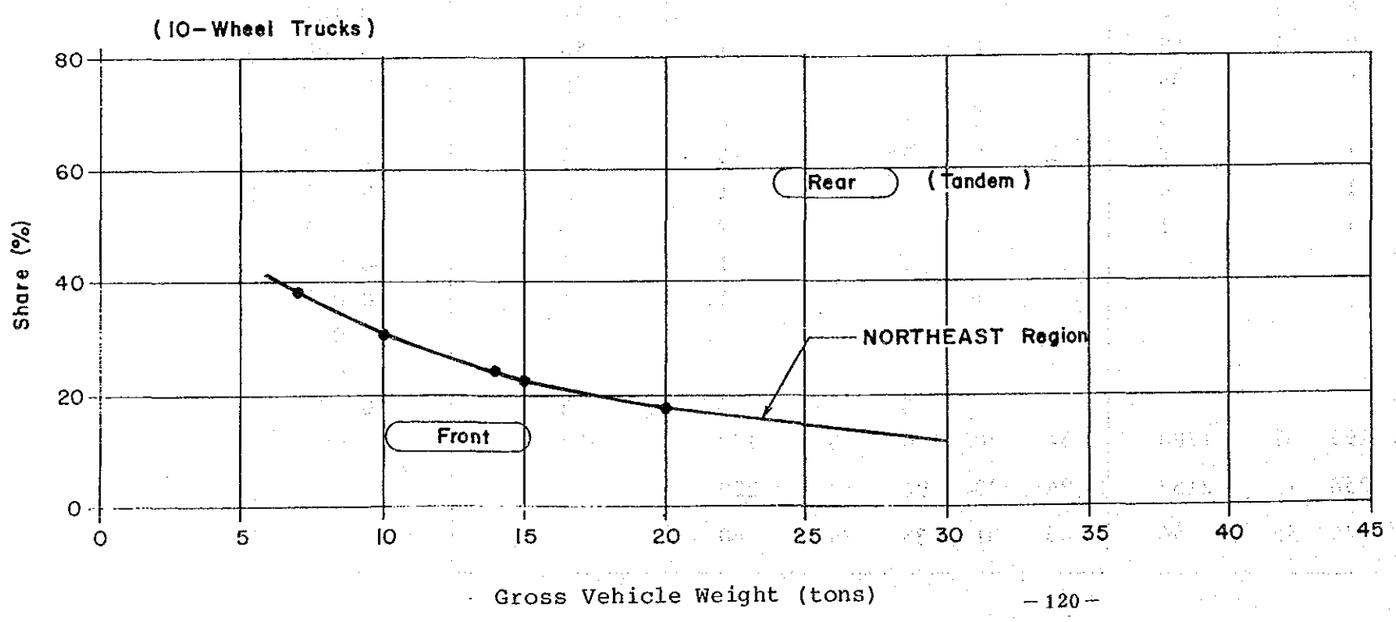
GROSS VEHICLE WEIGHT DISTRIBUTION

(10-Wheel Trucks)

Gross Weight (tons)		Location 1/ D1	D2	D3	D4	D5	D6	D7	(1) Total (No.)	Location J1	J2	J3	J4	(2) Total (No.)	(1) + (2) Total (no.)	(1) + (2) Share (%)
7.5- 8.5	8	1							1	2		2		4	5	0.374
8.5- 9.5	9	1		1				1	3	8				8	11	0.823
9.5-10.5	10	2	1	2				1	6	4				4	10	0.748
10.5-11.5	11	3	1	1			4	2	11			2		2	13	0.972
11.5-12.5	12	5	2	2	3		1	1	14	1				1	15	1.122
12.5-13.5	13	8	3	2	1	1	1	1	17	4		2		6	23	1.720
13.5-14.5	14	10	2	1	3	1	2	1	20	1	1	2		4	24	1.795
14.5-15.5	15	13	2	2	1	9	1	1	29	2				2	31	2.319
15.5-16.5	16	16	5	6	1	3	7	1	39	1		2	1	4	43	3.216
16.5-17.5	17	22	8	9	7	16	9	2	73	1				1	74	5.535
17.5-18.5	18	37	12	9	16	42	25	3	144	4	2	6	1	13	157	11.743
18.5-19.5	19	68	22	8	27	76	28	4	233	5		2	1	8	241	18.025
19.5-20.5	20	70	20	6	20	69	49	4	238	8	1	3		12	250	18.699
20.5-21.5	21	31	9	2	9	15	31	3	100	10	11	22		43	143	10.696
21.5-22.5	22	11	4	3	1	15	1	1	36			2		2	38	2.842
22.5-23.5	23	7	3	5	3	21	1	2	42	1	1	3		5	47	3.515
23.5-24.5	24	8	4	3	3	9	8	2	37	1				1	38	2.842
24.5-25.5	25	10	4	2	3	16	6	1	42						42	3.141
25.5-26.5	26	12	4	2	6	15	9	1	49		1			1	50	3.740
26.5-27.5	27	9	5	1	9	6	5		35						35	2.618
27.5-28.5	28	5	6	1	1	1	4		18		1	1		2	20	1.496
28.5-29.5	29	2	3	1		1	1		8	1		5		6	14	1.047
29.5-30.5	30	1	1	1			1		4			1		1	5	0.374
30.5-31.5	31						1		1		1	1		2	3	0.224
31.5-32.5	32											1		1	1	0.075
32.5-33.5	33										1			1	1	0.075
33.5-34.5	34															0
34.5-35.5	35															0
35.5-36.5	36											3		3	3	0.224
Total	Loaded	352	121	70	114	316	195	32	1200	54	20	60	3	137	1337	100
	Loaded +Empty	475	232	207	218	692	258	71	2153	94	29	94	12	229		
Empty	Rate(%)	26	48	66	48	54	24	55	44	43	31	36	75	40		

APPENDIX 4.3.4 AXLE LOAD DISTRIBUTION





Axle Load Distribution(%)

Gross Weight (ton)	6-Wheel		10-Wheel	
	F	R	F	R
2	52.8	47.2		
3	46.2	53.8		
4	42.0	58.0		
5	39.0	61.0		
6	36.0	64.0	41.0	5.90
7	34.0	66.0	38.2	61.8
8	32.0	68.0	35.4	64.6
9	30.5	69.5	33.1	66.9
10	29.0	71.0	30.8	69.2
11	28.0	72.0	28.9	71.1
12	27.0	73.0	27.0	73.0
13	26.5	73.5	25.5	74.5
14	26.0	74.0	24.0	76.0
15	25.1	74.9	22.7	77.3
16	24.2	75.8	21.4	78.6
17	23.6	76.4	20.3	79.7
18	23.0	77.0	19.2	80.8
19	22.8	77.2	18.3	81.7
20	22.6	77.4	17.4	82.6

Gross Weight (ton)	6-Wheel		10-Wheel	
	F	R	F	R
21	22.2	77.8	16.7	83.3
22	21.8	78.2	16.0	84.0
23	21.4	78.6	15.4	84.6
24	21.0	79.0	14.8	85.2
25			14.4	85.6
26			14.0	86.0
27			13.8	86.2
28			13.6	86.4
29			13.3	86.7
30			13.0	87.0
31			12.7	87.3
32			12.4	87.6
33			12.2	87.8
34			12.0	88.0
35			11.9	88.1
36			11.8	88.2
37			11.6	88.4
38			11.4	88.6
39			11.3	88.7
40			11.2	88.8

Note

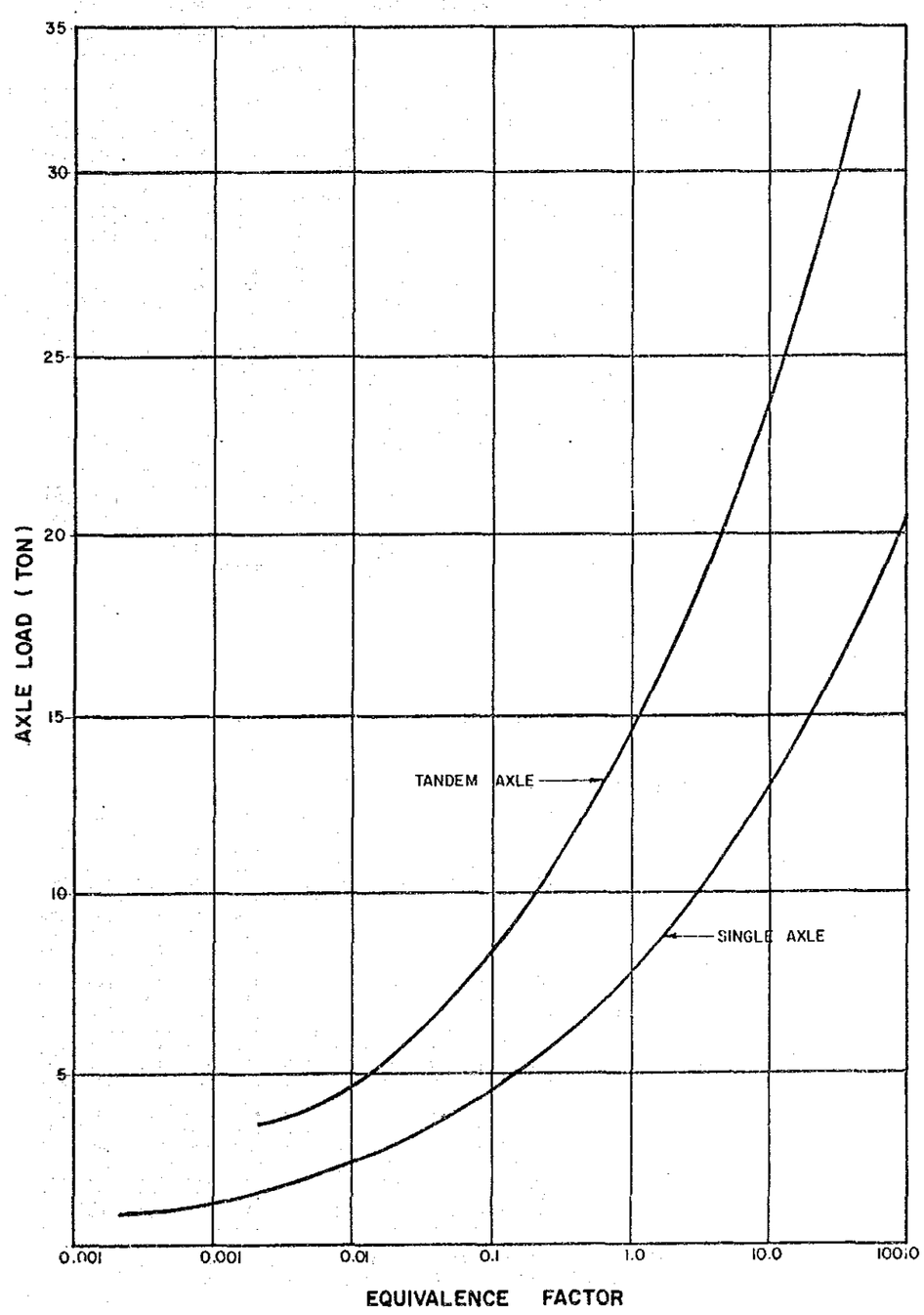
F : Front Axle

R : Rear Axle (s)

Pt = 2.0, SN = 2.0

Axle Load (tons)	Single Axle	Tandem Axle
0.91	0.0002	
1.81	0.003	
2.72	0.01	
3.63	0.04	
4.54	0.08	0.01
5.44	0.18	0.02
6.35	0.34	0.03
7.26	0.60	0.05
8.16	1.00	0.08
9.07	1.59	0.12
9.98	2.44	0.17
10.89	3.62	0.24
11.79	5.21	0.34
12.70	7.31	0.46
13.61	10.03	0.62
14.52	13.51	0.82
15.43	17.87	1.07
16.32	23.30	1.38
17.23	29.95	1.75
18.14	38.02	2.19
19.07		2.73
19.98		3.36
20.88		4.11
22.24		4.98

Source: AASHTO Interim Guide for Design of Pavement Structures, 1972



APPENDIX 4.7.1 INDICES FOR EACH COMPONENT OF VOC ON DIFFERENT CLASSES OF ROADS AND DIFFERENT SPEEDS (REHABILITATION)

INDICES : FUEL (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	130	115	103	93	87	85	86	89	94	***	108
	(B)	130	115	103	93	87	85	86	89	94	100	108
	(C)	170	150	133	119	111	107	106	108	117	125	135
LB	(A)	120	110	99	89	85	85	87	92	***	110	120
	(B)	120	110	99	89	85	85	87	92	100	110	120
	(C)	153	140	125	111	106	104	105	109	121	134	148
HB	(A)	190	160	132	108	96	90	89	92	***	111	126
	(B)	190	160	132	108	96	90	89	92	100	111	126
	(C)	288	243	196	159	138	130	128	133	147	163	187
LT	(A)	120	110	99	89	85	85	87	92	***	110	120
	(B)	120	110	99	89	85	85	87	92	100	110	120
	(C)	153	140	125	111	106	104	105	109	121	134	148
MT	(A)	190	160	132	108	96	90	89	92	***	111	126
	(B)	190	160	132	108	96	90	89	92	100	111	126
	(C)	288	243	196	159	138	130	128	133	147	163	187
HT	(A)	190	160	132	108	96	90	89	92	***	111	126
	(B)	190	160	132	108	96	90	89	92	100	111	126
	(C)	288	243	196	159	138	130	128	133	147	163	187

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : OIL (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	100	100	100	100	100	100	100	100	100	***	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	143	143	143	143	143	143	143	143	143	143	143
LB	(A)	100	100	100	100	100	100	100	100	***	100	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	160	160	160	160	160	160	160	160	160	160	160
HB	(A)	100	100	100	100	100	100	100	100	***	100	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	160	160	160	160	160	160	160	160	160	160	160
LT	(A)	100	100	100	100	100	100	100	100	***	100	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	160	160	160	160	160	160	160	160	160	160	160
MT	(A)	100	100	100	100	100	100	100	100	***	100	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	160	160	160	160	160	160	160	160	160	160	160
HT	(A)	100	100	100	100	100	100	100	100	***	100	100
	(B)	108	108	108	108	108	108	108	108	108	108	108
	(C)	160	160	160	160	160	160	160	160	160	160	160

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : TIRE AND TUBE (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267
LB	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267
HB	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267
LT	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267
MT	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267
HT	(A)	58	58	61	69	78	89	***	114	129	149	173
	(B)	69	69	72	82	92	105	118	135	152	176	201
	(C)	145	147	150	159	168	178	192	206	220	240	267

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : REPAIR AND MAINTENANCE (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	119	108	98	89	83	81	85	90	96	***	105
	(B)	126	114	104	94	88	86	90	95	102	106	111
	(C)	193	175	159	144	134	131	138	146	156	162	170
LB	(A)	120	109	99	90	87	85	90	95	***	105	110
	(B)	130	118	107	97	94	92	97	103	108	113	119
	(C)	205	186	169	154	149	145	154	162	171	180	188
HB	(A)	152	132	115	94	83	79	85	90	***	111	122
	(B)	169	147	128	104	92	88	94	100	111	123	135
	(C)	275	239	208	170	150	143	154	163	181	201	221
LT	(A)	120	109	99	90	87	85	90	95	***	105	110
	(B)	130	118	107	97	94	92	97	103	108	113	119
	(C)	205	186	169	154	149	145	154	162	171	180	188
MT	(A)	152	132	115	94	83	79	85	90	***	111	122
	(B)	169	147	128	104	92	88	94	100	111	123	135
	(C)	275	239	208	170	150	143	154	163	181	201	221
HT	(A)	152	132	115	94	83	79	85	90	***	111	122
	(B)	169	147	128	104	92	88	94	100	111	123	135
	(C)	275	239	208	170	150	143	154	163	181	201	221

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : DEPRECIATION AND INTEREST (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	100	100	100	100	100	100	***	100	100	100	100
	(B)	104	104	104	104	104	104	104	104	104	104	104
	(C)	141	139	137	135	131	128	125	111	100	90	81
LB	(A)	348	266	189	155	131	114	***	91	83	75	68
	(B)	368	279	200	165	140	122	107	97	88	80	73
	(C)	498	383	283	229	195	160	136	117	102	88	77
HB	(A)	356	270	190	156	132	115	***	93	83	75	68
	(B)	375	285	202	167	141	123	108	99	89	81	73
	(C)	505	395	289	236	201	164	138	119	104	90	78
LT	(A)	323	252	187	152	129	112	***	86	81	74	68
	(B)	345	261	195	157	135	118	105	91	85	78	71
	(C)	476	343	262	208	174	149	128	110	95	83	72
MT	(A)	356	270	190	156	132	115	***	93	83	75	68
	(B)	375	285	202	167	141	123	108	99	89	81	73
	(C)	505	395	289	236	201	164	138	119	104	90	78
HT	(A)	356	270	190	156	132	115	***	93	83	75	68
	(B)	375	285	202	167	141	123	108	99	89	81	73
	(C)	505	395	289	236	201	164	138	119	104	90	78

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : OVERHEAD (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64
LB	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64
HB	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64
LT	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64
MT	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64
HT	(A)	434	310	233	174	140	116	***	88	77	70	64
	(B)	434	310	233	174	140	116	100	88	77	70	64
	(C)	434	310	233	174	140	116	100	88	77	70	64

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

INDICES : CREW (DIFFERENT SPEED & ROAD CLASS)

(UNIT : % TO BASIC VALUE)

VEHICLE TYPE	ROAD CLASS	SPEED (KPH) 10	16	24	32	40	48	56	64	72	80	88
PC	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64
LB	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64
HB	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64
LT	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64
MT	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64
HT	(A)	560	350	233	175	140	117	***	88	78	70	64
	(B)	560	350	233	175	140	117	100	88	78	70	64
	(C)	560	350	233	175	140	117	100	88	78	70	64

N O T E
[1] ROAD CLASS : (A) = GOOD, (B) = FAIR, (C) = POOR
[2] "***" = 100% (CORRESPONDS TO BASIC VALUE)

APPENDIX 4.8.1 METHOD TO DETERMINE OVERLAY THICKNESS

Asphalt Institute Method

- For a given design life (L), cumulative ESA (N) is obtained by referring to Appendix 4.3.1.
- Design traffic number (DTN) can be obtained by the following formula:

$$DTN = 5.6804 \times 10^{-5} \times N - 0.6444$$

- Overlay thickness (T_A) can be read from Figure 4.5.1 corresponding to DTN.

DOH (California) Method

- Cumulative ESA (N) can be obtained as above.
- Cumulative ESA (N) can be converted to ESA' by the following formula:

$$ESA' = N \times \left(\frac{4100}{2268}\right)^4$$

where, N : cumulative number of equivalent 8.2t standard axles
ESA' : cumulative number of equivalent 4.5t standard axles
(See section 4.5.2)

- The allowable deflection of 2-inch asphalt concrete (Da) is as follows:

$$Da = 9.0881\ ESA'^{-0.1626}$$

- Percent reduction in deflection (P) is calculated by the following formula:

$$P = \frac{Dd - Da}{Dd} \times 100\ (\%)$$

- From Figure 4.5.4, thickness to be increased in gravel equivalent is obtained by applying the percent reduction in deflection.
- Required overlay thickness is calculated by transforming the increase in gravel equivalent to different layers of new surface by using the following conversion factor:

Thickness of asphalt concrete = 0.5 of gravel equivalent

APPENDIX 4.8.2 DETERMINATION OF DESIGN LIFE

APPENDIX 4.8.2

Asphalt Institute Method

- From the given design deflection (Dd) and overlay thickness (T_A), determine DTN by means of Figure 4.5.1.
- From DTN, cumulative ESA (N) can be obtained by the following formula:

$$N = (DTN + 0.6444) / 5.6804 \times 10^5$$

- The design life (L) can be obtained from the N value.

DOH (California) Method

- Asphalt concrete overlay thickness is converted to aggregate thickness. Percent reduction in deflection (P) can be obtained by Figure 4.5.4.
- From the percent reduction deflection (P) and the design deflection (Dd), the allowable deflection (Da) can be obtained by using the following formula:

$$P = \frac{Dd - Da}{Dd} \times 100\ (\%)$$

- From the given allowable deflection (Da), the cumulative ESA (N) can be obtained as follows:

$$N = 73468\ Da^{-6.15}$$

- Design life (L) can be determined by conversion from the cumulative ESA.

APPENDIX 4.8.3 OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RT - 224 (224 - 0100)

STUDY LENGTH : 10 KM WIDTH OF ROAD : 6 M SURFACE TYPE : AC

SECTION	EXISTING CONDITION		DESIGN	OVERLAY DESIGN							
					1ST OVERLAY				2ND OVERLAY			
	PSI	DEFLECTION (MM)	METHOD	CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)
10- 11	4.06	DM = 0.346	AI	127,528	-	-						
	(956)	DD = 0.485	DOH	49,442	-	-						
11- 12	3.47	DM = 0.320	AI	170,715	-	-						
	(1033)	DD = 0.491	DOH	77,082	-	-						
12- 13	3.52	DM = 0.394	AI	72,251	-	-						
	(1497)	DD = 0.516	DOH	21,501	-	-						
13- 14	2.95	DM = 0.403	AI	58,109	-	-						
	(2597)	DD = 0.625	DOH	16,262	-	-						
14- 15	2.78	DM = 0.669	AI	6,220	-	-						
	(2935)	DD = 0.891	DOH	602	7	1987	2,291	50				
					4	1987	1,369	35	6	1991	2,029	35
15- 16	3.26	DM = 0.514	AI	22,754	-	-						
	(2877)	DD = 0.694	DOH	3,915	-	-						
16- 17	2.80	DM = 0.533	AI	16,618	-	-						
	(2438)	DD = 0.752	DOH	2,594	-	-						
17- 18	3.48	DM = 0.448	AI	42,009	-	-						
	(2872)	DD = 0.621	DOH	9,632	-	-						
18- 19	3.43	DM = 0.251	AI	473,171	-	-						
	(1279)	DD = 0.362	DOH	349,581	-	-						
19- 20	3.68	DM = 0.297	AI	237,187	-	-						
	(1588)	DD = 0.436	DOH	124,648	-	-						

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 21 (304 - 0904)

STUDY LENGTH : 13 KM WIDTH OF ROAD : 7 M SURFACE TYPE : AC

SECTION	EXISTING CONDITION		DESIGN	OVERLAY DESIGN							
					1ST OVERLAY				2ND OVERLAY			
	PSI	DEFLECTION (MM)	METHOD	CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)
120-121	3.81	DM = 0.329	AI	156,457	-	-						
	(1192)	DD = 0.597	DOH	67,123	-	-						
121-122	3.87	DM = 0.181	AI	1,879,810	-	-						
	(946.)	DD = 0.317	DOH	2,661,620	-	-						
122-123	3.86	DM = 0.186	AI	1,690,060	-	-						
	(1106.)	DD = 0.378	DOH	2,274,080	-	-						
123-124	3.91	DM = 0.142	AI	5,243,460	-	-						
	(990)	DD = 0.255	DOH	12,141,700	-	-						
124-125	3.93	DM = 0.196	AI	1,352,670	-	-						
	(994)	DD = 0.302	DOH	1,634,000	-	-						
125-126	3.75	DM = 0.204	AI	1,144,130	-	-						
	(1535)	DD = 0.278	DOH	1,279,130	-	-						
126-127	3.87	DM = 0.234	AI	644,961	-	-						
	(1091)	DD = 0.427	DOH	546,343	-	-						
127-128	3.58	DM = 0.261	AI	405,373	-	-						
	(1371)	DD = 0.435	DOH	276,462	-	-						
128-129	3.61	DM = 0.225	AI	751,272	-	-						
	(1501)	DD = 0.403	DOH	688,533	-	-						
129-130	2.20	DM = 0.199	AI	476,042	-	-						
	(2337)	DD = 0.278	DOH	560,552	-	-						
130-131	3.70	DM = 0.315	AI	186,296	-	-						
	(1159)	DD = 0.471	DOH	87,109	-	-						
131-132	2.98	DM = 0.430	AI	44,774	-	-						
	(2269)	DD = 0.699	DOH	10,997	-	-						
132-133	3.05	DM = 0.349	AI	110,654	-	-						
	(1946)	DD = 0.541	DOH	41,752	-	-						

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 22 (2023 - 0100)

STUDY LENGTH : 8 KM WIDTH OF ROAD : 5 M SURFACE TYPE : PM

SECTION	EXISTING CONDITION PSI	EXISTING CONDITION DEFLECTION (MM)	DESIGN METHOD	OVERLAY DESIGN: CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	1ST OVERLAY: DESIGN PERIOD	1ST OVERLAY: YEAR OF OVERLAY	1ST OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	1ST OVERLAY: OVERLAY THICKNESS (MM)	2ND OVERLAY: DESIGN PERIOD	2ND OVERLAY: YEAR OF OVERLAY	2ND OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	2ND OVERLAY: OVERLAY THICKNESS (MM)
0- 1	2.83	DM = 0.602	AI	10,062	-	-						
	(4393)	DD = 0.817	DOH	1,221	-	-						
1- 2	2.91	DM = 0.635	AI	8,278	-	-						
	(3597)	DD = 0.901	DOH	900	-	-						
2- 3	2.57	DM = 0.788	AI	2,579	-	-						
	(3780)	DD = 1.078	DOH	172	7	1986	778	55				
					4	1986	424	35	5	1990	629	35
3- 4	2.83	DM = 0.572	AI	12,460	-	-						
	(2288)	DD = 0.770	DOH	1,679	-	-						
4- 5	2.70	DM = 0.552	AI	13,315	-	-						
	(2675)	DD = 0.788	DOH	1,917	-	-						
5- 6	2.68	DM = 0.767	AI	3,208	-	-						
	(3640)	DD = 1.026	DOH	230	7	1987	809	45				
					5	1987	576	35	6	1992	854	35
6- 7	2.76	DM = 0.682	AI	5,612	-	-						
	(3828)	DD = 0.835	DOH	519	14	1990	2,039	35				
7- 8	2.87	DM = 0.583	AI	11,730	-	-						
	(3432)	DD = 0.767	DOH	1,525	-	-						

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 5 (201 - 0102)

STUDY LENGTH : 19 KM WIDTH OF ROAD : 6 M SURFACE TYPE : PM

SECTION	EXISTING CONDITION		DESIGN	OVERLAY DESIGN							
					1ST OVERLAY				2ND OVERLAY			
	PSI	DEFLECTION (MM)	METHOD	CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)
20- 21	3.67	DM = 0.282	AI	293,621	-	-						
	(2361)	DD = 0.354	DOH	171,037	-	-						
21- 22	3.15	DM = 0.352	AI	109,488	-	-						
	(2979)	DD = 0.499	DOH	40,691	-	-						
22- 23	3.52	DM = 0.316	AI	181,419	-	-						
	(2216)	DD = 0.421	DOH	84,198	-	-						
23- 24	2.92	DM = 0.289	AI	233,759	-	-						
	(2713)	DD = 0.452	DOH	128,895	-	-						
24- 25	3.23	DM = 0.256	AI	420,880	-	-						
	(2964)	DD = 0.565	DOH	297,507	-	-						
25- 26	3.22	DM = 0.330	AI	145,787	-	-						
	(2839)	DD = 0.514	DOH	61,855	-	-						
26- 27	3.63	DM = 0.335	AI	142,575	-	-						
	(2718)	DD = 0.475	DOH	58,716	-	-						
27- 28	3.42	DM = 0.280	AI	299,408	-	-						
	(3288)	DD = 0.369	DOH	177,568	-	-						
28- 29	3.37	DM = 0.232	AI	647,042	-	-						
	(2713)	DD = 0.313	DOH	557,494	-	-						
29- 30	3.10	DM = 0.344	AI	118,806	-	-						
	(3597)	DD = 0.481	DOH	46,162	-	-						
30- 31	3.53	DM = 0.377	AI	86,588	-	-						
	(3408)	DD = 0.534	DOH	28,114	-	-						
31- 32	3.13	DM = 0.313	AI	178,130	-	-						
	(4060)	DD = 0.490	DOH	83,923	-	-						
32- 33	3.44	DM = 0.280	AI	299,517	-	-						
	(1839)	DD = 0.418	DOH	177,548	-	-						
33- 34	3.02	DM = 0.519	AI	20,425	-	-						
	(3775)	DD = 0.743	DOH	3,406	-	-						
34- 35	3.56	DM = 0.488	AI	29,640	-	-						
	(2988)	DD = 0.611	DOH	5,723	-	-						
35- 36	3.27	DM = 0.437	AI	45,064	-	-						
	(3423)	DD = 0.720	DOH	10,799	-	-						
36- 37	3.35	DM = 0.526	AI	20,898	-	-						
	(3717)	DD = 0.772	DOH	3,432	-	-						
37- 38	3.31	DM = 0.523	AI	21,274	-	-						
	(4577)	DD = 0.842	DOH	3,530	-	-						
38- 39	3.09	DM = 0.447	AI	39,294	-	-						
	(3630)	DD = 0.701	DOH	8,941	-	-						

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 12 (207 - 0202)

STUDY LENGTH : 10 KM WIDTH OF ROAD : 6.2 M SURFACE TYPE : DT/ST

SECTION	EXISTING CONDITION PSI	EXISTING CONDITION DEFLECTION (MM)	DESIGN METHOD	OVERLAY DESIGN: CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	1ST OVERLAY: DESIGN PERIOD	1ST OVERLAY: YEAR OF OVERLAY	1ST OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	1ST OVERLAY: OVERLAY THICKNESS (MM)	2ND OVERLAY: DESIGN PERIOD	2ND OVERLAY: YEAR OF OVERLAY	2ND OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	2ND OVERLAY: OVERLAY THICKNESS (MM)
488-489	1.50	DM = 0.873	AI	0	13	1985	1,095	35				
	(4132)	DD = 1.304	DOH	0	7	1985	498	85				
					4	1985	268	55	3	1989	230	40
489-490	1.50	DM = 0.705	AI	0	> 14	1985	3,554	35				
	(5494)	DD = 0.949	DOH	0	12	1985	927	35				
490-491	1.66	DM = 0.504	AI	0	> 14	1985	4,981	35				
	(4977)	DD = 0.898	DOH	0	> 14	1985	1,304	35				
491-492	2.74	DM = 0.691	AI	5,258	-	-						
	(4282)	DD = 1.087	DOH	472	7	1991	634	50				
					5	1991	403	35	5	1996	598	35
492-493	2.26	DM = 0.546	AI	7,241	-	-						
	(4702)	DD = 0.911	DOH	1,032	-	-						
493-494	2.20	DM = 0.746	AI	1,492	-	-						
	(4997)	DD = 1.196	DOH	108	7	1986	519	60				
					4	1986	278	40	4	1990	348	35
494-495	1.59	DM = 0.730	AI	0	> 14	1985	1,623	35				
	(6112)	DD = 1.176	DOH	0	7	1985	498	55				
					4	1985	268	40	5	1989	377	35
495-496	2.25	DM = 0.669	AI	2,910	-	-						
	(5166)	DD = 1.014	DOH	268	8	1988	617	35				
496-497	1.98	DM = 0.627	AI	0	> 14	1985	4,437	35				
	(4437)	DD = 0.919	DOH	0	14	1985	1,133	35				
497-498	2.17	DM = 1.118	AI	221	7	1988	562	45				
					5	1988	376	35	7	1993	672	35
	(4369)	DD = 1.723	DOH	6	7	1985	498	155				
					4	1985	268	130	3	1989	230	50

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 16 (214 - 0100)

STUDY LENGTH : 10 KM WIDTH OF ROAD : 6 M SURFACE TYPE : DT/ST

SECTION	EXISTING CONDITION		DESIGN	OVERLAY DESIGN							
					1ST OVERLAY				2ND OVERLAY			
	PSI	DEFLECTION (MM)	METHOD	CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)	DESIGN PERIOD	YEAR OF OVERLAY	CUMULATIVE NO. OF ESA (X 1000)	OVERLAY THICKNESS (MM)
7- 8	2.82	DM = 0.786	AI	3,185	-	-						
	(3350)	DD = 1.038	DOH	219	8	1989	534	35				
8- 9	2.04	DM = 0.743	AI	338	> 14	1991	1,738	35				
	(4176)	DD = 1.147	DOH	24	7	1985	385	45				
					5	1985	289	35	7	1990	429	35
9- 10	2.24	DM = 0.644	AI	3,389	-	-						
	(4234)	DD = 0.999	DOH	339	9	1991	679	35				
10- 11	2.00	DM = 0.715	AI	0	> 14	1985	1,931	35				
	(4866)	DD = 1.123	DOH	0	7	1985	385	40				
					6	1985	330	35	7	1991	489	35
11- 12	2.11	DM = 0.699	AI	1,188	-	-						
	(3022)	DD = 1.039	DOH	98	9	1986	532	35				
12- 13	2.40	DM = 0.607	AI	6,344	-	-						
	(3770)	DD = 0.957	DOH	730	-	-						
13- 14	2.68	DM = 0.546	AI	13,861	-	-						
	(3157)	DD = 0.696	DOH	2,044	-	-						
14- 15	3.18	DM = 0.404	AI	61,463	-	-						
	(2641)	DD = 0.582	DOH	17,240	-	-						
15- 16	2.87	DM = 0.544	AI	15,760	-	-						
	(2940)	DD = 0.788	DOH	2,366	-	-						
16- 17	3.06	DM = 0.502	AI	23,709	-	-						
	(2955)	DD = 0.753	DOH	4,233	-	-						

N O T E

[1] ( ) : ROUGHNESS

[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)

[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)

[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.

[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 25 (2071 - 0100)

STUDY LENGTH : 10 KM WIDTH OF ROAD : 5 M SURFACE TYPE : DT/ST

SECTION	EXISTING CONDITION PSI	EXISTING CONDITION DEFLECTION (MM)	DESIGN METHOD	OVERLAY DESIGN: CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	1ST OVERLAY: DESIGN PERIOD	1ST OVERLAY: YEAR OF OVERLAY	1ST OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	1ST OVERLAY: OVERLAY THICKNESS (MM)	2ND OVERLAY: DESIGN PERIOD	2ND OVERLAY: YEAR OF OVERLAY	2ND OVERLAY: CUMULATIVE NO. OF ESA (X 1000)	2ND OVERLAY: OVERLAY THICKNESS (MM)
7- 8	2.35	DM = 0.302	AI	118,761	-	-						
	(3910.)	DD = 0.464	DOH	59,312	-	-						
8- 9	2.58	DM = 0.283	AI	210,797	-	-						
	(3432)	DD = 0.381	DOH	120,820	-	-						
9- 10	2.04	DM = 0.368	AI	7,330	-	-						
	(4692)	DD = 0.552	DOH	2,378	-	-						
10- 11	1.78	DM = 0.347	AI	0	> 14	1985	35,921	35				
	(4514)	DD = 0.496	DOH	0	> 14	1985	50,178	35				
11- 12	1.72	DM = 0.364	AI	0	> 14	1985	26,868	35				
	(4625)	DD = 0.554	DOH	0	> 14	1985	25,485	35				
12- 13	1.53	DM = 0.428	AI	0	> 14	1985	21,875	35				
	(4803)	DD = 0.594	DOH	0	> 14	1985	16,648	35				
13- 14	1.90	DM = 0.321	AI	0	> 14	1985	33,905	35				
	(4789)	DD = 0.508	DOH	0	> 14	1985	43,553	35				
14- 15	1.72	DM = 0.400	AI	0	> 14	1985	17,274	35				
	(4813)	DD = 0.637	DOH	0	> 14	1985	10,799	35				
15- 16	1.73	DM = 0.292	AI	0	> 14	1985	54,596	35				
	(4466)	DD = 0.414	DOH	0	> 14	1985	153,285	35				
16- 17	1.67	DM = 0.366	AI	0	> 14	1985	12,070	35				
	(4316)	DD = 0.696	DOH	0	> 14	1985	6,257	35				

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

OVERLAY DESIGN : OVERLAY TIMING AND THICKNESS

STUDY ROUTE : RH - 27 (2160 - 0100)

STUDY LENGTH : 10 KM WIDTH OF ROAD : 5 M SURFACE TYPE : DT/ST

SECTION	EXISTING CONDITION PSI	EXISTING CONDITION DEFLECTION (MM)	DESIGN METHOD	CUMULATIVE NO. OF ESA SINCE 1985 TILL PSI=2 (X 1000)	OVERLAY DESIGN 1ST OVERLAY DESIGN PERIOD	1ST OVERLAY YEAR OF OVERLAY	1ST OVERLAY CUMULATIVE NO. OF ESA (X 1000)	1ST OVERLAY OVERLAY THICKNESS (MM)	2ND OVERLAY DESIGN PERIOD	2ND OVERLAY YEAR OF OVERLAY	2ND OVERLAY CUMULATIVE NO. OF ESA (X 1000)	2ND OVERLAY OVERLAY THICKNESS (MM)
9- 10	2.80	DM = 0.829	AI	2,504	-	-						
	(4606)	DD = 1.331	DOH	153	7	1988	341	70				
					4	1988	183	50	3	1992	183	35
10- 11	1.67	DM = 0.909	AI	0	> 14	1985	1,110	35				
	(5529)	DD = 1.300	DOH	0	7	1985	303	60				
					4	1985	163	40	4	1989	208	35
11- 12	1.83	DM = 1.189	AI	0	7	1985	303	50				
					4	1985	167	35	7	1989	332	35
	(7246)	DD = 2.202	DOH	0	7	1985	303	190				
					4	1985	163	170	3	1989	140	55
12- 13	2.14	DM = 1.184	AI	150	7	1988	341	45				
					6	1988	262	35	8	1994	507	35
	(3790)	DD = 1.938	DOH	4	7	1985	303	165				
					4	1985	163	140	3	1989	140	50
13- 14	3.10	DM = 1.407	AI	309	-	-						
	(3572)	DD = 2.582	DOH	6	7	1985	303	215				
					4	1985	163	200	3	1989	140	55
14- 15	1.85	DM = 1.401	AI	0	7	1985	303	65				
					4	1985	163	45	5	1989	261	35
	(6020)	DD = 2.562	DOH	0	7	1985	303	215				
					4	1985	163	200	3	1989	140	55
15- 16	2.41	DM = 0.802	AI	1,952	-	-						
	(4760)	DD = 1.560	DOH	124	7	1988	341	115				
					4	1988	183	90	3	1992	158	45
16- 17	2.08	DM = 1.004	AI	174	7	1989	355	40				
					6	1989	317	35	> 8	1995	528	35
	(5339)	DD = 1.837	DOH	6	7	1985	303	150				
					4	1985	163	125	3	1989	140	50
17- 18	2.00	DM = 1.245	AI	0	7	1985	303	55				
					4	1985	163	40	6	1989	288	35
	(5586)	DD = 2.296	DOH	0	7	1985	303	195				
					4	1985	163	175	3	1989	140	55
18- 19	1.17	DM = 1.113	AI	0	7	1985	303	50				
					4	1985	164	35	6	1989	315	35
	(9789)	DD = 2.222	DOH	0	7	1985	303	190				
					4	1985	163	170	3	1989	140	55

N O T E

[1] ( ) : ROUGHNESS
[2] DM : MEASURED DEFLECTION (ADJUSTED BY TEMPERATURE)
[3] DD : DESIGN DEFLECTION (AVE. + 1.5 * SIGMA)
[4] > ## : OVERLAY DESIGN LIFE IS GREATER THAN ## YEARS.
[5] - : OVERLAY IS NOT REQUISITE.

APPENDIX 4.8.4 ECONOMIC EVALUATION FOR OVERLAY DESIGN

STUDY ROUTE : RT - 224 (224 - 0100)

SECTION : 14 - 15

SURFACE TYPE : AC

WIDTH OF ROAD : 6.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1987	4187	289	3.6	642,802	2,712,400	4,287	2,716,680
1988	4382	592	3.0	0	2,837,200	3,696	2,840,900
1989	4548	907	2.7	0	2,628,220	3,079	2,631,300
1990	4721	1234	2.5	0	2,728,450	2,438	2,730,890
1991	4900	1573	2.3	0	2,831,680	1,773	2,833,450
1992	5087	1925	2.2	0	2,939,690	1,083	2,940,770
1993	5280	2291	2.1	0	3,051,700	366	3,052,070
TOTAL				642,802	19,729,300	16,721	19,746,100
DISCOUNTED TOTAL				512,438	10,176,000	9,754	10,185,800

NET PRESENT VALUE : 9,673,360
BENEFIT COST RATIO : 19.9
INTERNAL RATE OF RETURN : 425.3 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1987	4187	289	3.4	473,074	2,712,400	4,093	2,716,490
1988	4382	592	2.7	0	2,532,650	3,587	2,536,230
1989	4548	907	2.4	0	2,628,220	3,060	2,631,280
1990	4721	1234	2.2	0	2,728,450	2,514	2,730,970
1991	4900	339	3.5	473,074	3,172,200	4,194	3,176,390
1992	5087	691	2.9	0	2,939,690	3,797	2,943,490
1993	5280	1057	2.5	-236,537	3,051,700	3,384	3,055,090
TOTAL				709,611	19,765,300	24,629	19,789,900
DISCOUNTED TOTAL				540,647	10,136,500	12,854	10,149,400

NET PRESENT VALUE : 9,608,730
BENEFIT COST RATIO : 18.8
INTERNAL RATE OF RETURN : 568.8 %

STUDY ROUTE : RH - 22 (2023 - 0100)

SECTION : 2 - 3

SURFACE TYPE : PM

WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1986	2707	98	3.7	582,816	1,414,790	4,288	1,419,070
1987	2856	201	3.1	0	1,491,930	3,697	1,495,630
1988	3014	308	2.8	0	1,404,820	3,079	1,407,900
1989	3150	419	2.5	0	1,467,230	2,438	1,469,670
1990	3293	534	2.3	0	1,532,280	1,773	1,534,050
1991	3445	654	2.2	0	1,602,210	1,082	1,603,300
1992	3603	778	2.1	0	1,674,610	365	1,674,970
TOTAL				582,816	10,587,900	16,722	10,604,600
DISCOUNTED TOTAL				520,371	6,092,530	10,925	6,103,460

NET PRESENT VALUE : 5,583,080
BENEFIT COST RATIO : 11.7
INTERNAL RATE OF RETURN : 246.3 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1986	2707	98	3.5	394,228	1,414,790	4,047	1,418,830
1987	2856	201	2.7	0	1,332,160	3,492	1,335,660
1988	3014	308	2.4	0	1,404,820	2,914	1,407,740
1989	3150	419	2.1	0	1,467,230	2,315	1,469,550
1990	3293	115	3.6	394,228	1,715,900	4,157	1,720,060
1991	3445	235	2.9	0	1,602,210	3,721	1,605,930
1992	3603	359	2.5	-157,691	1,674,610	3,269	1,677,870
TOTAL				630,765	10,611,700	23,915	10,635,600
DISCOUNTED TOTAL				518,820	6,071,840	13,987	6,085,820

NET PRESENT VALUE : 5,567,000
BENEFIT COST RATIO : 11.7
INTERNAL RATE OF RETURN : 355.6 %

STUDY ROUTE : RH - 22 (2023 - 0100) SECTION : 5 - 6

SURFACE TYPE : PM WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1987	2856	103	3.7	488,522	1,491,930	4,285	1,496,220
1988	3014	210	3.1	0	1,573,240	3,691	1,576,930
1989	3150	321	2.8	0	1,467,230	3,074	1,470,310
1990	3293	436	2.5	0	1,532,280	2,435	1,534,710
1991	3445	556	2.3	0	1,602,210	1,770	1,603,980
1992	3603	680	2.2	0	1,674,610	1,080	1,675,690
1993	3768	809	2.1	0	1,749,690	365	1,750,050
TOTAL				488,522	11,091,200	16,700	11,107,900
DISCOUNTED TOTAL				389,447	5,702,660	9,742	5,712,400

NET PRESENT VALUE : 5,322,950
BENEFIT COST RATIO : 14.7
INTERNAL RATE OF RETURN : 309.3 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1987	2856	103	3.6	394,228	1,491,930	4,167	1,496,100
1988	3014	210	2.9	0	1,404,820	3,742	1,408,570
1989	3150	321	2.5	0	1,467,230	3,302	1,470,540
1990	3293	436	2.3	0	1,532,280	2,845	1,535,120
1991	3445	556	2.1	0	1,602,210	2,369	1,604,580
1992	3603	124	3.6	394,228	1,875,230	4,244	1,879,480
1993	3768	253	3.0	-262,819	1,959,250	3,898	1,963,150
TOTAL				525,638	11,333,000	24,568	11,357,500
DISCOUNTED TOTAL				407,985	5,752,230	12,851	5,765,080

NET PRESENT VALUE : 5,357,100
BENEFIT COST RATIO : 14.1
INTERNAL RATE OF RETURN : 375.6 %

STUDY ROUTE : RH - 22 (2023 - 0100) SECTION : 6 - 7

SURFACE TYPE : PM WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1990	3293	115	4.0	394,228	1,715,900	4,447	1,720,350
1991	3445	235	3.5	0	1,794,180	4,183	1,798,370
1992	3603	359	3.2	0	1,875,230	3,910	1,879,140
1993	3768	488	3.0	0	1,749,690	3,626	1,753,320
1994	3941	622	2.8	0	1,829,290	3,331	1,832,620
1995	4120	761	2.7	0	1,910,530	3,024	1,913,560
1996	4311	905	2.6	-197,114	1,997,890	2,707	2,000,600
TOTAL				197,114	12,872,700	25,227	12,898,000
DISCOUNTED TOTAL				178,522	4,720,280	9,668	4,729,950

NET PRESENT VALUE : 4,551,430
BENEFIT COST RATIO : 26.5
INTERNAL RATE OF RETURN : 440.6 %

STUDY ROUTE : RH - 12 (207 - 0202) SECTION : 488 - 489

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.1	1,435,910	570,608	4,444	575,053
1986	1084	128	3.5	0	596,610	4,177	600,787
1987	1135	196	3.2	0	624,724	3,899	628,623
1988	1186	268	3.0	0	653,695	3,606	657,301
1989	1233	341	2.8	0	615,582	3,303	618,885
1990	1282	418	2.7	0	639,910	2,989	642,899
1991	1334	498	2.6	-1,101,200	665,863	2,661	668,524
TOTAL				334,711	4,366,990	25,080	4,392,070
DISCOUNTED TOTAL				991,156	2,819,890	16,957	2,836,840

NET PRESENT VALUE : 1,845,690
BENEFIT COST RATIO : 2.9
INTERNAL RATE OF RETURN : 42.8 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	3.8	1,435,910	570,608	4,287	574,895
1986	1084	128	3.1	0	596,610	3,698	600,308
1987	1135	196	2.8	0	565,958	3,087	569,045
1988	1186	268	2.5	0	592,159	2,444	594,603
1989	1233	341	2.3	0	615,582	1,778	617,360
1990	1282	418	2.2	0	639,910	1,089	640,998
1991	1334	498	2.1	-1,101,200	665,863	368	666,230
TOTAL				334,711	4,246,690	16,751	4,263,440
DISCOUNTED TOTAL				991,156	2,738,950	12,253	2,751,200

NET PRESENT VALUE : 1,760,050
BENEFIT COST RATIO : 2.8
INTERNAL RATE OF RETURN : 41.6 %

STUDY ROUTE : RH - 12 (207 - 0202) SECTION : 489 - 490

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS.	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.3	488,843	570,608	4,535	575,144
1986	1084	128	4.0	0	596,610	4,453	601,063
1987	1135	196	3.7	0	624,724	4,367	629,092
1988	1186	268	3.6	0	653,695	4,277	657,972
1989	1233	341	3.4	0	679,573	4,184	683,757
1990	1282	418	3.3	0	706,389	4,087	710,476
1991	1334	498	3.2	-244,421	735,031	3,986	739,017
TOTAL				244,421	4,566,630	29,891	4,596,520
DISCOUNTED TOTAL				390,125	2,921,160	19,674	2,940,840

NET PRESENT VALUE : 2,550,710
BENEFIT COST RATIO : 7.5
INTERNAL RATE OF RETURN : 122.1 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.0	488,843	570,608	4,420	575,029
1986	1084	128	3.5	0	596,610	4,104	600,714
1987	1135	196	3.1	0	624,724	3,776	628,500
1988	1186	268	2.9	0	592,159	3,430	595,590
1989	1233	341	2.7	0	615,582	3,073	618,654
1990	1282	418	2.6	0	639,910	2,702	642,612
1991	1334	498	2.5	-203,685	665,863	2,315	668,177
TOTAL				285,158	4,305,460	23,821	4,329,280
DISCOUNTED TOTAL				406,578	2,780,780	16,246	2,797,020

NET PRESENT VALUE : 2,390,450
BENEFIT COST RATIO : 6.9
INTERNAL RATE OF RETURN : 120.8 %

STUDY ROUTE : RH - 12 (207 - 0202) SECTION : 490 - 491

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.4	488,843	570,608	4,547	575,155
1986	1084	128	4.1	0	596,610	4,488	601,098
1987	1135	196	3.9	0	624,724	4,427	629,151
1988	1186	268	3.7	0	653,695	4,363	658,058
1989	1233	341	3.6	0	679,573	4,296	683,870
1990	1282	418	3.5	0	706,389	4,227	710,616
1991	1334	498	3.4	-244,421	735,031	4,155	739,186
TOTAL				244,421	4,566,630	30,504	4,597,130
DISCOUNTED TOTAL				390,125	2,921,160	20,021	2,941,180

NET PRESENT VALUE : 2,551,060
BENEFIT COST RATIO : 7.5
INTERNAL RATE OF RETURN : 122.1 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.1	488,843	570,608	4,465	575,074
1986	1084	128	3.6	0	596,610	4,241	600,851
1987	1135	196	3.3	0	624,724	4,007	628,732
1988	1186	268	3.1	0	653,695	3,762	657,457
1989	1233	341	2.9	0	615,582	3,507	619,089
1990	1282	418	2.8	0	639,910	3,244	643,154
1991	1334	498	2.7	-244,421	665,863	2,969	668,831
TOTAL				244,421	4,366,990	26,196	4,393,190
DISCOUNTED TOTAL				390,125	2,819,890	17,587	2,837,470

NET PRESENT VALUE : 2,447,350
BENEFIT COST RATIO : 7.3
INTERNAL RATE OF RETURN : 121.5 %

STUDY ROUTE : RH - 12 (207 - 0202)

SECTION : 491 - 492

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.2 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1991	1334	80	3.8	664,229	735,031	4,287	739,318
1992	1389	164	3.1	0	765,457	3,695	769,152
1993	1444	250	2.8	0	721,244	3,082	724,326
1994	1502	340	2.5	0	749,774	2,447	752,221
1995	1562	434	2.3	0	779,554	1,783	781,336
1996	1625	532	2.2	0	811,712	1,090	812,802
1997	1689	634	2.1	0	842,818	368	843,186
TOTAL				664,229	5,405,590	16,752	5,422,340
DISCOUNTED TOTAL				336,519	1,768,740	6,208	1,774,950

NET PRESENT VALUE : 1,438,430
BENEFIT COST RATIO : 5.3
INTERNAL RATE OF RETURN : 112.1 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1991	1334	80	3.6	488,843	735,031	4,122	739,153
1992	1389	164	2.8	0	693,386	3,645	697,032
1993	1444	250	2.5	0	721,244	3,157	724,402
1994	1502	340	2.2	0	749,774	2,647	752,420
1995	1562	434	2.0	0	779,554	2,113	781,667
1996	1625	98	3.6	488,843	896,095	4,201	900,295
1997	1689	200	2.9	-293,306	842,818	3,810	846,629
TOTAL				684,380	5,417,900	23,695	5,441,600
DISCOUNTED TOTAL				328,178	1,761,290	7,886	1,769,180

NET PRESENT VALUE : 1,441,000
BENEFIT COST RATIO : 5.4
INTERNAL RATE OF RETURN : 147.9 %

STUDY ROUTE : RH - 12 (207 - 0202)

SECTION : 493 - 494

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.2 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1986	1084	65	3.8	781,154	596,610	4,289	600,899
1987	1135	133	3.1	0	624,724	3,703	628,427
1988	1186	205	2.8	0	592,159	3,086	595,245
1989	1233	278	2.5	0	615,582	2,447	618,029
1990	1282	355	2.3	0	639,910	1,785	641,695
1991	1334	435	2.2	0	665,863	1,093	666,956
1992	1389	519	2.1	0	693,386	370	693,757
TOTAL				781,154	4,428,230	16,774	4,445,010
DISCOUNTED TOTAL				697,459	2,551,350	10,954	2,562,310

NET PRESENT VALUE : 1,864,850
BENEFIT COST RATIO : 3.7
INTERNAL RATE OF RETURN : 77.1 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1986	1084	65	3.5	547,305	596,610	4,041	600,651
1987	1135	133	2.8	0	565,958	3,481	569,439
1988	1186	205	2.4	0	592,159	2,889	595,048
1989	1233	278	2.1	0	615,582	2,288	617,870
1990	1282	77	3.5	488,843	706,389	4,069	710,458
1991	1334	157	2.8	0	665,863	3,543	669,406
1992	1389	241	2.4	-122,211	693,386	2,990	696,376
TOTAL				913,937	4,435,950	23,302	4,459,250
DISCOUNTED TOTAL				721,978	2,543,210	13,706	2,556,910

NET PRESENT VALUE : 1,834,930
BENEFIT COST RATIO : 3.5
INTERNAL RATE OF RETURN : 103.5 %

STUDY ROUTE : RH - 12 (207 - 0202)

SECTION : 494 - 495

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.2	488,843	570,608	4,487	575,096
1986	1084	128	3.7	0	596,610	4,307	600,917
1987	1135	196	3.4	0	624,724	4,119	628,843
1988	1186	268	3.2	0	653,695	3,922	657,617
1989	1233	341	3.1	0	679,573	3,717	683,291
1990	1282	418	2.9	0	639,910	3,506	643,416
1991	1334	498	2.8	-244,421	665,863	3,285	669,147
TOTAL				244,421	4,430,980	27,343	4,458,330
DISCOUNTED TOTAL				390,125	2,856,200	18,236	2,874,430

NET PRESENT VALUE : 2,484,310
BENEFIT COST RATIO : 7.4
INTERNAL RATE OF RETURN : 121.8 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	3.8	722,691	570,608	4,287	574,895
1986	1084	128	3.1	0	596,610	3,698	600,308
1987	1135	196	2.8	0	565,958	3,087	569,045
1988	1186	268	2.5	0	592,159	2,444	594,603
1989	1233	341	2.3	0	615,582	1,778	617,360
1990	1282	418	2.2	0	639,910	1,089	640,998
1991	1334	498	2.1	0	665,863	368	666,230
TOTAL				722,691	4,246,690	16,751	4,263,440
DISCOUNTED TOTAL				722,691	2,738,950	12,253	2,751,200

NET PRESENT VALUE : 2,028,510
BENEFIT COST RATIO : 3.8
INTERNAL RATE OF RETURN : 79.8 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	3.5	547,305	570,608	4,038	574,646
1986	1084	128	2.8	0	540,510	3,483	543,993
1987	1135	196	2.4	0	565,958	2,903	568,861
1988	1186	268	2.1	0	592,159	2,288	594,447
1989	1233	73	3.6	488,843	679,573	4,133	683,707
1990	1282	150	2.9	0	639,910	3,667	643,576
1991	1334	230	2.5	-195,537	665,863	3,181	669,044
TOTAL				840,611	4,254,580	23,693	4,278,280
DISCOUNTED TOTAL				778,999	2,730,540	15,545	2,746,080

NET PRESENT VALUE : 1,967,080
BENEFIT COST RATIO : 3.5
INTERNAL RATE OF RETURN : 98.7 %

STUDY ROUTE : RH - 12 (207 - 0202) SECTION : 495 - 496

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.2 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	1186	72	3.8	488,843	653,695	4,309	658,004
1989	1233	145	3.2	0	679,573	3,771	683,345
1990	1282	222	2.8	0	639,910	3,215	643,125
1991	1334	302	2.6	0	665,863	2,633	668,496
1992	1389	386	2.4	0	693,386	2,025	695,411
1993	1444	472	2.3	0	721,244	1,395	722,639
1994	1502	562	2.1	-61,105	749,774	742	750,516
TOTAL				427,738	4,803,450	18,091	4,821,540
DISCOUNTED TOTAL				330,382	2,207,990	9,258	2,217,240

NET PRESENT VALUE : 1,886,860
BENEFIT COST RATIO : 6.7
INTERNAL RATE OF RETURN : 135.7 %

STUDY ROUTE : RH - 12 (207 - 0202) SECTION : 496 - 497

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.4	488,843	570,608	4,544	575,152
1986	1084	128	4.0	0	596,610	4,478	601,087
1987	1135	196	3.8	0	624,724	4,409	629,133
1988	1186	268	3.7	0	653,695	4,337	658,032
1989	1233	341	3.5	0	679,573	4,262	683,835
1990	1282	418	3.4	0	706,389	4,185	710,573
1991	1334	498	3.3	-244,421	735,031	4,104	739,135
TOTAL				244,421	4,566,630	30,317	4,596,950
DISCOUNTED TOTAL				390,125	2,921,160	19,915	2,941,080

NET PRESENT VALUE : 2,550,950
BENEFIT COST RATIO : 7.5
INTERNAL RATE OF RETURN : 122.1 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	4.1	488,843	570,608	4,449	575,057
1986	1084	128	3.5	0	596,610	4,190	600,800
1987	1135	196	3.2	0	624,724	3,922	628,646
1988	1186	268	3.0	0	653,695	3,639	657,334
1989	1233	341	2.9	0	615,582	3,347	618,929
1990	1282	418	2.7	0	639,910	3,044	642,953
1991	1334	498	2.6	-244,421	665,863	2,727	668,590
TOTAL				244,421	4,366,990	25,318	4,392,310
DISCOUNTED TOTAL				390,125	2,819,890	17,092	2,836,980

NET PRESENT VALUE : 2,446,850
BENEFIT COST RATIO : 7.3
INTERNAL RATE OF RETURN : 121.5 %

STUDY ROUTE : RH - 12 (207 - 0202)

SECTION : 497 - 498

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.2 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	1186	72	3.8	605,767	653,695	4,283	657,978
1989	1233	145	3.1	0	679,573	3,693	683,266
1990	1282	222	2.8	0	639,910	3,082	642,991
1991	1334	302	2.5	0	665,863	2,443	668,305
1992	1389	386	2.3	0	693,386	1,775	695,161
1993	1444	472	2.2	0	721,244	1,083	722,327
1994	1502	562	2.1	0	749,774	366	750,140
TOTAL				605,767	4,803,450	16,724	4,820,170
DISCOUNTED TOTAL				431,173	2,207,990	8,709	2,216,700

NET PRESENT VALUE : 1,785,520
BENEFIT COST RATIO : 5.1
INTERNAL RATE OF RETURN : 109.2 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	1186	72	3.6	488,843	653,695	4,138	657,833
1989	1233	145	2.9	0	615,582	3,695	619,276
1990	1282	222	2.5	0	639,910	3,226	643,136
1991	1334	302	2.3	0	665,863	2,740	668,603
1992	1389	386	2.1	0	693,386	2,229	695,616
1993	1444	86	3.7	488,843	796,214	4,283	800,498
1994	1502	176	3.1	-349,174	827,671	3,977	831,648
TOTAL				628,512	4,892,320	24,289	4,916,610
DISCOUNTED TOTAL				445,005	2,223,790	11,326	2,235,120

NET PRESENT VALUE : 1,790,110
BENEFIT COST RATIO : 5.0
INTERNAL RATE OF RETURN : 131.2 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	3.8	1,210,190	570,608	4,287	574,895
1986	1084	128	3.1	0	596,610	3,698	600,308
1987	1135	196	2.8	0	565,958	3,087	569,045
1988	1186	268	2.5	0	592,159	2,444	594,603
1989	1233	341	2.3	0	615,582	1,778	617,360
1990	1282	418	2.2	0	639,910	1,089	640,998
1991	1334	498	2.1	0	665,863	368	666,230
TOTAL				1,210,190	4,246,690	16,751	4,263,440
DISCOUNTED TOTAL				1,210,190	2,738,950	12,253	2,751,200

NET PRESENT VALUE : 1,541,020
BENEFIT COST RATIO : 2.3
INTERNAL RATE OF RETURN : 45.3 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1038	63	3.5	1,084,780	570,608	4,038	574,646
1986	1084	128	2.8	0	540,510	3,483	543,993
1987	1135	196	2.4	0	565,958	2,903	568,861
1988	1186	268	2.1	0	592,159	2,288	594,447
1989	1233	73	3.3	664,229	679,573	3,850	683,423
1990	1282	150	2.5	0	639,910	3,084	642,993
1991	1334	230	2.1	0	665,863	2,288	668,151
TOTAL				1,749,010	4,254,580	21,934	4,276,520
DISCOUNTED TOTAL				1,506,910	2,730,540	14,684	2,745,220

NET PRESENT VALUE : 1,238,310
BENEFIT COST RATIO : 1.8
INTERNAL RATE OF RETURN : 43.3 %

STUDY ROUTE : RH - 16 (214 - 0100) SECTION : 7 - 8

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1989	1736	58	3.8	473,074	834,572	4,328	838,899
1990	1801	117	3.2	0	865,244	3,827	869,071
1991	1870	179	2.9	0	811,713	3,309	815,022
1992	1941	243	2.6	0	842,519	2,769	845,288
1993	2013	309	2.5	0	873,584	2,213	875,797
1994	2091	378	2.3	0	907,282	1,635	908,917
1995	2171	450	2.2	-59,134	942,503	1,031	943,534
TOTAL				413,940	6,077,420	19,111	6,096,530
DISCOUNTED TOTAL				285,469	2,497,470	8,630	2,506,100

NET PRESENT VALUE : 2,220,630
BENEFIT COST RATIO : 8.8
INTERNAL RATE OF RETURN : 178.5 %

STUDY ROUTE : RH - 16 (214 - 0100) SECTION : 9 - 10

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1991	1870	62	3.9	473,074	898,433	4,367	902,800
1992	1941	126	3.3	0	932,511	3,943	936,454
1993	2013	192	3.0	0	873,584	3,505	877,089
1994	2091	261	2.7	0	907,282	3,050	910,332
1995	2171	333	2.6	0	942,503	2,575	945,078
1996	2253	407	2.4	0	978,221	2,083	980,303
1997	2339	485	2.3	-105,128	1,015,540	1,571	1,017,110
TOTAL				367,946	6,548,070	21,092	6,569,170
DISCOUNTED TOTAL				218,163	2,144,940	7,448	2,152,390

NET PRESENT VALUE : 1,934,230
BENEFIT COST RATIO : 9.9
INTERNAL RATE OF RETURN : 192.2 %

STUDY ROUTE : RH - 16 (214 - 0100) SECTION : 11 - 12

SURFACE TYPE : DT/ST WIDTH OF ROAD : 6.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1986	1539	50	3.9	473,074	738,735	4,361	743,096
1987	1604	102	3.3	0	770,058	3,923	773,980
1988	1671	158	3.0	0	725,275	3,459	728,734
1989	1736	216	2.7	0	753,984	2,969	756,953
1990	1801	275	2.5	0	781,738	2,466	784,204
1991	1870	337	2.4	0	811,713	1,946	813,659
1992	1941	401	2.3	-105,128	842,519	1,405	843,924
TOTAL				367,946	5,424,020	20,529	5,444,550
DISCOUNTED TOTAL				384,477	3,129,290	12,849	3,142,140

NET PRESENT VALUE : 2,757,670
BENEFIT COST RATIO : 8.2
INTERNAL RATE OF RETURN : 158.6 %

STUDY ROUTE : RH - 16 (214 - 0100)

SECTION : 8 - 9

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1991	1870	62	4.2	473,074	898,433	4,494	902,928
1992	1941	126	3.7	0	932,511	4,329	936,840
1993	2013	192	3.5	0	966,924	4,157	971,082
1994	2091	261	3.3	0	1,004,220	3,980	1,008,200
1995	2171	333	3.1	0	1,043,220	3,794	1,047,020
1996	2253	407	3.0	0	978,221	3,602	981,823
1997	2339	485	2.9	-236,537	1,015,540	3,402	1,018,940
TOTAL				236,537	6,839,070	27,759	6,866,830
DISCOUNTED TOTAL				191,274	2,238,770	9,357	2,248,120

NET PRESENT VALUE : 2,056,850
BENEFIT COST RATIO : 11.8
INTERNAL RATE OF RETURN : 194.5 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1475	48	3.8	586,226	706,926	4,291	711,217
1986	1539	98	3.2	0	738,735	3,708	742,444
1987	1604	150	2.8	0	695,777	3,102	698,879
1988	1671	206	2.6	0	725,275	2,460	727,735
1989	1736	264	2.4	0	753,984	1,783	755,767
1990	1801	323	2.2	0	781,738	1,088	782,826
1991	1870	385	2.1	0	811,713	368	812,082
TOTAL				586,226	5,214,150	16,800	5,230,950
DISCOUNTED TOTAL				586,226	3,367,330	12,288	3,379,610

NET PRESENT VALUE : 2,793,390
BENEFIT COST RATIO : 5.8
INTERNAL RATE OF RETURN : 122.5 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1475	48	3.7	473,074	706,926	4,197	711,122
1986	1539	98	3.0	0	667,528	3,801	671,329
1987	1604	150	2.6	0	695,777	3,390	699,167
1988	1671	206	2.4	0	725,275	2,948	728,223
1989	1736	264	2.2	0	753,984	2,489	756,473
1990	1801	59	3.7	473,074	865,244	4,261	869,505
1991	1870	121	3.1	-337,910	898,433	3,931	902,364
TOTAL				608,238	5,313,170	25,017	5,338,180
DISCOUNTED TOTAL				605,032	3,392,090	16,413	3,408,510

NET PRESENT VALUE : 2,803,470
BENEFIT COST RATIO : 5.6
INTERNAL RATE OF RETURN : 147.3 %

STUDY ROUTE : RH - 16 (214 - 0100)

SECTION : 10 - 11

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 6.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1475	48	4.3	473,074	706,926	4,519	711,445
1986	1539	98	3.9	0	738,735	4,403	743,138
1987	1604	150	3.6	0	770,058	4,282	774,340
1988	1671	206	3.4	0	802,771	4,154	806,925
1989	1736	264	3.3	0	834,572	4,019	838,591
1990	1801	323	3.2	0	865,244	3,881	869,125
1991	1870	385	3.1	-236,537	898,433	3,737	902,170
TOTAL				236,537	5,616,740	28,995	5,645,730
DISCOUNTED TOTAL				377,540	3,596,710	19,170	3,615,880

NET PRESENT VALUE : 3,238,340
BENEFIT COST RATIO : 9.6
INTERNAL RATE OF RETURN : 154.7 %

;DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1475	48	3.8	529,650	706,926	4,291	711,217
1986	1539	98	3.2	0	738,735	3,708	742,444
1987	1604	150	2.8	0	695,777	3,102	698,879
1988	1671	206	2.6	0	725,275	2,460	727,735
1989	1736	264	2.4	0	753,984	1,783	755,767
1990	1801	323	2.2	0	781,738	1,088	782,826
1991	1870	385	2.1	0	811,713	368	812,082
TOTAL				529,650	5,214,150	16,800	5,230,950
DISCOUNTED TOTAL				529,650	3,367,330	12,288	3,379,610

NET PRESENT VALUE : 2,849,960
BENEFIT COST RATIO : 6.4
INTERNAL RATE OF RETURN : 135.6 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1475	48	3.7	473,074	706,926	4,243	711,169
1986	1539	98	3.1	0	738,735	3,897	742,632
1987	1604	150	2.7	0	695,777	3,537	699,313
1988	1671	206	2.4	0	725,275	3,149	728,424
1989	1736	264	2.2	0	753,984	2,747	756,730
1990	1801	323	2.1	0	781,738	2,338	784,076
1991	1870	62	3.8	67,582	898,433	4,286	902,719
TOTAL				1,013,730	5,300,870	24,196	5,325,060
DISCOUNTED TOTAL				534,608	3,406,550	16,095	3,422,650

NET PRESENT VALUE : 2,888,040
BENEFIT COST RATIO : 6.4
INTERNAL RATE OF RETURN : 151.7 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 10 - 11

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.6	394,228	727,418	4,569	731,987
1986	1271	229	4.3	0	766,462	4,554	771,016
1987	1339	352	4.2	0	806,161	4,539	810,700
1988	1414	481	4.1	0	851,450	4,523	855,973
1989	1478	616	4.0	0	890,090	4,506	894,596
1990	1544	757	3.9	0	929,059	4,489	933,548
1991	1614	904	3.8	-197,114	970,513	4,470	974,983
TOTAL				197,114	5,941,150	31,650	5,972,800
DISCOUNTED TOTAL				314,617	3,790,180	20,668	3,810,850

NET PRESENT VALUE : 3,496,230
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.6	394,228	727,418	4,571	731,989
1986	1271	229	4.4	0	766,462	4,560	771,023
1987	1339	352	4.2	0	806,161	4,550	810,711
1988	1414	481	4.1	0	851,450	4,538	855,988
1989	1478	616	4.1	0	890,090	4,526	894,616
1990	1544	757	4.0	0	929,059	4,513	933,573
1991	1614	904	3.9	-197,114	970,513	4,500	975,013
TOTAL				197,114	5,941,150	31,759	5,972,910
DISCOUNTED TOTAL				314,617	3,790,180	20,730	3,810,910

NET PRESENT VALUE : 3,496,300
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 11 - 12

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.5	394,228	727,418	4,567	731,984
1986	1271	229	4.3	0	766,462	4,547	771,009
1987	1339	352	4.1	0	806,161	4,527	810,688
1988	1414	481	4.0	0	851,450	4,505	855,955
1989	1478	616	3.9	0	890,090	4,483	894,573
1990	1544	757	3.8	0	929,059	4,459	933,518
1991	1614	904	3.7	-197,114	970,513	4,435	974,947
TOTAL				197,114	5,941,150	31,521	5,972,680
DISCOUNTED TOTAL				314,617	3,790,180	20,596	3,810,780

NET PRESENT VALUE : 3,496,160
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.5	394,228	727,418	4,566	731,984
1986	1271	229	4.3	0	766,462	4,545	771,008
1987	1339	352	4.1	0	806,161	4,524	810,685
1988	1414	481	4.0	0	851,450	4,501	855,952
1989	1478	616	3.9	0	890,090	4,478	894,568
1990	1544	757	3.8	0	929,059	4,453	933,512
1991	1614	904	3.7	-197,114	970,513	4,427	974,940
TOTAL				197,114	5,941,150	31,494	5,972,650
DISCOUNTED TOTAL				314,617	3,790,180	20,580	3,810,760

NET PRESENT VALUE : 3,496,150
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 12 - 13

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.5	394,228	727,418	4,564	731,982
1986	1271	229	4.2	0	766,462	4,540	771,003
1987	1339	352	4.1	0	806,161	4,515	810,676
1988	1414	481	3.9	0	851,450	4,489	855,939
1989	1478	616	3.8	0	890,090	4,461	894,552
1990	1544	757	3.7	0	929,059	4,432	933,492
1991	1614	904	3.7	-197,114	970,513	4,402	974,915
TOTAL				197,114	5,941,150	31,405	5,972,560
DISCOUNTED TOTAL				314,617	3,790,180	20,530	3,810,710

NET PRESENT VALUE : 3,496,100
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.5	394,228	727,418	4,561	731,979
1986	1271	229	4.2	0	766,462	4,529	770,991
1987	1339	352	4.0	0	806,161	4,496	810,657
1988	1414	481	3.8	0	851,450	4,462	855,912
1989	1478	616	3.7	0	890,090	4,425	894,516
1990	1544	757	3.6	0	929,059	4,387	933,446
1991	1614	904	3.6	-197,114	970,513	4,348	974,861
TOTAL				197,114	5,941,150	31,208	5,972,360
DISCOUNTED TOTAL				314,617	3,790,180	20,419	3,810,600

NET PRESENT VALUE : 3,495,990
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 190.9 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 13 - 14

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.6	394,228	727,418	4,569	731,986
1986	1271	229	4.3	0	766,462	4,553	771,015
1987	1339	352	4.2	0	806,161	4,537	810,698
1988	1414	481	4.0	0	851,450	4,520	855,970
1989	1478	616	4.0	0	890,090	4,502	894,592
1990	1544	757	3.9	0	929,059	4,483	933,543
1991	1614	904	3.8	-197,114	970,513	4,464	974,977
TOTAL				197,114	5,941,150	31,627	5,972,780
DISCOUNTED TOTAL				314,617	3,790,180	20,655	3,810,840

NET PRESENT VALUE : 3,496,220
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.6	394,228	727,418	4,570	731,988
1986	1271	229	4.4	0	766,462	4,558	771,020
1987	1339	352	4.2	0	806,161	4,545	810,707
1988	1414	481	4.1	0	851,450	4,532	855,983
1989	1478	616	4.0	0	890,090	4,518	894,609
1990	1544	757	3.9	0	929,059	4,504	933,563
1991	1614	904	3.9	-197,114	970,513	4,489	975,002
TOTAL				197,114	5,941,150	31,717	5,972,870
DISCOUNTED TOTAL				314,617	3,790,180	20,706	3,810,890

NET PRESENT VALUE : 3,496,270
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 14 - 15

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.5	394,228	727,418	4,561	731,979
1986	1271	229	4.2	0	766,462	4,531	770,993
1987	1339	352	4.0	0	806,161	4,499	810,660
1988	1414	481	3.9	0	851,450	4,466	855,916
1989	1478	616	3.8	0	890,090	4,431	894,521
1990	1544	757	3.7	0	929,059	4,394	933,453
1991	1614	904	3.6	-197,114	970,513	4,356	974,869
TOTAL				197,114	5,941,150	31,238	5,972,390
DISCOUNTED TOTAL				314,617	3,790,180	20,436	3,810,620

NET PRESENT VALUE : 3,496,000
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 190.9 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.4	394,228	727,418	4,552	731,970
1986	1271	229	4.1	0	766,462	4,504	770,966
1987	1339	352	3.9	0	806,161	4,453	810,614
1988	1414	481	3.7	0	851,450	4,400	855,850
1989	1478	616	3.6	0	890,090	4,344	894,434
1990	1544	757	3.5	0	929,059	4,285	933,344
1991	1614	904	3.4	-197,114	970,513	4,224	974,737
TOTAL				197,114	5,941,150	30,762	5,971,920
DISCOUNTED TOTAL				314,617	3,790,180	20,167	3,810,350

NET PRESENT VALUE : 3,495,730
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 190.9 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 15 - 16

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.6	394,228	727,418	4,571	731,989
1986	1271	229	4.4	0	766,462	4,562	771,024
1987	1339	352	4.3	0	806,161	4,552	810,713
1988	1414	481	4.2	0	851,450	4,541	855,991
1989	1478	616	4.1	0	890,090	4,530	894,620
1990	1544	757	4.0	0	929,059	4,518	933,578
1991	1614	904	3.9	-197,114	970,513	4,506	975,019
TOTAL				197,114	5,941,150	31,781	5,972,940
DISCOUNTED TOTAL				314,617	3,790,180	20,742	3,810,930

NET PRESENT VALUE : 3,496,310
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.7	394,228	727,418	4,574	731,992
1986	1271	229	4.5	0	766,462	4,571	771,033
1987	1339	352	4.4	0	806,161	4,567	810,728
1988	1414	481	4.3	0	851,450	4,564	856,014
1989	1478	616	4.3	0	890,090	4,560	894,650
1990	1544	757	4.2	0	929,059	4,556	933,615
1991	1614	904	4.2	-197,114	970,513	4,551	975,064
TOTAL				197,114	5,941,150	31,943	5,973,100
DISCOUNTED TOTAL				314,617	3,790,180	20,833	3,811,020

NET PRESENT VALUE : 3,496,400
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 191.0 %

STUDY ROUTE : RH - 25 (2071 - 0100) SECTION : 16 - 17

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.4	394,228	727,418	4,555	731,973
1986	1271	229	4.1	0	766,462	4,512	770,974
1987	1339	352	3.9	0	806,161	4,466	810,627
1988	1414	481	3.7	0	851,450	4,418	855,869
1989	1478	616	3.6	0	890,090	4,368	894,458
1990	1544	757	3.5	0	929,059	4,316	933,375
1991	1614	904	3.4	-197,114	970,513	4,261	974,774
TOTAL				197,114	5,941,150	30,895	5,972,050
DISCOUNTED TOTAL				314,617	3,790,180	20,243	3,810,430

NET PRESENT VALUE : 3,495,810
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 190.9 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	1206	111	4.3	394,228	727,418	4,535	731,953
1986	1271	229	3.9	0	766,462	4,452	770,914
1987	1339	352	3.7	0	806,161	4,364	810,525
1988	1414	481	3.5	0	851,450	4,271	855,722
1989	1478	616	3.4	0	890,090	4,175	894,265
1990	1544	757	3.3	0	929,059	4,074	933,133
1991	1614	904	3.2	-197,114	970,513	3,969	974,481
TOTAL				197,114	5,941,150	29,839	5,970,990
DISCOUNTED TOTAL				314,617	3,790,180	19,647	3,809,830

NET PRESENT VALUE : 3,495,210
BENEFIT COST RATIO : 12.1
INTERNAL RATE OF RETURN : 190.9 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 9 - 10

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.8	724,256	483,767	4,287	488,054
1989	979	88	3.2	0	504,233	3,697	507,930
1990	1021	135	2.8	0	467,084	3,080	470,163
1991	1062	183	2.6	0	485,360	2,442	487,802
1992	1106	233	2.4	0	505,741	1,785	507,526
1993	1152	286	2.2	0	527,037	1,094	528,131
1994	1200	341	2.1	0	550,392	369	550,761
TOTAL				724,256	3,523,610	16,754	3,540,370
DISCOUNTED TOTAL				515,511	1,621,280	8,722	1,630,000

NET PRESENT VALUE : 1,114,490
BENEFIT COST RATIO : 3.2
INTERNAL RATE OF RETURN : 66.2 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.5	535,669	483,767	4,038	487,805
1989	979	88	2.8	0	447,198	3,476	450,674
1990	1021	135	2.4	0	467,084	2,888	469,972
1991	1062	183	2.1	0	485,360	2,288	487,648
1992	1106	50	3.4	394,228	570,156	3,950	574,106
1993	1152	103	2.7	0	527,037	3,287	530,324
1994	1200	158	2.3	0	550,392	2,599	552,991
TOTAL				929,897	3,530,990	22,526	3,553,520
DISCOUNTED TOTAL				559,607	1,614,930	10,654	1,625,580

NET PRESENT VALUE : 1,065,980
BENEFIT COST RATIO : 2.9
INTERNAL RATE OF RETURN : 83.1 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 10 - 11

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	4.2	394,228	417,589	4,498	422,087
1986	853	78	3.8	0	438,589	4,337	442,926
1987	897	120	3.5	0	461,742	4,168	465,910
1988	941	163	3.3	0	483,767	3,993	487,759
1989	979	208	3.2	0	504,233	3,811	508,044
1990	1021	255	3.0	0	526,646	3,622	530,268
1991	1062	303	2.9	-197,114	485,360	3,426	488,786
TOTAL				197,114	3,317,930	27,855	3,345,780
DISCOUNTED TOTAL				314,617	2,131,070	18,525	2,149,600

NET PRESENT VALUE : 1,834,980
BENEFIT COST RATIO : 6.8
INTERNAL RATE OF RETURN : 111.7 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	629,962	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				629,962	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				629,962	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,378,850
BENEFIT COST RATIO : 3.2
INTERNAL RATE OF RETURN : 66.4 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	441,375	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.6	394,228	504,233	4,080	508,312
1990	1021	92	2.8	0	467,084	3,562	470,645
1991	1062	140	2.4	-98,557	485,360	3,033	488,392
TOTAL				737,046	3,101,770	23,378	3,125,150
DISCOUNTED TOTAL				652,109	1,989,370	15,388	2,004,760

NET PRESENT VALUE : 1,352,650
BENEFIT COST RATIO : 3.1
INTERNAL RATE OF RETURN : 87.9 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 11 - 12

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	535,669	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				535,669	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				535,669	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,473,140
BENEFIT COST RATIO : 3.8
INTERNAL RATE OF RETURN : 78.8 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	394,228	417,589	4,055	421,644
1986	853	78	2.8	0	388,961	3,507	392,468
1987	897	120	2.4	0	409,487	2,932	412,419
1988	941	163	2.1	0	429,059	2,343	431,402
1989	979	45	3.8	394,228	504,233	4,266	508,498
1990	1021	92	3.1	0	526,646	3,942	530,588
1991	1062	140	2.8	-225,273	485,360	3,611	488,970
TOTAL				563,183	3,161,330	24,656	3,185,990
DISCOUNTED TOTAL				553,783	2,019,550	16,044	2,035,590

NET PRESENT VALUE : 1,481,810
BENEFIT COST RATIO : 3.7
INTERNAL RATE OF RETURN : 100.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,099,770	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				1,099,770	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,099,770	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 909,037
BENEFIT COST RATIO : 1.8
INTERNAL RATE OF RETURN : 34.6 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	1,021,020	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	582,816	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,603,840	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,391,410	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 612,626
BENEFIT COST RATIO : 1.4
INTERNAL RATE OF RETURN : 29.2 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 12 - 13

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.8	488,522	483,767	4,287	488,054
1989	979	88	3.2	0	504,233	3,697	507,930
1990	1021	135	2.8	0	467,084	3,080	470,163
1991	1062	183	2.6	0	485,360	2,442	487,802
1992	1106	233	2.4	0	505,741	1,785	507,526
1993	1152	286	2.2	0	527,037	1,094	528,131
1994	1200	341	2.1	0	550,392	369	550,761
TOTAL				488,522	3,523,610	16,754	3,540,370
DISCOUNTED TOTAL				347,720	1,621,280	8,722	1,630,000

NET PRESENT VALUE : 1,282,280
BENEFIT COST RATIO : 4.7
INTERNAL RATE OF RETURN : 100.0 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.7	394,228	483,767	4,200	487,967
1989	979	88	3.0	0	504,233	3,806	508,039
1990	1021	135	2.6	0	467,084	3,395	470,479
1991	1062	183	2.4	0	485,360	2,976	488,335
1992	1106	233	2.2	0	505,741	2,538	508,279
1993	1152	286	2.0	0	527,037	2,075	529,112
1994	1200	55	3.8	49,279	620,484	4,328	624,812
TOTAL				837,735	3,593,710	23,318	3,617,020
DISCOUNTED TOTAL				312,541	1,643,840	11,062	1,654,910

NET PRESENT VALUE : 1,342,370
BENEFIT COST RATIO : 5.3
INTERNAL RATE OF RETURN : 124.2 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,001,330	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				1,001,330	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,001,330	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,007,480
BENEFIT COST RATIO : 2.0
INTERNAL RATE OF RETURN : 39.0 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	902,893	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	535,669	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,438,560	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,243,320	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 760,717
BENEFIT COST RATIO : 1.6
INTERNAL RATE OF RETURN : 35.6 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 13 - 14

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,198,210	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				1,198,210	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,198,210	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 810,597
BENEFIT COST RATIO : 1.7
INTERNAL RATE OF RETURN : 30.8 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	1,139,150	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	582,816	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,721,960	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,509,540	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 494,498
BENEFIT COST RATIO : 1.3
INTERNAL RATE OF RETURN : 24.7 %

STUDY ROUTE : RH - 27 (2160 - 0100) SECTION : 14 - 15

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	677,109	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				677,109	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				677,109	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,331,700
BENEFIT COST RATIO : 3.0
INTERNAL RATE OF RETURN : 61.4 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	488,522	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.7	394,228	504,233	4,181	508,414
1990	1021	92	3.0	0	467,084	3,769	470,852
1991	1062	140	2.6	-157,691	485,360	3,348	488,707
TOTAL				725,059	3,101,770	24,001	3,125,770
DISCOUNTED TOTAL				675,372	1,989,370	15,693	2,005,060

NET PRESENT VALUE : 1,329,690
BENEFIT COST RATIO : 3.0
INTERNAL RATE OF RETURN : 79.0 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,198,210	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				1,198,210	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,198,210	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 810,597
BENEFIT COST RATIO : 1.7
INTERNAL RATE OF RETURN : 30.8 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	1,139,150	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	582,816	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,721,960	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,509,540	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 494,498
BENEFIT COST RATIO : 1.3
INTERNAL RATE OF RETURN : 24.7 %

STUDY ROUTE : RH - 27 (2160 - 0100) SECTION : 15 - 16

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.8	1,148,580	483,767	4,287	488,054
1989	979	88	3.2	0	504,233	3,697	507,930
1990	1021	135	2.8	0	467,084	3,080	470,163
1991	1062	183	2.6	0	485,360	2,442	487,802
1992	1106	233	2.4	0	505,741	1,785	507,526
1993	1152	286	2.2	0	527,037	1,094	528,131
1994	1200	341	2.1	0	550,392	369	550,761
TOTAL				1,148,580	3,523,610	16,754	3,540,370
DISCOUNTED TOTAL				817,535	1,621,280	8,722	1,630,000

NET PRESENT VALUE : 812,462
BENEFIT COST RATIO : 2.0
INTERNAL RATE OF RETURN : 38.9 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1988	941	43	3.5	912,844	483,767	4,038	487,805
1989	979	88	2.8	0	447,198	3,476	450,674
1990	1021	135	2.4	0	467,084	2,888	469,972
1991	1062	183	2.1	0	485,360	2,288	487,648
1992	1106	50	3.4	488,522	570,156	3,852	574,008
1993	1152	103	2.6	0	527,037	3,084	530,122
1994	1200	158	2.1	0	550,392	2,288	552,680
TOTAL				1,401,370	3,530,990	21,915	3,552,910
DISCOUNTED TOTAL				870,727	1,614,930	10,442	1,625,370

NET PRESENT VALUE : 754,644
BENEFIT COST RATIO : 1.9
INTERNAL RATE OF RETURN : 43.7 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 16 - 17

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1989	979	45	3.8	441,375	504,233	4,286	508,519
1990	1021	92	3.2	0	526,646	3,693	530,339
1991	1062	140	2.8	0	485,360	3,081	488,440
1992	1106	190	2.6	0	505,741	2,449	508,190
1993	1152	243	2.4	0	527,037	1,785	528,823
1994	1200	298	2.2	0	550,392	1,089	551,481
1995	1249	355	2.1	0	572,840	367	573,207
TOTAL				441,375	3,672,250	16,751	3,689,000
DISCOUNTED TOTAL				280,502	1,508,690	7,786	1,516,470

NET PRESENT VALUE : 1,235,970
BENEFIT COST RATIO : 5.4
INTERNAL RATE OF RETURN : 115.7 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1989	979	45	3.8	394,228	504,233	4,252	508,484
1990	1021	92	3.1	0	526,646	3,913	530,559
1991	1062	140	2.7	0	485,360	3,567	488,927
1992	1106	190	2.5	0	505,741	3,207	508,948
1993	1152	243	2.3	0	527,037	2,825	529,862
1994	1200	298	2.1	0	550,392	2,428	552,821
1995	1249	57	3.8	49,279	645,750	4,329	650,079
TOTAL				837,735	3,745,160	24,520	3,769,680
DISCOUNTED TOTAL				279,054	1,529,650	10,348	1,540,000

NET PRESENT VALUE : 1,260,940
BENEFIT COST RATIO : 5.5
INTERNAL RATE OF RETURN : 129.6 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	942,269	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				942,269	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				942,269	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,066,540
BENEFIT COST RATIO : 2.1
INTERNAL RATE OF RETURN : 42.1 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	843,829	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	535,669	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,379,500	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,184,260	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 819,781
BENEFIT COST RATIO : 1.7
INTERNAL RATE OF RETURN : 39.0 %

STUDY ROUTE : RH - 27 (2160 - 0100)

SECTION : 17 - 18

SURFACE TYPE : DT/ST

WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	582,816	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				582,816	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				582,816	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 1,425,990
BENEFIT COST RATIO : 3.4
INTERNAL RATE OF RETURN : 72.2 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	441,375	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.7	394,228	504,233	4,218	508,451
1990	1021	92	3.0	0	526,646	3,844	530,491
1991	1062	140	2.7	-197,114	485,360	3,462	488,822
TOTAL				638,489	3,161,330	24,228	3,185,560
DISCOUNTED TOTAL				612,303	2,019,550	15,804	2,035,350

NET PRESENT VALUE : 1,423,050
BENEFIT COST RATIO : 3.3
INTERNAL RATE OF RETURN : 88.6 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,119,460	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	0	485,360	362	485,722
TOTAL				1,119,460	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,119,460	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 889,349
BENEFIT COST RATIO : 1.8
INTERNAL RATE OF RETURN : 33.8 %

TWO OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMU-LATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.6	1,040,710	417,589	4,043	421,632
1986	853	78	2.8	0	388,961	3,481	392,442
1987	897	120	2.4	0	409,487	2,892	412,378
1988	941	163	2.1	0	429,059	2,288	431,347
1989	979	45	3.4	582,816	504,233	3,841	508,073
1990	1021	92	2.6	0	467,084	3,072	470,156
1991	1062	140	2.1	0	485,360	2,288	487,648
TOTAL				1,623,520	3,101,770	21,904	3,123,680
DISCOUNTED TOTAL				1,411,100	1,989,370	14,668	2,004,040

NET PRESENT VALUE : 592,938
BENEFIT COST RATIO : 1.4
INTERNAL RATE OF RETURN : 28.4 %

STUDY ROUTE : RH - 27 (2160 - 0100) SECTION : 18 - 19

SURFACE TYPE : DT/ST WIDTH OF ROAD : 5.0 M

ASPHALT INSTITUTE METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,487,750	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	-1,054,800	485,360	362	485,722
TOTAL				432,957	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,061,740	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 947,071
BENEFIT COST RATIO : 1.9
INTERNAL RATE OF RETURN : 28.8 %

DOH (CALIFORNIA) METHOD

ONE OVERLAY CASE (UNIT OF COST & BENEFIT : BAHT)

YEAR	AADT	CUMULATIVE E S A (X1000)	PSI	COSTS	BENEFITS		
				OVERLAY COST	V O C SAVING	R M C SAVING	TOTAL
1985	813	38	3.8	1,487,750	417,589	4,289	421,878
1986	853	78	3.2	0	438,589	3,700	442,289
1987	897	120	2.8	0	409,487	3,081	412,567
1988	941	163	2.6	0	429,059	2,439	431,498
1989	979	208	2.4	0	447,198	1,775	448,973
1990	1021	255	2.2	0	467,084	1,080	468,163
1991	1062	303	2.1	-1,054,800	485,360	362	485,722
TOTAL				432,957	3,094,360	16,726	3,111,090
DISCOUNTED TOTAL				1,061,740	1,996,570	12,240	2,008,810

NET PRESENT VALUE : 947,071
BENEFIT COST RATIO : 1.9
INTERNAL RATE OF RETURN : 28.8 %