Appendix 4.2.3 MINIMUM DESIGN STANDARDS FOR PROVINCIAL ROADS

Controlling Factors

1. Access control : When designated under the Highway Law.
2. Highway crossing : Grade separation only after proven viable by economic feasibility calculations.
3. Railraod crossing: Grade separation only after proven viable by economic feasibility calculations.
4. Bridge width (1) : Bridge width shall be one of the following
   (a) Full roadway width (shoulder to shoulder or curb to curb)
   (b) 1.50m greater than carriageway width
   (c) 7.00m for class F_6 road.
5. Sidewalk (2): Sidewalk shall be one of the following
   (a) 1.50m for bridges in urban and suburban areas.
   (b) 1.00m for bridges in rural areas.
   (c) 0.50m for bridges with no pedestrian
6. Vertical clearance = 4.30m (14 ft.)
7. Design bridge loading = HS 20-44 (MS 18)
8. Pavement design shall be based on the accumulated number of equivalent axle loads predicted during the first 7-year after construction.
9. Follow AASHTO recommendation for nay design details not separately specified.

	F_D	F_1	F_2	F_3	F_4	F_5	F_6	Remarks
Average Daily Traffic	Above 8,000	4,000-8,000	2,000-4,000	1,000-2,000	300-1,000	← Below 300 →		
Design Speed k.p.h.								
Flat and moderately rolling	← 70-90 →				60-80	← 60 →		
Rolling and hilly	← 55-70 →				45-60	← 45 →		
Mountainous	← 40-55 →				30-45	← 30 →		
Maximum Gradient %								
Flat and moderately rolling	← 6 →				8	← 12 →		
Rolling and hilly	← 8 →				10	← 12 →		
Mountainous	← 10 →				10	← 12 →		
Suggested Surface Type	← High →		← Intermediate →		Low	← Soil Aggregate →		
Width of Carriageway m.	Divided 2@ 7.00	7.00	6.50	6.00	5.50	9.00	6.00	
Width of Shoulder m.	2.50, 1.50*	2.50	2.25	2.00	1.75	Travelled	Travelled	
Right of Way m.	← 40-60 →				← 20-40 →			

Explanatory Notes

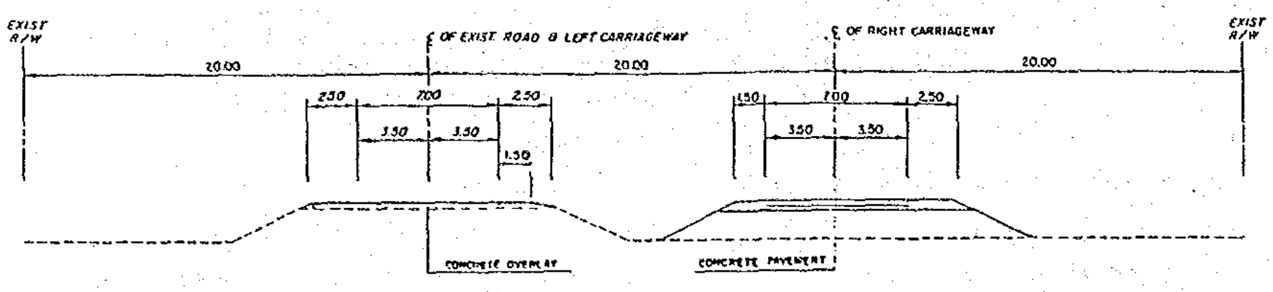
1. Bridges shall be to the full roadway width except as specified below
   (a) Bridges in urban areas
   (b) Bridges in short curves
   (c) Bridges with low traffic volumes
   (d) Bridges with special conditions such as crossing large river
2. Where required by the number of pedestrians, a minimum of 1 m of sidewalk shall be provided on both sides of 2-lane 2-way highway and on left side of divided highway.
3. Design speed may be relaxed in exceptional circumstances on account of right of way difficulties or mountainous terrian.
4. Refer to the AASHTO policy on Geometric Design of Rural Highways to relate desirable grade lengths, climbing lanes, etc.
5. May be reduced in urban or semi-urban conditions at the direction of the Department provided that a suitable cross section including service roads, where necessary, is obtainable.
6. Class F_D roads are required on the basis of a 7-year ADT projection or be justified by economic feasibility calculations. Class F_1 to F_3 roads are required on the basis of a 15-year ADT projection. Class F_4 roads have a projected ADT more than 300 in 7 years and less than 1,000 in 15 years. Class F_5 roads have a projected ADT less than 300 in 7 years and more than 300 in 15 years. Class F_6 roads have a projected ADT less than 300 in 15 years.

Remark

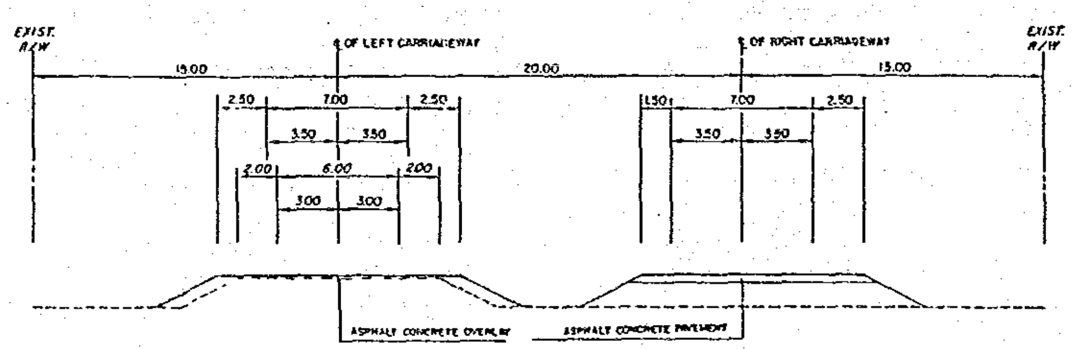
In special cases, the Department may reduce the carriageway width to 3.5, 4, 4.5 or 5 m on various roadbed width, i.e. 4m on 8m roadbed width. Such the case the class of the road will be defined as class F_4 (4/8). If the geometric standard of the road section in the said case below than F_4 then the road class will be defined as F_4 (4/8).

Appendix 4.2.4 TYPICAL CROSS SECTIONS

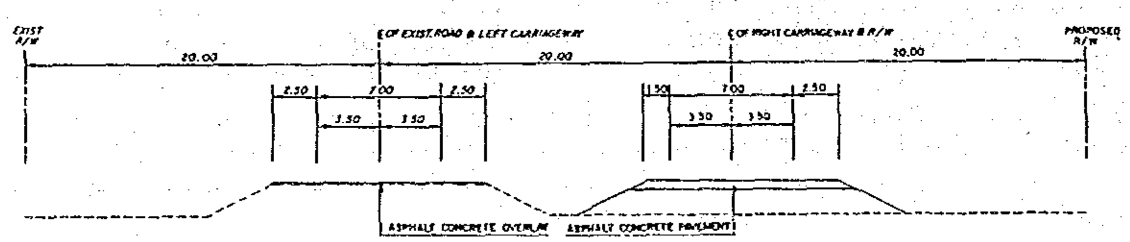
ML－1



ML－2

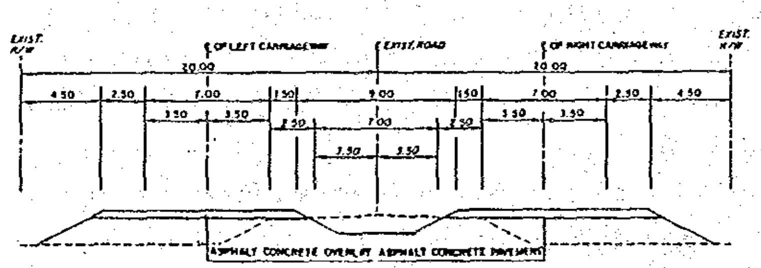


ML－4 (a)



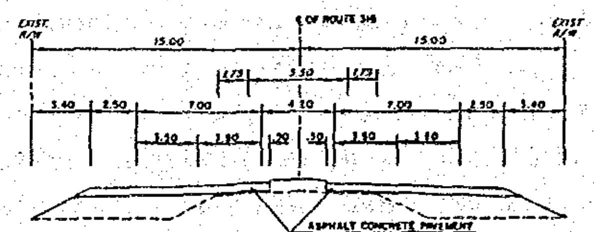
NORMAL SECTION

(b)



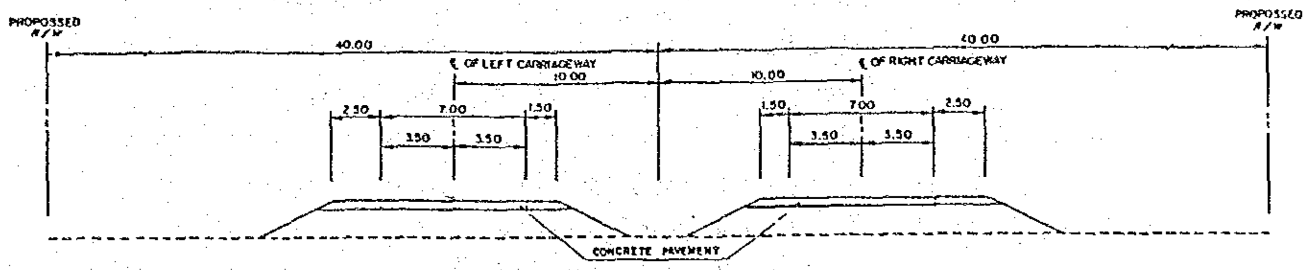
SECTION IN VILLAGE AREA

(c)



SECTION IN URBAN AREA

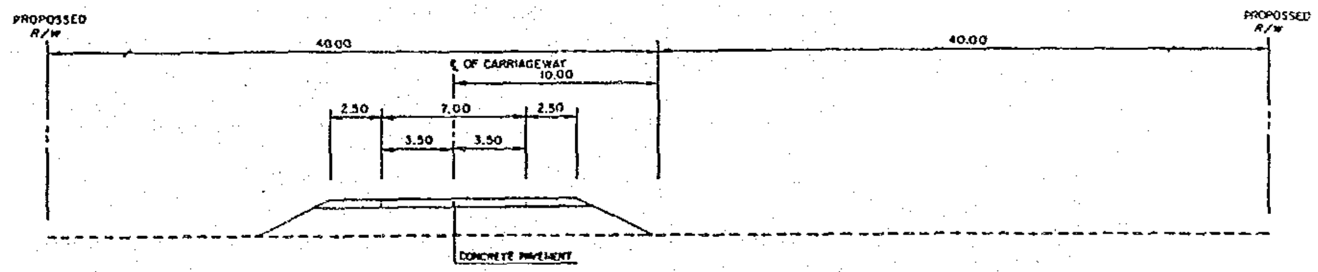
ML－5 (a)



MAINLINE STA. 0+000 TO STA. 24+800

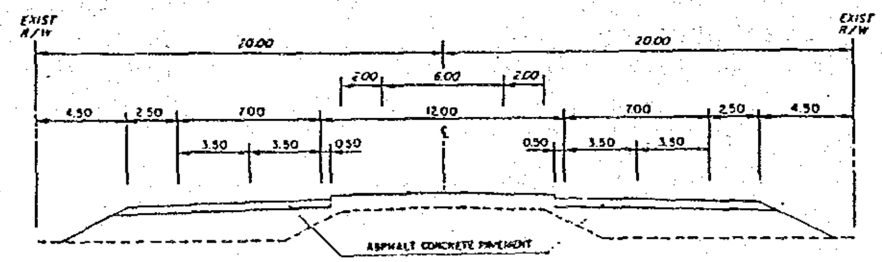
(b)

SPUR STA. 0+000 TO STA. 8+366



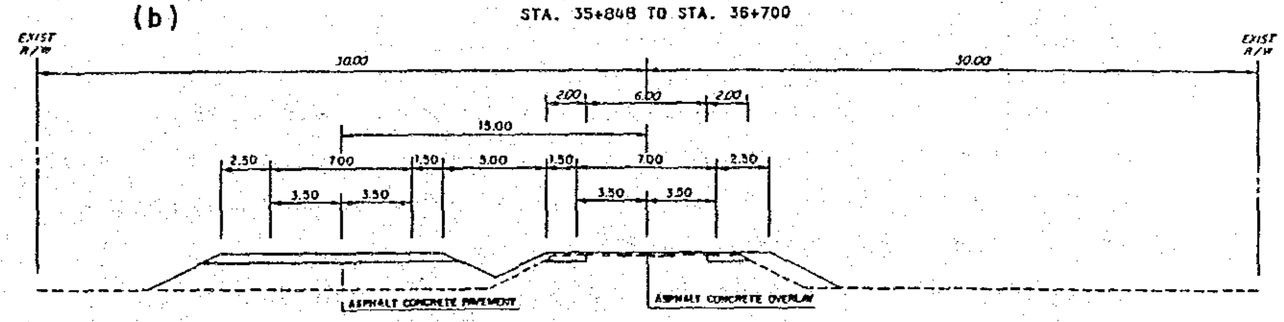
MAINLINE STA. 24+800 TO STA. 41+932

ML－7 (a)



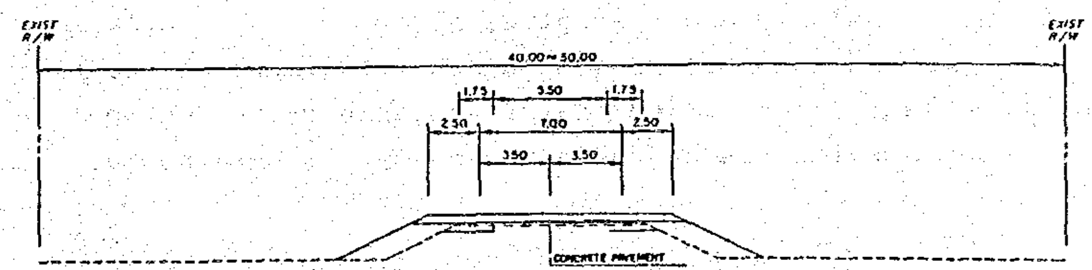
STA. 35+848 TO STA. 36+700

(b)



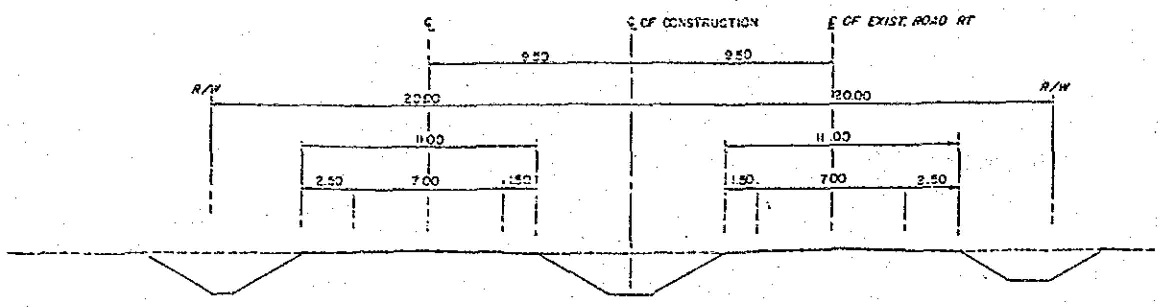
STA. 36+700 TO STA. 76+754

IM－23



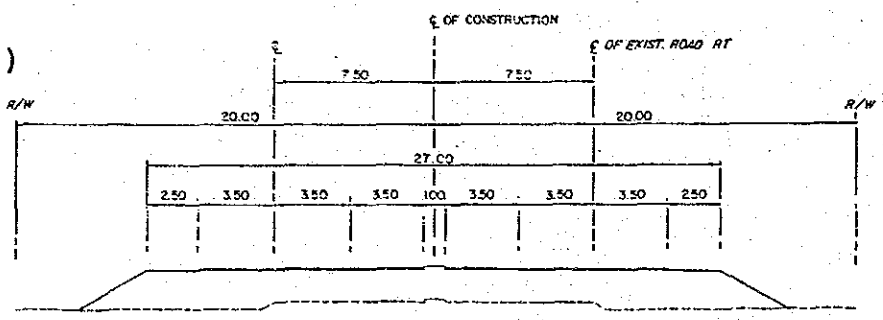
RAISING UP AND WIDENING SICTION

ML–3 (a)



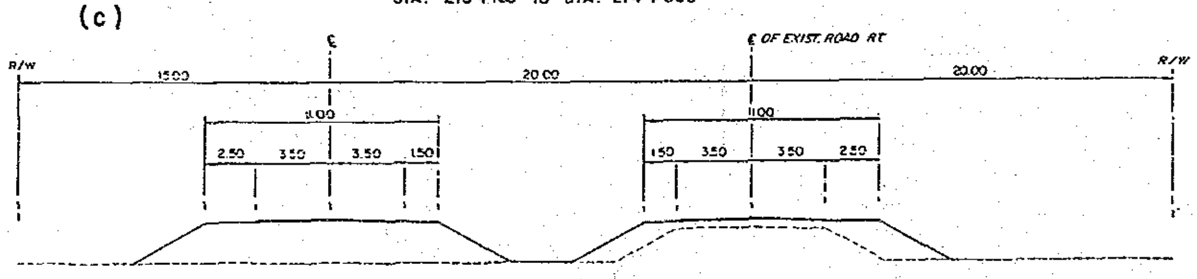
STA. 197 + 500 TO STA. 198 + 307
STA. 214 + 000 TO STA. 219 + 750

(b)



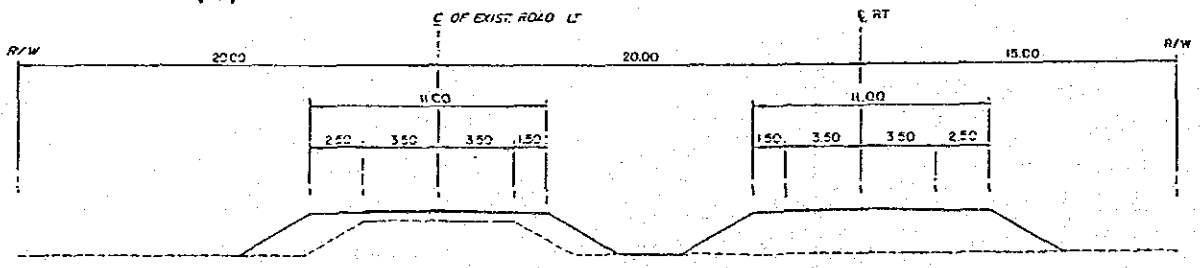
STA. 204+991 TO STA. 205+919
STA. 213 +133 TO STA. 214 +000

(c)



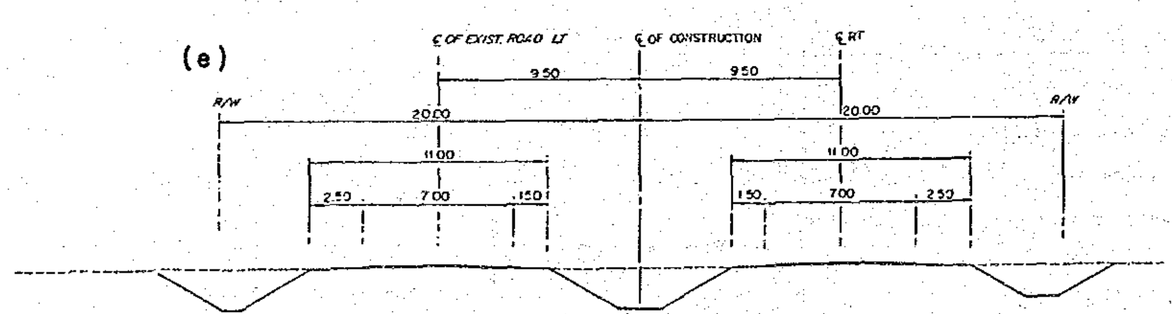
STA. 195 + 553 TO STA. 197 +500
STA. 198 +307 TO STA. 204+991
STA. 209 + 000 TO STA. 210 +000

(d)



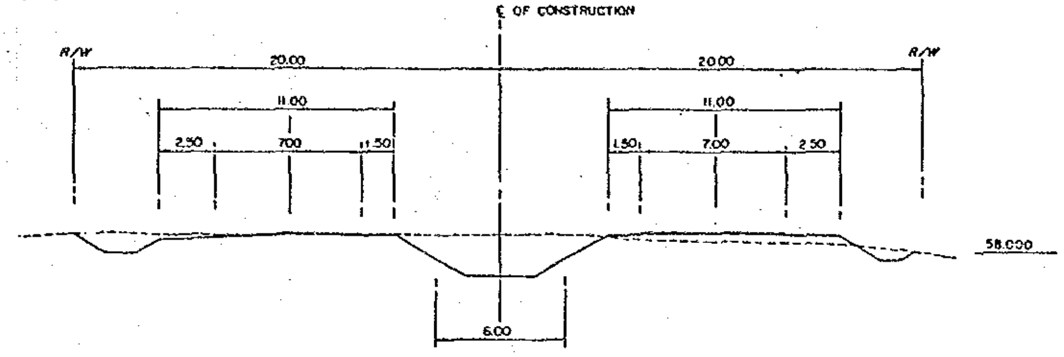
STA. 178 + 704 TO STA. 192+543
STA. 210 + 000 TO STA. 213 + 133

(e)



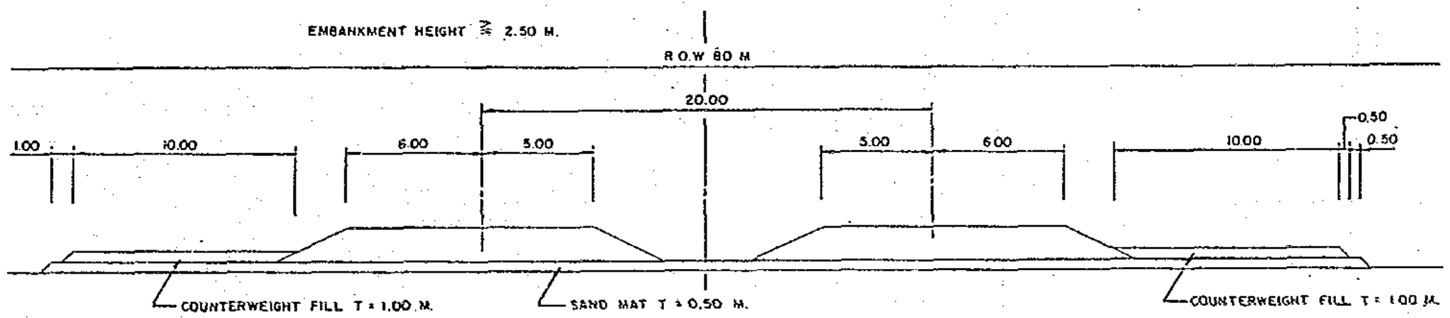
STA. 175 +049 TO STA. 178 + 704
STA. 192 +543 TO STA. 195 + 553
STA. 205+919 TO STA. 209 + 000 (MAP TA PHUT)

ML–3 (f)

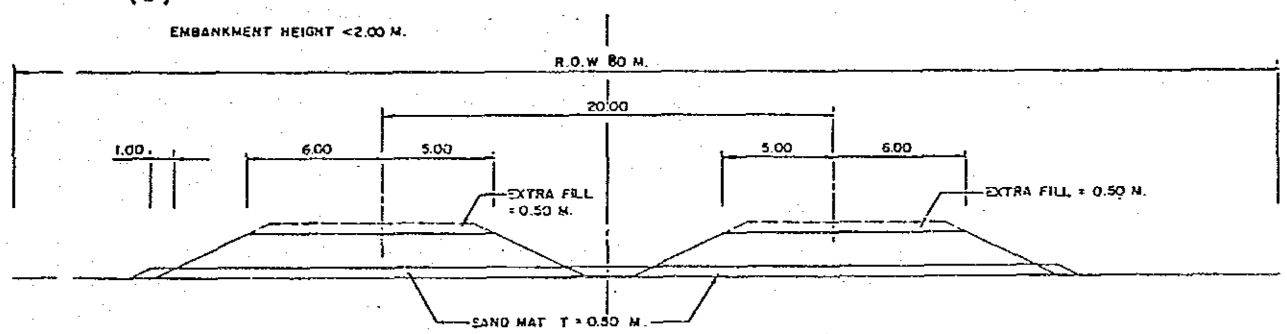


BUILT–UP SECTION

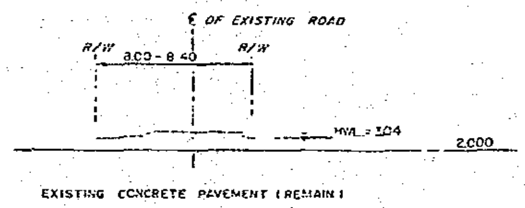
ML–9 (a)



(b)

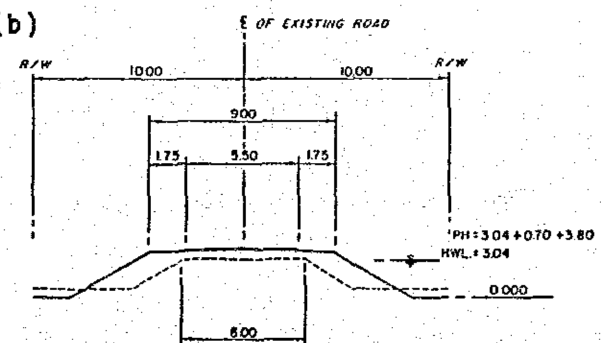


IM–1 (a)



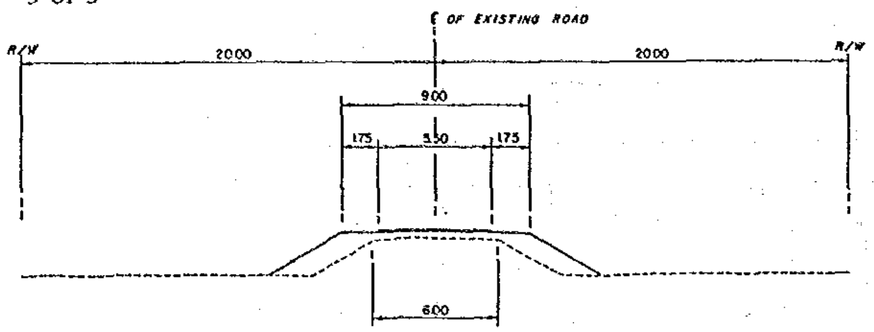
STA. 13+930 TO STA. 14+590
BUILT - UP AREA

(b)

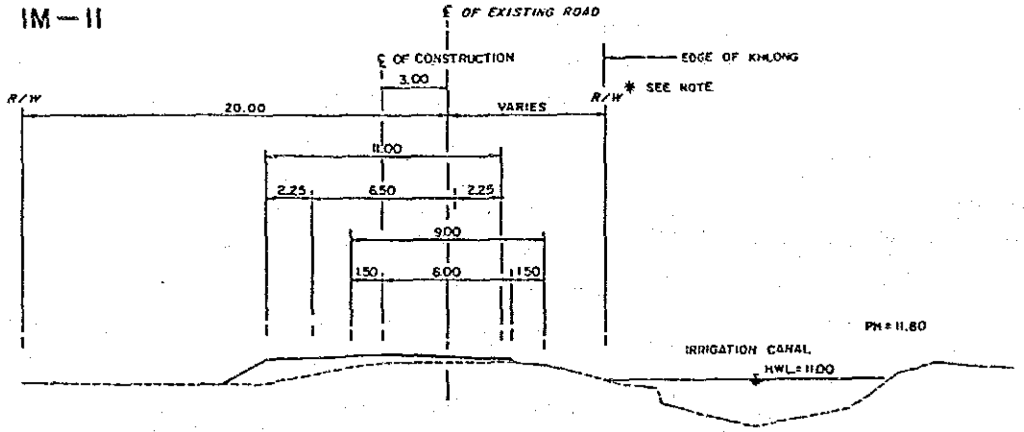


STA. 0+000 TO STA. 13+930
STA. 14+590 TO STA. 18 + 713

IM−2



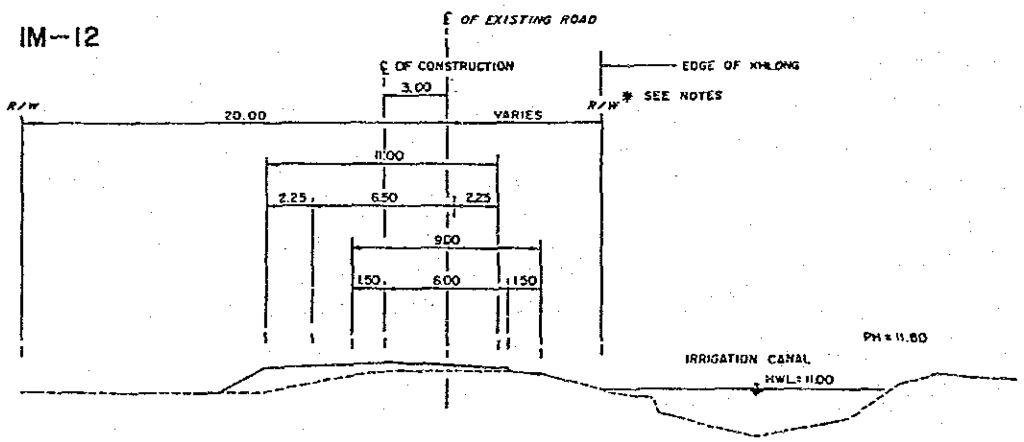
IM−11



STA. 0+000 TO STA. 28+500
STA. 30+164 TO STA. 40+652

NOTE
FROM STA 28+500 TO STA. 30+164,
R/W WIDTH 40 M.

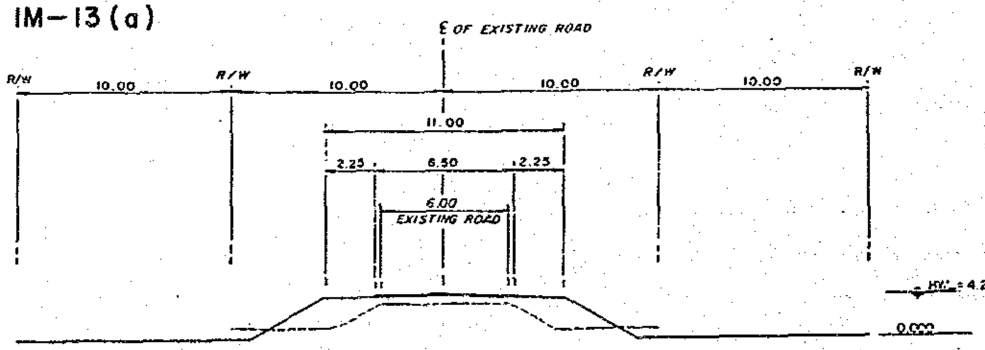
IM−12



STA. 0+000 TO STA. 17+100
STA. 34+117 TO STA. 49+300

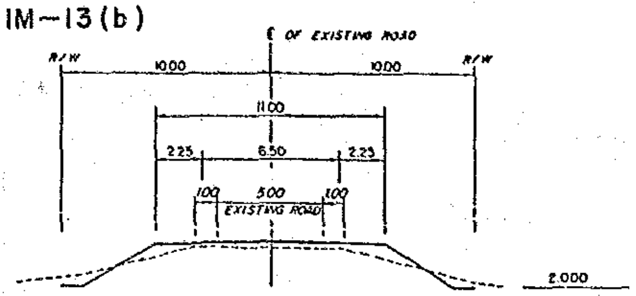
NOTES
1. FROM STA 17+100 TO STA. 34+117
R/W WIDTH 40 M.
2. FROM STA 49+300 TO STA. 51+010
NEW R/W WIDTH 40 M.

IM−13 (a)



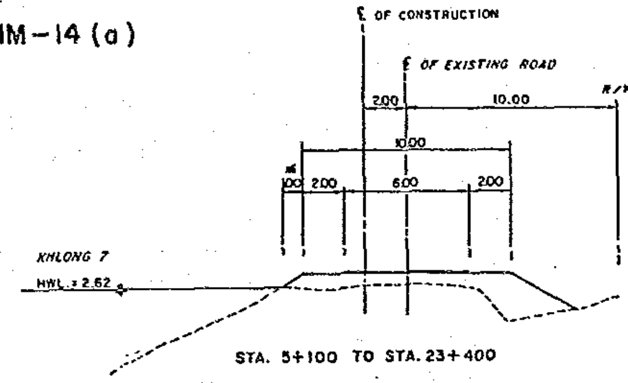
STA. 0+000 TO STA. 8+000

IM−13 (b)



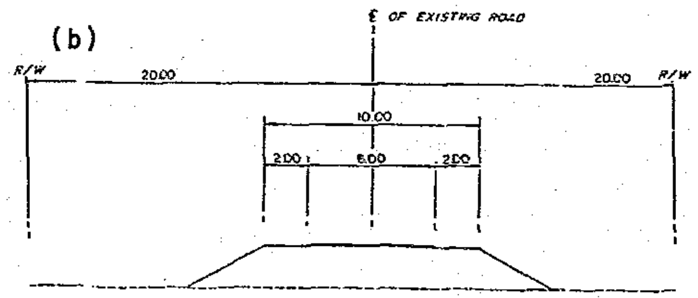
STA. 8+000 TO STA. 17+849

IM−14 (a)



STA. 5+100 TO STA. 23+400

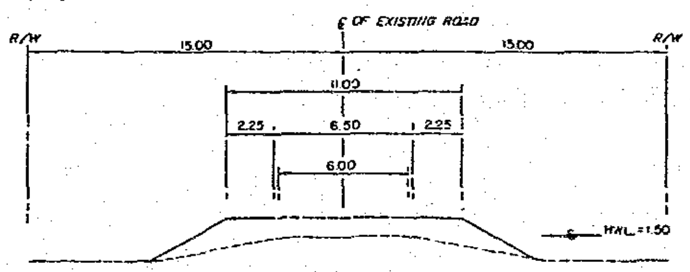
(b)



NOTES
1. FROM STA 0+000 TO STA 1+100 AND
STA. 23+900 TO STA. 25+563
EXISTING ROAD R/W 10.00 M.

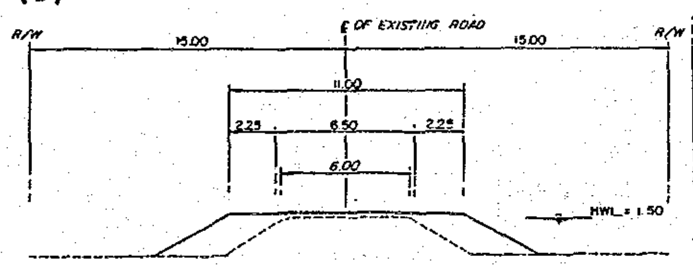
STA. 1+100 TO STA. 5+100
STA. 23+400 TO STA. 23+900
NEW CONSTRUCTION SECTION

IM−17 (a)



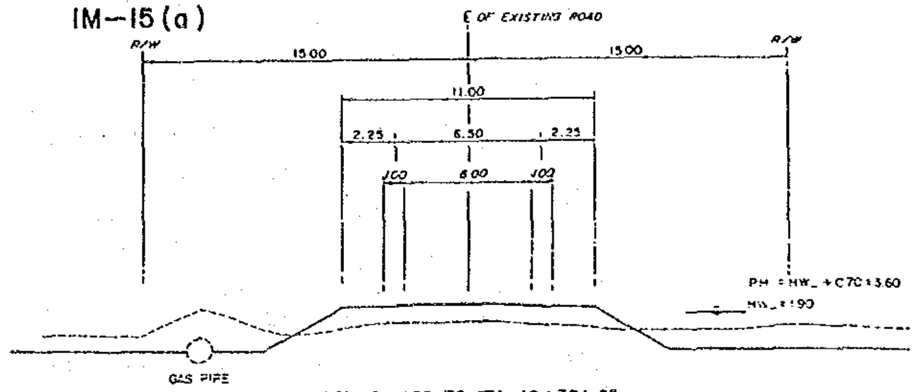
STA 8+400 TO STA. 19+200

(b)



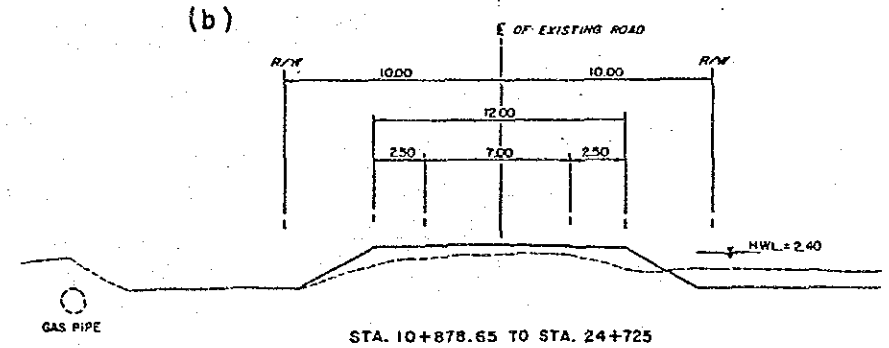
STA 0+000 TO STA. 8+400

IM−15 (a)



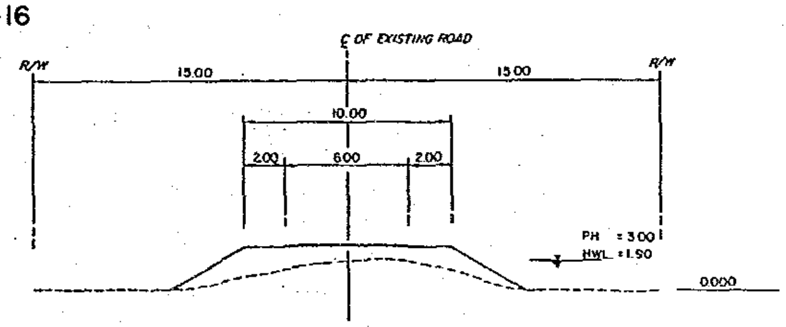
STA. 0+000 TO STA. 10+391.65

(b)

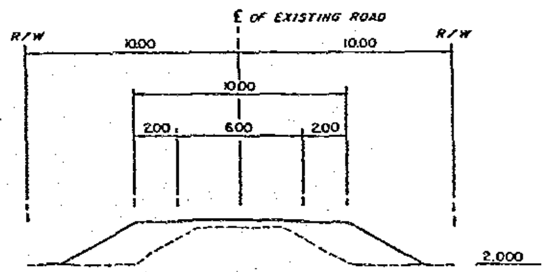


STA. 10+878.65 TO STA. 24+725

IM−16

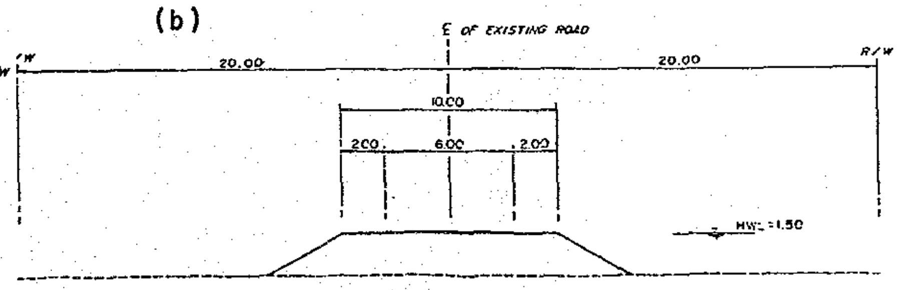


IM−22 (a)



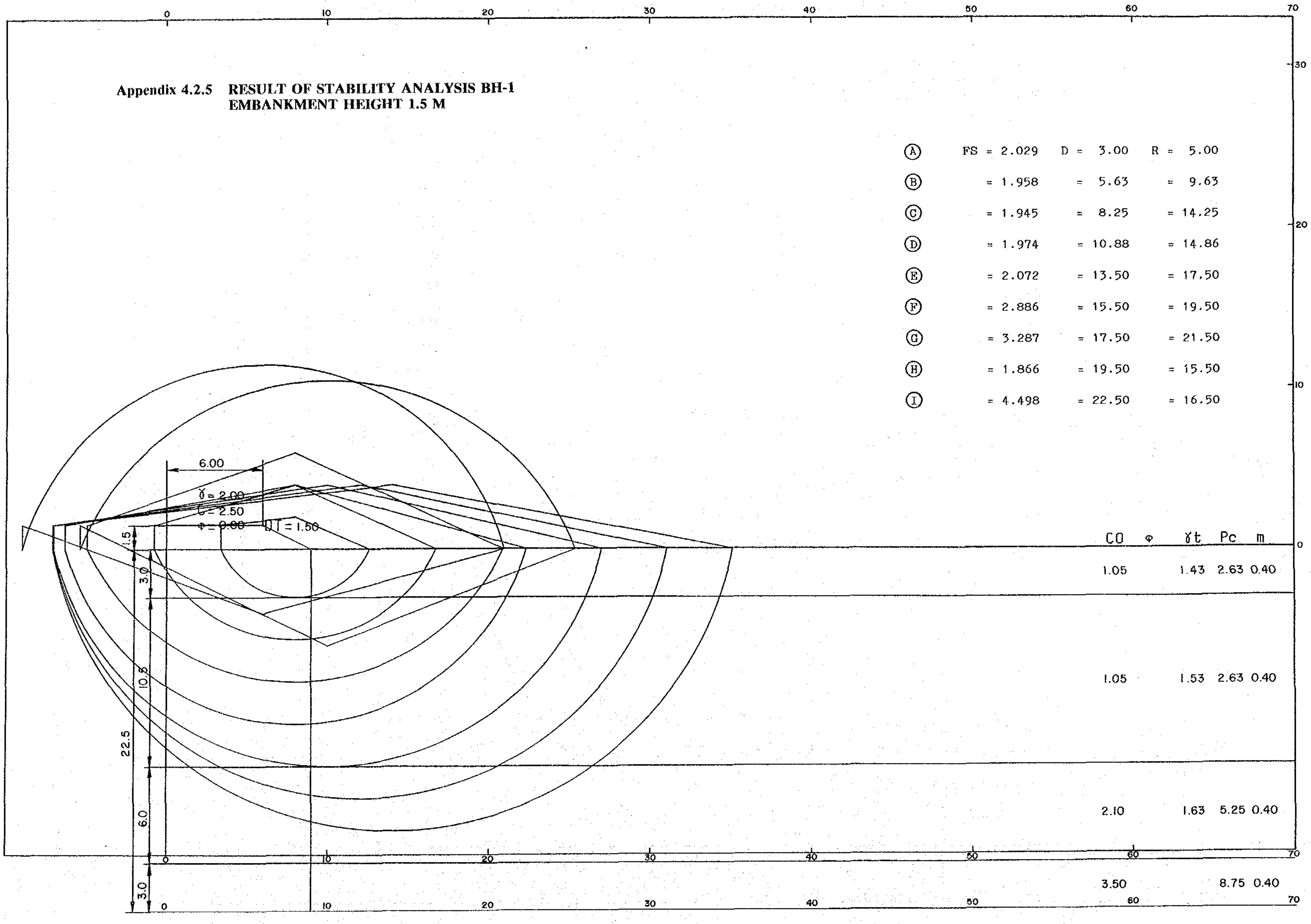
STA. 0+000 TO STA. 1+100
STA. 5+632.29 TO STA. 15+905

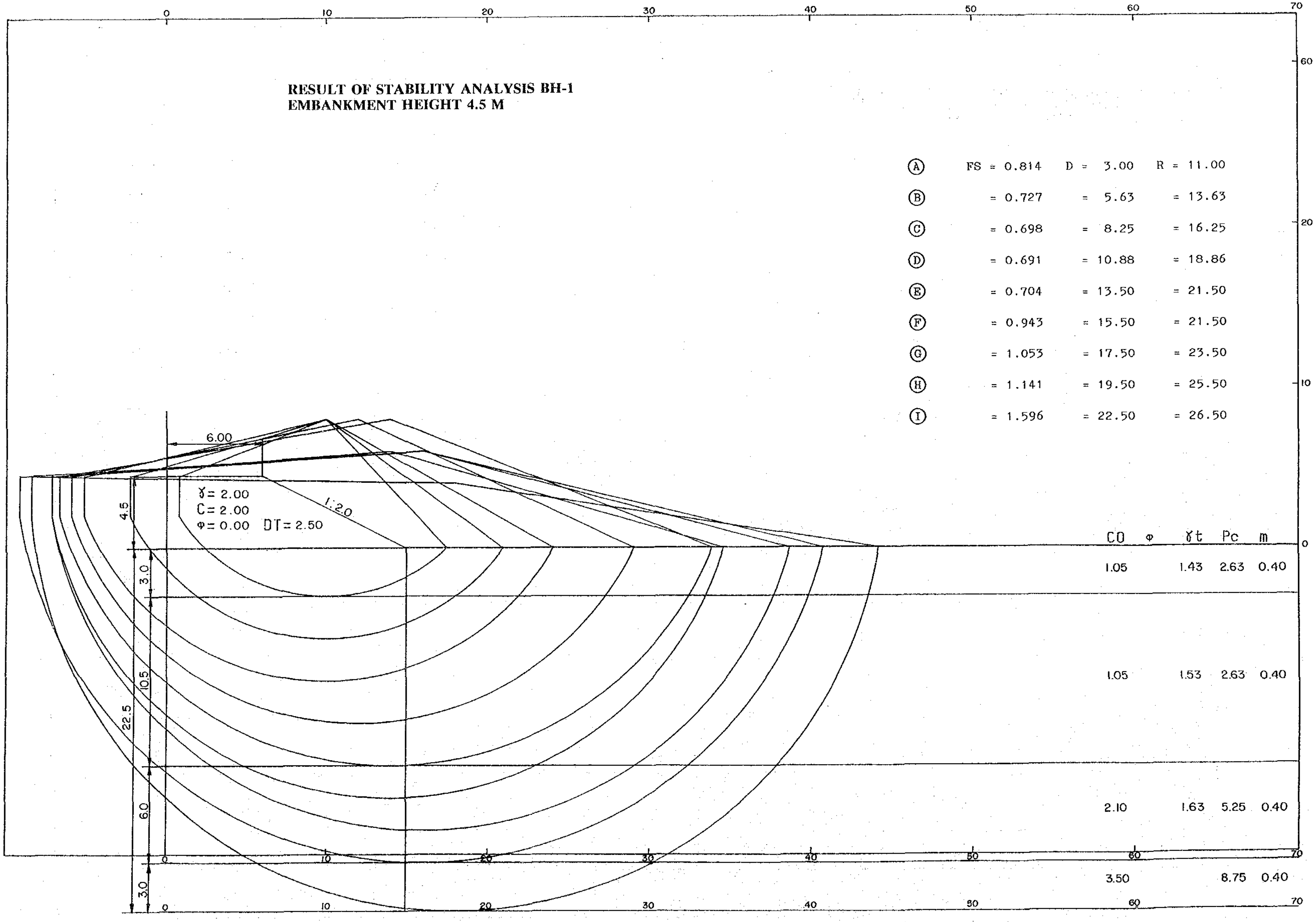
(b)



STA. 1+100 TO STA. 5+632.29
NEW CONSTRUCTION SECTION

**Appendix 4.2.5 RESULT OF STABILITY ANALYSIS BH-1
EMBANKMENT HEIGHT 1.5 M**




RESULT OF STABILITY ANALYSIS BH-1
EMBANKMENT HEIGHT 4.5 M
(A) FS = 0.814 D = 3.00 R = 11.00
(B) = 0.727 = 5.63 = 13.63
(C) = 0.698 = 8.25 = 16.25
(D) = 0.691 = 10.88 = 18.86
(E) = 0.704 = 13.50 = 21.50
(F) = 0.943 = 15.50 = 21.50
(G) = 1.053 = 17.50 = 23.50
(H) = 1.141 = 19.50 = 25.50
(I) = 1.596 = 22.50 = 26.50
6.00
γ= 2.00
C= 2.00
Φ= 0.00 DT= 2.50
1:2.0
4.5
3.0
10.5
22.5
6.0
3.0
CO Φ γt Pc m
1.05 1.43 2.63 0.40
1.05 1.53 2.63 0.40
2.10 1.63 5.25 0.40
3.50 8.75 0.40

Appendix 4.2.6 AASHTO GUIDE METHOD

AASHO METHOD

1. PAVEMENT DESIGNS FOR NEW CONSTRUCTION

1.1 DESIGN OF AC PAVEMENT

1.1.1 Basic Equation

A basic equation used for flexible pavement designs is as follows:

$$\log_{10}(W_{18}) = Z_R \times S_o + 9.36 \times \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2-1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 \times \log_{10}(M_R) - 8.07$$

where

W18 = predicted number of 18-kip equivalent single axle load applications.

ZR = standard normal deviate

So = combined standard error of the traffic prediction and performance

PSI = difference between the initial design serviceability index, Po, and the design terminal serviceability index, Pt, and

MR = resilient modulus (psi).

SN is equal to the structural number indicative of the total pavement thickness required:

SN = a1 D1 + a2 D2 m2 + a3 D3 m3

where

ai = ith layer coefficient
Di = ith layer thickness (inches) and
mi = ith layer drainage coefficient

1.1.2 Design Chart

The design nomograph to solve the equation is prepared in this quide. In this study, however, an another design chart by which required thickness of pavements can simply determined was developed based on the equation in this guide. This is shown in Figure I.1.1.

In the development of the design chart, design variables were applied as follows:

W18 = This was calculated based on ESA conversion factors and traffic volumes of heavy vehicles for each project route.

Zr and So = These are neglect in this study.

PSI = Initial design service ability index (Po) of 4.5 and terminal design serviceability index (Pt) of 2.0 were selected.
So PSI is 2.6.
In the Master Plan Study. Po of 4.6 was applied, but this value was revised to 4.5 in the Feasibility Study, because 4.6 was considered a little high through the PSI survey carried out later.

MR (PSi) = 1500 x CBR (this correlation are given in this guide)

a1,a2 and a3 = They are estimated using figures in this quide (Figure 1.1.2, 1.1.3, and 1.1.4) as follows:

STRUCTURAL LAYER COEFFICIENT

Layer Material	Layer Cofficient	Remark
AC	0.45	E = 450,000 PSI (at 20 C)
UPM	0.29	E = 200,000 PSI (at 20 C)
DBST, SST	0.19	E = 100,000 PSI (at 20 C)
Base Course	0.13	Crushed Stone (CBR = 80)
Sub Base	0.09	Soil Aggregate (CBR = 20)

m2 and m3 = These were neglected in this study

Figure 1.1.1 DESIGN CHART FOR FLEXIBLE PAVEMENT

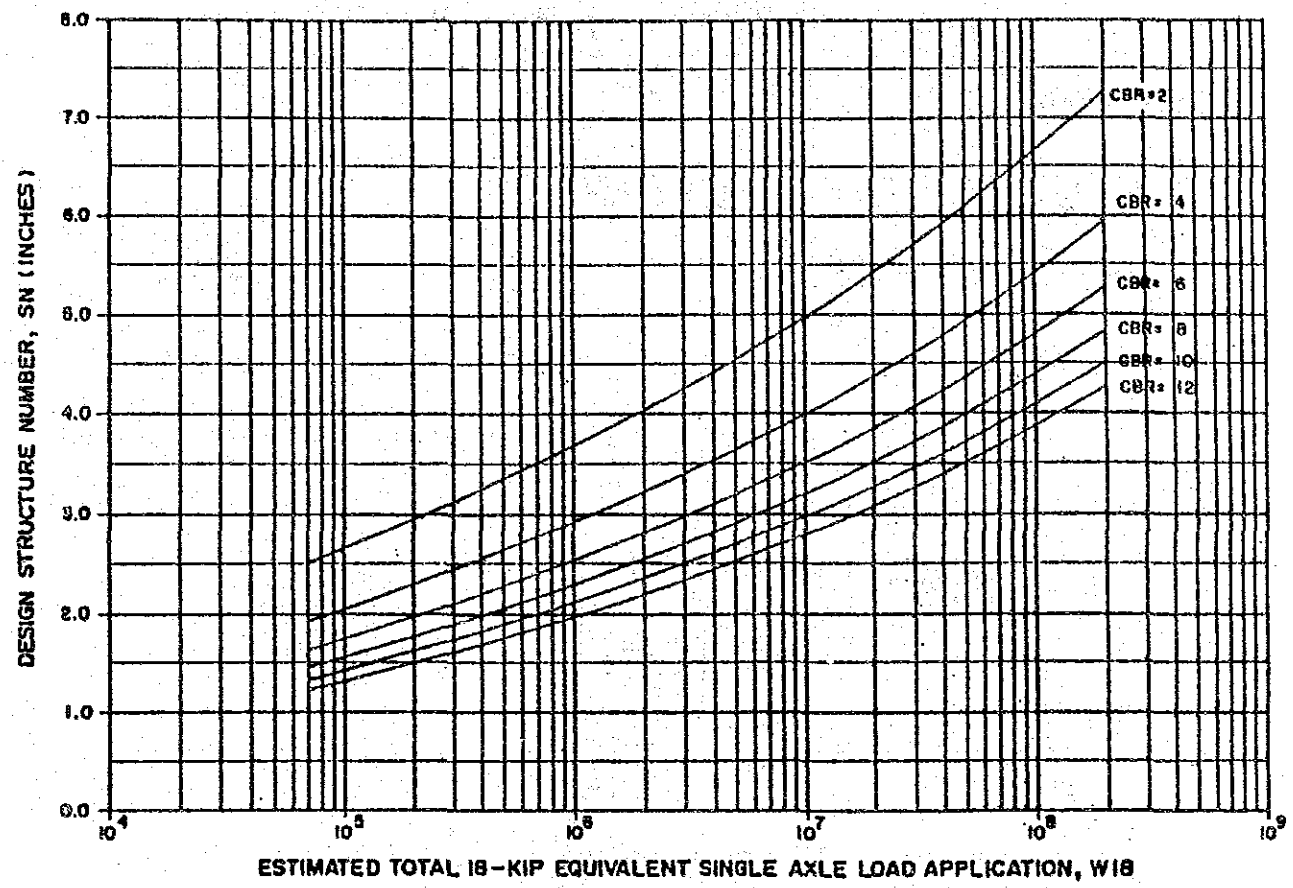


Figure 1.1.2 CHART FOR ESTIMATING STRUCTURAL LAYER COEFFICIENT OF DENSE-GRADED ASPHALT CONCRETE BASED ON ELASTIC (RESILIENT) MODULUS (3)

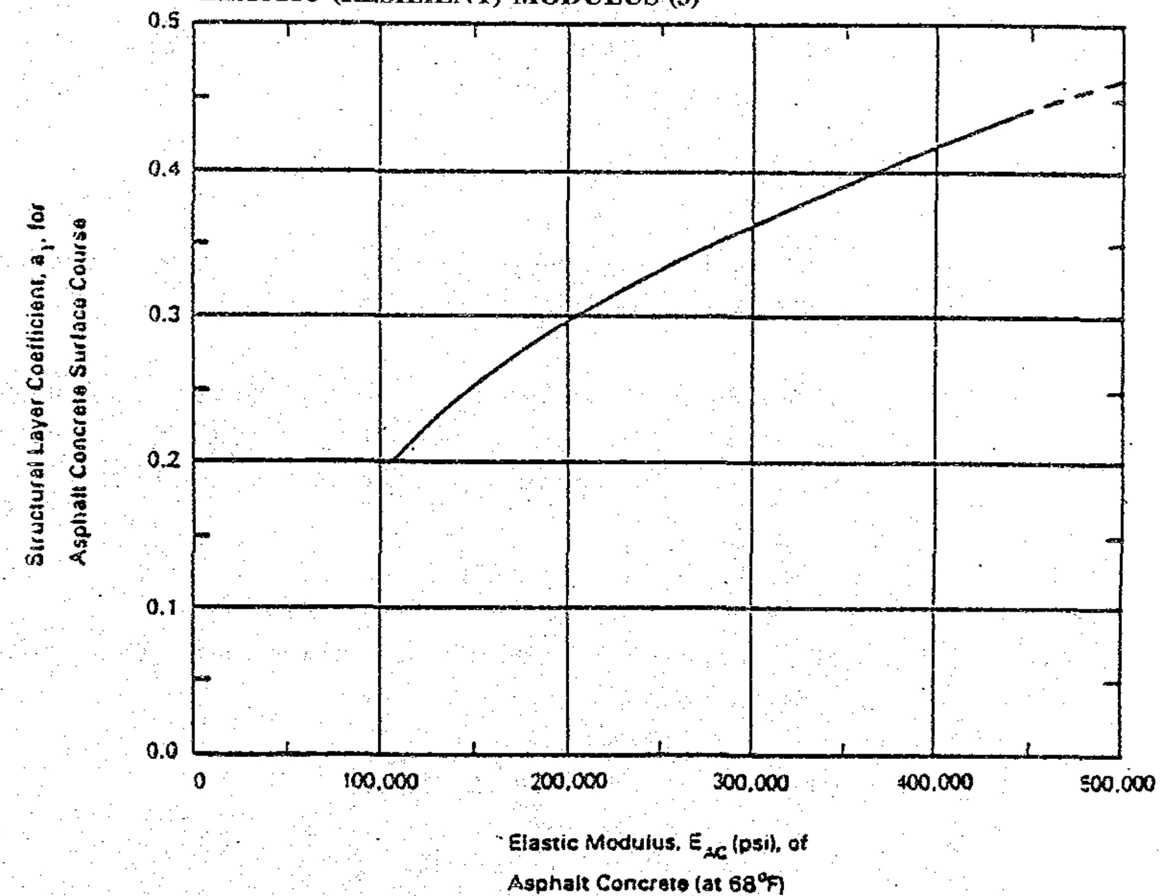
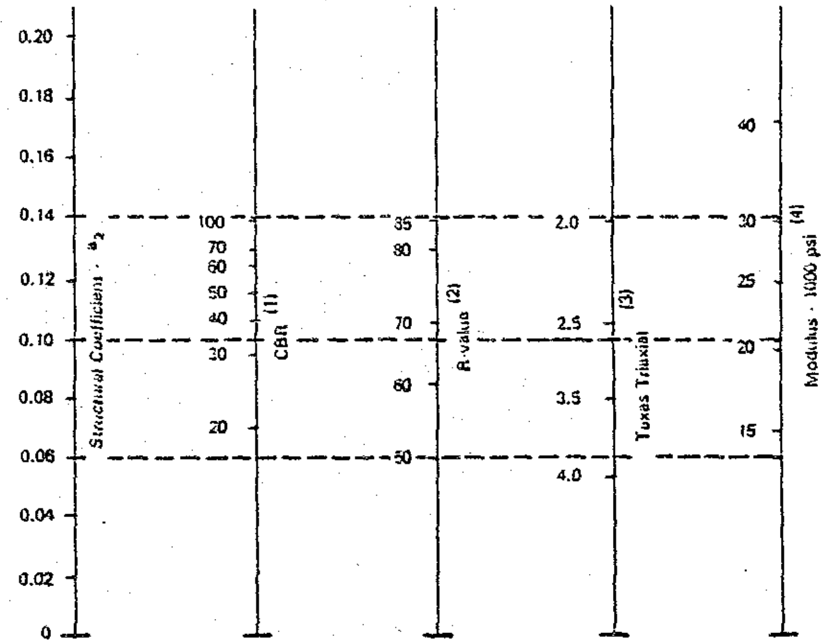
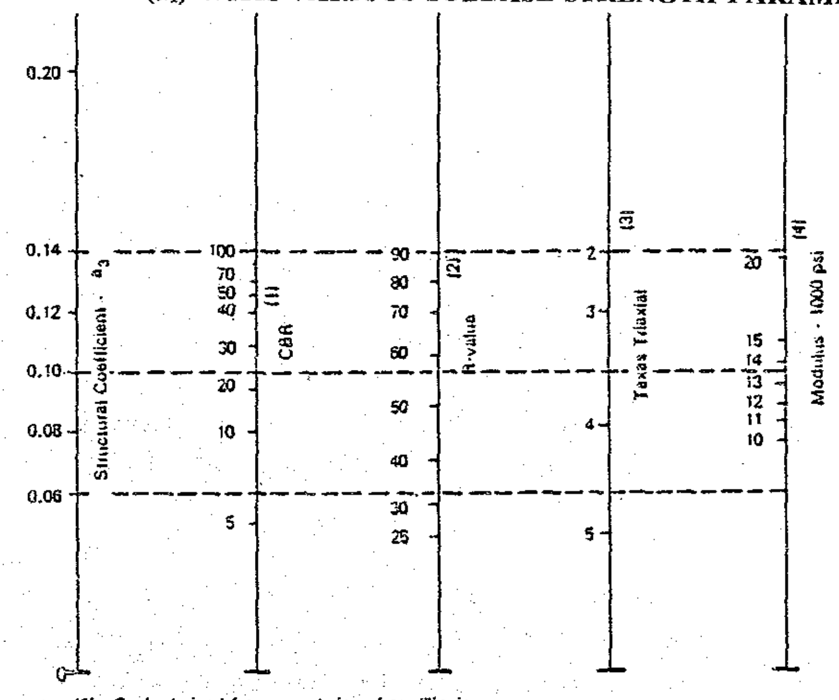


Figure 1.1.3 VARIATION IN GRANULAR BASE LAYER COEFFICIENT (a_2) WITH VARIOUS BASE STRENGTH PARAMETERS (3)



(1) Scale derived by averaging correlations obtained from Illinois.
(2) Scale derived by averaging correlations obtained from California, New Mexico and Wyoming.
(3) Scale derived by averaging correlations obtained from Texas.
(4) Scale derived on NCHRP project (3).

Figure 1.1.4 VARIATION IN GRANULAR SUBBASE LAYER COEFFICIENT (a_1) WITH VARIOUS SUBBASE STRENGTH PARAMETERS (3)



(1) Scale derived from correlations from Illinois.
(2) Scale derived from correlations obtained from The Asphalt Institute, California, New Mexico and Wyoming.
(3) Scale derived from correlations obtained from Texas.
(4) Scale derived on NCHRP project (3).

1.2 DESIGN OF PCC PAVEMENT

1.2.1 Basic Equation

A basic equation used for rigid pavement designs is as follows:

$$\log_{10}(W_{18}) = Z_R \times S_o + 7.35 \times \log_{10}(D+1) - 0.06 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.5-1.5}\right]}{1+\frac{1.624 \times 10^7}{(D+1)^{8.46}}} + (4.22 - 0.32 \times p_t) \times \log_{10}\left[\frac{S'_c \times C_d \times (D^{0.75} - 1.132)}{215.63 \times J\left[D^{0.75} - \frac{18.42}{(E_c/k)^{0.25}}\right]}\right]$$

where

W18	=	predicted number of 18-kip equivalent single axle load applications,
ZR	=	standard normal deviate,
So	=	combined standard errow of the traffic prediction and performance prediction
Δ PSI	=	difference between the initial design serviceability index, po, and the design terminal serviceability index Pt,
S'c	=	modulus of rupture (psi) for portland cement concrete used on a specific project.
J	=	load transfer coefficient used to adjust for load transfer characteristics of a specific design,
Cd	=	drainage coefficient,
Ec	=	modulus of elasticity (psi) for portland cement concrete, and
k	=	modulus of subgrade reaction (psi).

1.2.2 Design Chart

A design chart was also developed in a similar way in the AC pavement designs. This is shown in Figure 1.2.1.

In the development of the design chart, design variables were applied as follows:

W18, Zr,
So and PSI= These were estimated or neglected in the same way as described in AC pavement designs.

S'c (PSi) = Only compressive strength of 250 kg/sq.cm is specified as a concrete strength for a pavement slab in DOHs Specification.

Therefore, S'c was calculated as follows:

S'c = 250 kg/sq.cmx0.16 = 40 kg/sq.cm = 571 psi

J = 3.2 was selected from the below table shown in this quide.

RECOMMENDED LOAD TRANSFER COEFFICIENT FOR VARIOUS PAVEMENT TYPES AND DESIGN CONDITIONS

Shoulder	Asphalt		Tied P.C.C.	
Load Transfer Devices	Yes	No	Yes	No
Pavement Type				
1. Plain Jointed and Jointed Reinforced	3.2	3.8 - 4.4	2.5 - 3.1	3.6 - 4.2
2. CRCP	2.9 - 3.2	N/A		N/A

cd = This was neglected in this study

Ec = This was calculated based on a equation shown in this guide as follows:

$$Ec = 57{,}000\ (Fc)^{0.5} = 57{,}000\ (3571)^{0.5} = 3{,}400{,}000$$

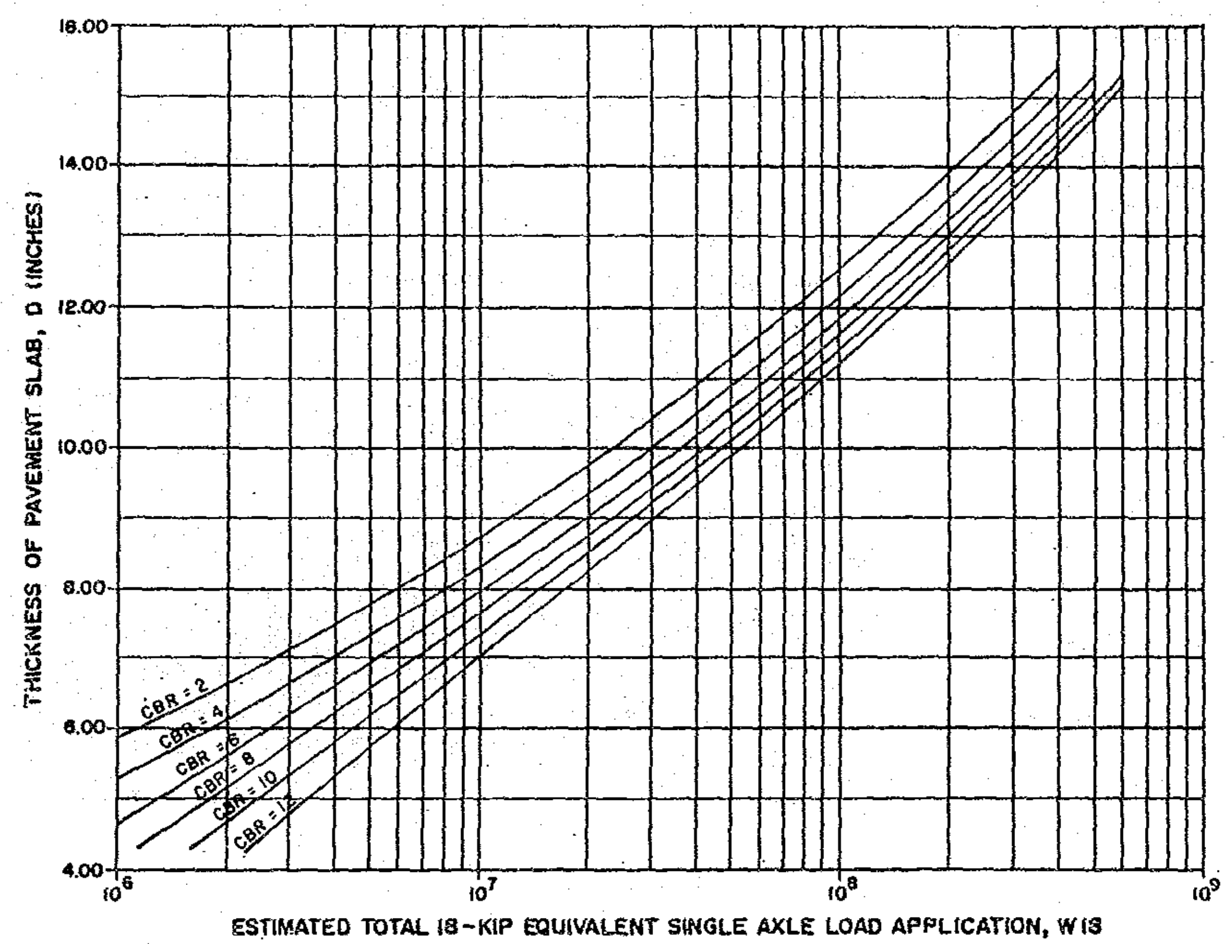
Where

Fc (Compressive strength) = 250 kg/sq.cm = 3571 psi

K = This was calculated based on a equation shown in this guide as follows:

K = Mr/19.4 and Mr = 1500 x CBR

Figure 1.2.1 DESIGN CHART FOR RIGID PAVEMENT



2. PAVEMENT DESIGNS FOR REHABILITATION

2.1 DESIGN OF FLEXIBLE OVERLAY - FLEXIBLE EXISTING

A basic equation to obtain required thickness of asphaltic overly (hol) is as follows:

hol = SNol/aol = (SNy - SN xeff)/aol

where:

SNol = structural number of the required asphalt concrete overlay,

ahol = structural layer cofficient of the overlay material,

SNy = structural number required for a new pavement,

FRL = remaining life factor, and

SNxeff = Cx x Sno, effective structural number of the existing pavement at the time the overlay is placed.

Cx = condition value

Sno = initial structural number of the existing pavemnet.

FRL = remaining life factor

Applied design variables are as follows:

a0l = 0.45 (see design of AC pavements for new construction

SNy = This can be obtained by the design chart shown in the pavement design for new construction.

SN xeff = CX x NSo

CX = This was estimated from the table shown in this guide (Table 2.1.1)

SNo = This was calculated based on thickness of existing pavement layers and structural layer cofficients shown in the design of AC pavements for new construction.

FRL = This is obtained from Figure 2.1.1 shown in this guide. When the overlay design is carried out on condition that a terminal design serviceabbility is 2.0, Rlx and RLY are 0. Therfore, FRL is 0.7

2.2 DESIGN OF RIGID OVERLAY - FLEXIBLE EXISTING

In this guide, rigid overlays on flexible existing pavement are designed as follows:

- To estimate composite K-Value of existing pavements by measuring NDT deflection.

- To design new rigid pavement appling estimated composite K-Value.

However, in any design methods, estimated thickness of pavement are not change, but constant from when CBR or K-Value exceeded some certain value.

This limitation value is considered to be 10 to 15 of CBR by reviewing following design methods:

- JRA Method: There is no design table to obtain thickness of rigid pavement in case of more than 12 of CBR.

- Road Note 29 : Estimated thickness of pavement is constant in case of more than 15 of CBR in the design chart. It recommend that slab thickness is reduced by 25 mm on very stable subgrades (CBR 15 percent or more)

- AASHTO Guide Method: the design nomograph can be used only in case of less than 10 of CBR.

From this fact, overlays by rigid pavement on existing flexible pavements were designed appling the maximum CBR or K-Value shown in each design method in this study.

2.3 DESIGN OF FLEXIBLE OVERLAY - RIGID EXISTING

A design equation is given based on evaluated effective thickness of existing PCC layer. However, in order to minimize reflective cracking, at least a 4 inch thick asphalt concret overlay is required as shown in below.

MINIMUM ASPHALT CONCRETE STRUCTURAL OVERLAY THICKNESS FOR PCC PAVEMENT (FROM THE ASPHALT INSTITUTE MS-17)

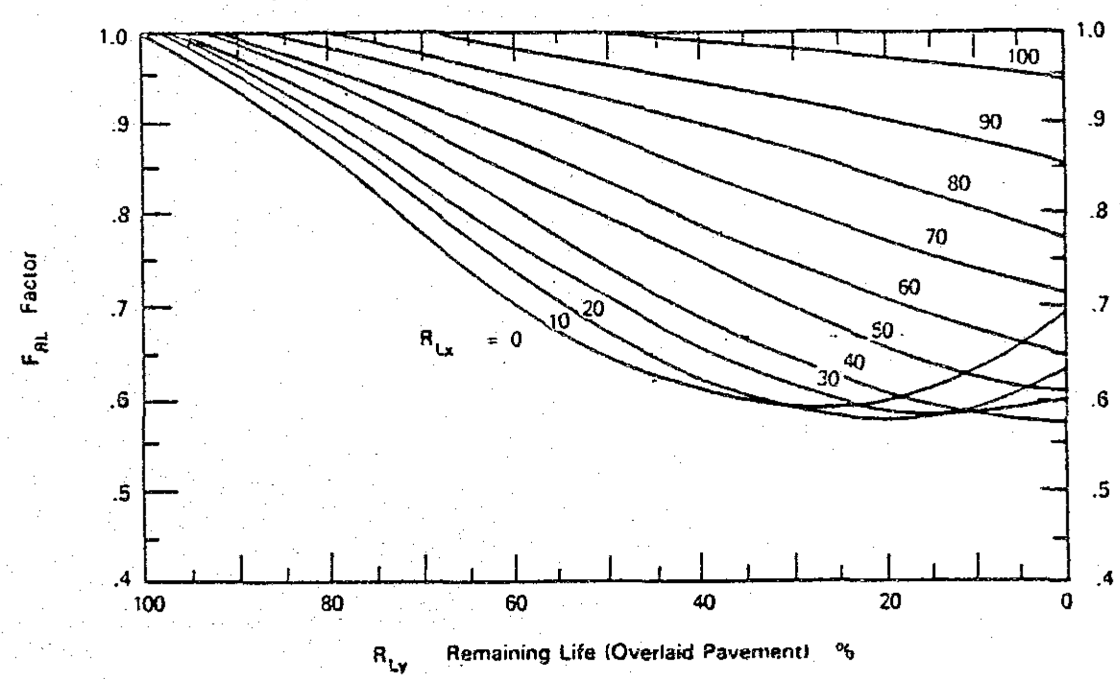
Existing PCC Slab Length (ft)	h (min - inches) Maximum Annual Temperature Differential (F)					
	30	40	50	60	70	80
10	4	4	4	4	4	4
15	4	4	4	4	4	4
20	4	4	4	5	5	5.5
25	4	4	4	6	6	7
30	4	4	5	6	7	8
35	4	4.5	6	7	8.5	*
40	4	5.5	7	8	*	*
45	4.5	6	7.5	9	*	*
50	5	7	8.5	*	*	*
60	6	8	*	*	*	*

Table 2.1.1 VISUAL STRUCTURAL CONDITION VALUES (Cx)

Layer Type	Pavement Condition	C Struct Cond Factor Value	Remarks
Asphaltic	1. Asphalt layers that are sound, stable, uncracked and have little to no deformation in the wheel paths	.95	
	2. Asphalt layers that exhibit some intermittent cracking with slight to moderate wheel path deformation but are still stable	.85	PSI = 2.5
	3. Asphalt layers that exhibit some moderate to high cracking, have ravelling or aggregate degradation and show moderate to high deformation in wheel path	.70	PSI = 2.0
	4. Asphalt layers that show very heavy (extensive) cracking, considerable ravelling or degradation and very apprecable wheel path deformations	.60	PSI = 1.5
Granular Base/ Subbase	1. Unbound granular layers showing no evidence of shear or desification distress, reasonably identical physical properties as when constructed and existing at the same "normal" moisture-density conditions as when constructed	.95	Deflection >= 0.6 mm
	2. Visible evidence of significant distress within layers (shear or densification), aggregate properties have changed significantly due to abrasion, intrusion of fines from subgrade or pumping, and/or significant change in in situ moisture caused by surface infiltration or other sources	.60	Deflection < 0.6 mm

Note: CX values were assumed cresponding to PSI and deflection values of existing pavements

Figure 2.1.1 REMAINING LIFE FACTOR AS A FUNCTION OF REMAINING LIFE OF EXISTING AND OVERLAID PAVEMENTS



Appendix 4.2.7 ROAD NOTE 29 METHOD

ROAD NOTE 29 METHOD

This is a guide the structural design of pavements for new roads.

1. DESIGN OF AC PAVEMENT

Based on cumulative numbers of standard axiles of commercial vehicles and CBRs of the subgrade, required thickness of the sub-base are given by Figure I.1.

Figure 1.2 -1.5 give the thickness required for each of roadbase materials and for surfacing course in terms of the cumulative numbers of standard axiles to be carried.

The roadbase materials comprise lean concrete, dense tarmacadam, dense bitumen macadam, rolled asphalt, wet-mix macadam, dry-bound macadam soil cement and cement-bound granular material. Among them, soil cement roadbases and cement-bound granula roadbases should only be used when the cumulative number of standard exiles is less than 15 million, and less than 5 millions, respectively.

2. DESIGN OF PCC PAVEMENT

The minimum thickness of sub-base recommended for the three type of subgrade is given in the below table:

CLASSIFICATION OF SUBGRADES FOR CONCRETE ROAD AND MINIMUM THICKNESSES OF SUBBASE REQUIRED

Type of subgrade	Definition	Minimum thickness of sub-base required
Weak	All subgrades of CBR value 2 per cent	150 mm
Normal	Subgrades other than those defined by the other categories	80 mm
Very stable	All subgrades of CBR value 15 per cent. This category includes undisturbed foundations of old roads	0

Figure 2.1 gives the thickness required for reinforced and unreinforced concrete slabs in terms of the cumulative number of standard axiles to be carried for the three types of subgrade considered in the above table.

This required thicknesses in this note are based on a minimum crushing strength for concrete of 28 MN/sq.m at 28 days using oridinary portland cement.

Figure 1.1 DESIGN CHART FOR THICKNESS OF SUBBASE

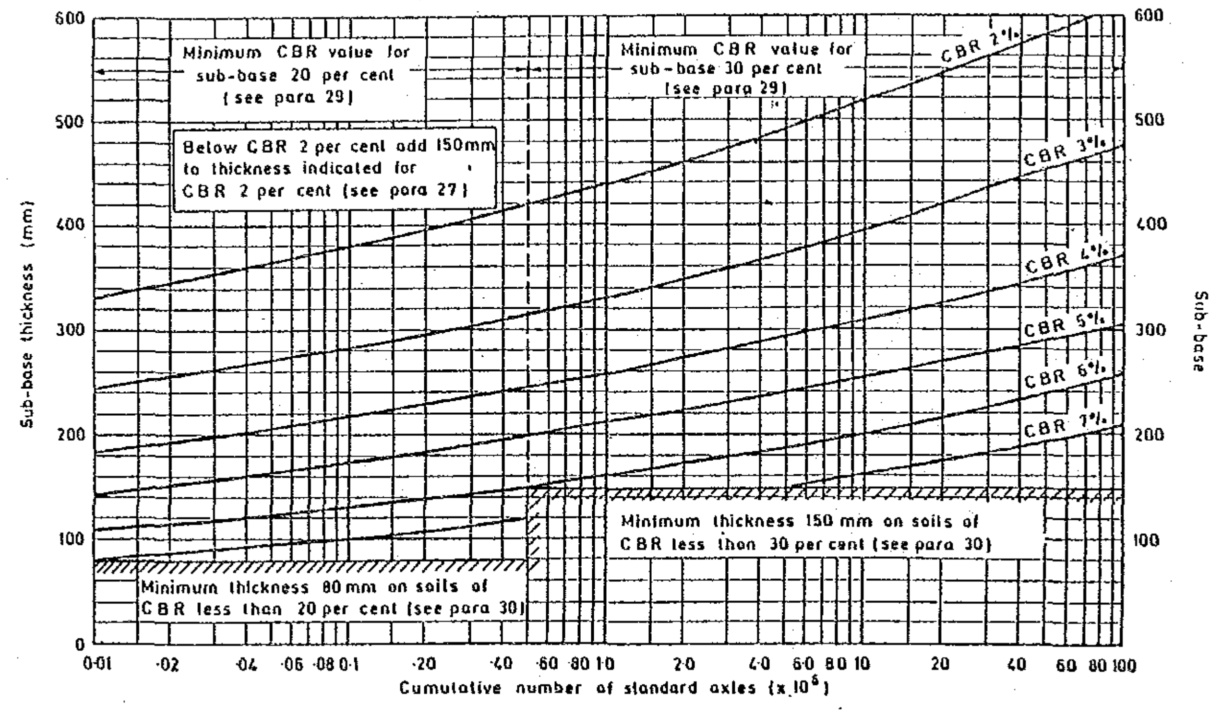


Figure 1.2 DESIGN CHART FOR THICKNESS OF BASE AND SURFACE

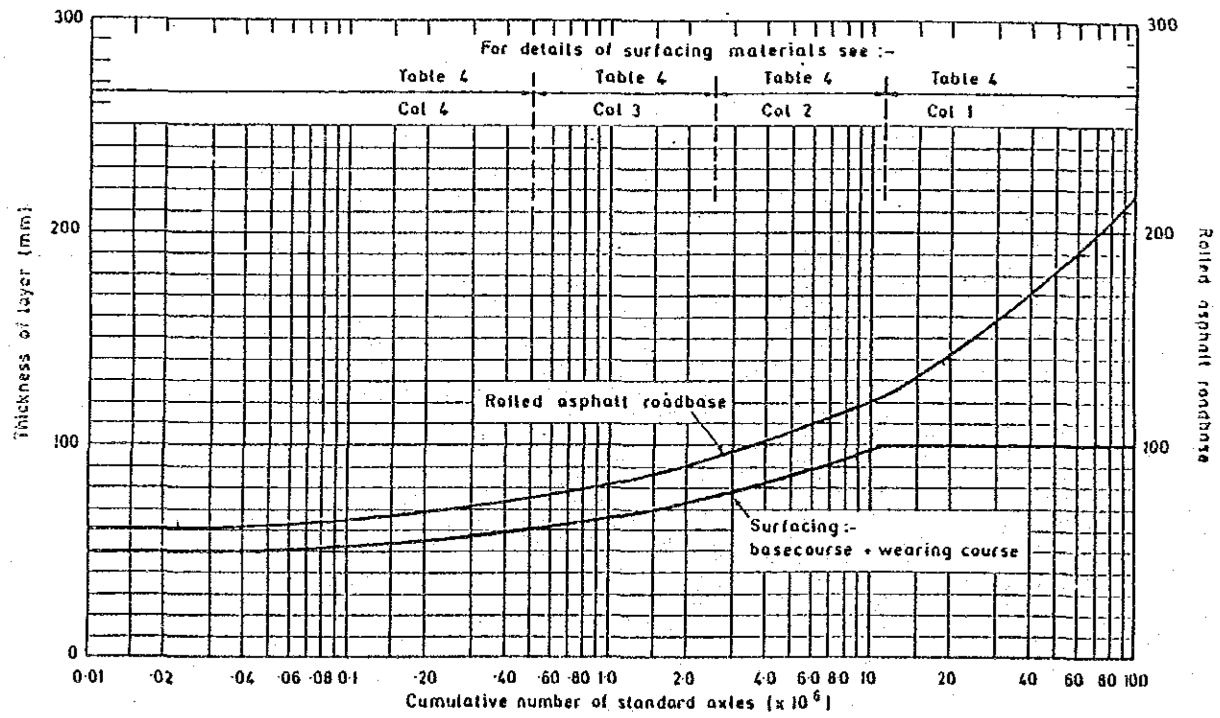


Figure 1.3 DESIGN CHART FOR THICKNESS OF BASE AND SURFACE

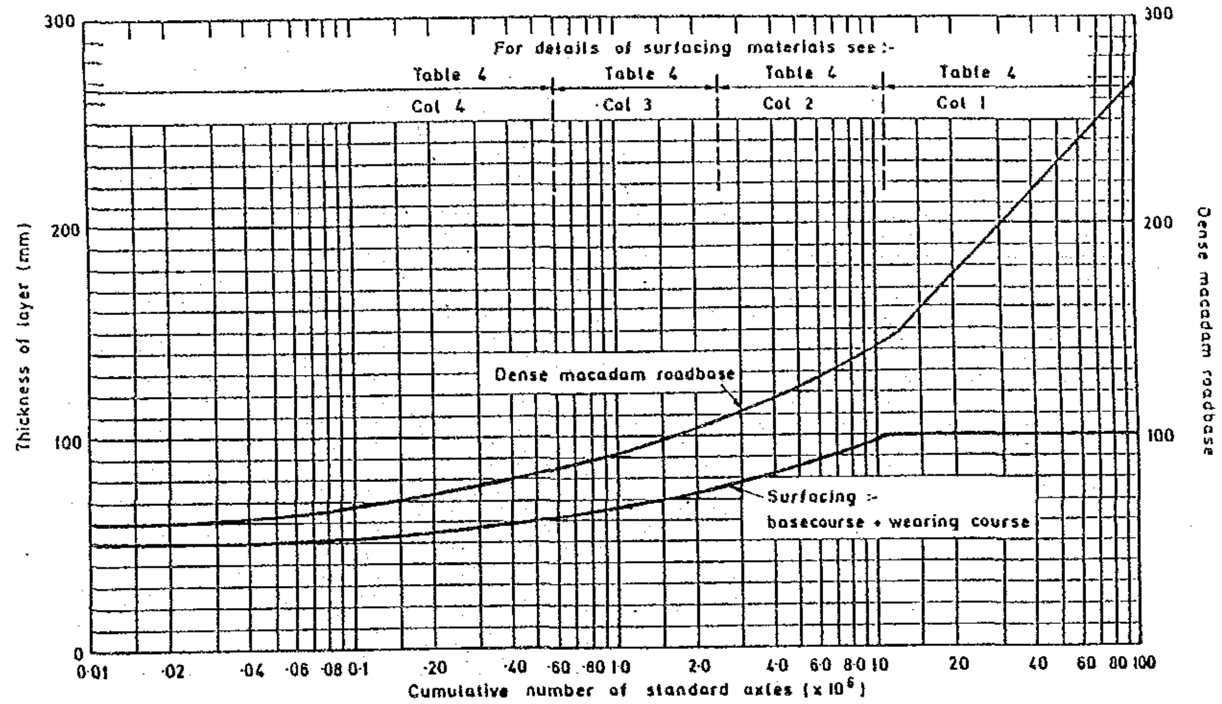


Figure 1.4 DESIGN CHART FOR THICKNESS OF BASE AND SURFACE

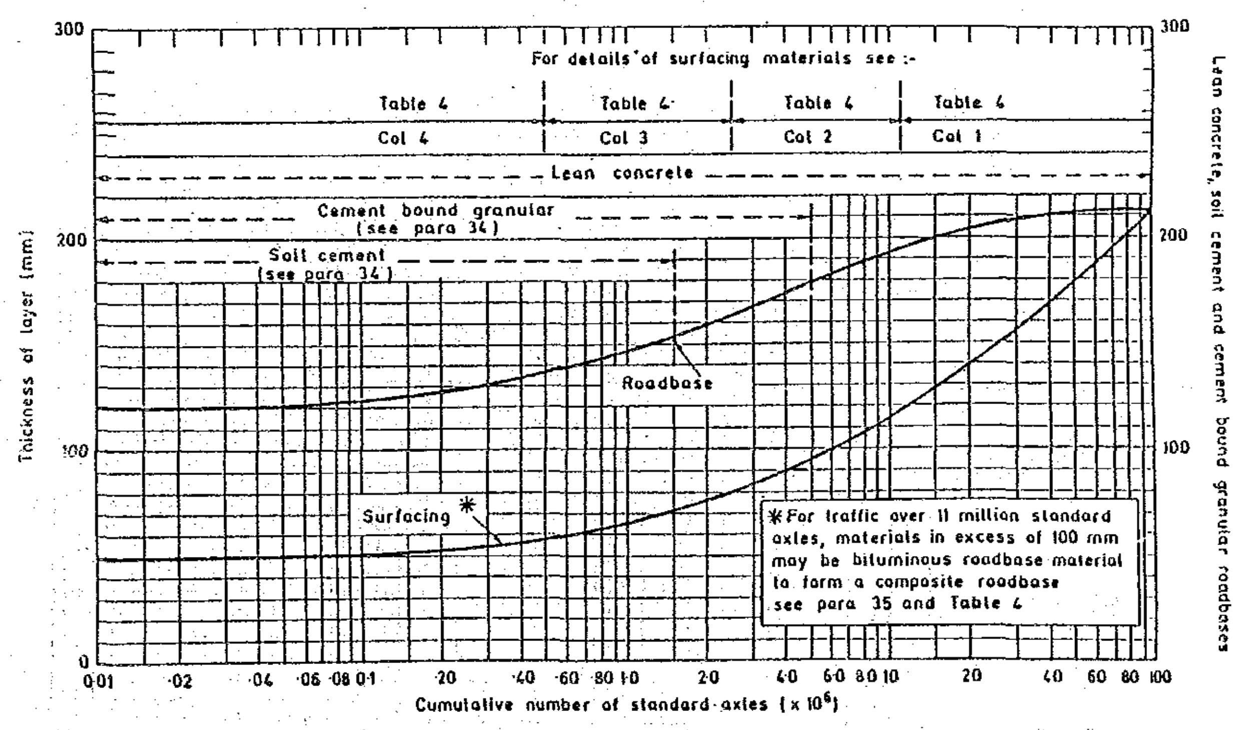


Figure 1.5 DESIGN CHART FOR THICKNESS OF BASE AND SURFACE

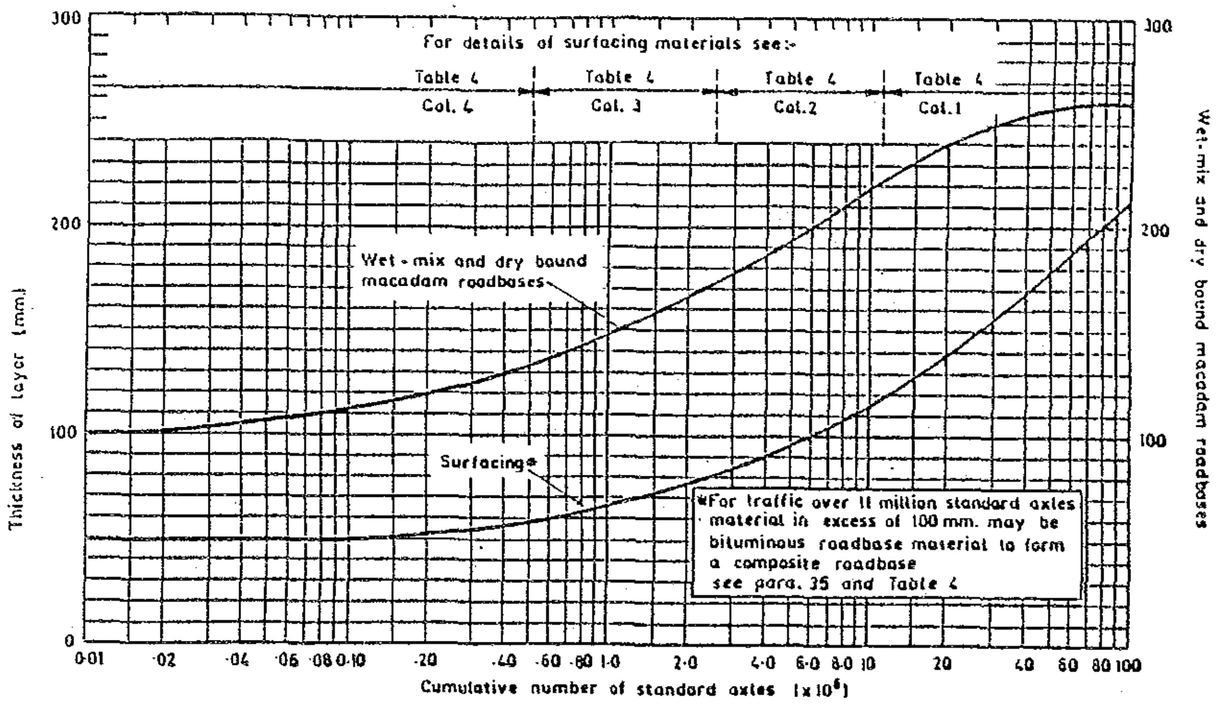
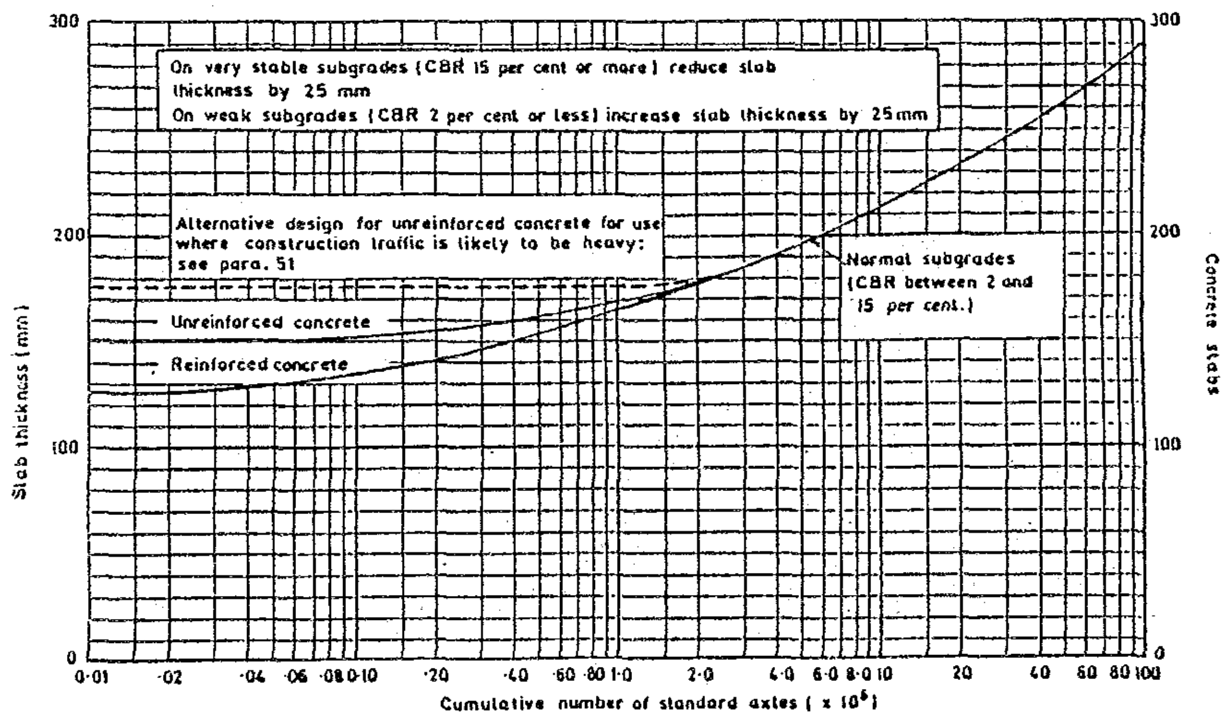


Figure 2.1 DESIGN CHART FOR THICKNESS OF CONCRETE SLAB



Appendix 4.2.8 JRA METHOD

JRA METHOD

1. PAVEMENT DESIGNS FOR NEW CONSTRUCTION

1.1 DESIGN OF AC PAVEMENT

The classification of traffic volume level is determined based on daily traffic volumes of heavy vehicles in one direction at the 5th year after new pavements:

CLASSIFICATION OF TRAFFIC

Traffic Classification	Number of Heavy Trucks
L	100 > DAD
A	100 < DAD < 250
B	250 < DAD < 1000
C	1000 < DAD < 3000
D	3000 < DAD

Note: DAD: Daily average on design lane

The required structural numbers (TA) and the minimum total thickness of pavements are shown in relationship between design CBRs of the subgrade and the traffic classification as follows:

REQUIRED TA AND MINIMUM TOTAL THICKNESS OF PAVEMENT

(CM)

Design CBR	Traffic Classification									
	L		A		B		C		D	
	TA	Thick	TA	Thick	TA	Thick	TA	Thick	TA	Thick
2	17	52	21	61	29	94	39	90	51	105
3	15	41	19	48	26	58	35	70	45	83
4	14	35	18	41	24	49	32	59	41	70
6	12	27	16	32	21	38	28	47	37	55
8	11	23	14	27	19	32	26	39	34	46
12	-	-	13	21	17	26	23	31	30	36
more than 20	-	-	-	-	-	-	20	23	26	27

The layer thickness of pavement is estimated from the following equation:

TA = a1 T1 + a2 T2 ...... an + Tn

where

a1 . a2 ..... an = layer equivalent factor
T1 . T2 ..... T3 = thickness of layer

The layer equivalent factors are given in the below table:

LAYER EQUIVALENT FACTOR

Layer	Material	Classification	Equivalent Factor an
Surface	Asphaltic concrete		1.0
Base	Bituminous treated	Hot mixture	0.8
	-DO-	Cold mixture	0.55
	Cement stabilized	Qu >30 kg/sq.cm (7th day)	0.55
	Lime stabilized	Qu > 10kg/sq.cm(10th day)	0.45
	Crashed stone	CBR > 80	0.35
Sub-base	Sand and gravel, Crasher run, etc.	CBR > 30	0.25
	-DO-	CBR = 20 to 30	0.20

In addition to the restriction of the minimum total thickness of pavements, the minimum thicknesses of the asphaltic concrete surface required are also given as follow:

REQUIRED MINIMUM THICKNESS OF AC SURFACE

Traffic Classification	Minimum Thickness (cm)
L and A	5
B	10
C	15
D	20

1.2 DESIGN OF PCC PAVEMENT

Traffic are classified in the same way of that of the design of AC pavement.

Required thickness of the sub-base is shown in relationship between design CBRs of the subgrade and the traffic classification. This is shown in the below table:

REQUIRED THICKNESS OF SUBBASE
(cm)

Traffic Classification	Design CBR					
	2	3	4	6	8	more than 12
L and A	50	35	25	20	15	15
B,C and D	60	45	35	25	20	15

As the sub-base course, crushed stones, cement stabilized aggregate, etc. were mainly applied. In the case that the crushed stone sub-base is applied under C and D of the traffic classification, an asphalt concrete intermediate course is usually placed between the crushed stone sub-base course and the PCC slab.

Required thickness of the PCC slab is given in the below table in connection with the traffic classification.

REQUIRED THICKNESS OF PCC SLAB

Traffic Classification	Thickness (cm)
L	15 (20)
A	20 (25)
B	25
C	28
D	30

Note: Standard fluxural strength is 45 Kg/sq.cm.

( ) in case that the fluxural strength is 40 kg/sq.cm.

2. PAVEMENT DESIGN FOR REHABILITATION

2.1 DESIGN OF FLEXIBLE OVERLAY - FLEXIBLE EXISTING

Traffic at the 5th year after overlaying is classified in the same way of that in the pavement design for new construction.

Cased on the traffic classification and measured delection required thickness of overlay is determined by the following table:

REQUIRED OVERLAY THICKNESS (cm)

Deflection: D (mm)	Classification of Traffic				
	L	A	B	C	D
0.6 > D	-	-	-	4	4
0.6 < D < 1.0	-	-	4	6	8
1.0 < D < 1.5	-	4	6	10	12
1.5 < D < 2.0	4	6	10	12	15
2.0 < D	6	10	12	15	-

2.2 DESIGN OF FLEXIBLE OVERLAY - RIGID EXISTING

The overlay design carried out in the same manner described in 2.1. However, in order to minimize reflective cracking, at least a 8 cm thick asphalt concrete overlay is required.

Appendix 4.2.9 CUMULATIVE NUMBER OF ESA

Route	ML-1	Section	3-0403-E	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1992	2764	636	14362	8283	180	39	8958	4479
1993	2898	1302	15168	17030	285	102	18434	9217
1994	3038	2001	16020	26269	450	200	28470	14235
1995	3280	2755	17049	36101	571	325	39181	19591
1996	3540	3569	18144	46564	724	484	50617	25309
1997	3822	4448	19309	57700	918	685	62833	31417
1998	4126	5396	20549	69551	1164	940	75887	37944
1999	4454	6421	21869	82162	1475	1263	89846	44923
2000	3551	7237	18300	92716	16	1266	101219	50610
2001	3762	8102	19204	103791	28	1273	113166	56583
2002	3986	9019	20152	115413	48	1283	125715	62858
2003	4223	9990	21147	127608	82	1301	138899	69450
2004	4474	11019	22192	140406	142	1332	152757	76379
2005	4740	12109	23288	153836	245	1386	167331	83666
2006	5021	13263	24438	167930	423	1478	182671	91336
2007	5320	14487	25645	182719	730	1638	198844	99422
2008	5636	15783	26911	198239	1259	1914	215936	107968
2009	5804	17117	27575	214141	1716	2290	233548	116774
2010	5976	18491	28256	230437	2339	2802	251730	125865
2011	6154	19907	28954	247134	3187	3500	270541	135271
2012	6337	21364	29669	264245	4344	4451	290060	145030
2013	6525	22864	30402	281777	5920	5748	310389	155195

Route	ML-4	Section	3-1000	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	1211	278	1552	895	431	94	1267	634
1995	1268	570	1624	1832	453	194	2596	1298
1996	1327	875	1698	2811	476	298	3984	1992
1997	1389	1195	1777	3836	500	407	5438	2719
1998	1454	1529	1859	4908	526	523	6960	3480
1999	1522	1879	1944	6029	553	644	8552	4276
2000	1593	2245	2034	7202	581	771	10218	5109
2001	1660	2627	2095	8410	611	905	11942	5971
2002	1729	3025	2158	9655	642	1045	13725	6863
2003	1802	3439	2223	10937	674	1193	15569	7785
2004	1877	3871	2289	12257	709	1348	17476	8738
2005	1956	4320	2358	13616	745	1511	19447	9724
2006	2038	4789	2429	15017	782	1683	21489	10745
2007	2123	5277	2502	16460	822	1863	23600	11800
2008	2212	5786	2577	17946	864	2052	25784	12892
2009	2258	6305	2616	19455	886	2246	28006	14003
2010	2306	6835	2655	20986	908	2445	30266	15133
2011	2354	7377	2695	22540	932	2649	32566	16283
2012	2403	7929	2735	24118	955	2858	34905	17453
2013	2454	8493	2776	25719	980	3073	37285	18643

Route	ML-2	Section	3-158KM	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	320	74	153	88	497	109	271	136
1995	335	151	161	181	524	224	556	278
1996	351	231	169	279	552	344	854	427
1997	367	316	178	381	582	472	1169	585
1998	385	404	187	489	614	606	1499	750
1999	403	497	197	603	647	748	1848	924
2000	422	594	207	722	682	897	2213	1107
2001	441	695	216	847	716	1054	2596	1298
2002	462	802	225	976	753	1219	2997	1499
2003	483	913	235	1112	790	1392	3417	1709
2004	505	1029	245	1253	830	1574	3856	1928
2005	528	1150	255	1400	872	1765	4315	2158
2006	552	1277	266	1554	916	1966	4797	2399
2007	578	1410	277	1713	962	2176	5299	2650
2008	604	1549	289	1880	1011	2398	5827	2914
2009	618	1691	295	2050	1036	2624	6365	3183
2010	632	1836	301	2224	1063	2857	6917	3459
2011	646	1985	308	2401	1089	3096	7482	3741
2012	661	2137	314	2582	1117	3340	8059	4030
2013	676	2292	321	2768	1145	3591	8651	4326

Route	ML-4	Section	316	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	522	120	288	166	277	61	347	174
1995	550	247	304	341	291	124	712	356
1996	579	380	320	526	305	191	1097	549
1997	610	520	338	721	320	261	1502	751
1998	643	668	356	926	335	335	1929	965
1999	677	823	376	1143	352	412	2378	1189
2000	713	987	396	1371	369	493	2851	1426
2001	744	1158	410	1608	385	577	3343	1672
2002	777	1337	425	1853	401	665	3855	1928
2003	811	1524	440	2107	418	756	4387	2194
2004	847	1718	455	2369	436	852	4939	2470
2005	884	1922	471	2641	455	951	5514	2757
2006	922	2134	488	2922	475	1055	6111	3056
2007	963	2355	505	3213	495	1164	6732	3366
2008	1005	2586	523	3515	516	1277	7378	3689
2009	1027	2822	532	3822	527	1392	8036	4018
2010	1050	3064	542	4134	538	1510	8708	4354
2011	1073	3311	551	4452	550	1630	9393	4697
2012	1096	3563	561	4776	562	1754	10093	5047
2013	1120	3820	571	5105	574	1879	10804	5402

AXLE LOAD ANALYSIS

Route	ML-5	Section	BP-N	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1992	1553	357	3601	2077	1869	409	2843	1422
1993	1576	720	3723	4224	1988	845	5789	2895
1994	1599	1087	3850	6444	2115	1308	8839	4420
1995	1710	1480	4109	8814	2250	1801	12095	6048
1996	1828	1901	4384	11342	2393	2325	15568	7784
1997	1954	2350	4679	14040	2545	2882	19272	9636
1998	2090	2831	4993	16920	2707	3475	23226	11613
1999	2234	3344	5328	19992	2880	4106	27442	13721
2000	2389	3894	5686	23272	3063	4776	31942	15971
2001	2489	4466	5914	26682	3234	5485	36633	18317
2002	2594	5063	6150	30229	3414	6232	41524	20762
2003	2703	5684	6396	33917	3605	7022	46623	23312
2004	2816	6332	6652	37754	3806	7855	51941	25971
2005	2935	7007	6919	41744	4019	8735	57486	28743
2006	3058	7710	7196	45894	4243	9665	63269	31635
2007	3186	8442	7483	50209	4480	10646	69297	34649
2008	3320	9206	7783	54698	4730	11682	75586	37793
2009	3390	9985	7939	59276	4862	12746	82007	41004
2010	3461	10781	8098	63946	4998	13841	88568	44284
2011	3534	11594	8260	68710	5137	14966	95270	47635
2012	3608	12424	8425	73568	5281	16123	102115	51058
2013	3683	13270	8594	78525	5428	17311	109106	54553

Route	ML-5	Section	BP-S	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1992	582	134	1144	660	494	108	902	451
1993	557	262	1090	1288	525	223	1773	887
1994	533	384	1038	1887	559	346	2617	1309
1995	581	518	1122	2534	595	476	3528	1764
1996	634	664	1213	3234	633	615	4513	2257
1997	691	823	1311	3990	673	762	5575	2788
1998	754	996	1417	4807	716	919	6722	3361
1999	822	1185	1531	5690	761	1085	7960	3980
2000	897	1391	1655	6644	810	1263	9298	4649
2001	929	1605	1707	7629	855	1450	10684	5342
2002	962	1826	1761	8644	903	1648	12118	6059
2003	997	2056	1817	9692	953	1856	13604	6802
2004	1032	2293	1874	10773	1007	2077	15143	7572
2005	1069	2539	1934	11888	1063	2310	16737	8369
2006	1107	2793	1995	13039	1122	2556	18388	9194
2007	1147	3057	2058	14225	1185	2815	20097	10049
2008	1188	3330	2123	15450	1251	3089	21869	10935
2009	1209	3608	2157	16694	1286	3371	23673	11837
2010	1231	3891	2191	17957	1322	3660	25508	12754
2011	1253	4179	2225	19240	1359	3958	27377	13689
2012	1275	4473	2260	20544	1397	4264	29281	14641
2013	1298	4771	2296	21868	1436	4578	31217	15609

Route	ML-5	Section	BP-W	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1992	971	223	2457	1417	1375	301	1941	971
1993	1017	457	2629	2933	1463	622	4012	2006
1994	1066	702	2812	4555	1556	962	6219	3110
1995	1127	961	2986	6277	1655	1325	8563	4282
1996	1192	1236	3171	8106	1760	1710	11052	5526
1997	1261	1525	3367	10047	1872	2120	13692	6846
1998	1334	1832	3575	12109	1991	2556	16497	8249
1999	1411	2157	3796	14298	2118	3020	19475	9738
2000	1492	2500	4031	16623	2253	3513	22636	11318
2001	1560	2859	4206	19048	2379	4034	25941	12971
2002	1631	3234	4388	21579	2512	4585	29398	14699
2003	1706	3626	4578	24219	2652	5165	33010	16505
2004	1784	4036	4777	26974	2800	5779	36789	18395
2005	1865	4465	4984	29848	2956	6426	40739	20370
2006	1950	4913	5200	32847	3121	7109	44869	22435
2007	2039	5382	5425	35976	3295	7831	49189	24595
2008	2132	5872	5660	39240	3479	8593	53705	26853
2009	2181	6374	5783	42575	3576	9376	58325	29163
2010	2230	6887	5908	45982	3676	10181	63050	31525
2011	2281	7411	6036	49463	3778	11008	67882	33941
2012	2333	7948	6167	53019	3884	11859	72826	36413
2013	2387	8497	6300	56653	3992	12733	77883	38942

Route	ML-7	Section	304-40KM	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	1294	298	554	319	824	180	797	399
1995	1372	613	588	659	876	372	1644	822
1996	1454	947	625	1019	932	576	2542	1271
1997	1541	1302	663	1401	991	793	3496	1748
1998	1634	1677	704	1807	1055	1024	4508	2254
1999	1732	2076	748	2239	1122	1270	5585	2793
2000	1836	2498	794	2697	1193	1531	6726	3363
2001	1919	2939	826	3173	1244	1804	7916	3958
2002	2006	3401	860	3669	1297	2088	9158	4579
2003	2097	3883	895	4185	1352	2384	10452	5226
2004	2192	4387	931	4722	1409	2693	11802	5901
2005	2291	4914	969	5281	1469	3014	13209	6605
2006	2394	5464	1008	5862	1532	3350	14676	7338
2007	2503	6040	1049	6467	1597	3700	16207	8104
2008	2616	6641	1092	7097	1665	4064	17802	8901
2009	2675	7256	1114	7739	1700	4437	19432	9716
2010	2736	7885	1137	8395	1737	4817	21097	10549
2011	2798	8529	1160	9064	1774	5205	22798	11399
2012	2861	9187	1183	9746	1811	5602	24535	12268
2013	2926	9860	1208	10443	1850	6007	26310	13155

Phase I Projects

Route	IM-23	Section	3267- 5KM	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	633	146	884	510	236	52	708	354
1995	664	298	914	1037	248	106	1441	721
1996	697	459	945	1582	260	163	2204	1102
1997	731	627	977	2145	273	223	2995	1498
1998	767	803	1010	2728	286	285	3816	1908
1999	804	988	1045	3330	300	351	4669	2335
2000	844	1182	1080	3953	315	420	5555	2778
2001	882	1385	1123	4601	330	492	6478	3239
2002	922	1597	1169	5275	346	568	7440	3720
2003	963	1818	1215	5976	363	648	8442	4221
2004	1007	2050	1264	6705	381	731	9486	4743
2005	1052	2292	1315	7463	400	819	10574	5287
2006	1100	2545	1368	8252	419	910	11707	5854
2007	1149	2809	1423	9073	440	1007	12889	6445
2008	1201	3085	1480	9926	461	1108	14119	7060
2009	1228	3367	1510	10797	472	1211	15375	7688
2010	1256	3656	1540	11685	484	1317	16658	8329
2011	1284	3951	1571	12591	496	1426	17968	8984
2012	1313	4253	1603	13516	508	1537	19306	9653
2013	1343	4562	1635	14458	520	1651	20671	10336

Phase II Projects

Route	ML-3	Section	3-0702	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	3158	726	99	57	65	14	797	399
1995	3302	1485	104	117	68	29	1631	816
1996	3452	2279	109	180	72	45	2504	1252
1997	3609	3109	114	246	76	62	3417	1709
1998	3774	3977	120	315	80	79	4371	2186
1999	3945	4884	126	388	84	97	5369	2685
2000	4125	5833	132	464	88	117	6414	3207
2001	4301	6822	138	543	92	137	7502	3751
2002	4485	7853	144	626	97	158	8637	4319
2003	4676	8928	150	713	102	180	9821	4911
2004	4876	10050	157	803	107	204	11057	5529
2005	5084	11219	164	898	113	229	12346	6173
2006	5302	12438	171	997	119	255	13690	6845
2007	5528	13709	178	1099	125	282	15090	7545
2008	5764	15034	186	1206	131	311	16551	8276
2009	5887	16388	190	1316	134	340	18044	9022
2010	6013	17771	194	1428	138	370	19569	9785
2011	6141	19183	198	1542	141	401	21126	10563
2012	6272	20625	203	1659	145	433	22717	11359
2013	6406	22098	207	1779	149	466	24343	12172

Route	ML-5	Section	1	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	3563	819	2358	1360	2390	523	2702	1351
1995	3774	1687	2506	2805	2521	1076	5568	2784
1996	3997	2606	2662	4340	2659	1658	8604	4302
1997	4233	3580	2829	5972	2805	2272	11824	5912
1998	4484	4611	3006	7705	2959	2920	15236	7618
1999	4749	5703	3194	9547	3121	3604	18854	9427
2000	5030	6859	3394	11505	3292	4325	22689	11345
2001	5276	8073	3554	13554	3455	5081	26708	13354
2002	5534	9345	3721	15700	3626	5875	30920	15460
2003	5804	10680	3896	17947	3806	6709	35336	17668
2004	6088	12080	4079	20299	3994	7584	39963	19982
2005	6385	13548	4271	22762	4192	8502	44812	22406
2006	6697	15088	4472	25341	4399	9465	49894	24947
2007	7025	16703	4682	28041	4617	10476	55220	27610
2008	7368	18398	4902	30868	4846	11537	60803	30402
2009	7548	20133	5017	33762	4966	12625	66520	33260
2010	7732	21911	5135	36723	5089	13739	72373	36187
2011	7921	23733	5256	39754	5215	14881	78368	39184
2012	8115	25599	5380	42857	5344	16052	84508	42254
2013	8313	27510	5506	46032	5476	17251	90793	45397

Route	ML-9	Section	3	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	1633	376	2364	1363	2275	498	2237	1119
1995	1729	773	2509	2810	2400	1024	4607	2304
1996	1830	1194	2663	4346	2531	1578	7118	3559
1997	1938	1640	2826	5976	2670	2163	9779	4890
1998	2051	2111	3000	7706	2816	2780	12597	6299
1999	2172	2611	3184	9542	2970	3430	15583	7792
2000	2299	3139	3379	11491	3133	4116	18746	9373
2001	2409	3693	3534	13529	3288	4836	22058	11029
2002	2524	4274	3696	15660	3451	5592	25526	12763
2003	2644	4882	3866	17890	3622	6385	29157	14579
2004	2771	5519	4044	20222	3801	7218	32959	16480
2005	2903	6186	4229	22661	3989	8091	36938	18469
2006	3042	6886	4423	25212	4186	9008	41106	20553
2007	3187	7619	4627	27880	4394	9970	45469	22735
2008	3339	8387	4839	30671	4611	10980	50038	25019
2009	3419	9173	4950	33525	4725	12015	54713	27357
2010	3500	9978	5064	36446	4842	13075	59499	29750
2011	3584	10802	5180	39433	4962	14162	64397	32199
2012	3670	11646	5299	42489	5085	15275	69410	34705
2013	3757	12510	5421	45615	5210	16416	74541	37271

Route	IM-1	Section	PWD-N	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	45	10	119	69	37	8	87	44
1995	47	21	124	140	39	17	178	89
1996	49	33	129	215	41	26	274	137
1997	51	44	135	293	43	35	372	186
1998	53	56	140	373	45	45	474	237
1999	56	69	146	458	48	55	582	291
2000	58	83	152	545	50	66	694	347
2001	60	96	158	636	53	78	810	405
2002	63	111	165	732	55	90	933	467
2003	65	126	172	831	58	103	1060	530
2004	68	141	179	934	61	116	1191	596
2005	71	158	186	1041	64	130	1329	665
2006	74	175	194	1153	68	145	1473	737
2007	77	193	202	1270	71	161	1624	812
2008	80	211	211	1391	75	177	1779	890
2009	82	230	215	1515	77	194	1939	970
2010	84	249	219	1641	78	211	2101	1051
2011	85	269	224	1771	80	228	2268	1134
2012	87	289	229	1903	83	247	2439	1220
2013	89	309	233	2037	85	265	2611	1306

Route	ML-9	Section	7	Lane	4

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	1699	391	4025	2321	2115	463	3175	1588
1995	1798	804	4264	4780	2250	956	6540	3270
1996	1903	1242	4516	7385	2393	1480	10107	5054
1997	2015	1705	4784	10144	2545	2037	13886	6943
1998	2132	2195	5067	13066	2707	2630	17891	8946
1999	2257	2714	5368	16161	2880	3261	22136	11068
2000	2389	3264	5686	19441	3063	3932	26637	13319
2001	2489	3836	5914	22851	3234	4640	31327	15664
2002	2594	4433	6150	26398	3414	5388	36219	18110
2003	2703	5054	6396	30086	3605	6177	41317	20659
2004	2816	5702	6652	33923	3806	7011	46636	23318
2005	2935	6377	6919	37913	4019	7891	52181	26091
2006	3058	7080	7196	42063	4243	8820	57963	28982
2007	3186	7812	7483	46378	4480	9801	63991	31996
2008	3320	8576	7783	50867	4730	10837	70280	35140
2009	3390	9355	7939	55445	4862	11902	76702	38351
2010	3461	10151	8098	60115	4998	12996	83262	41631
2011	3534	10964	8260	64879	5137	14121	89964	44982
2012	3608	11793	8425	69737	5281	15278	96808	48404
2013	3683	12640	8594	74694	5428	16467	103801	51901

Route	IM-2	Section	3306-0100-E	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	91	21	4	2	6	1	24	12
1995	95	43	4	5	6	3	51	26
1996	99	66	4	7	7	4	77	39
1997	103	89	4	9	7	6	104	52
1998	107	114	5	12	7	7	133	67
1999	111	139	5	15	8	9	163	82
2000	116	166	5	18	8	11	195	98
2001	121	194	5	21	9	13	228	114
2002	126	223	5	24	9	15	262	131
2003	131	253	6	27	9	17	297	149
2004	136	284	6	30	10	19	333	167
2005	142	317	6	34	10	21	372	186
2006	148	351	6	37	11	23	411	206
2007	154	386	7	41	11	26	453	227
2008	160	423	7	45	12	29	497	249
2009	164	461	7	49	12	31	541	271
2010	167	499	7	53	13	34	586	293
2011	171	539	7	57	13	37	633	317
2012	174	579	7	62	13	40	681	341
2013	178	620	8	66	14	43	729	365

Route	IM-11	Section	RID-S	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number

Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	464	107	137	79	3	1	187	94
1995	499	221	148	164	3	1	386	193
1996	537	345	160	257	3	2	604	302
1997	579	478	172	356	4	3	837	419
1998	623	621	186	463	4	4	1088	544
1999	671	776	201	579	4	5	1360	680
2000	722	942	217	704	5	6	1652	826
2001	767	1118	232	838	5	7	1963	982
2002	814	1305	247	980	5	8	2293	1147
2003	865	1504	264	1133	5	9	2646	1323
2004	918	1715	282	1295	5	10	3020	1510
2005	975	1939	301	1469	5	11	3419	1710
2006	1035	2177	321	1654	5	12	3843	1922
2007	1099	2430	343	1852	5	13	4295	2148
2008	1167	2698	366	2063	6	14	4775	2388
2009	1203	2975	379	2282	6	16	5273	2637
2010	1240	3260	391	2507	6	17	5784	2892
2011	1279	3554	405	2741	6	18	6313	3157
2012	1318	3857	418	2982	6	20	6859	3430
2013	1359	4170	432	3231	6	21	7422	3711

Route	IM-12	Section	RID-N	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number

Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	96	22	80	46	24	5	73	37
1995	104	46	87	96	26	11	153	77
1996	112	72	94	151	28	17	240	120
1997	120	99	101	209	30	24	332	166
1998	129	129	109	272	32	31	432	216
1999	139	161	118	340	34	38	539	270
2000	150	195	127	413	37	46	654	327
2001	159	232	136	492	38	55	779	390
2002	169	271	145	575	39	63	909	455
2003	179	312	155	665	40	72	1049	525
2004	190	356	165	760	41	81	1197	599
2005	202	402	176	861	41	90	1353	677
2006	215	452	188	970	42	99	1521	761
2007	228	504	201	1086	43	108	1698	849
2008	242	560	214	1209	44	118	1887	944
2009	250	617	222	1337	45	128	2082	1041
2010	257	676	229	1469	45	138	2283	1142
2011	265	737	237	1606	46	148	2491	1246
2012	273	800	245	1747	46	158	2705	1353
2013	282	865	253	1893	47	168	2926	1463

Route	IM-13	Section	PWD	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number

Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	28	6	51	30	294	64	100	50
1995	29	13	54	61	309	132	206	103
1996	31	20	56	93	326	203	316	158
1997	32	28	59	127	343	278	433	217
1998	34	35	61	162	361	358	555	278
1999	36	44	64	199	380	441	684	342
2000	38	52	67	238	400	528	818	409
2001	39	61	70	278	418	620	959	480
2002	41	71	72	320	438	716	1107	554
2003	43	81	75	363	457	816	1260	630
2004	45	91	78	408	478	921	1420	710
2005	47	102	81	455	500	1030	1587	794
2006	50	113	84	503	523	1145	1761	881
2007	52	125	87	553	547	1264	1942	971
2008	54	138	90	605	571	1390	2133	1067
2009	56	151	92	658	584	1518	2327	1164
2010	57	164	93	712	598	1648	2524	1262
2011	58	177	95	767	611	1782	2726	1363
2012	60	191	97	823	625	1919	2933	1467
2013	61	205	99	880	639	2059	3144	1572

Route	IM-14	Section	RULAL-N	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number

Unit:1000

Year	MT		HT		HB		Total ESA	
	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	49	11	478	275	1	0	286	143
1995	52	23	499	563	2	1	587	294
1996	54	36	521	864	2	1	901	451
1997	57	49	544	1177	2	2	1228	614
1998	59	62	568	1505	2	2	1569	785
1999	62	77	593	1847	2	3	1927	964
2000	65	92	619	2204	2	3	2299	1150
2001	68	107	645	2576	2	3	2686	1343
2002	71	124	672	2963	2	4	3091	1546
2003	74	141	700	3367	2	4	3512	1756
2004	77	158	729	3787	2	5	3950	1975
2005	81	177	760	4226	3	5	4408	2204
2006	84	196	791	4682	3	6	4884	2442
2007	88	217	824	5157	3	7	5381	2691
2008	91	238	859	5652	3	7	5897	2949
2009	93	259	877	6158	3	8	6425	3213
2010	95	281	895	6674	3	9	6964	3482
2011	97	303	914	7202	3	9	7514	3757
2012	100	326	933	7740	3	10	8076	4038
2013	102	350	953	8289	3	11	8650	4325

Route IM-15 Section RULAL-S Lane 2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	600	138	946	545	45	10	693	347
1995	634	284	993	1118	48	20	1422	711
1996	669	438	1042	1719	51	31	2188	1094
1997	706	600	1095	2350	54	43	2993	1497
1998	745	771	1149	3013	57	56	3840	1920
1999	786	952	1207	3709	61	69	4730	2365
2000	830	1143	1267	4440	65	83	5666	2833
2001	869	1343	1324	5203	68	98	6644	3322
2002	910	1552	1384	6002	71	114	7668	3834
2003	953	1771	1447	6836	75	130	8737	4369
2004	999	2001	1512	7708	78	147	9856	4928
2005	1046	2241	1581	8620	82	165	11026	5513
2006	1096	2493	1652	9572	86	184	12249	6125
2007	1147	2757	1727	10568	90	204	13529	6765
2008	1202	3034	1805	11609	95	225	14868	7434
2009	1230	3316	1846	12674	97	246	16236	8118
2010	1260	3606	1887	13762	100	268	17636	8818
2011	1289	3902	1930	14875	102	290	19067	9534
2012	1320	4206	1974	16013	105	313	20532	10266
2013	1351	4517	2018	17177	107	336	22030	11015

Route IM-22 Section RULAL Lane 2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	51	12	37	21	12	3	36	18
1995	55	24	38	43	13	6	73	37
1996	58	38	40	66	14	9	113	57
1997	62	52	41	90	14	12	154	77
1998	66	67	42	114	15	15	196	98
1999	70	83	44	140	16	18	241	121
2000	75	101	45	166	17	22	289	145
2001	78	118	48	193	18	26	337	169
2002	82	137	51	223	19	30	390	195
2003	86	157	54	254	20	35	446	223
2004	89	178	57	287	21	39	504	252
2005	93	199	60	321	22	44	564	282
2006	98	222	63	358	23	49	629	315
2007	102	245	67	396	24	54	695	348
2008	106	269	71	437	25	60	766	383
2009	109	294	73	479	26	66	839	420
2010	111	320	75	523	26	71	914	457
2011	114	346	77	567	27	77	990	495
2012	116	373	79	613	28	83	1069	535
2013	119	400	82	660	28	89	1149	575

Route IM-16 Section 3312 Lane 2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	53	12	24	14	81	18	44	22
1995	56	25	25	28	85	36	89	45
1996	58	38	27	44	89	56	138	69
1997	61	52	28	60	94	76	188	94
1998	63	67	30	77	98	98	242	121
1999	66	82	31	95	103	120	297	149
2000	69	98	33	114	108	144	356	178
2001	73	115	35	134	115	169	418	209
2002	77	133	37	156	122	196	485	243
2003	81	151	39	178	129	224	553	277
2004	86	171	41	202	136	254	627	314
2005	91	192	44	227	144	286	705	353
2006	96	214	46	254	153	319	787	394
2007	101	237	49	282	162	355	874	437
2008	107	262	52	312	171	392	966	483
2009	110	287	53	342	176	431	1060	530
2010	113	313	55	374	181	470	1157	579
2011	116	340	56	406	187	511	1257	629
2012	120	367	58	440	192	553	1360	680
2013	123	396	60	475	198	597	1468	734

Route IM-17 Section PWD-E Lane 2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	147	34	147	85	30	7	126	63
1995	155	70	155	174	31	13	257	129
1996	163	107	164	268	33	21	396	198
1997	171	146	174	369	35	28	543	272
1998	180	188	184	475	37	36	699	350
1999	190	231	195	587	39	45	863	432
2000	200	277	206	706	41	54	1037	519
2001	211	326	218	832	43	63	1221	611
2002	222	377	230	965	45	73	1415	708
2003	235	431	243	1105	47	83	1619	810
2004	248	488	256	1252	50	94	1834	917
2005	262	548	271	1409	52	106	2063	1032
2006	276	612	286	1574	55	118	2304	1152
2007	291	679	302	1748	58	130	2557	1279
2008	308	749	319	1932	60	144	2825	1413
2009	316	822	328	2121	62	157	3100	1550
2010	325	897	337	2315	63	171	3383	1692
2011	334	973	347	2515	65	185	3673	1837
2012	343	1052	357	2721	67	200	3973	1987
2013	353	1134	367	2933	68	215	4282	2141

Route	RH-2	Section	225-0100-N	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	173	40	211	122	173	38	200	100
1995	180	81	220	249	182	78	408	204
1996	187	124	229	381	191	120	625	313
1997	195	169	238	518	201	164	851	426
1998	203	216	248	661	211	210	1087	544
1999	211	264	258	810	222	258	1332	666
2000	220	315	269	965	233	309	1589	795
2001	229	367	280	1126	245	363	1856	928
2002	239	422	292	1295	257	419	2136	1068
2003	249	480	304	1470	271	479	2429	1215
2004	259	539	316	1652	284	541	2732	1366
2005	270	601	329	1842	299	606	3049	1525
2006	281	666	343	2040	314	675	3381	1691
2007	293	733	357	2246	330	747	3726	1863
2008	305	803	372	2460	347	823	4086	2043
2009	311	875	380	2679	356	901	4455	2228
2010	318	948	388	2903	365	981	4832	2416
2011	324	1023	396	3131	374	1063	5217	2609
2012	331	1099	404	3364	384	1147	5610	2805
2013	338	1176	412	3602	394	1234	6012	3006

Route	RH-5	Section	344-0200-N	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	421	97	995	574	844	185	856	428
1995	445	199	1043	1175	876	377	1751	876
1996	470	307	1093	1806	910	576	2689	1345
1997	496	421	1146	2467	945	783	3671	1836
1998	524	542	1201	3159	981	998	4699	2350
1999	554	669	1259	3885	1018	1221	5775	2888
2000	585	804	1320	4646	1057	1452	6902	3451
2001	612	944	1365	5434	1095	1692	8070	4035
2002	641	1092	1412	6248	1135	1941	9281	4641
2003	671	1246	1461	7091	1175	2198	10535	5268
2004	702	1408	1511	7962	1218	2465	11835	5918
2005	735	1577	1563	8863	1262	2741	13181	6591
2006	769	1753	1616	9795	1307	3027	14575	7288
2007	805	1938	1672	10759	1354	3324	16021	8011
2008	843	2132	1729	11757	1403	3631	17520	8760
2009	863	2331	1759	12771	1428	3944	19046	9523
2010	883	2534	1789	13803	1454	4262	20599	10300
2011	903	2741	1820	14852	1480	4586	22179	11090
2012	925	2954	1851	15920	1507	4916	23790	11895
2013	946	3172	1883	17006	1534	5252	25430	12715

Route	RH-3	Section	325-0200	Lane	2

ESA Conversion Factor

MT	HT	HB
0.63	1.58	0.6

ESA 8.2 Ton Cumulative Number — Unit:1000

	MT		HT		HB		Total ESA	
Year	Vehicles / Day	ESA	Vehicles / Day	ESA	Vehicles / Day	ESA	Total	Per Direct.
1994	391	90	334	193	608	133	416	208
1995	407	184	348	393	636	272	849	425
1996	424	281	363	603	666	418	1302	651
1997	441	382	379	821	697	571	1774	887
1998	459	488	395	1049	730	731	2268	1134
1999	478	598	411	1286	764	898	2782	1391
2000	498	712	429	1533	800	1073	3318	1659
2001	517	831	447	1791	833	1256	3878	1939
2002	537	955	466	2060	867	1446	4461	2231
2003	558	1083	485	2340	903	1643	5066	2533
2004	580	1216	505	2631	940	1849	5696	2848
2005	602	1355	526	2934	979	2064	6353	3177
2006	626	1499	548	3250	1019	2287	7036	3518
2007	650	1648	571	3580	1061	2519	7747	3874
2008	675	1803	595	3923	1105	2761	8487	4244
2009	688	1962	607	4273	1128	3008	9243	4622
2010	701	2123	620	4630	1151	3260	10013	5007
2011	715	2287	633	4995	1175	3518	10800	5400
2012	729	2455	646	5368	1199	3780	11603	5802
2013	743	2626	660	5749	1224	4048	12423	6212

Appendix 4.2.10 RESULTS OF THE PAVEMENT STRUCTURE DESIGN

	ML-1	ML-2	ML-4 ①	ML-4 ②	ML-5N	ML-5W	ML-5S	ML-7
AASHTO METHOD	REQUIRED SN = 4.15 THICKNESS (CM.) / SN ASPHALT CONCRETE 10 1.80 PRIME COAT BASE COURSE (CRUSHED RD) 25 1.30 SUB BASE 30 1.08 SN = 4.18	REQUIRED SN = 2.30 THICKNESS (CM.) / SN ASPHALT CONCRETE 5 0.90 BASE COURSE (CRUSHED RD.) 20 1.04 SUB BASE 15 0.54 SN=2.48	REQUIRED SN = 3.20 THICKNESS (CM.) / SN ASPHALT CONCRETE 10 1.80 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN=3.38	REQUIRED SN = 2.60 THICKNESS (CM.) / SN ASPHALT CONCRETE 5 0.90 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 2.66	REQUIRED SN = 3.55 THICKNESS (CM.) / SN ASPHALT CONCRETE 10 1.80 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 3.56	REQUIRED SN = 3.40 THICKNESS (CM.) / SN ASPHALT CONCRETE 10 1.80 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 3.48	REQUIRED SN = 3.00 THICKNESS (CM.) / SN ASPHALT CONCRETE 7.5 1.35 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 3.11	REQUIRED SN = 3.25 THICKNESS (CM.) / SN ASPHALT CONCRETE 10 1.80 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 3.38
ROAD NOTE 29 METHOD	THICKNESS (CM.) ASPHALT CONCRETE 10 BITUMINOUS STABILIZATION 22 SUB BASE 20	THICKNESS (CM.) ASPHALT CONCRETE 6 BITUMINOUS STABILIZATION 9 SUB BASE 15	THICKNESS (CM.) ASPHALT CONCRETE 9 BITUMINOUS STABILIZATION 12 SUB BASE 15	THICKNESS (CM.) ASPHALT CONCRETE 7 BITUMINOUS STABILIZATION 9 SUB BASE 15	THICKNESS (CM.) ASPHALT CONCRETE 10 BITUMINOUS STABILIZATION 14 SUB BASE 18	THICKNESS (CM.) ASPHALT CONCRETE 10 BITUMINOUS STABILIZATION 13 SUB BASE 18	THICKNESS (CM.) ASPHALT CONCRETE 9 BITUMINOUS STABILIZATION 11 SUB BASE 15	THICKNESS (CM.) ASPHALT CONCRETE 8 BITUMINOUS STABILIZATION 11 SUB BASE 15
JRA METHOD	REQUIRED TA = 34 THICKNESS (CM.) / TA ASPHALT CONCRETE 15 15.0 BITUMINOUS STABILIZATION 13 10.4 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 34.4	REQUIRED TA = 19 THICKNESS (CM.) / TA ASPHALT CONCRETE 5 5 BITUMINOUS STABILIZATION 10 8 SUB BASE 25 6.3 TA=19.3	REQUIRED TA = 26 THICKNESS (CM.) / TA ASPHALT CONCRETE 10 10.0 BITUMINOUS STABILIZATION 10 8.0 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 27.0	REQUIRED TA = 19 THICKNESS (CM.) / TA ASPHALT CONCRETE 5 5 BITUMINOUS STABILIZATION 10 8 SUB BASE 25 6.3 TA = 19.3	REQUIRED TA = 34 THICKNESS (CM.) / TA ASPHALT CONCRETE 15 15.0 BITUMINOUS STABILIZATION 13 10.4 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 34.4	REQUIRED TA = 34 THICKNESS (CM.) / TA ASPHALT CONCRETE 15 15.0 BITUMINOUS STABILIZATION 13 10.4 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 34.4	REQUIRED TA = 26 THICKNESS (CM.) / TA ASPHALT CONCRETE 10 10 BITUMINOUS STABILIZATION 10 8 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 27.0	REQUIRED TA = 26 THICKNESS (CM.) / TA ASPHALT CONCRETE 10 10 BITUMINOUS STABILIZATION 10 8 BASE COURSE 15 5.3 SUB BASE 15 3.7 TA = 27.0

	ML-1	ML-2	ML-4 (1)	ML-4 (2)	ML-5N	ML-5W	ML-5S	ML-7
AASHTO METHOD	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 15 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 18 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 28 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 25 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15
ROAD NOTE 29 METHOD	THICKNESS (CM.) CONCRETE SLAB 30 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 15 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 20 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 28 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 25 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 23 PRIME COAT SUB BASE 15
JRA METHOD	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 25 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 25 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM.) CONCRETE SLAB 30 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15

	IM-1	IM-2	IM-11	IM-12	IM-13	IM-14	IM-15
AASHTO METHOD	REQUIRED SN = 2.65 THICKNESS (CM) SN AC 5 0.90 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 2.66	REQUIRED SN = 1.40 THICKNESS (CM) SN DBST 2.5 0.19 BASE COURSE 15 0.78 SUB BASE 15 0.54 SN = 1.51	REQUIRED SN = 3.05 THICKNESS (CM) SN AC 7.5 1.35 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 3.11	REQUIRED SN = 3.40 THICKNESS (CM) SN AC 10 1.80 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 3.48	REQUIRED SN = 3.45 THICKNESS (CM) SN AC 10 1.80 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 3.48	REQUIRED SN = 3.90 THICKNESS (CM) SN AC 10 1.80 BASE COURSE 20 1.04 SUB BASE 30 1.08 SN = 3.92	REQUIRED SN = 3.50 THICKNESS (CM) SN AC 10 1.80 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 3.48
ROAD NOTE 29 METHOD	THICKNESS (CM) AC 5 BASE COURSE (COURSE RC) 10 SUB BASE 15	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 10	THICKNESS (CM) AC 7.5 BASE COURSE 10 SUB BASE 25	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 30	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 30	THICKNESS (CM) AC 7.5 BASE COURSE 10 SUB BASE 35	THICKNESS (CM) AC 7.5 BITUMINOUS STABILIZATION 10 SUB BASE 30
JRA METHOD	REQUIRED TA = 18 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 20 7.0 SUB BASE 25 6.3 TA = 18.30	REQUIRED TA = 11 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 10 3.5 SUB BASE 10 2.5 TA = 11.00	REQUIRED TA = 24 THICKNESS (CM) TA AC 5 5.0 BITUMINOUS STABILIZATION 10 8.0 BASE COURSE 15 5.25 SUB BASE 25 6.25 TA = 24.50	REQUIRED TA = 19 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 20 7.0 SUB BASE 30 7.5 TA = 19.50	REQUIRED TA = 19 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 20 7.0 SUB BASE 30 7.5 TA = 19.50	REQUIRED TA = 26 THICKESS (CM) TA AC 5 5.0 BITUMINOUS STABILIZATION 10 8.0 BASE COURSE 20 1.0 SUB BASE 25 6.25 TA = 26.30	REQUIRED TA = 24 THICKESS (CM) TA AC 5 5.0 BITUMINOUS STABILIZATION 10 8.0 BASE COURSE 15 5.25 SUB BASE 25 6.25 TA = 24.50

	IM-16	IM-17	IM-22	ML-3	ML-9.1	ML-9.2	ML-9.3
AASHTO METHOD	REQUIRED SN = 2.45 THICKNESS (CM) SN AC 5 0.90 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 2.48	REQUIRED SN = 2.85 THICKNESS (CM) SN AC 7.5 1.35 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 2.93	REQUIRED SN = 2.45 THICKNESS (CM) SN AC 5 1.35 BASE COURSE 20 1.04 SUB BASE 15 0.54 SN = 2.48	REQUIRED SN = 3.60 THICKNESS (CM) SN AC 10 1.80 BASE COURSE 20 1.04 SUB BASE 20 0.72 SN = 3.56	REQUIRED SN = 4.30 THICKNESS (CM) SN AC 10 1.80 PRIME COAT BASE COURSE 28 1.43 SUB BASE 30 1.08 SN = 4.31	REQUIRED SN = 4.15 THICKNESS (CM) SN AC 10 1.80 PRIME COAT BASE COURSE 25 1.30 SUB BASE 30 1.08 SN = 4.18	REQUIRED SN = 4.45 THICKNESS (CM) SN AC 12.5 2.25 PRIME COAT BASE COURSE 25 1.30 SUB BASE 30 1.08 SN = 4.63
ROAD NOTE 29 METHOD	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 25	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 25	THICKNESS (CM) AC 5 BASE COURSE 10 SUB BASE 25	THICKNESS (CM) AC 10 BITUMINOUS STABILIZATION 10 SUB BASE 30	THICKNESS (CM) AC 10 BITUMINOUS STABILIZATION 13 SUB BASE 30	THICKNESS (CM) AC 10 BITUMINOUS STABILIZATION 12 SUB BASE 30	THICKNESS (CM) AC 10 BITUMINOUS STABILIZATION 14 SUB BASE 30
JRA METHOD	REQUIRED TA = 14 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 15 5.25 SUB BASE 15 3.15 TA = 14.0	REQUIRED TA = 18 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 20 7.0 SUB BASE 25 6.25 TA = 18.3	REQUIRED TA = 14 THICKNESS (CM) TA AC 5 5.0 BASE COURSE 15 7.0 SUB BASE 15 5.0 TA = 14.0	REQUIRED TA = 32 THICKNESS (CM) TA AC 10 10.0 BITUMINOUS STABILIZATION 12 9.6 BASE COURSE 20 7.0 SUB BASE 25 6.3 TA = 32.9	REQUIRED TA = 41 THICKNESS (CM) TA AC 15 15.0 BITUMINOUS STABILIZATION 18 14.4 BASE COURSE 20 7.0 SUB BASE 20 5.0 TA = 41.4	REQUIRED TA = 41 THICKNESS (CM) TA AC 15 15.0 BITUMINOUS STABILIZATION 18 14.4 BASE COURSE 20 7.0 SUB BASE 20 5.0 TA = 41.4	REQUIRED TA = 41 THICKNESS (CM) TA AC 15 15.0 BITUMINOUS STABILIZATION 18 14.4 BASE COURSE 20 7.0 SUB BASE 20 5.0 TA = 41.4

	IM - 15	ML - 3	ML-9.1 & ML-9.3	ML - 9.2
AASHTO METHOD	THICKNESS (CM) CONCRETE SLAB 23 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 23 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 28 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 25 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15
ROAD NOTE 29 METHOD	THICKNESS (CM) CONCRETE SLAB 23 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 23 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 26 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 25 PRIME COAT SUB BASE 15
JRA METHOD	THICKNESS (CM) CONCRETE SLAB 25 AC. INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 28 AC INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 30 AC INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15	THICKNESS (CM) CONCRETE SLAB 30 AC INTERMEDIATE COURSE 3.5 PRIME COAT SUB BASE 15

Appendix 4.2.11 ESTIMATION OF REMAINING LIFE OF AC PAVEMENT

The basic equation for AC pavement in AASHTO Method expresses the change of PSI in relatioinship with the cumulative number of ESA, the CBR (MR), and the structural number of the existing pavement.

Based on an analysis of the basic equation, the chart to estimate remaining life of AC pavements was prepared in this study. (see Figure 1 to 6)

By this chart, the time when the present serviceability indes (PSI) measured in present surface conditions will decrease to the terminal serviceability index (Pt = 2.0), which requires overlays can roughly be estimated by given the CBR, the cumulative number of ESA and the structural number of the existing pavement.

Figure 1 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT

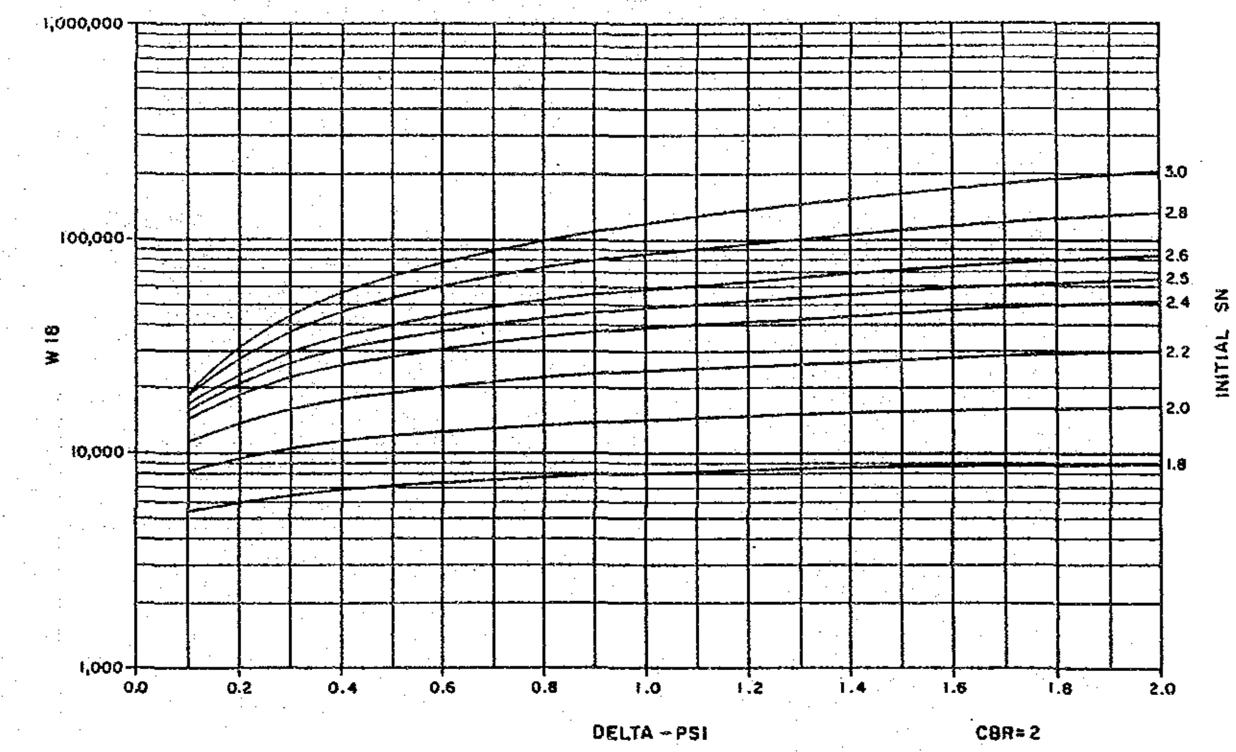


Figure 2 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT

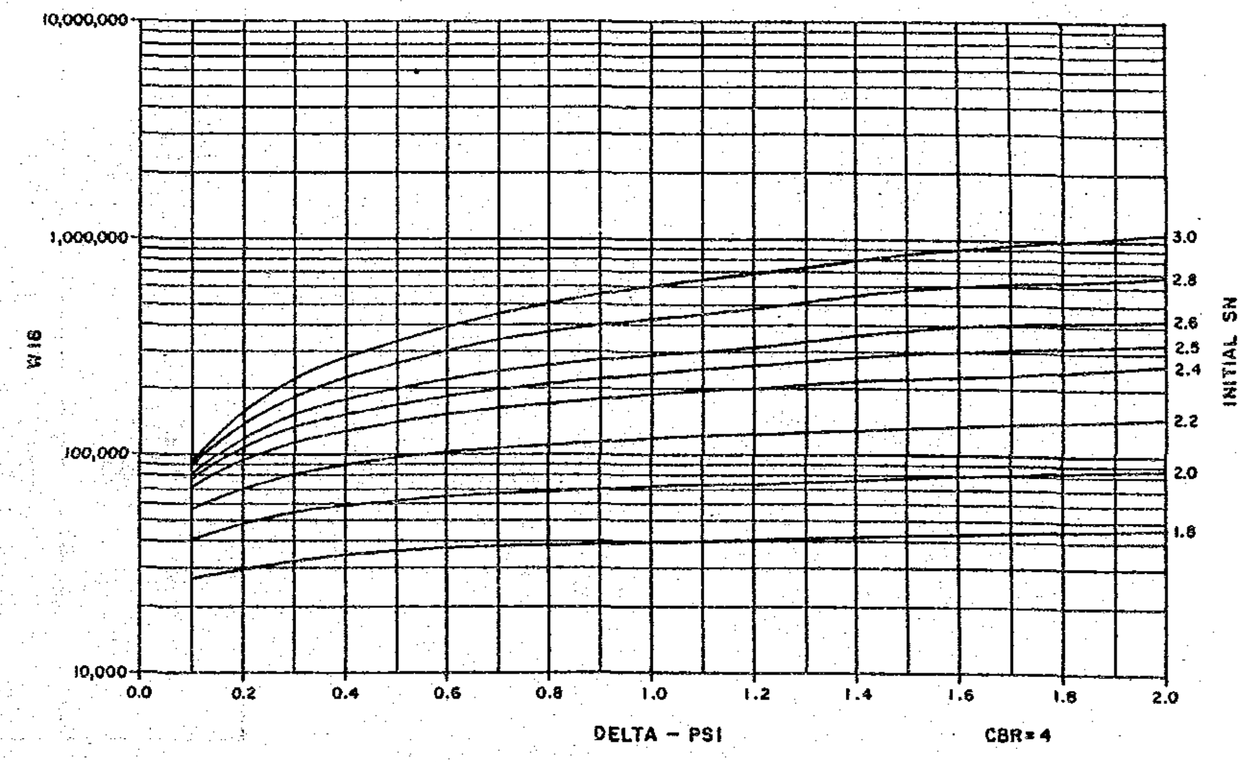


Figure 3 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT

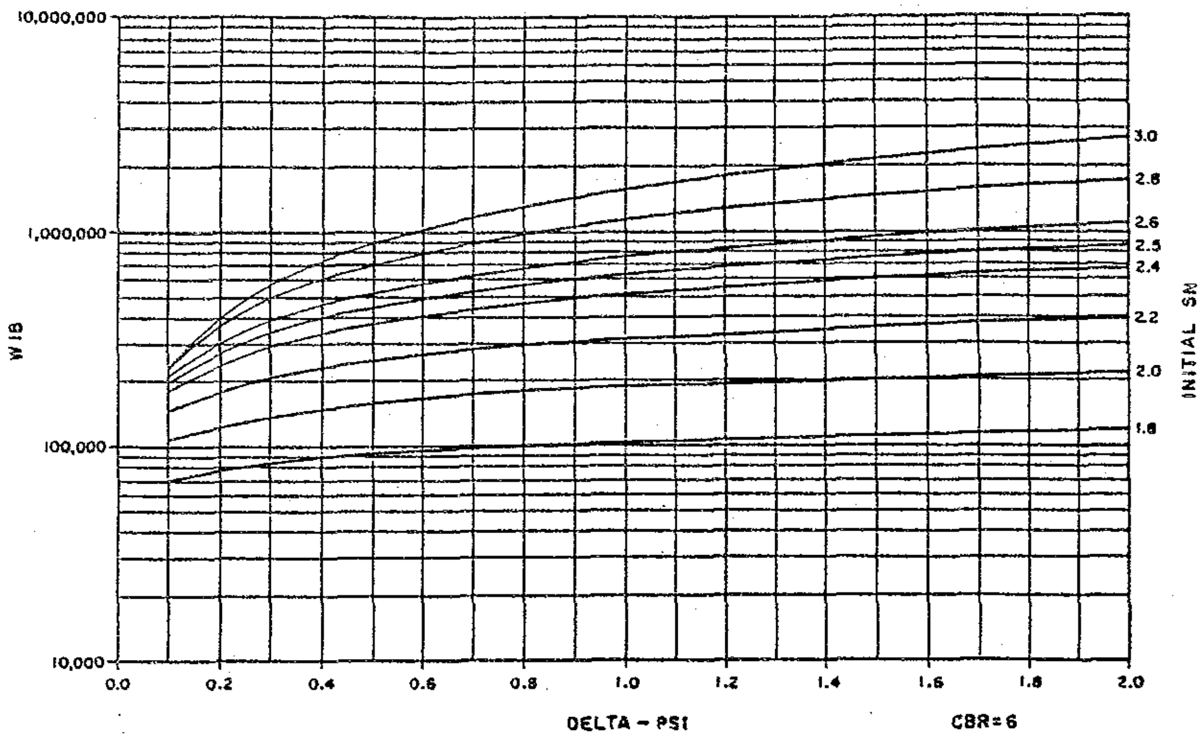


Figure 4 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT

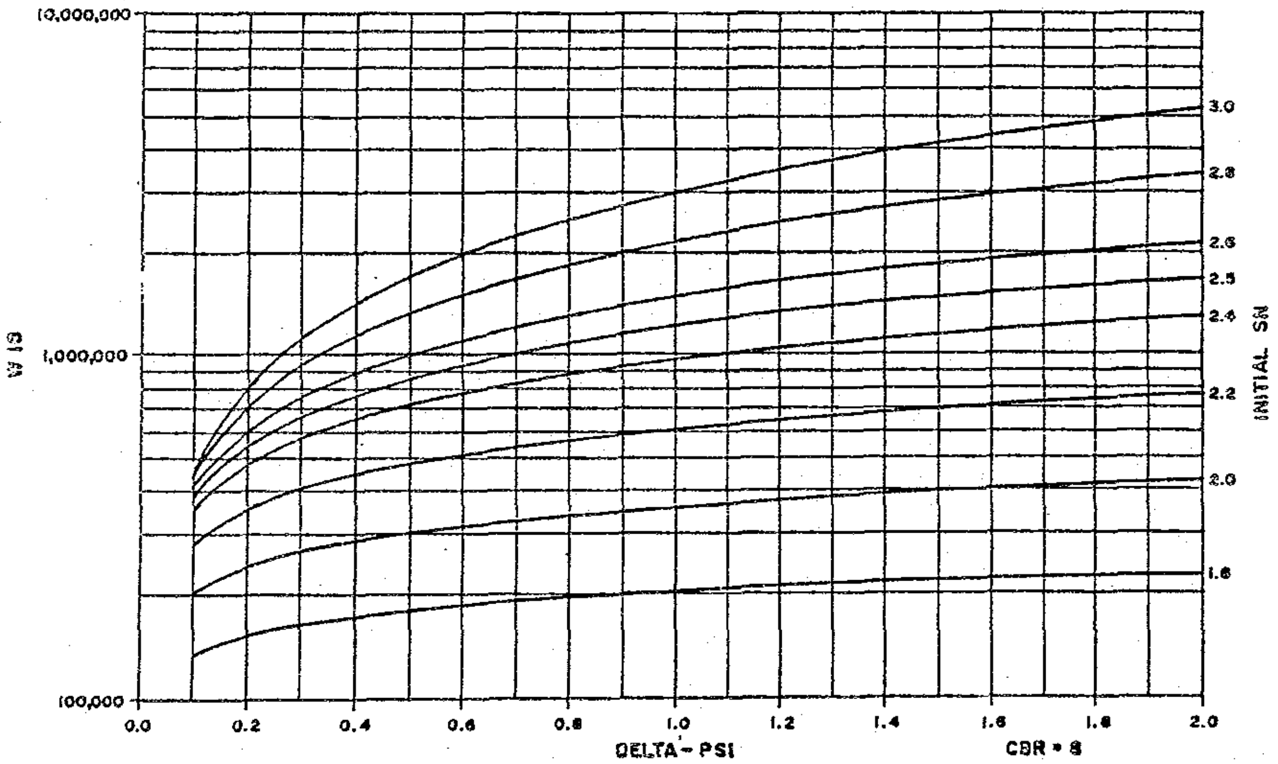


Figure 5 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT

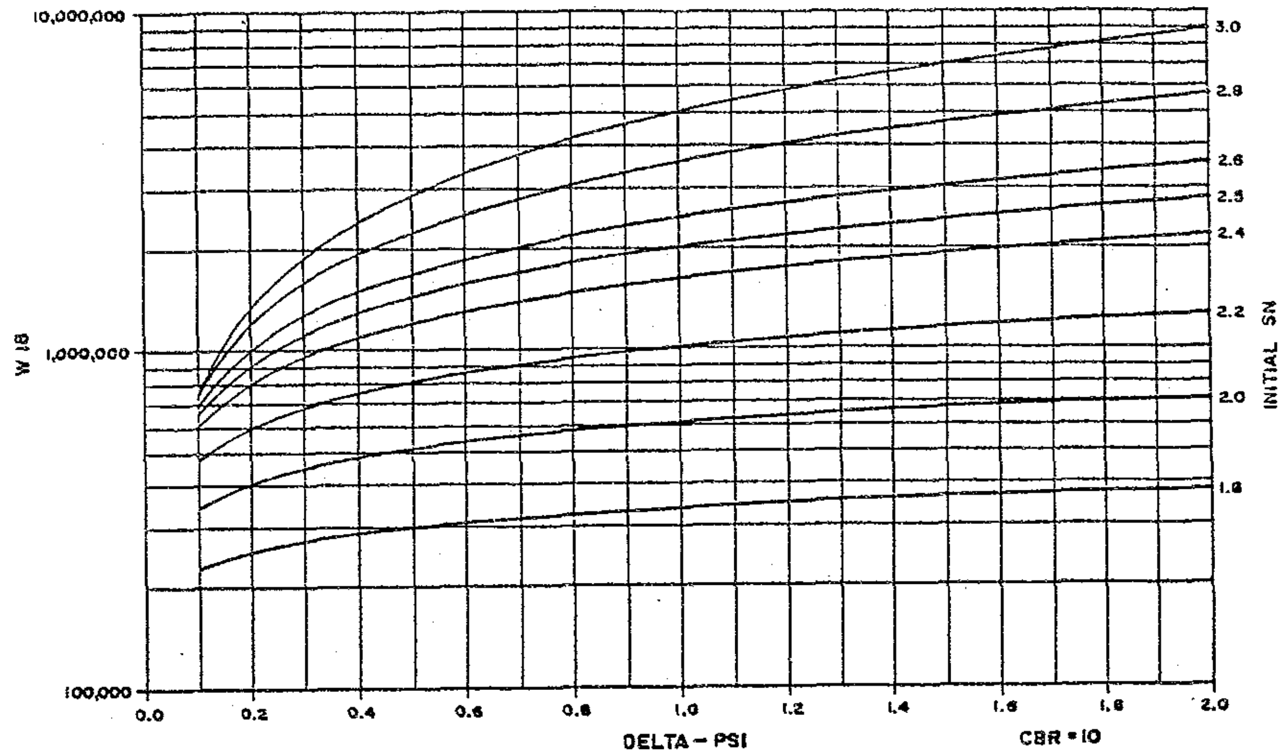
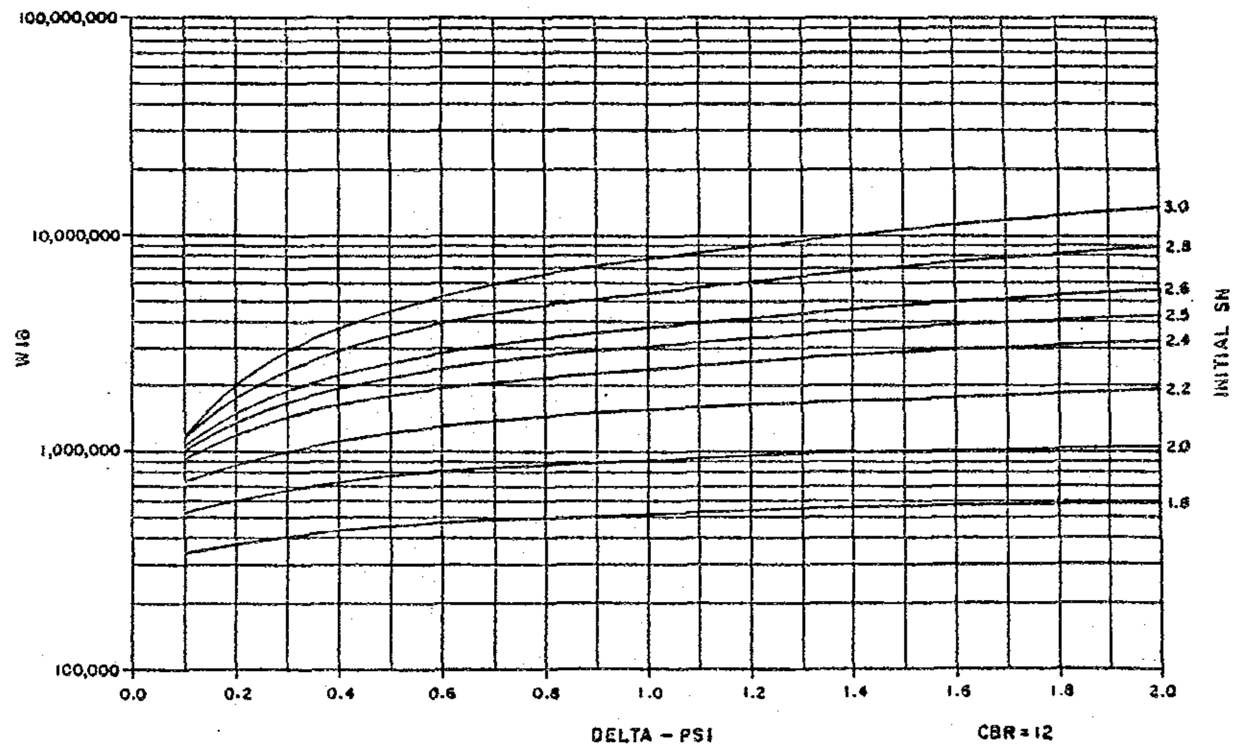


Figure 6 CHART TO ESTIMATE REMAINING LIFE OF EXISTING AC PAVEMENT



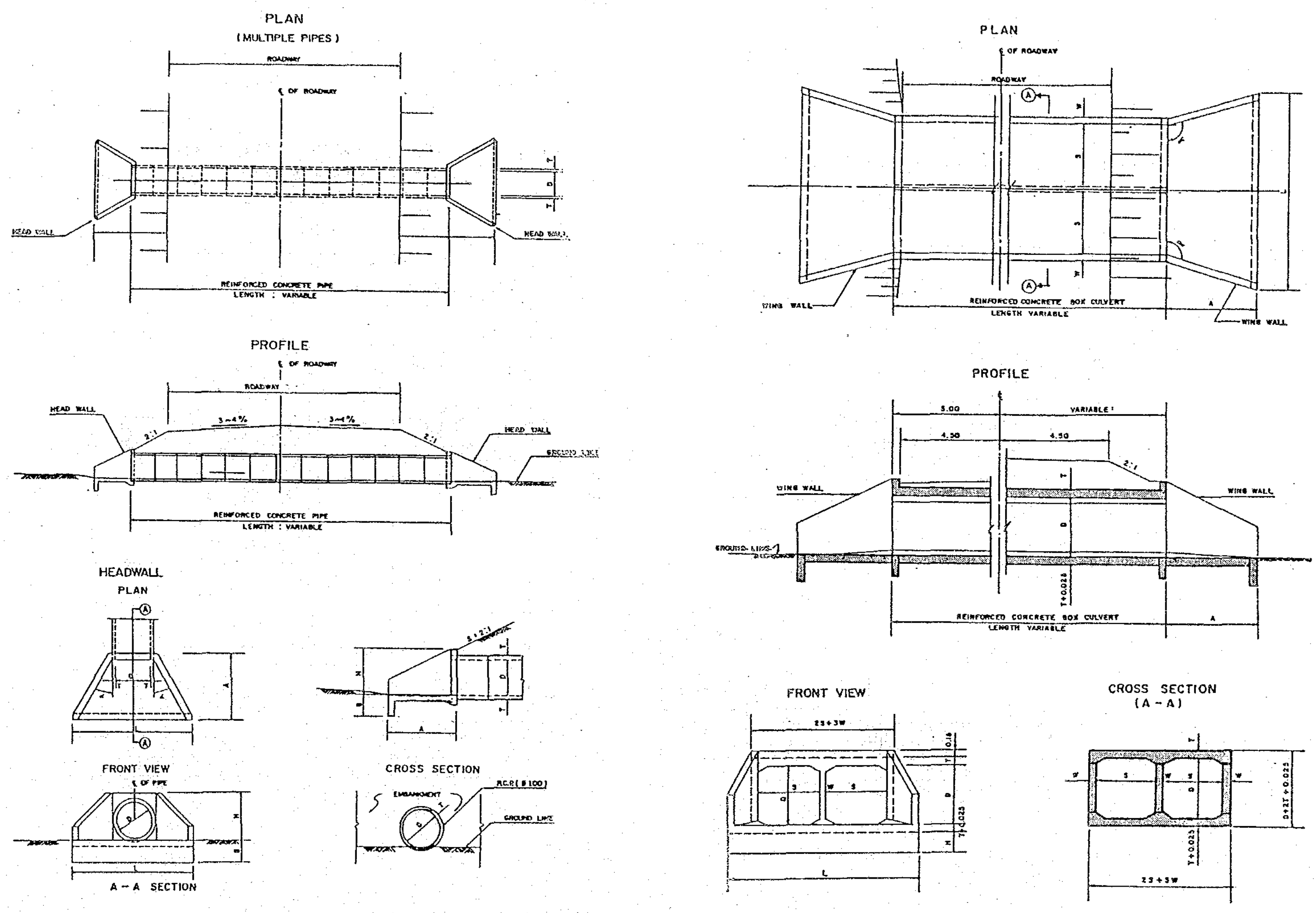
Appendix 4.2.12 YEARS ESTIMATED TO BE 2.0 OF PSI

Km	Km	ML-1 Existing PSI	ML-1 Year of PSI to 2.0	ML-2 Existing PSI	ML-2 Year of PSI to 2.0	ML-4 Existing PSI	ML-4 Year of PSI to 2.0	ML-7 Existing PSI	ML-7 Year of PSI to 2.0	IN-23 Existing PSI	IN-23 Year of PSI to 2.0
0	1	1.8	-	2.1	93	3.4	92	3.0	91	2.0	-
1	2	1.8	-	1.9	-	3.5	92	2.8	90	2.5	90
2	3	2.1	89	1.9	-	3.4	92	2.9	91	1.9	-
3	4	2.2	89	1.9	-	3.6	93	2.9	91	2.2	90
4	5	2.4	89	2.1	93	3.6	93	2.6	90	1.5	-
5	6	2.3	89	2.0	-	3.5	92	2.6	90	1.9	-
6	7	2.3	89	1.9	-	3.6	93	2.5	90	1.9	-
7	8	2.3	89	1.9	-	3.4	92	3.0	91	2.8	92
8	9	2.6	90	1.9	-	3.4	92	2.8	90	2.1	90
9	10	2.6	90	2.4	93	3.7	93	2.7	90	1.7	-
10	11	2.6	90	2.3	93	3.4	92	3.0	91	1.2	-
11	12	2.7	90	1.9	-	3.7	93	3.0	91	1.8	-
12	13	2.9	90	2.1	93	3.9	93	2.9	91	2.1	89
13	14	2.4	89	2.1	93	3.8	93	2.9	91	2.1	89
14	15			2.3	93	3.7	93	2.8	90	2.1	89
15	16			2.0	-	3.8	93	2.9	91	2.7	91
16	17			2.1	93	3.8	93	2.8	90	2.9	92
17	18			2.1	93	3.4	92	2.8	90	2.9	92
18	19			2.2	93	2.6	91	2.6	90	2.3	90
19	20			2.3	93	2.8	91	2.8	90	2.4	92
20	21			2.2	93	2.8	91	2.9	91	2.5	92
21	22			2.1	93	3.5	92	2.9	91	2.7	91
22	23			2.3	93	3.0	91	2.9	91	1.9	-
23	24			2.3	93	2.9	91	2.9	91	2.8	92
24	25			2.5	93	3.3	92	2.8	91	2.0	-
25	26			2.1	93	3.3	92	2.3	89	1.9	-
26	27					3.2	92	2.6	90	2.2	89
27	28					3.7	93	3.0	91		
28	29					3.7	93	3.1	91		
29	30					3.6	93	3.0	91		
30	31					3.6	93	2.9	91		
31	32					3.7	93	3.0	91		
32	33					3.2	92	2.9	91		
33	34					2.9	91	3.0	91		
34	35					2.7	91	3.1	91		
35	36					2.5	90	2.8	90		
36	37					2.6	91	2.7	90		
37	38					2.6	91	2.9	91		
38	39					2.7	91	2.8	90		
39	40					3.0	91	3.0	91		
40	41					3.0	91	2.7	90		
41	42					3.0	92	2.4	90		
42	43					3.0	91				
43	44					3.0	91				
44	45					3.0	91				
45	46					3.0	91				
46	47					3.0	91				
47	48					3.1	92				
48	49					3.4	92				
49	50					3.5	92				
50	51					3.4	92				
51	52					3.3	92				
52	53					2.6	91				
53	54					2.4	90				
54	55					2.5	90				
55	56										

Km	Km	ML-3 Existing PSI	ML-3 Year of PSI to 2.0	RH-2 Existing PSI	RH-2 Year of PSI to 2.0	RH-3 Existing PSI	RH-3 Year of PSI to 2.0	RH-5 (1) Existing PSI	RH-5 (1) Year of PSI to 2.0	RH-5 (2) Existing PSI	RH-5 (2) Year of PSI to 2.
0	1	1.9	-	2.6	90	2.5	89	3.3	92	3.3	92
1	2	1.9	-	2.6	90	2.5	89	3.1	92	3.0	91
2	3	1.9	-	2.5	90	2.1	89	3.1	91	2.9	91
3	4	2.1	89	2.5	90	2.4	89	3.1	91	3.1	91
4	5	1.8	-	2.3	90	2.3	89	2.6	91	2.8	91
5	6	1.8	-	2.2	89	2.2	89	3.1	91	3.0	91
6	7	2.1	89	2.4	90	2.1	89	2.8	91	2.9	91
7	8	2.1	89	2.4	89	2.1	89	2.7	91	2.7	91
8	9	2.1	89	2.4	90	1.9	-	2.8	91	2.6	91
9	10	1.8	-	2.7	90	1.9	-	2.9	91	2.9	91
10	11	1.4	-	2.7	90	2.0	-	2.9	91	2.6	91
11	12	1.5	-	2.6	90	2.6	89	2.4	90	2.1	89
12	13	2.1	89	2.6	90	2.4	89	2.8	91	2.2	90
13	14	1.9	-	2.6	90	2.3	89	2.8	91	2.4	90
14	15	1.9	-	2.8	90	1.9	-	2.5	91	2.4	90
15	16	1.6	-	2.6	90	2.2	89	2.8	91	2.8	91
16	17	1.6	-	2.6	90	2.1	89	3.1	91	3.3	92
17	18	1.8	-	2.6	90	2.1	89	3.4	92	3.1	92
18	19	1.8	-	2.4	90	2.2	89	2.3	91	2.0	-
19	20	1.9	-	2.5	90			3.0	91	2.9	91
20	21	1.7	-	2.6	90			3.1	91	3.1	91
21	22	1.6	-	2.6	90			3.1	91	3.0	91
22	23	1.6	-	2.4	90			3.0	91	2.6	91
23	24	1.9	-	2.4	90			2.6	91	1.8	-
24	25	1.9	-	2.4	90			2.9	91	2.0	-
25	26	1.8	-	2.5	90			2.8	91	2.7	91
26	27	1.6	-	2.3	90			2.5	91	2.4	90
27	28	1.6	-	2.4	90			3.1	91	3.1	91
28	29	2.3	89	2.3	90			3.0	91	2.9	91
29	30	2.6	90	2.3	90			3.1	91	2.9	91
30	31	2.2	89	2.2	89			3.2	91	2.9	-
31	32	2.8	89	2.3	90			3.1	91	2.6	-
32	33	2.6	90	2.3	90			2.8	91	2.5	-
33	34	2.8	90	2.4	90			2.8	91	2.5	-
34	35	2.8	90	2.6	90			3.1	91	2.3	-
35	36	2.8	90	2.2	89			3.3	92	2.1	-
36	37	2.9	90	2.1	89			3.4	92	3.2	-
37	38	2.9	90	2.0	-			2.8	91	2.5	-
38	39	3.0	90	1.9	-			2.6	91	2.4	-
39	40	3.1	90	1.7	-			3.1	91	2.8	-
40	41	3.1	90					3.1	91	2.8	-
41	42	3.3	90								
42	43	3.2	90								
43	44	2.8	90								
44	45	2.9	90								

Note: (1) Chanthaburi Bound
(2) Chon Buri Bound

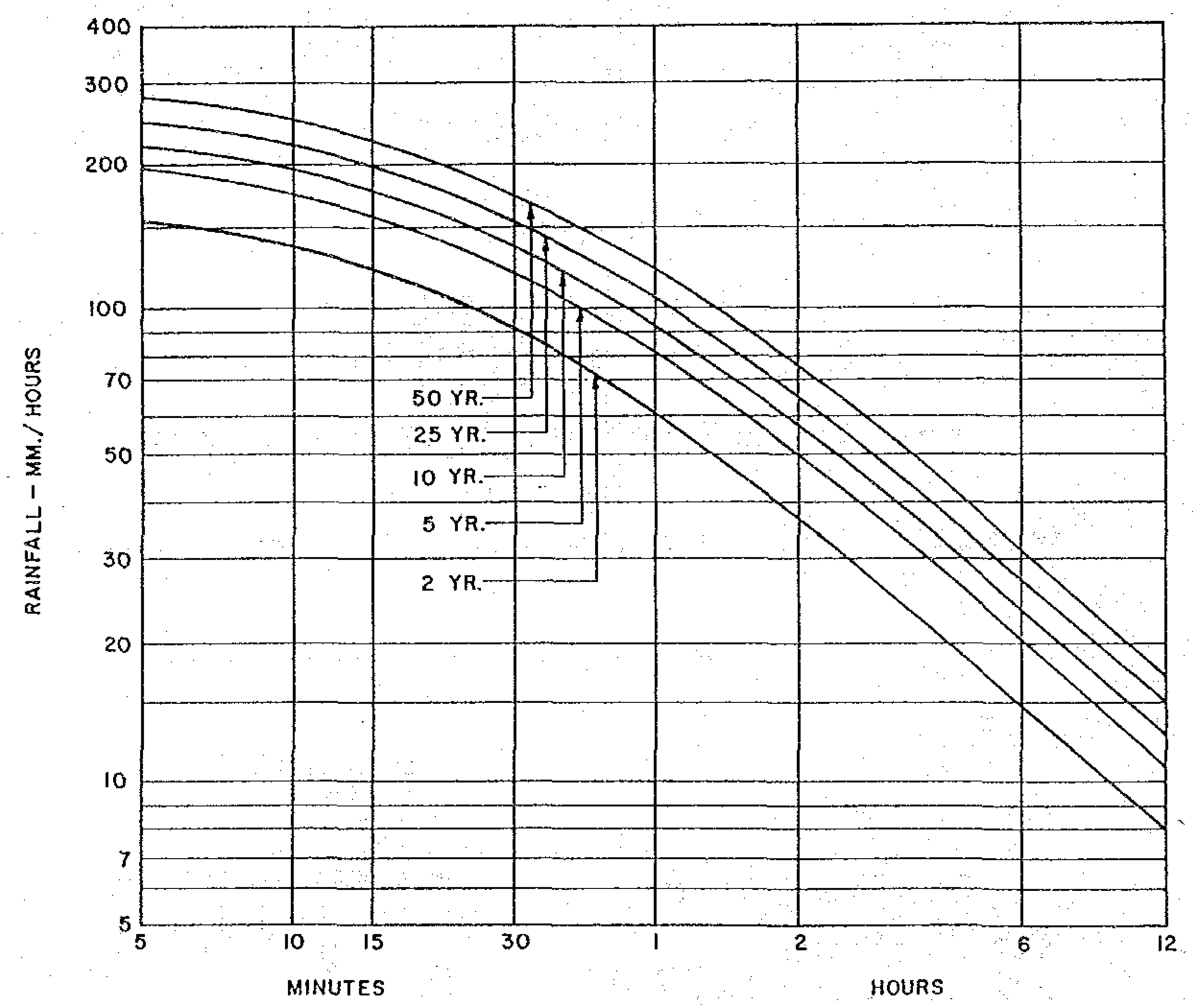
Appendix 4.2.13 TYPICAL DESIGN OF PIPE AND BOX CULVERTS



Appendix 4.2.14 RAINFALL INTENSITY-DURATION CURVE BY STATION

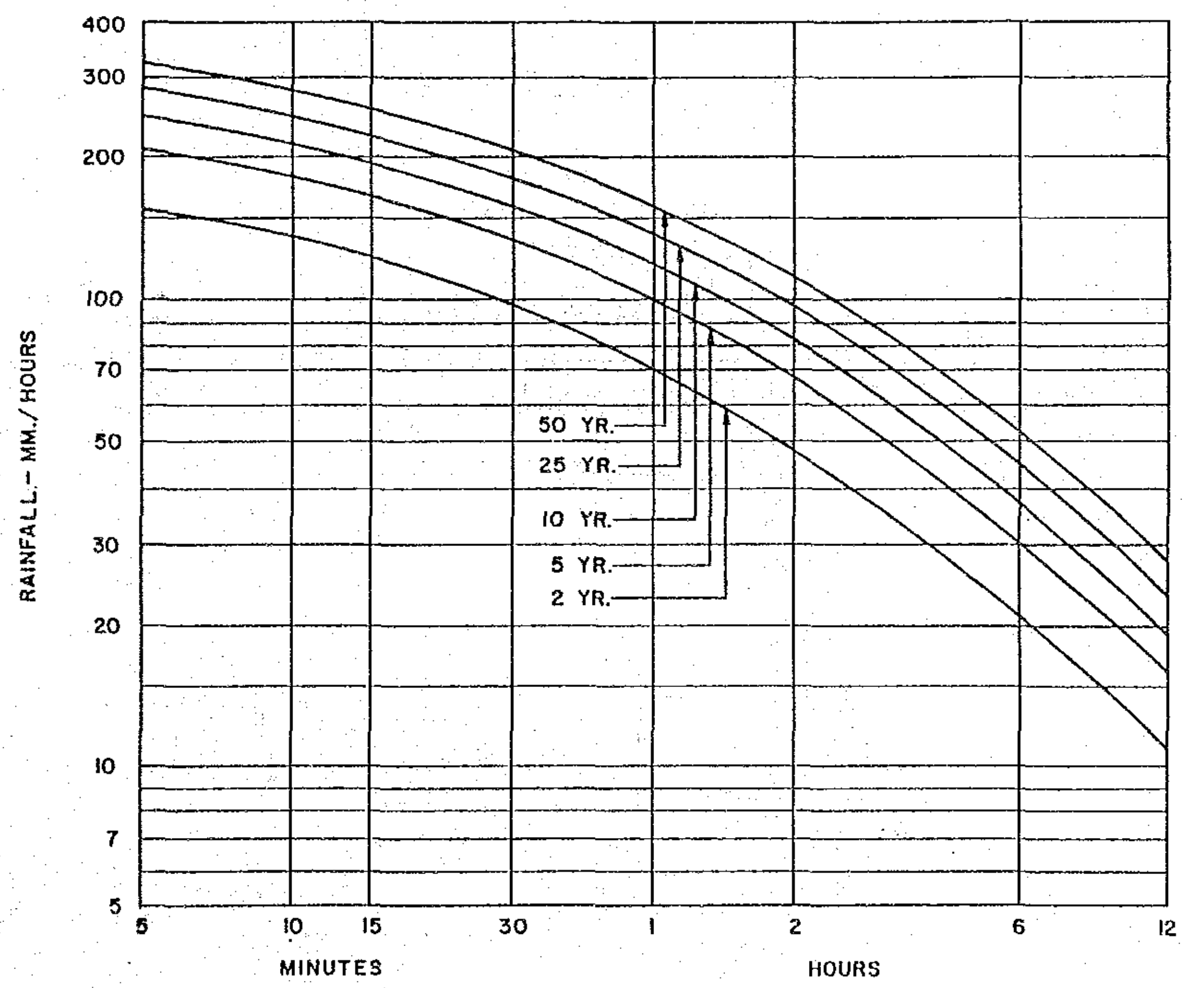
CHON BURI STATION

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES



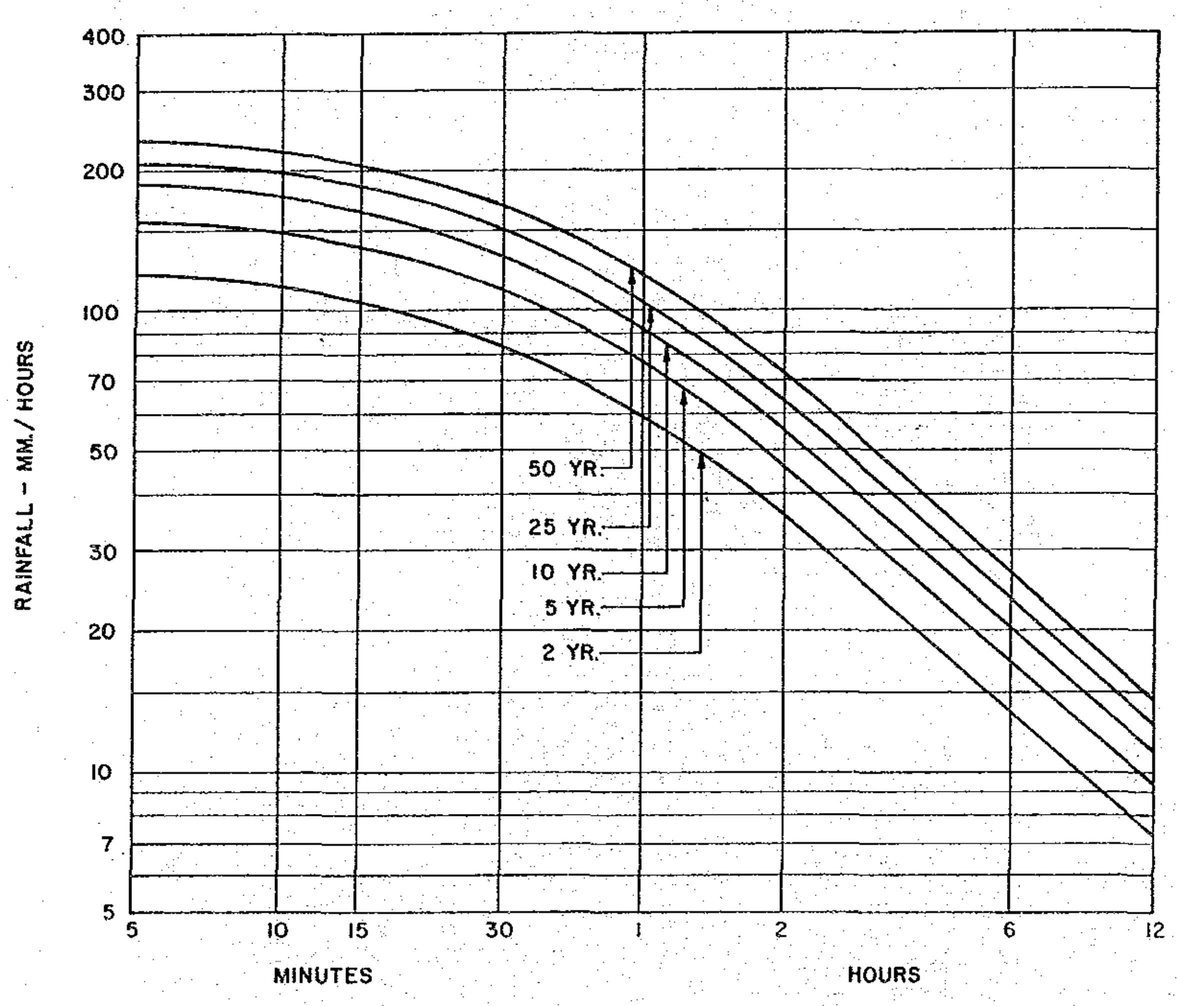
CHANTHABURI STATION

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES



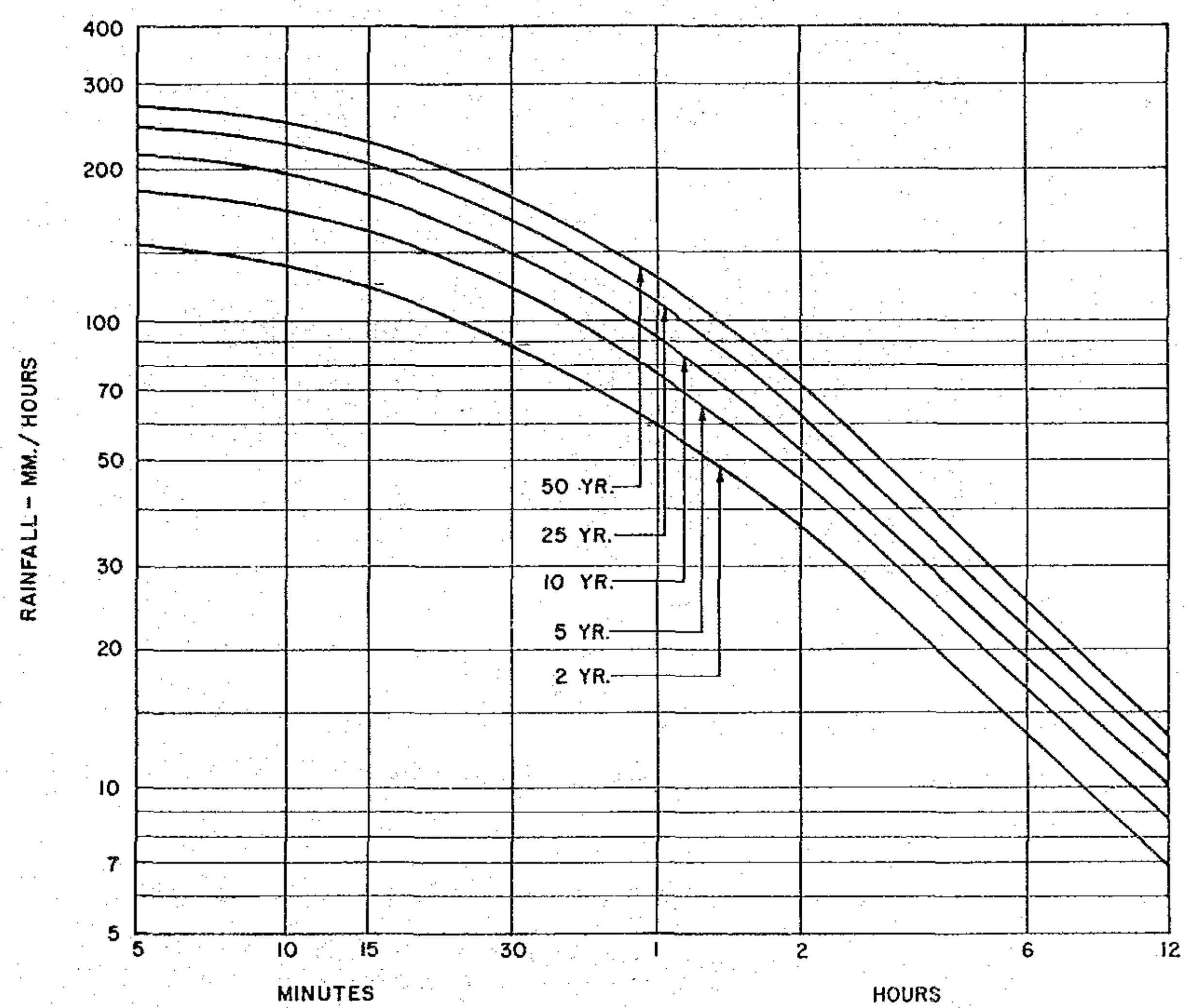
BANGKOK STATION

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

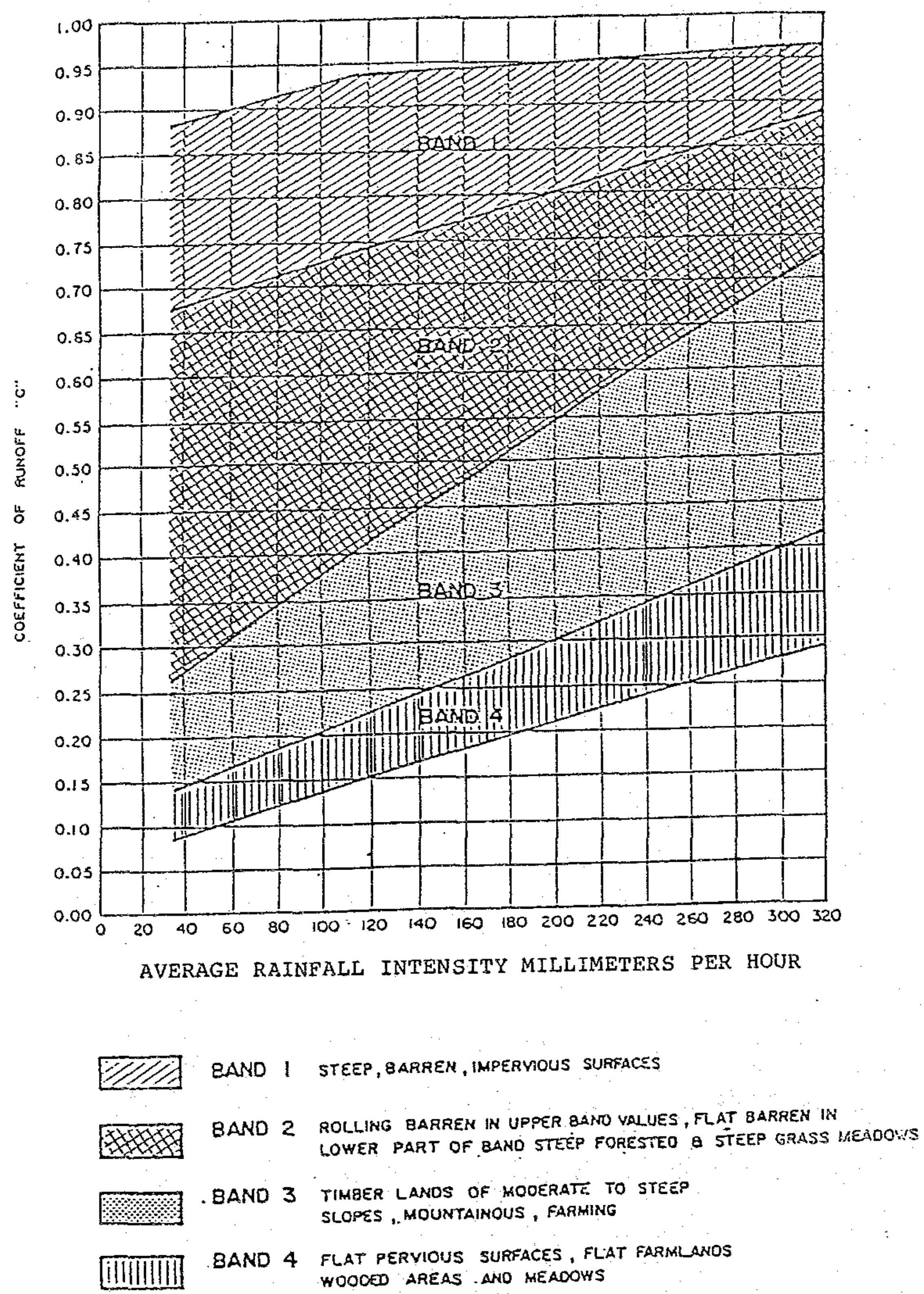


LOPBURI STATION

RAINFALL INTENSITY-DURATION-FREQUENCY CURVES

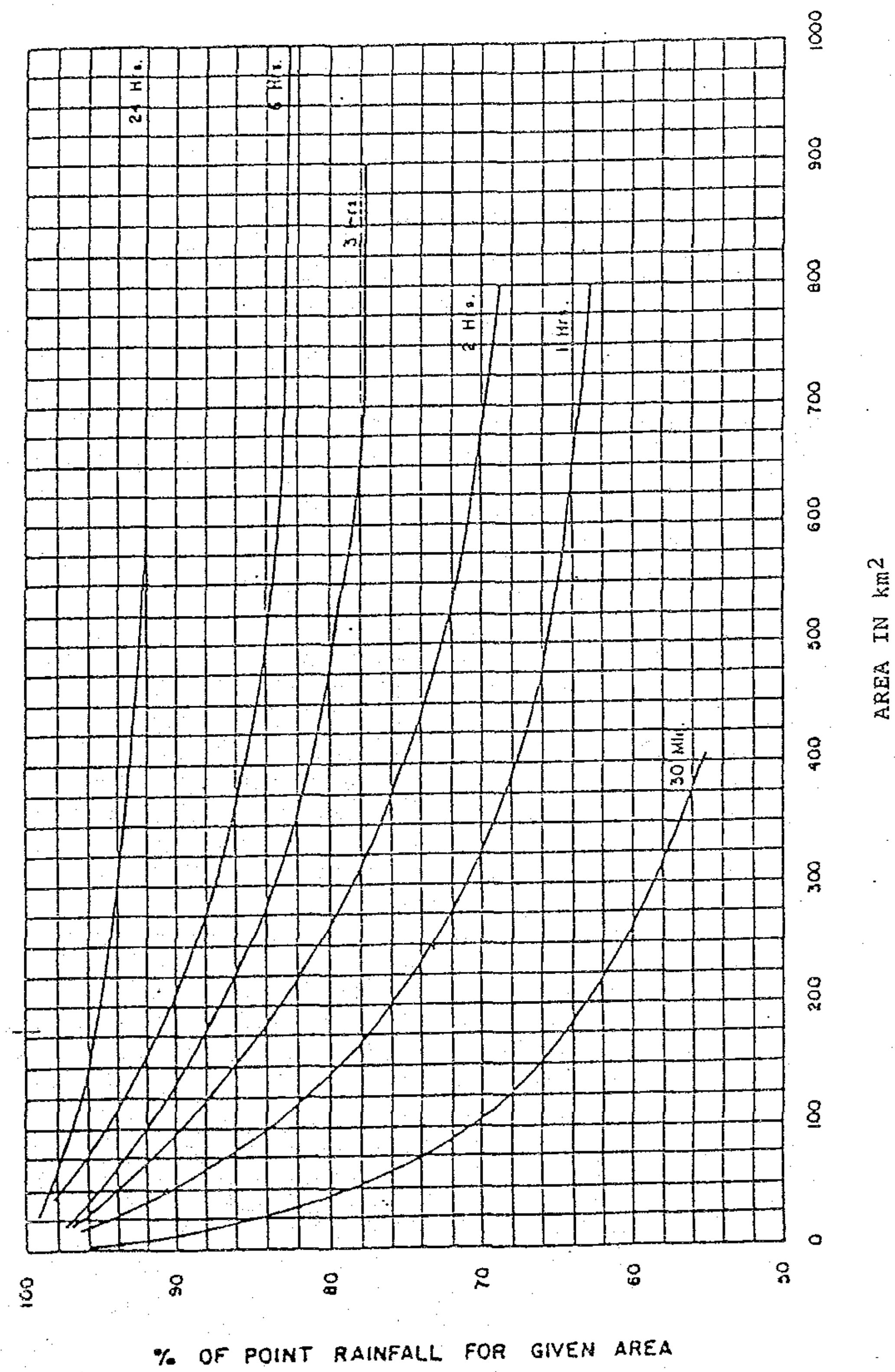


Appendix 4.2.15 COEFFICIENT OF RUNOFF



SOURCE : STUDY TEAM

Appendix 4.2.16 RAINFALL REDUCTION FACTOR



SOURCE : U.S.W.B.

Appendix 4.2.17 UNIT HYDROGRAPH PEAK DISCHARGE COEFFICIENTS

Catchment Topography	Peak Discharge Coefficient K_p
Foothills and gently undulating slopes with forest or grass cover	28 - 30
Steep forested terrain in the headwaters; foothills and plain with a cover of forest or grass in the lower reaches	30 - 32
Steep forested slopes of high hills and low mountains	32 - 34

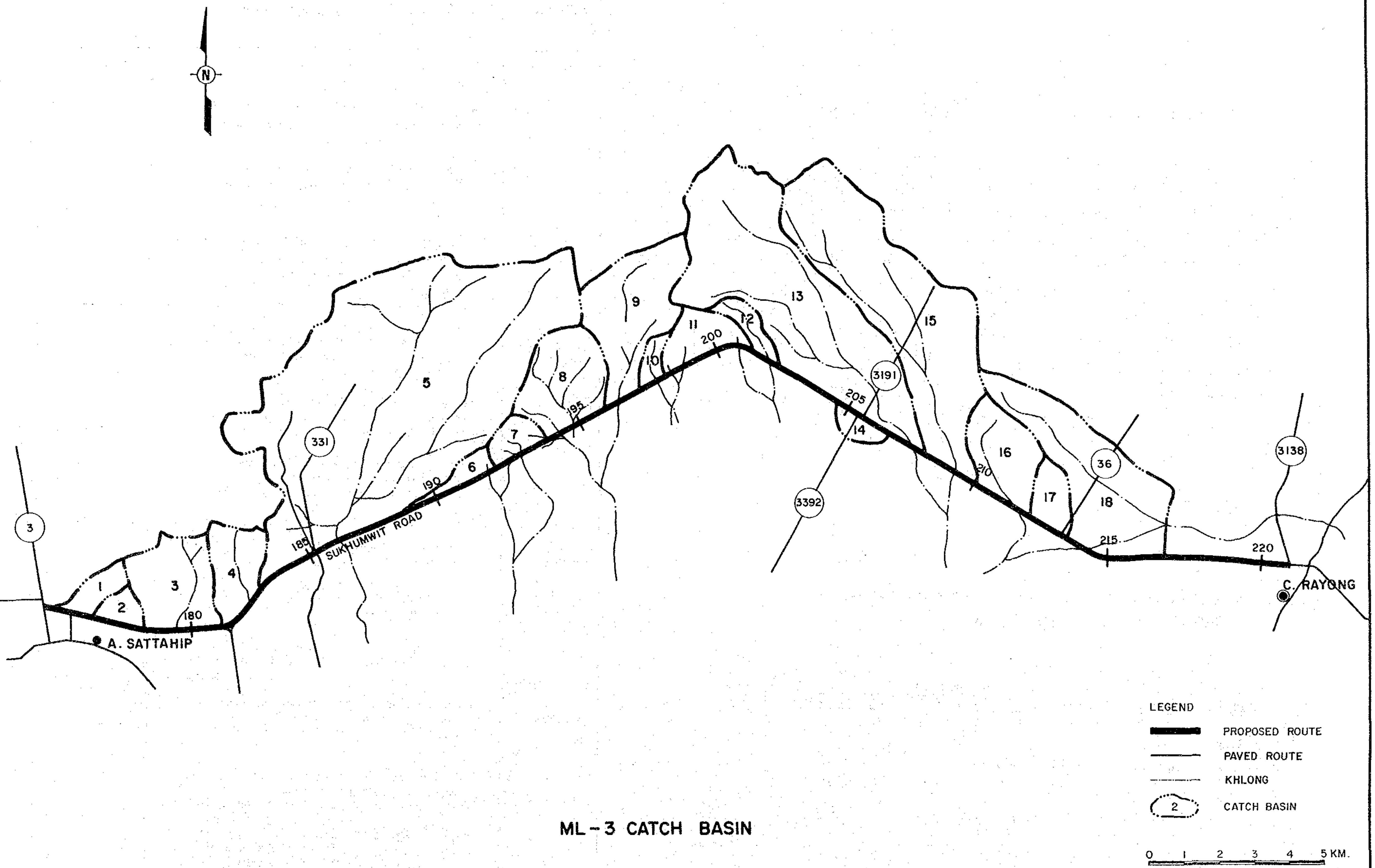
Appendix 4.2.18 COVER FACTORS AND INFILTRATION CAPACITY FOR PERMANENT FOREST AND GRASS

		φ (mm/hr)		
Cover Factor	Type	Clays	Clay Loams	Sandy Loams
1.0 - 2.0	Poor	2 - 9	4 - 13	5 - 20
2.0 - 4.0	Medium	5 - 17	8 - 27	13 - 45
4.0 - 8.0	Good	10 - 35	15 - 55	25 - 90

Appendix 4.2.19 INFILTRATION COVER FACTORS

Vegetation	Condition	Cover Factor
Forest	Good - dense canopy, thick undergrowth, plant litter and humus more than 25 mm in thickness	4.0 - 8.0
	Medium - thin forest, sparse undergrowth of shrubs and grasses, litter and humus 5-25 mm thick, slight soil erosion	2.0 -4.0
	Poor - isolated clumps of trees and bamboo, little grass between clumps, humus less than 5 mm thick, area eroded or overgrazed	1.0 - 2.0
Grasses (including rice)	Good - dense vegetal cover of high quality grass, area in grass for several years, not overgrazed, inundated rice at all stages of growth	4.0 -8.0
	Medium - vegetal density 30-80% that of good areas, area in grass at least 2 years, not overgrazed	2.0 - 4.0
	Poor - density of vegetation less than 30% that of good areas, sparse growth of poor quality grass, area overgrazed	1.0 - 2.0
Close Growing Crops (small grains)	Good - high plant density, soil fertility at a high level	2.5 - 3.0
	Medium - density and fertility 30-80% that of good areas	1.5 - 2.0
	Poor - sparse cover, density and fertility less than 30% that of good areas	1.0 - 1.5
Row Crops	Good - flourishing vegetation, high soil fertility, land in best rotation, good farming practices followed	1.3 - 1.5
	Medium - vegetation good, fertility 30-80% that of good areas, land in fair rotation, conservative farming practices followed	1.1 - 1.3
	Poor - vegetation poor, fertility less than 30% that of good areas, row crops grown continuously, poor farming practices followed	1.0 - 1.1

Appendix 4.2.20 **DISCHARGE CALCULATION FOR ML-3**



ML – 3 CATCH BASIN

HYDROLOGIC STUDY

ROUTE ML-3 (A. SATTAHIP - C. RAYONG)
DISTRICT :

Chainage	No.	Catchment Basin	A (Sq.Km)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist Structures
175+049 - 176+200	1	-	1.50	3.50	20	1.27	I (10)=85 I (20)=95	c = 0.12	4.25	4.75			2-Dia 1.00 2-Dia 1.00		
176+200 - 178+700	2	-	1.00	2.50	10	1.13	I (10)=90 I (20)=105	c = 0.13	3.25	3.79			1-Dia 0.80 1-Dia 1.00		
178+700 - 181+300	3	KHLONG TUP	6.00	7.00	20	2.83	I (50)=60	c = 0.11			11.00		1-Dia 1.00 1-Dia 0.60 1-Dia 0.60 1-Dia 0.60 1-Dia 0.80	Bridge 12x8	
181+300 - 182+900	4	-	3.50	5.00	2	4.66	I (10)=30 I (10)=38	c = 0.08	2.34	2.96			1-Dia 0.80 1-Dia 0.60 1-Dia 0.60 1-Dia 0.80		
182+900 188+500	5	KHLONG BANG PHAI	67.00	14.00	35	tr=1.10 (hrs)	I (50)=120	Qp=25.50 (lit/sec/km2) α = 0.85 Ø = 10			172.90		1-Dia 0.60 1-Dia 0.60 1-Dia 0.60 1-Dia 0.60 1-Dia 0.80 1-Dia 0.60 1-Dia 1.00 1-Dia 0.60	Bridge 9x45	
188+500 - 192+000	6	KHLONG PHLA	1.20	3.50	10	1.66	I (10)=70 I (20)=80	c = 0.11	2.57	2.94			1-Dia 0.80 1-Dia 0.80 1-Dia 1.00		
192+000 - 193+900	7	KHLONG LUK	1.30	2.00	10	0.87	I (10)=110 I (20)=120	c = 0.14	5.57	6.07			1-Dia 1.00 2-Dia 1.00 1-Dia 1.00		

HYDROLOGIC STUDY

ROUTE ML-3 (A. SATTAHIP - C. RAYONG)
DISTRICT :

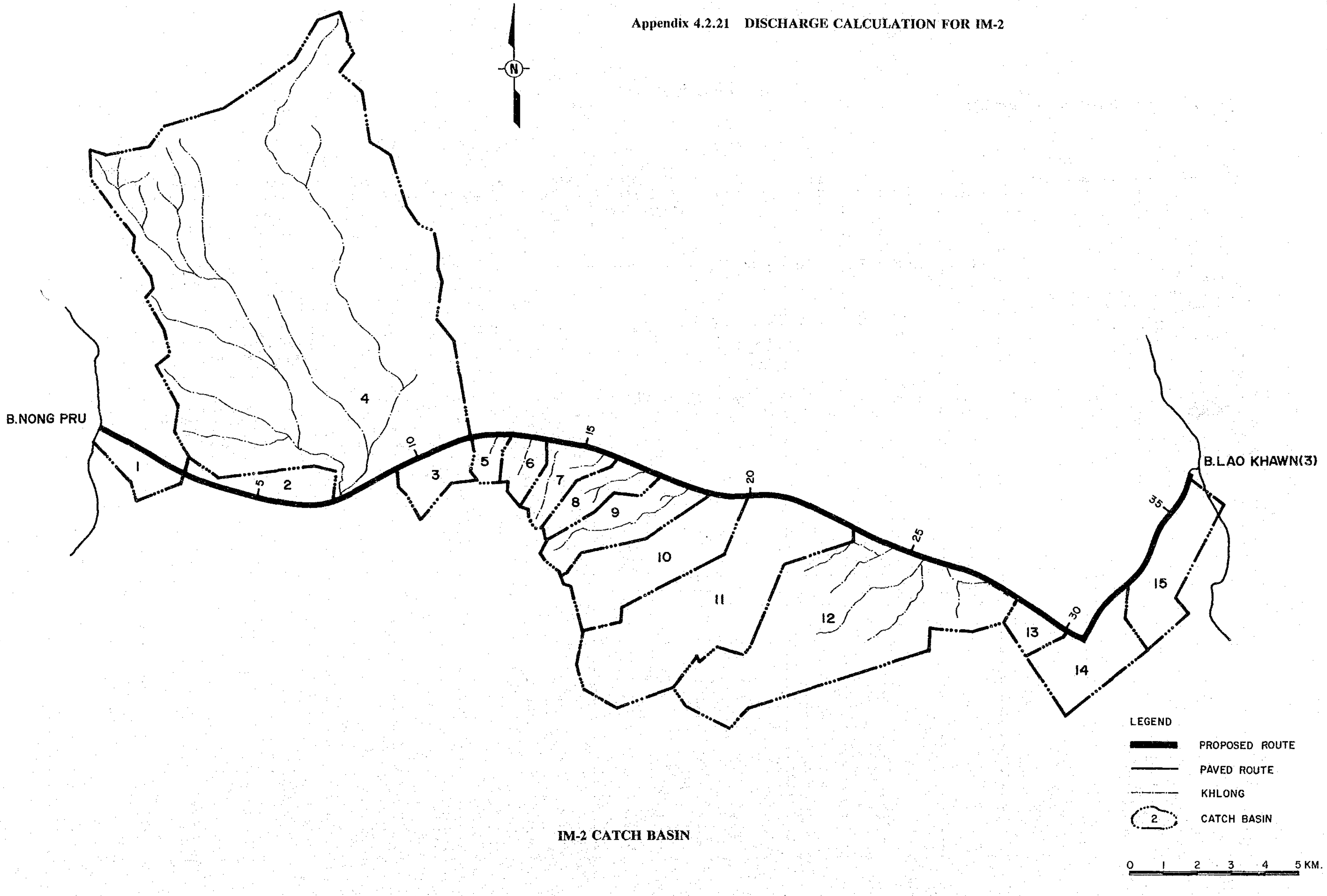
Chainage	No.	Catchment Basin	A (Sq.Km.)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/Sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist Structures
193+900 - 196+000	8	-	7.00	5.00	20	1.92	I (10)=60 I (20)=70	c = 0.11	12.84	14.98			BOX 1-2.00x2.50		BOX 1-1.20x2.00
196+000 - 197+200	9	KHLONG PHAYUN	10.00	6.50	50	1.80	I (50)=86	c = 0.12			29.98			Bridge 9.00x35	
197+200 - 198+200	10	-	1.00	3.00	20	1.06	I (10)=100 I (20)=110	c = 0.13	3.61	3.98			1-Dia 0.80 1-Dia 1.00		
198+200 - 201+300	11	-	2.50	2.00	20	0.67	I (10)=130 I (20)=140	c = 0.16	14.46	15.57			1-Dia 1.00 1-Dia 1.00 2-Dia 1.00 1-Dia 1.00 3-Dia 1.00		
201+300 - 202+800	12	KHLONG CHAK MAK	1.50	6.00	20	2.37	I (10)=54 I (20)=60	c = 0.11	2.48	2.75			1-Dia 1.00 1-Dia 1.00		
202+800 - 208+000	13	KHLONG LOT	29.00	15.00	70	4.20	I (50)=47	c = 0.1			37.28			Bridge 12.00x15	
204+500 - 206+050	14		1.00	1.50	10	0.62	I (10)=130 I (20)=148	c = 0.16	5.78	6.58			4-Dia 1.00		
208+000 - 210+200	15	HUAI YAI	25.00	15.00	65	4.30	I (50)=46	c = 0.1			31.97			Bridge 12.00x24	

HYDROLOGIC STUDY

ROUTE ML-3 (A. SATTAHIP - C. RAYONG)
DISTRICT :

Chainage	No.	Catchment Basin	A (Sq.Km.)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/Sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist Structures
210+200 - 212+300	16		6.00	5.00	20	1.90	I (50)=82	c = 0.12			16.41			Bridge 12.00x12	
212+300 - 213+500	17	-	2.50	3.00	10	1.39	I (10)=80 I (20)=90	c = 0.12	6.67	7.50			2-Dia 0.60 1-Dia 0.60 1-Dia 0.60		
213+500 - 216+800	18	KHLONG NAM HU	14.00	13.00	30	5.00	I (50)=40	c = 0.09			14.01			Bridge 12.00x18	

Appendix 4.2.21 DISCHARGE CALCULATION FOR IM-2



IM-2 CATCH BASIN

HYDROLOGIC STUDY

ROUTE IM-2 (B. NONG PRU - A. LAO KHWAN)
DISTRICT : KANCHANABURI

ROUTE : 3306
DIVISION : BANGKOK

Chainage	No.	Catchment Basin	A (Sq.Km)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/Sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist. Structures
0+000 - 3+200	1	-	2.50	3.00	50	0.75	I (10)=80 I (20)=88	C=0.12	6.70	7.34			RCP 2-Dia 1.00 BOX 3-2.65x2.50 RCP 1-Dia 0.60 RCP 2 Dia-0.60		
3+200 - 7+000	2	-	4.00	3.00	10	1.40	I (10)=50 I (20)=55	C=0.10	5.56	6.12			RCP 1-Dia 0.60 RCP 1-Dia 0.80 RCP 1-Dia 0.60 RCP 1-Dia 0.80 RCP 2-Dia 1.00 RCP 1-Dia 0.80		
9+200 - 11+800	3	-	2.50	2.00	10	0.85	I (10)=75 I (20)=85	C=0.12	6.26	7.09			RCP 2-Dia 0.80 RCP 2-Dia 0.60 RCP 2-Dia 0.80 RCP 1-Dia 0.60		
7+000 - 11+800	4	Huai Yang	92.00	25.00	40	tr=3.5	I (10)=18 I (20)=20	Qp=8.55 (lit/sec/km2)	19.60	24.85			RCP 1-Dia 0.80 RCP 1-Dia 0.80 RCP 1-Dia 0.60 RCP 2-Dia 1.00 BOX 3-2.65x3.00		
11+800 - 13+100	5	Huai Thian	1.00	2.00	20	0.67	I (10)=85 I (20)=95	C=0.13	3.07	3.43			RCP 1-Dia 0.60 RCP 2-Dia 0.80		
13+100 - 14+000	6	Huai Nam Rat	2.00	2.50	40	0.66	I (10)=87 I (20)=100	C=0.13	6.29	7.23			BOX 3-2.65x3.15		
14+000 - 16+000	7	-	2.50	3.00	40	0.81	I (10)=75 I (20)=85	C=0.12	6.26	7.09			RCP 2-Dia 0.80 RCP 1-Dia 0.60 RCP 2-Dia 0.80 RCP 2-Dia 0.60		

HYDROLOGIC STUDY

ROUTE IM-2 (B. NONG PRU - A. LAO KHWAN)
DISTRICT : KANCHANABURI

ROUTE : 3306
DIVISION : BANGKOK

Chainage	No.	Catchment Basin	A (Sq.Km)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/Sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist. Structures
16+000 - 17+400	8	-	3.00	4.50	40	1.30	I (10)=52 I (20)=58	C=0.10	4.34	4.84			BOX 2-2.20x2.30		
17+400 - 18+800	9	-	5.00	7.00	40	2.17	I (10)=37 I (20)=42	C=0.08	4.11	4.67			RCP 1-Dia 1.00 RCP 2-Dia 0.80		
18+800 - 20+000	10	-	7.50	10.00	60	2.80	I (10)=30 I (20)=34	C=0.08	5.00	5.67			RCP 1-Dia 0.60 RCP 3-Dia 1.00 RCP 2-Dia 1.00		
20+000 - 23+100	11	-	16.00	14.00	60	4.13	I (10)=22 I (20)=27	C=0.08	7.83	9.61			RCP 1-Dia 1.00 RCP 1-Dia 0.60 RCP 1-Dia 0.60 RCP 1-Dia 0.80 RCP 2-Dia 0.80		
23+100 - 28+400	12	Huai Nong Amphoe Chin	22.00	11.00	40	3.65	I (10)=24 I (20)=29	C=0.08	11.75	14.19			RCP 1-Dia 1.00 RCP 1-Dia 1.00 RCP 1-Dia 0.60 RCP 1-Dia 0.60 RCP 2-Dia 0.80 RCP 1-Dia 0.60 RCP 1-Dia 0.60 BOX 3-2.20x2.50 RCP 2-Dia 0.60 RCP 2-Dia 1.00 BOX 2-2.20x2.30 RCP 1-Dia 0.60		
28+400 - 30+100	13	-	1.50	2.00	10	0.87	I (10)=74 I (20)=83	C=0.12	3.70	4.15			RCP 1-Dia 0.80 RCP 1-Dia 0.80		

HYDROLOGIC STUDY

ROUTE IM-2 (B. NONG PRU - A. LAO KHWAN)
DISTRICT : KANCHANABURI

ROUTE : 3306
DIVISION : BANGKOK

3 of 3

Chainage	No.	Catchment Basin	A (Sq.Km)	L (Km.)	H (m.)	Tc (Hr.)	I (m.m/Hr)	Specific Yields of Flood flow m3/Sec/Km2	Q10 (m3/Sec)	Q20 (m3/Sec)	Q50 (m3/Sec)	Q10c (m3/Sec)	Minor Structure	Major Structure	Remarks Exist. Structures
30+100 - 32+700	14	-	3.50	4.50	10	2.22	I (10)=36 I (20)=41	C=0.08	2.80	3.19			RCP 1-Dia 0.60 RCP 1-Dia 0.60 RCP 1-Dia 0.60 RCP 1-Dia 0.60 RCP 1-Dia 0.60		
32+700 - 36+000	15	-	5.50	5.00	10	2.51	I (10)=32 I (20)=36	C=0.08	3.91	4.40			RCP 1-Dia 1.00 RCP 1-Dia 0.80 RCP 1-Dia 0.80 RCP 1-Dia 0.60 RCP 1-Dia 0.60		