APPENDIX C

WORKSHEETS, EQUATIONS AND DATA FOR PROJECT EVALUATION IN PROVINCE GROUP - C

PROVINCES : Isabela

Kalinga - Apayao

Quirino

Aurora

Occidental Mindoro

Oriental Mindoro

Palawan

Quezon

Masbate

Nogros Oriental

Northern Samar

Samar

Basilan

Sulu

Tawi-Tawi

Agusan del Sur

Davao Oriental

Surigao del Sur

Maguindanao

North Cotabato

Sultan Kudarat

WORKSHEETS,EQUATIONS AND DATA FOR PROJECT EVALUATION
IN PROVINCE GROUPE - C

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - C)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) AADT

PRESENT AADT	LIGHT VEHICLE (CAR/VAN/JEEPNEY)		VEH.	%	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n =
	HEAVY VEHICLE (BUS / TRUCK)		VEH. ②	%		AADT IN OPENING YEAR (① x 1.03^n)	③
	TOTAL	①	VEH.	100 %			

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										TOTAL
LENGTH OF SUBSECTION (KM) ④										
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT	SLOPE PROTECTION	CUT SLOPE LENGTH (M) ⑤								
		EMBANKMENT SLOPE LENGTH (M) ⑥								
	FLOOD SECTION	FLOOD DEPTH (M) ⑦								
		FLOOD SECTION LENGTH (M) ⑧								
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. C.I-1)									
	CARRIAGEWAY WIDTH (M) (REF. C.I-1) ⑨									
	SHOULDER WIDTH (M) (REF. C.I-1) ⑩									
	TOTAL WIDTH (M) (⑨+2x⑩) ⑪									
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. C.I-1)									
COST (MP)	ROAD	UNIT COST/KM. (REF. C.I-3) ⑫								
		COST (⑫x④) ⑬								
	SLOPE PROTECTION — CUT SLOPE	UNIT COST/M (REF. C.I-4) ⑭								
		COST (⑭x⑤) ⑮								
	SLOPE PROTECTION — EMBANK SLOPE	UNIT COST/M (REF. C.I-4) ⑯								
		COST (⑯x⑥) ⑰								
	FLOOD SECTION	UNIT COST/KM. (1.976·⑦+0.173·⑪-0.850) ⑱								
		COST (⑱x⑧) ⑲								
	TOTAL COST (⑬+⑮+⑰+⑲)									⑳

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										TOTAL
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. C.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE	NO. OF LANES									
	LENGTH (M) ㉑									
	NO. OF SPANS (㉑/20 & ROUND) ㉒									
	COST (MP) — SUPER STRUCTURE	UNIT COST/M (REF. C.I-6) ㉓								
		COST (㉓x㉑) ㉔								
	ABUTMENT	UNIT COST/EACH (REF. C.I-6) ㉕								
		COST (㉕x2) ㉖								
	PIER	UNIT COST/EACH (REF. C.I-6) ㉗								
		COST (㉗x(㉒-1)) ㉘								
	TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY	NO. OF LANES									
	LENGTH (M) ㉚									
	COST (MP) — UNIT COST/M (REF. C.I-6) ㉛									
	COST (㉛x㉚) ㉜									
RCBC	1-CELL OR 2-CELL									
	LENGTH (M) (USUALLY ⑪+3.0) ㉝									
	COST (MP) — RCBC — UNIT COST/M (REF. C.I-6) ㉞									
		COST (㉞x㉝) ㉟								
	WINGWALL & APRON (REF. C.I-6) ㊱									
	TOTAL COST (㉟+㊱) ㊲									
COST (MP) (㉙+㉜+㊲)										㊳

5) BENEFIT

AADT IN OPENING YEAR (③)										
PERCENT HEAVY VEHICLES (②)										
BRIDGE LENGTH (M) (㉑ + ㉚) ㊴										
BENEFIT	TRAFFIC BENEFIT	CONSTANT "k" (REF. C.I-7) ㊵								
		UNIT BENEFIT/KM/VEH. (㊵ + 0.000036 x ②) ㊶								
		BENEFIT (㊶x④x③) ㊷								
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066 x ㊶ - 0.00035) ㊸								
		BENEFIT. (㊸x㉙x③) ㊹								
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM (REF. C.I-9) ㊺								
		BENEFIT (㊺x④) ㊻								
	TOTAL BENEFIT (㊷+㊹+㊻)									㊼

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (⑳+㊳)	㊽	
ECONOMIC COST (㊽ x 0.831)	㊾	
B/C RATIO (㊼ / ㊾)		
IRR (REF. C.I-11)		

7) COMMENT

C.I-1 Proposed Pavement Type

Select from Table below.

Pavement Type and Width

Road Class	AADT in Opening Year	Pavement Type 1)	Carriageway Width(m)	Shoulder Width (m) Flat	Roll'g	Mount
Primary Major	Over 2000	PCC 3)	6.7	3.0	2.0	1.5
	1000-2000	PCC 3)	6.7	2.5	1.5	1.0
	400-1000	AC 3)	6.7	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	2.0	1.5	1.0
	100- 200	BMP 2)3)	6.0	1.5	1.0	0.5
	Below 100	Gravel	6.0	1.5	1.0	0.5
Secondary Major	Over 2000	PCC 3)	6.7	2.5	1.5	1.0
	1000-2000	PCC 3)	6.0	2.5	1.5	1.0
	400-1000	AC 3)	6.0	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	Below 200	Gravel	6.0	1.0	0.5	0.5
Collector	Over 400	AC 3)	6.0	1.5	1.0	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	50- 200	Gravel	6.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	1.0	0.5	0.5
Feeder	Over 400	AC 3)	6.0	1.5	1.0	0.5
	200- 400	BMP 2)3)	6.0	1.0	0.5	0.5
	50- 200	Gravel	4.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	0.5	0.5	0.5

Note 1) Where existing pavement type is superior to the one posed above, use existing type.
2) BMP can be replaced by DBST where subgrade and drainage conditions are good. It is, however, recommended to assume BMP for budgetary and evaluation purposes.
3) Use AC overlay, where existing condition warrants the use of AC overlay.

Type of Improvement

Existing Surface Type	Existing Surface Condition	Existing Carriageway Width	Type of Improvement
Standard or Superior	Good/Fair	Standard	-
	Good/Fair	Substandard	Widening
	Bad/Very bad	any	Rehabilitation
Substandard or Non-existing	Good/Fair	any	Improvement-2
	Bad/Very bad	any	Improvement-1
	Impassable	any	New Construction

C.I-2 Proposed Structure Type

Select from Table below.

Existing Type	Proposed Type: Primary Major / Secondary Major	Proposed Type: Collector / Feeder	
Ford Crossing	2-lane Brigde (2-BR)	Carriageway width of approach road 4.0 m	1-lane Spillway (1-SW)
		Carriageway width of approach road 6.0 m	2-lane Spillway (2-SW)
Spillway	2-lane Bridge (2-BR)	-	
Timber Bridge	2-lane Bridge (2-BR)	AADT < 200	1-lane Bridge (1-BR)
		AADT > 200	2-lane Bridge (2-BR)
Bailey Bridge	2-lane Bridge (2-BR)	AADT < 300	-
		AADT > 300	2-lane Bridge (2-BR)

Note : Use RCBC instead of bridge where length is short and topography is suitable.

C.I-3 Road Construction Cost

Equation : RCC = RCCu·Ls

where , RCC = road construction cost, in Mp
RCCu= unit road construction cost, in Mp/km, given in Table below
Ls = subsection length, in km

Unit road construction cost "RCCu", in Mp/km

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	PCC	4.0	0.5	-	2.050	2.651
			1.0	1.827	2.264	-
			1.5	1.936	-	-
		6.0	0.5	-	-	3.065
			1.0	-	2.678	3.200
			1.5	2.651	2.952	-
			2.0	2.775	-	-
			2.5	2.914	-	-
		6.7	1.0	-	-	3.693
			1.5	-	3.142	3.768
			2.0	3.100	3.476	-
			2.5	3.466	-	-
			3.0	3.712	-	-
		Widening	0.5	-	-	0.923
			1.0	-	0.982	1.481
			1.5	0.873	1.892	-
			2.0	1.070	-	-
			2.5	1.168	-	-
	AC	4.0	0.5	-	1.909	2.516
			1.0	1.677	2.098	-
			1.5	1.820	-	-
		6.0	0.5	-	-	2.782
			1.0	-	2.364	2.858
			1.5	2.374	2.785	-
			2.0	2.565	-	-
			2.5	2.779	-	-
		6.7	1.0	-	-	3.369
			1.5	-	2.867	3.483
			2.0	2.869	3.172	-
			2.5	3.108	-	-
			3.0	3.315	-	-
		Widening	0.5	-	-	0.907
			1.0	-	0.944	1.478
			1.5	0.819	1.416	-
			2.0	1.023	-	-
			2.5	1.106	-	-

-- continued --

Unit road construction cost "RCCu", in Mp/km (continued)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	BMP	4.0	0.5	-	1.334	1.650
			1.0	1.199	1.769	-
			1.5	1.237	-	-
		6.0	0.5	-	1.818	2.350
			1.0	1.690	2.084	2.418
			1.5	1.744	2.398	-
			2.0	1.978	-	-
		Widening	0.5	-	0.714	0.879
			1.0	0.592	0.842	1.388
			1.5	0.650	-	-
			2.0	0.668	-	-
	Gravel	4.0	0.5	0.482	0.511	0.601
			1.0	0.526	-	-
		6.0	0.5	-	0.965	1.321
			1.0	0.714	1.013	1.510
			1.5	0.823	1.045	-
			2.0	0.896	-	-
	Overlay	4.0	any	1.048	1.048	1.048
		6.0	any	1.325	1.325	1.325
		6.7	any	1.505	1.505	1.505
New Construction	PCC	6.0	1.0	-	-	4.184
			1.5	-	3.790	-
			2.0	3.534	-	-
			2.5	3.739	-	-
		6.7	1.0	-	-	4.434
			1.5	-	4.040	5.064
			2.0	3.781	4.618	-
			2.5	3.989	-	-
			3.0	4.152	-	-
	AC	6.0	0.5	-	-	3.228
			1.0	-	2.900	3.863
			1.5	2.920	3.484	-
			2.0	3.346	-	-
			2.5	3.630	-	-
		6.7	1.0	-	-	4.072
			1.5	-	3.690	4.712
			2.0	3.552	4.281	-
			2.5	3.808	-	-
			3.0	4.007	-	-
	BMP	4.0	0.5	-	1.534	1.815
			1.0	1.334	-	-
		6.0	0.5	-	2.197	2.637
			1.0	2.193	2.758	3.250
			1.5	2.598	2.846	-
			2.0	2.684	-	-
	Gravel	4.0	0.5	0.536	0.611	0.713
			1.0	0.643	-	-
		6.0	0.5	-	1.637	2.003
			1.0	1.430	1.772	-
			1.5	1.553	-	-

C.I-4 Slope Protection Cost

Equation : SPC = SPCC+SPCE

SPCC = SPCCu·Lc
SPCE = SPCEu·Le

where , SPC = slope protection cost, in Mp
SPCC = cut slope protection cost, in Mp
SPCE = embankment slope protection cost, in Mp

SPCCu= unit cost for cut slope protection, in Mp/m, given in Table below
SPCEu= unit cost for embankment slope protection, in Mp/m, given in Table below
Lc = length of cut slope to be protected, in m
Le = length of embankment slope to be protected, in m

Unit cost for slope protection "SPCCu","SPCEu", in Mp/m

Item		Unit Cost
Cut Slope Protection	"SPCCu"	0.0253
Embankment Slope Protection	"SPCEu"	0.0275

C.I-5 Additional Cost for Flood Section

Equation : FSC = FSCu·Lf
FSCu= 1.976·Df+0.173·Wr-0.850

where , FSC = additional cost for flood section, in Mp
FSCu= unit additional cost for flood section, in Mp/km
Lf = length of flood section, in km
Df = flood depth, in m
Wr = road width, in m

C.I-6 Structure Cost

Equation : STC = BRC+SWC+BCC

BRC = SSu·Lss+ABu·Nab+PRu·Npr
SWC = SWu·Lsw
BCC = BCu·Lbc+WW

where , STC = structure cost, in Mp
BRC = bridge cost, in Mp
SWC = spillway cost, in Mp
BCC = RCBC cost, in Mp

SSu = unit cost of superstructure, in Mp/m, given in Table below
ABu = unit cost of abutment, in Mp/each, given in Table below
PRu = unit cost of pier, in Mp/each, given in Table below
Lss = length of superstructure, in m
Nab = number of abutments
Npr = number of piers
SWu = unit cost of spillway, in Mp/m, given in Table below
Lsw = length of spillway, in m
BCu = unit cost of RCBC, in Mp/m,given in Table below
Lbc = length of RCBC, in m, usually road width plus 3.0 m
WW = cost for wingwall and apron, in Mp/set(both sides total), given in Table below

Unit cost "SSu","ABu","PRu","SWu","BCu","WW"

Type of Structure	Item		Unit Cost
2-lane Bridge	Superstructure	"SSu"	0.0478 Mp/m
	Abutment	"ABu"	0.3630 Mp/each
	Pier	"PRu"	0.3135 Mp/each
1-lane Bridge	Superstructure	"SSu"	0.0357 Mp/m
	Abutment	"ABu"	0.2530 Mp/each
	Pier	"PRu"	0.2200 Mp/each
2-lane Spillway	Spillway	"SWu"	0.0182 Mp/m
1-lane Spillway	Spillway	"SWu"	0.0132 Mp/m
1-cell RCBC	RCBC	"BCu"	0.0227 Mp/m
	Wingwall/Apron	"WW "	0.1452 Mp/set
2-cell RCBC	RCBC	"BCu"	0.0396 Mp/m
	Wingwall/Apron	"WW "	0.1705 Mp/set

C.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k+0.000036·HV

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km/veh
Ls = subsection length, in km
VEH = AADT, in veh
HV = percent heavy vehicles, in %
k = constant, given in Table below

Constant "k"

Proposed Pavemrnt Type	Existing Surface Type and Condition	Terrain		
		Flat	Rolling	Mountain's
PCC/AC	Paved - Bad	.00529	.00470	.00517
	Paved - Very Bad	.01452	.01392	.01440
	Gravel- Good/Fair	.00713	.00653	.00701
	Gravel- Bad	.00765	.00705	.00753
	Gravel- Very Bad	.01544	.01484	.01532
	Earth - Bad	.01283	.01224	.01271
	Earth - Very Bad	.02397	.02338	.02385
BMP/DBST	Paved - Bad	.00420	.00361	.00408
	Paved - Very Bad	.01343	.01284	.01331
	Gravel- Good/Fair	.00604	.00545	.00592
	Gravel- Bad	.00656	.00597	.00644
	Gravel- Very Bad	.01435	.01376	.01423
	Earth - Bad	.01174	.01115	.01162
	Earth - Very Bad	.02288	.02229	.02276
Gravel	Gravel- Bad	.00467	.00408	.00455
	Gravel- Very Bad	.01246	.01187	.01234
	Earth - Bad	.00986	.00926	.00974
	Earth - Very Bad	.02099	.02040	.02087

C.I-8 Bridge Benefit

Equation : BRB = BRBu·Lb·VEH
BRBu= 0.0660·TRBu-0.000351

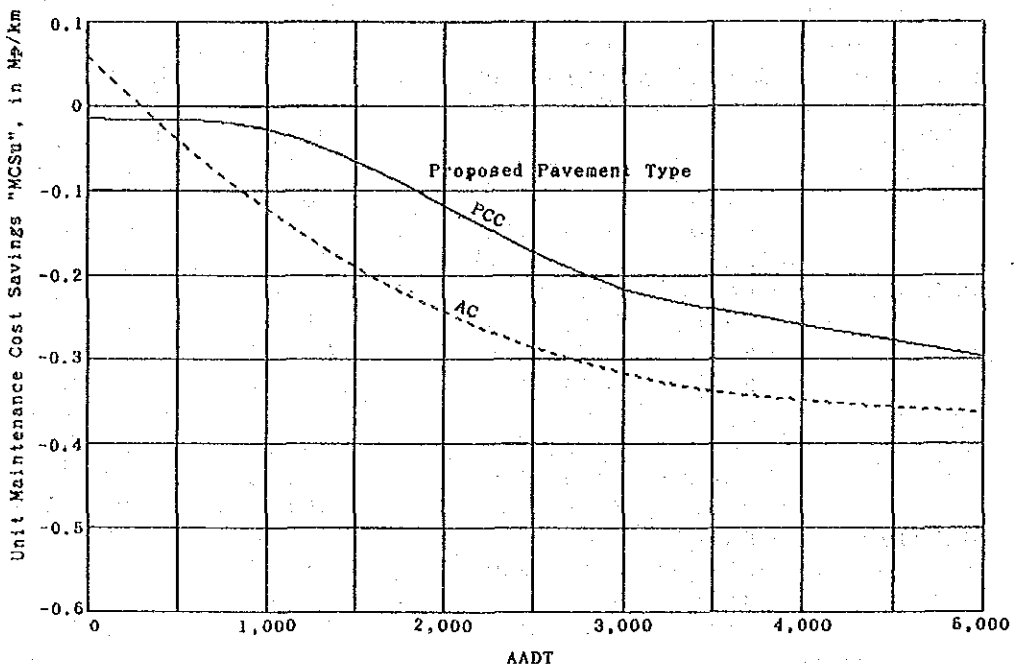
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from C.I-7

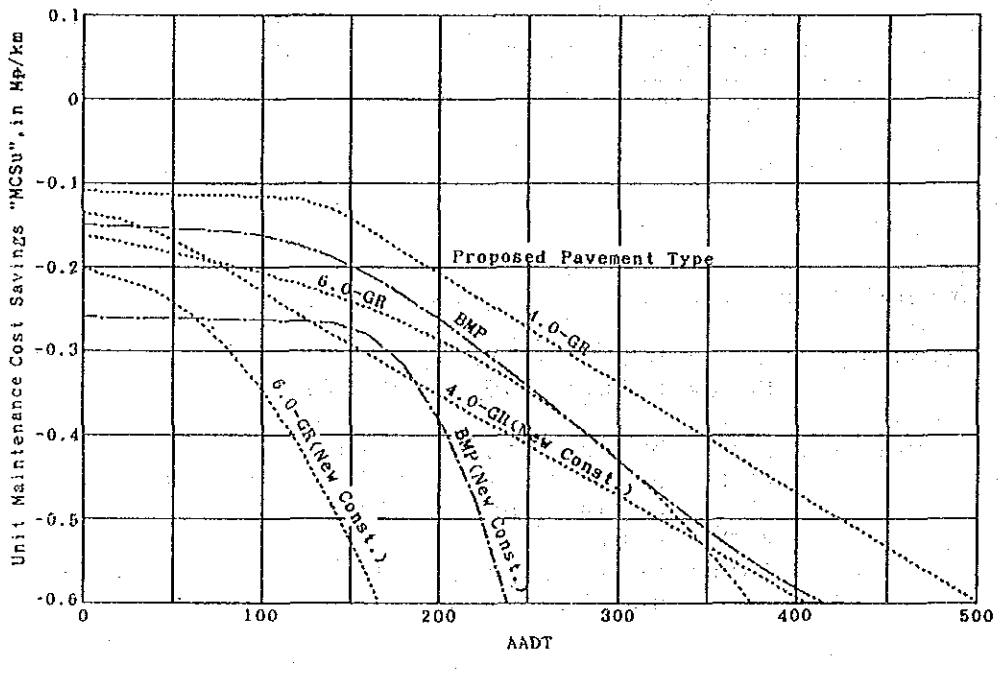
C.I-9 Maintenance Cost Savings

Equation : MCS = MCSu·Ls

where , MCS = maintenance cost savings, in Mp
MCSu= unit maintenance cost savings, in Mp/km, given in Chart below
Ls = subsection length, in km

Chart for estimating unit maintanance cost savings "MCSu"





C.I-10 B/C Ratio

Equation : $BC = TB/EC$

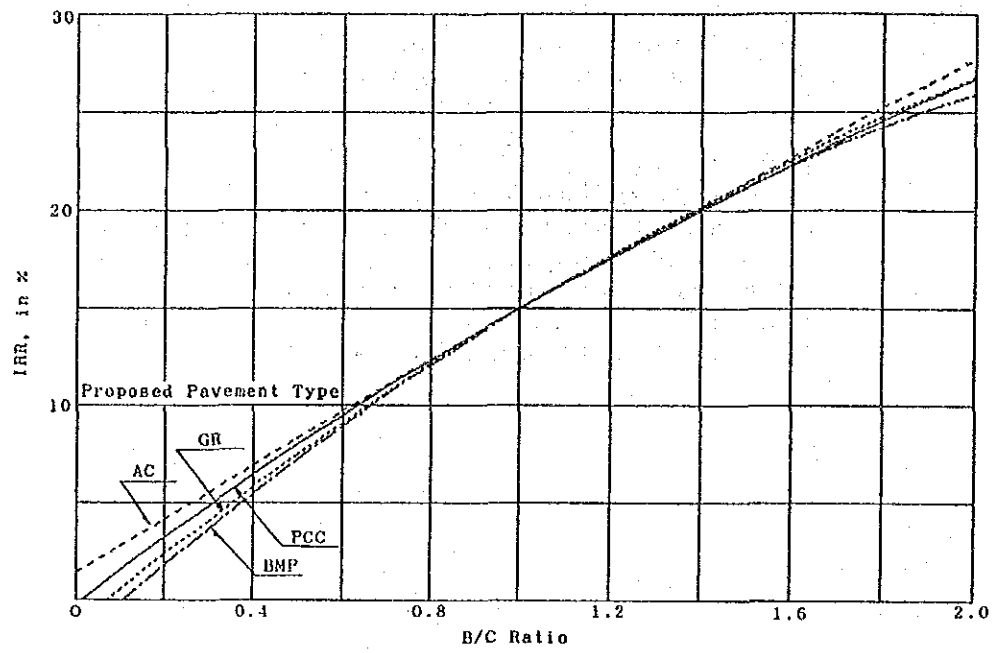
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

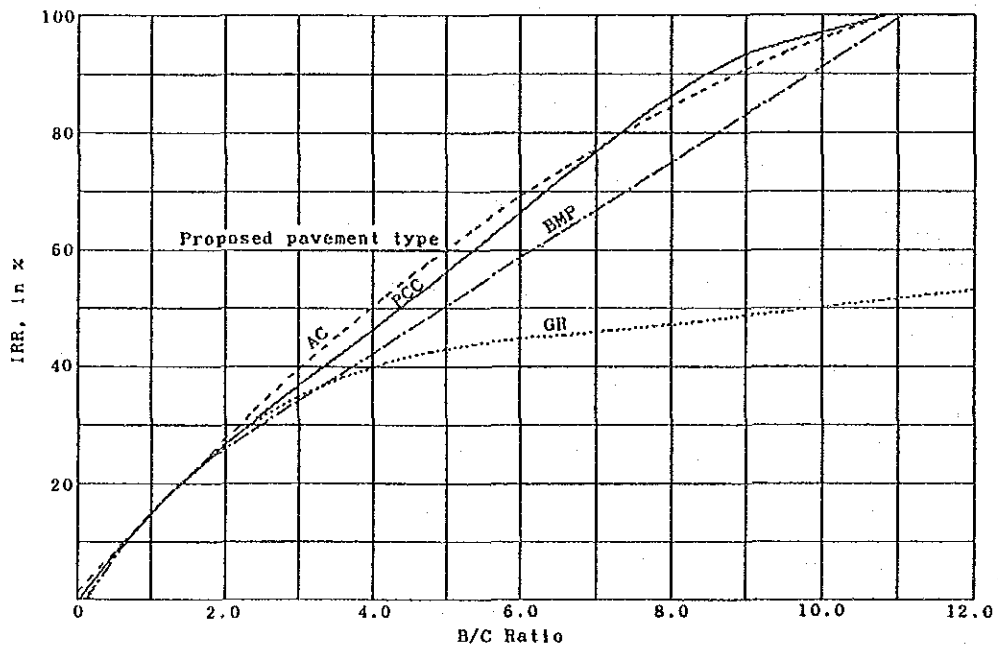
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB= traffic benefit, in Mp
BRB= bridge benefit, in Mp
MCS= maintenance cost savings, in Mp
RCC= road construction cost, in Mp
SPC= slope protection cost, in Mp
FSC= additional cost for flood section, in Mp
STC= structure cost, in Mp

C.I-11 Internal Rate of Return (IRR)

Obtain from Chart below.





PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - C)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pt	①	TOTAL ROAD LENGTH : Lt	③ KM	Pt / Lt (①/③)	⑤
CULTIVATED AREA WITHIN RIA : At	② HA	At / Lt (②/③)	④	AADT (REF. C.II - 1)	⑥
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	C : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ⑦										③
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑧										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑨										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑩										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑪										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. C.II - 2)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. C.II - 2) ⑫										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. C.II - 2) ⑬										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. C.II - 2)										
COST (M$) — ROAD — UNIT COST/KM. (REF. C.II - 4) ⑮										
COST (M$) — ROAD — COST (⑮ x ⑦) ⑯										
COST (M$) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. C.II - 5) ⑰										
COST (M$) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱										
COST (M$) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. C.II-5) ⑲										
COST (M$) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳										
COST (M$) — FLOOD SECTION — UNIT COST/KM. (1.976·⑩ + 0.173·⑭ - 0.850) ㉑										
COST (M$) — FLOOD SECTION — COST (㉑ x ⑪) ㉒										
COST (M$) — TOTAL COST (⑯ + ⑱ + ⑳ + ㉒)										㉓

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

									TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED									
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)									
PROPOSED TYPE (REF. C.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)									
BRIDGE — NO. OF LANES									
BRIDGE — LENGTH (M) ㉔									
BRIDGE — NO. OF SPANS (㉔ /20 & ROUND) ㉕									
BRIDGE — COST (M$) — SUPER-STRUCTURE — UNIT COST/M (REF. C.II-7) ㉖									
BRIDGE — COST (M$) — SUPER-STRUCTURE — COST (㉖ x ㉔) ㉗									
BRIDGE — COST (M$) — ABUTMENT — UNIT COST/EACH (REF. C.II-7) ㉘									
BRIDGE — COST (M$) — ABUTMENT — COST (㉘ x 2) ㉙									
BRIDGE — COST (M$) — PIER — UNIT COST/EACH (REF. C.II-7) ㉚									
BRIDGE — COST (M$) — PIER — COST (㉚ x(㉕ - 1)) ㉛									
BRIDGE — TOTAL COST (㉗ + ㉙ + ㉛) ㉜									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉝									
SPILLWAY — COST (M$) — UNIT COST/M (REF. C.II-7) ㉞									
SPILLWAY — COST (M$) — COST (㉞ x ㉝) ㉟									
RCBC — 1-CELL OR 2-CELL									
RCBC — LENGTH (M) (USUALLY ⑭ + 3.0) ㊱									
RCBC — COST (M$) — RCBC — UNIT COST/M (REF. C.II-7) ㊲									
RCBC — COST (M$) — RCBC — COST (㊲ x ㊱) ㊳									
RCBC — COST (M$) — WINGWALL & APRON (REF. C.II-7) ㊴									
RCBC — COST (M$) — TOTAL COST (㊳ + ㊴) ㊵									
COST (M$) (㉜ + ㉟ + ㊵)									㊶

5) BENEFIT

BRIDGE LENGTH (M) (㉔ + ㉝)										㊷
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM. (REF. C.II-8)										㊸
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦)										㊹
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0.066 x ㊸ - 0.000351 x ⑥)										㊺
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷)										㊻
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. C.II-10										㊼
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K + 0.001116 x ④ - 0.000077 x ⑤)										㊽
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦)										㊾
BENEFIT — MAINTE-NANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. C.II-11)										㊿
BENEFIT — MAINTE-NANCE COST SAVINGS — BENEFIT (㊿ x ⑦)										(51)
TOTAL BENEFIT (⑭ + ㊻ + ㊾ + (51))										(52)

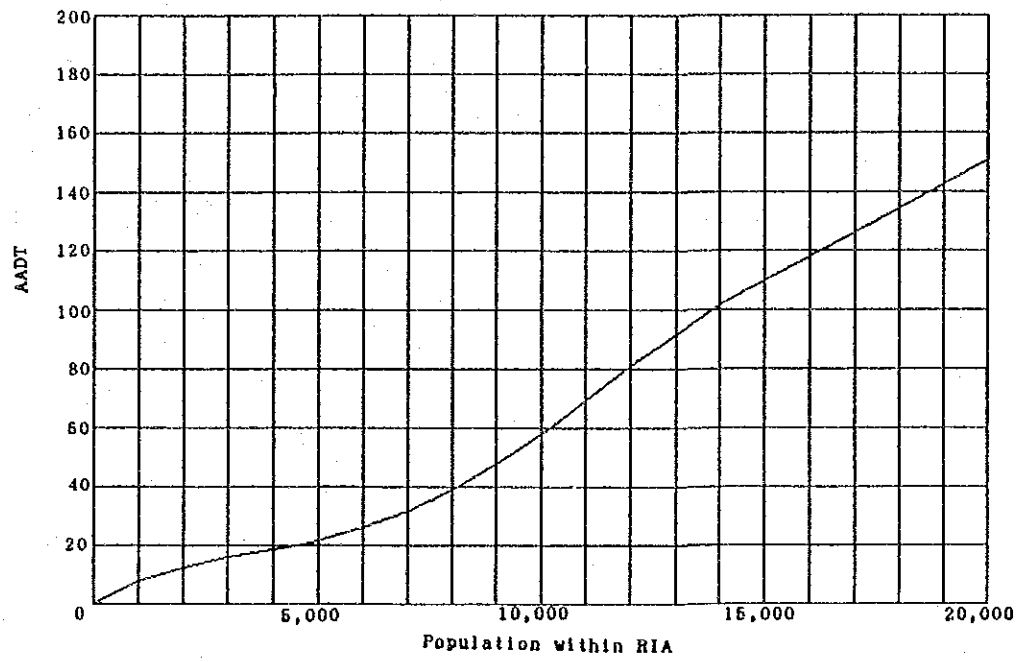
6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓ + ㊶) (53)	
ECONOMIC COST	((53) x 0.831) (54)	
B/C RATIO	((52) / (54))	
I R R	(REF. C.II-13)	

7) COMMENT

C.II-1 AADT

Obtain from Chart below.



C.II-2 Proposed Pavement Type

Apply C.I-1.

C.II-3 Proposed Structure Type

Apply C.I-2.

C.II-4 Road Construction Cost

Apply C.I-3.

C.II-5 Slope Protection Cost

Apply C.I-4.

C.II-6 Additional Cost for Flood Section

Apply C.I-5.

C.II-7 Structure Cost

Apply C.I-6.

C.II-8 Traffic Benefit

Equation : $TRB = TRBu \cdot Ls$

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km, given in Chart below
Ls = subsection length, in km

Selection of Chart for estimating unit traffic benefit "TRBu"

Population Distribution Pattern	Selection of Parameter	
	AADT	Population
A : Gradually Decreasing Pattern	Fig. A-1	Fig. A-2
B : Evenly Distributing Pattern	Fig. B-1	Fig. B-2
C : Tip Concentration Pattern	Fig. C-1	Fig. C-2

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - A
(Gradually Decreasing Pattern)

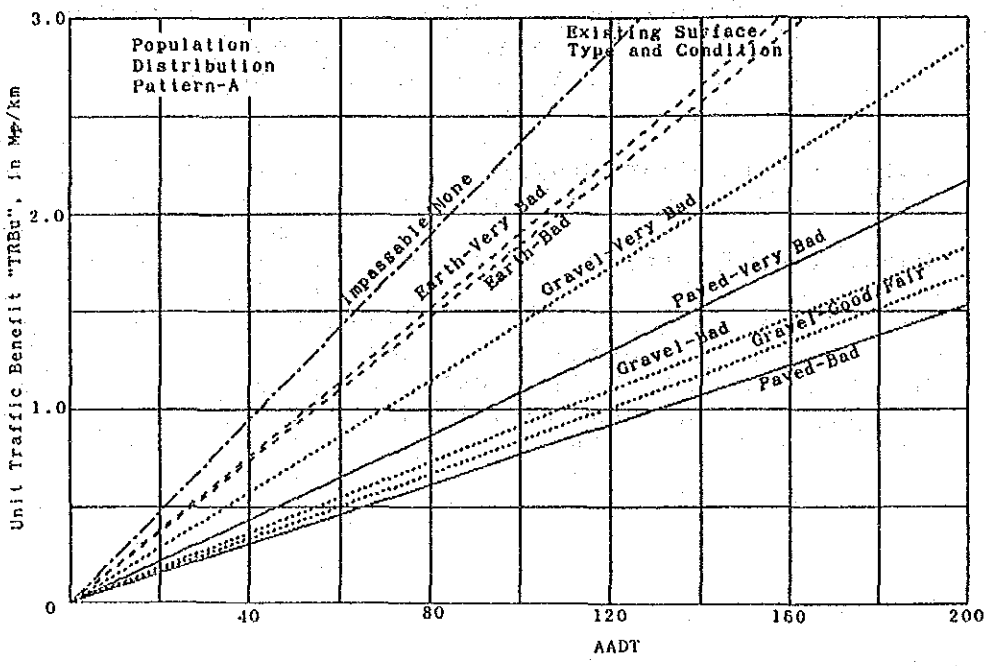


Figure A-1 "TRBu" Based on AADT

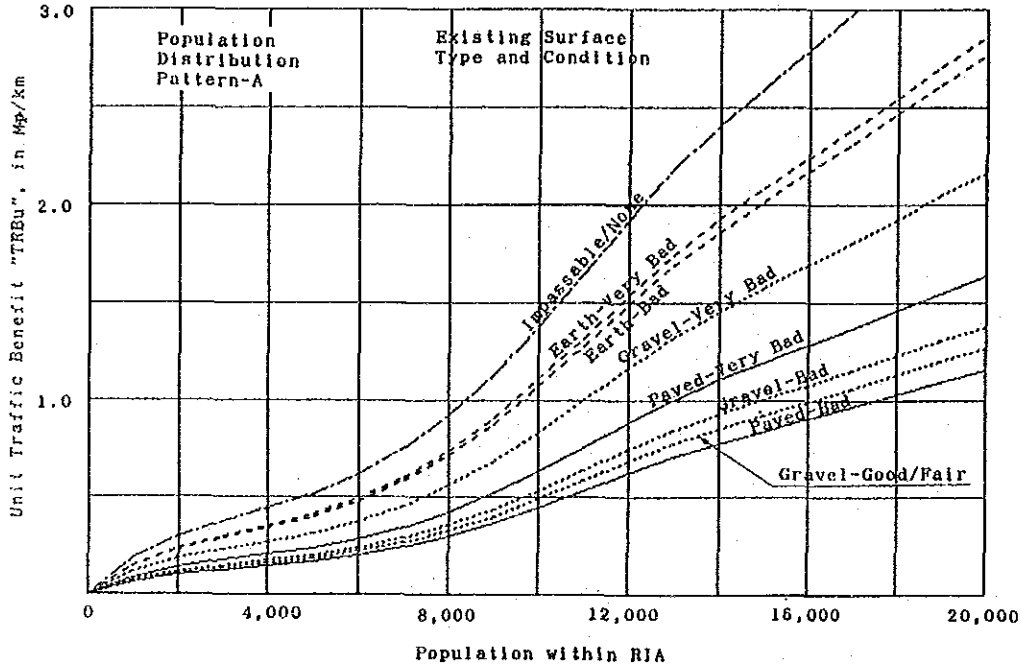


Figure A-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - B
(Evenly Distributing Pattern)

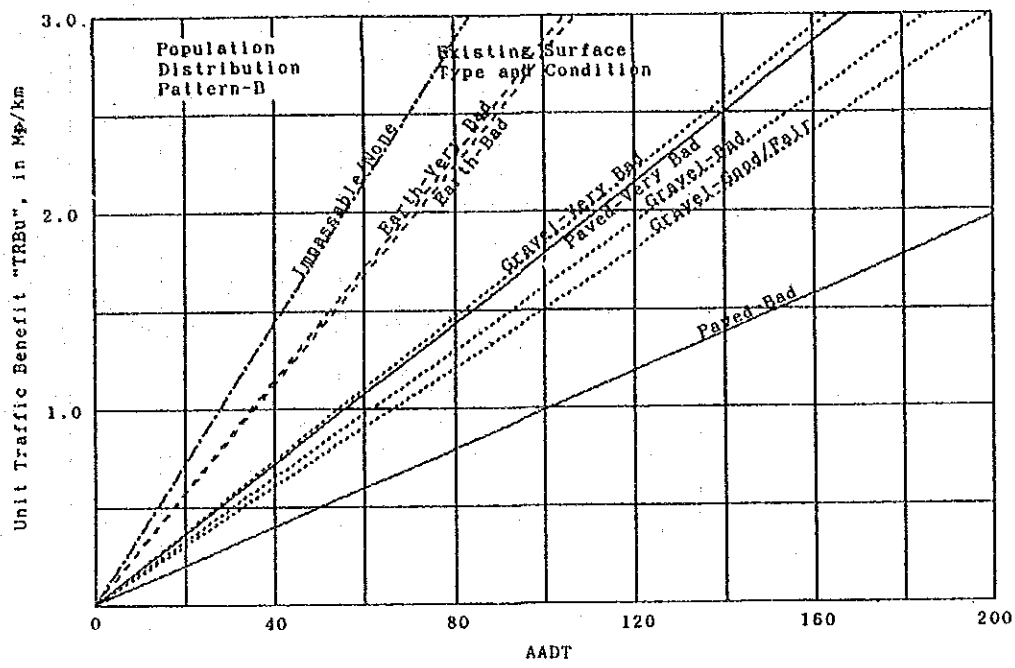


Figure B-1 "TRBu" Based on AADT

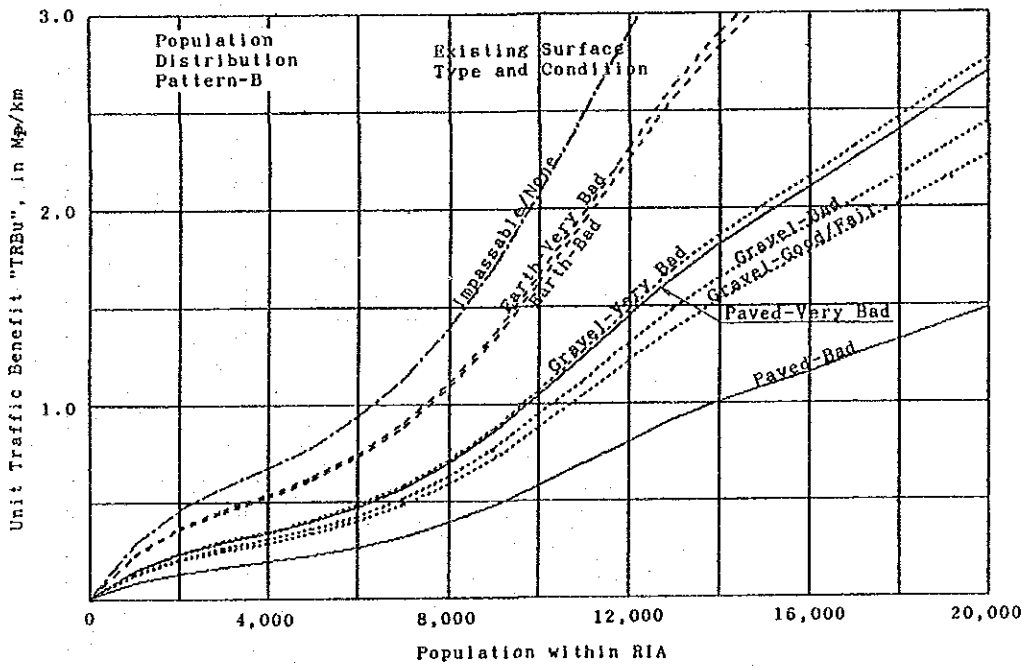


Figure B-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - C
(Tip Concentration Pattern)

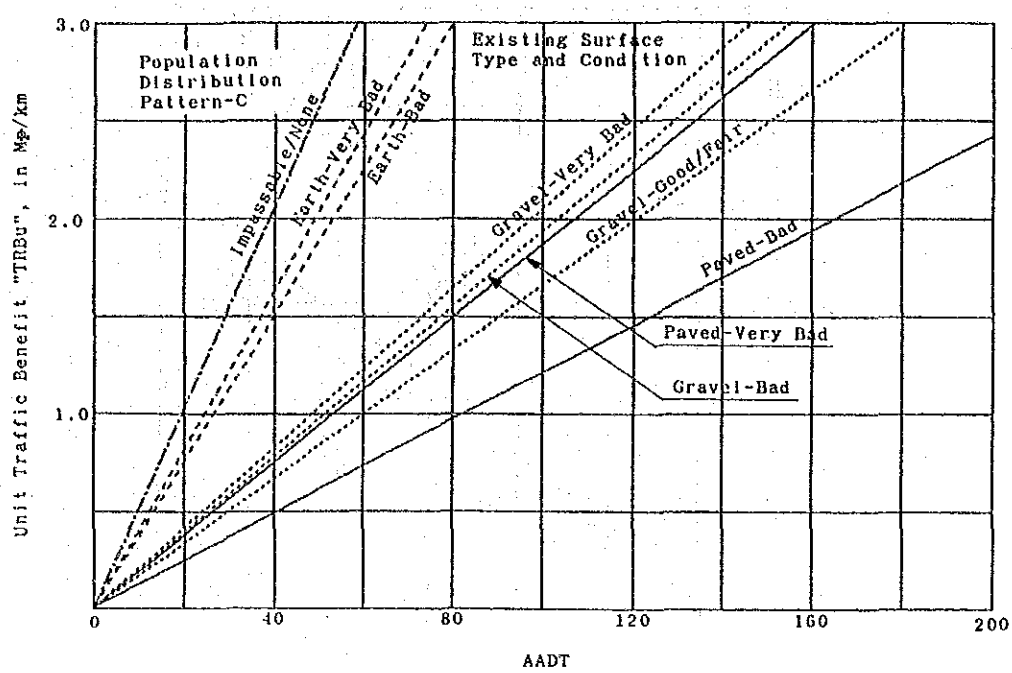


Figure C-1 "TRBu" Based on AADT

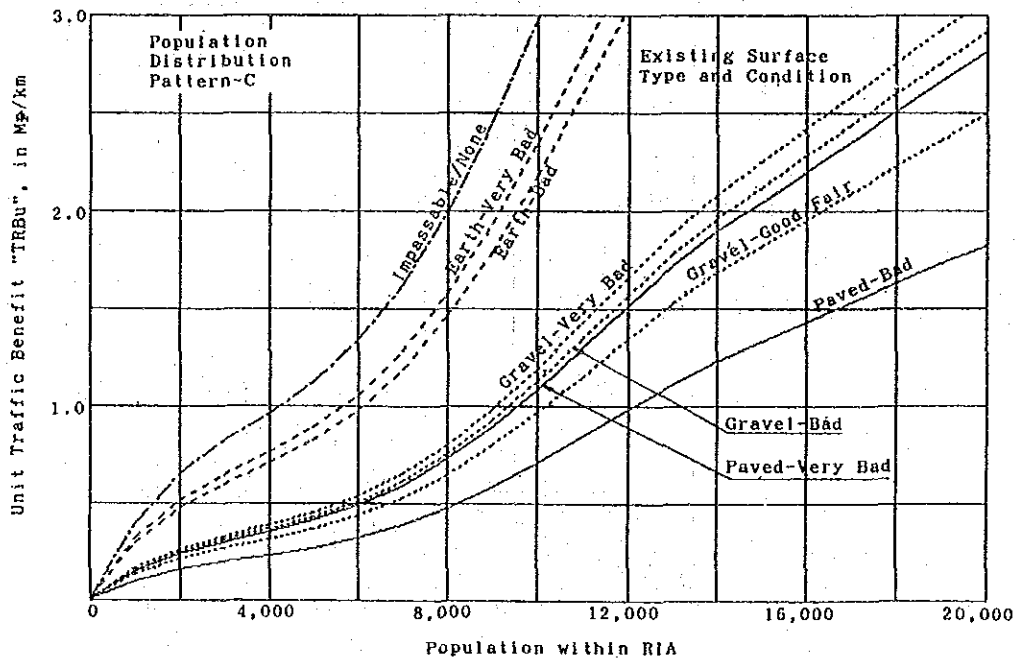


Figure C-2 "TRBu" Based on Population

C.II-9 Bridge Benefit

Equation : BRB = BRBu·Lb
BRBu= 0.0660·TRBu-0.000351·VEH

where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m
Lb = bridge length, in m
TRBu= unit traffic benefit, in Mp/km, obtained from C.II-8
VEH = AADT, in veh

C.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.001116·At/Lt-0.000077·Pt/Lt

where , DVB = development benefit, in Mp
DVBu= unit development benefit,in Mp/km
k = constant, given in Table below
At = total cultivated area within RIA, in ha
Pt = total population within RIA, in person
Lt = total road length, in km
Ls = subsection length, in km

Constant "k"

Existing Surface Type and Condition	Terrain		
	Flat	Rolling	Mountain's
Paved - Bad	.1933	.1250	.0612
Paved - Very Bad	.1979	.1296	.0658
Gravel- Good/Fair	.2060	.1377	.0739
Gravel- Bad	.1975	.1292	.0654
Gravel- Very Bad	.2066	.1383	.0745
Earth - Bad	.0827	.0144	-.0494
Earth - Very Bad	.0001	-.0682	-.1320
Any - Impassable/ Non-exist'g	.2410	.1727	.1089

C.II-11 Maintenance Cost Savings

Apply C.I-9.

C.II-12 B/C Ratio

Equation : BC = TB/EC

TB = TRB+BRB+DVB+MCS
EC = 0.831·TC
TC = RCC+SPC+FSC+STC

where , BC = B/C Ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB = traffic benefit, in Mp
BRB = bridge benefit, in Mp
DVB = development benefit, in Mp
MCS = maintenance cost savings, in Mp
RCC = road construction cost, in Mp
SPC = slope protection cost, in Mp
FSC = additional cost for flood section, in Mp
STC = structure cost, in Mp

C.II-13 Internal Rate of Return (IRR)

Apply C.I-11.

APPENDIX D

WORKSHEET, EQUATIONS AND DATA FOR PROJECT EVALUATION IN PROVINCE GROUP - D

PROVINCES : Camarines Norte

Aklan

Cebu

Eastern Samar

Zamboanga del Norte

Zamboanga del Sur

Agusan del Norte

Davao del Norte

Davao del Sur

Lanao del Norte

WORKSHEETS,EQUATIONS AND DATA FOR PROJECT EVALUATION
IN PROVINCE GROUPE - D

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - D)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) AADT

PRESENT AADT	LIGHT VEHICLE (CAR/VAN/JEEPNEY)		VEH.	%	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n =
	HEAVY VEHICLE (BUS / TRUCK)		VEH. ②	%		AADT IN OPENING YEAR (①x 1.03^n)	③
	TOTAL	①	VEH.	100 %			

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										TOTAL
LENGTH OF SUBSECTION (KM) ④										
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT	SLOPE PROTECTION	CUT SLOPE LENGTH (M) ⑤								
		EMBANKMENT SLOPE LENGTH (M) ⑥								
	FLOOD SECTION	FLOOD DEPTH (M) ⑦								
		FLOOD SECTION LENGTH (M) ⑧								
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. D.I-1)									
	CARRIAGEWAY WIDTH (M) (REF. D.I-1) ⑨									
	SHOULDER WIDTH (M) (REF. D.I-1) ⑩									
	TOTAL WIDTH (M) (⑨+2x⑩) ⑪									
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. D.I-1)									
COST (MP)	ROAD	UNIT COST/KM. (REF. D.I-3) ⑫								
		COST (⑫x④) ⑬								
	SLOPE PROTECTION	CUT SLOPE: UNIT COST/M (REF. D.I-4) ⑭								
		CUT SLOPE: COST (⑭x⑤) ⑮								
		EMBANK SLOPE: UNIT COST/M (REF. D.I-4) ⑯								
		EMBANK SLOPE: COST (⑯x⑥) ⑰								
	FLOOD SECTION	UNIT COST/KM. (1.976·⑦+0.173·⑪-0.850) ⑱								
		COST (⑱x⑧) ⑲								
	TOTAL COST (⑬+⑮+⑰+⑲)									⑳

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										TOTAL
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. D.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE	NO. OF LANES									
	LENGTH (M) ㉑									
	NO. OF SPANS (㉑/20 & ROUND) ㉒									
	COST (MP): SUPER STRUCTURE: UNIT COST/M (REF. D.I-6) ㉓									
	COST (MP): SUPER STRUCTURE: COST (㉓x㉑) ㉔									
	COST (MP): ABUTMENT: UNIT COST/EACH (REF. D.I-6) ㉕									
	COST (MP): ABUTMENT: COST (㉕x 2) ㉖									
	COST (MP): PIER: UNIT COST/EACH (REF. D.I-6) ㉗									
	COST (MP): PIER: COST (㉗x(㉒-1)) ㉘									
	TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY	NO. OF LANES									
	LENGTH (M) ㉚									
	COST (MP): UNIT COST/M (REF. D.I-6) ㉛									
	COST (MP): COST (㉛x㉚) ㉜									
RCBC	1-CELL OR 2-CELL									
	LENGTH (M) (USUALLY ⑪+3.0) ㉝									
	COST (MP): RCBC: UNIT COST/M (REF. D.I-6) ㉞									
	COST (MP): RCBC: COST (㉞x㉝) ㉟									
	COST (MP): WINGWALL & APRON (REF. D.I-6) ㊱									
	COST (MP): TOTAL COST (㉟+㊱) ㊲									
COST (MP) (㉙+㉜+㊲)										㊳

5) BENEFIT

AADT IN OPENING YEAR (③)										③
PERCENT HEAVY VEHICLES (②)										②
BRIDGE LENGTH (M) (㉑ + ㉚)										㊴
BENEFIT	TRAFFIC BENEFIT	CONSTANT "k" (REF. D.I-7) ㊵								
		UNIT BENEFIT/KM/VEH. (㊵) ㊶								
		BENEFIT (㊶x④x③) ㊷								
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066 x ㊶ - 0.00035I) ㊸								
		BENEFIT (㊸x㊴x③) ㊹								
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM (REF. D.I-9) ㊺								
		BENEFIT (㊺x④) ㊻								
	TOTAL BENEFIT (㊷+㊹+㊻)									㊼

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (⑳+㊳)	㊽	
ECONOMIC COST (㊽ x 0.831)	㊾	
B/C RATIO (㊼ / ㊾)		
IRR (REF. D.I-11)		

7) COMMENT

D.I-1 Proposed Pavement Type

Select from Table below.

Pavement Type and Width

Road Class	AADT in Opening Year	Pavement Type 1)	Carriageway Width(m)	Shoulder Width (m) Flat	Roll'g	Mount
Primary Major	Over 2000	PCC 3)	6.7	3.0	2.0	1.5
	1000-2000	PCC 3)	6.7	2.5	1.5	1.0
	400-1000	AC 3)	6.7	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	2.0	1.5	1.0
	100- 200	BMP 2)3)	6.0	1.5	1.0	0.5
	Below 100	Gravel	6.0	1.5	1.0	0.5
Secondary Major	Over 2000	PCC 3)	6.7	2.5	1.5	1.0
	1000-2000	PCC 3)	6.0	2.5	1.5	1.0
	400-1000	AC 3)	6.0	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	Below 200	Gravel	6.0	1.0	0.5	0.5
Collector	Over 400	AC 3)	6.0	1.5	1.0	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	50- 200	Gravel	6.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	1.0	0.5	0.5
Feeder	Over 400	AC 3)	6.0	1.5	1.0	0.5
	200- 400	BMP 2)3)	6.0	1.0	0.5	0.5
	50- 200	Gravel	4.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	0.5	0.5	0.5

Note 1) Where existing pavement type is superior to the one posed above, use existing type.
2) BMP can be replaced by DBST where subgrade and drainage conditions are good. It is, however, recommended to assume BMP for budgetary and evaluation purposes.
3) Use AC overlay, where existing condition warrants the use of AC overlay.

Type of Improvement

Existing Surface Type	Existing Surface Condition	Existing Carriageway Width	Type of Improvement
Standard or Superior	Good/Fair	Standard	-
	Good/Fair	Substandard	Widening
	Bad/Very bad	any	Rehabilitation
Substandard or Non-existing	Good/Fair	any	Improvement-2
	Bad/Very bad	any	Improvement-1
	Impassable	any	New Construction

D.I-2 Proposed Structure Type

Select from Table below.

Existing Type	Proposed Type: Primary Major / Secondary Major	Proposed Type: Collector / Feeder	
Ford Crossing	2-lane Brigde (2-BR)	Carriageway width of approach road 4.0 m	1-lane Spillway (1-SW)
		Carriageway width of approach road 6.0 m	2-lane Spillway (2-SW)
Spillway	2-lane Bridge (2-BR)	-	
Timber Bridge	2-lane Bridge (2-BR)	AADT < 200	1-lane Bridge (1-BR)
		AADT > 200	2-lane Bridge (2-BR)
Bailey Bridge	2-lane Bridge (2-BR)	AADT < 300	-
		AADT > 300	2-lane Bridge (2-BR)

Note : Use RCBC instead of bridge where length is short and topography is suitable.

D.I-3 Road Construction Cost

Equation : RCC = RCCu·Ls

where , RCC = road construction cost, in Mp
RCCu= unit road construction cost, in Mp/km, given in Table below
Ls = subsection length, in km

Unit road construction cost "RCCu", in Mp/km

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
			0.5	-	2.050	2.651
		4.0	1.0	1.827	2.264	-
			1.5	1.936	-	-
			0.5	-	-	3.065
			1.0	-	2.678	3.200
		6.0	1.5	2.651	2.952	-
			2.0	2.776	-	-
			2.5	2.914	-	-
	PCC		1.0	-	-	3.693
			1.5	-	3.142	3.768
		6.7	2.0	3.100	3.476	-
			2.5	3.466	-	-
			3.0	3.712	-	-
			0.5	-	-	0.923
			1.0	-	0.982	1.481
Rehabilita-		Widening	1.5	0.873	1.892	-
			2.0	1.070	-	-
tion/			2.5	1.168	-	-
			0.5	-	1.909	2.516
Improvement/		4.0	1.0	1.677	2.098	-
			1.5	1.820	-	-
Widening			0.5	-	-	2.782
			1.0	-	2.364	2.858
		6.0	1.5	2.374	2.786	-
			2.0	2.565	-	-
			2.5	2.779	-	-
	AC		1.0	-	-	3.369
			1.5	-	2.867	3.483
		6.7	2.0	2.869	3.172	-
			2.5	3.108	-	-
			3.0	3.315	-	-
			0.5	-	-	0.907
			1.0	-	0.944	1.478
		Widening	1.5	0.819	1.416	-
			2.0	1.023	-	-
			2.5	1.106	-	-

-- continued --

Unit road construction cost "RCCu", in Mp/km (continued)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	BMP	4.0	0.5	-	1.334	1.650
			1.0	1.199	1.769	-
			1.5	1.237	-	-
		6.0	0.5	-	1.818	2.350
			1.0	1.690	2.084	2.418
			1.5	1.744	2.398	-
			2.0	1.978	-	-
		Widening	0.5	-	0.714	0.879
			1.0	0.592	0.842	1.388
			1.5	0.650	-	-
			2.0	0.668	-	-
	Gravel	4.0	0.5	0.482	0.511	0.601
			1.0	0.526	-	-
		6.0	0.5	-	0.965	1.321
			1.0	0.714	1.013	1.510
			1.5	0.823	1.045	-
			2.0	0.896	-	-
	Overlay	4.0	any	1.048	1.048	1.048
		6.0	any	1.325	1.325	1.325
		6.7	any	1.505	1.505	1.505
New Construction	PCC	6.0	1.0	-	-	4.184
			1.5	-	3.790	-
			2.0	3.534	-	-
			2.5	3.739	-	-
		6.7	1.0	-	-	4.434
			1.5	-	4.040	5.064
			2.0	3.781	4.618	-
			2.5	3.989	-	-
			3.0	4.152	-	-
	AC	6.0	0.5	-	-	3.228
			1.0	-	2.900	3.863
			1.5	2.920	3.484	-
			2.0	3.346	-	-
			2.5	3.630	-	-
		6.7	1.0	-	-	4.072
			1.5	-	3.690	4.712
			2.0	3.552	4.281	-
			2.5	3.808	-	-
			3.0	4.007	-	-
	BMP	4.0	0.5	-	1.534	1.815
			1.0	1.334	-	-
		6.0	0.5	-	2.197	2.637
			1.0	2.193	2.758	3.250
			1.5	2.598	2.846	-
			2.0	2.684	-	-
	Gravel	4.0	0.5	0.536	0.611	0.713
			1.0	0.643	-	-
		6.0	0.5	-	1.637	2.003
			1.0	1.430	1.772	-
			1.5	1.553	-	-

D.I-4 Slope Protection Cost

Equation : SPC = SPCC+SPCE

SPCC = SPCCu·Lc
SPCE = SPCEu·Le

where , SPC = slope protection cost, in Mp
SPCC = cut slope protection cost, in Mp
SPCE = embankment slope protection cost, in Mp

SPCCu= unit cost for cut slope protection, in Mp/m, given in Table below
SPCEu= unit cost for embankment slope protection, in Mp/m, given in Table below
Lc = length of cut slope to be protected, in m
Le = length of embankment slope to be protected, in m

Unit cost for slope protection "SPCCu","SPCEu", in Mp/m

Item		Unit Cost
Cut Slope Protection	"SPCCu"	0.0253
Embankment Slope Protection	"SPCEu"	0.0275

D.I-5 Additional Cost for Flood Section

Equation : FSC = FSCu·Lf
FSCu= 1.976·Df+0.173·Wr-0.850

where , FSC = additional cost for flood section, in Mp
FSCu= unit additional cost for flood section, in Mp/km
Lf = length of flood section, in km
Df = flood depth, in m
Wr = road width, in m

D.I-6 Structure Cost

Equation : STC = BRC+SWC+BCC

BRC = SSu·Lss+ABu·Nab+PRu·Npr
SWC = SWu·Lsw
BCC = BCu·Lbc+WW

where , STC = structure cost, in Mp
BRC = bridge cost, in Mp
SWC = spillway cost, in Mp
BCC = RCBC cost, in Mp

SSu = unit cost of superstructure, in Mp/m, given in Table below
ABu = unit cost of abutment, in Mp/each, given in Table below
PRu = unit cost of pier, in Mp/each, given in Table below
Lss = length of superstructure, in m
Nab = number of abutments
Npr = number of piers
SWu = unit cost of spillway, in Mp/m, given in Table below
Lsw = length of spillway, in m
BCu = unit cost of RCBC, in Mp/m,given in Table below
Lbc = length of RCBC, in m, usually road width plus 3.0 m
WW = cost for wingwall and apron, in Mp/set(both sides total), given in Table below

Unit cost "SSu","ABu","PRu","SWu","BCu","WW"

Type of Structure	Item		Unit Cost
2-lane Bridge	Superstructure	"SSu"	0.0478 Mp/m
	Abutment	"ABu"	0.3630 Mp/each
	Pier	"PRu"	0.3135 Mp/each
1-lane Bridge	Superstructure	"SSu"	0.0357 Mp/m
	Abutment	"ABu"	0.2530 Mp/each
	Pier	"PRu"	0.2200 Mp/each
2-lane Spillway	Spillway	"SWu"	0.0182 Mp/m
1-lane Spillway	Spillway	"SWu"	0.0132 Mp/m
1-cell RCBC	RCBC	"BCu"	0.0227 Mp/m
	Wingwall/Apron	"WW "	0.1452 Mp/set
2-cell RCBC	RCBC	"BCu"	0.0396 Mp/m
	Wingwall/Apron	"WW "	0.1705 Mp/set

D.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km/veh
Ls = subsection length, in km
VEH = AADT, in veh
k = constant, given in Table below

Constant "k"

Proposed Pavemrnt Type	Existing Surface Type and Condition	Terrain		
		Flat	Rolling	Mountain's
PCC/AC	Paved - Bad	.00751	.00726	.00737
	Paved - Very Bad	.01230	.01205	.01216
	Gravel- Good/Fair	.00788	.00763	.00774
	Gravel- Bad	.00824	.00799	.00811
	Gravel- Very Bad	.01354	.01329	.01341
	Earth - Bad	.01247	.01222	.01234
	Earth - Very Bad	.01698	.01673	.01684
BMP/DBST	Paved - Bad	.00647	.00622	.00633
	Paved - Very Bad	.01126	.01101	.01113
	Gravel- Good/Fair	.00684	.00659	.00671
	Gravel- Bad	.00721	.00696	.00707
	Gravel- Very Bad	.01250	.01225	.01237
	Earth - Bad	.01144	.01119	.01130
	Earth - Very Bad	.01594	.01569	.01581
Gravel	Gravel- Bad	.00642	.00617	.00628
	Gravel- Very Bad	.01172	.01147	.01158
	Earth - Bad	.01065	.01040	.01051
	Earth - Very Bad	.01516	.01491	.01502

D.I-8 Bridge Benefit

Equation : BRB = BRBu·Lb·VEH
BRBu= 0.0660·TRBu-0.000351

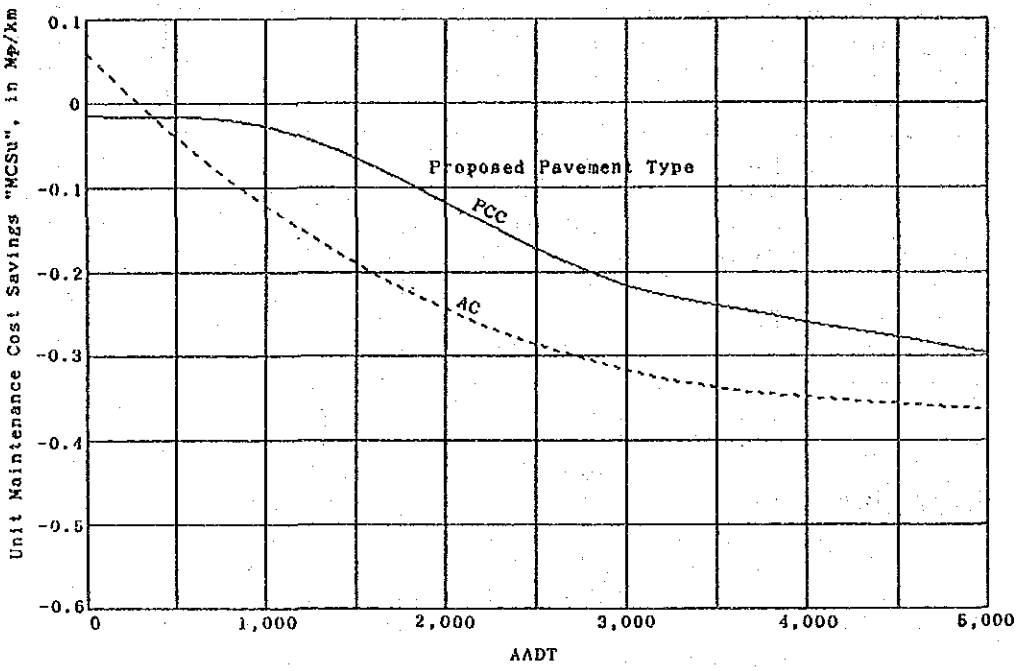
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from D.I-7

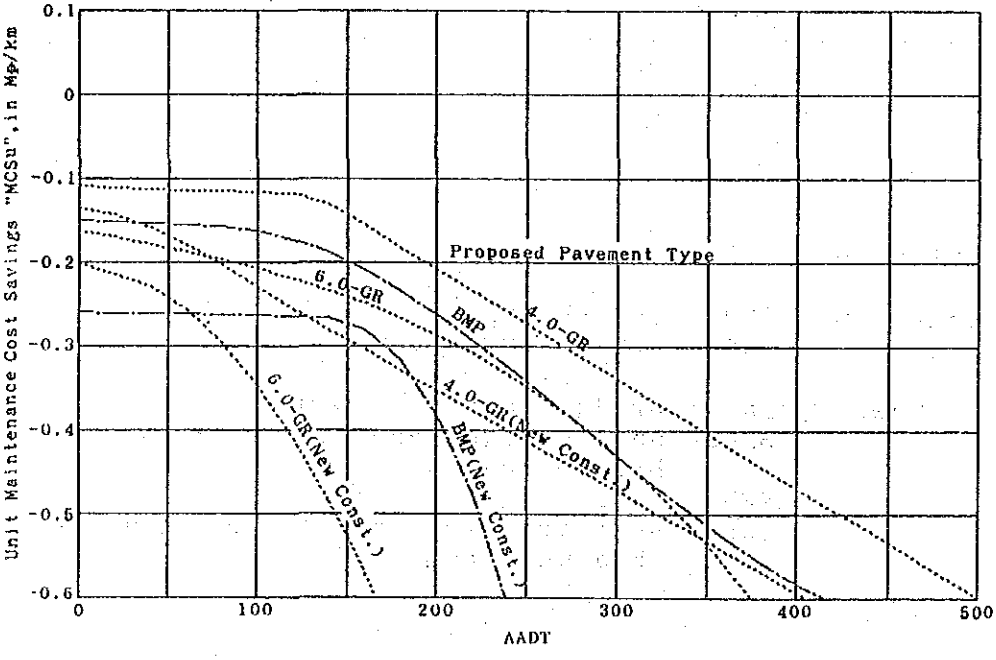
D.I-9 Maintenance Cost Savings

Equation : MCS = MCSu·Ls

where , MCS = maintenance cost savings, in Mp
MCSu= unit maintenance cost savings, in Mp/km, given in Chart below
Ls = subsection length, in km

Chart for estimating unit maintanance cost savings "MCSu"





D.I-10 B/C Ratio

Equation : $BC = TB/EC$

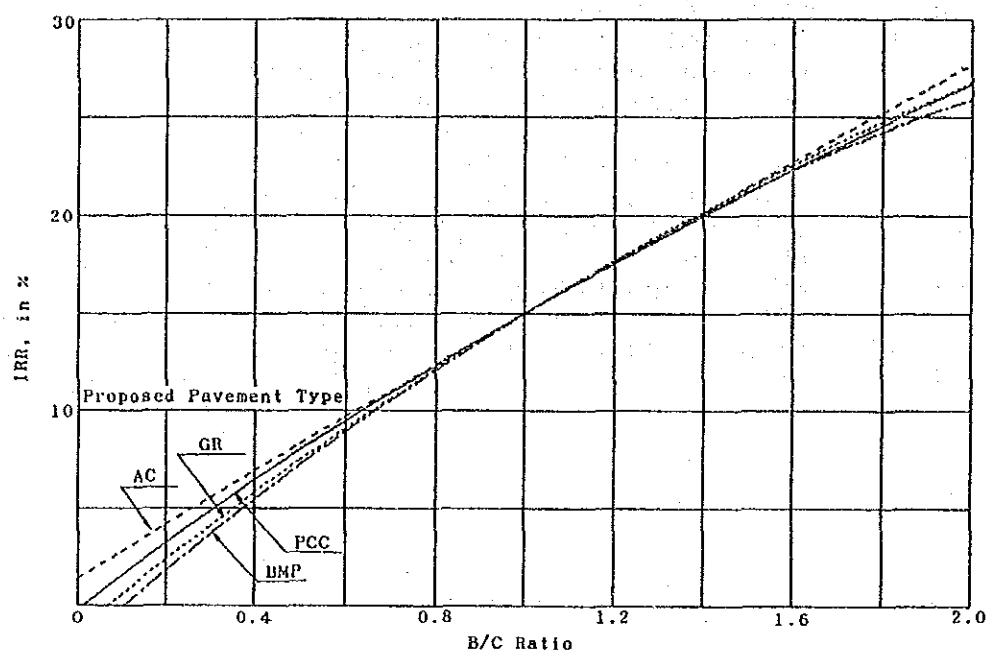
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

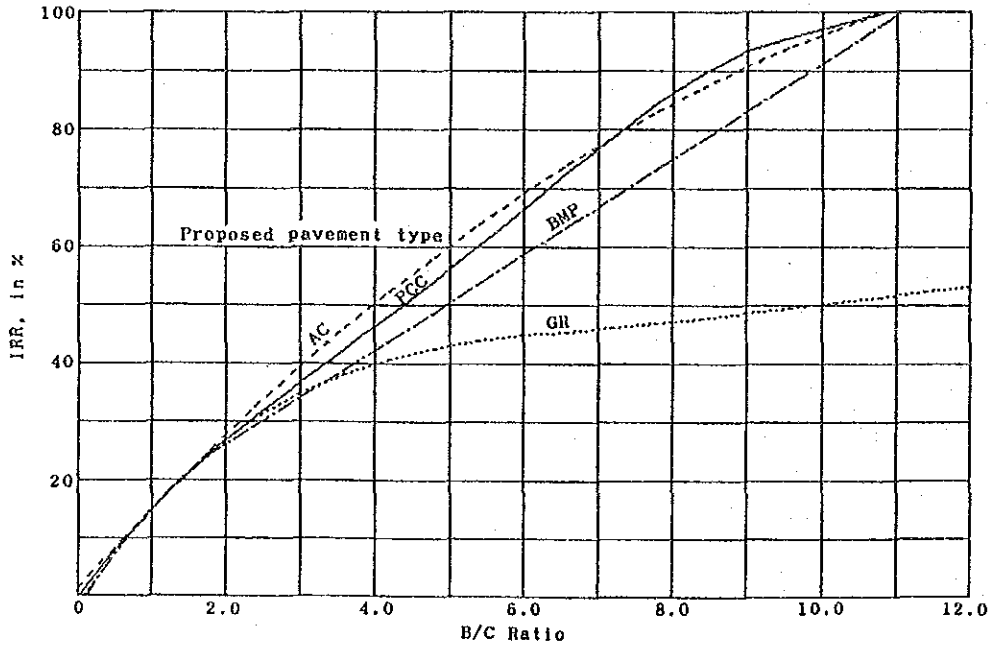
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB= traffic benefit, in Mp
BRB= bridge benefit, in Mp
MCS= maintenance cost savings, in Mp
RCC= road construction cost, in Mp
SPC= slope protection cost, in Mp
FSC= additional cost for flood section, in Mp
STC= structure cost, in Mp

D.I-11 Internal Rate of Return (IRR)

Obtain from Chart below.





PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - D)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pt	①	TOTAL ROAD LENGTH : Lt	③ KM	Pt / Lt (①)/(③)	⑤
CULTIVATED AREA WITHIN RIA : At	② HA	At / Lt (②)/(③)	④	AADT (REF. D.II - 1)	⑥
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	C : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ⑦										⑦
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑧										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑨										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑩										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑪										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. D.II - 2)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. D.II - 2) ⑫										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. D.II - 2) ⑬										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. D.II - 2)										
COST (MP) — ROAD — UNIT COST/KM. (REF. D.II - 4) ⑮										
COST (MP) — ROAD — COST (⑮ x ⑦) ⑯										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. D.II - 5) ⑰										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. D.II-5) ⑲										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳										
COST (MP) — FLOOD SECTION — UNIT COST/KM. (1.976·⑩ + 0.173·⑭ - 0.850) ㉑										
COST (MP) — FLOOD SECTION — COST (㉑ x ⑪) ㉒										
COST (MP) — TOTAL COST (⑯ + ⑱ + ⑳ + ㉒)										㉓

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. D.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE — NO. OF LANES										
BRIDGE — LENGTH (M) ㉔										
BRIDGE — NO. OF SPANS (㉔ /20 & ROUND) ㉕										
BRIDGE — COST (MP) — SUPER-STRUCTURE — UNIT COST/M (REF. D.II-7) ㉖										
BRIDGE — COST (MP) — SUPER-STRUCTURE — COST (㉖ x ㉔) ㉗										
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. D.II-7) ㉘										
BRIDGE — COST (MP) — ABUTMENT — COST (㉘ x 2) ㉙										
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. D.II-7) ㉚										
BRIDGE — COST (MP) — PIER — COST (㉚ x(㉕ -1)) ㉛										
BRIDGE — TOTAL COST (㉗ + ㉙ + ㉛) ㉜										
SPILLWAY — NO. OF LANES										
SPILLWAY — LENGTH (M) ㉝										
SPILLWAY — COST (MP) — UNIT COST/M (REF. D.II-7) ㉞										
SPILLWAY — COST (MP) — COST (㉞ x ㉝) ㉟										
RCBC — 1-CELL OR 2-CELL										
RCBC — LENGTH (M) (USUALLY ⑭ + 3.0) ㊱										
RCBC — COST (MP) — RCBC — UNIT COST/M (REF. D.II-7) ㊲										
RCBC — COST (MP) — RCBC — COST (㊲ x ㊱) ㊳										
RCBC — COST (MP) — WINGWALL & APRON (REF. D.II-7) ㊴										
RCBC — COST (MP) — TOTAL COST (㊳ + ㊴) ㊵										
COST (MP) (㉜ + ㉟ + ㊵)										㊶

5) BENEFIT

BRIDGE LENGTH (M) (㉔ + ㉝) ㊷										
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM. (REF. D.II-8) ㊸										
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦) ㊹										
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0.066 x ㊷ - 0.000351 x ⑥) ㊺										
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷) ㊻										
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. D.II-10) ㊼										
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K+0.000312x④+0.000109x⑤) ㊽										
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦) ㊾										
BENEFIT — MAINTE-NANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. D.II-11) ㊿										
BENEFIT — MAINTE-NANCE COST SAVINGS — BENEFIT (㊿ x ⑦) (51)										
BENEFIT — TOTAL BENEFIT (㊹ + ㊻ + ㊾ + (51)) (52)										

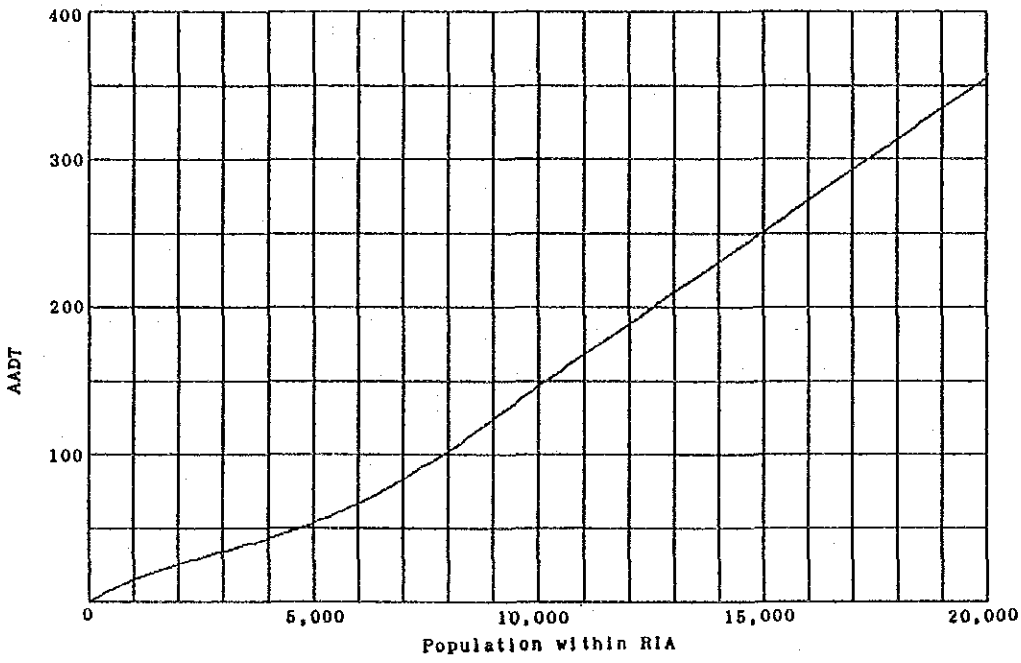
6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓ + ㊶) (53)	
ECONOMIC COST	((53) x 0.831) (54)	
B/C RATIO	((52) / (54))	
I R R	(REF. D.II-13)	

7) COMMENT

D.II-1 AADT

Obtain from Chart below.



D.II-2 Proposed Pavement Type

Apply D.I-1.

D.II-3 Proposed Structure Type

Apply D.I-2.

D.II-4 Road Construction Cost

Apply D.I-3.

D.II-5 Slope Protection Cost

Apply D.I-4.

D.II-6 Additional Cost for Flood Section

Apply D.I-5.

D.II-7 Structure Cost

Apply D.I-6.

D.II-8 Traffic Benefit

Equation : TRB = TRBu·Ls

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km, given in Chart below
Ls = subsection length, in km

Selection of Chart for estimating unit traffic benefit "TRBu"

Population Distribution Pattern	Selection of Parameter	
	AADT	Population
A : Gradually Decreasing Pattern	Fig. A-1	Fig. A-2
B : Evenly Distributing Pattern	Fig. B-1	Fig. B-2
C : Tip Concentration Pattern	Fig. C-1	Fig. C-2

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - A
(Gradually Decreasing Pattern)

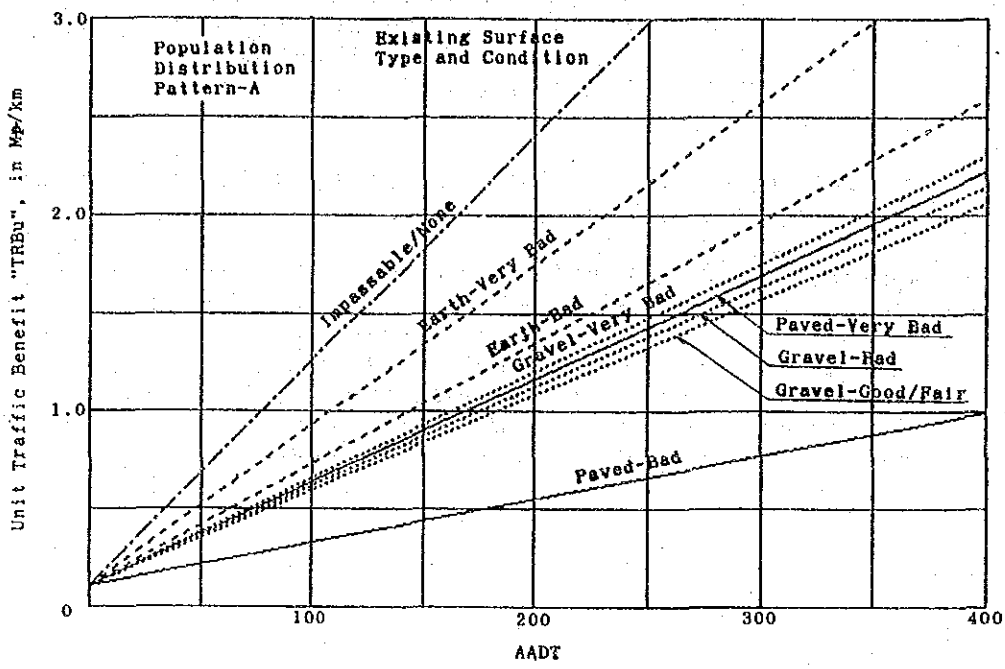


Figure A-1 "TRBu" Based on AADT

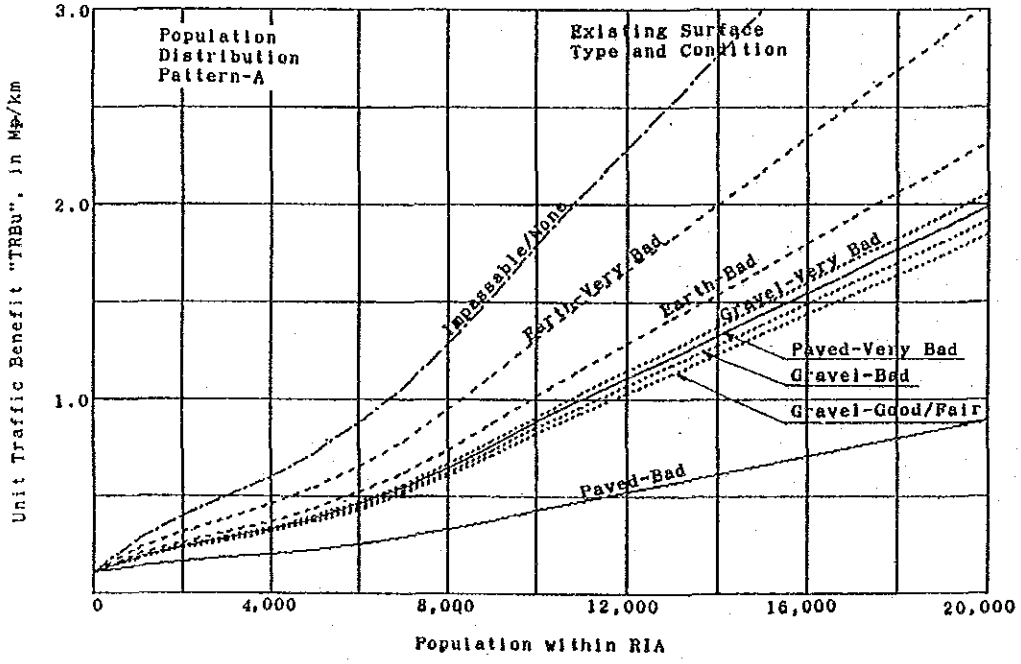


Figure A-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - B
(Evenly Distributing Pattern)

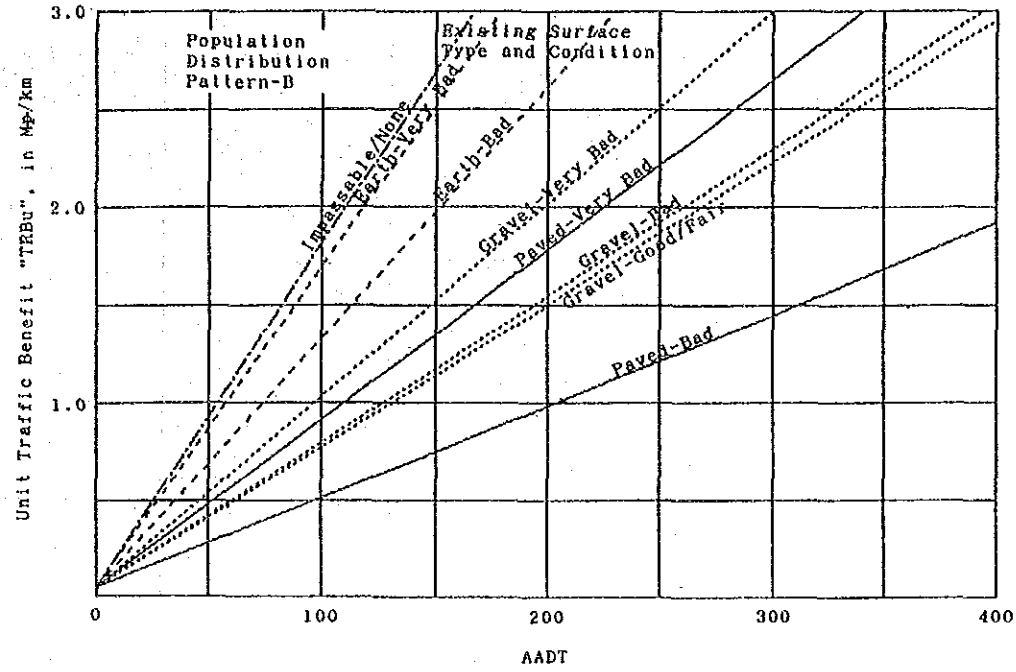


Figure B-1 "TRBu" Based on AADT

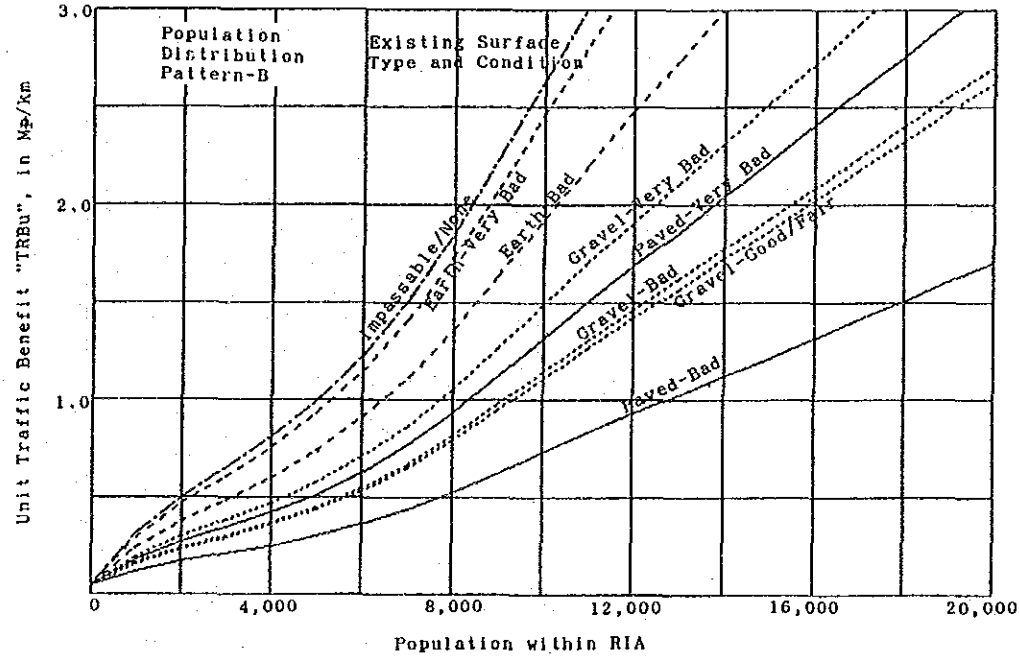


Figure B-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - C
(Tip Concentration Pattern)

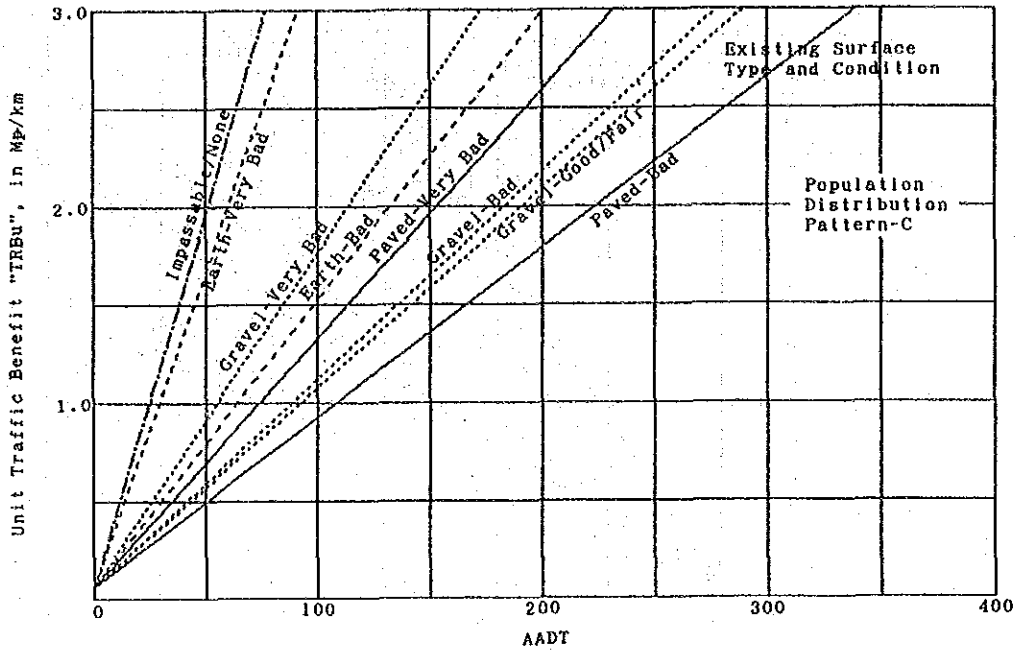


Figure C-1 "TRBu" Based on AADT

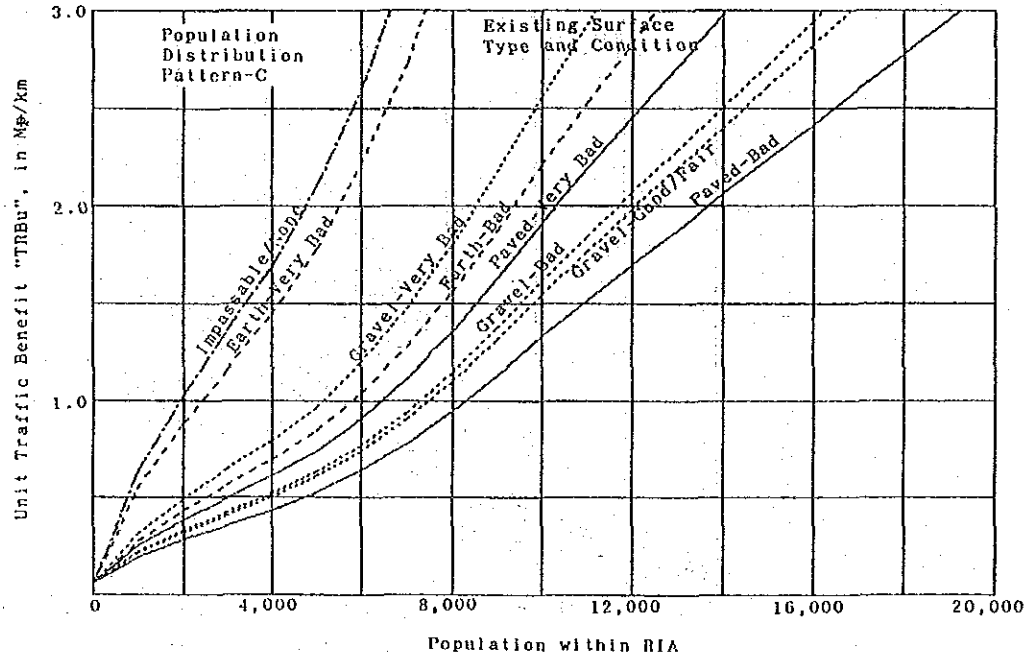


Figure C-2 "TRBu" Based on Population

D.II-9 Bridge Benefit

Equation : BRB = BRBu·Lb
BRBu= 0.0660·TRBu-0.000351·VEH

where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m
Lb = bridge length, in m
TRBu= unit traffic benefit, in Mp/km, obtained from D.II-8
VEH = AADT, in veh

D.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.000312·At/Lt+0.000109·Pt/Lt

where , DVB = development benefit, in Mp
DVBu= unit development benefit,in Mp/km
k = constant, given in Table below
At = total cultivated area within RIA, in ha
Pt = total population within RIA, in person
Lt = total road length, in km
Ls = subsection length, in km

Constant "k"

Existing Surface Type and Condition	Terrain		
	Flat	Rolling	Mountain's
Paved - Bad	-.0832	.1469	-.0558
Paved - Very Bad	-.0849	.1452	-.0575
Gravel- Good/Fair	-.0809	.1491	-.0536
Gravel- Bad	-.0719	.1582	-.0445
Gravel- Very Bad	-.0866	.1435	-.0592
Earth - Bad	-.0351	.1950	-.0077
Earth - Very Bad	.0004	.2305	.0278
Any - Impassable/ Non-exist'g	.0241	.2542	.0515

D.II-11 Maintenance Cost Savings

Apply D.I-9.

D.II-12 B/C Ratio

Equation : BC = TB/EC

TB = TRB+BRB+DVB+MCS
EC = 0.831·TC
TC = RCC+SPC+FSC+STC

where , BC = B/C Ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB = traffic benefit, in Mp
BRB = bridge benefit, in Mp
DVB = development benefit, in Mp
MCS = maintenance cost savings, in Mp
RCC = road construction cost, in Mp
SPC = slope protection cost, in Mp
FSC = additional cost for flood section, in Mp
STC = structure cost, in Mp

D.II-13 Internal Rate of Return (IRR)

Apply D.I-11.

APPENDIX E

WORKSHEET, EQUATIONS AND DATA FOR PROJECT EVALUATION IN PROVINCE GROUP - E

PROVINCES : Abra

Mountain Province

Pangasinan

Cagayan

Ifugao

Nueva Ecija

Tarlac

Iloilo

Leyte

Bukidnon

Misamis Oriental

South Cotabato

WORKSHEETS,EQUATIONS AND DATA FOR PROJECT EVALUATION
IN PROVINCE GROUPE - E

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - E)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) AADT

PRESENT AADT	LIGHT VEHICLE (CAR/VAN/JEEPNEY)		VEH.	%	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n =
	HEAVY VEHICLE (BUS / TRUCK)	②	VEH.	%			
	TOTAL	①	VEH.	100 %		AADT IN OPENING YEAR (① x 1.03^n)	③

3) PROPOSED IMPROVEMENT AND COST (ROAD)

									TOTAL
SUBSECTION NO.									
LENGTH OF SUBSECTION (KM) ④									
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)									
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)									
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)									
SPECIAL TREATMENT	SLOPE PROTECTION	CUT SLOPE LENGTH (M) ⑤							
		EMBANKMENT SLOPE LENGTH (M) ⑥							
	FLOOD SECTION	FLOOD DEPTH (M) ⑦							
		FLOOD SECTION LENGTH (M) ⑧							
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. E.I-1)								
	CARRIAGEWAY WIDTH (M) (REF. E.I-1) ⑨								
	SHOULDER WIDTH (M) (REF. E.I-1) ⑩								
	TOTAL WIDTH (M) (⑨+2x⑩) ⑪								
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. E.I-1)								
COST (MP)	ROAD	UNIT COST/KM. (REF. E.I-3) ⑫							
		COST (⑫x④) ⑬							
	SLOPE PROTECTION	CUT SLOPE: UNIT COST/M (REF. E.I-4) ⑭							
		CUT SLOPE: COST (⑭x⑤) ⑮							
		EMBANK SLOPE: UNIT COST/M (REF. E.I-4) ⑯							
		EMBANK SLOPE: COST (⑯x⑥) ⑰							
	FLOOD SECTION	UNIT COST/KM. (1.976·⑦+0.173·⑪-0.850) ⑱							
		COST (⑱x⑧) ⑲							
	TOTAL COST (⑬+⑮+⑰+⑲)								⑳

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

									TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED									
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)									
PROPOSED TYPE (REF. E.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)									
BRIDGE	NO. OF LANES								
	LENGTH (M) ㉑								
	NO. OF SPANS (㉑/20 & ROUND) ㉒								
	COST (MP): SUPER STRUCTURE: UNIT COST/M (REF. E.I-6) ㉓								
	COST (MP): SUPER STRUCTURE: COST (㉓x㉑) ㉔								
	COST (MP): ABUTMENT: UNIT COST/EACH (REF. E.I-6) ㉕								
	COST (MP): ABUTMENT: COST (㉕x2) ㉖								
	COST (MP): PIER: UNIT COST/EACH (REF. E.I-6) ㉗								
	COST (MP): PIER: COST (㉗x(㉒-1)) ㉘								
	TOTAL COST (㉔+㉖+㉘) ㉙								
SPILLWAY	NO. OF LANES								
	LENGTH (M) ㉚								
	COST (MP): UNIT COST/M (REF. E.I-6) ㉛								
	COST (MP): COST (㉛x㉚) ㉜								
RCBC	1-CELL OR 2-CELL								
	LENGTH (M) (USUALLY ⑪+3.0) ㉝								
	COST (MP): RCBC: UNIT COST/M (REF. E.I-6) ㉞								
	COST (MP): RCBC: COST (㉞x㉝) ㉟								
	COST (MP): WINGWALL & APRON (REF. E.I-6) ㊱								
	COST (MP): TOTAL COST (㉟+㊱) ㊲								
COST (MP) (㉙+㉜+㊲)									㊳

5) BENEFIT

AADT IN OPENING YEAR (③) ③								
PERCENT HEAVY VEHICLES (②) ②								
BRIDGE LENGTH (M) (㉑ + ㉚) ㊴								
BENEFIT	TRAFFIC BENEFIT	CONSTANT "k" (REF. E.I-7) ㊵							
		UNIT BENEFIT/KM/VEH. (㊵ + 0.000083 x ②) ㊶							
		BENEFIT (㊶x④x③) ㊷							
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066 x ㊶ - 0.00035) ㊸							
		BENEFIT (㊸x㊴x③) ㊹							
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM (REF. E.I-9) ㊺							
		BENEFIT (㊺x④) ㊻							
	TOTAL BENEFIT (㊷+㊹+㊻)								㊼

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (⑳+㊳)	㊽	
ECONOMIC COST (㊽ x 0.831)	㊾	
B/C RATIO (㊼ / ㊾)		
IRR (REF. E.I-11)		

7) COMMENT

E.I-1 Proposed Pavement Type

Select from Table below.

Pavement Type and Width

Road Class	AADT in Opening Year	Pavement Type 1)	Carriageway Width(m)	Shoulder Width (m) Flat	Roll'g	Mount
Primary Major	Over 2000	PCC 3)	6.7	3.0	2.0	1.5
	1000-2000	PCC 3)	6.7	2.5	1.5	1.0
	400-1000	AC 3)	6.7	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	2.0	1.5	1.0
	100- 200	BMP 2)3)	6.0	1.5	1.0	0.5
	Below 100	Gravel	6.0	1.5	1.0	0.5
Secondary Major	Over 2000	PCC 3)	6.7	2.5	1.5	1.0
	1000-2000	PCC 3)	6.0	2.5	1.5	1.0
	400-1000	AC 3)	6.0	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	Below 200	Gravel	6.0	1.0	0.5	0.5
Collector	Over 400	AC 3)	6.0	1.5	1.0	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	50- 200	Gravel	6.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	1.0	0.5	0.5
Feeder	Over 400	AC 3)	6.0	1.5	1.0	0.5
	200- 400	BMP 2)3)	6.0	1.0	0.5	0.5
	50- 200	Gravel	4.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	0.5	0.5	0.5

Note 1) Where existing pavement type is superior to the one proposed above, use existing type.
2) BMP can be replaced by DBST where subgrade and drainage conditions are good. It is, however, recommended to assume BMP for budgetary and evaluation purposes.
3) Use AC overlay, where existing condition warrants the use of AC overlay.

Type of Improvement

Existing Surface Type	Existing Surface Condition	Existing Carriageway Width	Type of Improvement
Standard or Superior	Good/Fair	Standard	-
	Good/Fair	Substandard	Widening
	Bad/Very bad	any	Rehabilitation
Substandard or Non-existing	Good/Fair	any	Improvement-2
	Bad/Very bad	any	Improvement-1
	Impassable	any	New Construction

E.I-2 Proposed Structure Type

Select from Table below.

Existing Type	Proposed Type		
	Primary Major Secondary Major	Collector Feeder	
Ford Crossing	2-lane Brigde (2-BR)	Carriageway width of approach road 4.0 m	1-lane Spillway (1-SW)
		Carriageway width of approach road 6.0 m	2-lane Spillway (2-SW)
Spillway	2-lane Bridge (2-BR)	-	
Timber Bridge	2-lane Bridge (2-BR)	AADT < 200	1-lane Bridge (1-BR)
		AADT > 200	2-lane Bridge (2-BR)
Bailey Bridge	2-lane Bridge (2-BR)	AADT < 300	-
		AADT > 300	2-lane Bridge (2-BR)

Note : Use RCBC instead of bridge where length is short and topography is suitable.

E.I-3 Road Construction Cost

Equation : RCC = RCCu·Ls

where , RCC = road construction cost, in Mp
RCCu= unit road construction cost, in Mp/km, given in Table below
Ls = subsection length, in km

Unit road construction cost "RCCu", in Mp/km

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
			0.5	-	2.050	2.651
		4.0	1.0	1.827	2.264	-
			1.5	1.936	-	-
			0.5	-	-	3.065
			1.0	-	2.678	3.200
		6.0	1.5	2.651	2.952	-
			2.0	2.776	-	-
			2.5	2.914	-	-
	PCC		1.0	-	-	3.693
			1.5	-	3.142	3.768
		6.7	2.0	3.100	3.476	-
			2.5	3.466	-	-
			3.0	3.712	-	-
			0.5	-	-	0.923
			1.0	-	0.982	1.481
Rehabilita-		Widening	1.5	0.873	1.892	-
			2.0	1.070	-	-
tion/			2.5	1.168	-	-
			0.5	-	1.909	2.516
Improvement/		4.0	1.0	1.677	2.098	-
			1.5	1.820	-	-
Widening			0.5	-	-	2.782
			1.0	-	2.364	2.858
		6.0	1.5	2.374	2.785	-
			2.0	2.565	-	-
			2.5	2.779	-	-
	AC		1.0	-	-	3.369
			1.5	-	2.867	3.483
		6.7	2.0	2.869	3.172	-
			2.5	3.108	-	-
			3.0	3.315	-	-
			0.5	-	-	0.907
			1.0	-	0.944	1.478
		Widening	1.5	0.819	1.416	-
			2.0	1.023	-	-
			2.5	1.106	-	-

-- continued --

Unit road construction cost "RCCu", in Mp/km (continued)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain: Flat	Terrain: Rolling	Terrain: Mountain's
Rehabilitation/ Improvement/ Widening	BMP	4.0	0.5	-	1.334	1.650
			1.0	1.199	1.769	-
			1.5	1.237	-	-
		6.0	0.5	-	1.818	2.350
			1.0	1.690	2.084	2.418
			1.5	1.744	2.398	-
			2.0	1.978	-	-
		Widening	0.5	-	0.714	0.879
			1.0	0.592	0.842	1.388
			1.5	0.650	-	-
			2.0	0.668	-	-
	Gravel	4.0	0.5	0.482	0.511	0.601
			1.0	0.526	-	-
		6.0	0.5	-	0.965	1.321
			1.0	0.714	1.013	1.510
			1.5	0.823	1.045	-
			2.0	0.896	-	-
	Overlay	4.0	any	1.048	1.048	1.048
		6.0	any	1.325	1.325	1.325
		6.7	any	1.505	1.505	1.505
New Construction	PCC	6.0	1.0	-	-	4.184
			1.5	-	3.790	-
			2.0	3.534	-	-
			2.5	3.739	-	-
		6.7	1.0	-	-	4.434
			1.5	-	4.040	5.064
			2.0	3.781	4.618	-
			2.5	3.989	-	-
			3.0	4.152	-	-
	AC	6.0	0.5	-	-	3.228
			1.0	-	2.900	3.863
			1.5	2.920	3.484	-
			2.0	3.346	-	-
			2.5	3.630	-	-
		6.7	1.0	-	-	4.072
			1.5	-	3.690	4.712
			2.0	3.552	4.281	-
			2.5	3.808	-	-
			3.0	4.007	-	-
	BMP	4.0	0.5	-	1.534	1.815
			1.0	1.334	-	-
		6.0	0.5	-	2.197	2.637
			1.0	2.193	2.758	3.250
			1.5	2.598	2.846	-
			2.0	2.684	-	-
	Gravel	4.0	0.5	0.536	0.611	0.713
			1.0	0.643	-	-
		6.0	0.5	-	1.637	2.003
			1.0	1.430	1.772	-
			1.5	1.553	-	-

E.I-4 Slope Protection Cost

Equation : SPC = SPCC+SPCE

SPCC = SPCCu·Lc
SPCE = SPCEu·Le

where , SPC = slope protection cost, in Mp
SPCC = cut slope protection cost, in Mp
SPCE = embankment slope protection cost, in Mp

SPCCu= unit cost for cut slope protection, in Mp/m, given in Table below
SPCEu= unit cost for embankment slope protection, in Mp/m, given in Table below
Lc = length of cut slope to be protected, in m
Le = length of embankment slope to be protected, in m

Unit cost for slope protection "SPCCu","SPCEu", in Mp/m

Item		Unit Cost
Cut Slope Protection	"SPCCu"	0.0253
Embankment Slope Protection	"SPCEu"	0.0275

E.I-5 Additional Cost for Flood Section

Equation : FSC = FSCu·Lf
FSCu= 1.976·Df+0.173·Wr-0.850

where , FSC = additional cost for flood section, in Mp
FSCu= unit additional cost for flood section, in Mp/km
Lf = length of flood section, in km
Df = flood depth, in m
Wr = road width, in m

E.I-6 Structure Cost

Equation : STC = BRC+SWC+BCC

BRC = SSu·Lss+ABu·Nab+PRu·Npr
SWC = SWu·Lsw
BCC = BCu·Lbc+WW

where , STC = structure cost, in Mp
BRC = bridge cost, in Mp
SWC = spillway cost, in Mp
BCC = RCBC cost, in Mp

SSu = unit cost of superstructure, in Mp/m, given in Table below
ABu = unit cost of abutment, in Mp/each, given in Table below
PRu = unit cost of pier, in Mp/each, given in Table below
Lss = length of superstructure, in m
Nab = number of abutments
Npr = number of piers
SWu = unit cost of spillway, in Mp/m, given in Table below
Lsw = length of spillway, in m
BCu = unit cost of RCBC, in Mp/m,given in Table below
Lbc = length of RCBC, in m, usually road width plus 3.0 m
WW = cost for wingwall and apron, in Mp/set(both sides total), given in Table below

Unit cost "SSu","ABu","PRu","SWu","BCu","WW"

Type of Structure	Item		Unit Cost
2-lane Bridge	Superstructure	"SSu"	0.0478 Mp/m
	Abutment	"ABu"	0.3630 Mp/each
	Pier	"PRu"	0.3135 Mp/each
1-lane Bridge	Superstructure	"SSu"	0.0357 Mp/m
	Abutment	"ABu"	0.2530 Mp/each
	Pier	"PRu"	0.2200 Mp/each
2-lane Spillway	Spillway	"SWu"	0.0182 Mp/m
1-lane Spillway	Spillway	"SWu"	0.0132 Mp/m
1-cell RCBC	RCBC	"BCu"	0.0227 Mp/m
	Wingwall/Apron	"WW "	0.1452 Mp/set
2-cell RCBC	RCBC	"BCu"	0.0396 Mp/m
	Wingwall/Apron	"WW "	0.1705 Mp/set

E.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k+0.000083·HV

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km/veh
Ls = subsection length, in km
VEH = AADT, in veh
HV = percent heavy vehicles, in %
k = constant, given in Table below

Constant "k"

Proposed Pavemrnt Type	Existing Surface Type and Condition	Terrain		
		Flat	Rolling	Mountain's
PCC/AC	Paved - Bad	.00344	.00297	.00294
	Paved - Very Bad	.00929	.00882	.00879
	Gravel- Good/Fair	.00537	.00490	.00487
	Gravel- Bad	.00546	.00498	.00495
	Gravel- Very Bad	.01113	.01066	.01063
	Earth - Bad	.01236	.01189	.01186
	Earth - Very Bad	.01854	.01807	.01804
BMP/DBST	Paved - Bad	.00099	.00052	.00049
	Paved - Very Bad	.00684	.00636	.00633
	Gravel- Good/Fair	.00292	.00245	.00242
	Gravel- Bad	.00300	.00253	.00250
	Gravel- Very Bad	.00868	.00821	.00818
	Earth - Bad	.00991	.00944	.00941
	Earth - Very Bad	.01609	.01562	.01559
Gravel	Gravel- Bad	.00218	.00171	.00168
	Gravel- Very Bad	.00786	.00739	.00736
	Earth - Bad	.00908	.00861	.00858
	Earth - Very Bad	.01526	.01479	.01476

E.I-8 Bridge Benefit

Equation : BRB = BRBu·Lb·VEH
BRBu= 0.0660·TRBu-0.000351

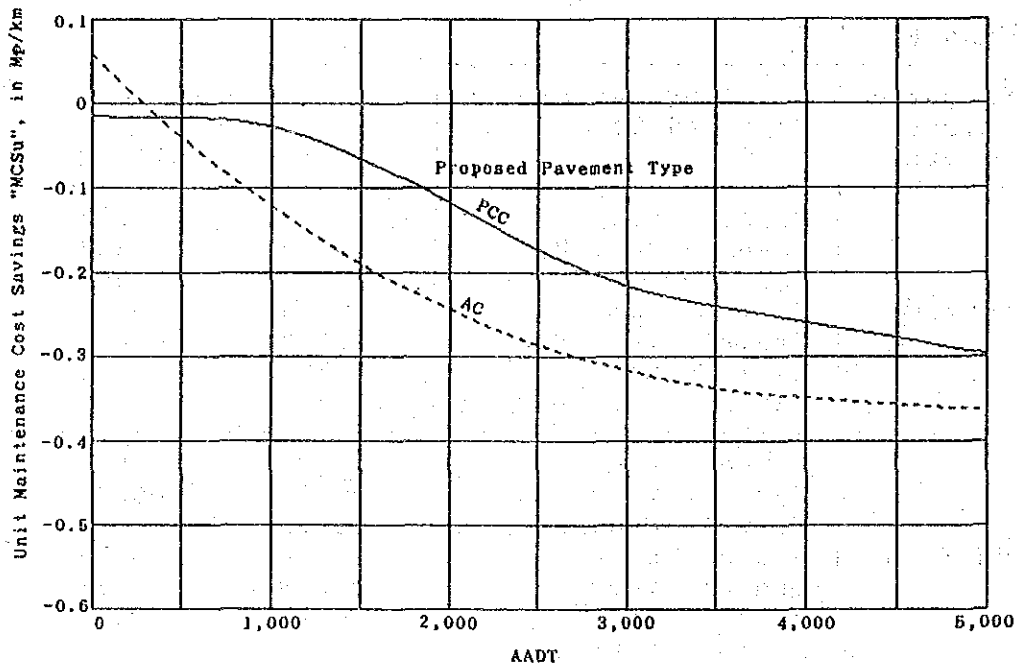
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from E.I-7

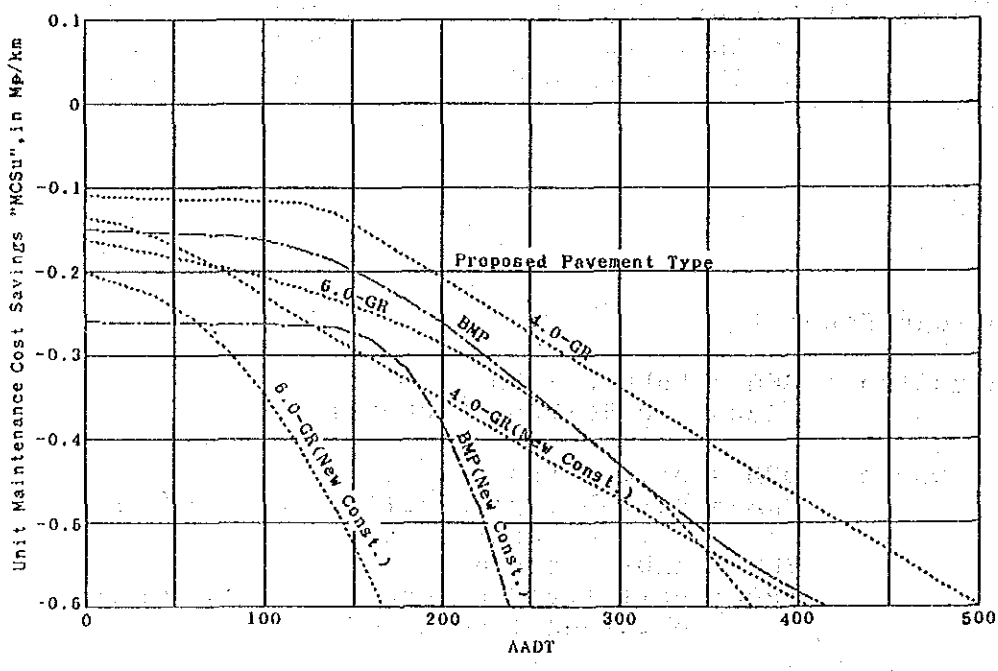
E.I-9 Maintenance Cost Savings

Equation : MCS = MCSu·Ls

where , MCS = maintenance cost savings, in Mp
MCSu= unit maintenance cost savings, in Mp/km, given in Chart below
Ls = subsection length, in km

Chart for estimating unit maintanance cost savings "MCSu"





E.I-10 B/C Ratio

Equation : $BC = TB/EC$

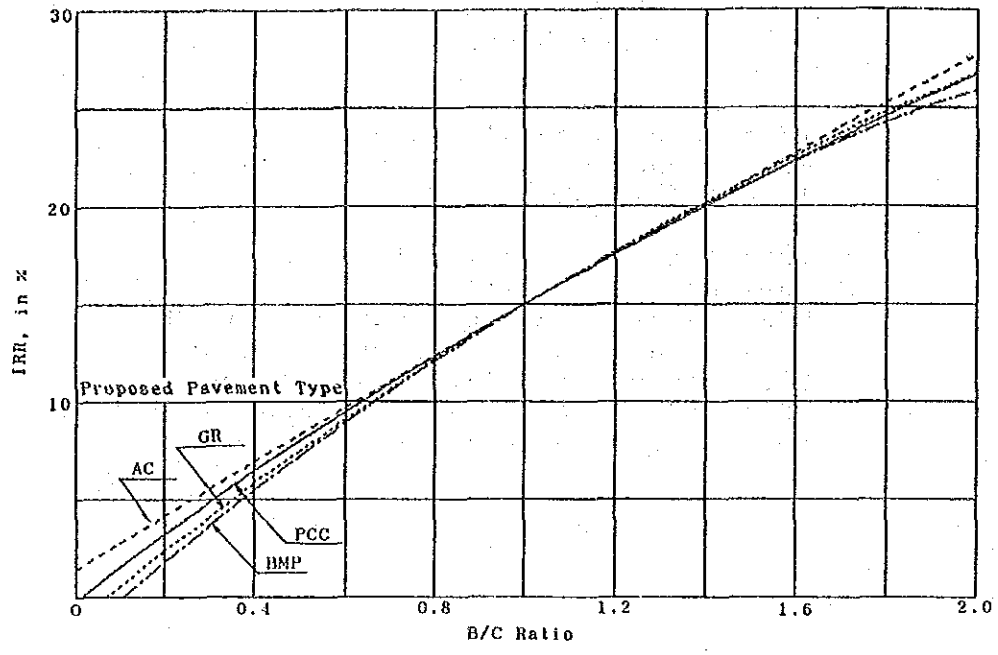
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

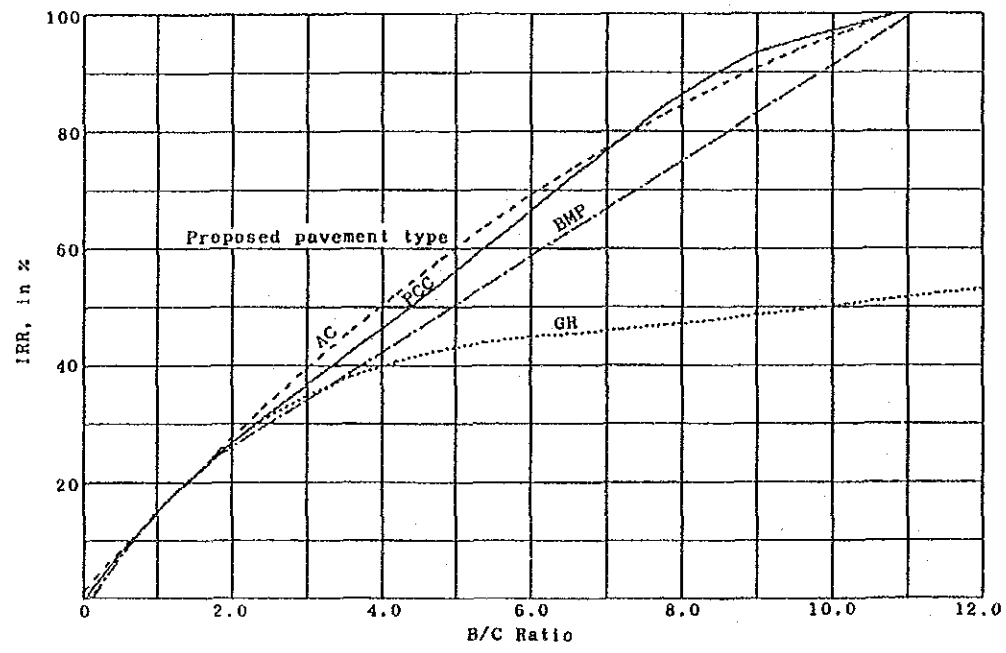
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB= traffic benefit, in Mp
BRB= bridge benefit, in Mp
MCS= maintenance cost savings, in Mp
RCC= road construction cost, in Mp
SPC= slope protection cost, in Mp
FSC= additional cost for flood section, in Mp
STC= structure cost, in Mp

E.I-11 Internal Rate of Return (IRR)

Obtain from Chart below.





PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - E)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pt	①	TOTAL ROAD LENGTH : Lt	③ KM	Pt / Lt (①/③)	⑤
CULTIVATED AREA WITHIN RIA : At	② HA	At / Lt (②/③)	④	AADT (REF. E.II - 1)	⑥
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	C : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ⑦										⑤
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑧										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑨										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑩										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑪										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. E.II - 2)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. E.II - 2) ⑫										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. E.II - 2) ⑬										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. E.II-2)										
COST (MP) — ROAD — UNIT COST/KM. (REF. E.II-4) ⑮										
COST (MP) — ROAD — COST (⑮ x ⑦) ⑯										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. E.II-5) ⑰										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. E.II-5) ⑲										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳										
COST (MP) — FLOOD SECTION — UNIT COST/KM. (1,976·⑩ + 0,173·⑭ - 0,850) ㉑										
COST (MP) — FLOOD SECTION — COST (㉑ x ⑪) ㉒										
COST (MP) — TOTAL COST (⑯ + ⑱ + ⑳ + ㉒)										㉓

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

									TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED									
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)									
PROPOSED TYPE (REF. E.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)									
BRIDGE — NO. OF LANES									
BRIDGE — LENGTH (M) ㉔									
BRIDGE — NO. OF SPANS (㉔ /20 & ROUND) ㉕									
BRIDGE — COST (MP) — SUPER-STRUCTURE — UNIT COST/M (REF. E.II-7) ㉖									
BRIDGE — COST (MP) — SUPER-STRUCTURE — COST (㉖ x ㉔) ㉗									
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. E.II-7) ㉘									
BRIDGE — COST (MP) — ABUTMENT — COST (㉘ x 2) ㉙									
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. E.II-7) ㉚									
BRIDGE — COST (MP) — PIER — COST (㉚ x (㉕ - 1)) ㉛									
BRIDGE — COST (MP) — TOTAL COST (㉗ + ㉙ + ㉛) ㉜									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉝									
SPILLWAY — COST (MP) — UNIT COST/M (REF. E.II-7) ㉞									
SPILLWAY — COST (MP) — COST (㉞ x ㉝) ㉟									
RCBC — 1-CELL OR 2-CELL									
RCBC — LENGTH (M) (USUALLY ⑭ + 3.0) ㊱									
RCBC — COST (MP) — RCBC — UNIT COST/M (REF. E.II-7) ㊲									
RCBC — COST (MP) — RCBC — COST (㊲ x ㊱) ㊳									
RCBC — COST (MP) — WINGWALL & APRON (REF. E.II-7) ㊴									
RCBC — COST (MP) — TOTAL COST (㊳ + ㊴) ㊵									
COST (MP) (㉜ + ㉟ + ㊵)									㊶

5) BENEFIT

BRIDGE LENGTH (M) (㉔ + ㊱) ㊷									
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM. (REF. E.II-8) ㊸									
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦) ㊹									
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0,066 x ㊸ - 0,000351 x ⑤) ㊺									
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷) ㊻									
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. E.II-10) ㊼									
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K + 0,001275 x ④ + 0,000019 x ⑤) ㊽									
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦) ㊾									
BENEFIT — MAINTE-NANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. E.II-11) ㊿									
BENEFIT — MAINTE-NANCE COST SAVINGS — BENEFIT (㊿ x ⑦) (51)									
BENEFIT — TOTAL BENEFIT (㊹ + ㊻ + ㊾ + (51)) (52)									

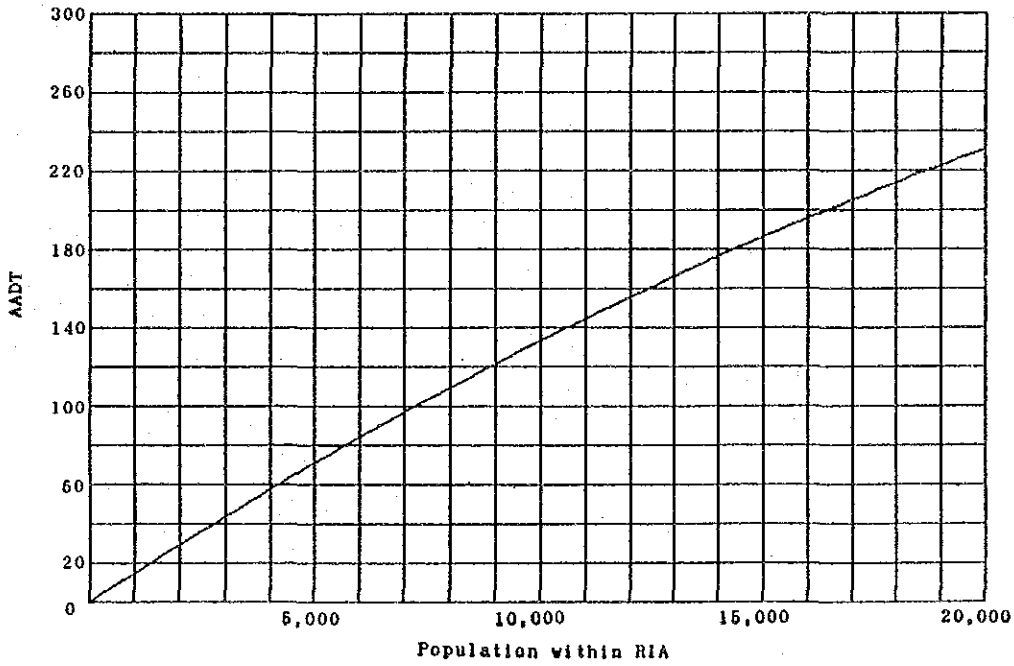
6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓ + ㊶) (53)	
ECONOMIC COST	((53) x 0,831) (54)	
B/C RATIO	((52) / (54))	
I R R	(REF. E.II-13)	

7) COMMENT

E.II-1 AADT

Obtain from Chart below.



E.II-2 Proposed Pavement Type

Apply E.I-1.

E.II-3 Proposed Structure Type

Apply E.I-2.

E.II-4 Road Construction Cost

Apply E.I-3.

E.II-5 Slope Protection Cost

Apply E.I-4.

E.II-6 Additional Cost for Flood Section

Apply E.I-5.

E.II-7 Structure Cost

Apply E.I-6.

E.II-8 Traffic Benefit

Equation : TRB = TRBu·Ls

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km,
given in Chart below
Ls = subsection length, in km

Selection of Chart for estimating unit traffic benefit "TRBu"

Population Distribution Pattern	Selection of Parameter	
	AADT	Population
A : Gradually Decreasing Pattern	Fig. A-1	Fig. A-2
B : Evenly Distributing Pattern	Fig. B-1	Fig. B-2
C : Tip Concentration Pattern	Fig. C-1	Fig. C-2

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - A
(Gradually Decreasing Pattern)

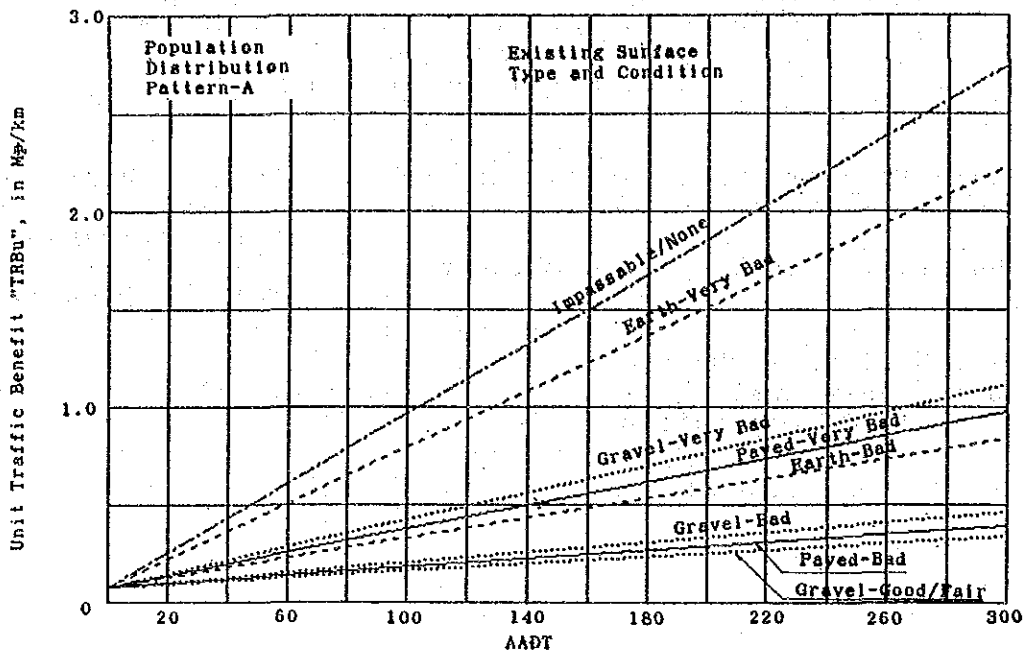


Figure A-1 "TRBu" Based on AADT

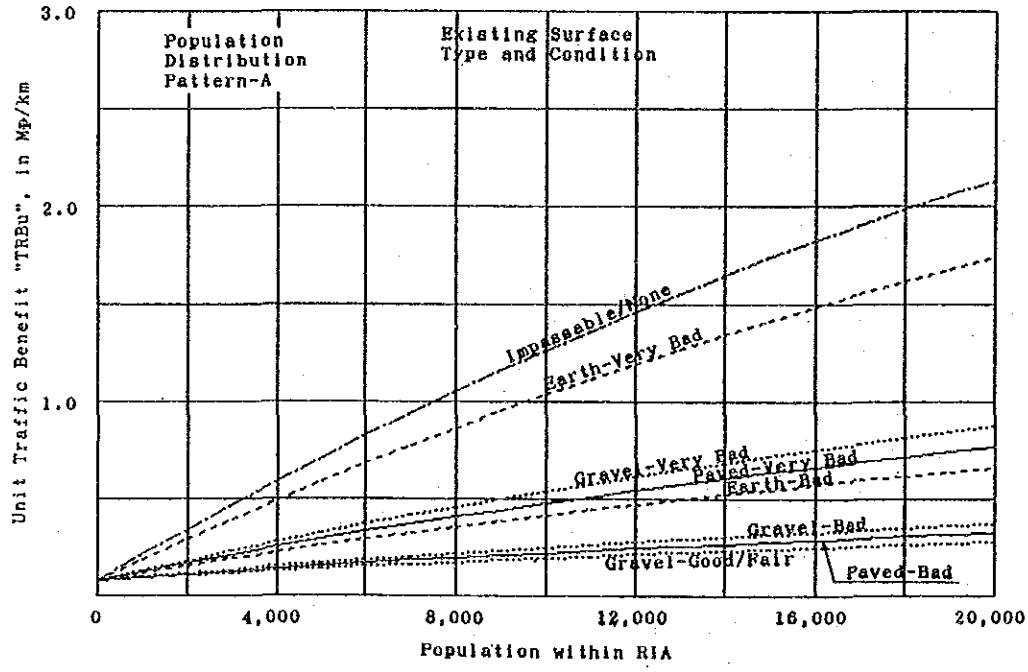


Figure A-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - B
(Evenly Distributing Pattern)

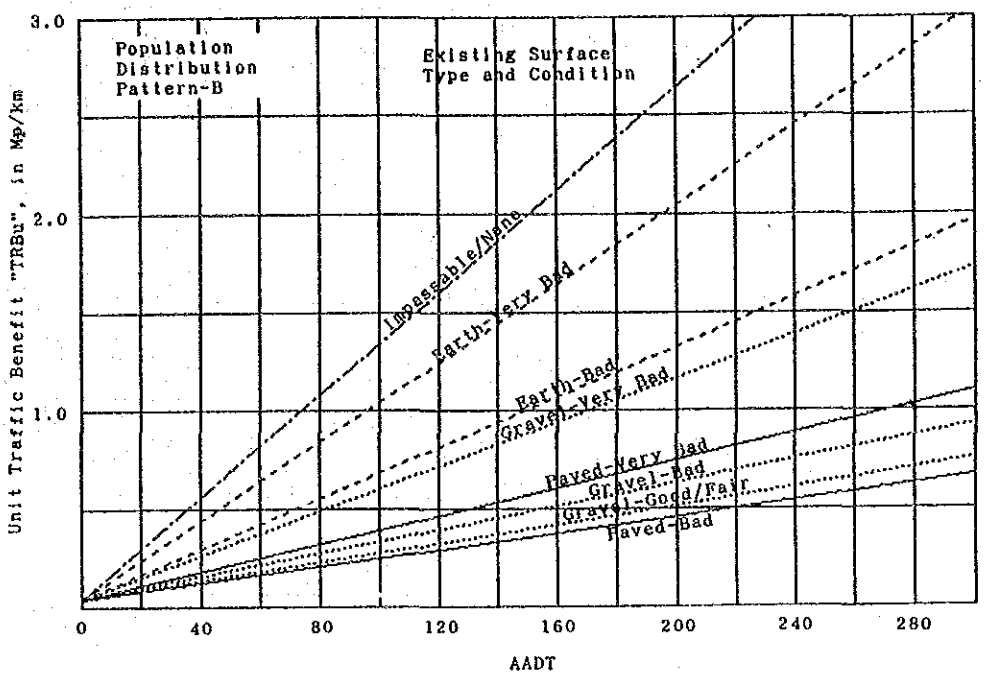


Figure B-1 "TRBu" Based on AADT

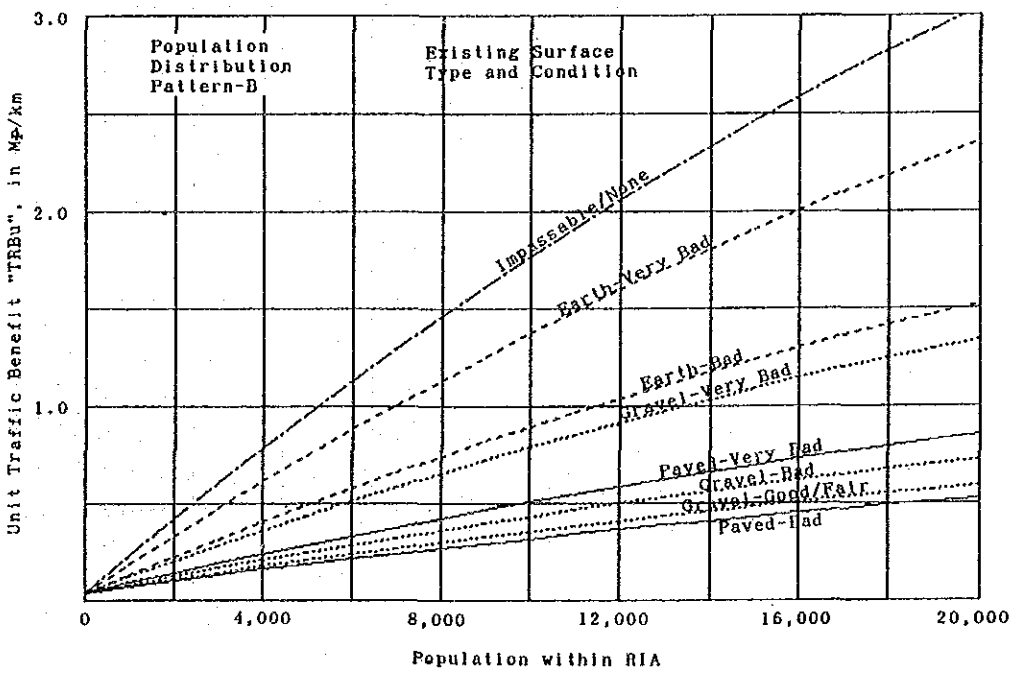


Figure B-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - C
(Tip Concentration Pattern)

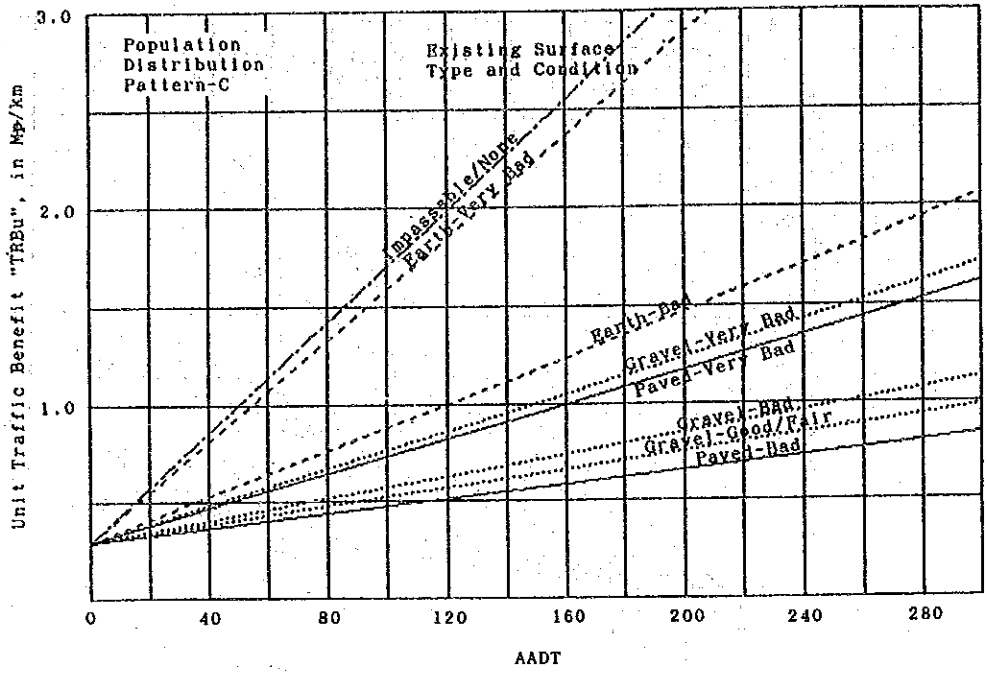


Figure C-1 "TRBu" Based on AADT

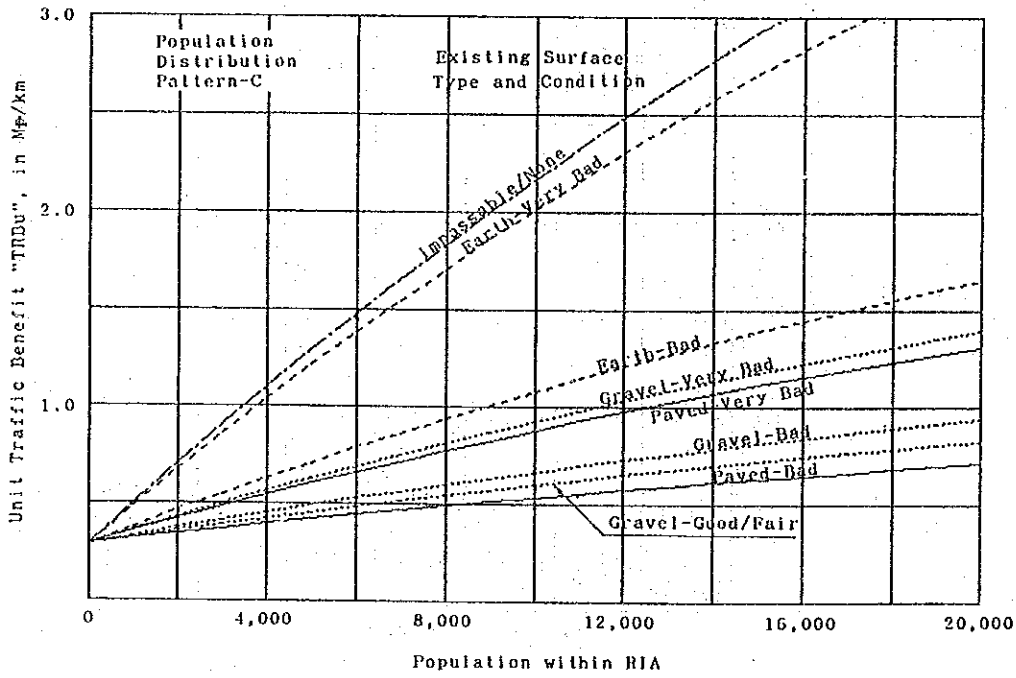


Figure C-2 "TRBu" Based on Population

E.II-9 Bridge Benefit

Equation : BRB = BRBu·Lb
BRBu= 0.0660·TRBu-0.000351·VEH

where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m
Lb = bridge length, in m
TRBu= unit traffic benefit, in Mp/km, obtained from E.II-8
VEH = AADT, in veh

E.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.001275·At/Lt+0.000019·Pt/Lt

where , DVB = development benefit, in Mp
DVBu= unit development benefit,in Mp/km
k = constant, given in Table below
At = total cultivated area within RIA, in ha
Pt = total population within RIA, in person
Lt = total road length, in km
Ls = subsection length, in km

Constant "k"

Existing Surface Type and Condition	Terrain		
	Flat	Rolling	Mountain's
Paved - Bad	-.626	-.685	-.693
Paved - Very Bad	-.283	-.343	-.350
Gravel- Good/Fair	.125	.065	.057
Gravel- Bad	.643	.584	.576
Gravel- Very Bad	.096	.037	.029
Earth - Bad	.217	.157	.149
Earth - Very Bad	-.019	-.078	-.086
Any - Impassable/ Non-exist'g	.070	.011	.003

E.II-11 Maintenance Cost Savings

Apply E.I-9.

E.II-12 B/C Ratio

Equation : BC = TB/EC

TB = TRB+BRB+DVB+MCS
EC = 0.831·TC
TC = RCC+SPC+FSC+STC

where , BC = B/C Ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB = traffic benefit, in Mp
BRB = bridge benefit, in Mp
DVB = development benefit, in Mp
MCS = maintenance cost savings, in Mp
RCC = road construction cost, in Mp
SPC = slope protection cost, in Mp
FSC = additional cost for flood section, in Mp
STC = structure cost, in Mp

E.II-13 Internal Rate of Return (IRR)

Apply E.I-11.

APPENDIX F

WORKSHEETS, EQUATIONS AND DATA FOR PROJECT EVALUATION IN PROVINCE GROUP - F

PROVINCES : Marinduque

Albay

Camarines Sur

Catanduanes

Sorsogon

Antique

Capiz

Negros Occidental

Misamis Occidental

Surigao del Norte

WORKSHEETS,EQUATIONS AND DATA FOR PROJECT EVALUATION
IN PROVINCE GROUPE - F

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - F)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) AADT

PRESENT AADT	LIGHT VEHICLE (CAR/VAN/JEEPNEY)		VEH.	%	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n =
	HEAVY VEHICLE (BUS / TRUCK)		VEH. ②	%		AADT IN OPENING YEAR (① x 1.03^n)	③
	TOTAL	①	VEH.	100 %			

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ④										
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑤										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑥										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑦										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑧										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. F.I-1)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. F.I-1) ⑨										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. F.I-1) ⑩										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑨+2x⑩) ⑪										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. F.I-1)										
COST (MP) — ROAD — UNIT COST/KM. (REF. F.I-3) ⑫										
COST (MP) — ROAD — COST (⑫x④) ⑬										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M (REF. F.I-4) ⑭										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑭x⑤) ⑮										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M (REF. F.I-4) ⑯										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑯x⑥) ⑰										
COST (MP) — FLOOD SECTION — UNIT COST/KM. (1.976·⑦+0.173·⑪-0.850) ⑱										
COST (MP) — FLOOD SECTION — COST (⑱x⑧) ⑲										
TOTAL COST (⑬+⑮+⑰+⑲)										⑳

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. F.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE — NO. OF LANES										
BRIDGE — LENGTH (M) ㉑										
BRIDGE — NO. OF SPANS (㉑/20 & ROUND) ㉒										
BRIDGE — COST (MP) — SUPER STRUCTURE — UNIT COST/M (REF. F.I-6) ㉓										
BRIDGE — COST (MP) — SUPER STRUCTURE — COST (㉓x㉑) ㉔										
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. F.I-6) ㉕										
BRIDGE — COST (MP) — ABUTMENT — COST (㉕x2) ㉖										
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. F.I-6) ㉗										
BRIDGE — COST (MP) — PIER — COST (㉗x(㉒-1)) ㉘										
BRIDGE — TOTAL COST (㉔+㉖+㉘) ㉙										
SPILLWAY — NO. OF LANES										
SPILLWAY — LENGTH (M) ㉚										
SPILLWAY — COST(MP) — UNIT COST/M (REF. F.I-6) ㉛										
SPILLWAY — COST(MP) — COST (㉛x㉚) ㉜										
RCBC — 1-CELL OR 2-CELL										
RCBC — LENGTH (M) (USUALLY ⑪+3.0) ㉝										
RCBC — COST (MP) — RCBC — UNIT COST/M (REF. F.I-6) ㉞										
RCBC — COST (MP) — RCBC — COST (㉞x㉝) ㉟										
RCBC — COST (MP) — WINGWALL & APRON (REF. F.I-6) ㊱										
RCBC — COST (MP) — TOTAL COST (㉟+㊱) ㊲										
COST (MP) (㉙+㉜+㊲)										㊳

5) BENEFIT

AADT IN OPENING YEAR (③)										
PERCENT HEAVY VEHICLES (②)										
BRIDGE LENGTH (M) (㉑ + ㉚) ㊴										
BENEFIT — TRAFFIC BENEFIT — CONSTANT "k" (REF. F.I-7) ㊵										
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM/VEH. (㊵+0.000060 x ②) ㊶										
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊶x④x③) ㊷										
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/M/VEH. (0.066 x ㊶ - 0.000351) ㊸										
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊸x㊴x③) ㊹										
BENEFIT — MAINTENANCE COST SAVINGS — UNIT BENEFIT/KM (REF. F.I-9) ㊺										
BENEFIT — MAINTENANCE COST SAVINGS — BENEFIT (㊺x④) ㊻										
TOTAL BENEFIT (㊷+㊹+㊻)										㊼

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (⑳+㊳)	㊽	
ECONOMIC COST (㊽ x 0.831)	㊾	
B/C RATIO (⑰ / ㊾)		
IRR (REF. F.I-11)		

7) COMMENT

F.I-1 Proposed Pavement Type

Select from Table below.

Pavement Type and Width

Road Class	AADT in Opening Year	Pavement Type 1)	Carriageway Width(m)	Shoulder Width (m) Flat	Roll'g	Mount
Primary Major	Over 2000	PCC 3)	6.7	3.0	2.0	1.5
	1000-2000	PCC 3)	6.7	2.5	1.5	1.0
	400-1000	AC 3)	6.7	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	2.0	1.5	1.0
	100- 200	BMP 2)3)	6.0	1.5	1.0	0.5
	Below 100	Gravel	6.0	1.5	1.0	0.5
Secondary Major	Over 2000	PCC 3)	6.7	2.5	1.5	1.0
	1000-2000	PCC 3)	6.0	2.5	1.5	1.0
	400-1000	AC 3)	6.0	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	Below 200	Gravel	6.0	1.0	0.5	0.5
Collector	Over 400	AC 3)	6.0	1.5	1.0	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	50- 200	Gravel	6.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	1.0	0.5	0.5
Feeder	Over 400	AC 3)	6.0	1.5	1.0	0.5
	200- 400	BMP 2)3)	6.0	1.0	0.5	0.5
	50- 200	Gravel	4.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	0.5	0.5	0.5

Note 1) Where existing pavement type is superior to the one posed above, use existing type.
2) BMP can be replaced by DBST where subgrade and drainage conditions are good. It is, however, recommended to assume BMP for budgetary and evaluation purposes.
3) Use AC overlay, where existing condition warrants the use of AC overlay.

Type of Improvement

Existing Surface Type	Existing Surface Condition	Existing Carriageway Width	Type of Improvement
Standard or Superior	Good/Fair	Standard	-
	Good/Fair	Substandard	Widening
	Bad/Very bad	any	Rehabilitation
Substandard or Non-existing	Good/Fair	any	Improvement-2
	Bad/Very bad	any	Improvement-1
	Impassable	any	New Construction

F.I-2 Proposed Structure Type

Select from Table below.

Existing Type	Proposed Type: Primary Major / Secondary Major	Proposed Type: Collector / Feeder	
Ford Crossing	2-lane Brigde (2-BR)	Carriageway width of approach road 4.0 m	1-lane Spillway (1-SW)
		Carriageway width of approach road 6.0 m	2-lane Spillway (2-SW)
Spillway	2-lane Bridge (2-BR)	-	
Timber Bridge	2-lane Bridge (2-BR)	AADT < 200	1-lane Bridge (1-BR)
		AADT > 200	2-lane Bridge (2-BR)
Bailey Bridge	2-lane Bridge (2-BR)	AADT < 300	-
		AADT > 300	2-lane Bridge (2-BR)

Note : Use RCBC instead of bridge where length is short and topography is suitable.

F.I-3 Road Construction Cost

Equation : RCC = RCCu·Ls

where , RCC = road construction cost, in Mp
RCCu= unit road construction cost, in Mp/km, given in Table below
Ls = subsection length, in km

Unit road construction cost "RCCu", in Mp/km

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	PCC	4.0	0.5	-	2.050	2.651
			1.0	1.827	2.264	-
			1.5	1.936	-	-
		6.0	0.5	-	-	3.065
			1.0	-	2.678	3.200
			1.5	2.651	2.952	-
			2.0	2.776	-	-
			2.5	2.914	-	-
		6.7	1.0	-	-	3.693
			1.5	-	3.142	3.768
			2.0	3.100	3.476	-
			2.5	3.466	-	-
			3.0	3.712	-	-
		Widening	0.5	-	-	0.923
			1.0	-	0.982	1.481
			1.5	0.873	1.892	-
			2.0	1.070	-	-
			2.5	1.168	-	-
	AC	4.0	0.5	-	1.909	2.516
			1.0	1.677	2.098	-
			1.5	1.820	-	-
		6.0	0.5	-	-	2.782
			1.0	-	2.364	2.858
			1.5	2.374	2.785	-
			2.0	2.565	-	-
			2.5	2.779	-	-
		6.7	1.0	-	-	3.369
			1.5	-	2.867	3.483
			2.0	2.865	3.172	-
			2.5	3.108	-	-
			3.0	3.315	-	-
		Widening	0.5	-	-	0.907
			1.0	-	0.944	1.478
			1.5	0.819	1.416	-
			2.0	1.023	-	-
			2.5	1.106	-	-

-- continued --

Unit road construction cost "RCCu", in Mp/km (continued)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	BMP	4.0	0.5	-	1.334	1.650
			1.0	1.199	1.769	-
			1.5	1.237	-	-
		6.0	0.5	-	1.818	2.350
			1.0	1.690	2.084	2.418
			1.5	1.744	2.398	-
			2.0	1.978	-	-
		Widening	0.5	-	0.714	0.879
			1.0	0.592	0.842	1.388
			1.5	0.650	-	-
			2.0	0.668	-	-
	Gravel	4.0	0.5	0.482	0.511	0.601
			1.0	0.526	-	-
		6.0	0.5	-	0.965	1.321
			1.0	0.714	1.013	1.510
			1.5	0.823	1.045	-
			2.0	0.896	-	-
	Overlay	4.0	any	1.048	1.048	1.048
		6.0	any	1.325	1.325	1.325
		6.7	any	1.505	1.505	1.505
New Construction	PCC	6.0	1.0	-	-	4.184
			1.5	-	3.790	-
			2.0	3.534	-	-
			2.5	3.739	-	-
		6.7	1.0	-	-	4.434
			1.5	-	4.040	5.064
			2.0	3.781	4.618	-
			2.5	3.989	-	-
			3.0	4.152	-	-
	AC	6.0	0.5	-	-	3.228
			1.0	-	2.900	3.863
			1.5	2.920	3.484	-
			2.0	3.346	-	-
			2.5	3.630	-	-
		6.7	1.0	-	-	4.072
			1.5	-	3.690	4.712
			2.0	3.552	4.281	-
			2.5	3.808	-	-
			3.0	4.007	-	-
	BMP	4.0	0.5	-	1.534	1.815
			1.0	1.334	-	-
		6.0	0.5	-	2.197	2.637
			1.0	2.193	2.758	3.250
			1.5	2.598	2.846	-
			2.0	2.684	-	-
	Gravel	4.0	0.5	0.536	0.611	0.713
			1.0	0.643	-	-
		6.0	0.5	-	1.637	2.003
			1.0	1.430	1.772	-
			1.5	1.553	-	-

F.I-4 Slope Protection Cost

Equation : SPC = SPCC+SPCE

SPCC = SPCCu·Lc
SPCE = SPCEu·Le

where , SPC = slope protection cost, in Mp
SPCC = cut slope protection cost, in Mp
SPCE = embankment slope protection cost, in Mp

SPCCu= unit cost for cut slope protection, in Mp/m, given in Table below
SPCEu= unit cost for embankment slope protection, in Mp/m, given in Table below
Lc = length of cut slope to be protected, in m
Le = length of embankment slope to be protected, in m

Unit cost for slope protection "SPCCu","SPCEu", in Mp/m

Item		Unit Cost
Cut Slope Protection	"SPCCu"	0.0253
Embankment Slope Protection	"SPCEu"	0.0275

F.I-5 Additional Cost for Flood Section

Equation : FSC = FSCu·Lf
FSCu= 1.976·Df+0.173·Wr-0.850

where , FSC = additional cost for flood section, in Mp
FSCu= unit additional cost for flood section, in Mp/km
Lf = length of flood section, in km
Df = flood depth, in m
Wr = road width, in m

F.I-6 Structure Cost

Equation : STC = BRC+SWC+BCC

BRC = SSu·Lss+ABu·Nab+PRu·Npr
SWC = SWu·Lsw
BCC = BCu·Lbc+WW

where , STC = structure cost, in Mp
BRC = bridge cost, in Mp
SWC = spillway cost, in Mp
BCC = RCBC cost, in Mp

SSu = unit cost of superstructure, in Mp/m, given in Table below
ABu = unit cost of abutment, in Mp/each, given in Table below
PRu = unit cost of pier, in Mp/each, given in Table below
Lss = length of superstructure, in m
Nab = number of abutments
Npr = number of piers
SWu = unit cost of spillway, in Mp/m, given in Table below
Lsw = length of spillway, in m
BCu = unit cost of RCBC, in Mp/m,given in Table below
Lbc = length of RCBC, in m, usually road width plus 3.0 m
WW = cost for wingwall and apron, in Mp/set(both sides total), given in Table below

Unit cost "SSu","ABu","PRu","SWu","BCu","WW"

Type of Structure	Item		Unit Cost
2-lane Bridge	Superstructure	"SSu"	0.0478 Mp/m
	Abutment	"ABu"	0.3630 Mp/each
	Pier	"PRu"	0.3135 Mp/each
1-lane Bridge	Superstructure	"SSu"	0.0357 Mp/m
	Abutment	"ABu"	0.2530 Mp/each
	Pier	"PRu"	0.2200 Mp/each
2-lane Spillway	Spillway	"SWu"	0.0182 Mp/m
1-lane Spillway	Spillway	"SWu"	0.0132 Mp/m
1-cell RCBC	RCBC	"BCu"	0.0227 Mp/m
	Wingwall/Apron	"WW "	0.1452 Mp/set
2-cell RCBC	RCBC	"BCu"	0.0396 Mp/m
	Wingwall/Apron	"WW "	0.1705 Mp/set

F.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k+0.000060·HV

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km/veh
Ls = subsection length, in km
VEH = AADT, in veh
HV = percent heavy vehicles, in %
k = constant, given in Table below

Constant "k"

Proposed Pavemrnt Type	Existing Surface Type and Condition	Terrain		
		Flat	Rolling	Mountain's
PCC/AC	Paved - Bad	.00431	.00470	.00588
	Paved - Very Bad	.00871	.00910	.01028
	Gravel- Good/Fair	.00528	.00567	.00685
	Gravel- Bad	.00532	.00571	.00689
	Gravel- Very Bad	.00997	.01036	.01154
	Earth - Bad	.01102	.01141	.01259
	Earth - Very Bad	.01633	.01672	.01790
BMP/DBST	Paved - Bad	.00234	.00272	.00390
	Paved - Very Bad	.00674	.00712	.00830
	Gravel- Good/Fair	.00331	.00370	.00487
	Gravel- Bad	.00335	.00373	.00491
	Gravel- Very Bad	.00799	.00838	.00956
	Earth - Bad	.00905	.00944	.01061
	Earth - Very Bad	.01436	.01475	.01592
Gravel	Gravel- Bad	.00282	.00321	.00439
	Gravel- Very Bad	.00747	.00785	.00903
	Earth - Bad	.00852	.00891	.01009
	Earth - Very Bad	.01383	.01422	.01540

F.I-8 Bridge Benefit

Equation : BRB = BRBu·Lb·VEH
BRBu= 0.0660·TRBu-0.000351

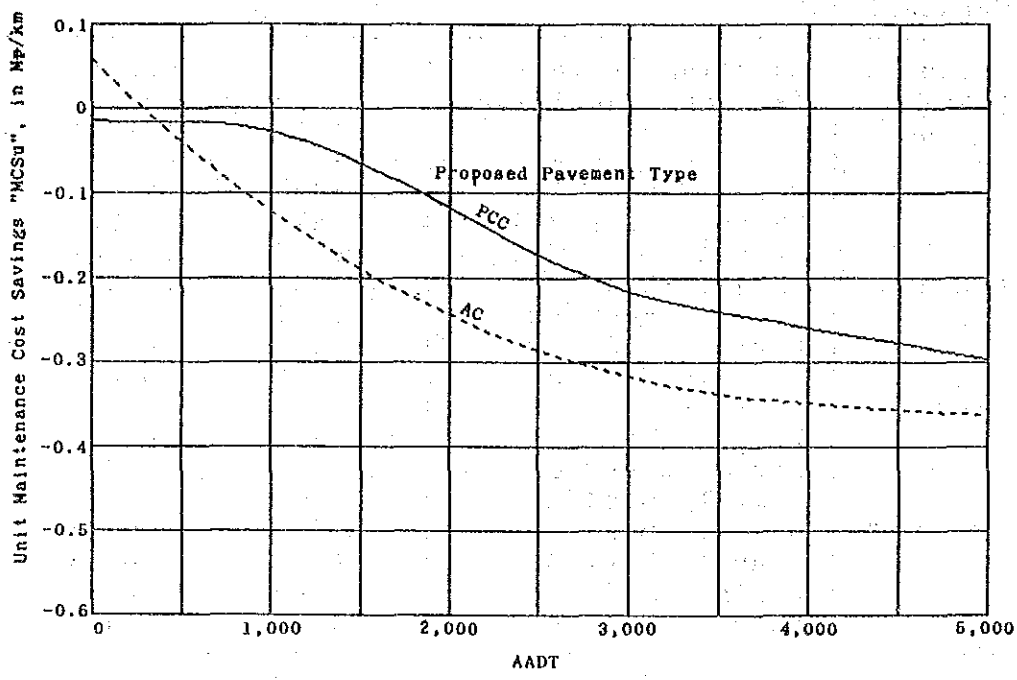
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from F.I-7

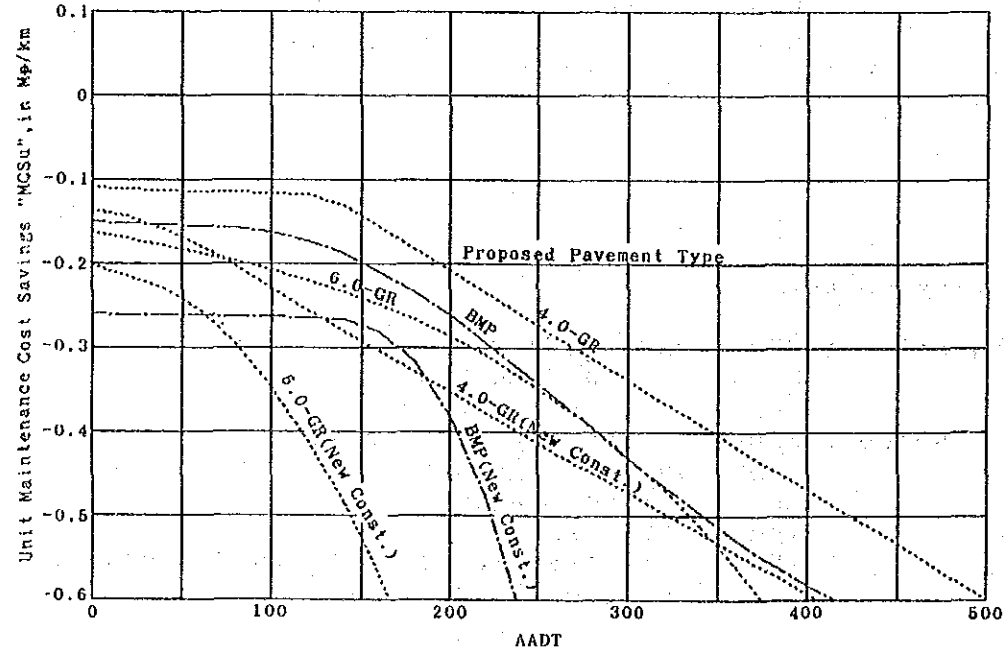
F.I-9 Maintenance Cost Savings

Equation : MCS = MCSu·Ls

where , MCS = maintenance cost savings, in Mp
MCSu= unit maintenance cost savings, in Mp/km, given in Chart below
Ls = subsection length, in km

Chart for estimating unit maintanance cost savings "MCSu"





F.I-10 B/C Ratio

Equation : $BC = TB/EC$

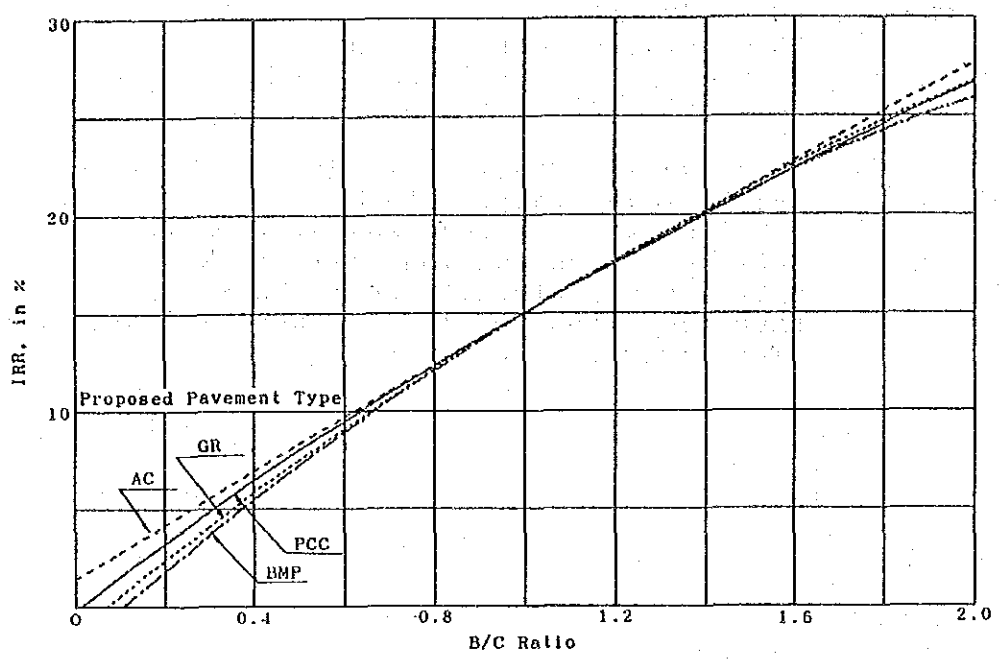
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

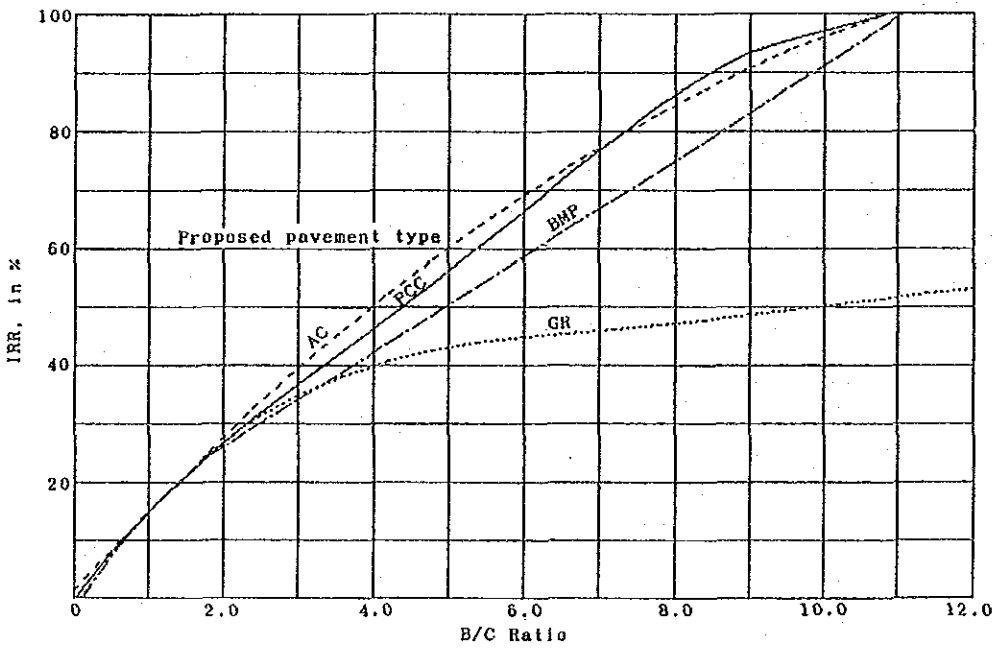
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB= traffic benefit, in Mp
BRB= bridge benefit, in Mp
MCS= maintenance cost savings, in Mp
RCC= road construction cost, in Mp
SPC= slope protection cost, in Mp
FSC= additional cost for flood section, in Mp
STC= structure cost, in Mp

F.I-11 Internal Rate of Return (IRR)

Obtain from Chart below.





PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - F)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pt	①	TOTAL ROAD LENGTH : Lt	③ KM	Pt/Lt (①/③)	⑤
CULTIVATED AREA WITHIN RIA : At	② HA	At/Lt (②/③)	④	AADT (REF. F.II - 1)	⑥
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	C : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ⑦										③
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑧										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑨										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑩										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑪										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. F.II - 2)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. F.II - 2) ⑫										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. F.II - 2) ⑬										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. F.II - 2)										
COST (MP) — ROAD — UNIT COST/KM. (REF. F.II - 4) ⑮										
COST (MP) — ROAD — COST (⑮ x ⑦) ⑯										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. F.II - 5) ⑰										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. F.II-5) ⑲										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳										
COST (MP) — FLOOD SECTION — UNIT COST/KM. (1.976·⑩ + 0.173·⑭ - 0.850) ㉑										
COST (MP) — FLOOD SECTION — COST (㉑ x ⑪) ㉒										
TOTAL COST (⑯ + ⑱ + ⑳ + ㉒)										㉓

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

									TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED									
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)									
PROPOSED TYPE (REF. F.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)									
BRIDGE — NO. OF LANES									
BRIDGE — LENGTH (M) ㉔									
BRIDGE — NO. OF SPANS (㉔ /20 & ROUND) ㉕									
BRIDGE — COST (MP) — SUPER-STRUCTURE — UNIT COST/M (REF. F.II-7) ㉖									
BRIDGE — COST (MP) — SUPER-STRUCTURE — COST (㉖ x ㉔) ㉗									
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. F.II-7) ㉘									
BRIDGE — COST (MP) — ABUTMENT — COST (㉘ x 2) ㉙									
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. F.II-7) ㉚									
BRIDGE — COST (MP) — PIER — COST (㉚ x (㉕ - 1)) ㉛									
BRIDGE — TOTAL COST (㉗ + ㉙ + ㉛) ㉜									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉝									
SPILLWAY — COST (MP) — UNIT COST/M (REF. F.II-7) ㉞									
SPILLWAY — COST (MP) — COST (㉞ x ㉝) ㉟									
RCBC — 1-CELL OR 2-CELL									
RCBC — LENGTH (M) (USUALLY ⑭ + 3.0) ㊱									
RCBC — COST (MP) — RCBC — UNIT COST/M (REF. F.II-7) ㊲									
RCBC — COST (MP) — RCBC — COST (㊲ x ㊱) ㊳									
RCBC — COST (MP) — WINGWALL & APRON (REF. F.II-7) ㊴									
RCBC — COST (MP) — TOTAL COST (㊳ + ㊴) ㊵									
COST (MP) (㉜ + ㉟ + ㊵)									㊶

5) BENEFIT

										TOTAL
BRIDGE LENGTH (M) (㉔ + ㉝) ㊷										
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM. (REF. F.II-6) ㊸										
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦) ㊹										
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0.066 x ㊷ - 0.000351 x ⑥) ㊺										
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷) ㊻										
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. F.II-10) ㊼										
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K + 0.002613 x ④ - 0.000058 x ⑤) ㊽										
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦) ㊾										
BENEFIT — MAINTE-NANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. F.II-11) ㊿										
BENEFIT — MAINTE-NANCE COST SAVINGS — BENEFIT (㊿ x ⑦) (51)										
TOTAL BENEFIT (㊹ + ㊻ + ㊾ + (51))										(52)

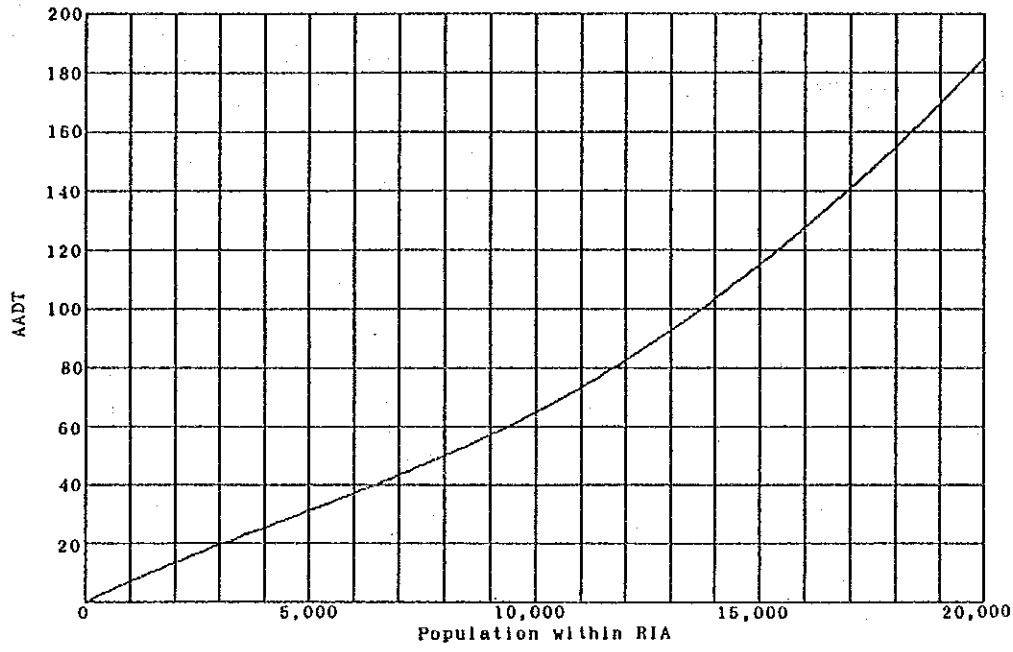
6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓ + ㊶) (53)	
ECONOMIC COST	((53) x 0.831) (54)	
B/C RATIO	((52) / (54))	
I R R	(REF. F.II-13)	

7) COMMENT

F.II-1 AADT

Obtain from Chart below.



F.II-2 Proposed Pavement Type

Apply F.I-1.

F.II-3 Proposed Structure Type

Apply F.I-2.

F.II-4 Road Construction Cost

Apply F.I-3.

F.II-5 Slope Protection Cost

Apply F.I-4.

F.II-6 Additional Cost for Flood Section

Apply F.I-5.

F.II-7 Structure Cost

Apply F.I-6.

F.II-8 Traffic Benefit

Equation : TRB = TRBu·Ls

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km, given in Chart below
Ls = subsection length, in km

Selection of Chart for estimating unit traffic benefit "TRBu"

Population Distribution Pattern	Selection of Parameter	
	AADT	Population
A : Gradually Decreasing Pattern	Fig. A-1	Fig. A-2
B : Evenly Distributing Pattern	Fig. B-1	Fig. B-2
C : Tip Concentration Pattern	Fig. C-1	Fig. C-2

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - A
(Gradually Decreasing Pattern)

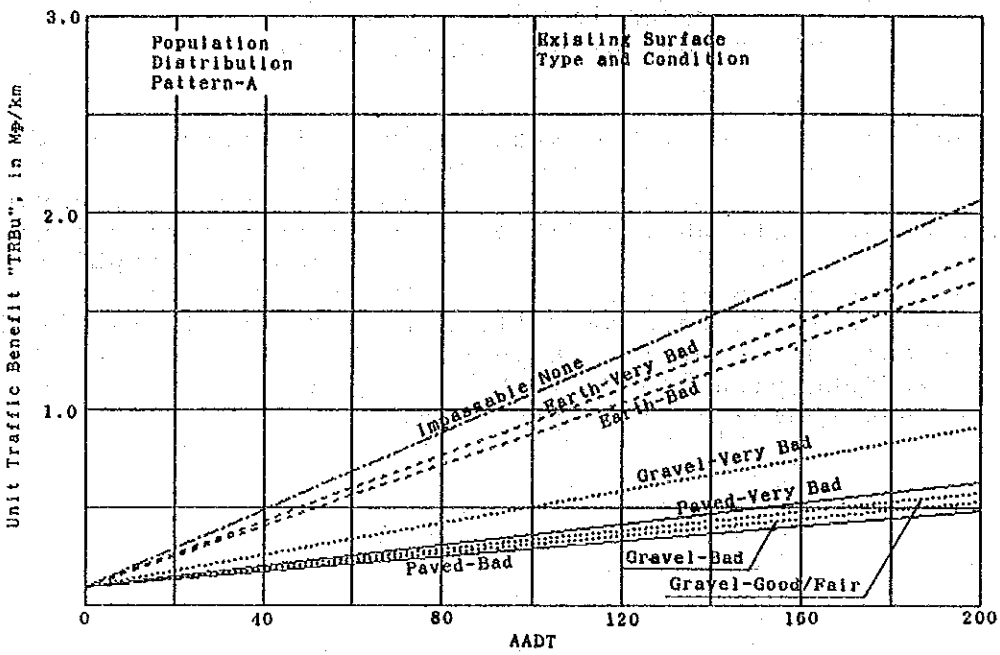


Figure A-1 "TRBu" Based on AADT

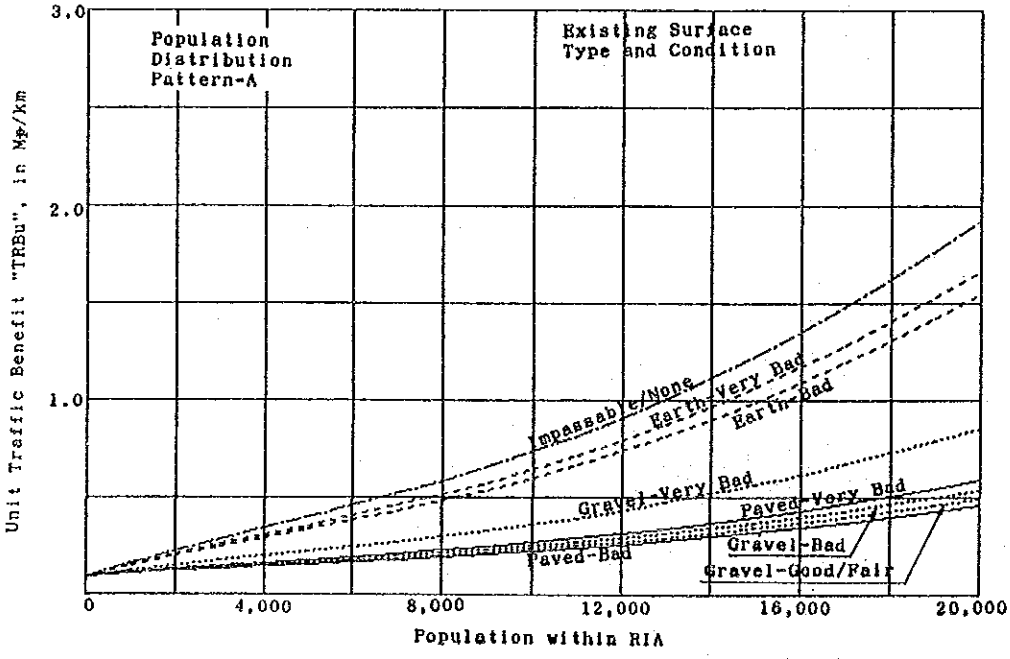


Figure A-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - B
(Evenly Distributing Pattern)

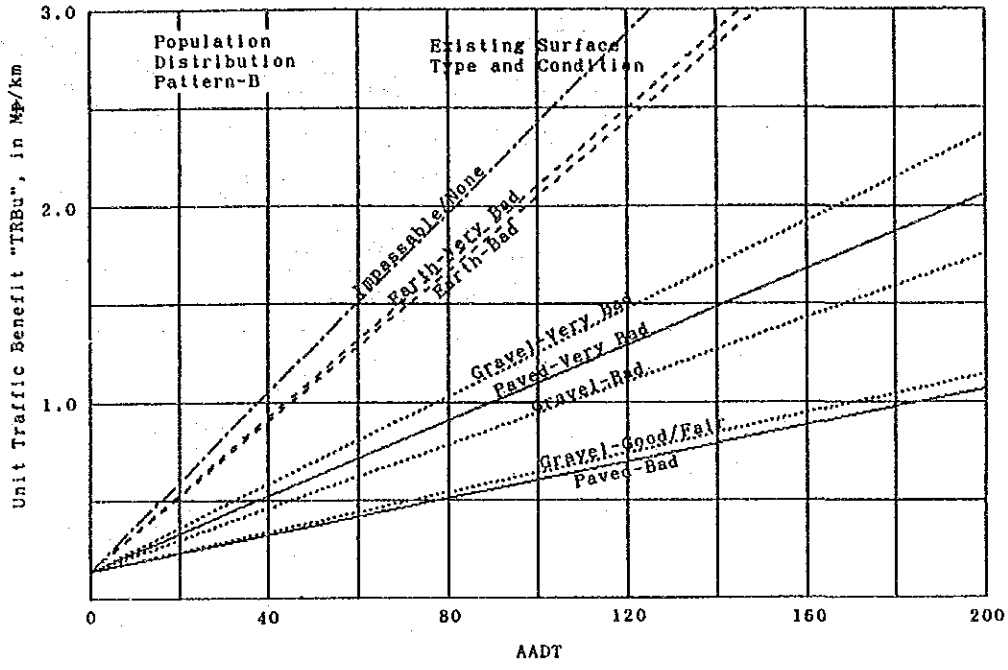


Figure B-1 "TRBu" Based on AADT

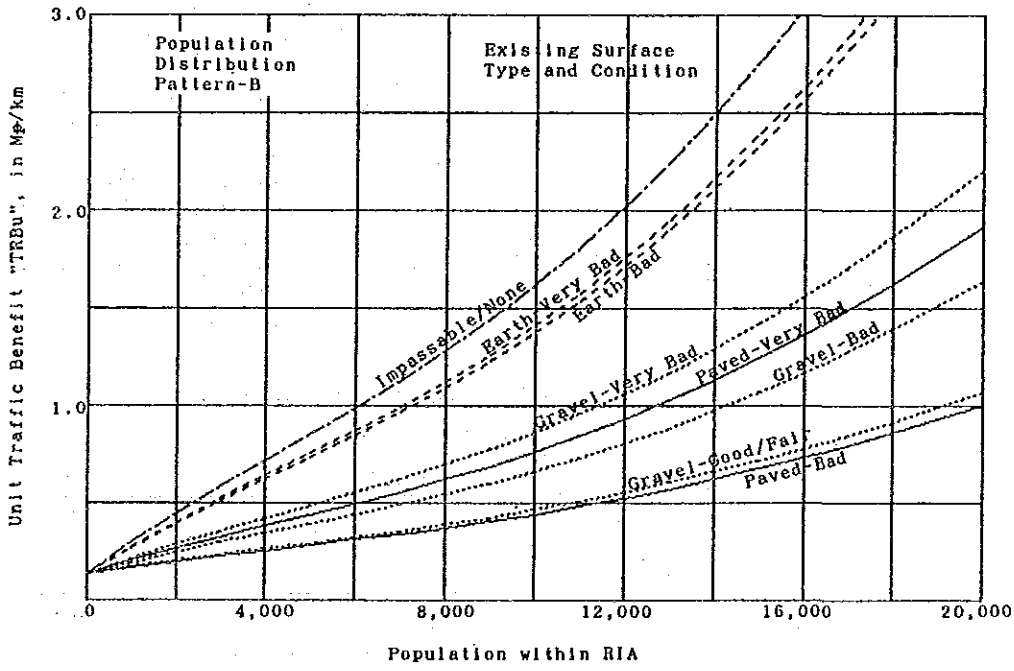


Figure B-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - C
(Tip Concentration Pattern)

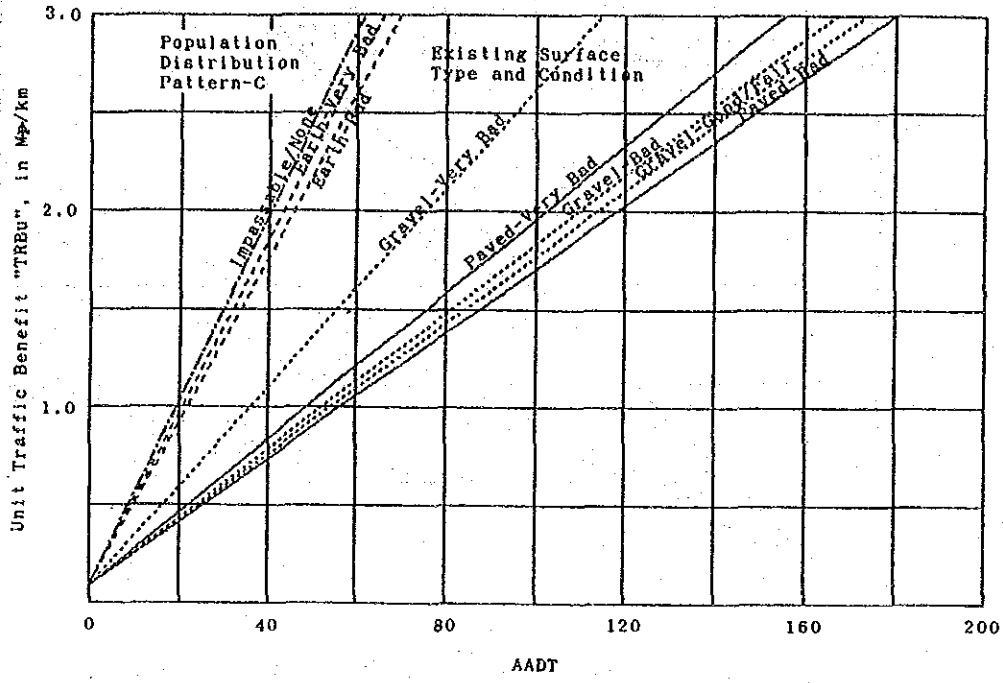


Figure C-1 "TRBu" Based on AADT

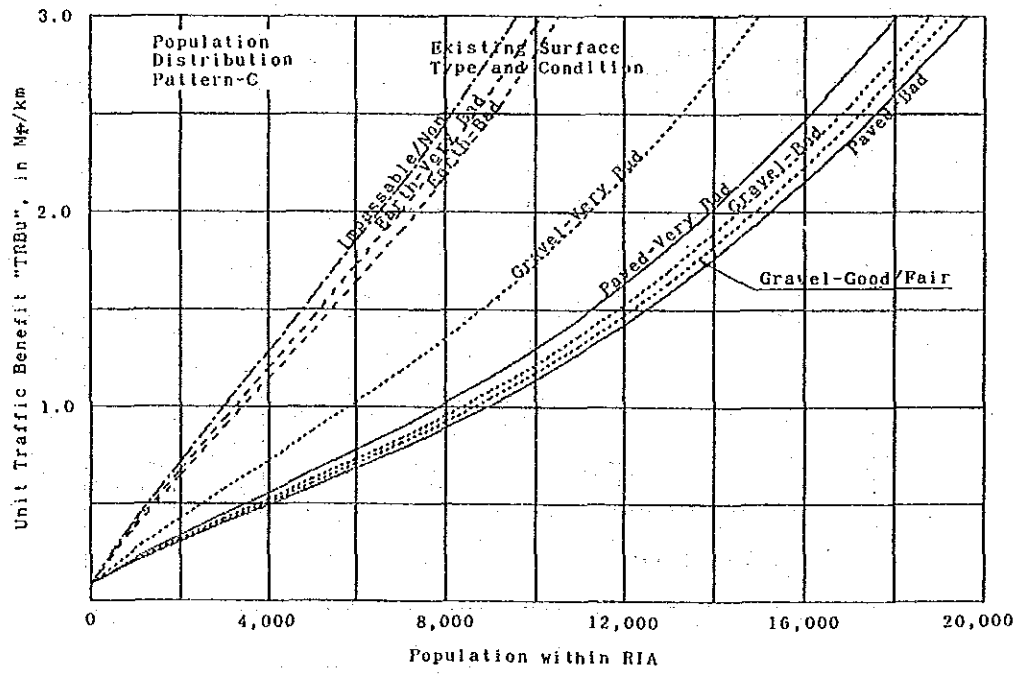


Figure C-2 "TRBu" Based on Population

F.II-9 Bridge Benefit

Equation : BRB = BRBu·Lb
BRBu= 0.0660·TRBu-0.000351·VEH

where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m
Lb = bridge length, in m
TRBu= unit traffic benefit, in Mp/km, obtained from F.II-8
VEH = AADT, in veh

F.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.002613·At/Lt-0.000058·Pt/Lt

where , DVB = development benefit, in Mp
DVBu= unit development benefit,in Mp/km
k = constant, given in Table below
At = total cultivated area within RIA, in ha
Pt = total population within RIA, in person
Lt = total road length, in km
Ls = subsection length, in km

Constant "k"

Existing Surface Type and Condition	Terrain		
	Flat	Rolling	Mountain's
Paved - Bad	.222	-.038	.036
Paved - Very Bad	.336	.076	.150
Gravel- Good/Fair	.488	.228	.302
Gravel- Bad	.285	.025	.099
Gravel- Very Bad	.127	-.133	-.059
Earth - Bad	.487	.227	.301
Earth - Very Bad	-.023	-.283	-.209
Any - Impassable/ Non-exist'g	.443	.183	.256

F.II-11 Maintenance Cost Savings

Apply F.I-9.

F.II-12 B/C Ratio

Equation : BC = TB/EC

TB = TRB+BRB+DVB+MCS
EC = 0.831·TC
TC = RCC+SPC+FSC+STC

where , BC = B/C Ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB = traffic benefit, in Mp
BRB = bridge benefit, in Mp
DVB = development benefit, in Mp
MCS = maintenance cost savings, in Mp
RCC = road construction cost, in Mp
SPC = slope protection cost, in Mp
FSC = additional cost for flood section, in Mp
STC = structure cost, in Mp

F.II-13 Internal Rate of Return (IRR)

Apply F.I-11.

APPENDIX G

WORKSHEETS, EQUATIONS AND DATA FOR PROJECT EVALUATION IN PROVINCE GROUP - G

PROVINCES : Ilocos Norte

Ilocos Sur

Batanes

Nueva Vizcaya

Batangas

Romblon

Bohol

Siquijor

Southern Leyte

Camiguin

Lanao del Sur

WORKSHEETS,EQUATIONS AND DATA FOR PROJECT EVALUATION
IN PROVINCE GROUPE - G

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - G)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) AADT

PRESENT AADT	LIGHT VEHICLE (CAR/VAN/JEEPNEY)		VEH.	%	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n =
	HEAVY VEHICLE (BUS / TRUCK)		VEH. ②	%			
	TOTAL	①	VEH.	100 %		AADT IN OPENING YEAR (①x 1.03^n)	③

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										TOTAL
LENGTH OF SUBSECTION (KM) ④										
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT	SLOPE PROTECTION	CUT SLOPE LENGTH (M) ⑤								
		EMBANKMENT SLOPE LENGTH (M) ⑥								
	FLOOD SECTION	FLOOD DEPTH (M) ⑦								
		FLOOD SECTION LENGTH (M) ⑧								
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. G.I-1)									
	CARRIAGEWAY WIDTH (M) (REF. G.I-1) ⑨									
	SHOULDER WIDTH (M) (REF. G.I-1) ⑩									
	TOTAL WIDTH (M) (⑨+2x⑩) ⑪									
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. G.I-1)									
COST (MP)	ROAD	UNIT COST/KM. (REF. G.I-3) ⑫								
		COST (⑫x④) ⑬								
	SLOPE PROTECTION	CUT SLOPE UNIT COST/M (REF. G.I-4) ⑭								
		CUT SLOPE COST (⑭x⑤) ⑱								
		EMBANK SLOPE UNIT COST/M (REF. G.I-4) ⑯								
		EMBANK SLOPE COST (⑯x⑥) ⑰								
	FLOOD SECTION	UNIT COST/KM. (1.976·⑦+0.173·⑪-0.850) ⑱								
		COST (⑱x⑧) ⑲								
	TOTAL COST (⑬+⑮+⑰+⑲)									⑳

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										TOTAL
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. G.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE	NO. OF LANES									
	LENGTH (M) ㉑									
	NO. OF SPANS (㉑/20 & ROUND) ㉒									
	COST (MP) SUPER STRUCTURE	UNIT COST/M (REF. G.I-6) ㉓								
		COST (㉓x㉑) ㉔								
	ABUTMENT	UNIT COST/EACH (REF. G.I-6) ㉕								
		COST (㉕x2) ㉖								
	PIER	UNIT COST/EACH (REF. G.I-6) ㉗								
		COST (㉗x(㉒-1)) ㉘								
	TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY	NO. OF LANES									
	LENGTH (M) ㉚									
	COST (MP) UNIT COST/M (REF. G.I-6) ㉛									
	COST (㉛x㉚) ㉜									
RCBC	1-CELL OR 2-CELL									
	LENGTH (M) (USUALLY ⑪+3.0) ㉝									
	COST (MP) RCSC UNIT COST/M (REF. G.I-6) ㉞									
	RCSC COST (㉞x㉝) ㉟									
	WINGWALL & APRON (REF. G.I-6) ㊱									
	TOTAL COST (㉟+㊱) ㊲									
COST (MP) (㉙+㉜+㊲)										㊳

5) BENEFIT

AADT IN OPENING YEAR (③) ③										
PERCENT HEAVY VEHICLES (②) ②										
BRIDGE LENGTH (M) (② + ㉚) ㊴										
BENEFIT	TRAFFIC BENEFIT	CONSTANT "k" (REF. G.I-7) ㊵								
		UNIT BENEFIT/KM/VEH. (㊵) ㊶								
		BENEFIT (㊶x④x③) ㊷								
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066 x ㊶ - 0.00035) ㊸								
		BENEFIT (㊸x㊴x③) ㊹								
	MAINTE-NANCE COST SAVINGS	UNIT BENEFIT/KM (REF. G.I-9) ㊺								
		BENEFIT (㊺x④) ㊻								
	TOTAL BENEFIT (㊷+㊹+㊻)									㊼

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (⑳+㊳)	㊽	
ECONOMIC COST (㊽ x 0.831)	㊾	
B/C RATIO (㊼ / ㊾)		
IRR (REF. G.I-11)		

7) COMMENT

G.I-1 Proposed Pavement Type

Select from Table below.

Pavement Type and Width

Road Class	AADT in Opening Year	Pavement Type 1)	Carriageway Width(m)	Shoulder Width (m) Flat	Roll'g	Mount
Primary Major	Over 2000	PCC 3)	6.7	3.0	2.0	1.5
	1000-2000	PCC 3)	6.7	2.5	1.5	1.0
	400-1000	AC 3)	6.7	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	2.0	1.5	1.0
	100- 200	BMP 2)3)	6.0	1.5	1.0	0.5
	Below 100	Gravel	6.0	1.5	1.0	0.5
Secondary Major	Over 2000	PCC 3)	6.7	2.5	1.5	1.0
	1000-2000	PCC 3)	6.0	2.5	1.5	1.0
	400-1000	AC 3)	6.0	2.0	1.5	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	Below 200	Gravel	6.0	1.0	0.5	0.5
Collector	Over 400	AC 3)	6.0	1.5	1.0	1.0
	200- 400	BMP 2)3)	6.0	1.5	1.0	1.0
	50- 200	Gravel	6.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	1.0	0.5	0.5
Feeder	Over 400	AC 3)	6.0	1.5	1.0	0.5
	200- 400	BMP 2)3)	6.0	1.0	0.5	0.5
	50- 200	Gravel	4.0	1.0	0.5	0.5
	Below 50	Gravel	4.0	0.5	0.5	0.5

Note 1) Where existing pavement type is superior to the one poposed above, use existing type.
2) BMP can be replaced by DBST where subgrade and drainage conditions are good. It is, however, recommended to assume BMP for budgetary and evaluation purposes.
3) Use AC overlay, where existing condition warrants the use of AC overlay.

Type of Improvement

Existing Surface Type	Existing Surface Condition	Existing Carriageway Width	Type of Improvement
Standard or Superior	Good/Fair	Standard	-
	Good/Fair	Substandard	Widening
	Bad/Very bad	any	Rehabilitation
Substandard or Non-existing	Good/Fair	any	Improvement-2
	Bad/Very bad	any	Improvement-1
	Impassable	any	New Construction

G.I-2 Proposed Structure Type

Select from Table below.

Existing Type	Proposed Type: Primary Major / Secondary Major	Proposed Type: Collector / Feeder	
Ford Crossing	2-lane Brigde (2-BR)	Carriageway width of approach road 4.0 m	1-lane Spillway (1-SW)
		Carriageway width of approach road 6.0 m	2-lane Spillway (2-SW)
Spillway	2-lane Bridge (2-BR)	-	
Timber Bridge	2-lane Bridge (2-BR)	AADT < 200	1-lane Bridge (1-BR)
		AADT > 200	2-lane Bridge (2-BR)
Bailey Bridge	2-lane Bridge (2-BR)	AADT < 300	-
		AADT > 300	2-lane Bridge (2-BR)

Note : Use RCBC instead of bridge where length is short and topography is suitable.

G.I-3 Road Construction Cost

Equation : RCC = RCCu·Ls

where , RCC = road construction cost, in Mp
RCCu= unit road construction cost, in Mp/km, given in Table below
Ls = subsection length, in km

Unit road construction cost "RCCu", in Mp/km

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	PCC	4.0	0.5	-	2.050	2.651
			1.0	1.827	2.264	-
			1.5	1.936	-	-
		6.0	0.5	-	-	3.065
			1.0	-	2.678	3.200
			1.5	2.651	2.952	-
			2.0	2.775	-	-
			2.5	2.914	-	-
		6.7	1.0	-	-	3.693
			1.5	-	3.142	3.768
			2.0	3.100	3.476	-
			2.5	3.466	-	-
			3.0	3.712	-	-
		Widening	0.5	-	-	0.923
			1.0	-	0.982	1.481
			1.5	0.873	1.892	-
			2.0	1.070	-	-
			2.5	1.168	-	-
	AC	4.0	0.5	-	1.909	2.516
			1.0	1.677	2.098	-
			1.5	1.820	-	-
		6.0	0.5	-	-	2.782
			1.0	-	2.364	2.858
			1.5	2.374	2.785	-
			2.0	2.565	-	-
			2.5	2.779	-	-
		6.7	1.0	-	-	3.369
			1.5	-	2.867	3.483
			2.0	2.869	3.172	-
			2.5	3.108	-	-
			3.0	3.315	-	-
		Widening	0.5	-	-	0.907
			1.0	-	0.944	1.478
			1.5	0.819	1.416	-
			2.0	1.023	-	-
			2.5	1.106	-	-

-- continued --

Unit road construction cost "RCCu", in Mp/km (continued)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain		
				Flat	Rolling	Mountain's
Rehabilitation/ Improvement/ Widening	BMP	4.0	0.5	-	1.334	1.650
			1.0	1.199	1.769	-
			1.5	1.237	-	-
		6.0	0.5	-	1.818	2.350
			1.0	1.690	2.084	2.418
			1.5	1.744	2.398	-
			2.0	1.978	-	-
		Widening	0.5	-	0.714	0.879
			1.0	0.592	0.842	1.388
			1.5	0.650	-	-
			2.0	0.668	-	-
	Gravel	4.0	0.5	0.482	0.511	0.601
			1.0	0.526	-	-
		6.0	0.5	-	0.965	1.321
			1.0	0.714	1.013	1.510
			1.5	0.823	1.045	-
			2.0	0.896	-	-
	Overlay	4.0	any	1.048	1.048	1.048
		6.0	any	1.325	1.325	1.325
		6.7	any	1.505	1.505	1.505
New Construction	PCC	6.0	1.0	-	-	4.184
			1.5	-	3.790	-
			2.0	3.534	-	-
			2.5	3.739	-	-
		6.7	1.0	-	-	4.434
			1.5	-	4.040	5.064
			2.0	3.781	4.618	-
			2.5	3.989	-	-
			3.0	4.152	-	-
	AC	6.0	0.5	-	-	3.228
			1.0	-	2.900	3.863
			1.5	2.920	3.484	-
			2.0	3.346	-	-
			2.5	3.630	-	-
		6.7	1.0	-	-	4.072
			1.5	-	3.690	4.712
			2.0	3.552	4.281	-
			2.5	3.808	-	-
			3.0	4.007	-	-
	BMP	4.0	0.5	-	1.534	1.815
			1.0	1.334	-	-
		6.0	0.5	-	2.197	2.637
			1.0	2.193	2.758	3.250
			1.5	2.598	2.846	-
			2.0	2.684	-	-
	Gravel	4.0	0.5	0.536	0.611	0.713
			1.0	0.643	-	-
		6.0	0.5	-	1.637	2.003
			1.0	1.430	1.772	-
			1.5	1.553	-	-

G.I-4 Slope Protection Cost

Equation : SPC = SPCC+SPCE

SPCC = SPCCu·Lc
SPCE = SPCEu·Le

where , SPC = slope protection cost, in Mp
SPCC = cut slope protection cost, in Mp
SPCE = embankment slope protection cost, in Mp

SPCCu= unit cost for cut slope protection, in Mp/m, given in Table below
SPCEu= unit cost for embankment slope protection, in Mp/m, given in Table below
Lc = length of cut slope to be protected, in m
Le = length of embankment slope to be protected, in m

Unit cost for slope protection "SPCCu","SPCEu", in Mp/m

Item		Unit Cost
Cut Slope Protection	"SPCCu"	0.0253
Embankment Slope Protection	"SPCEu"	0.0275

G.I-5 Additional Cost for Flood Section

Equation : FSC = FSCu·Lf
FSCu= 1.976·Df+0.173·Wr-0.850

where , FSC = additional cost for flood section, in Mp
FSCu= unit additional cost for flood section, in Mp/km
Lf = length of flood section, in km
Df = flood depth, in m
Wr = road width, in m

G.I-6 Structure Cost

Equation : STC = BRC+SWC+BCC

BRC = SSu·Lss+ABu·Nab+PRu·Npr
SWC = SWu·Lsw
BCC = BCu·Lbc+WW

where , STC = structure cost, in Mp
BRC = bridge cost, in Mp
SWC = spillway cost, in Mp
BCC = RCBC cost, in Mp

SSu = unit cost of superstructure, in Mp/m, given in Table below
ABu = unit cost of abutment, in Mp/each, given in Table below
PRu = unit cost of pier, in Mp/each, given in Table below
Lss = length of superstructure, in m
Nab = number of abutments
Npr = number of piers
SWu = unit cost of spillway, in Mp/m, given in Table below
Lsw = length of spillway, in m
BCu = unit cost of RCBC, in Mp/m,given in Table below
Lbc = length of RCBC, in m, usually road width plus 3.0 m
WW = cost for wingwall and apron, in Mp/set(both sides total), given in Table below

Unit cost "SSu","ABu","PRu","SWu","BCu","WW"

Type of Structure	Item		Unit Cost
2-lane Bridge	Superstructure	"SSu"	0.0478 Mp/m
	Abutment	"ABu"	0.3630 Mp/each
	Pier	"PRu"	0.3135 Mp/each
1-lane Bridge	Superstructure	"SSu"	0.0357 Mp/m
	Abutment	"ABu"	0.2530 Mp/each
	Pier	"PRu"	0.2200 Mp/each
2-lane Spillway	Spillway	"SWu"	0.0182 Mp/m
1-lane Spillway	Spillway	"SWu"	0.0132 Mp/m
1-cell RCBC	RCBC	"BCu"	0.0227 Mp/m
	Wingwall/Apron	"WW "	0.1452 Mp/set
2-cell RCBC	RCBC	"BCu"	0.0396 Mp/m
	Wingwall/Apron	"WW "	0.1705 Mp/set

G.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km/veh
Ls = subsection length, in km
VEH = AADT, in veh
k = constant, given in Table below

Constant "k"

Proposed Pavemrnt Type	Existing Surface Type and Condition	Terrain		
		Flat	Rolling	Mountain's
PCC/AC	Paved - Bad	.00668	.00852	.01034
	Paved - Very Bad	.01253	.01436	.01618
	Gravel- Good/Fair	.00857	.01040	.01222
	Gravel- Bad	.00858	.01041	.01223
	Gravel- Very Bad	.01437	.01621	.01802
	Earth - Bad	.01512	.01695	.01877
	Earth - Very Bad	.02178	.02361	.02543
BMP/DBST	Paved - Bad	.00569	.00753	.00935
	Paved - Very Bad	.01154	.01337	.01519
	Gravel- Good/Fair	.00758	.00941	.01123
	Gravel- Bad	.00759	.00942	.01124
	Gravel- Very Bad	.01338	.01522	.01704
	Earth - Bad	.01413	.01597	.01778
	Earth - Very Bad	.02079	.02262	.02444
Gravel	Gravel- Bad	.00747	.00931	.01113
	Gravel- Very Bad	.01327	.01510	.01692
	Earth - Bad	.01402	.01585	.01767
	Earth - Very Bad	.02067	.02251	.02433

G.I-8 Bridge Benefit

Equation : BRB = BRBu·Lb·VEH
BRBu= 0.0660·TRBu-0.000351

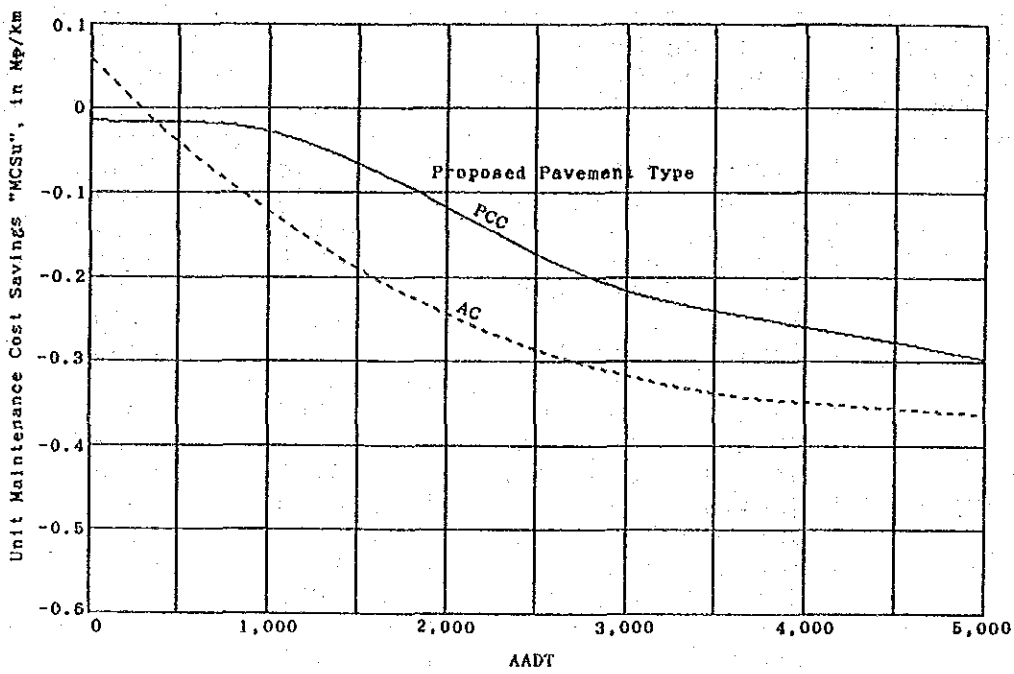
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from G.I-7

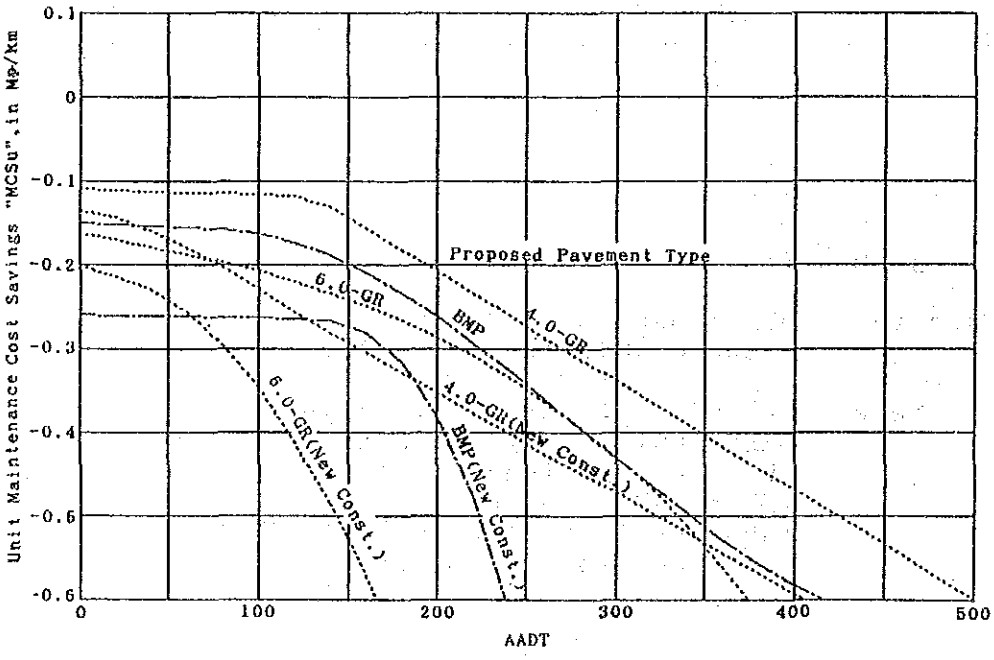
G.I-9 Maintenance Cost Savings

Equation : MCS = MCSu·Ls

where , MCS = maintenance cost savings, in Mp
MCSu= unit maintenance cost savings, in Mp/km, given in Chart below
Ls = subsection length, in km

Chart for estimating unit maintanance cost savings "MCSu"





G.I-10 B/C Ratio

Equation : $BC = TB/EC$

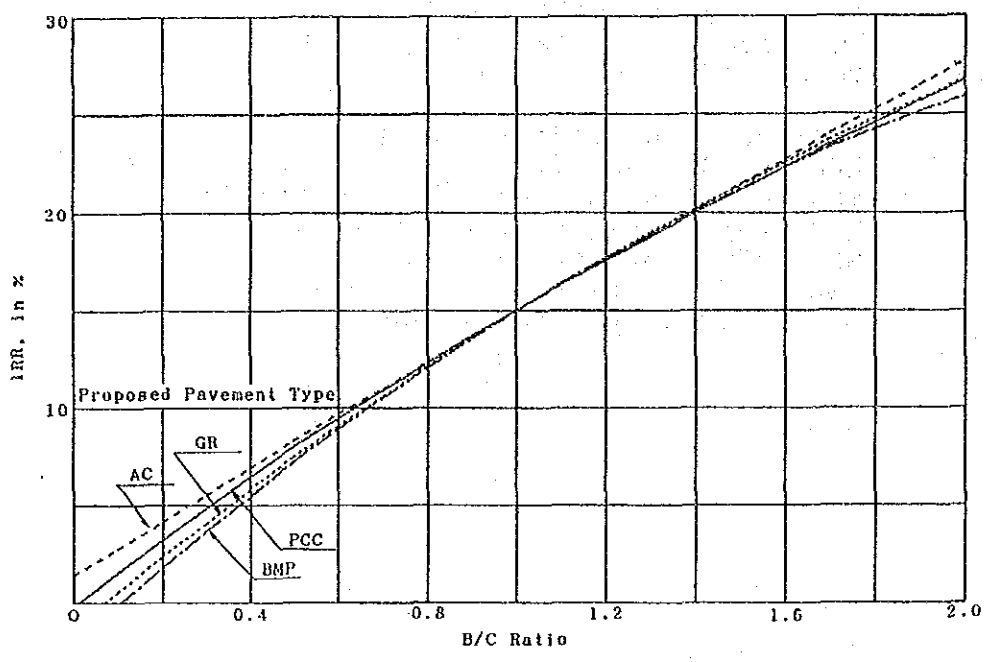
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

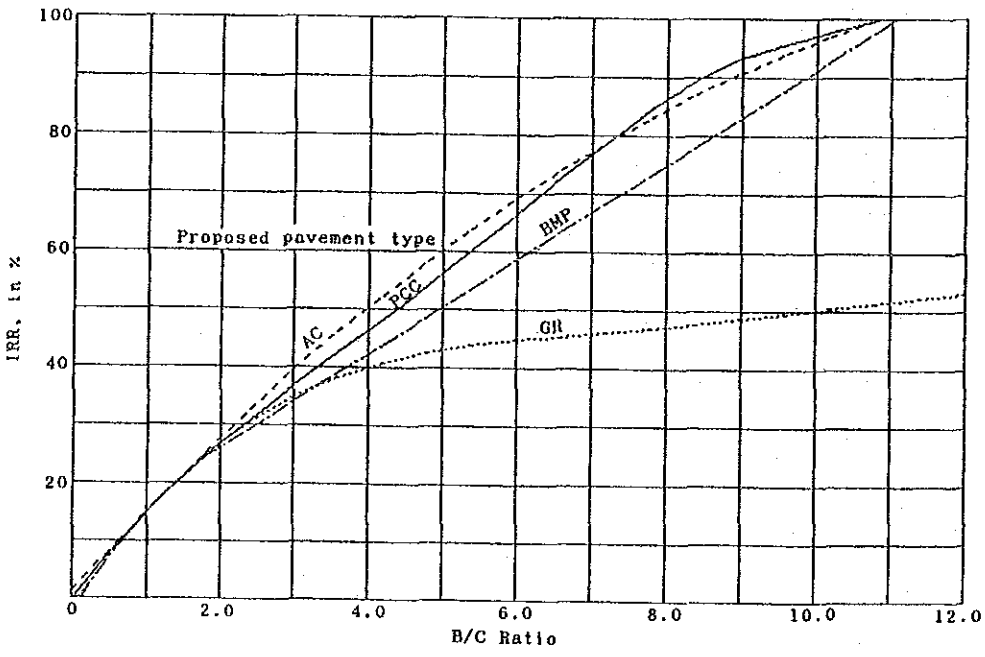
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB= traffic benefit, in Mp
BRB= bridge benefit, in Mp
MCS= maintenance cost savings, in Mp
RCC= road construction cost, in Mp
SPC= slope protection cost, in Mp
FSC= additional cost for flood section, in Mp
STC= structure cost, in Mp

G.I-11 Internal Rate of Return (IRR)

Obtain from Chart below.





PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - G)
FUNCTIONAL CLASSIFICATION (REF. CHAPTER 2)	1. PRIMARY MAJOR 2. SECONDARY MAJOR 3. COLLECTOR 4. FEEDER

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pt	①	TOTAL ROAD LENGTH : Lt	③ KM	Pt/Lt (①/③)	⑤
CULTIVATED AREA WITHIN RIA : At	② HA	At/Lt (②/③)	④	AADT (REF. G.II - 1)	⑥
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	C : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM) ⑦										③
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)										
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)										
SPECIAL TREATMENT — SLOPE PROTECTION — CUT SLOPE LENGTH (M) ⑧										
SPECIAL TREATMENT — SLOPE PROTECTION — EMBANKMENT SLOPE LENGTH (M) ⑨										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD DEPTH (M) ⑩										
SPECIAL TREATMENT — FLOOD SECTION — FLOOD SECTION LENGTH (M) ⑪										
PROPOSED PAVEMENT — TYPE (PCC/AC/BMP/GRAVEL) (REF. G.II-2)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. G.II-2) ⑫										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. G.II-2) ⑬										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. G.II-2)										
COST (MP) — ROAD — UNIT COST/KM. (REF. G.II-4) ⑮										
COST (MP) — ROAD — COST (⑮ x ⑦) ⑯										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. G.II-5) ⑰										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. G.II-5) ⑲										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳										
COST (MP) — FLOOD SECTION — UNIT COST/KM. (1.976·⑩ + 0.173·⑭ - 0.850) ㉑										
COST (MP) — FLOOD SECTION — COST (㉑ x ⑪) ㉒										
COST (MP) — TOTAL COST (⑯ + ⑱ + ⑳ + ㉒)										㉓

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

										TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED										
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. G.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE — NO. OF LANES										
BRIDGE — LENGTH (M) ㉔										
BRIDGE — NO. OF SPANS (㉔ /20 & ROUND) ㉕										
BRIDGE — COST (MP) — SUPER-STRUCTURE — UNIT COST/M (REF. G.II-7) ㉖										
BRIDGE — COST (MP) — SUPER-STRUCTURE — COST (㉖ x ㉔) ㉗										
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. G.II-7) ㉘										
BRIDGE — COST (MP) — ABUTMENT — COST (㉘ x 2) ㉙										
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. G.II-7) ㉚										
BRIDGE — COST (MP) — PIER — COST (㉚ x (㉕ - 1)) ㉛										
BRIDGE — TOTAL COST (㉗ + ㉙ + ㉛) ㉜										
SPILLWAY — NO. OF LANES										
SPILLWAY — LENGTH (M) ㉝										
SPILLWAY — COST (MP) — UNIT COST/M (REF. G.II-7) ㉞										
SPILLWAY — COST (MP) — COST (㉞ x ㉝) ㉟										
RCBC — 1-CELL OR 2-CELL										
RCBC — LENGTH (M) (USUALLY (⑭ + 3.0)) ㊱										
RCBC — COST (MP) — RCBC — UNIT COST/M (REF. G.II-7) ㊲										
RCBC — COST (MP) — RCBC — COST (㊲ x ㊱) ㊳										
RCBC — COST (MP) — WINGWALL & APRON (REF. G.II-7) ㊴										
RCBC — COST (MP) — TOTAL COST (㊳ + ㊴) ㊵										
COST (MP) (㉜ + ㉟ + ㊵)										㊶

5) BENEFIT

BRIDGE LENGTH (M) (㉔ + ㊲) ㊷									
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM. (REF. G.II-8) ㊸									
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦) ㊹									
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0.066 x ㊸ - 0.000351 x ⑥) ㊺									
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷) ㊻									
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. G.II-10) ㊼									
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K + 0.000262 x ⑭ - 0.000017 x ⑤) ㊽									
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦) ㊾									
BENEFIT — MAINTE-NANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. G.II-11) ㊿									
BENEFIT — MAINTE-NANCE COST SAVINGS — BENEFIT (㊿ x ⑦) (51)									
TOTAL BENEFIT (㊹ + ㊻ + ㊾ + (51)) (52)									

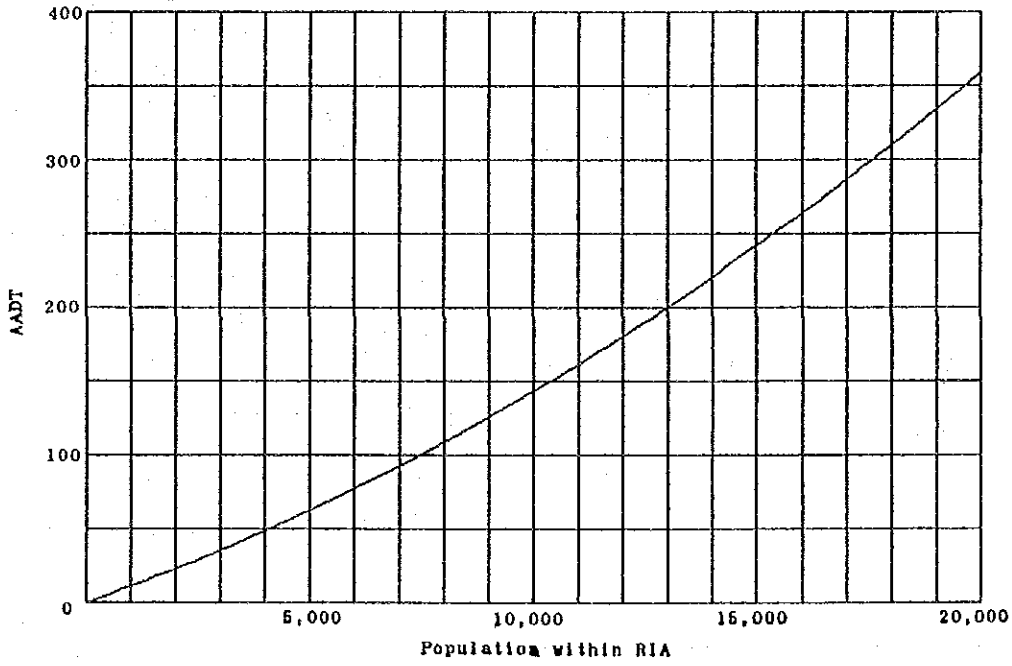
6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓ + ㊶) (53)	
ECONOMIC COST	(53 x 0.831) (54)	
B/C RATIO	(52 / 54)	
I R R	(REF. G.II-13)	

7) COMMENT

G.II-1 AADT

Obtain from Chart below.



G.II-2 Proposed Pavement Type

Apply G.I-1.

G.II-3 Proposed Structure Type

Apply G.I-2.

G.II-4 Road Construction Cost

Apply G.I-3.

G.II-5 Slope Protection Cost

Apply G.I-4.

G.II-6 Additional Cost for Flood Section

Apply G.I-5.

G.II-7 Structure Cost

Apply G.I-6.

G.II-8 Traffic Benefit

Equation : TRB = TRBu·Ls

where , TRB = traffic benefit, in Mp
TRBu= unit traffic benefit, in Mp/km, given in Chart below
Ls = subsection length, in km

Selection of Chart for estimating unit traffic benefit "TRBu"

Population Distribution Pattern	Selection of Parameter	
	AADT	Population
A : Gradually Decreasing Pattern	Fig. A-1	Fig. A-2
B : Evenly Distributing Pattern	Fig. B-1	Fig. B-2
C : Tip Concentration Pattern	Fig. C-1	Fig. C-2

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - A
(Gradually Decreasing Pattern)

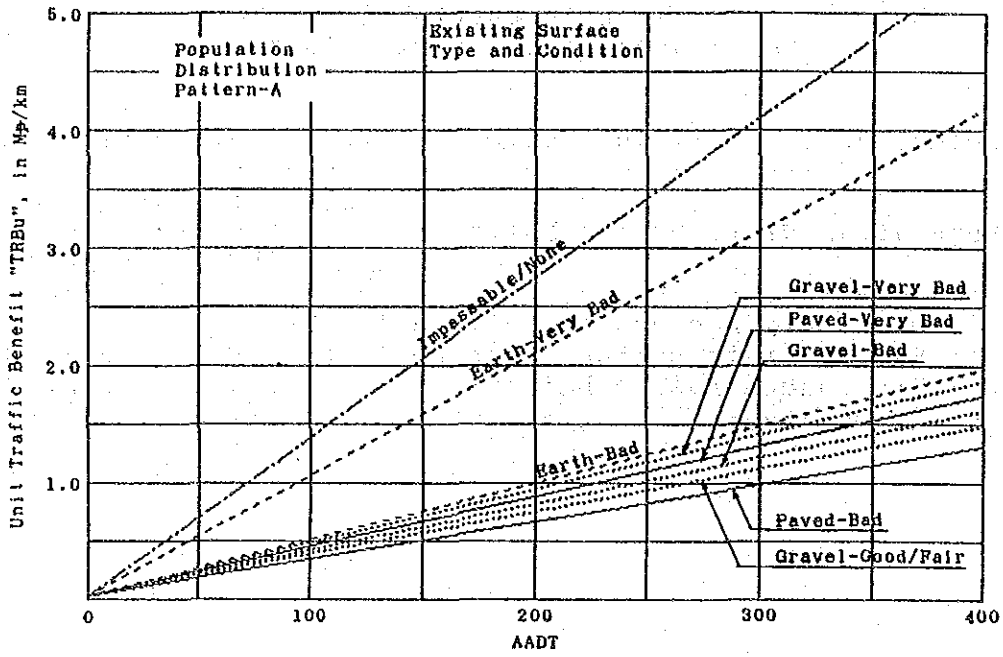


Figure A-1 "TRBu" Based on AADT

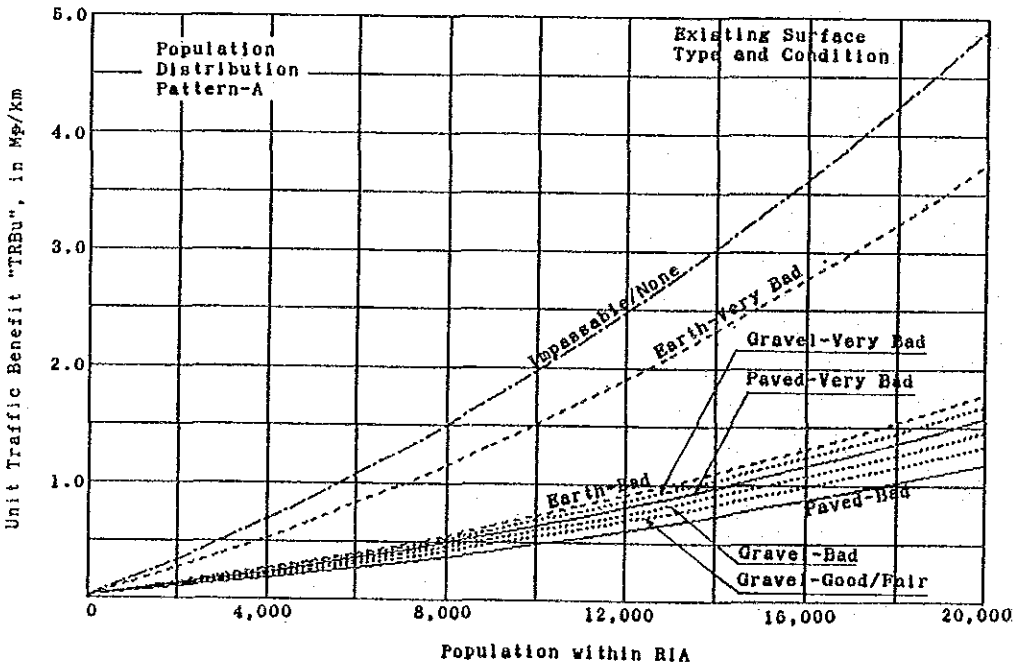


Figure A-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - B
(Evenly Distributing Pattern)

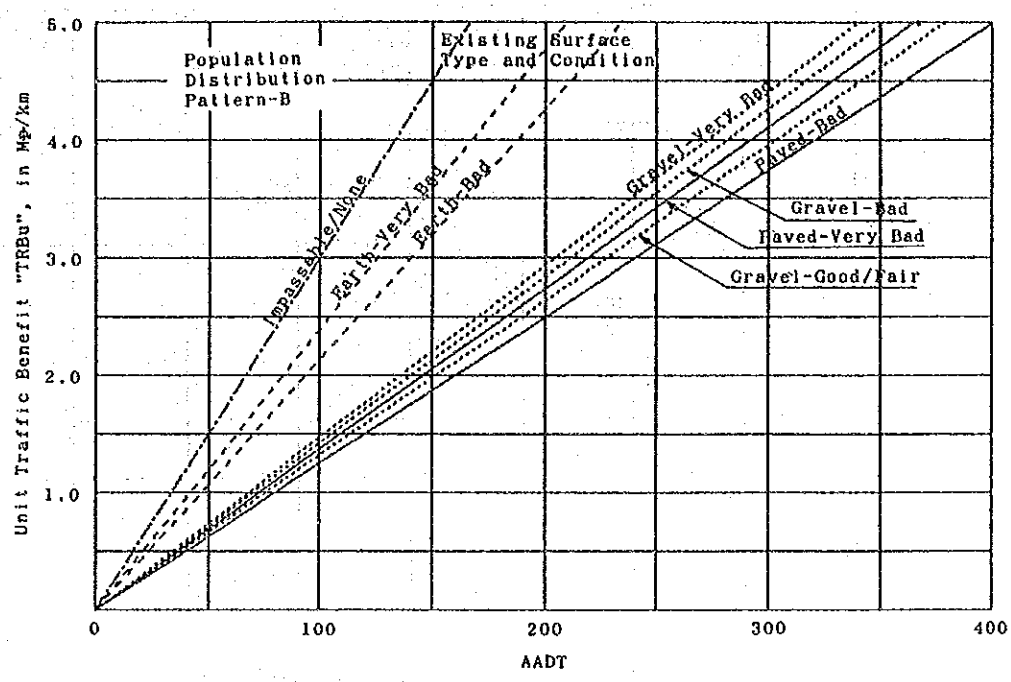


Figure B-1 "TRBu" Based on AADT

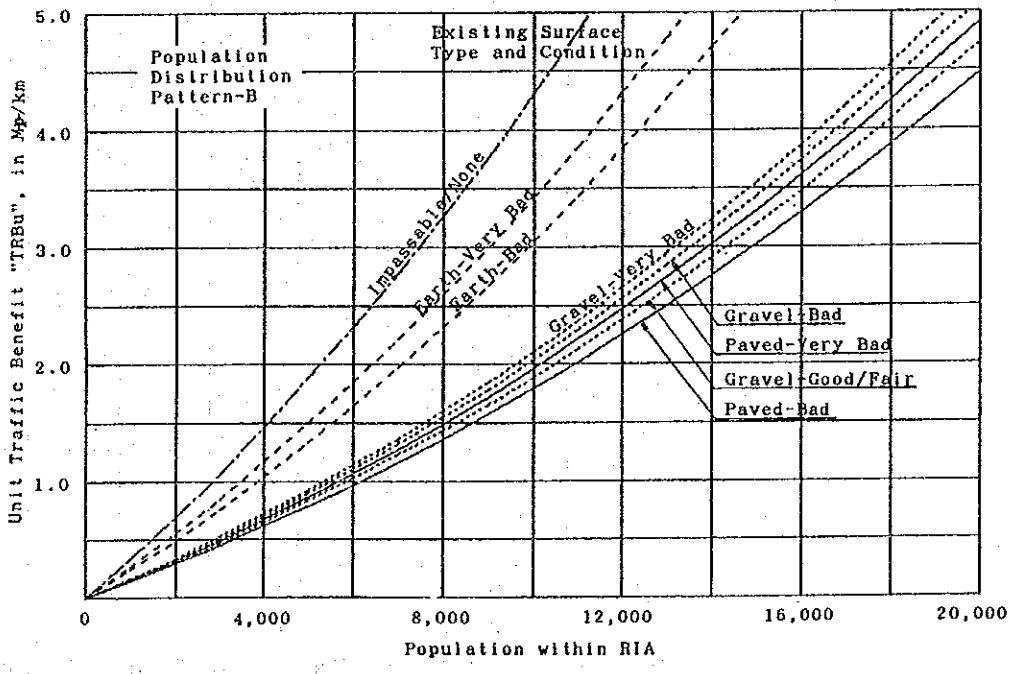


Figure B-2 "TRBu" Based on Population

Chart for estimating unit traffic benefit "TRBu"
for Population Distribution Pattern - C
(Tip Concentration Pattern)

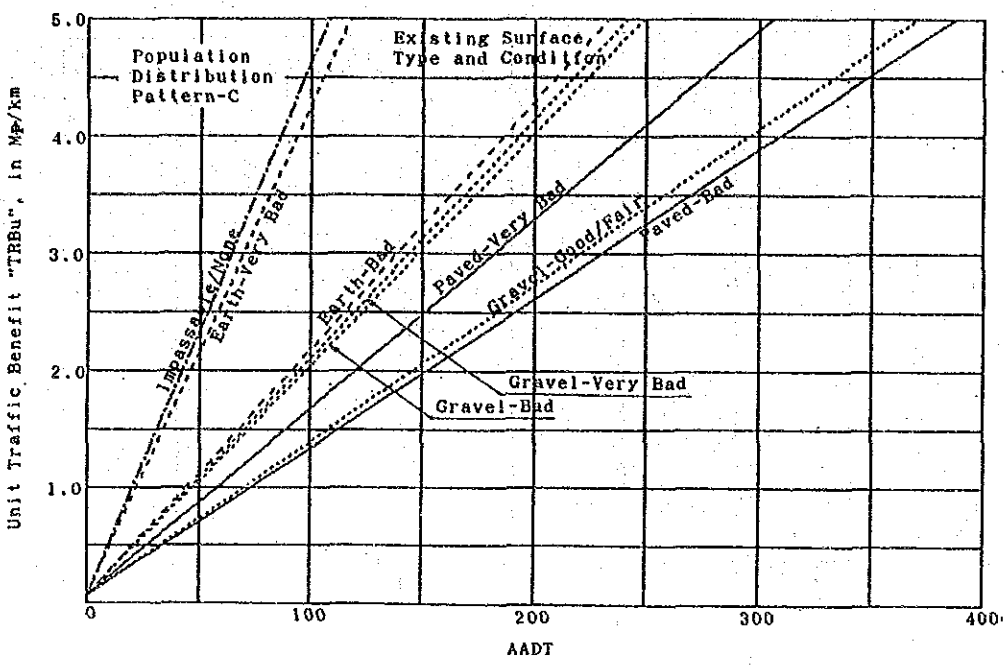


Figure C-1 "TRBu" Based on AADT

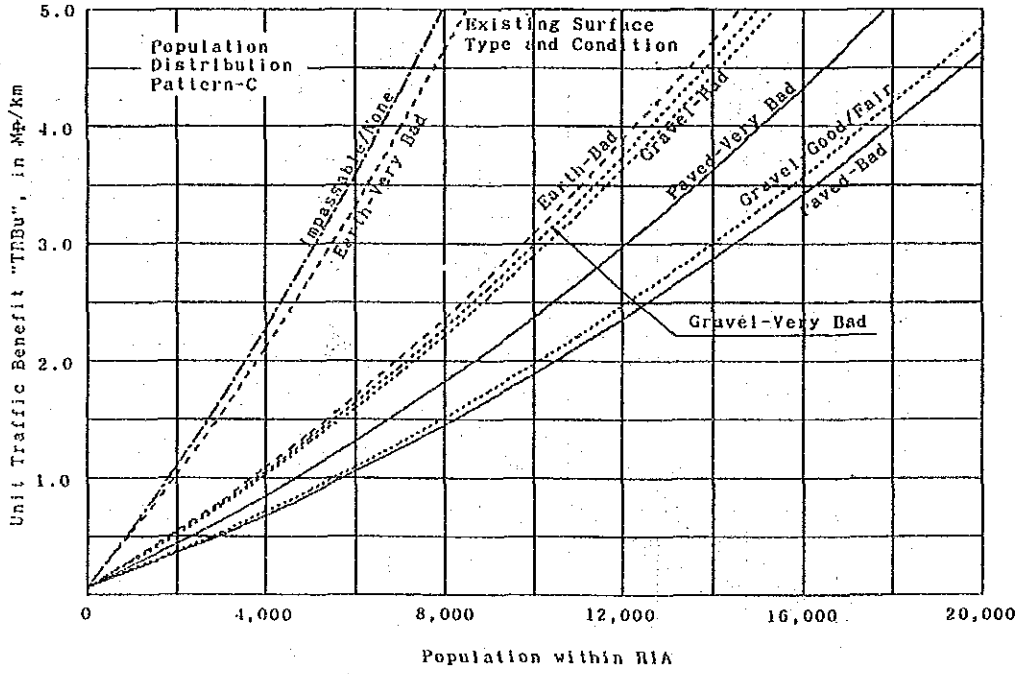


Figure C-2 "TRBu" Based on Population

G.II-9 Bridge Benefit

Equation : BRB = BRBu·Lb
BRBu= 0.0660·TRBu-0.000351·VEH

where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m
Lb = bridge length, in m
TRBu= unit traffic benefit, in Mp/km, obtained from G.II-8
VEH = AADT, in veh

G.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.000262·At/Lt-0.000017·Pt/Lt

where , DVB = development benefit, in Mp
DVBu= unit development benefit,in Mp/km
k = constant, given in Table below
At = total cultivated area within RIA, in ha
Pt = total population within RIA, in person
Lt = total road length, in km
Ls = subsection length, in km

Constant "k"

Existing Surface Type and Condition	Terrain		
	Flat	Rolling	Mountain's
Paved - Bad	.0713	.0856	.0513
Paved - Very Bad	.0815	.0959	.0616
Gravel- Good/Fair	-.0238	-.0094	-.0437
Gravel- Bad	.0734	.0877	.0534
Gravel- Very Bad	.0973	.1116	.0773
Earth - Bad	.0719	.0862	.0520
Earth - Very Bad	.1816	.1960	.1617
Any - Impassable/ Non-exist'g	.1821	.1964	.1622

G.II-11 Maintenance Cost Savings

Apply G.I-9.

G.II-12 B/C Ratio

Equation : BC = TB/EC

TB = TRB+BRB+DVB+MCS
EC = 0.831%TC
TC = RCC+SPC+FSC+STC

where , BC = B/C Ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

TRB = traffic benefit, in Mp
BRB = bridge benefit, in Mp
DVB = development benefit, in Mp
MCS = maintenance cost savings, in Mp
RCC = road construction cost, in Mp
SPC = slope protection cost, in Mp
FSC = additional cost for flood section, in Mp
STC = structure cost, in Mp

G.II-13 Internal Rate of Return (IRR)

Apply G.I-11.