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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS & HIGHWAYS

Feasibility Study
on
The Rural Road Network Development Project

FINAL REPORT (Volume 26)

GUIDE FOR
SIMPLIFIED PROJECT EVALUATION

OCTOBER, 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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CHAPTER 1 INTRODUCTION

1.1 Background

With a view to promoting a functional development of road network in the rural areas, the Pilot Study for the Rural Road Network Development Project was conducted in 1987-1989, including the evaluation of the road projects in the four (4) pilot provinces, followed by the Feasibility Study on the Rural Road Network Development Project in 1989-1990, in which the road projects in the 11 study provinces were evaluated. The road projects evaluated in the both studies are as follows:

Study	Province	Number of Road Projects Studied	Total Length (km.)
The Pilot Study	Cavite	138	665.4
	Masbate	61	523.3
	Bohol	78	551.8
	Agusan del Norte	52	291.1
The Feasibility Study	La Union	45	313.7
	Nueva Vizcaya	41	381.0
	Nueva Ecija	66	692.0
	Rizal	26	178.8
	Occidental Mindoro	63	404.1
	Albay	67	534.9
	Antique	49	400.0
	Samar	42	527.0
	Leyte	79	761.0
	Misamis Oriental	62	499.8
	Davao del Norte	64	598.8
	Total	933	7,322.7

The evaluation results were statistically analyzed with the objective of developing a series of estimation models to be used for estimating the project costs and economic viability based on easily obtainable data. The procedures and methodologies of this Guide were developed based on the above analysis.

1.2 Scope of the Guide

Chapter 2 discusses road classification, focusing on functional road classification which is necessary to attain a systematic development of road network.

Chapter 3 provides the engineering standards and typical road sections.

Chapter 4 presents the input data sheet for project evaluation and instructions for entry.

Chapter 5 provides the basic assumptions in the project evaluation in this Guide and procedures for project evaluation.

Chapter 6 provides the procedures for evaluation of the projects in which traffic diversion is expected.

Chapter 7 discusses the way of updating costs and benefits for the future use.

Chapter 8 presents sample calculations.

1.3 Limitations of the Guide

The studies mentioned in 1.1 did not cover national primary roads defined in Executive Order No. 113 "Establishing the Classification of Roads" nor roads serving as streets within built-up population centers. This Guide is, therefore, not applicable to national primary roads and streets.

CHAPTER 2 ROAD CLASSIFICATION

2.1 Administrative Road Classification

Roads are classified, mainly based on the administrative responsibilities and jurisdiction of the agencies concerned in the funding, planning, construction/improvement and maintenance, into the following five (5) classes:

- National Roads
- Provincial Roads
- City Roads
- Municipal Roads
- Barangay Roads

These classes are defined as follows and show conceptually in Figure 2-1.

National Roads are all roads that form part of the main trunkline system continuous in extent; all roads leading to national airports, national seaports, national parks or coast-to-coast roads.

Provincial Roads are those roads connecting one municipality with another municipality, the termini to be public plazas; all roads extending from a municipality or from a provincial or national road to a public wharf or railway station; and any other road to be designated as such by the Sangguniang Panlalawigan.

City Roads are those roads/streets within the urban area of the city to be designated as such by the Sangguniang Panglungsod.

Municipal Roads are those roads/streets within the poblacion area of a municipality to be designated as such by the Sangguniang Bayan.

Barangay Roads are rural roads located either outside the urban area of a city or outside industrial, commercial or residential subdivisions which act as feeder or farm-to-market roads, and which are not otherwise classified as national, provincial, city or municipal roads. Roads located outside the poblacion area of a municipality and those roads located outside the urban area of a city are to be designated as such by the Barangay Council concerned.

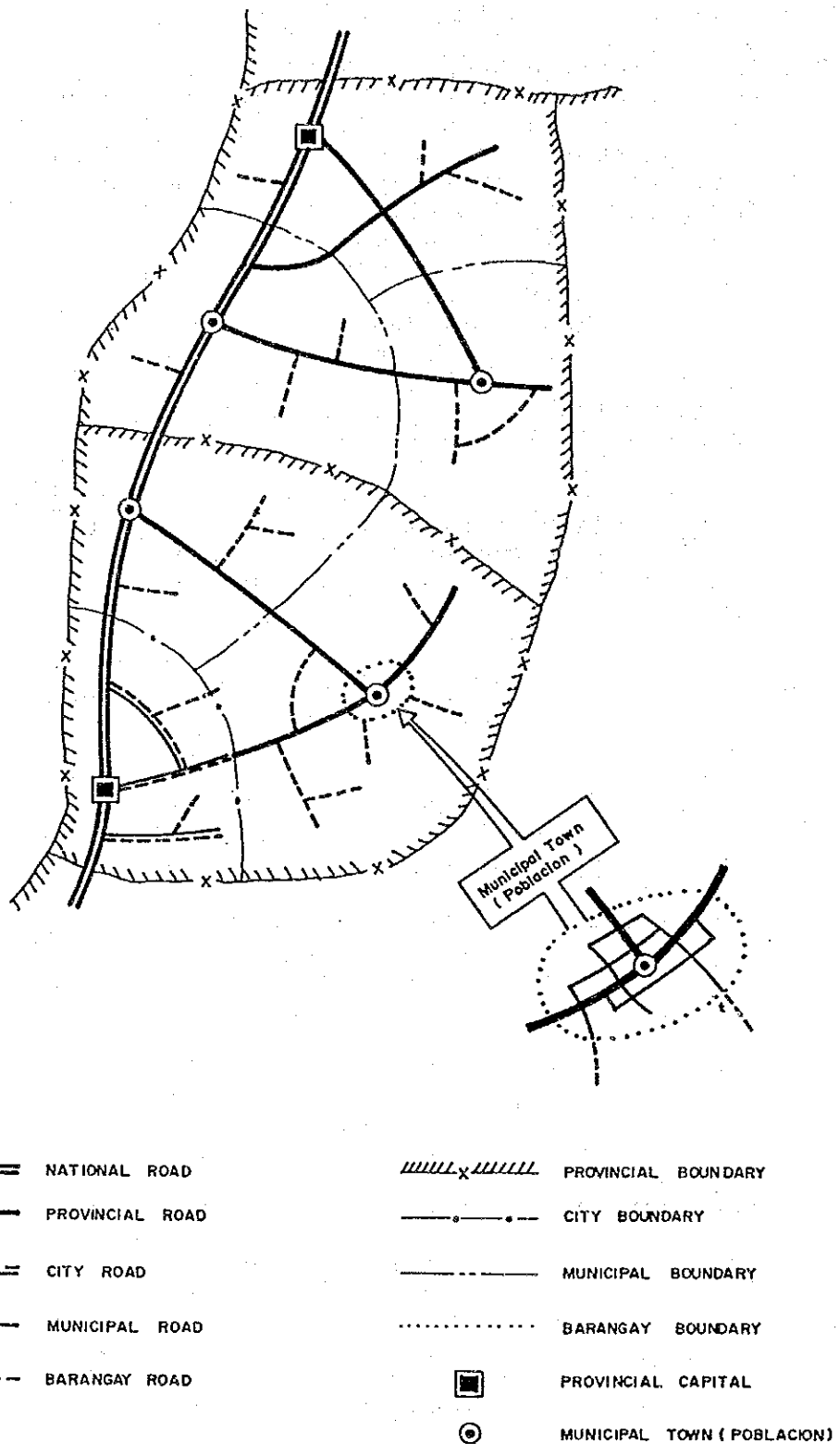


FIGURE 2.1 CONCEPTUAL ROAD NETWORK BY ADMINISTRATIVE CLASSIFICATION

2.2 Functional Road Classification

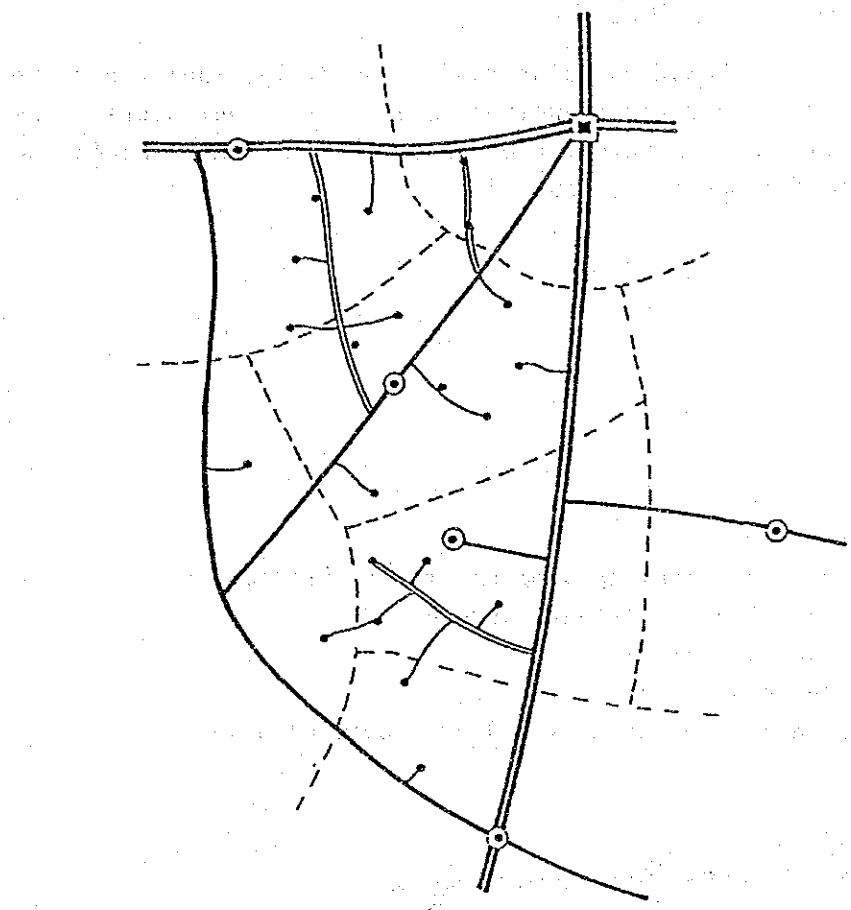
For planning and developing an efficient road network, roads should be classified according to importance and the character of services they are intended to provide. Individual road links of similar importance and quality of services are organized into systems so that a road network in accordance with the hierarchy of functions can be planned and formed. Thus they can be efficiently managed with consistent policies, design and operation.

From this point of view, the functional road classification criteria are proposed as shown in Table 2-1. Roads are classified into the following five (5) classes as shown conceptually in Figure 2-2.

Major Roads :	Primary Major Roads
	Secondary Major Roads
Minor Roads :	Collector Roads
	Feeder Roads
	Streets

TABLE 2-1 PROPOSED FUNCTIONAL CLASSIFICATION FOR RURAL ROAD NETWORK

Functional Classification		General Definition	General Characteristics and Services Provided	Relationship with Administrative Classification				
				National Road	Provincial Road	City Road	Municipal Road	Barangay Road
Major Road	Primary Major Road	• Major inter-provincial roads • Intra-provincial roads linking two (2) or more municipal towns to the Provincial Capital • Intra-provincial roads which form a skelton road network of a province	• Provides the highest level of service at the high speed for the long uninterrupted distance • Serves for long distance trips • Mobility is given the highest consideration	●				
	Secondary Major Road	• Roads linking municipal towns each other • Roads linking a municipal town to the Provincial Capital • Roads linking one (1) or more municipal towns to the primary major road network	• Provides high level of service • Serves for medium distance trips • Mobility is given high consideration	●	●	●		
Minor Road	Collector Road	• Roads linking secondary major roads each other or a primary road with a secondary road • Roads linking two (2) or more barangays to the municipal town or to the higher level network	• Provides rather low level of mobility • Serves for short distance trips • Collects traffic from feeder roads and connects them with major roads • Mobility and land access functions be harmonized		●	●		●
	Feeder Road	• Roads linking one or more barangay centers to the higher level network • Roads linking farm areas to their respective barangay centers or to the higher level network	• Primarily provides access to abutting land with little or no through traffic • Serves for local traffic • Land access is given high consideration			●		●
Street		• Roads within built-up population centers (Poblacion) with essentially urban rather than rural functions	• Primarily provides access to abutting land in urban areas • Through traffic usage discouraged			●	●	



Legends :

- Primary Major Road
- Secondary Major Road
- Collector / Distributor Road
- Feeder Road
- Municipal Boundary
- Provincial Capital
- Municipal Town
- Barangay

FIGURE 2-2 CONCEPTUAL ROAD NETWORK
BY FUNCTIONAL CLASSIFICATION

Verification of Major Road Density

In order to establish a well-balanced major road network, two indicators are introduced to examine the balance of network size. If indicators show imbalanced values, addition or deletion of major road links should be considered. Two indicators are as follows:

a)Network Value

$$N_V = \frac{L}{\sqrt{PA}}$$

where:

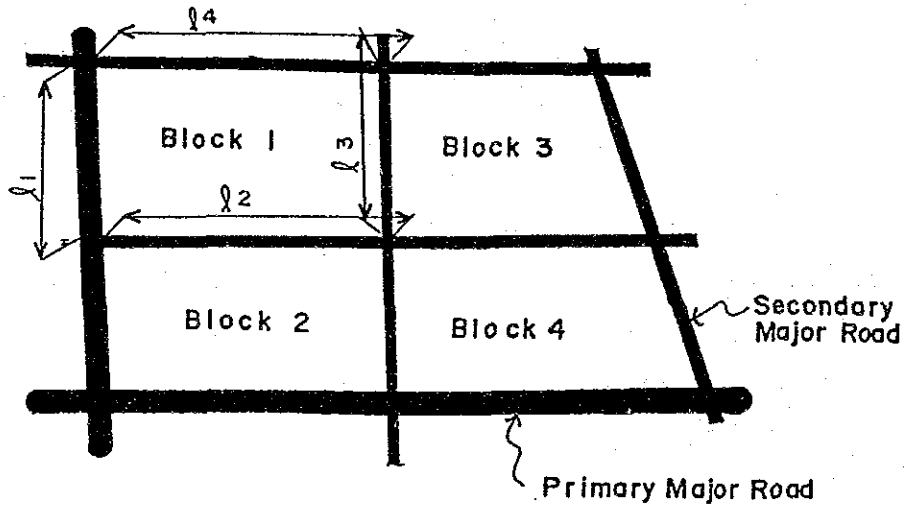
N_V = Network value

L = Road length delineating a block (= $\ell 1 + \ell 2 + \ell 3 + \ell 4$, in case of block 1 of the figure below)

P = Population in a block

A = Land area in a block

Block = Area delineated by primary and/or secondary major road



b)Accessibility

Accessibility $Ac = \sum p \cdot \ell$

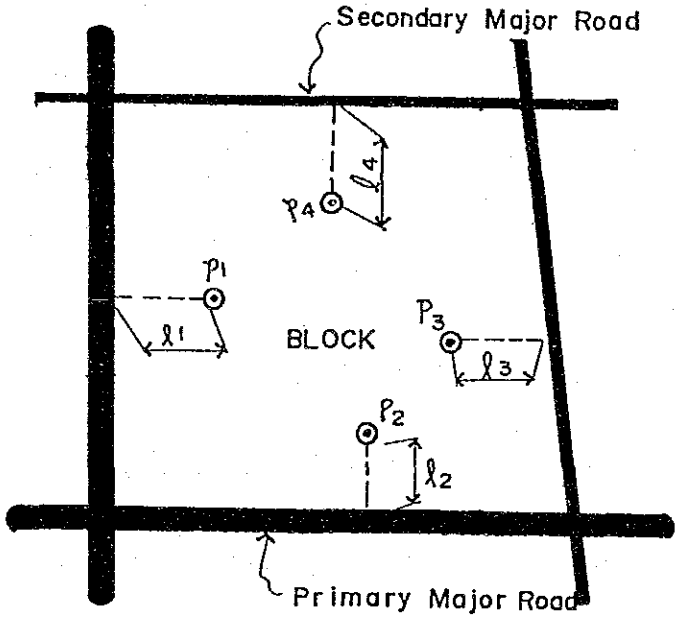
Average accessibility $A_{ave} = \dfrac{\sum p \cdot \ell}{P}$

where:

p = Population of a barangay

ℓ = Distance from a barangay center to respective primary or secondary major road

P = Total Population in a block



⊙ Barangay center

Accessibility = $p_1 \cdot \ell_1 + p_2 \cdot \ell_2 + p_3 \cdot \ell_3 + p_4 \cdot \ell_4$

Average accessibility = $\dfrac{\text{Accessibility}}{p_1 + p_2 + p_3 + p_4}$

CHAPTER 3 ENGINEERING STANDARDS AND TYPICAL ROAD SECTIONS

3.1 Design Concept

The principal objective of the rural road network development project is to provide all-weather transport facilities to depressed areas. In line with this objective, the basic design concept is formulated as follows:

- Improvement of surface condition shall be the principal concern of design.
- Improvement of horizontal and vertical alignment shall be limited to the required minimum.
- In the case where all-weather access is not attained only by improvement of surface condition, special consideration shall be given, e.g., PCC paving for steep gradient sections to enable vehicles to climb up even in the wet season; slope protection; and grade raising in flood sections.
- Adequate cross and side drainage shall be provided.
- Permanent structures shall be provided in accordance with the improvement criteria for bridges.

3.2 Engineering Standards

See Table 3-1.

3.3 Typical Road Sections

The improvement works are categorized into five types according to the type and degree of road deficiencies; as shown in Table 3-2.

Typical road sections are shown in Table 3-3 and Figures 3-1 to 3-6.

TABLE 3-1 PROPOSED ENGINEERING STANDARDS

Functional Classification	Major Road											Minor Road								
	Primary Major Road						Secondary Major Road					Collector Road				Feeder Road				
Administration Classification	National Road						National /Provincial City Road					Provincial/City/ Barangay Road				City/Barangay Road				
AADT in Opening Year	Under 100	100- 200	200- 400	400- 1,000	1,000- 2,000	Over 2,000	Under 100	200- 400	400- 1,000	1,000- 2,000	Over 2,000	Under 50	50- 200	200- 400	Over 400	Under 50	50- 200	200- 400	Over 400	
1) Design speed (km/hr.)																				
Flat	60	60	70	70	80	90	50	60	60	70	80	40	50	60	60	40	40	50	50	
Rolling	40	40	50	60	60	70	40	50	50	50	60	30	40	40	50	30	30	40	40	
Mountainous	30	30	40	40	50	60	30	40	40	40	50	30	30	30	30	30	30	30	30	
2) Carriageway Width (m)	6.0	6.0	6.0	6.7-6.0	6.7	6.7	6.0	6.0	6.0	6.0	6.7	5.5	5.5-6.0	5.5-6.0	6.0	4.0	4.0-5.5	5.5-6.0	6.0	
3) Shoulder Width (m)																				
Flat	1.5	1.5	2.0	2.0	2.5	3.0	1.0	1.5	2.0	2.5	2.5	1.0	1.0	1.5	1.5	0.5	1.0	1.0	1.5	
Rolling	1.0	1.0	1.5	1.5	1.5	2.0	0.5	1.0	1.5	1.5	1.5	0.5	0.5	1.0	1.0	0.5	0.5	0.5	1.0	
Mountainous	0.5	0.5	1.0	1.0	1.0	1.5	0.5	1.0	1.0	1.0	1.0	0.5	0.5	1.0	1.0	0.5	0.5	0.5	0.5	
4) ROW Width (m)	20	20	30	30	30	30	20	20	30	30	30	20	20	20	20	10	10	15	15	
5) Radius (m)																				
Flat	120	120	160	160	220	280	85	120	120	160	220	55	85	120	120	55	55	85	85	
Rolling	55	55	50	120	120	160	55	85	85	85	120	30	55	55	85	25	30	55	55	
Mountainous	30	30	40	50	80	120	30	50	50	50	80	30	30	30	30	25	30	30	30	
6) Grade (%)																				
Flat	6.0	6.0	6.0	5.0	4.0	4.0	6.0	6.0	6.0	5.0	4.0	8.0	7.0	6.0	6.0	8.0	8.0	7.0	7.0	
Rolling	8.0	8.0	7.0	6.0	5.0	5.0	8.0	7.0	7.0	7.0	5.0	10.0	8.0	8.0	7.0	10.0	10.0	8.0	8.0	
Mountainous	10.0	10.0	9.0	8.0	7.0	7.0	10.0	9.0	8.0	8.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
7) Acceptable Pavement Type	.S or DBST .BMP .BMT .Cr. Gr.	.S or DBST .BMP .BMT .Cr. Gr.	.AC .DBST	.PCC .AC	.PCC .AC	.PCC .AC	.S or DBST .BMP .BMT .Cr. Gr.	.AC .DBST	.PCC .AC	.PCC .AC	.PCC .AC	.Cr. Gr.	.BPT .Cr. Gr.	.S or DBST .BMP	.AC .DBST	.Nat or Cr. Gr.	.Nat or Cr. Gr. .BMT	.S or DBST .BMP	.AC .DBST	
8) Pavement Type Recommended In this Study	.Gr	1) .BMP/ DBST	1) .BMP/ DBST	.AC	.PCC	.PCC	.Gr	1) .BMP/ DBST	.AC	.PCC	.PCC	.Gr	.Gr	.AC .BMP/ DBST	.AC	.Gr	.Gr	.AC .BMP/ DBST	.AC	

Pavement Type

S or DBST..... Single or Double bituminous treatment
BMP ..... Bitumious macadam pavement
BPT..... Bitumious preservative treatment
Nat. or Cr. Gr. ..... Natural or crushed gravel
AC..... Aspahalt concrete pavement
PCC..... Portland cement concrete pavement

NOTE:

1) Choice of BMP/DBST depends on the conditions of subrage, traffic loadimg, drainage, etc.

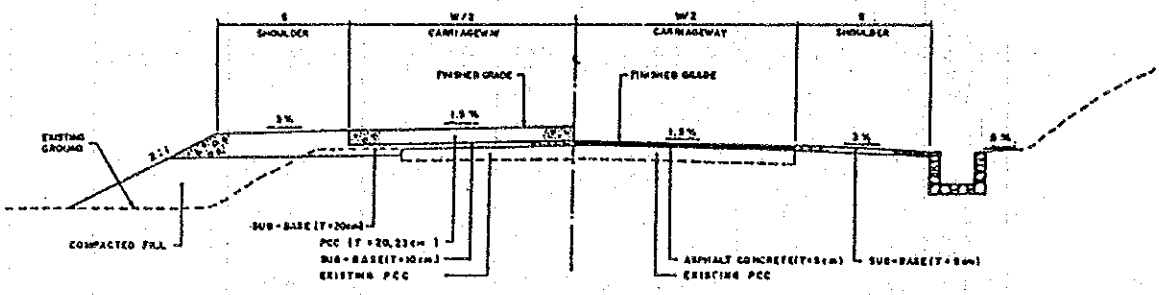
2) 4.0 m in case of less than 25 AADT.

TABLE 3-2 TYPE OF IMPROVEMENT

Type	Existing Pavement Type	Existing Surface Condition	Proposed Improvement Work
Rehabilitation	Standard or Superior	Bad/ Very Bad	Improvement of Surface Condition
Improvement-1	Substandard	Bad/ Very Bad	Upgrading of Surface Type
Improvement-2	Substandard	Good/Fair	Upgrading of Surface Type
Widening	Standard (carriageway is narrower than standard)	Good/Fair	Widening of Existing Road
New Construction	Impassable/Abandoned Non-existing		Construction New Road

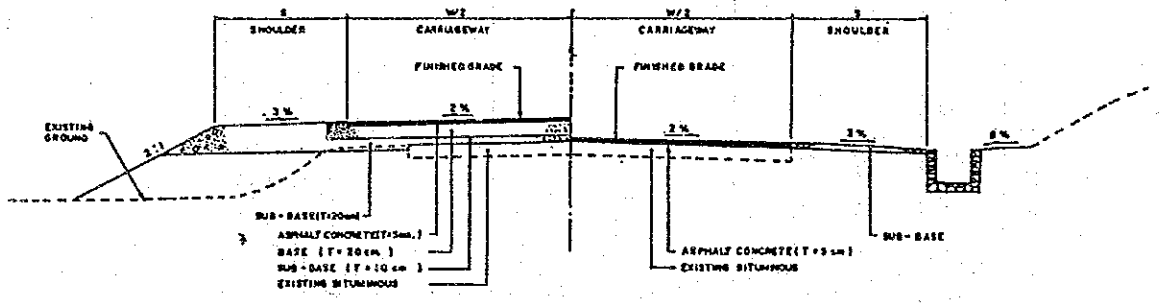
TABLE 3.3 TYPICAL ROAD SECTION

Type of Improvement	Road Section Type	Existing Pavement Type	Existing Pavement condition	Proposed Pavement Type	Pavement Structure (cm) Surface Course	Base	Subbase
Rehabilitation	1 - 1	PCC	Bad/very bad	PCC	20 - 23	-	10
	1 - 2	PCC	Bad/very bad	AC Overlay	5	-	-
	1 - 3	Bituminous	-do-	AC	5	20	10
	1 - 4	Bituminous	-do-	AC Overlay	5	-	-
	1 - 5	Bituminous	-do-	BMP/DBST	5.5/1.6	15	5
	1 - 6	Gravel	-do-	Gravel	15	-	10
Improvement - 1	2 - 1	Bituminous	Bad/very bad	PCC	20 - 23	-	10
	2 - 2	Gravel	-do-	PCC	20 - 23	-	20
	2 - 3	Gravel	-do-	AC	5	20	20
	2 - 4	Gravel	-do-	BMP/DBST	5.5/1.6	15	15
	2 - 5	Earth	Any condition	PCC	20 - 23	-	20
	2 - 6	Earth	-do-	AC	5	20	20
	2 - 7	Earth	-do-	BMP/DBST	5.5/1.6	15	15
	2 - 8	Earth	-do-	Gravel	15	-	10
Improvement - 2	3 - 1	Bituminous	Good/fair	PCC	20 - 23	-	10
	3 - 2	Gravel	-do-	PCC	20 - 23	-	10
	3 - 3	Gravel	-do-	AC	5	20	10
	3 - 4	Gravel	-do-	BMP/DBST	5.5/1.6	15	5
Widening	4 - 1	PCC	Good/fair	Widening W/PCC	20 - 23	-	20
	4 - 2	Bituminous	-do-	Widening W/AC	5	20	20
	4 - 3	Bituminous	-do-	Widening W/BMP/DBST	5.5/1.6	15	15
	4 - 4	Gravel	-do-	Widening W/Gravel	15	-	10
New Construction	5 - 1	-	-	PCC	20 - 23	-	20
	5 - 2	-	-	AC	5	20	20
	5 - 3	-	-	BMP/DBST	5.5/1.6	15	15
	5 - 4	-	-	Gravel	15	-	10
Special Treatment	6	PCC pavement for steep gradient section					
	7	Grade raising in flood area					



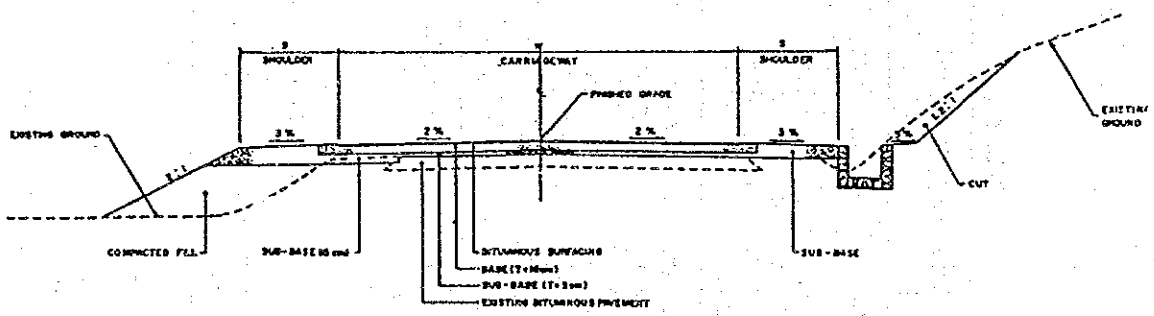
TYPE I-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : PCC (BAD / VERY BAD)

TYPE I-2
PROPOSED PAVEMENT : ASPHALT CONCRETE OVERLAY
EXISTING PAVEMENT : PCC (BAD / VERY BAD)

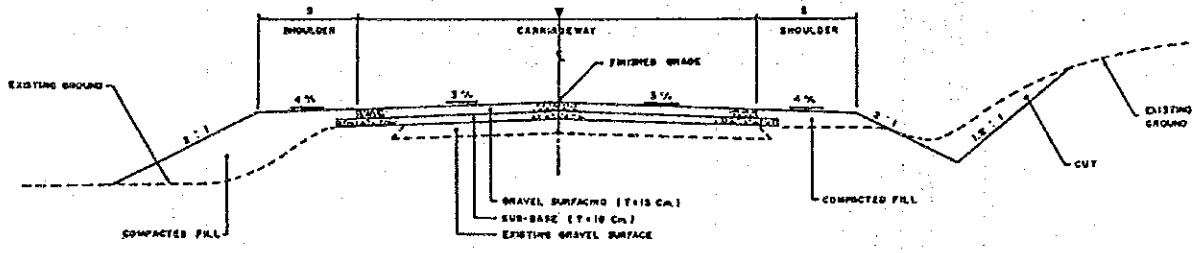


TYPE I-3
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : BITUMINOUS (BAD/VERY BAD)

TYPE I-4
PROPOSED PAVEMENT : ASPHALT CONCRETE OVERLAY
EXISTING PAVEMENT : BITUMINOUS (BAD/VERY BAD)



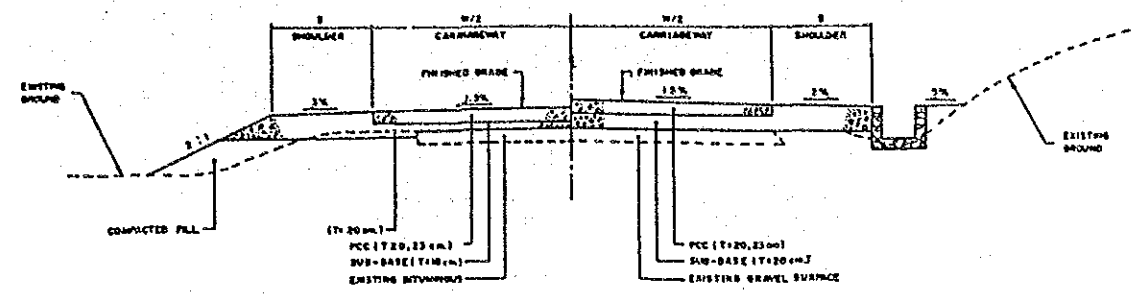
TYPE I-5
PROPOSED PAVEMENT : BITUMINOUS MACADAM/DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : BITUMINOUS (BAD / VERY BAD)



TYPE I-6
PROPOSED PAVEMENT : GRAVEL SURFACING
EXISTING PAVEMENT : GRAVEL SURFACING (BAD/VERY BAD)

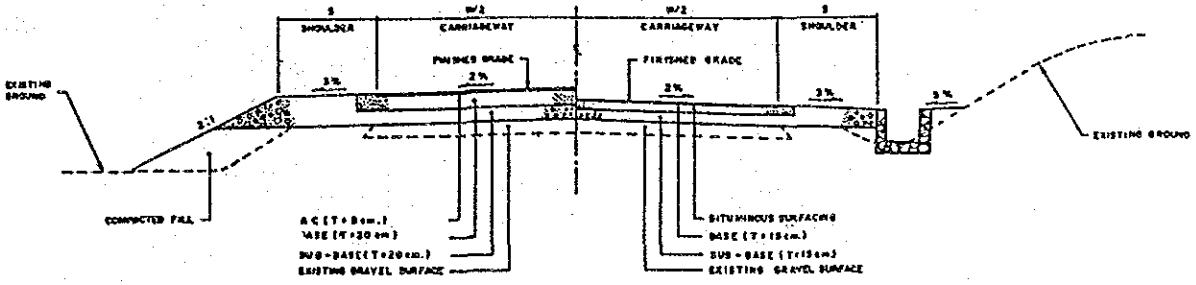
REHABILITATION

FIGURE 3-1 TYPICAL ROAD SECTIONS (1)



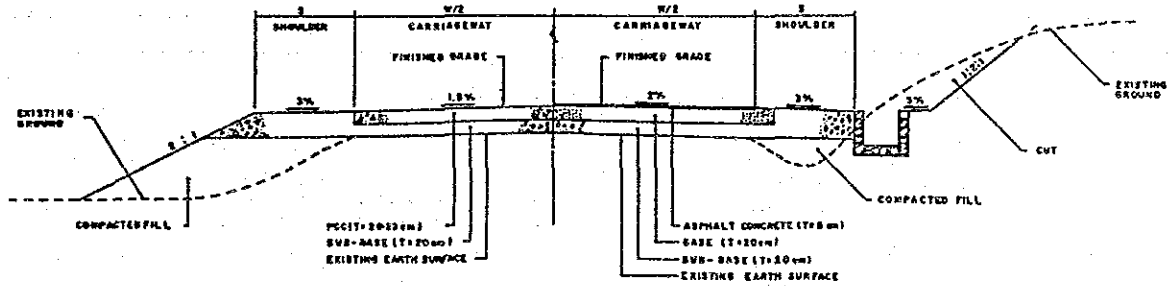
TYPE 2-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : BITUMINOUS (BAD/VERY BAD)

TYPE 2-2
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : GRAVEL SURFACING (BAD/VERY BAD)



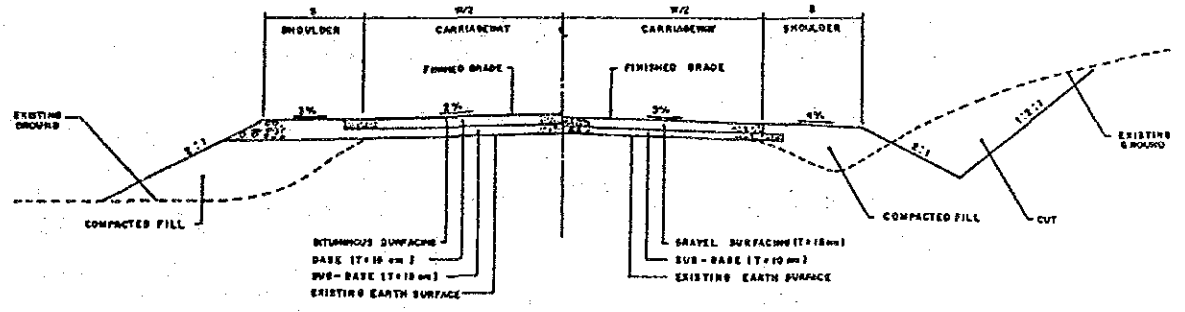
TYPE 2-3
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : GRAVEL SURFACING (BAD/VERY BAD)

TYPE 2-4
PROPOSED PAVEMENT : BITUMINOUS MACADAM / DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : GRAVEL SURFACING (BAD/VERY BAD)



TYPE 2-5
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : EARTH SURFACE

TYPE 2-6
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : EARTH SURFACE



TYPE 2-7
PROPOSED PAVEMENT : BITUMINOUS MACADAM / DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : EARTH SURFACE

TYPE 2-8
PROPOSED PAVEMENT : GRAVEL SURFACING
EXISTING PAVEMENT : EARTH SURFACING

IMPROVEMENT - I

FIGURE 3-2 TYPICAL ROAD SECTIONS (2)

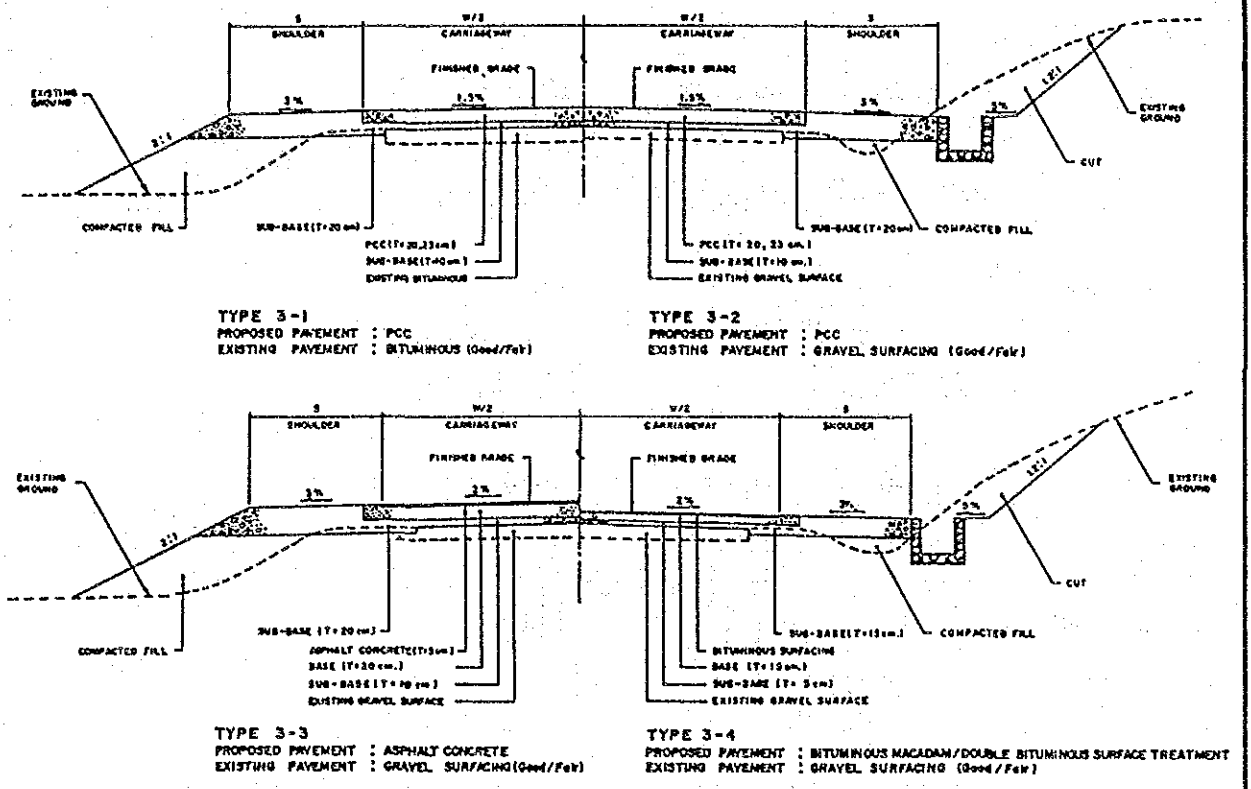


FIGURE 3-3 TYPICAL ROAD SECTIONS (3)

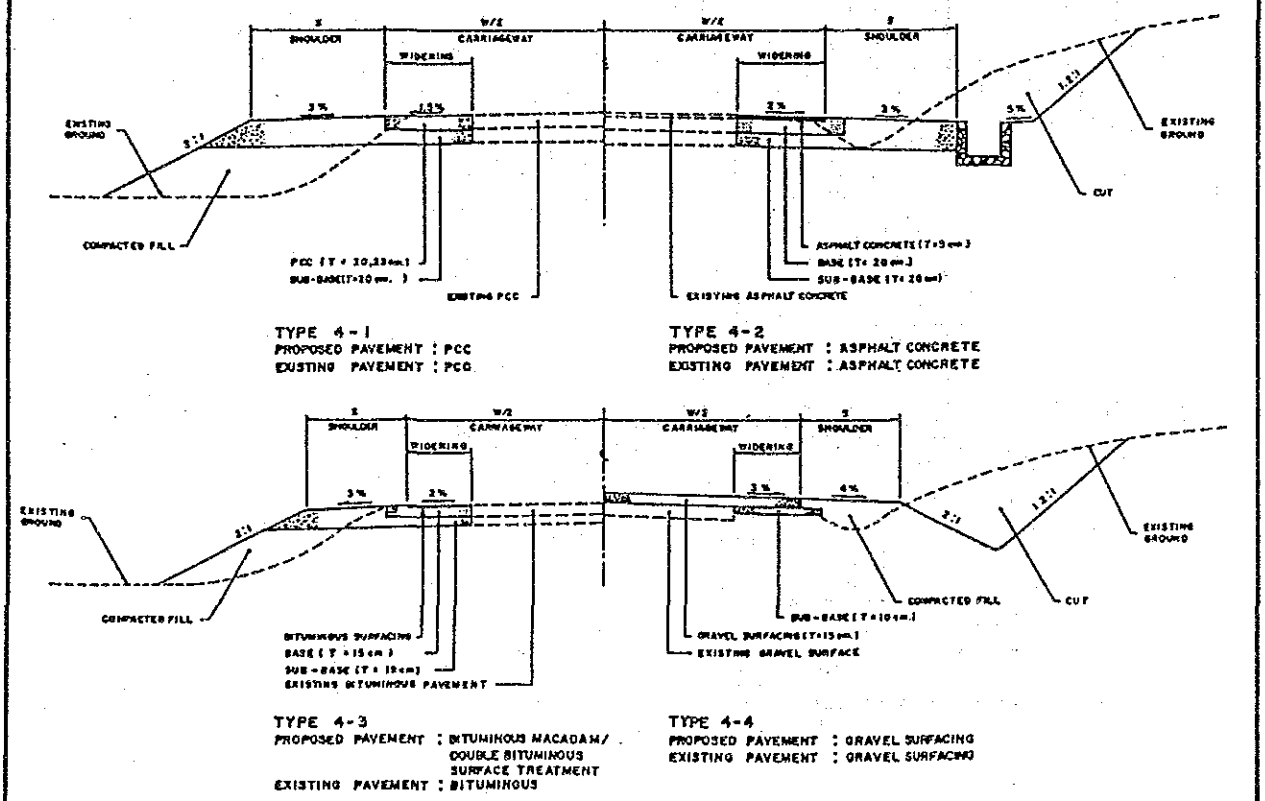
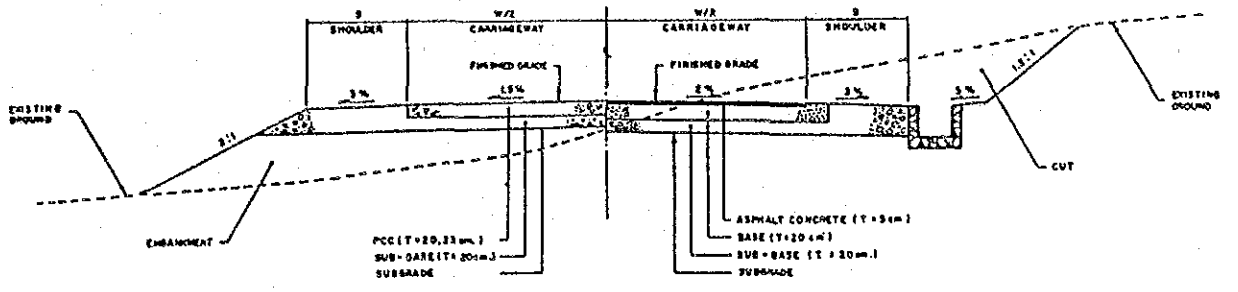
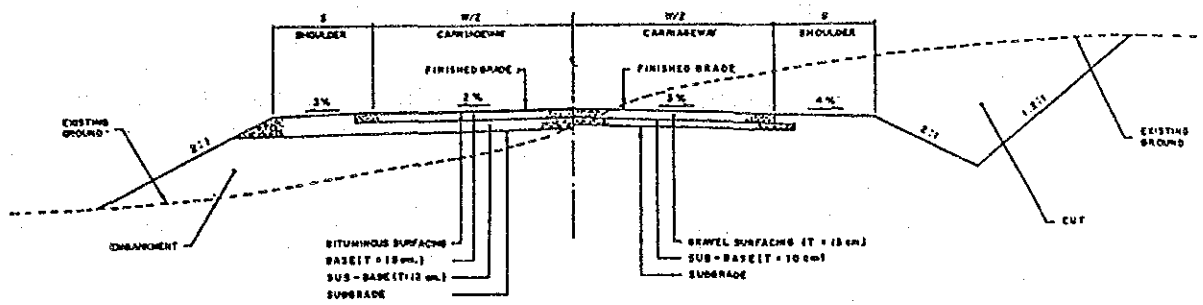


FIGURE 3-4 TYPICAL ROAD SECTIONS (4)



TYPE 5-1
PROPOSED PAVEMENT : PCC

TYPE 5-2
PROPOSED PAVEMENT : ASPHALT CONCRETE

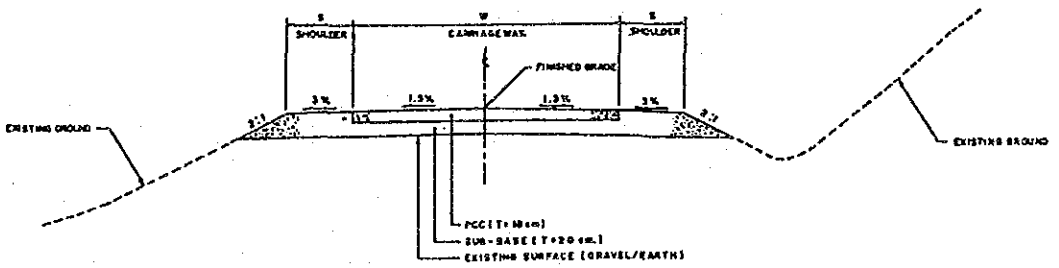


TYPE 5-3
PROPOSED PAVEMENT : BITUMINOUS MACADAM/ DOUBLE BITUMINOUS SURFACE TREATMENT

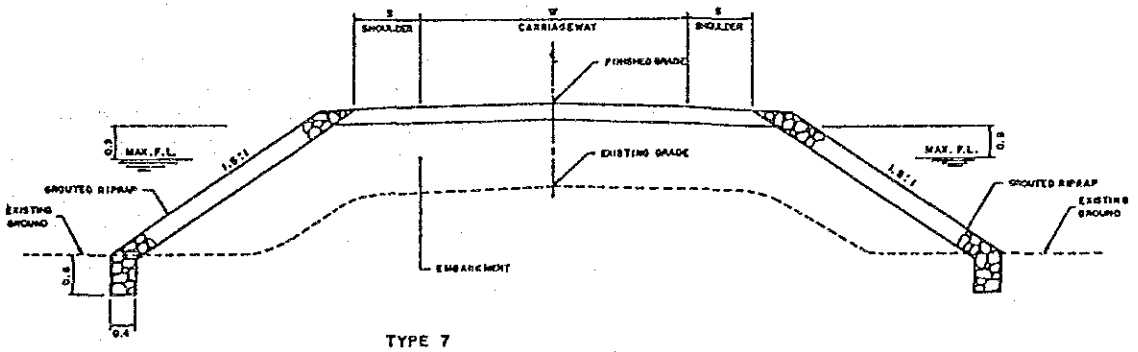
TYPE 5-4
PROPOSED PAVEMENT : GRAVEL SURFACING

NEW CONSTRUCTION

FIGURE 3-5 TYPICAL ROAD SECTIONS (5)



TYPE 6
PCC PAVEMENT FOR STEEP GRADIENT SECTIONS



TYPE 7
GRADE RAISING IN FLOOD AREA

FIGURE 3-6 TYPICAL ROAD SECTIONS (6)

CHAPTER 4 INPUT DATA FOR PROJECT EVALUATION

4.1 Input Data Sheet

See Page 4-9.

4.2 Instruction for Entry

1. Road Name and Class

Road Name

Enter the official road name or names of places at both ends of the road.

Province

Enter the name of the province where the road is located.

Province Group

Select from Table 4-1 and encircle the corresponding letter.

Administrative Classification

Select among 1. National, 2. Provincial, 3, City, 4. Barangay and encircle the corresponding number.

Functional Classification

According to the criteria for functional road classification discussed in Chapter 2 (Table 2-1), select a class among 1. Primary Major, 2. Secondary Major, 3. Collector, and 4. Feeder and encircle the corresponding number.

Project Classification

Project are classified, mainly by the method of economic analysis required, into the following two (2) types:

Traffic Projects: In projects involving the restoration/reconstruction/upgrading of the existing road which is accessible to motorized vehicles at all times, the impact of the investment would be generally confined to the transport sector. The effect of such projects would have a limited impact on the overall structure of the economy in the area served by the road.

TABLE 4-1 PROVINCE GROUP

Province	Province Group	Province	Province Group
Region I		Region VII	
Abra	E	Bohol	G
Benguet	A	Cebu	D
Ilocos Norte	G	Negros Oriental	C
Ilocos Sur	G	Siquijor	G
La Union	A	Region VIII	
Mountain Province	E	Leyte	E
Pangasinan	E	Southern Leyte	G
Region II		Eastern Samar	D
Batanes	G	Northern Samar	C
Cagayan	E	Samar	C
Ifugao	E	Region IX	
Isabela	C	Basilan	C
Kalinga-Apayao	C	Sulu	C
Nueva Vizcaya	G	Tawi-Tawi	C
Quirino	C	Zamboanga del Norte	D
Region III		Zamboanga del Sur	D
Bataan	B	Region X	
Bulacan	A	Agusan del Norte	D
Nueva Ecija	E	Agusan del SUr	C
Pampanga	A	Bukidnon	E
Tarlac	E	Camiguin	G
Zambales	A	Misamis Occidental	F
Region IV		Misamis Oriental	E
Aurora	C	Surigao del Sur	F
Batangas	G	Region XI	
Cavite	A	Davao del Norte	D
Laguna	A	Davao del Sur	D
Marindugue	F	Davao Oriental	C
Occidental Mindoro	C	South Cotabato	E
Oriental Mindoro	C	Surigao del Sur	C
Palawan	C	Region XII	
Quezon	C	Lanao del Norte	D
Rizal	B	Lanao del Sur	G
Romblon	G	Maguindanao	C
Region V		North Cotabato	C
Albay	F	Sultan Kudarat	C
Camarines Norte	D		
Camarines Sur	F		
Catanduanes	F		
Masbate	C		
Sorsogon	F		
Region VI			
Aklan	D		
Antique	F		
Capiz	F		
Iloilo	E		
Negros Occidental	F		

Development Projects: In projects for providing all-weather access or only seasonal access, to the area which presently has either no motorized access the impact of the investment would affect not only the transport sector but also sectors in the local economy, especially the agricultural sector.

Roads located in the area of high agricultural potential served by very rough but all-weather roads are considered development project roads.

Major roads (primary and secondary major roads) are generally classified as traffic projects, while minor roads (collector and feeder roads) as development projects, except for some secondary major roads which are considered as development projects.

Select a project type and encircle the corresponding number.

2.Road data

The project road shall be divided into subsections, each of which is homogeneous in terrain, cross section, surface type and condition. Road data shall be prepared by subsection.

Total Length
Enter the total length of the project road.

Station
Enter the stations at both ends of the subsection.

Subsection Length
Enter the length of the subsection.

Surface Type
Select either of :
. PCC : portland cement concrete pavement,
. AC : asphalt concrete pavement,
. BST : bituminous surface treatment or bituminous penetration macadam pavement,
. G : gravel surface,
. E : earth road, or
. None : non-existing.

Surface Condition

Select either of :

. G (Good) : No potholes or rutting or corrugation. Less than 5 potholes per 1000 meters. Cracking which does not affect driving condition may be ignored,

. F (Fair) : More than 5 but less than 20 potholes per 1000 meters and/or slight cracking and/or rutting and/or corrugated (less than 50% of the section length). Passenger car speed will exceed 30 km. per hour,

. B (Bad) : More than 20 potholes per 1000 meters and/or slightly rutted and/or corrugated (more than 50% of the section length) and/or corrugated over approximately the entire length. Pavements, if any, starting to break up. Maximum comfortable travel speed (car) is 30 km/hr,

. VB (Very Bad) :
Pavement breaking up and gravel surface deteriorated into numerous potholes. Just passable for cars. Maximum comfortable travel speed (car) is about 20 km/hr,or

. Imp (Impassable) :
Impassable to motorized vehicles at all times or in the wet season, or non-existing.

Possibility of Rehabilitation by AC Overlay

Select either of :

. Yes : Subgrade, subbase, base course and drainage are in sound condition and pavement distress is primarily caused by traffic and by surface course material,

. No : Other than above.

Terrain

Select either of :

.Fl (Flat) : Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars,

. Rl (Rolling):
Any combination of grades and horizontal and vertical alignment causing heavy vehicles to reduce their speed substantially below that of passenger cars, but not causing heavy vehicles to operate at crawl speed for any significant length of time.

. Mt (Mountainous):
Any combination of grades and horizontal and vertical alignment causing heavy vehicles to operate a crawl speed for significant distances or at frequent intervals.

Width
Enter the width of carriageway and shoulder (average of both side). In case of non-existing, enter 0.

Length of Slope to be Protected
If there are disaster prone slope (a) needing protection measures, enter the length of the slope separately for cut and embankment slopes.

Flood Section to be Raised
If there is a flood area needing grade raising, enter the water depth above existing road surface and length of flood section.

3.Structure Data

The places where river crossing facility is absent and needed shall be included as well as the existing bridges. The permanent bridge in sound condition may be omitted.

Station
Enter the Station.

Type
Select among :
. St : steel bridge
. Con : concrete bridge
. Bail : bailey bridge
. Tim : timber bridge
. Sw : spillway
. Fd : ford crossing or no bridge

Length

Enter the length of the bridge. In case of no bridge, enter 0.

Width

Enter the width of the bridge. In case of no bridge, enter 0.

Structural Condition

Select either of :

. G (Good) : Bridges that have been carrying normal traffic for a longer length of time, no sign of distress/deterioration and their load carrying capacity is considered adequate; no work or improvement to be done.

. F (Fair) : Bridges that show sign of deterioration on the superstructure and substructure such as spalling on concrete deck, light cracks on concrete surfaces, rusty steel trusses, scouring on piers, damaged slope protection.

. B (Bad) : Bridges that show signs of heavy deterioration on the structure such as showing heavy longitudinal cracks/random cracks, splitting of concrete at tension reinforcement level, heavy spalling of concrete surfaces, exposed rusty reinforcing bars at girders and bridges that are extensively damaged and structurally unsafe for vehicular traffic.

.VB(Very Bad) : Bridges incapable of carrying future traffic, structurally and hydraulically deficient, and liable to collapse.

In case of no bridge, remain blank.

Proposed Bridge Length

Enter the proposed bridge length.

4.Traffic Data

Traffic data are omissible for development projects.

Present Traffic

Enter AADT by vehicle type; car/van, jeepney, bus, and truck and compute the total of them.

Potential Traffic Diverted

If traffic is expected to divert to the project road from other route, enter the diverted traffic by vehicle type and the total.

Date of Survey

Enter the date of traffic survey.

Road from which diversion is expected

If traffic diversion is expected, enter the name, length, surface type and condition of the road from which traffic diversion is expected, into the corresponding columns.

5. Socio-economic Data

Socio-economic data are required only for development project.

Population within Road Influence Area (RIA)

Enter the population within the RIA. The RIA is defined as the area from which local existing or potential traffic (whether vehicle, animal-drawn or pedestrian) using the road derives.

Cultivated Area within RIA

Enter the total cultivated area within the RIA.

Population Distribution Pattern

Distribution of population along the road is generally categorized into the following three (3) patterns :

.Pattern -A: Population is distributed, gradually decreasing from the connection point with higher class road as going to the terminal. The average travel distance of the road users is about one third of the entire length of the road.

.Pattern -B: Population is evenly distributed over the whole length of the road. The average travel distance is about one half of the entire length of the road.

.Pattern -C: Population is concentrated at the tip of the road. The average travel distance is almost equal to the entire length of the road.

The population distribution patterns are conceptually shown in Figure 4-1.

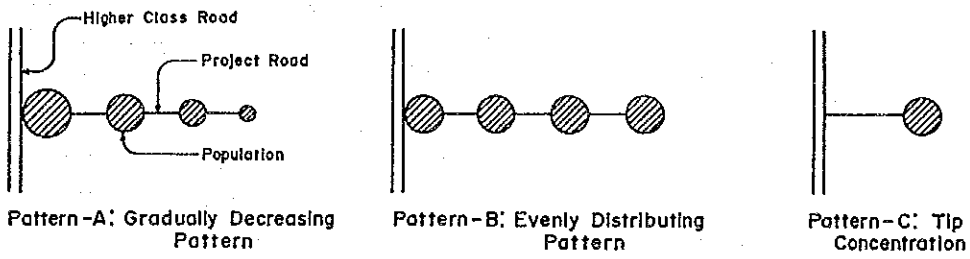


Figure 4-1 Population Distribution Pattern

The selection of pattern may be done according to the average travel distance of the road users, or center of gravity of population, as follows :

Average travel distance divided by entire length	Pattern
0 - 0.4	A
0.4 - 0.6	B
0.6 - 1.0	C

6. General Remarks

Describe specific matters on the project if any.

Attachment

Attach the map showing the project road with subsectioning and location of bridges, preferably on 1:50,000 topographic map.

INPUT DATA SHEET FOR PROJECT EVALUATION

1. ROAD NAME AND CLASS

ROAD NAME			
PROVINCE		PROVINCE GROUP	A B C D E F G
ADMINISTRATIVE CLASSIFICATION	1. NATIONAL	2. PROVINCIAL	3. BARANGAY
FUNCTIONAL CLASSIFICATION	1. PRIMARY MAJOR	2. SECONDARY MAJOR	3. COLLECTOR 4. FEEDER
PROJECT CLASSIFICATION	1. TRAFFIC PROJECT	2. DEVELOPMENT PROJECT	

2. ROAD DATA

TOTAL LENGTH ____ km.

STATION	FROM							
	TO							
SUBSECTION LENGTH (km.)								
SURFACE TYPE (PCC/AC/BST/G/E/NONE)								
SURFACE CONDITION (G/F/B/VB/IMP.)								
POSSIBILITY OF REHABILITATION BY AC OVERLAY (YES/NO)								
TERRAIN (FL/RI/MT)								
WIDTH	CARRIAGEWAY (m)							
	SHOULDER (m)							
LENGTH OF SLOPE TO BE PROTECTED	CUT SLOPE (m)							
	EMBANKMENT SLOPE (m)							
FLOOD SECTION TO BE RAISED	FLOOD DEPTH (m)							
	LENGTH (km)							

3. STRUCTURE DATA

STATION							
TYPE (St/Con/Bol)/Tim/Sw/Fd)							
LENGTH (m)							
WIDTH (m)							
STRUCTURAL CONDITION (G/F/B/VB)							
PROPOSED BRIDGE LENGTH (m)							

4. TRAFFIC DATA (OMISSIBLE FOR DEVELOPMENT PROJECT)

	PRESENT TRAFFIC	POTENTIAL TRAFFIC DIVERTED	DATE OF SURVEY
CAR/VAN			
JEEPNEY			
BUS			
TRUCK			
TOTAL			

ROAD FROM WHICH DIVERSION IS EXPECTED	
NAME :	
LENGTH (km)	
SURFACE TYPE (PCC/AC/BST/G/E)	
SURFACE CONDITION (G/F/B/VB)	
REMARKS :	

5. SOCIO-ECONOMIC DATA (ONLY FOR DEVELOPMENT PROJECT)

POPULATION WITHIN ROAD INFLUENCE AREA (RIA)	
CULTIVATED AREA WITH RIA	ha.

POPULATION DISTRIBUTION PATTERN	A. GRADUALLY DECREASING PATTERN B. EVENLY DISTRIBUTING PATTERN C. TIP CONCENTRATION PATTERN

6. GENERAL REMARKS

NOTE : ATTACH MAP INDICATING GENERAL LOCATION OF PROPOSED PROJECT, PREFERABLY IN 1:50,000 TOPOGRAPHIC MAP.

CHAPTER 5 PROJECT EVALUATION

-PROJECT WITHOUT TRAFFIC DIVERSION-

Worksheets for project evaluation and equations together with tabular and graphic information needed to complete a project evaluation are provided in Appendices A to G for province group A to G, respectively. This chapter presents step-by-step instructions for project evaluation computations.

5.1 General

1) Basic Assumptions

- Analysis Period

  1st Year - Detailed engineering
  2nd Year - Construction
  3rd Year ┐
  ⋮ ├ Project life (25 years)
  27th Year ┘

- Discounted Rate : 15% p.a.

- Quantified Cost [1]
  - .Initial construction/improvement costs [2]

- Quantified Benefit
  - .Traffic benefit (only normal and generated traffic benefits) [3]
  - .Bridge benefit
  - .Development benefit (only for development project) [4]
  - .Maintenance cost savings [5]

- Price Level [6]

  1990 price level

Note: 1) Initial construction/improvement costs calculated in accordance with this Guide are undiscounted financial costs not including the costs for detailed engineering and construction supervision. The discounted economic costs are, however, used in the computation of economic indicators with the following conversion.

Year	Item	Economic Cost	Discounted Eco. Cost
1st	Detailed Engineering	4.0%	4.0%
2nd	Construction cost less 15% tax	85.0%	73.9%
2nd	Construction Supervision	6.0%	5.2%
	Total	95.0%	83.1%

2) All benefits calculated in accordance with this Guide are total discounted benefits for 27-year analysis period.

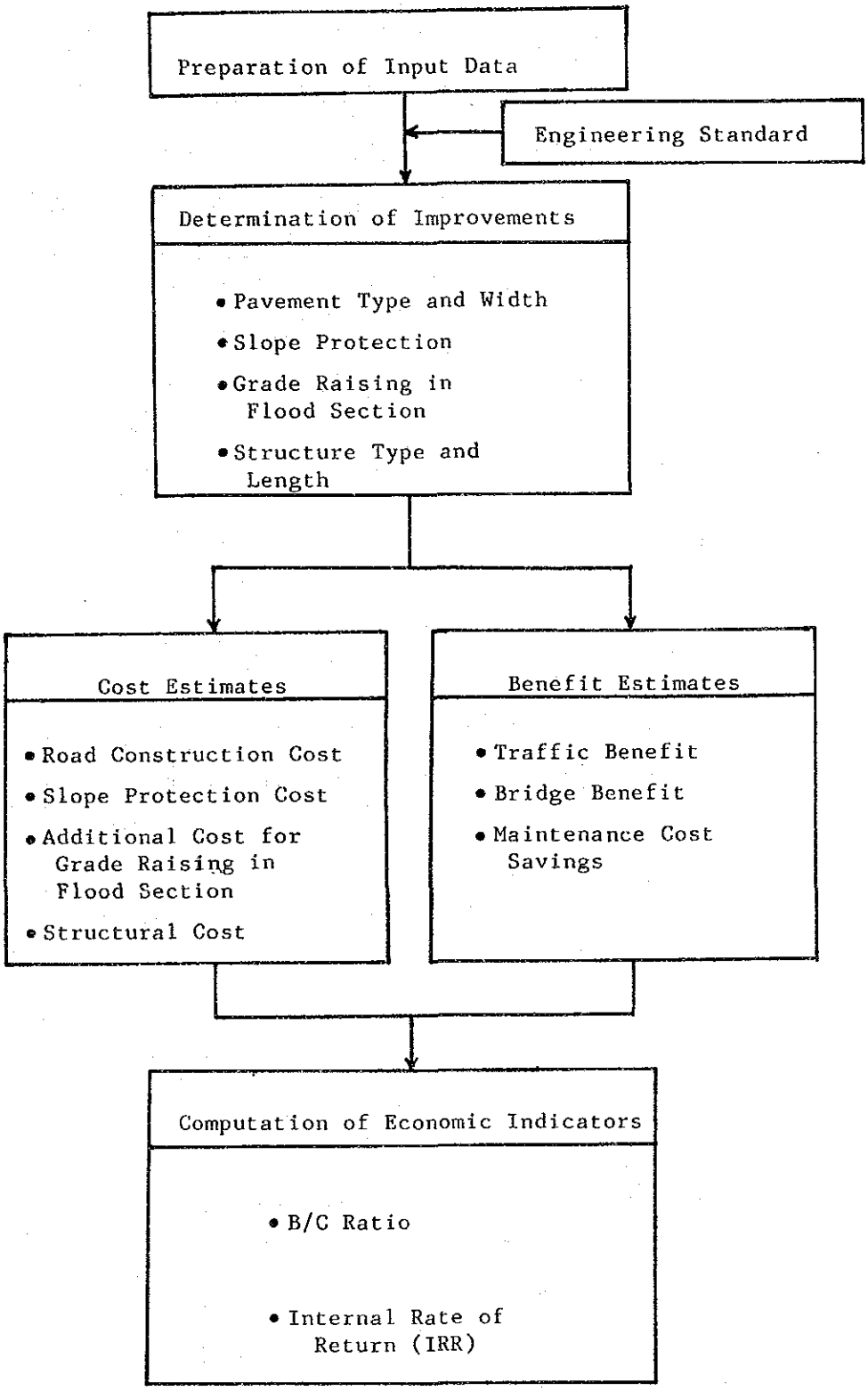
3) Bridge benefit is, in this Guide, defined as traffic benefit accruing from bridge construction/replacement, which is segregated from traffic benefit accruing from improvement of road surface type and condition.

4) Development benefit is generated by the road improvement as a whole and cannot be divided in to the effects of improvements of individual subsections. In this Manual, however, development benefit is computed as a sum of benefits calculated in individual subsections. It is only for the convenience of computation.

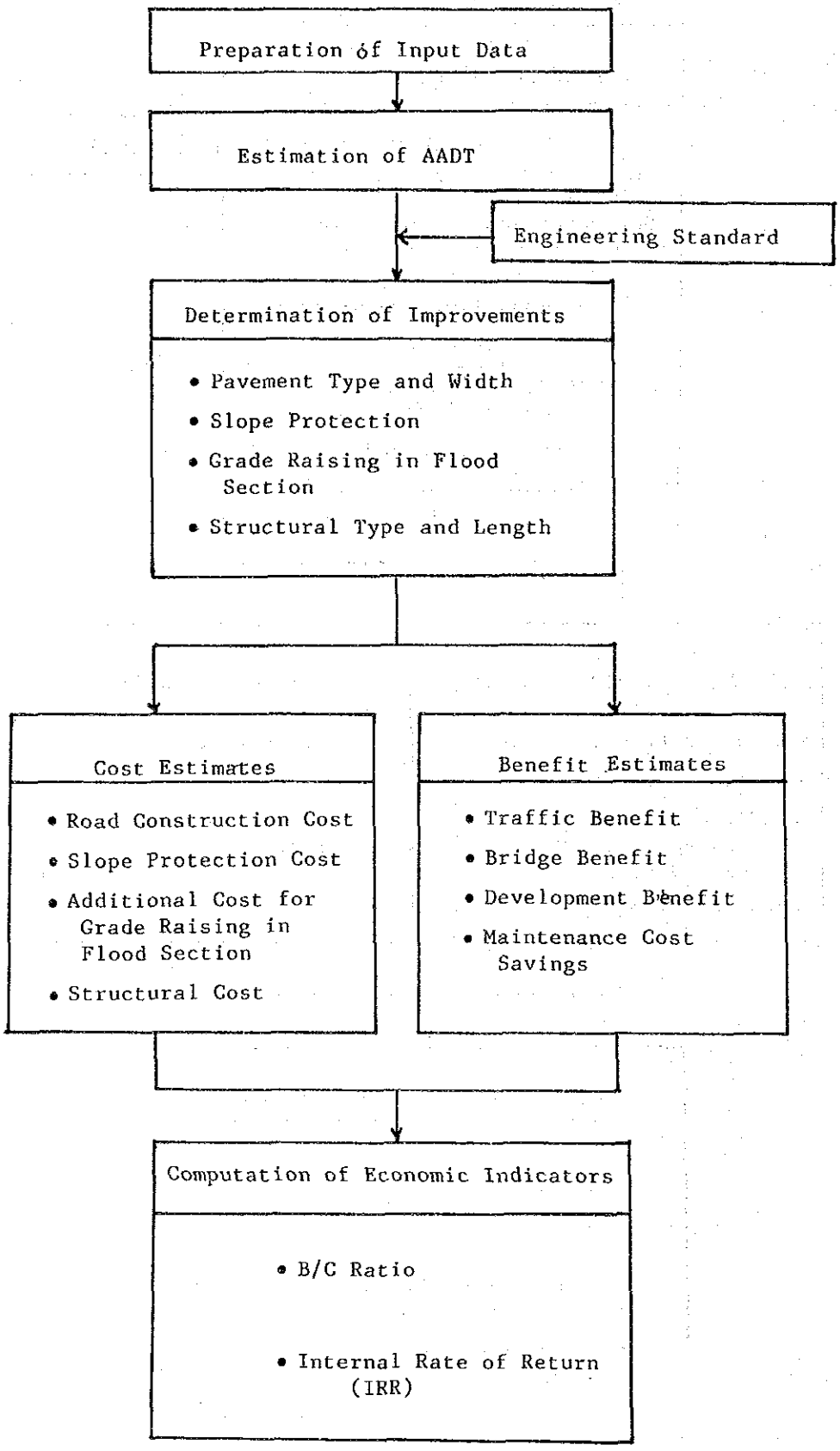
5) In addition to the savings in routine maintenance costs, the periodic maintenance costs, or rehabilitation costs, such as overlay, regravelling and reconstruction which will be needed after completion of the project to prolong the pavement life are included in "Maintenance Costs Savings" as a negative benefit. As a consequence, the maintenance costs savings become negative in most cases.

6) Adjustment for price escalation will be needed for future use. See Chapter 7.

2) General Procedure for Traffic Project Evaluation



3) General Procedure for Development Project Evaluation



4) Selection of Worksheet

In the step of preparing input data (chapter 4), the province group and project classification have been determined. The appendix containing the worksheet, equations and information to be used is selected depending on province group and project classification as follows :

Province Group \ Project Classification	Traffic Project	Development Project
A	Appendix -A.I	Appendix -A.II
B	Appendix -B.I	Appendix -B.II
C	Appendix -C.I	Appendix -C.II
D	Appendix -D.I	Appendix -D.II
E	Appendix -E.I	Appendix -E.II
F	Appendix -F.I	Appendix -F.II
G	Appendix -G.I	Appendix -G.II

5.2 Procedures for Traffic Project Evaluation

The information entered in INPUT DATA SHEET FOR PROJECT EVALUATION is used as input data for project evaluation. The worksheet prepared for each province group is used to summarize computations for project evaluation (see Figure 5-1.)

1) Road Name and Class

Name of Road, Province and Functional Classification are taken directly from INPUT DATA SHEET.

2) AADT

Present AADT

Based on Traffic Data in INPUT DATA SHEET, the numbers of light vehicles and heavy vehicles and their percentages are calculated. Light and heavy vehicles are defined as follows :

Light vehicle = car/van + jeepney
Heavy vehicle = bus + truck

Figure 5-1 PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - A)
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	**
	HEAVY VEHICLE (BUS/TRUCK)		VEH. ②	%		AADT IN OPENING YEAR (①x1.03^**)	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/SMP/GRAVEL) (REF. A.I-1)									
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. A.I-1) ⑨									
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. A.I-1) ⑩									
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑨+2x⑩) ⑪									
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. A.I-1)									
COST (M*) — ROAD — UNIT COST/KM. (REF. A.I-3) ⑫									
COST (M*) — ROAD — COST (⑫x④) ⑬									
COST (M*) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M (REF. A.I-4) ⑭									
COST (M*) — SLOPE PROTECTION — CUT SLOPE — COST (⑭x⑤) ⑮									
COST (M*) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M (REF. A.I-4) ⑯									
COST (M*) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑯x⑥) ⑰									
COST (M*) — FLOOD SECTION — UNIT COST/KM. (1.976-⑦x0.173-⑪-0.850) ⑱									
COST (M*) — FLOOD SECTION — COST (⑱x⑧) ⑲									
TOTAL COST (⑬+⑮+⑰+⑲)									㉙

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

									TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED									
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)									
PROPOSED TYPE (REF. A.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 (M*) — SUPER STRUCTURE — UNIT COST/M (REF. A.I-5) ㉓									
BRIDGE — COST (M*) — SUPER STRUCTURE — COST (㉓x㉑) ㉔									
BRIDGE — COST (M*) — ABUTMENT — UNIT COST/EACH (REF. A.I-6) ㉕									
BRIDGE — COST (M*) — ABUTMENT — COST (㉕x2) ㉖									
BRIDGE — COST (M*) — PIER — UNIT COST/EACH (REF. A.I-6) ㉗									
BRIDGE — COST (M*) — PIER — COST (㉗x(㉒-1)) ㉘									
BRIDGE — COST (M*) — TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉚									
SPILLWAY — COST (M*) — UNIT COST/M (REF. A.I-6) ㉛									
SPILLWAY — COST (M*) — COST (㉛x㉚) ㉜									
RCBC — 1-CELL OR 2-CELL									
RCBC — LENGTH (M) (USUALLY ⑪+3.0) ㉝									
RCBC — COST (M*) — RCBC — UNIT COST/M (REF. A.I-6) ㉞									
RCBC — COST (M*) — RCBC — COST (㉞x㉝) ㉟									
RCBC — COST (M*) — WINGWALL & APRON (REF. A.I-6) ㊱									
RCBC — COST (M*) — TOTAL COST (㉟x㊱) ㊲									
COST (M*) (㉙x㉜x㊲)									㊴

5) BENEFIT

AADT IN OPENING YEAR (③) ③									
PERCENT HEAVY VEHICLES (②) ②									
BRIDGE LENGTH (M) (㉑+㉚) ㊵									
BENEFIT — TRAFFIC BENEFIT — CONSTANT "E" (REF. A.I-7) ㊶									
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM/VEH. (㊶+0.000172x②) ㊷									
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊷x④x③) ㊸									
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/M/VEH. (0.066x④-0.000351) ㊹									
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊹x㊵x③) ㊺									
BENEFIT — MAINTENANCE COST SAVINGS — UNIT BENEFIT/KM (REF. A.I-8) ㊻									
BENEFIT — MAINTENANCE COST SAVINGS — BENEFIT (㊻x④) ㊼									
TOTAL BENEFIT (㊸+㊺+㊼)									㊽

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST (㊴x㊾)	㊾	
ECONOMIC COST (㊾ x 0.83)	㊿	
B/C RATIO (㊽ / ㊿)		
IRR (REF. A.I-11)		

7) COMMENT

Opening Year

AADT in the opening year is calculated assuming 3% of annual traffic growth rate based on present traffic, as follows :

AADT in opening year = Present AADT X 1.03^n

Where, n = number of years to the opening year

3) Proposed Improvement and Cost (Road)

Subsection No.

Put sequential numbers to subsections.

Length of Subsection
Existing Surface Type
Existing Surface Condition
Terrain
Slope Protection : Cut Slope Length
Slope Protection : Embankment Slope Length
Flood Section : Flood Depth
Flood Section : Flood Section Length

These are taken directly from INPUT DATA SHEET.

Proposed Pavement : Type
Proposed Pavement : Carriageway Width
Proposed Pavement : Shoulder Width

These are selected from Table in Appendix X.I-1 [1)] based on functional road classification and AADT in the opening year.
The Table only shows the standard and the actual proposal depends on engineer's judgment.

Note 1) The first letter in Appendix number corresponds to the letter indicating province group. For instance, X.I-1 is used as A.I-1 for province group -A. The same rule is applied hereinafter.

Proposed Pavement : Total Width

Total width is calculated as the sum of carriageway width and shoulder width times 2.

Proposed Pavement : Type of Improvement

Type of improvement is selected from Table in Appendix X.I-1 based on :

- Existing and proposed types comparison
- Existing surface condition, and
- Existing and proposed widths comparison

Cost : Road

Unit Cost/Km is selected from Table in Appendix X.I-3, based on type of improvement, proposed pavement type, carriageway width, shoulder width and terrain.

Cost per subsection is calculated by multiplying the unit cost by length of subsection.

Cost : Slope Protection

Unit cost/m is given in Table in Appendix X.I-4.

Cost is computed as the product of unit cost and length of slope.

Calculation is made separately for cut slope and embankment slope.

Cost : Flood Section

This means the additional cost for grade raising in flood section.

Unit cost/km is calculated as :
1.976 X Flood depth + 0.173 X road width -0.850

Cost is computed by multiplying the unit cost by length of flood section.

Total Cost

Total cost of the subsection is computed as the sum of road cost, cut slope protection cost, embankment slope protection cost and additional cost for flood section.

Total cost of subsection are summed up to obtain total road cost of the project .

3) Proposed Improvement and Cost (Structure)

Subsection No. where the structure is located

Subsection number is found based on the station of the structure shown in INPUT DATA SHEET.

Existing Type

This is taken directly from INPUT DATA SHEET.

Proposed Type

Proposed type is selected from Table in Appendix X.I-2 based on existing type, functional road classification and in some cases, carriageway width of approach road and AADT.
The Table shows only the standard and the actual proposal depends on engineer's judgement.

Bridges : No. of Lanes

Number of lanes was determined at a time of proposed type selection.

Bridges : Length

Proposed bridge length is taken directly from INPUT DATA SHEET.

Number of Spans

Number of spans should be decided based on site conditions. The standard number of spans is given by dividing bridge length in meter by 20 and rounding it, unless site conditions indicate that another number is appropriate.

Bridge Cost : Superstructure

Unit cost/m is given in Table in Appendix X.I-6. Cost is calculated as the product of the unit cost and length of bridge.

Bridge Cost : Abutment

Unit cost/each is given in table in Appendix X.I-6.
Cost is computed as the unit cost times 2.

Bridge Cost : Pier

Unit cost/each is given in table in Appendix X.I-6.
Cost is computed as the unit cost times number of piers (number of spans minus 1).

Bridge Cost : Total

Total bridge cost is computed as the sum of costs of superstructure, abutment and pier.

Spillway : Number of Lanes

Number of lanes was determined at a time of proposed type selection.

Spillway : Length

Proposed length is taken directly from INPUT DATA SHEET.

Spillway Cost

Unit cost/m is given in Table in Appendix X.I-6.
Cost is computed as the product of the unit cost and length.

RCBC : 1-cell or 2-cell

Selection criteria are as follows :
Stream crossing width 3.0m or less : 1-cell
3.0m - 6.0m : 2-cell

RCBC : Length

The length depends on the road cross-section.
Standard length is given as the road width plus 3.0m.

RCBC Cost

Unit cost/m is given in Table Appendix X.I-6.
Cost is computed as the product of the unit cost and length.

RCBC Cost : Wingwall and Apron

Both sides total cost is given in Table in Appendix X.I-6.

RCBC Cost : Total

Total RCBC cost is computed as the sum of the costs of RCBC and Wingwall and apron.

Total Cost

Total cost is computed as the sum of bridge cost, spillway cost and RCBC cost.

4) Benefit

All benefits are expressed by total discounted benefit for 27-year analysis period.

AADT in Opening Year
Percent Heavy Vehicles

These are taken directly from the entries in columns for 2) AADT.

Bridge Length

Bridge length to be entered here is the total length of proposed bridges and spillways which are located within the subsection considered.

Traffic Benefit

Unit traffic benefit/km/veh is given by the following equation :

$$TRBu = k + \alpha \times HV$$

Where, TRBu = unit traffic benefit/km/veh
k = constant depending on proposed pavement type, existing surface type and condition and terrain.
α = coefficient common within the province group
HV = percent heavy vehicles

k is selected from Table in Appendix X.I-7
Then, unit traffic benefit/km/veh is computed in accordance with the equation shown in Appendix X.I-7.
Traffic benefit is calculated as the product of the unit traffic benefits, length of subsection and AADT in the opening year.

Bridge Benefit

Unit bridge benefit is computed as :

BRBU = 0.0660 X TRBU - 0.000351
Where, BRBU = unit bridge benefit/m/veh
TRBU = unit traffic benefit/km/veh, obtained above.

Bridge benefit is obtained as the product of the unit bridge benefit, bridge length and AADT in the opening year.

Maintenance Cost Savings

Unit maintenance cost savings/km is found from chart in Appendix X.I-9, based on proposed pavement type and AADT in the opening year.

Maintenance cost savings are computed as the product of the unit maintenance cost savings and length of subsection.

Total Benefit

Total benefit of the subsection is computed as the sum of traffic benefit, bridge benefit and maintenance cost savings.

Total benefits of subsection are summed up to obtain total benefit of the project.

6) Economic Indicator

Total Construction Cost

Total Construction Cost is computed as the sum of total road cost and total structure cost.
This is the financial cost excluding the cost for detailed engineering and construction supervision.

Economic Cost

Economic cost is computed as the total construction cost times 0.831. This is the discounted economic cost including the costs for detailed engineering and construction supervision.

B/C Ratio

B/C ratio is computed by dividing the total benefit by the economic cost.

IRR

IRR is found from Chart in Appendix X.I-11, based on B/C ratio and proposed pavement type.

5.3 Procedures for Development Project Evaluation

The information entered in INPUT DATA SHEET FOR PROJECT EVALUATION is used as input data for project evaluation. The worksheet prepared for each province group is used to summarize computations for project evaluation (See Figure 5-2).

1) Road Name and Class

Same as in traffic project evaluation

2) Socio-economic Data and AADT

Population within RIA : Pt
Cultivated Area within RIA:At
Population Distribution Pattern
Total Road Length : Lt

These are taken directly from INPUT DATA SHEET.

At/Lt

This is computed by dividing the cultivated area within RIA by the total road length.

Pt/Lt

This is computed by dividing the population within RIA by the total road length.

AADT

AADT in the opening year is found from Chart in Appendix X.II-1, based on Population within RIA.

3) Proposed Improvement and Cost (Road)

Same as in traffic project evaluation.

Figure 5-2 PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

1) ROAD NAME AND CLASS

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

2) SOCIO-ECONOMIC DATA AND AADT

POPULATION WITHIN RIA : Pr	①	TOTAL ROAD LENGTH : Lr	③ KM	Pr/Lr (①/③)	⑤
CULTIVATED AREA WITHIN RIA : Ar	② HA	Ar/Lr (②/③)	④	AADT (REF. A.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									⑨
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 (RCC/AC/BMP/GRAVEL) (REF. A.II-2)									
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. A.II-2) ⑫									
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. A.II-2) ⑬									
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑫ + 2 x ⑬) ⑭									
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. A.II-2)									
COST (M$) — ROAD — UNIT COST/KM. (REF. A.II-4) ⑮									
COST (M$) — ROAD — COST (⑭ x ⑦) ⑯									
COST (M$) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M. (REF. A.II-5) ⑰									
COST (M$) — SLOPE PROTECTION — CUT SLOPE — COST (⑰ x ⑧) ⑱									
COST (M$) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M. (REF. A.II-5) ⑲									
COST (M$) — SLOPE PROTECTION — EMBANK SLOPE — COST (⑲ x ⑨) ⑳									
COST (M$) — FLOOD SECTION — UNIT COST/KM. (1.975·⑭+0.173·⑭−0.850) ㉑									
COST (M$) — 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. A.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$) — SUPER-STRUCTURE — UNIT COST/M (REF. A.II-7) ㉖									
BRIDGE — COST (M$) — SUPER-STRUCTURE — COST (㉔ x ㉖) ㉗									
BRIDGE — COST (M$) — ABUTMENT — UNIT COST/EACH (REF. A.II-7) ㉘									
BRIDGE — COST (M$) — ABUTMENT — COST (㉘ x 2) ㉙									
BRIDGE — COST (M$) — PIER — UNIT COST/EACH (REF. A.II-7) ㉚									
BRIDGE — COST (M$) — PIER — COST (㉚ x (㉕ − 1)) ㉛									
BRIDGE — COST (M$) — TOTAL COST (㉗ + ㉙ + ㉛) ㉜									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉝									
SPILLWAY — COST (M$) — UNIT COST/M (REF. A.II-7) ㉞									
SPILLWAY — COST (M$) — COST (㉝ x ㉞) ㉟									
RCBC — 1-CELL OR 2-CELL									
RCBC — LENGTH (M) (USUALLY (㉔)+3.0) ㊱									
RCBC — COST (M$) — RCBC — UNIT COST/M (REF. A.II-7) ㊲									
RCBC — COST (M$) — RCBC — COST (㊱ x ㊲) ㊳									
RCBC — COST (M$) — WINGWALL & APRON (REF. A.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. A.II-8) ㊸									
BENEFIT — TRAFFIC BENEFIT — BENEFIT (㊸ x ⑦) ㊹									
BENEFIT — BRIDGE BENEFIT — UNIT BENEFIT/KM. (0.066 x ㊷ − 0.0035 x ⑥) ㊺									
BENEFIT — BRIDGE BENEFIT — BENEFIT (㊺ x ㊷) ㊻									
BENEFIT — DEV'T. BENEFIT — CONSTANT "K" (REF. A.II-10) ㊼									
BENEFIT — DEV'T. BENEFIT — UNIT BENEFIT (K+0.000058 x ④ − 0.000015 x ⑤) ㊽									
BENEFIT — DEV'T. BENEFIT — BENEFIT (㊽ x ⑦) ㊾									
BENEFIT — MAINTENANCE COST SAVINGS — UNIT BENEFIT/KM. (REF. A.II-11) ㊿									
BENEFIT — MAINTENANCE 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 (㊷ x 0.85)	(54)	
B/C RATIO (㊷ / (54))		
I R R (REF. A.II-13)		

7) COMMENT

4) Proposed Improvement and Cost (Structure)

Same as in traffic evaluation.

5) Benefit
All benefits are expressed by total discounted benefit for 27-year analysis period.

Bridge Length

Bridge length to be entered here is the total length of proposed bridges and spillways which are located within the subsection considered.

Traffic Benefit

Unit traffic benefit/km is estimated based on existing surface type and condition, population distribution pattern, and either AADT or population within RIA. Six (6) charts for estimating unit traffic benefit are presented in Appendix X.II-8; two each for population distribution pattern -A,B and C consisting of one each based on AADT and population within RIA. Select the right chart depending on population distribution pattern and choice of parameter,weather AADT or population and using the chart, find the unit traffic benefit.

Then, traffic benefit is computed as the product of the unit traffic benefit and length of subsection.

Bridge Benefit

Unit bridge benefit/km is computed as :

BRBu = 0.0660 X TRBU - 0.000351 X VEH
Where, BRBu = unit bridge benefit/km
TRBu = unit traffic benefit/km, obtained above
VEH = AADT

Bridge benefit is calculated as the product of the unit bridge benefit and bridge length.

Development Benefit

Unit development benefit/km is given by the following equation :

$$DVBu = k + \alpha \times At/Lt + B \times Pt/Lt$$

- k = Constant depending on existing pavement type and condition
- α, B = Coefficients common within the province group
- At/Lt = Cultivated area within RIA divided by total road length
- Pt/Lt = Population within RIA divided by total road length

k is selected from Table in Appendix X.II-10.

Then, unit development benefit/km is computed using the equation shown in Appendix X.II-10.

Development benefit is calculated as the product of the unit development benefit and length of subsection.

Maintenance Cost Savings

Same as in traffic project evaluation

Total Benefit

Total benefit of the subsection is computed as the sum of traffic benefit, bridge benefit, development benefit and maintenance cost savings, and then summed up for all subsections to obtain total benefit of the project.

6) Economic Indicator

Same as in traffic project evaluation.

CHAPTER 6 PROJECT EVALUATION

-PROJECT WITH TRAFFIC DIVERSION-

Following are the procedures for evaluation of the projects in which traffic diversion is expected.

1) All computations are made applying the same method described in Chapter 5, except for traffic benefit estimates.

2) Traffic benefit is estimated in the following procedures :

   Step 1: Calculate traffic benefit in the ordinary way (the way of evaluating the projects without traffic diversion), based on non-diverted traffic.

   Step 2: Regarding the surface type and condition of the road from which diversion is expected as existing surface type and condition of the project road, calculate traffic benefit in the ordinary way, based on diverted traffic.

   Step 3: Compute the following traffic value :

$$L' \times \sum_{vt} TC'_{vt} \quad VEH_{vt}$$

Where, L' = Reduction in length resulting from traffic diversion, in km.

TC'_{vt} = Unit traffic cost, in Mt/km/veh, of vehicle type vt, in terms of total discounted cost for 27-year analysis period, depending on surface type and condition of the road from which diversion is expected

VEH_{vt} = diverted traffic of vehicle type vt in the opening year

L' is calculated by subtracting the length of the project road from the length of the road from which diversion is expected. If the former is longer than the latter, L' takes a negative value.

TC'vt is given in Table 6-1.

VEHvt is estimated based on present diverted traffic, assuming an appropriate traffic growth rate (usually 3% p.a.).

All necessary information is given in INPUT DATA SHEET.

Step4 : Traffic benefit is computed as the sum of the values obtained in Step 1, 2 and 3.

TABLE 6.1 Unit Traffic Cost "TC'vt" (Discounted Total for 27-year Analysis Period)

(unit : Mp/km/veh)

Surface Type	Surface Condition	Car/ Van	Jeep- ney	Bus	Truck	Tri- cycle	Motor cycle	Animal Drawn	Walk- ing	Banca Boat
PCC/AC	Good	.0056	.0050	.0126	.0107	.0018	.0012			
	Fair	.0065	.0058	.0149	.0126	.0021	.0014			
	Bad	.0087	.0086	.0220	.0165	.0032	.0024			
	Very Bad	.0118	.0122	.0311	.0224	.0054	.0039			
BMP/ DBST	Good	.0062	.0054	.0139	.0120	.0020	.0014			
	Fair	.0075	.0065	.0167	.0145	.0024	.0017			
	Bad	.0097	.0092	.0236	.0185	.0034	.0025			
	Very Bad	.0125	.0126	.0322	.0238	.0055	.0040			
Gravel	Good	.0070	.0060	.0152	.0135	.0023	.0015	.0105	.0032	.0059
	Fair	.0086	.0073	.0187	.0167	.0027	.0019			
	Bad	.0107	.0099	.0253	.0205	.0036	.0027			
	Very Bad	.0133	.0131	.0334	.0252	.0057	.0042			
	Impassable	.0189	.0212	.0545	.0352	.0098	.0070			
Earth	Bad	.0133	.0131	.0334	.0252	.0057	.0042			
	Very Bad	.0181	.0207	.0532	.0336	.0096	.0068			
	Impassable	.0189	.0212	.0545	.0352	.0098	.0070			

CHAPTER 7 ADJUSTMENT FOR PRICE ESCALATION

As mentioned in Chapter 5, all data on costs and benefits provided in this Guide are at 1990 price level. When using this Guide in the future, cost and benefits will be needed to be updated according to the price level at the time. This Chapter discusses the way of such adjustment.

7.1 Construction Cost

Table 7-1 shows the breakdown of construction cost into costs of material, equipment and labor. Based on the escalation rate to the 1990 price level in each component, the adjustment factor is derived from the following equation :

$$Fc = fm \times Gm + fe \times Ge + f\ell \times G\ell$$

Where, Fc = adjustment factor for construction cost

fm, fe, fℓ = cost components of material, equipment and labor, respectively, in fraction, given in Table 7-1.

Gm, Ge, Gℓ = escalation rates of material cost, equipment cost and labor cost, respectively, to the 1990 price, in fraction.

Table 7-1 Construction Cost Components

		Material fm	Equipment fe	Labor fℓ
Road Construction Cost	PCC	0.46	0.45	0.09
	AC	0.37	0.54	0.09
	BMP	0.35	0.53	0.12
	Gravel	0.10	0.78	0.12
	Overlay	0.68	0.26	0.06
Slope Protection Cost		0.35	0.48	0.17
Additional Cost for Grade Raising in Flood Section		0.38	0.35	0.27
Structure Cost		0.75	0.10	0.15

7.2 Traffic Benefit

Table 7-2 shows the breakdown of traffic benefit into running cost, fixed cost, time cost and non-motorized transport cost. Based on the escalation rate to the 1990 price level in each component, the adjustment factor is derived from the following equation :

$$Ft = fr \cdot Gr + ft \cdot Gf + ft \cdot Gt + fn \cdot Gn$$

Where, fr,ft,ft,fn = benefit component of running cost, fixed cost, time cost and non-motorized transport cost, respectively, in fraction, given in Table 7-2.

Gr,Gf,Gt,Gn = escalation rate of running cost, fixed cost, time cost and non-motorized transport cost, respectively, to the 1990 price, in fraction.

Since running cost, fixed cost and time cost are updated time to time by the DPWH, Gr,Gf,and Gt are easily gotten. Gn is estimated based on the consumer price index for all items.

Table 7-2 Traffic Benefit Component

	Running Cost fr	Fixed Cost ff	Time Cost ft	Non-motorized Transport Cost fn
Traffic Project	0.49	0.25	0.26	-
Development Proj.	0.25	0.21	0.25	0.29

7.3 Bridge Benefit

The same adjustment factor as for traffic benefit is applicable

7.4 Development Benefit

Adjustment factor is reasonably estimated based on the producer price index for agricultural products.

7.5 Maintenance Cost Savings

One of the adjustment factors for road construction cost is applicable to the adjustment of maintenance cost savings. The selection of adjustment factor depends on proposed pavement type, as follows :

Proposed Pavement Type	Adjustment Factor to be applied
PCC	Adjustment factor for road construction cost (for overlay)
AC	-do-
BMP	-do-
Gravel	(gravel)
Overlay	(overlay)

CHAPTER 8 SAMPLE CALCULATION

Calculation 1 : Traffic Project

Input data sheet, location map and project evaluation worksheet are presented on Page 8-2, 8-3 and 8-4, respectively.

Calculation 2 : Development Project

Input data sheet, location map and project evaluation worksheet are presented on Page 8-5, 8-6 and 8-7, respectively.

INPUT DATA SHEET FOR PROJECT EVALUATION

1. ROAD NAME AND CLASS

ROAD NAME	P89 SAN ROQUE - NUEVA ILOCO		
PROVINCE	DAVAO DEL NORTE	PROVINCE GROUP	A B C (D) E F G
ADMINISTRATIVE CLASSIFICATION	1. NATIONAL (2) PROVINCIAL	3. BARANGAY	
FUNCTIONAL CLASSIFICATION	1. PRIMARY MAJOR (2) SECONDARY MAJOR	3. COLLECTOR	4. FEEDER
PROJECT CLASSIFICATION	(1) TRAFFIC PROJECT	2. DEVELOPMENT PROJECT	

2. ROAD DATA

TOTAL LENGTH 7.5 km.

STATION	FROM	0.0	5.9					
	TO	5.9	7.5					
SUBSECTION LENGTH (km.)		5.9	1.6					
SURFACE TYPE (PCC/AC/BST/G/E/NONE)		G	G					
SURFACE CONDITION (G/F/B/VB/IMP.)		B	F					
POSSIBILITY OF REHABILITATION BY AC OVERLAY (YES/NO)		No	No					
TERRAIN (Fl / Rl / Mt)		Fl	Fl					
WIDTH	CARRIAGEWAY (m)	4.5	4.0					
	SHOULDER (m)	0.75	0.75					
LENGTH OF SLOPE TO BE PROTECTED	CUT SLOPE (m)	–	–					
	EMBANKMENT SLOPE (m)	–	–					
FLOOD SECTION TO BE RAISED	FLOOD DEPTH (m)	–	–					
	LENGTH (km)	–	–					

3. STRUCTURE DATA

STATION	3.5	5.9					
TYPE (St/Con/Bail/Tim/Sw/Fd)	Con	Tim					
LENGTH (m)	6.0	25.8					
WIDTH (m)	3.9	5.8					
STRUCTURAL CONDITION (G/F/B/VB)	VB	B					
PROPOSED BRIDGE LENGTH (m)	6.0	26.0					

4. TRAFFIC DATA (OMISSIBLE FOR DEVELOPMENT PROJECT)

	PRESENT TRAFFIC	POTENTIAL TRAFFIC DIVERTED	DATE OF SURVEY
CAR/VAN	102	–	
JEEPNEY	99	–	
BUS	8	–	
TRUCK	52	–	
TOTAL	261	–	

ROAD FROM WHICH DIVERSION IS EXPECTED	–
NAME :	–
LENGTH (km)	–
SURFACE TYPE (PCC/AC/BST/G/E)	–
SURFACE CONDITION (G/F/B/VB)	–
REMARKS :	

5. SOCIO-ECONOMIC DATA (ONLY FOR DEVELOPMENT PROJECT)

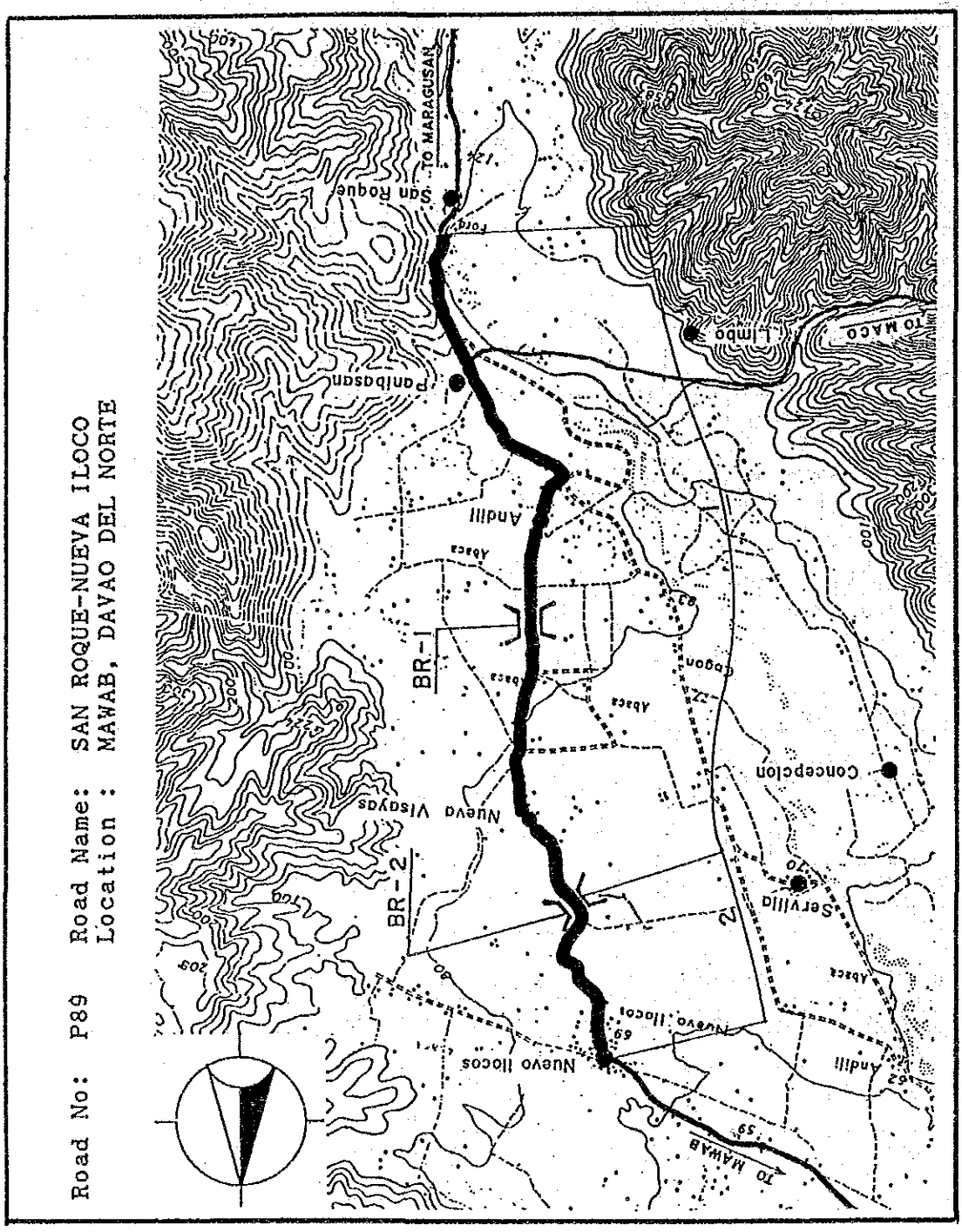
POPULATION WITHIN ROAD INFLUENCE AREA (RIA)	
CULTIVATED AREA WITH RIA	ha.

POPULATION DISTRIBUTION PATTERN	A. GRADUALLY DECREASING PATTERN B. EVENLY DISTRIBUTING PATTERN C. TIP CONCENTRATION PATTERN

6. GENERAL REMARKS

NOTE : ATTACH MAP INDICATING GENERAL LOCATION OF PROPOSED PROJECT, PREFERABLY IN 1:50,000 TOPOGRAPHIC MAP.

CALCULATION 1 LOCATION MAP



PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

CALCULATION 1 PROJECT EVALUATION WORKSHEET

1) ROAD NAME AND CLASS

NAME OF ROAD	P89 SAN ROQUE - NUEVA ILOCO
PROVINCE	DAVAO DEL NORTE (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)	201 VEH.	77.01 %	OPENING YEAR	NUMBERS OF YEARS TO THE OPENING YEAR	n = 3
	HEAVY VEHICLE (BUS/TRUCK)	60 VEH.	(2) 22.99 %		AADT IN OPENING YEAR ((1) x 1.03^n)	(3) 285
	TOTAL	(1) 261 VEH.	100 %			

3) PROPOSED IMPROVEMENT AND COST (ROAD)

				1	2						TOTAL
SUBSECTION NO.											
LENGTH OF SUBSECTION (KM) (4)				5.9	1.6						7.5
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)				G	G						
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)				B	F						
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)				F	F						
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)			BMP	BMP						
	CARRIAGEWAY WIDTH (M) (REF. D.I-1) (9)			6.0	6.0						
	SHOULDER WIDTH (M) (REF. D.I-1) (10)			1.5	1.5						
	TOTAL WIDTH (M) ((9)+2x(10)) (11)			9.0	9.0						
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. D.I-1)			IMP-1	IMP-2						
COST (MP)	ROAD	UNIT COST/KM. (REF. D.I-3) (12)		1.744	1.744						
		COST ((12)x(4)) (13)		10.290	2.790						13.080
	SLOPE PROTECTION	CUT SLOPE	UNIT COST/M (REF. D.I-4) (14)	–	–						
			COST ((14)x(5)) (15)	–	–						
		EMBANK SLOPE	UNIT COST/M (REF. D.I-4) (16)	–	–						
			COST ((16)x(6)) (17)	–	–						
	FLOOD SECTION	UNIT COST/KM. (1.976·(7)+0.173·(11)-0.850) (18)		–	–						
		COST ((18)x(8)) (19)		–	–						
	TOTAL COST ((13)+(15)+(17)+(19))			10.290	2.790						(20) 13.080

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

					1	2						TOTAL
SUBSECTION NO. WHERE THE STRUCTURE IS LOCATED												
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)					OTHER	TIMBER						
PROPOSED TYPE (REF. D.I-2) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)					2-BR	2-BR						
BRIDGE	NO. OF LANES				2	2						
	LENGTH (M) (21)				6.0	26.0						
	NO. OF SPANS ((21)/20 & ROUND) (22)				1	2						
	COST (MP)	SUPER STRUCTURE	UNIT COST/M (REF. D.I-6) (23)		0.0478	0.0478						
			COST ((22)x(21)) (24)		0.2868	1.2428						
		ABUTMENT	UNIT COST/EACH (REF. D.I-6) (25)		0.3630	0.3630						
			COST ((25)x2) (26)		0.726	0.726						
		PIER	UNIT COST/EACH (REF. D.I-6) (27)									
			COST ((27)x((22)-1)) (28)									
	TOTAL COST ((24)+(26)+(28)) (29)				1.0128	1.9688						2.9816
SPILLWAY	NO. OF LANES											
	LENGTH (M) (30)											
	COST (MP)	UNIT COST/M (REF. D.I-6) (31)										
		COST ((31)x(30)) (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 ((34)x(33)) (35)									
		WINGWALL & APRON (REF. D.I-6) (36)										
		TOTAL COST ((35)+(36)) (37)										
COST (MP) ((29)+(32)+(37))					1.0128	1.9688						(38) 2.982

5) BENEFIT

				1	2						TOTAL
AADT IN OPENING YEAR ((3)) (3)				285	285						
PERCENT HEAVY VEHICLES ((2)) (2)				22.99	22.99						
BRIDGE LENGTH (M) ((21)+(30)) (39)				6.0	26.0						
BENEFIT	TRAFFIC BENEFIT	CONSTANT "k" (REF. D.I-7) (40)		0.00721	0.00684						
		UNIT BENEFIT/KM/VEH. ((40)) (41)		0.00721	0.00684						
		BENEFIT ((41)x(4)x(3)) (42)		12.124	3.119						15.243
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066 x (41) - 0.000351) (43)		0.000128286	0.000100884						
		BENEFIT ((43)x(39)x(3)) (44)		0.213	0.744						0.957
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM (REF. D.I-9) (45)		-0.405	-0.405						
		BENEFIT ((45)x(4)) (46)		-2.389	-0.648						-3.037
	TOTAL BENEFIT ((42)+(44)+(46))			9.948	3.210						(47) 13.163

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST ((20)+(38))	(48)	16.062
ECONOMIC COST ((48) x 0.831)	(49)	13.347
B/C RATIO	((47)/(49))	0.986
IRR	(REF. D.I-11)	14.8

7) COMMENT

INPUT DATA SHEET FOR PROJECT EVALUATION

1. ROAD NAME AND CLASS

ROAD NAME	P4-1		
PROVINCE	PANGASINAN - STA ANA	PROVINCE GROUP	A B C D E (F) G
ADMINISTRATIVE CLASSIFICATION	1. NATIONAL (2.) PROVINCIAL	3. BARANGAY	
FUNCTIONAL CLASSIFICATION	1. PRIMARY MAJOR	2. SECONDARY MAJOR	3. COLLECTOR (4.) FEEDER
PROJECT CLASSIFICATION	1. TRAFFIC PROJECT (2.) DEVELOPMENT PROJECT		

2. ROAD DATA

TOTAL LENGTH 1.9 km.

STATION	FROM	0.00	0.70					
	TO	0.70	1.90					
SUBSECTION LENGTH (km.)		0.7	1.2					
SURFACE TYPE (PCC/AC/BST/G/E/NONE)		G	G					
SURFACE CONDITION (G/F/B/VB/IMP.)		B	F					
POSSIBILITY OF REHABILITATION BY AC OVERLAY (YES/NO)		No	No					
TERRAIN (Fl/Rl/Mt)		F	F					
WIDTH	CARRIAGEWAY (m)	4.0	4.5					
	SHOULDER (m)	0.5	0.75					
LENGTH OF SLOPE TO BE PROTECTED	CUT SLOPE (m)	—	—					
	EMBANKMENT SLOPE (m)	—	—					
FLOOD SECTION TO BE RAISED	FLOOD DEPTH (m)	—	—					
	LENGTH (km)	—	—					

3. STRUCTURE DATA

STATION	1.3	1.9					
TYPE (St/Con/Boil/Tim/Sw/Fd)	Bail	Bail					
LENGTH (m)	16.2	15.3					
WIDTH (m)	3.8	3.8					
STRUCTURAL CONDITION (G/F/B/VB)	G	G					
PROPOSED BRIDGE LENGTH (m)	—	—					

4. TRAFFIC DATA (OMISSIBLE FOR DEVELOPMENT PROJECT)

	PRESENT TRAFFIC	POTENTIAL TRAFFIC DIVERTED	DATE OF SURVEY
CAR/VAN			
JEEPNEY			
BUS			
TRUCK			
TOTAL			

ROAD FROM WHICH DIVERSION IS EXPECTED	
NAME :	
LENGTH (km)	
SURFACE TYPE (PCC/AC/BST/G/E)	
SURFACE CONDITION (G/F/B/VB)	
REMARKS :	

5. SOCIO-ECONOMIC DATA (ONLY FOR DEVELOPMENT PROJECT)

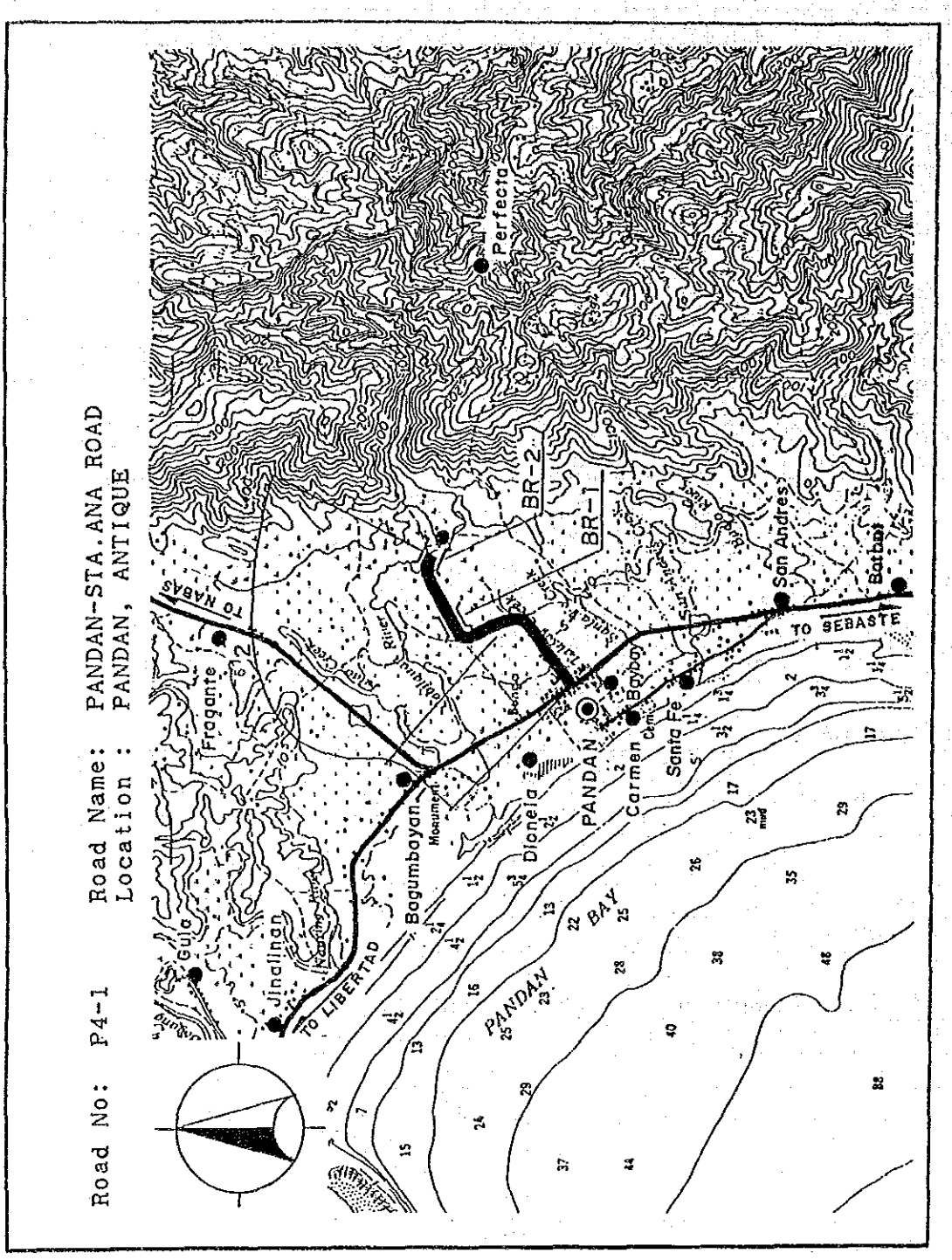
POPULATION WITHIN ROAD INFLUENCE AREA (RIA)	3,553
CULTIVATED AREA WITH RIA	580 ha.

POPULATION DISTRIBUTION PATTERN	A. GRADUALLY DECREASING PATTERN B. EVENLY DISTRIBUTING PATTERN (C.) TIP CONCENTRATION PATTERN

6. GENERAL REMARKS

NOTE : ATTACH MAP INDICATING GENERAL LOCATION OF PROPOSED PROJECT, PREFERABLY IN 1:50,000 TOPOGRAPHIC MAP.

CALCULATION 2 LOCATION MAP



PROJECT EVALUATION WORKSHEET (DEVELOPMENT PROJECT)

CALCULATION 2 PROJECT EVALUATION WORKSHEET

1) ROAD NAME AND CLASS

NAME OF ROAD	P4-1. PANDAN - STA ANA
PROVINCE	ANTIQUE (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 3,153	TOTAL ROAD LENGTH : Lt	③ 1.9 KM	Pt / Lt (①/③)	⑤ 1659.47
CULTIVATED AREA WITHIN RIA : At	② 580 HA	At / Lt (②/③)	④ 305.26	AADT (REF. F.II-1)	⑥ 20.0
POPULATION DISTRIBUTION PATTERN	A : GRADUALLY DECREASING PATTERN	B : EVENLY DISTRIBUTING PATTERN	(C) : TIP CONCENTRATION PATTERN		

3) PROPOSED IMPROVEMENT AND COST (ROAD)

										TOTAL
SUBSECTION NO.				1	2					
LENGTH OF SUBSECTION (KM) ⑦				0.7	1.2					③ 1.9
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH/NONE)				G	G					
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD/IMPASSABLE)				B	F					
TERRAIN (FLAT/ROLLING/MOUNTAINOUS)				F	F					
SPECIAL TREATMENT	SLOPE PROTECTION	CUT SLOPE LENGTH (M) ⑧								
		EMBANKMENT SLOPE LENGTH (M) ⑨								
	FLOOD SECTION	FLOOD DEPTH (M) ⑩								
		FLOOD SECTION LENGTH (M) ⑪								
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. F.II-2)			G	G					
	CARRIAGEWAY WIDTH (M) (REF. F.II-2) ⑫			6.0	6.0					
	SHOULDER WIDTH (M) (REF. F.II-2) ⑬			1.0	1.0					
	TOTAL WIDTH (M) (⑫+2x⑬) ⑭			8.0	8.0					
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. F.II-2)			Rehab	Widen					
COST (MP)	ROAD	UNIT COST/KM. (REF. F.II-4) ⑮		0.714	0.714					
		COST (⑮x⑦) ⑯		0.2998	0.8568					1.3566
	SLOPE PROTECTION	CUT SLOPE	UNIT COST/M. (REF. F.II-5) ⑰							
			COST (⑰x⑧) ⑱							
		EMBANK SLOPE	UNIT COST/M. (REF. F.II-5) ⑲							
			COST (⑲x⑨) ⑳							
	FLOOD SECTION	UNIT COST/KM. (1.976·⑩+0.173·⑭-0.850) ㉑								
		COST (㉑x⑪) ㉒								
	TOTAL COST (⑯+⑱+⑳+㉒)			0.2998	0.8568					㉓ 1.357

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								
	LENGTH (M) ㉔								
	NO. OF SPANS (㉔/20 & ROUND) ㉕								
	COST (MP) SUPER-STRUCTURE	UNIT COST/M (REF. F.II-7) ㉖							
		COST (㉕x㉔) ㉗							
	ABUTMENT	UNIT COST/EACH (REF. F.II-7) ㉘							
		COST (㉘x2) ㉙							
	PIER	UNIT COST/EACH (REF. F.II-7) ㉚							
		COST (㉚x(㉕-1)) ㉛							
	TOTAL COST (㉗+㉙+㉛) ㉜								
SPILLWAY	NO. OF LANES								
	LENGTH (M) ㉝								
	COST (MP) UNIT COST/M (REF. F.II-7) ㉞								
	COST (㉞x㉝) ㉟								
RCBC	1-CELL OR 2-CELL								
	LENGTH (M) (USUALLY ⑭+3.0) ㊱								
	COST (MP) RCBC UNIT COST/M (REF. F.II-7) ㊲								
	COST (㊲x㊱) ㊳								
	WINGWALL & APRON (REF. F.II-7) ㊴								
	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. F.II-8) ㊸	0.43	0.43					
		BENEFIT (㊸x⑦) ㊹	0.301	0.516					0.817
	BRIDGE BENEFIT	UNIT BENEFIT/KM. (0.066x㊸-0.00035I x⑥) ㊺							
		BENEFIT (㊺x㊷) ㊻							
	DEV'T. BENEFIT	CONSTANT "K" (REF. F.II-10) ㊼	0.285	0.488					
		UNIT BENEFIT (K+0.002613x④-0.000058x⑤) ㊽	0.9864	1.1894					
		BENEFIT (㊽x⑦) ㊾	0.6905	1.4273					2.118
	MAINTE-NANCE COST SAVINGS	UNIT BENEFIT/KM. (REF. F.II-11) ㊿	-0.17	-0.17					
		BENEFIT (㊿x⑦) (51)	-0.119	-0.204					-0.323
	TOTAL BENEFIT (㊹+㊻+㊾+(51))		0.918	1.739					(52) 2.612

6) ECONOMIC INDICATOR

TOTAL CONSTRUCTION COST	(㉓+㊶) (53)	1.357
ECONOMIC COST	(53x0.831) (54)	1.128
B/C RATIO	(52/54)	2.32
I R R	(REF. F.II-13)	29.8

7) COMMENT

APPENDIX A

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

PROVINCES : Benguet

La Union

Bulacan

Pampanga

Zambales

Cavite

Laguna

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

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - A)
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.										
LENGTH OF SUBSECTION (KM) ④										
EXISTING SURFACE TYPE (PAVED/GRAVEL/EARTH)										
EXISTING SURFACE CONDITION (GOOD/FAIR/BAD/VERY BAD)										
YERRAIN (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. A.I-1)									
	CARRIAGEWAY WIDTH (M) (REF. A.I-1) ⑨									
	SHOULDER WIDTH (M) (REF. A.I-1) ⑩									
	TOTAL WIDTH (M) (⑨+2x⑩) ⑪									
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. A.I-1)									
COST (M/P)	ROAD	UNIT COST/KM. (REF. A.I-3) ⑫								
		COST (⑫x④) ⑬								
	SLOPE PROTECTION — CUT SLOPE	UNIT COST/M (REF. A.I-4) ⑭								
		COST (⑭x⑤) ⑮								
		EMBANK SLOPE — UNIT COST/M (REF. A.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										
EXISTING TYPE (FORD/SPILLWAY/TIMBER/BAILEY/OTHER)										
PROPOSED TYPE (REF. A.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 (M/P) — SUPER STRUCTURE — UNIT COST/M (REF. A.I-6) ㉓									
		COST (㉓x㉑) ㉔								
	ABUTMENT — UNIT COST/EACH (REF. A.I-6) ㉕									
		COST (㉕x 2) ㉖								
	PIER — UNIT COST/EACH (REF. A.I-6) ㉗									
		COST (㉗x(㉒-1)) ㉘								
	TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY	NO. OF LANES									
	LENGTH (M) ㉚									
	COST(M/P) — UNIT COST/M (REF. A.I-6) ㉛									
		COST (㉛x㉚) ㉜								
RCBC	1-CELL OR 2-CELL									
	LENGTH (M) (USUALLY ⑪+3.0) ㉝									
	COST (M/P) — RCBC — UNIT COST/M (REF. A.I-6) ㉞									
		COST (㉞x㉝) ㉟								
	WINGWALL & APRON (REF. A.I-6) ㊱									
	TOTAL COST (㉟+㊱) ㊲									
COST (M/P) (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. A.I-7) ㊵								
		UNIT BENEFIT/KM/VEH. (㊵+0.000172x②) 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. A.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. A.I-11)		

7) COMMENT

A.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

A.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.

A.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	-	-	3.066
			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	-	-

A.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

A.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

A.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

A.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k+0.000172·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	.00465	.00414	.00440
	Paved - Very Bad	.00884	.00832	.00859
	Gravel- Good/Fair	.00573	.00522	.00548
	Gravel- Bad	.00592	.00541	.00567
	Gravel- Very Bad	.00885	.00834	.00860
	Earth - Bad	.01277	.01226	.01252
	Earth - Very Bad	.01771	.01720	.01746
BMP/DBST	Paved - Bad	.00333	.00282	.00308
	Paved - Very Bad	.00752	.00701	.00727
	Gravel- Good/Fair	.00442	.00390	.00416
	Gravel- Bad	.00461	.00409	.00436
	Gravel- Very Bad	.00753	.00702	.00728
	Earth - Bad	.01145	.01094	.01120
	Earth - Very Bad	.01639	.01588	.01614
Gravel	Gravel- Bad	.00422	.00371	.00397
	Gravel- Very Bad	.00715	.00663	.00690
	Earth - Bad	.01107	.01055	.01082
	Earth - Very Bad	.01601	.01550	.01576

A.I-8 Bridge Benefit

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

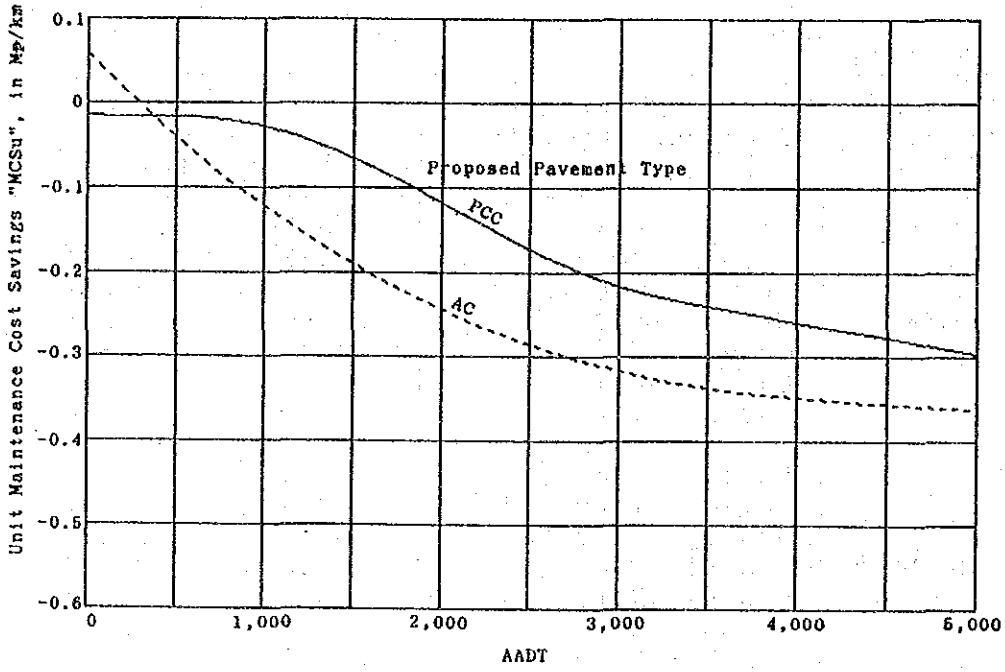
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh,
obtained from A.I-7

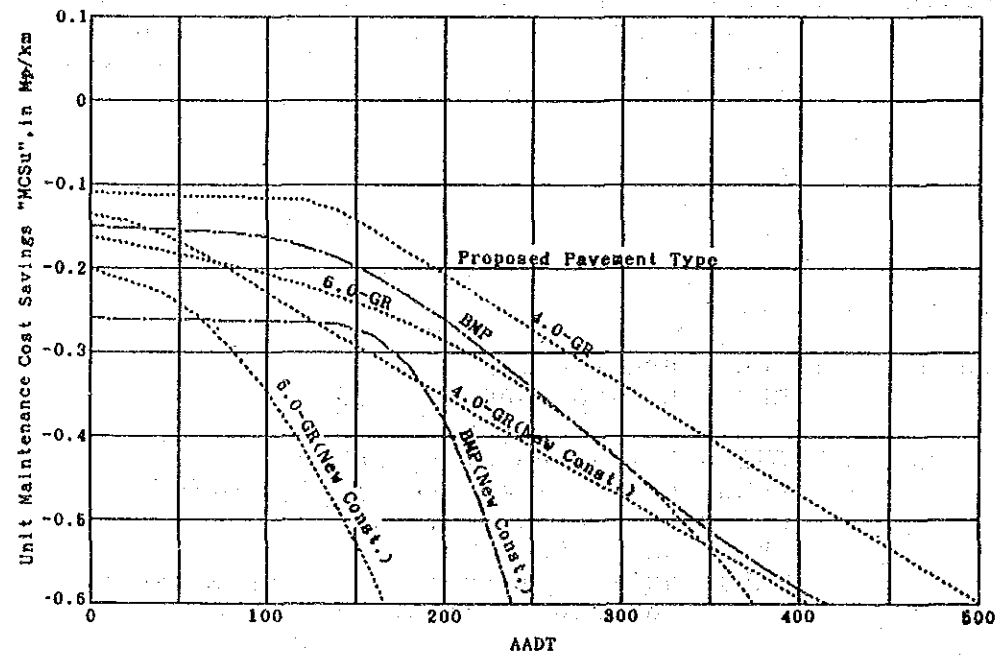
A.I-9 Maintenance Cost Savings

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"





A.I-10 B/C Ratio

Equation : $BC = TB/EC$

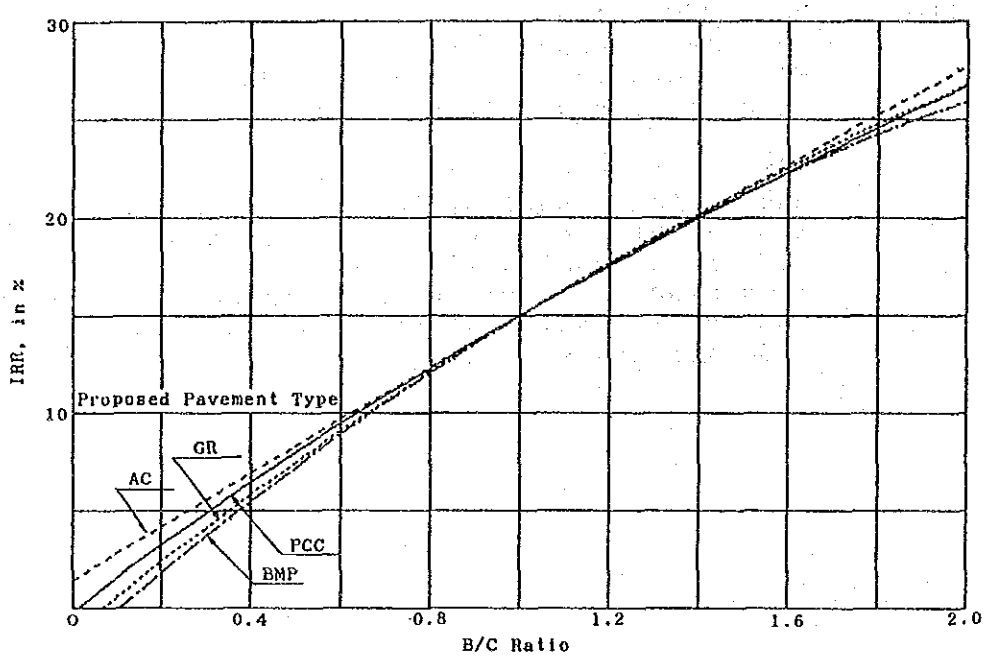
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

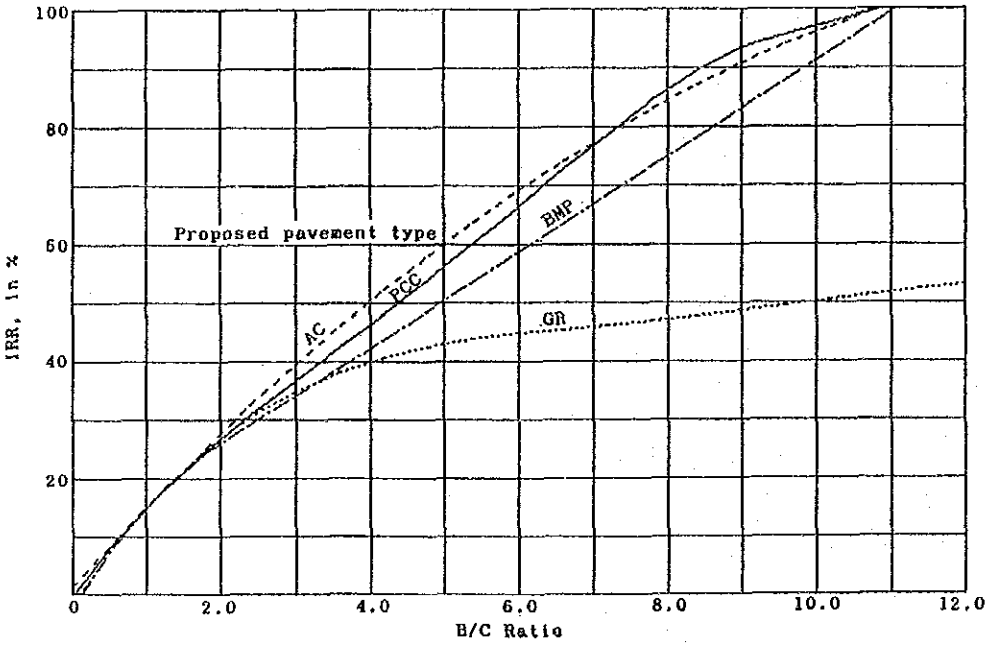
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

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

A.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 - A)
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. A.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)							
	EMBANKMENT SLOPE LENGTH (M)	(9)							
SPECIAL TREATMENT — FLOOD SECTION	FLOOD DEPTH (M)	(10)							
	FLOOD SECTION LENGTH (M)	(11)							
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. A.II - 2)								
	CARRIAGEWAY WIDTH (M) (REF. A.II - 2)	(12)							
	SHOULDER WIDTH (M) (REF. A.II - 2)	(13)							
	TOTAL WIDTH (M) ((12) + 2 x (13))	(14)							
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. A.II - 2)								
COST (M$P) — ROAD	UNIT COST/KM. (REF. A.II - 4)	(15)							
	COST ((15) x (7))	(16)							
SLOPE PROTECTION — CUT SLOPE	UNIT COST/M. (REF. A.II - 5)	(17)							
	COST ((17) x (8))	(18)							
SLOPE PROTECTION — EMBANK SLOPE	UNIT COST/M. (REF. A.II - 5)	(19)							
	COST ((19) x (9))	(20)							
FLOOD SECTION	UNIT COST/KM. (1.976·(10) + 0.173·(14) - 0.850)	(21)							
	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. A.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)									
BRIDGE	NO. OF LANES								
	LENGTH (M)	(24)							
	NO. OF SPANS ((24)/20 & ROUND)	(25)							
COST (M$P) — SUPER-STRUCTURE	UNIT COST/M (REF. A.II-7)	(26)							
	COST ((25) x (24))	(27)							
ABUTMENT	UNIT COST/EACH (REF. A.II-7)	(28)							
	COST ((28) x 2)	(29)							
PIER	UNIT COST/EACH (REF. A.II-7)	(30)							
	COST ((24) x ((25) - 1))	(31)							
TOTAL COST ((27) + (29) + (31))		(32)							
SPILLWAY	NO. OF LANES								
	LENGTH (M)	(33)							
COST (M$P)	UNIT COST/M (REF. A.II-7)	(34)							
	COST ((34) x (33))	(35)							
RCBC	1-CELL OR 2-CELL								
	LENGTH (M) (USUALLY (14) + 3.0)	(36)							
COST (M$P) — RCBC	UNIT COST/M (REF. A.II-7)	(37)							
	COST ((37) x (36))	(38)							
	WINGWALL & APRON (REF. A.II-7)	(39)							
	TOTAL COST ((38) + (39))	(40)							
COST (M$P) ((32) + (35) + (40))									(41)

5) BENEFIT

BRIDGE LENGTH (M) ((24) + (33))		(42)							
BENEFIT — TRAFFIC BENEFIT	UNIT BENEFIT/KM. (REF. A.II-8)	(43)							
	BENEFIT ((43) x (7))	(44)							
BRIDGE BENEFIT	UNIT BENEFIT/KM. (0.066 x (43) - 0.000351 x (6))	(45)							
	BENEFIT ((45) x (42))	(46)							
DEV'T. BENEFIT	CONSTANT "K" (REF. A.II-10)	(47)							
	UNIT BENEFIT (K + 0.000581 x (4) - 0.000013 x (5))	(48)							
	BENEFIT ((48) x (7))	(49)							
MAINTE-NANCE COST SAVINGS	UNIT BENEFIT/KM. (REF. A.II-11)	(50)							
	BENEFIT ((50) x (7))	(51)							
TOTAL BENEFIT ((44) + (46) + (49) + (51))									(52)

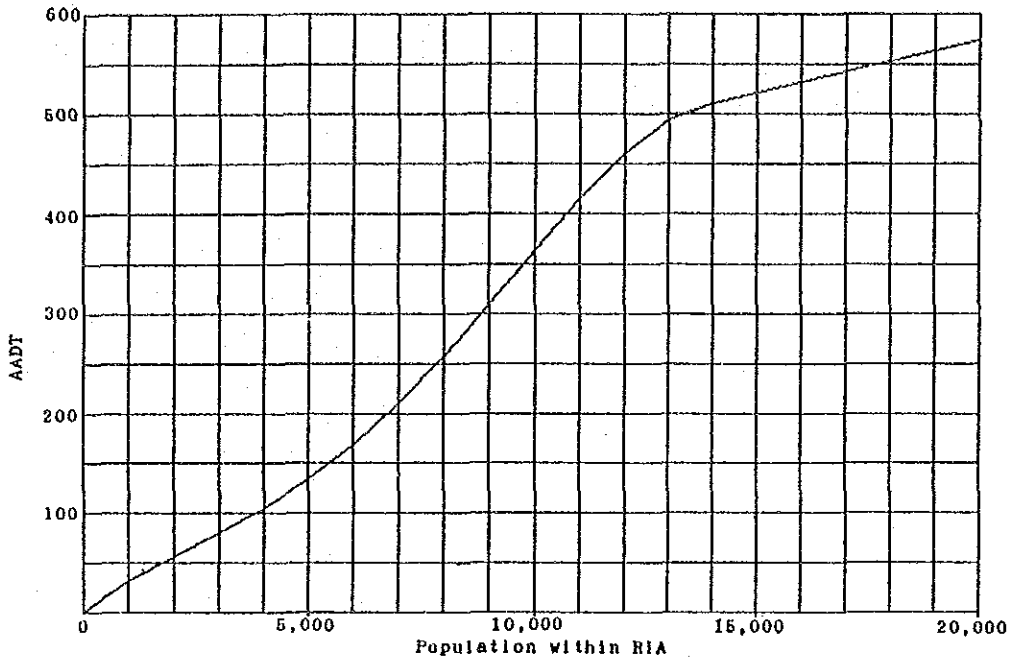
6) ECONOMIC INDICATOR

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

7) COMMENT

A.II-1 AADT

Obtain from Chart below.



A.II-2 Proposed Pavement Type

Apply A.I-1.

A.II-3 Proposed Structure Type

Apply A.I-2.

A.II-4 Road Construction Cost

Apply A.I-3.

A.II-5 Slope Protection Cost

Apply A.I-4.

A.II-6 Additional Cost for Flood Section

Apply A.I-5.

A.II-7 Structure Cost

Apply A.I-6.

A.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)

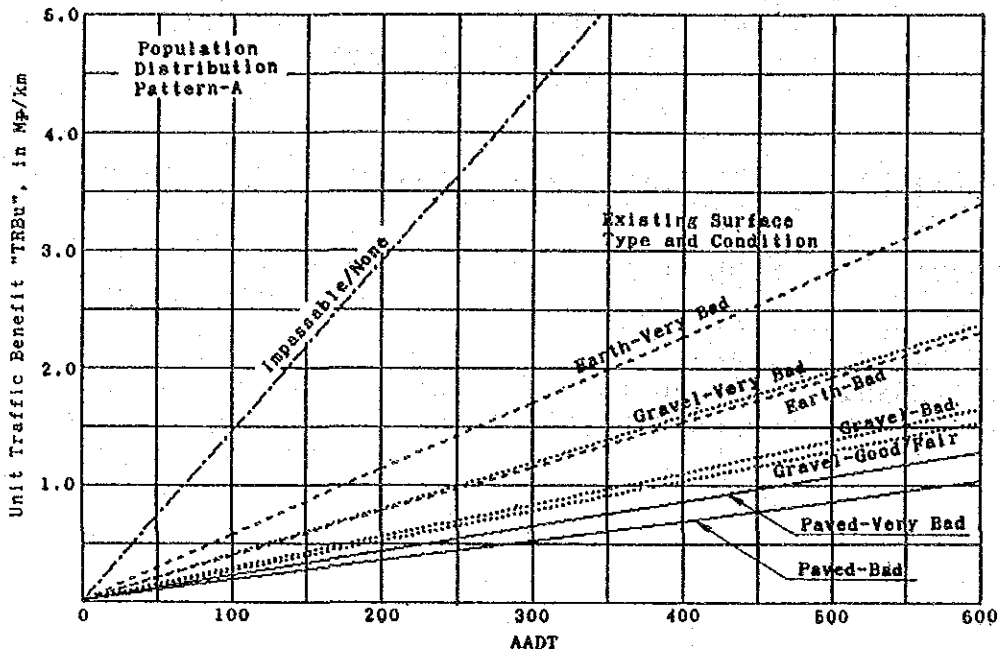


Figure A-1 "TRBu" Based on AADT

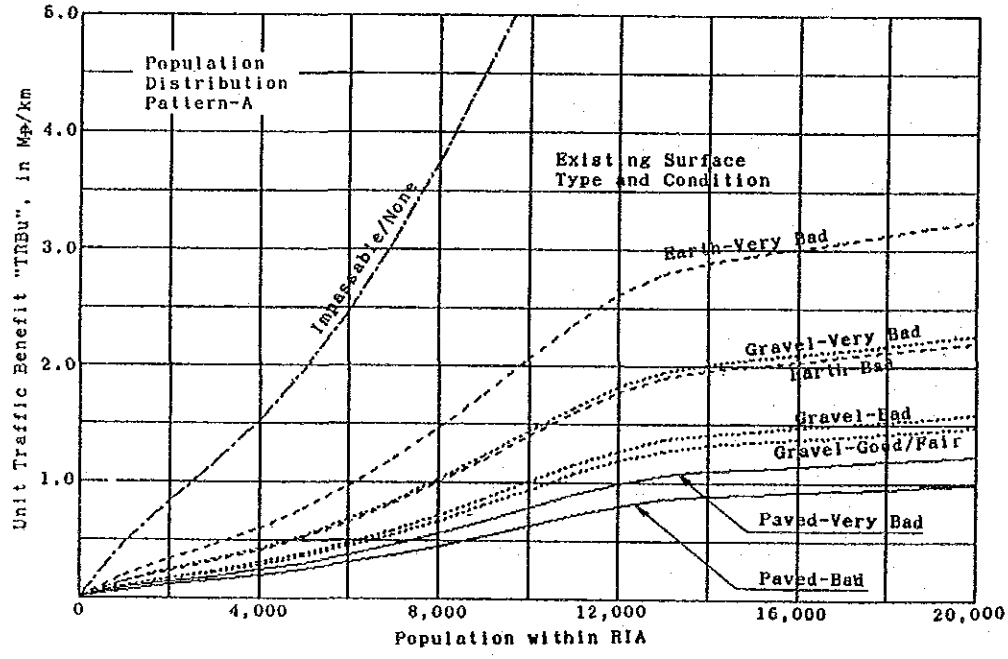


Figure A-2 "TRBu" Based on Population

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

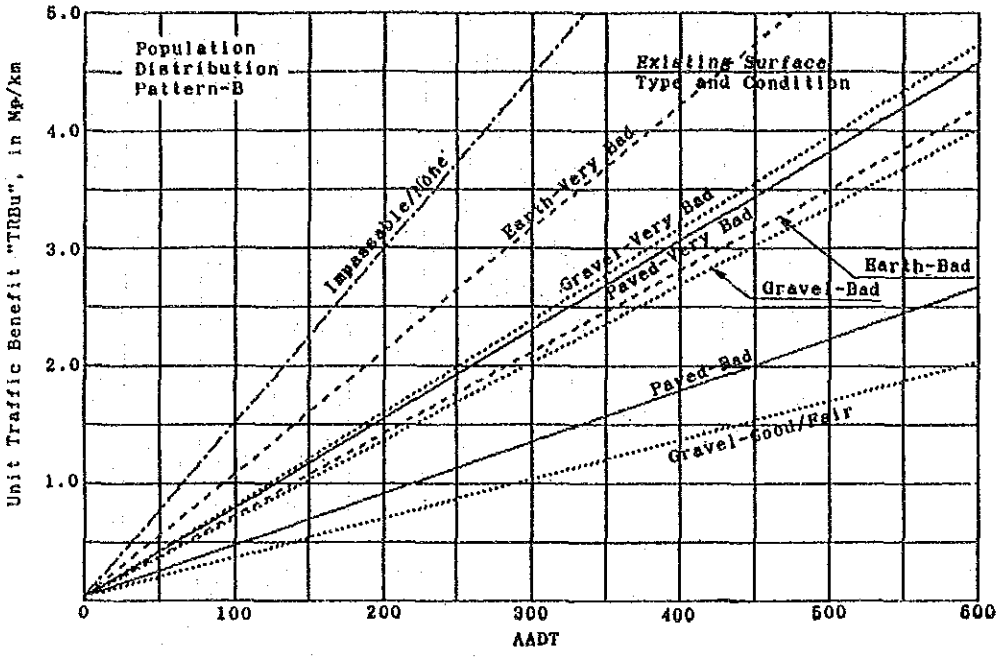


Figure B-1 "TRBu" Based ON AADT

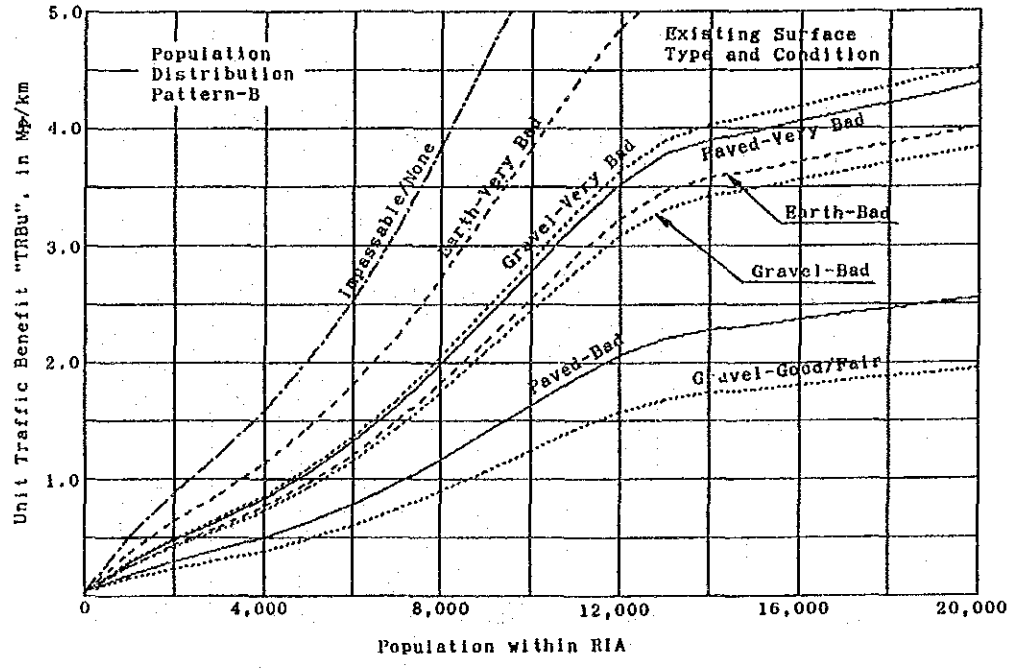


Figure B-2 "TRBu" Based on Population

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

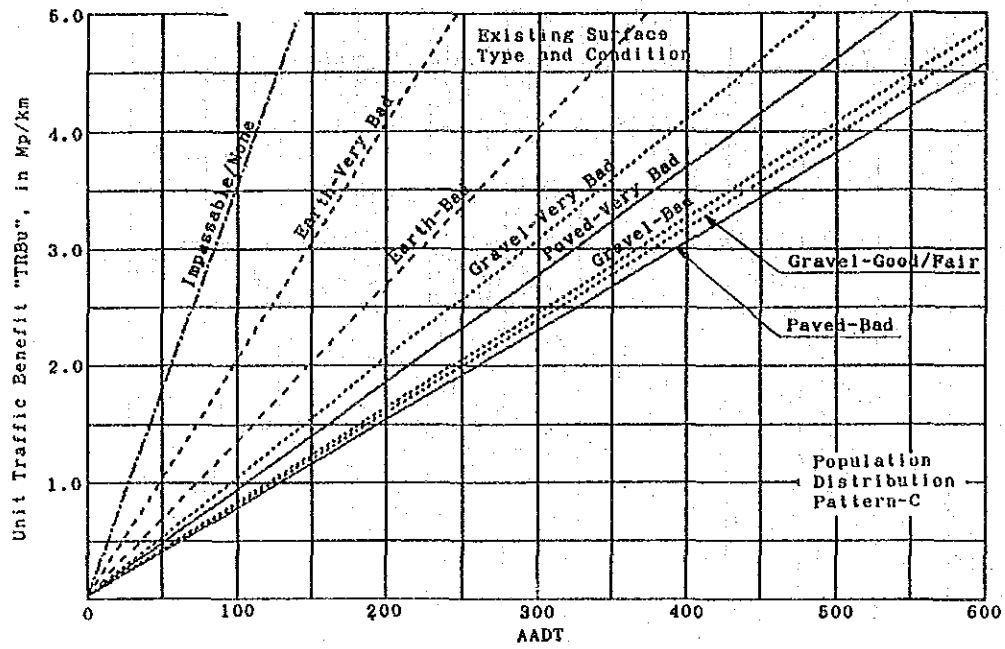


Figure C-1 "TRBu" Based on AADT

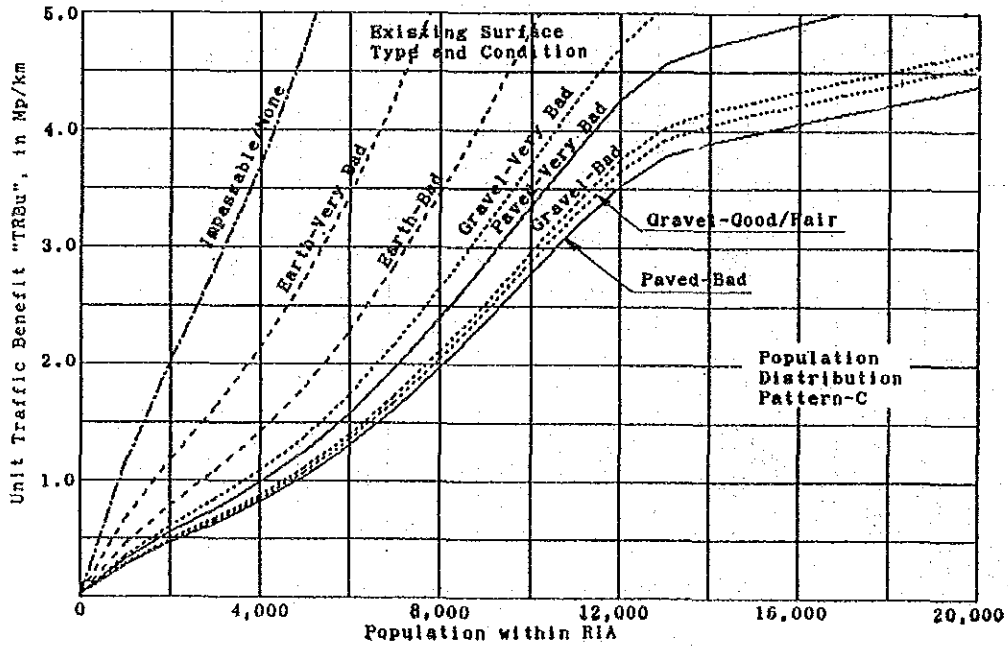


Figure C-2 "TRBu" Based on Population

A.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 A.II-8
VEH = AADT, in veh

A.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.000581·At/Lt-0.000013·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	.1281	.1554	.1340
Paved - Very Bad	.1840	.2114	.1899
Gravel- Good/Fair	.0137	.0410	.0195
Gravel- Bad	-.0152	.0122	-.0093
Gravel- Very Bad	.0019	.0292	.0077
Earth - Bad	.0215	.0488	.0274
Earth - Very Bad	.0583	.0856	.0642
Any - Impassable/ Non-exist'g	.1048	.1321	.1107

A.II-11 Maintenance Cost Savings

Apply A.I-9.

A.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

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

Apply A.I-11.

APPENDIX B

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

PROVINCES : Bataan

Rizal

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

CONTENTS

PROJECT EVALUATION WORKSHEET (TRAFFIC PROJECT)

1) ROAD NAME AND CLASS

NAME OF ROAD	
PROVINCE	(PROVINCE GROUP - B)
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.										
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. B.I-1)										
PROPOSED PAVEMENT — CARRIAGEWAY WIDTH (M) (REF. B.I-1) ⑨										
PROPOSED PAVEMENT — SHOULDER WIDTH (M) (REF. B.I-1) ⑩										
PROPOSED PAVEMENT — TOTAL WIDTH (M) (⑨+2x⑩) ⑪										
PROPOSED PAVEMENT — TYPE OF IMPROVEMENT (REHAB./IMPR./ WIDENING/NEW CONST.) (REF. B.I-1)										
COST (MP) — ROAD — UNIT COST/KM. (REF. B.I-3) ⑫										
COST (MP) — ROAD — COST (⑫x④) ⑬										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — UNIT COST/M (REF. B.I-4) ⑭										
COST (MP) — SLOPE PROTECTION — CUT SLOPE — COST (⑭x⑤) ⑮										
COST (MP) — SLOPE PROTECTION — EMBANK SLOPE — UNIT COST/M (REF. B.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. B.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. B.I-6) ㉓									
BRIDGE — COST (MP) — SUPER STRUCTURE — COST (㉓x㉑) ㉔									
BRIDGE — COST (MP) — ABUTMENT — UNIT COST/EACH (REF. B.I-6) ㉕									
BRIDGE — COST (MP) — ABUTMENT — COST (㉕x 2) ㉖									
BRIDGE — COST (MP) — PIER — UNIT COST/EACH (REF. B.I-6) ㉗									
BRIDGE — COST (MP) — PIER — COST (㉗x(㉒-1)) ㉘									
BRIDGE — COST (MP) — TOTAL COST (㉔+㉖+㉘) ㉙									
SPILLWAY — NO. OF LANES									
SPILLWAY — LENGTH (M) ㉚									
SPILLWAY — COST (MP) — UNIT COST/M (REF. B.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. B.I-6) ㉞									
RCBC — COST (MP) — RCBC — COST (㉞x㉝) ㉟									
RCBC — COST (MP) — WINGWALL & APRON (REF. B.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. B.I-7) ㊵										
BENEFIT — TRAFFIC BENEFIT — UNIT BENEFIT/KM/VEH. (㊵+0.000133 x②) 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. B.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 (㊼ / ㊾)		
IRR (REF. B.I-11)		

7) COMMENT

B.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

B.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.

B.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	2.786	-
			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	-	-

B.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

B.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

B.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

B.I-7 Traffic Benefit

Equation : TRB = TRBu·Ls·VEH
TRBu= k+0.000133·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	.00280	.00382	.00455
	Paved - Very Bad	.00683	.00784	.00858
	Gravel- Good/Fair	.00694	.00796	.00869
	Gravel- Bad	.00724	.00826	.00900
	Gravel- Very Bad	.00837	.00938	.01012
	Earth - Bad	.00939	.01041	.01114
	Earth - Very Bad	.01455	.01557	.01631
BMP/DBST	Paved - Bad	.00098	.00200	.00273
	Paved - Very Bad	.00501	.00602	.00676
	Gravel- Good/Fair	.00512	.00614	.00687
	Gravel- Bad	.00542	.00644	.00717
	Gravel- Very Bad	.00654	.00756	.00830
	Earth - Bad	.00757	.00859	.00932
	Earth - Very Bad	.01273	.01375	.01448
Gravel	Gravel- Bad	.00471	.00573	.00646
	Gravel- Very Bad	.00583	.00685	.00759
	Earth - Bad	.00686	.00787	.00861
	Earth - Very Bad	.01202	.01304	.01377

B.I-8 Bridge Benefit

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

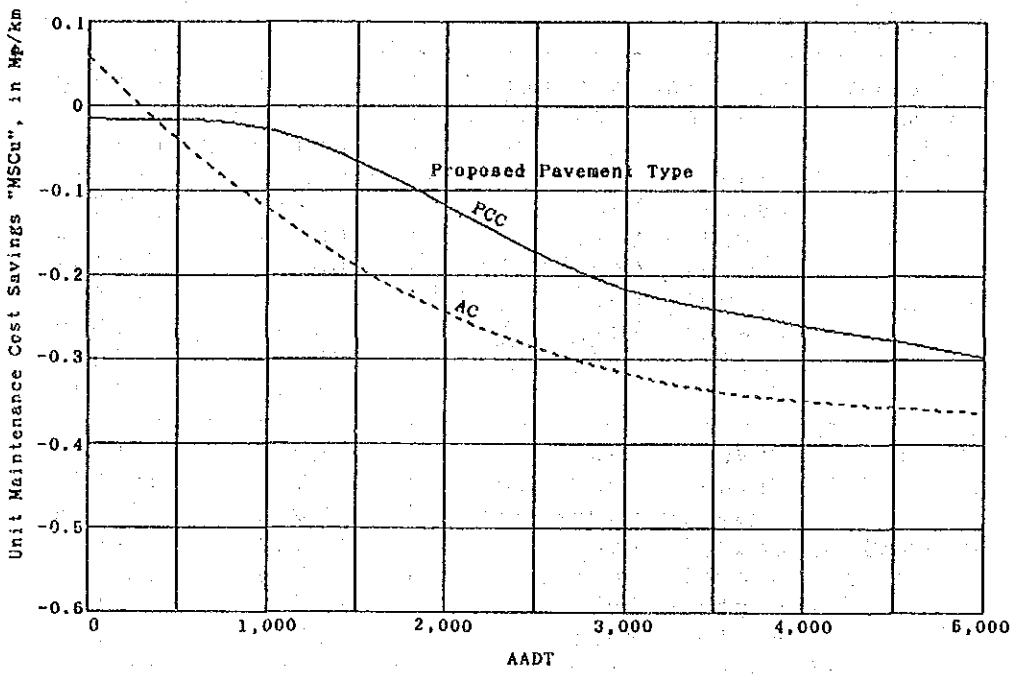
where , BRB = bridge benefit, in Mp
BRBu= unit bridge benefit, in Mp/m/veh
Lb = bridge length, in m
VEH = AADT, in veh
TRBu= unit traffic benefit, in Mp/km/veh, obtained from B.I-7

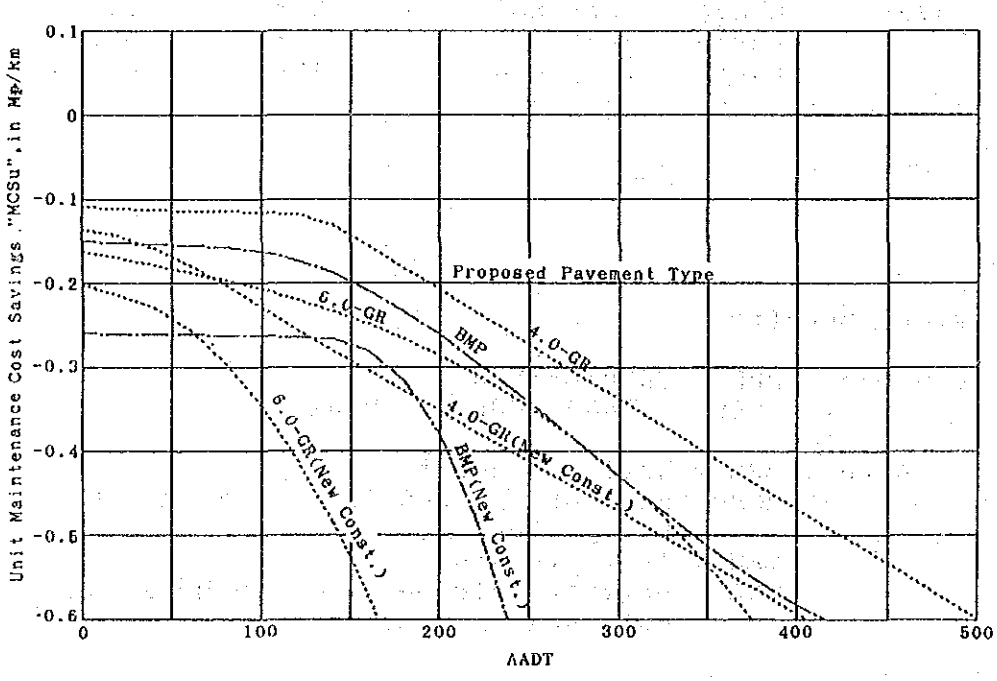
B.I-9 Maintenance Cost Savings

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"





B.I-10 B/C Ratio

Equation : $BC = TB/EC$

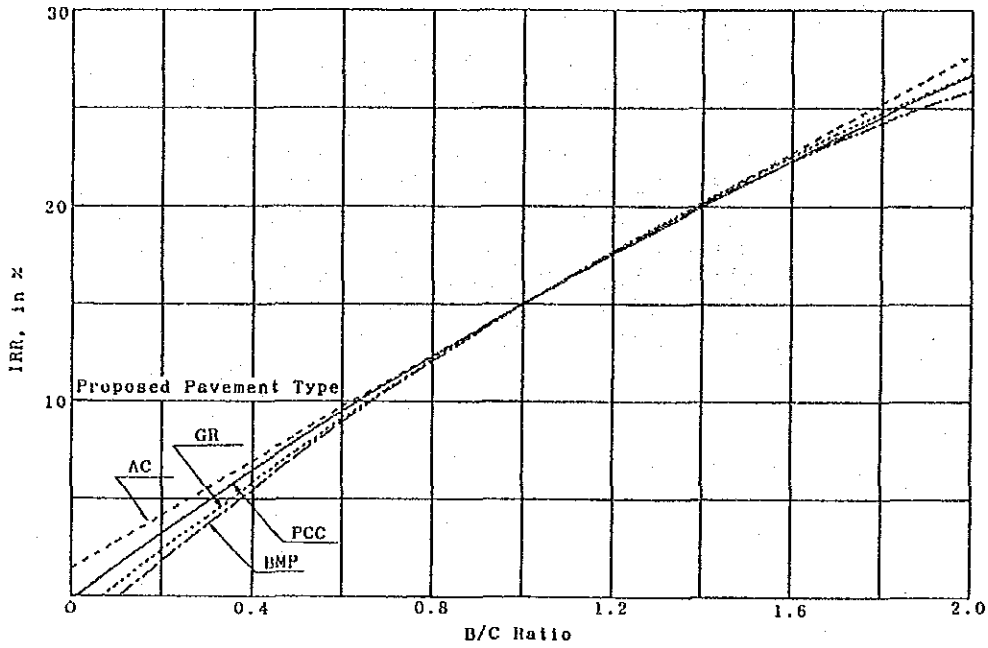
$TB = TRB+BRB+MCS$
$EC = 0.831 \cdot TC$
$TC = RCC+SPC+FSC+STC$

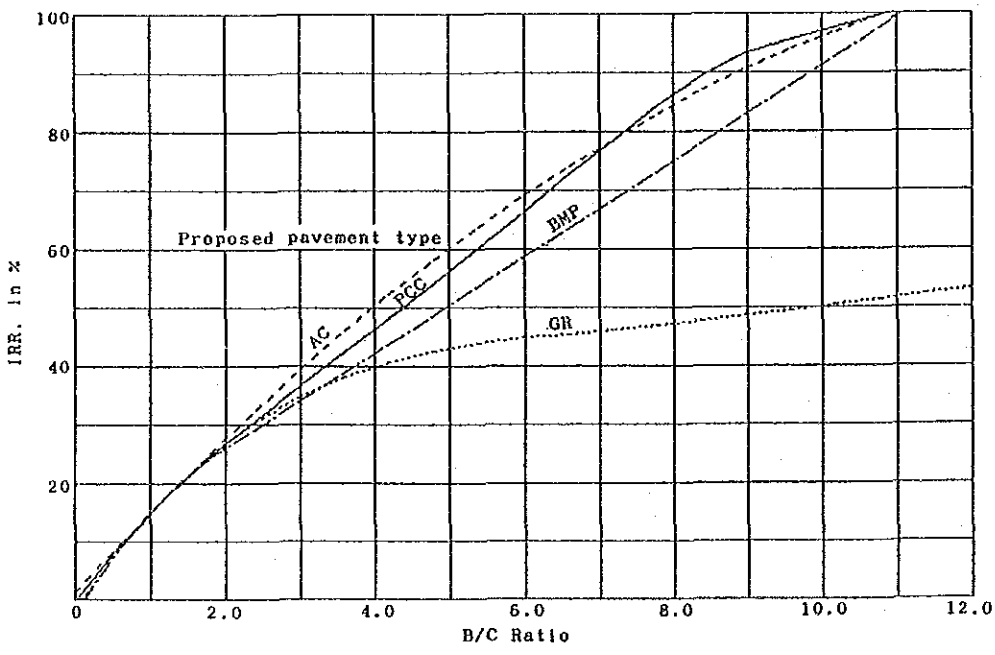
Where , BC = B/C ratio
TB = total benefit, in Mp
EC = economic total cost, in Mp
TC = total cost, in Mp

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

B.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 - B)
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. B.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							
		EMBANKMENT SLOPE LENGTH (M)	⑨							
	FLOOD SECTION	FLOOD DEPTH (M)	⑩							
		FLOOD SECTION LENGTH (M)	⑪							
PROPOSED PAVEMENT	TYPE (PCC/AC/BMP/GRAVEL) (REF. B.II - 2)									
	CARRIAGEWAY WIDTH (M) (REF. B.II - 2)		⑫							
	SHOULDER WIDTH (M) (REF. B.II - 2)		⑬							
	TOTAL WIDTH (M) (⑫ + 2 x ⑬)		⑭							
	TYPE OF IMPROVEMENT (REHAB./IMPR./WIDENING/NEW CONST.) (REF. B.II - 2)									
COST (M$)	ROAD	UNIT COST/KM. (REF. B.II - 4)	⑮							
		COST (⑮ x ⑦)	⑯							
	SLOPE PROTECTION	CUT SLOPE: UNIT COST/M. (REF. B.II - 5)	⑰							
		CUT SLOPE: COST (⑰ x ⑧)	⑱							
		EMBANK SLOPE: UNIT COST/M. (REF. B.II - 5)	⑲							
		EMBANK SLOPE: COST (⑲ x ⑨)	⑳							
	FLOOD SECTION	UNIT COST/KM. (1.976 · ⑩ + 0.173 · ⑭ - 0.850)	㉑							
		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. B.II-3) (2-BR/1-BR/2-SW/1-SW/1-RCBC/2-RCBC)										
BRIDGE COST (M$)	NO. OF LANES									
	LENGTH (M)		㉔							
	NO. OF SPANS (㉔ /20 & ROUND)		㉕							
	SUPERSTRUCTURE	UNIT COST/M (REF. B.II-7)	㉖							
		COST (㉖ x ㉔)	㉗							
	ABUTMENT	UNIT COST/EACH (REF. B.II-7)	㉘							
		COST (㉘ x 2)	㉙							
	PIER	UNIT COST/EACH (REF. B.II-7)	㉚							
		COST (㉚ x (㉕ - 1))	㉛							
	TOTAL COST (㉗ + ㉙ + ㉛)		㉜							
SPILLWAY COST (M$)	NO. OF LANES									
	LENGTH (M)		㉝							
	UNIT COST/M (REF. B.II - 7)		㉞							
	COST (㉞ x ㉝)		㉟							
RCBC COST (M$)	1-CELL OR 2-CELL									
	LENGTH (M) (USUALLY ⑭ + 3.0)		㊱							
	RCBC: UNIT COST/M (REF. B.II-7)		㊲							
	RCBC: COST (㊲ x ㊱)		㊳							
	WINGWALL & APRON (REF. B.II-7)		㊴							
	TOTAL COST (㊳ + ㊴)		㊵							
COST (M$) (㉜ + ㊱ + ㊵)										㊶

5) BENEFIT

BRIDGE LENGTH (M) (㉔ + ㉝)			㊷							
BENEFIT	TRAFFIC BENEFIT	UNIT BENEFIT/KM. (REF. B.II-8)	㊸							
		BENEFIT (㊸ x ⑦)	㊹							
	BRIDGE BENEFIT	UNIT BENEFIT/KM. (0.066 x ㊸ - 0.000351 x ⑤)	㊺							
		BENEFIT (㊺ x ㊷)	㊻							
	DEV'T. BENEFIT	CONSTANT "K" (REF. B.II-10	㊼							
		UNIT BENEFIT (K + 0.007661 x ④ - 0.000133 x ⑤)	㊽							
		BENEFIT (㊽ x ⑦)	㊾							
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM. (REF. B.II-11)	㊿							
		BENEFIT (㊿ x ⑦)	(51)							
	TOTAL BENEFIT (㊹ + ㊻ + ㊾ + (51))									(52)

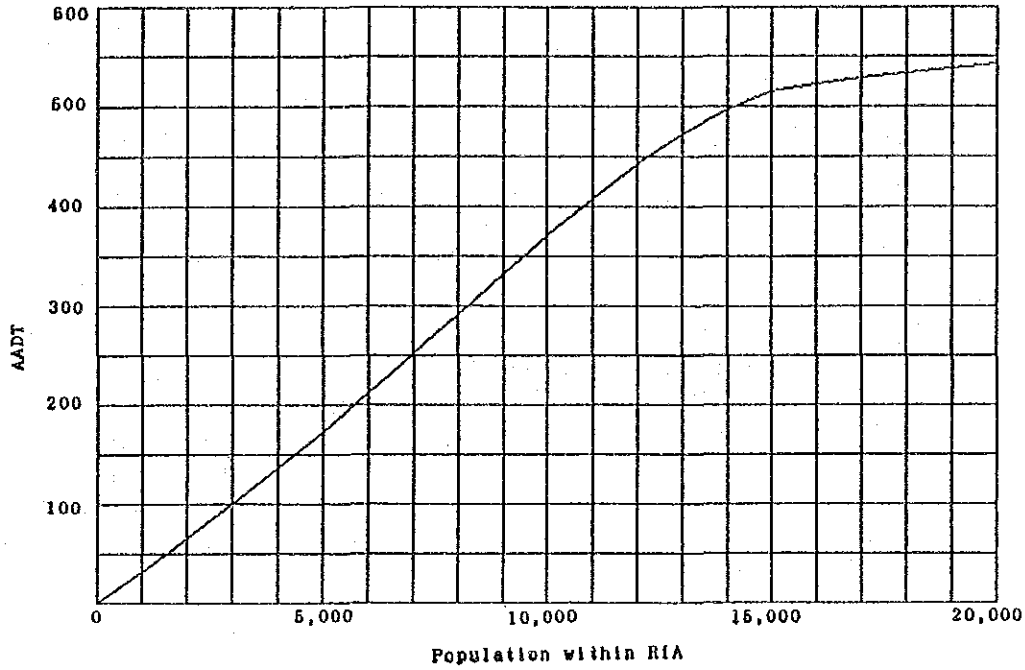
6) ECONOMIC INDICATOR

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

7) COMMENT

B.II-1 AADT

Obtain from Chart below.



B.II-2 Proposed Pavement Type

Apply B.I-1.

B.II-3 Proposed Structure Type

Apply B.I-2.

B.II-4 Road Construction Cost

Apply B.I-3.

B.II-5 Slope Protection Cost

Apply B.I-4.

B.II-6 Additional Cost for Flood Section

Apply B.I-5.

B.II-7 Structure Cost

Apply B.I-6.

B.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)

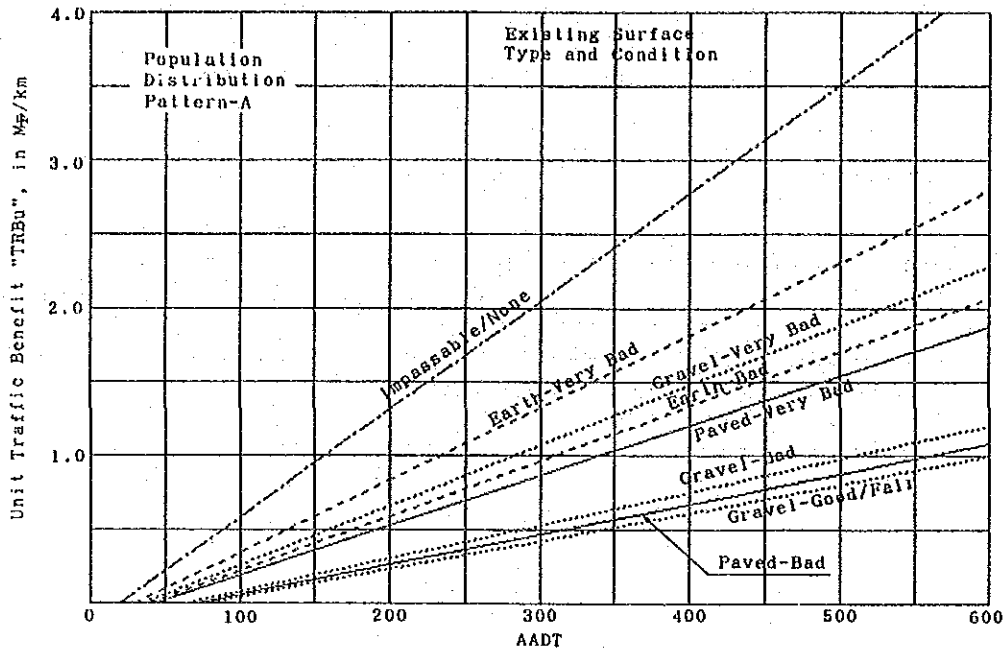


Figure A-1 "TRBu" Based on AADT

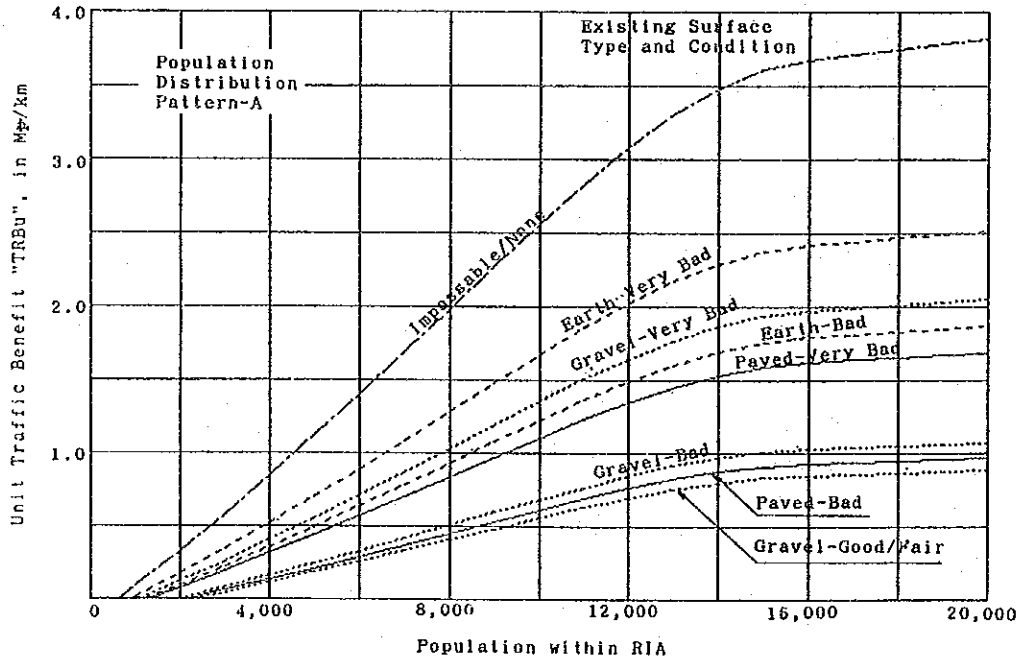


Figure A-2 "TRBu" Based on Population

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

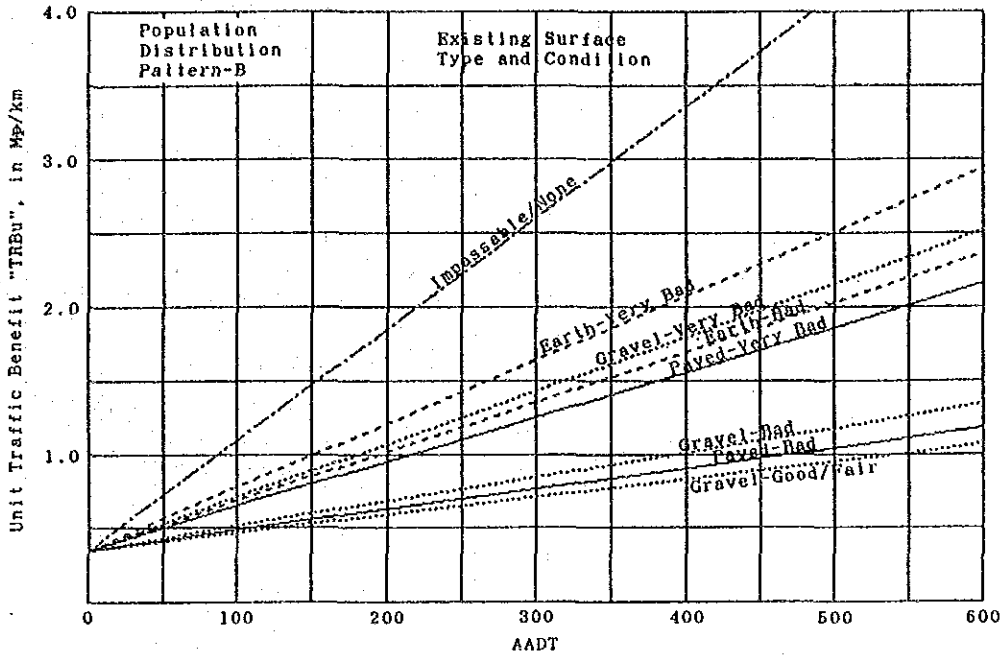


Figure B-1 "TRBu" Based ON AADT

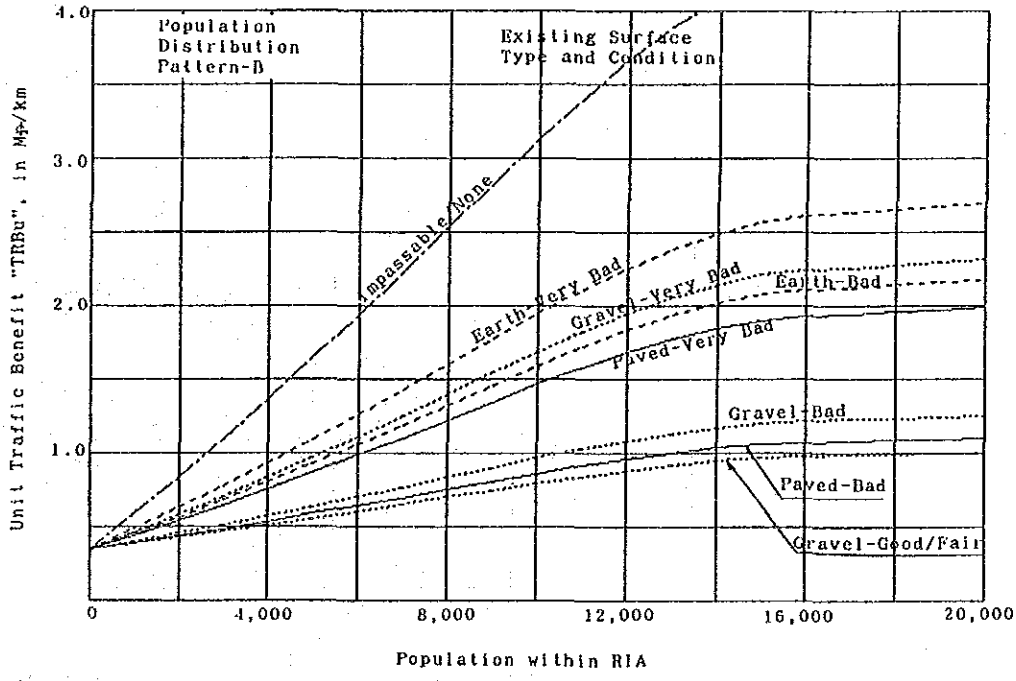


Figure B-2 "TRBu" Based on Population

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

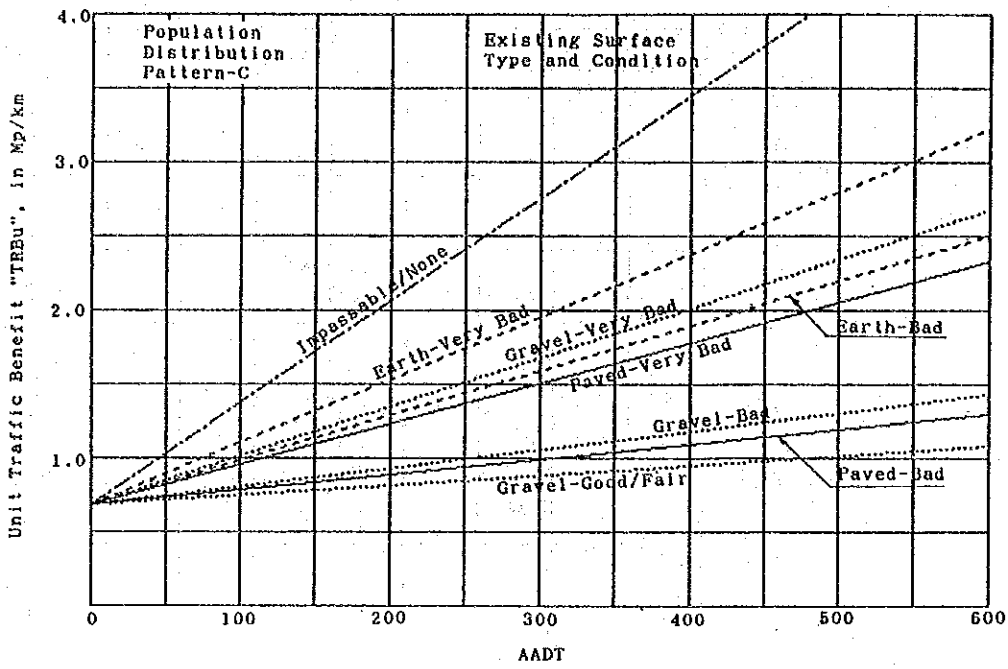


Figure C-1 "TRBu" Based on AADT

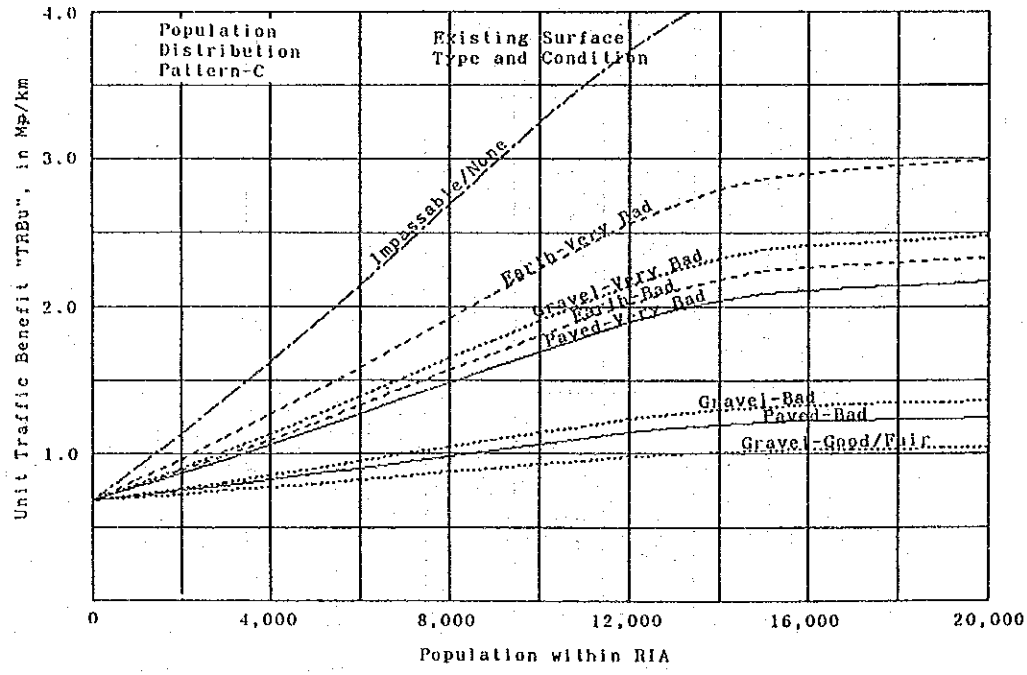


Figure C-2 "TRBu" Based on Population

B.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 B.II-8
VEH = AADT, in veh

B.II-10 Development Benefit

Equation : DVB = DVBu·Ls
Equation : DVB = k+0.007661·At/Lt-0.000133·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	.756	.680	1.340
Paved - Very Bad	.331	.256	.915
Gravel- Good/Fair	-1.514	-1.589	-.930
Gravel- Bad	-.099	-.174	.485
Gravel- Very Bad	.706	.631	1.291
Earth - Bad	.356	.281	.940
Earth - Very Bad	.756	.681	1.341
Any - Impassable/ Non-exist'g	.836	.761	1.421

B.II-11 Maintenance Cost Savings

Apply B.I-9.

B.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

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

Apply B.I-11.