3.1.3 Road Classification

(1) Administrative Road Classification

Road classification in the Philippines has been established by a series of Executive Orders, Republic Acts and/or Presidential Decrees, of which the most fundamental one was the Republic Act No. 917 (the Philippine Highway Act) whose classification of roads is as follows:

- National Primary and Secondary Roads
- "National Aid" Roads
- Provincial and City Roads
- Municipal Roads

This classification was more clearly defined by the Executive Order No. 113 issued in 1955. Since then, various amendments have been made including those shown below.

- "National Aid" roads no longer appear in the Revised Philippine Highway Act, 1972 (Presidential Decree No. 17)

- A new class of roads known as Barangay Roads was introduced by the Presidential Decree No. 702, 1975.

Today, the Department of Public Works and Highways (DPWH) classifies roads into the following five (5) groups:

- National Roads (possibly sub-classified into national primary and national secondary)
- Provincial Roads
- City Roads
- Municipal Roads
- Barangay Roads

Definition of each class is given below, while Figure 3.1-2 shows the underlying concept.

National Roads - are all roads that form a 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 to another, normally, terminating at 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.

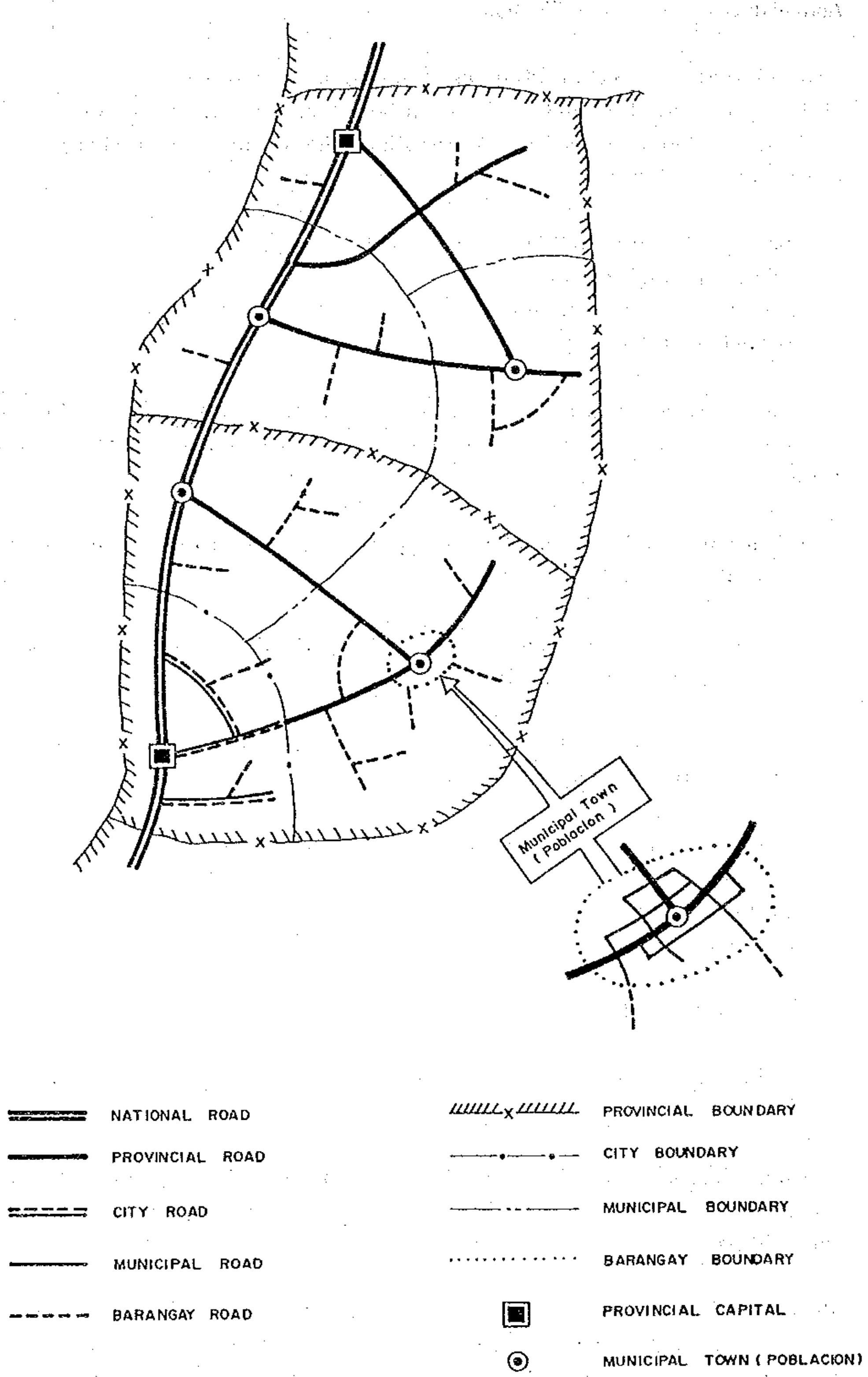


FIGURE 3.1-2 CONCEPTUAL ROAD NETWORK BY ADMINISTRATIVE CLASSIFICATION

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 of 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 to be designated as such by the Barangay Council concerned.

(2) Functional Road Classification

a) Needs of Functional Road Classification

Road classification by the DPWH is mainly based on the administrative on the responsibilities and jurisdiction of the agencies concerned in the funding, planning, construction/improvement and maintenance, rather than on the functions of roads. National and provincial roads or provincial and barangay roads are often indistinguishable, because some provincial roads have comparable functions with national roads, while some function only as feeder roads which is the main function of barangay roads. Sometimes, classification of a road is changed at a provincial or a municipal boundary, for instance, from a provincial road to a barangay road.

For planning and developing an efficient road network, functional classification is essential. Functional classification groups roads according to their importance and character of services they intend 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.

b) Previous Studies

Functional road classification of rural roads was made by two (2) studies. In 1982, IBRD Assisted Rural Roads Development Program II classified roads into the following five (5) classes:

- Primary Roads
- Secondary Roads
- Tertiary Roads
- Farm-to-Market Roads
- Streets

Definition for classification used by that study is presented in Table 3.1-3.

IBRD Assisted Functional Road Classification Study, which was undertaken in 1986, classifies the rural roads as follows:

TABLE 3.1-3 PREVIOUS FUNCTIONAL ROAD CLASSIFICAION OF RURAL ROADS

IBRD Assisted **Functional Road Classification Study (DPWH), 1986**	**IBRD Assisted** **Rural Roads Development Program II (DLG), 1982**
(1) National Primary Road Connect primary centers	
(2) National Secondary Road Connect secondary centers to one another and to National Primary roads	(a) Primary Road Major inter-provincial roads or major intra-provincial truck roads linking one or more municipal towns to the Provincial Capital
(3) National Tertiary Road Connect tertiary centers to one another to a National Primary or National Secondary road	
(4) Provincial Road Connect cities and municipalities not classified as primary/secondary/tertiary center to a national road.	(b) Secondary Road Roads (other than above) linking municipalities with each other or to the provincial capital or to the primary network
	(c) Tertiary Road Roads linking barangays to the municipal towns and to the primary or secondary network
(5) Feeder Road Connect barangays, outside urban development areas as of a city or municipality, to one another and roads not classified as national or provincial	(d) Farm-to-Market Road Roads linking farm areas to their respective barangay centers or to the higher level network
	(e) Street Roads within built-up population centers with essentially urban rather than rural functions

- **Primary Center (28)**
  - either a national or regional capital
  - or base for a national base seaport
  - or base for an international airport
  - or having a rating of 9 or less
- **Secondary Center (58)**
  - either a provincial capital
  - or base for a national sub-base port
  - or having a rating of 10 to 13 inclusive
- **Tertiary Center (14)**
  - either a sub-provincial capital
  - or having a rating of 14 to 16

Rating	
National/Regional Capital	1
Provincial Capital	2
If combined	0
Sub-provincial Capital	3
National Base Seaport	1
International Airport	1
National Sub-base Seaport	2
National Trunkline Airport	2
National Seaport/Secondary Airport	3
Feeder Port	4
Population over 100,000	1
75,000 100,000	2
50,000 75,000	3
If none	5

- National Primary Roads
- National Secondary Roads
- National Tertiary Roads
- Provincial Roads
- Feeder Roads

Definition for classification is presented in Table 3.1-3. The focus of that study was placed more on the classification of national roads.

c) Proposed Functional Classification

Based on the review of two (2) previous studies, functional classification criteria similar to those of IBRD Assisted Rural Roads Development Program II Study were proposed as shown in Table 3.1-4. Figure 3.1-3 shows the conceptual network.

Roads are classified into the following five (5) classes:

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

Functional classification is related to administrative classification. National roads are mostly classified as either primary or secondary major or collector roads. Since city roads under administrative classification have a variety of functions, they are classified as either secondary major, collector or feeder roads or streets. Municipal roads are those within urban centers (poblacion) and are, therefore, classified as streets. Barangay roads are classified as either collector or feeder roads.

3.1.4 Formulation of Basic (Major) Road Network

As discussed in Section 3.1.3 Road Classification, major roads (primary and secondary major roads) are either inter-provincial roads or roads linking municipal towns within the province, and are considered to form the basic road network in the province. The basic road network is defined as being the same as the major road network in this Study.

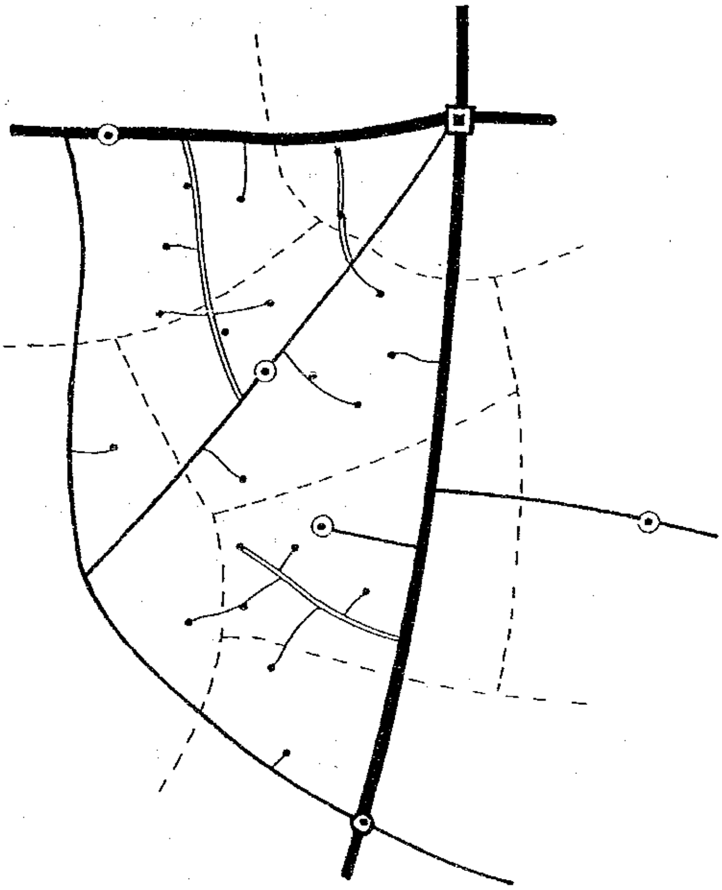
The major road network was formulated in accordance with the following procedure:

Step 1 : All existing roads are functionally classified in accordance with "Functional Road Classification Criteria", and all roads classified as a major road are selected. Based on this analysis, the initial major road network is prepared.

TABLE 3.1-4 PROPOSED FUNCTIONAL ROAD CLASSIFICATION CRITERIA 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	●				
Major Road	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		●	●		●
Minor Road	Feeder Road	. Roads linking one or more barangays 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			●		●
S t r e e t		. Roads within built-up population centers (Poblacion) with essentially urban rather than rural rural functions	. Primarily provides access to abutting land in urban areas . Through traffic usage discouraged			●	●	

NOTE: Relationship between functional classification and administrative classification gives only general guideline, therefore, some national roads may be classified as minor roads, or some barangay roads may be classified as major roads.



Legends :

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

FIGURE 3.1-3 CONCEPTUAL ROAD NETWORK BY FUNCTIONAL CLASSIFICATION

Step 2 : In order to establish a well-balanced major road network, the initial major road network is assessed by two (2) indicators, i.e. "Network Value" and "Accessibility". If the indicators show imbalanced values, major road links are either added or deleted until these values are balanced.

Step 3 : As a result of Step 2, the major road network is formulated.

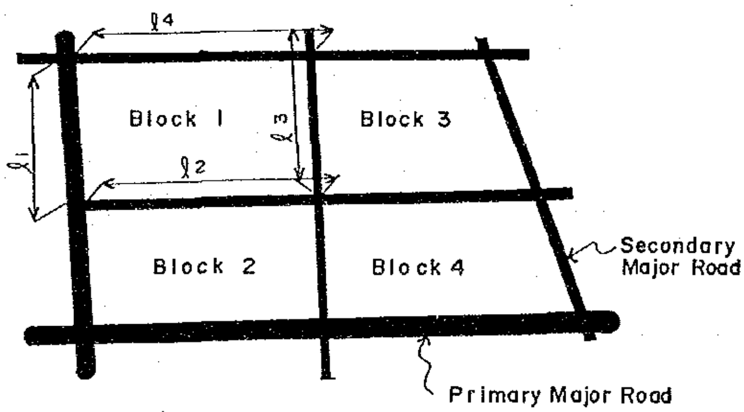
The two (2) indicators used for assessment of network balance are defined as follows:

Network Value

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

where:

Nv	=	Network value
L	=	Road length delineating a block (= $l_1 + l_2 + l_3 + l_4$, 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 roads



Accessibility

Accessibility $Ac = \sum p.l$

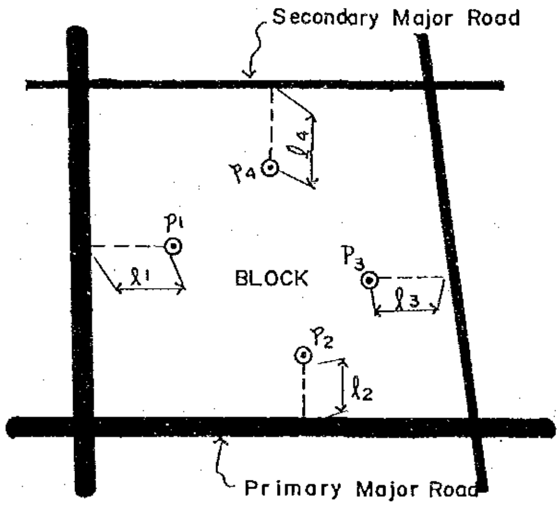
Average Accessibility $A\ ave = \frac{\sum p.l}{P}$

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



Θ: Barangay Center

$Accessibility = p_1 \cdot l_1 + p_2 \cdot l_2 + p_3 \cdot l_3 + p_4 \cdot l_4$

$Average\ Accessibility = \frac{Accessibility}{p_1 + p_2 + p_3 + p_4}$

3.1.5 Engineering Standards

(1) Present Engineering Standards in the Philippines

The Department of Public Works and Highways (DPWH) established the Highway Design Guideline in 1984 and issued the Barangay Road Design Criteria as per the Ministry Order No. 4 series of 1987. Meanwhile, the Department of Local Government (DLG) published the Interim Design Guideline in 1981. The main provisions set forth in these Guidelines as engineering standards are summarized in Table 3.1-5.

Since this Study involves roads placed under the jurisdiction of two departments, DPWH and DLG, the standards must be consolidated to enable project implementation.

(2) Proposed Engineering Standards

The existing guidelines mentioned above were reviewed. As a result, the engineering standards as shown in Table 3.1-6 were proposed for this project.

a) Road Classification and Design Traffic Volume

The DPWH is responsible for national roads and barangay roads, while the DLG is the competent authority for provincial, city and municipal roads.

To properly harmonize the present design standards of the two Departments, principal consideration was given to the design traffic volumes as classified by both design guidelines which were used as the element in unifying both. Due to this consideration, precedence was given to functional classification over administrative classification both in the discussions of the basic road network and in the study of engineering standard.

In the proposed standards, AADTs of primary and secondary major roads were classified into six (6) and five (5) groups respectively, basically following the DPWH standards, while those of collector and feeder roads were grouped into four (4) in accordance with the DLG standards.

b) Design Speed

In connection with the AADT classification, the design speeds for the major roads (primary and secondary) and minor roads (collector and feeder) were proposed based on the DPWH and DLG standards, respectively, with minor adjustments.

TABLE 3.1-5 DESIGN STANDARDS

	DPWH: Highway Design Guidelines (1984)					DLG: Interim Design Guidelines (1981)				DPWH: Ministry Order No. 4 (1987) Barangay Road Design Criteria			
	AADT in Opening Year					AADT in Opening Year				A A D T			
	Under 200	200-400	400-1,000	1,000-2,000	More than 2,000	Under 50	50-150	150-400	Over 400	Less than 50	51-150	151-300	More than 300
a) Design Speed (km/hr)													
Flat	60	70	70	80	90	-	60	60	60				
. Rolling	40	50	60	60	70	-	40/50	40/50	40/50				
Mountainous	30	40	40	50	60	-	30	30	30				
b) Pavement Width (m)	4.0	5.5-6	6.10	6.70	6.70-7.30	4.0	5.5-6.0	5.5-6.0	6.0	4.0	5.0-6.0	6.0	6.0-6.7
c) Shoulder Width (m)													
Flat						-	0.5	1.0	1.5				
Rolling	0.5	1.0	1.5-2.0	2.5-3.0	3.0	-	0.5	1.0	1.25	Optional	0.5	0.5-1.0	1.0-1.5
Mountainous						-	0.5	1.0	1.0				
d) Radius (m)													
Flat	120	160	160	220	280	-	120	120	120				
Rolling	55	85	120	120	160	-	55/85	55/85	55/85				
Mountainous	30	50	50	80	120	-	30	30	30				
e) Grade (%)													
Flat	6.0	6.0	5.0	4.0	4.0	6.0	6.0	5.0	5.0				
Rolling	8.0	7.0	6.0	5.0	5.0	9.0	8.0	7.0	6.0				
Mountainous	10.0	9.0	8.0	7.0	7.0	12.0	10.0	9.0	8.0				
f) ROW Width (m)	20	30	30	30	60					10.0	10.0	15.0	15.0
g) Surface Type	. Gravel Cr. Gr. or Cr. Stone . Bit Preser-vative Treat-ment . Single or Double Bit. Surface Treat-ment . Bit. Macadam Pavement	. Gravel Cr. Gr. or Cr. Stone . Bit Preser-vative Treat-ment . Single or Double Bit. Surface Treat-ment . Bit. Macadam Pavemen	. Bit. Macadam Pavement . Dense or Open Graded Plant Mix Surface Course . Bit Conc. Surface Course	. Bit Conc. Surface Course	. Bit Conc. Surface Course . Port-land cement conc. pavement	. Natural Gravel	. Crushed Gravel	. Crushed Gravel	. Surface Treat-ment	. Gravel	. Gravel with light Asphalt at popula-tion centers	. Gravel . Bit. macadam	. Bit. macadam . Asphal-tic Conc.

TABLE 3.1-6 PROPOSED ENGINEERING STANDARDS

Functional Classification	Major Road											Minor Road							
	Primary Major Road						Secondary Major Road					Collector Road				Feeder Road			
Administrative 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 200	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	80	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	50	50	60	30	40	40	40	50	50	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	85	120	120	160	55	85	85	85	120	30	55	55	85	25	30	55	55
Mountainous	30	30	50	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	7.0	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 - BPT - Cr Gr	-S or DBST -BMP -BPT -Cr Gr	- AC - DBST	- PCC - AC	- PCC - AC	- PCC - AC	- S or DBST - BMP - BPT - 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 -BPT	-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	1) BMP/ DBST	AC	Gr	Gr	1) BMP/ DBST	AC

Pavement Type
S or DBST .... Single or double bituminous treatment
BMP .... Bituminous macadam pavement
BPT .... Bituminous preservative treatment
Nat. or Cr. Gr. .. Natural or crushed gravel
AC .... Asphalt concrete pavement
PCC .... Portland cement concrete pavement

NOTE:
1) Choice of BMP/DBST depends on the conditions of subgrade, traffic loading, drainage, etc.

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

c) Carriageway Width

The carriageway widths prescribed in the present design guidelines vary from 4.0 to 7.3 m. In consideration of the fact that the width of the Pan-Philippine Highway is 6.7 m, 7.3 m was deemed as a little too wide even for the major roads. On the other hand, 4.0 m may be narrow for a two-lane road even in rural areas, except for collector roads with AADT less than 25 and feeder roads with AADT less than 200. Based on these facts and the level of services to be assigned to each class of road, the standard widths were proposed as follows:

<u>High Class Roads, 6.7 m (3.35 m × 2)</u>

Primary major roads with AADT more than 400
Secondary major roads with AADT more than 2000

<u>Average Class Roads, 6.0 m (3.0 m × 2)</u>

Primary major roads with AADT less than 400
Secondary major roads with AADT less than 2000
Minor roads, (both collector and feeder roads) with AADT more than 200

<u>Low Class Roads, 5.5 m (2.75 m × 2)</u>

Collector roads with AADT between 200 and 25

<u>Low Class Roads, 4.0 m (1-lane)</u>

Collector roads with AADT less than 25
Feeder roads with AADT less than 200

d) Shoulder Width and ROW Width

The shoulder widths were proposed in accordance with the present guidelines of DPWH and DLG. However, the R.O.W. width of 60 m which is used for roads with AADT more than 2000 in the DPWH Guideline was not recommended.

e) Radius and Grade

As for the radius and grade, which are basic elements of highway geometric design, no change was proposed because almost the same values were adopted in both design guidelines.

f) Pavement Type

Recommendation on pavement type was made based on the study on low-class pavement under Part B of this study.

3.1.6 Project Identification

(1) Pre-screening

a) Major Roads

All major roads were taken up for study; no pre-screening was undertaken.

b) Minor Roads

Minor roads are quite extensive in length as well as in number of links. Therefore, it is not practical to investigate and survey all minor roads. Pre-screening of minor roads is conducted by two (2) approaches.

i) Pre-screening by the Study Team

National and Provincial Roads, which are classified as minor roads, are pre-screened by the Study Team while roads classified as collector class roads are selected and subjected to field investigation by the Study Team.
Pre-screening of barangay roads was undertaken by the local officials concerned, not by the Study Team.

ii) Pre-screening by local officials

The local officials who are directly involved in road administration, planning and maintenance are most familiar with road conditions and problems that exist therein. The Study Team requested the District/Provincial/City/Municipal Engineering Offices to submit a proposed project list for rural roads development. At the same time, each province's medium-term plan and investment program were referred to. Based on the findings, a proposed project list is prepared. Road conditions of the proposed project were obtained by interviewing local officials.

(2) Criteria for Project Identification

Existing roads for the study exposes many types of problems, such as conditional deterioration, functional deficiencies and substandard facilities. Severe problems were found to involve: a) substandard pavement types, b) deteriorated surface conditions, c) abandoned/non-existing, d) narrow carriageway widths, e) ford crossings or temporary bridges, f) geometric deficiencies, g) drainage inadequacies, etc.

Considering the nature of the Study, however, the following five (5) conditions were used to identify road links calling for improvement.

- Pavement Type .... Substandard pavement type
- Road Surface Condition .... Bad/very bad condition
- Abandoned/Non-existing road .... To be newly constructed
- Carriageway Width .... Substandard width
- Bridges .... Ford crossings/temporary bridges

In this Study, improvement of geometric deficiencies is not taken up. However, special consideration is given to steep gradient sections with gravel surfaces.

Although correction work for drainage inadequacies is not independently proposed, it is included in other associated works such as improvement of surface condition and/or improvement of pavement type.

Table 3.1-7 shows the identification criteria established based on the above consideration,

TABLE 3.1-7 IDENTIFICATION CRITERIA

Item	Condition of Identification	
	Major Roads	Minor Roads
(1) Existing Links * Carriageway Width	Less than 6.0 meters	Less than 4.0 meters
* Pavement Type	Inferior to recommended type in the engineering Standards (Table 3.1-6)	Inferior to Gravel
* Surface Condition	Bad or very bad 1/	Bad or very bad 2/
(2) New Links	Impassable Abandoned Non-existing	
(3) Bridges	Ford crossing Spillway Timber bridge Bailey bridge	Ford crossing Spillway in structurally unsound condition Bailey bridge for AADT more than 300

Notes: 1/ Gravel roads proposed for improvement by local officials shall be identified, even though surface condition may be "fair".
2/ Gravel roads with "fair" surface condition shall be identified, as the surface condiion of gravel minor roads easily deteriorates.

(3) Improvement Criteria

The improvement works are proposed depending on the type and degree of road deficiencies. The improvement criteria are shown in Table 3.1-8. Road improvement works are categorized into five (5) types as shown in Table 3.1-9.

TABLE 3.1-8 IMPROVEMENT CRITERIA FOR ROAD

Road Class	Major Road		Minor Road	
	Standard/ Superior	Substandard	Standard/ Superior	Substandard
Good/Fair	No improvement or widening (widening)	Upgrading of pavement type (Improvement-2)	No improvement	No improvement
Bad/Very Bad	Improvement of surface condition (Rehabilitation)	Upgrading of pavement type (Improvement-1)	Improvement surface condition (Rehabilitation)	Upgrading of pavement type (Improvement-1)
Abandoned/ Non-existing	Construction of new road (New Construction)			

Note: 1) In case of carriageway width less than 6.0 meters.

TABLE 3.1-9 TYPES 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 of new road

Note: Improvement-2 and Widening are not applied to minor roads.

Table 3.1-10 shows the improvement criteria for bridges.

TABLE 3.1-10 IMPROVEMENT CRITERIA FOR BRIDGES

Existing Bridge Type	Proposed Improvement	
	Major Road	Minor Road
Ford Crossing	2-lane permanent bridge	Carriageway width 4.0 m 1-lane spillway Carriageway width 6.0 m 2-lane spillway
Spillway	2-lane permanent bridge	No Improvement
Timber Bridge	2-lane permanent bridge	AADT less than 200: 1-lane permanent bridge AADT more than 200: 2-lane permanent bridge
Bailey Bridge	2-lane permanent bridge	AADT less than 300: No improvement AADT more than 300: 2-lane permanent bridge

Note: 1) Where the site condition is not favorable for a spillway, a permanent bridge should be planned in accordance with the criteria for a timber bridge.
2) When the existing spillway is structurally sound and traffic disturbance is estimated less, the existing one can be utilized. Under other conditions, a permanent bridge should be planned in accordance with the criteria for a timber bridge.

3.1.7 Project Screening

(1) Categorization

Road projects are categorized by the following factors in order to establish comprehensive prioritization criteria:

a) Classes of Roads

Major Roads	Minor Roads
- Primary major roads	- National/provincial/city roads
- Secondary major roads	- Barangay roads

b) Urgency of Work

The improvement works are classified into five (5) types as described in Table 3.1-9. The types of improvement are subdivided into the two (2) following groups in accordance with the urgency of work.

Types A (Urgent Projects)

- Rehabilitation — Improvement of deteriorated road surface, but standard or superior class pavement, to acceptable condition.

- Improvement-1 — Improvement of deteriorated road surface and substandard class pavement, to acceptable and standard pavement.

- New Construction — Construction of new road including reconstruction of abandoned road.

Type B (Less Urgent Projects)

- Improvement-2 — Upgrading of substandard pavement class to standard pavement class, though existing road surface condition is acceptable.

- Widening — Widening of roads with substandard carriageway width, other conditions meet engineering standards.

Note: Road projects which include only improvement of bridges are classified as "Rehabilitation".

c) Economic Viability

Major Roads

Simplified economic evaluation is conducted for major roads. The Internal Rate of Return (IRR) is calculated based on roughly estimated construction cost and traffic cost savings. Categorization is made as follows:

Improvement Type A:

- IRR of 7.5% or more
- IRR of less than 7.5%

Improvement Type B:

- IRR of 15.0% or more
- IRR of less than 15.0%

Minor Roads

The Minor Road Pre-evaluation Indicator (MPI) is developed based on the Phase-I Study results (refer to Appendix 3-1). Minor roads are categorized using the following calculated MPIs as the bases.

- MPI of 7.5 or more
- MPI of less than 7.5

Based on the factors described above, road projects are categorized into eight (8) groups for major roads and four (4) for minor roads as shown in Table 3.1-11 and Table 3.1-12, respectively.

TABLE 3.1-11 CATEGORY OF MAJOR ROAD PROJECTS

Class of Roads	Type of Improvement and IRR			
	Rehabilitation, New Construction		Improvement-1	Improvement-2 Widening
	IRR ≥ 7.5	IRR < 7.5	IRR ≥ 15.0	IRR < 15.0
Primary Major Road	Category 1	Category 5	Category 3	Category 7
Secondary Major Road	Category 2	Category 6	Category 4	Category 8

TABLE 3.1-12 CATEGORY OF MAJOR ROAD PROJECTS

Class of Roads	Type of Improvement and MPI		
	Rehabilitation, New Construction	Improvement-1	Improvement-2 Widening
	MPI ≥ 7.5	MPI < 7.5	
National/ Provincial/ City Road	Category 1	Category 3	not identified
Barangay Road	Category 2	Category 4	not identified

(2) Prioritization

a) Major Roads

Categories 1 and 2 are considered to have the highest priority in view of the urgent needs of improvement as well as high viability. On the other hand, categories 7 and 8 are given low priority because of lesser urgency and lower economic viability. Categories 3 and 4 (Rehabilitation/Improvement-1/New Construction, low IRR) and Categories 5 and 6 (Improvement-2/Widening, high IRR) are given equal priority.

In consequence, major roads are classified into three priority groups as shown in Table 3.1-13.

b) Minor Roads

Prioritization of minor roads is made according to MPI as shown in Table 3.1-14.

c) Selection of Road Projects for Feasibility Study

The project evaluation to be conducted in the next stage of the Study has the following two (2) major objectives:

i) Detailed evaluation to select road projects for implementation.

ii) Development of simplified and commonly applicable evaluation methodology for rural roads.

To achieve the first objective, high priority projects should be selected, while for the second objective, it is preferable to cover wide-ranging projects. From this point of view, the criteria for selecting the road projects for Feasibility Study are proposed as follows:

i) Major roads classified as priority MA-1 and MA-2 (categories 1-6)
ii) Minor roads classified as priority MI-1 (categories 1-2)
iii) Engineering Considerations, especially for minor roads.

- When selected roads are concentrated too much into a certain area, some roads are to be deleted.

- When road projects are found scarce in a certain area, some roads are to be added.

- In case a lower class road is connected with a higher class road and the former is selected while the latter is not, the higher class road is to be added.

TABLE 3.1-13 PRIORITIZATION AND SELECTION OF ROAD PROJECTS

- Major Roads -

Category	Road Class	Type of Improvement	IRR	Priority Criteria	Selection Criteria
1	Primary	A	7.5 ≤ IRR	MA-1	To be selected for F/S
2	Secondary	A	7.5 ≤ IRR	MA-1	To be selected for F/S
3	Primary	B	15.0 ≤ IRR	MA-2	To be selected for F/S
4	Secondary	B	15.0 ≤ IRR	MA-2	To be selected for F/S
5	Primary	A	IRR < 7.5	MA-2	To be selected for F/S
6	Secondary	A	IRR < 7.5	MA-2	To be selected for F/S
7	Primary	B	IRR < 15.0	MA-3	
8	Secondary	B	IRR < 15.0	MA-3	

TABLE 3.1-14 PRIORITIZATION AND SELECTION OF ROAD PROJECTS

- Minor Roads -

Category	Road Class	Type of Improvement	MPI	Priority Criteria	Selection Criteria
1	National/ Provincial/ City	A	7.5 ≤ MPI	MI-1	To be selected for F/S
2	Barangay	A	7.5 ≤ MPI	MI-1	To be selected for F/S
3	National/ Provincial/ City	A	MPI < 7.5	MI-2	
4	Barangay	A	MPI < 7.5	MI-2	

Note: Improvement Type A: Rehabilitation, Improvement-1, New Construction
Improvement Type B: Improvement-2, Widening

3.2 PROJECT IDENTIFICATION IN THE STUDY PROVINCES

3.2.1 Evaluation of Present Road Network

The level of present road network development was assessed for each study province from the following point of the view:

i) Road extension level (quantity of roads)
ii) Road surface type and conditions (quality of roads)
iii) Road network pattern

Based on the above assessment, future direction of road network development was proposed for each study province.

Table 3.2-1 summarizes the level of present road network development for eleven (11) study provinces.

More detailed discussions are presented in Volumes 4 through 14.

3.2.2 Proposed Major Road Network

In due consideration of the present road network pattern, the future direction of road network development, and functional road classification criteria, major road network for each study province was proposed and summarized in Table 3.2-2. Detailed discussions are given in Volumes 4 through 14.

3.2.3 Identified Road Projects

The major road network for each study porovince was proposed by taken into account the present road network pattern as well as the functional road classification criteria. This is summarized in Table 3.2-3. A total of 9,217 kms. of roads was identified, consisting of 1,895 kms of national roads, 3,825 kms of provincial/city roads and 3,497 kms of barangay roads.

TABLE 3.2-1 (1) SUMMARY OF PRESENT ROAD NETWORK EVALUATION

PROVINCE	TOPOGRAPHICAL CHARACTERISTICS	PRESENT ROAD NETWORK DEVELOPMENT LEVEL			FUTURE DIRECTION OF ROAD NETWORK DEVELOPMENT
		Road Extension (Quantity of Roads)	Surface Type and Conditions (Quality of Roads)	Road Network Formation	
LA UNION	* Narrow but long in north-south direction * Predominantly mountainous with narrow coastal plain * Typical sea-side mountainous province	* National/Provincial Roads - In high level * Barangay Roads - In high level	* National Roads - In quite high level * Provincial Roads - Still in very low standard	* Comb type network pattern with Manila North Road as an axis * All municipal towns are provided with access * When three (3) provincial roads, currently impassable, are improved, network efficiency will be improved	* Priority should be given to the improvement of existing, especially provincial roads and barangay roads. * Improvement of currently impassable three (3) provincial roads be studied for their viability.
NUEVA VIZCAYA	* Predominantly mountainous located in the Caraballo Mountains and the Central Cordillera * Typical Inland mountainous province	* National/Provincial Roads - In quite high level * Barangay Roads - In quite high level	* National Roads - Still in very low standard * Provincial Roads - Still in very low standard	* Fish-born type network with Pan-Philippine Highway as an axis * Two (2) municipal towns are not accessed, therefore, basic network is not formed yet.	* Improvement of existing roads which form a major road network should be given first priority. * Next priority will be improvement of other existing roads.
NUEVA ECIJA	* Situated in the Central Plains, the province is mostly flat, except areas near Nueva Vizcaya and Aurora where terrain is mountainous. * Typical Inland flat province.	* National/Provincial Roads - In standard level * Barangay Roads - In standard level	* National Roads - Still in low level * Provincial Roads - Still in low level	* Fairly fine mesh type network * North-South axes are Pan-Philippine Highway and Manila North Road * East-West axes are three (3) national/provincial roads * All municipal towns are provided with access	* Improvement of existing roads which form a major road network should be given first priority. * Next priority will be given to the improvement of other existing roads.
RIZAL	* Northern and Eastern areas are mountainous where Southern Sierra Madre Ranges are situated. * The areas facing Laguna de Bay and Metro Manila are flat low land.	* National/Provincial Roads - Still low level, particularly Provincial Roads * Provincial Roads - In high level	* Mesh type network in the southern and the south-western areas. * In the northern area, road network is quite scarce. * The main axis is the national road running along Laguna de Bay.	* As provincial roads are quite scarce, collector class roads should be strengthened. * Existing roads in the northern are should be improved.	
OCCIDENTAL MINDORO	* Mountain Ranges are situated in the eastern portion of the province * Predominantly, mountainous with narrow plain along the western coast. * Typical sea-side mountainous province.	* National/Provincial Roads - In high level * Barangay Roads - In standard level	* National Roads - Still in very low level * Provincial Roads - Still in very low level	* Comb type network with the road along the coast as an axis. * No linkage with Oriental Mindoro * All municipal towns are provided with access.	* Upgrading of national and provincial roads should be given priority * Completion of roads in the northern and southern tip of the province which connect with Oriental Mindoro should be seriously considered.

TABLE 3.2-1 (2) SUMMARY OF PRESENT ROAD NETWORK EVALUATION

PROVINCE	TOPOGRAPHICAL CHARACTERISTICS	PRESENT ROAD NETWORK DEVELOPMENT LEVEL			FUTURE DIRECTION OF ROAD NETWORK DEVELOPMENT
		Road Extension (Quantity of Roads)	Surface Type and Conditions (Quality of Roads)	Road Network Formation	
ALBAY	* Generally flat land with several upheaved high volcanoes	* National/Provincial Roads - In high level * Barangay Roads - In low level	* National Roads - In high level * Provincial Roads - Still in low standard	* Two (2) fish-born type of network, with Pan-Philippine Highway as one axis and with Legaspi-Tabaco-Tiwi Rd. as another axis. * Road network in the southern area is less developed. * All municipal towns are provided with access.	* Improvement of existing provincial roads and development of road network in the southern area should be given priority.
ANTIQUE	* Very narrow but stretching long in the north-south direction. * Predominantly mountainous with very narrow coastal plain * Typical sea-side mountainous province.	* National/Provincial Roads - National Roads are in quite high but Provincial Rds. are in quite low level * Barangay Roads - In high level	* National Roads - Still in low standard * Provincial Roads - Still in low standard	* Comb type network with the national road along the western coast as an axis * Accesses with adjacent provinces are provided only at the northern and southern tips of the province. * All municipal towns are provided with access.	* First priority will be up-grading of pavement type of national roads. * Second priority will be improvement of existing provincial and barangay roads.
SAMAR	* Most areas are rolling to mountainous, except the narrow western coastal area where the land is flat.	* National/Provincial Roads - In extremely low level * Barangay Roads - In extremely low level	* National Roads - In high level * Provincial Roads - Still in low level	* Comb type network with Pan-Philippine Highway as an axis. * Several municipal towns are not provided with access	* Priority should be given to improvement of the existing roads, at the same time efforts should be made to provide access to all municipal towns.
LEYTE	* Eastern area is generally flat. * Western area is mostly mountainous with narrow flat land along the coast.	* National/Provincial Roads - National Roads are in quite high level but Provincial roads are in low level. * Barangay Roads - In standard level	* National Roads - In standard level * Provincial Roads - Still in very low level	* Relatively fine mesh type network in the eastern area. * Mesh type network in north-western area. * Comb type network in the western area. * Pan-Philippine Highway and West Leyte Roads are two (2) north-south axes. * Palo-Jaro-Capoocan Road and Mahaplag-Baybay Rd. are two (2) east-west axes. * All municipal towns are provided with access.	* Major national roads are being and will soon be improved, next step will be improvement of existing provincial roads and barangay roads.

TABLE 3.2-1 (3) SUMMARY OF PRESENT ROAD NETWORK EVALUATION

PROVINCE	TOPOGRAPHICAL CHARACTERISTICS	PRESENT ROAD NETWORK DEVELOPMENT LEVEL			FUTURE DIRECTION OF ROAD NETWORK DEVELOPMENT
		Road Extension (Quantity of Roads)	Surface Type and Conditions (Quality of Roads)	Road Network Formation	
MISAMIS ORIENTAL	* Predominantly mountainous with narrow flat land along the coast. * Typical sea-side mountainous province.	* National/Provincial Roads - In very high level * Barangay Roads - In very high level	* National Roads - In high level * Provincial Roads - Still in low standard	* Comb type network with Butuan-Cagayan de Oro-Iligan Road as an axis. * All municipal towns are provided with access.	* Priority should be given to the improvement of existing provincial and barangay roads.
DAVAO DEL NORTE	* Central area is relatively wide flat land. * The rest of the province is predominantly mountainous.	* National/Provincial Roads. - National Roads are still in low level, but Provincial roads are in high level. * Barangay Roads - In the standard level	* National Roads - In the standard level * Provincial Roads - Still in very low level	* Fish-born type network with Pan-Philippine Highway as an axis * The central flat area has a dense road network, however, mountainous areas have less developed road network. * All municipal towns are provided with access.	* Improvement of existing national and provincial roads, especially those which form a major road network, should be given priority.

TABLE 3.2-2 PROPOSED MAJOR ROADS

Province	Existing Road Length • National • Provincial • Brangay • Total	Proposed Major Road Length • National • Provincial • Barngay • Total	Road Density (L/√PA)	Network Value	Accessibility	Terrain/ Road Network Pattern
La Union	216 252 639 1,107	198.6 68.3 — 266.9	0.299	0.385 ~ 0.742 (0.518)	0.60 ~ 1.52 (1.18)	• Sea-side Mountainous • Comb Type Network
Nueva Vizcaya	313 370 1,434 2,117	243.7 45.2 — 288.9	0.269	0.464 ~ 1.622 (0.548)	0.59 ~ 3.62 (2.11)	• In-land Mountainous • Fish-bone Type Network
Nueva Ecija	427 698 1,740 2,865	492.9 242.2 — 735.1	0.286	0.274 ~ 1.010 (0.541)	0.24 ~ 2.34 (1.16)	• In-land Flat • Mesh Type Network
Rizal	244 67 783 1,094	208.3 — — 208.3	0.215	0.438 ~ 0.891 (0.557)	0.07 ~ 1.57 (0.50)	• Sea-side Flat/Mountainous • Combination of Mesh and Fish-bone Type
Occ. Mindoro	359 322 794 1,475	274.6 115.8 — 390.4	0.310	0.55 ~ 1.24 (0.57)	0.30 ~ 2.31 (1.30)	• Sea-side Mountainous • Comb Type Network
Albay	385 375 684 1,444	293.8 16.2 — 310.0	0.200	0.267 ~ 0.676 (0.377)	0.50 ~ 2.39 (1.47)	• Sea-side Flat/Mountainous • Fish-bone Type
Antique	363 97 754 1,214	354.4 — 6.0 360.4	0.356	0.362 ~ 0.646 (0.437)	0.60 ~ 2.18 (1.60)	• Sea-side Mountainous • Comb Type Network
Samar	232 135 300 667	351.0 136.1 8.4 495.5	0.288	0.39 ~ 1.02 (0.58)	0.49 ~ 2.55 (1.53)	• Sea-side Mountainous • Comb Type Network
Leyte	959 521 1,913 3,393	759.2 41.8 40.0 841.0	0.276	0.28 ~ 0.74 (0.47)	0.60 ~ 6.22 (1.62)	• Sea-side Flat/Mountainous • Combination of Mash and Comb Type
Misamis Oriental	453 502 2,220 3,175	343.3 4.4 — 347.7	0.199	0.233 ~ 1.274 (0.319)	0.53 ~ 2.94 (2.13)	• Sea-side Mountainous • Comb Type Network
Davao del Norte	352 744 1,641 2,737	269.2 256.2 — 525.4	0.200	0.231 ~ 1.030 (0.452)	0.34 ~ 2.84 (2.36)	• Sea-side Flat/Mountainous • Combination of Mash and Comb Type

TABLE 3.2-3 IDENTIFIED ROAD PROJECTS

	La Union	Nueva Vizcaya	Nueva Ecija	Rizal	Occidental Mindoro	Albay	Antique	Samar	Leyte	Misamis Oriental	Davao del Norte	Total
1. Population (1987)	532,000	295,000	1,245,000	718,000	269,000	944,000	406,000	529,000	1,478,000	855,000	853,000	8,124,000
2. Land Area (sq. km)	1,493	3,904	5,284	1,309	5,880	2,553	2,552	5,591	6,268	3,570	8,130	46,534
3. No. of Cities/Municipalities	20	15	32	14	9	18	18	21	43	26	18	234
4. Road Length (1987 DPWH Data)												
• National Road	216	313	427	244	589	385	363	232	959	453	352	4,533
• Provincial/City Road	252	370	738	67	322	402	97	145	582	566	744	4,285
• Barangay Road	639	1,434	1,740	783	794	684	754	300	1,913	2,220	1,641	12,902
Total	1,107	2,117	2,905	1,094	1,705	1,471	1,214	677	3,454	3,239	2,737	21,720
5. Proposed Major Road Network												
• National Road	199	244	493	208	274	294	354	351	759	343	269	3,788
• Provincial/City Road	68	45	242	-	116	16	-	136	42	5	256	925
• Barangay Road	-	-	-	-	-	-	6	8	40	-	-	54
Total	267	289	735	208	390	310	360	495	841	348	525	4,768
Network Characteristics												
• Network Value	0.518	0.548	0.451	0.557	0.57	0.377	0.437	0.58	0.47	0.319	0.452	
• Average Access to Major Road (km)	1.18	2.11	1.16	0.50	1.30	1.47	1.60	1.53	1.62	2.13	2.36	
6. Studied Road Length												
• National Road	212	301	521	243	324	337	404	364	943	343	358	4,350
• Provincial/City Road	216	473	489	41	285	355	107	201	483	499	1,035	4,186
• Barangay Road	214	213	318	127	233	286	285	425	705	314	453	3,576
Total	644	987	1,328	411	842	978	796	990	2,131	1,156	1,846	12,109
7. Identified Road Projects Major Road												
• National Road	57	78	181	120	92	209	240	112	244	70	64	1,467
• Provincial/City Road	55	25	187	-	56	16	-	66	33	4	230	672
• Barangay Road	-	-	-	-	-	-	6	8	40	-	-	54
Total	112	103	368	120	148	225	246	186	317	74	294	2,193
Minor Road												
• National Road	4	53	28	22	38	43	28	1	139	-	72	428
• Provincial/City Road	150	401	247	37	158	281	101	65	439	495	779	3,153
• Barangay Road	214	213	318	127	233	242	269	416	665	293	453	3,443
Total	368	667	593	186	429	566	398	482	1,243	788	1,304	7,024
Total :												
• National Road	61	131	209	142	130	252	268	113	383	70	136	1,895
• Provincial/City Road	205	426	434	37	214	297	101	131	472	499	1,009	3,825
• Barangay Road	214	213	318	127	233	242	275	424	705	293	453	3,497
Total	480	770	961	306	577	791	644	668	1,560	862	1,598	9,217

3.3 PROJECT SCREENING IN THE STUDY PROVINCES

In accordance with the procedure and methodology discussed in Section 3.1, identified road projects were screened and road projects for feasibility studies were selected as shown in Table 3.3-1.

A total of 5,291.1 kms. of road projects, whose composition is shown below, was selected for feasibility studies.

Road Class	Road Length (kms.)	No. of Road Links	Average Length of Road Link
Primary Major Roads	447.3 (8.5%)	28	16.0 kms
Secondary Major Roads	1,601.1 (30.2%)	133	12.0 kms
Major Roads Total	2,048.4 (38.7%)	161	12.7 kms
Minor Roads (National/ Provincial Roads)	2,022.8 (38.2%)	268	7.5 kms
Minor Roads (Barangay Roads)	1,219.9 (23.1%)	175	7.0 kms
Minor Roads Total	3,242.7 (61.3%)	443	7.3 kms
T o t a l	5,291.1 (100.0%)	604	8.8 kms

TABLE 3.3-1 SELECTED ROAD PROJECTS FOR F/S

Province	MAJOR ROADS			MINOR ROADS			TOTAL
	Primary Major Roads	Secondary Major Roads	Sub-Total	National/ Provincial Roads	Barangay Roads	Sub-Total	
La Union	- (-)	111.6 (9)	111.6 (9)	96.8 (15)	105.3 (21)	202.1 (36)	313.7 (45)
Nueva Vizcaya	- (-)	53.8 (6)	53.8 (6)	271.7 (22)	55.5 (13)	327.2 (35)	381.0 (41)
Nueva Ecija	129.7 (8)	232.7 (23)	362.4 (31)	189.9 (20)	139.7 (15)	329.6 (35)	692.0 (66)
Rizal	8.2 (2)	103.3 (10)	111.5 (12)	34.7 (8)	32.6 (6)	67.3 (14)	178.8 (26)
Occidental Mindoro	60.2 (2)	84.1 (8)	144.3 (10)	146.9 (26)	112.9 (27)	259.8 (53)	404.1 (63)
Albay	51.1 (3)	174.2 (8)	225.3 (11)	257.5 (41)	52.1 (15)	309.6 (56)	534.9 (67)
Antique	115.7 (9)	130.4 (11)	246.1 (20)	81.5 (23)	72.4 (6)	153.9 (29)	400.0 (49)
Samar	82.4 (4)	99.1 (7)	181.5 (11)	65.5 (7)	280.0 (24)	345.5 (31)	527.0 (42)
Leyte	- (-)	299.8 (24)	299.8 (24)	343.6 (38)	117.6 (17)	461.2 (55)	761.0 (79)
Misamis Oriental	- (-)	74.2 (3)	74.2 (3)	271.2 (36)	154.4 (23)	425.6 (59)	499.8 (62)
Davao del Norte	- (-)	237.9 (24)	237.9 (24)	263.5 (32)	97.4 (8)	360.9 (40)	598.8 (64)
Total	447.3 (28)	1,601.1 (133)	2,048.4 (161)	2,022.8 (268)	1,219.9 (175)	3,242.7 (443)	5,291.1 (604)

Note : ( ) : Number of Road Links

CHAPTER 4

PROJECT EVALUATION

4.1 METHODOLOGY

4.1.1 General Procedure

4

The general procedure adopted for project evaluation is illustrated in Figure 4.1-1.

The project roads selected for feasibility studies were grouped, based chiefly on the method of economic analysis, into two types, traffic projects and development projects.

Traffic Projects

In projects involving the rehabilitation/reconstruction/ upgrading of existing roads which are 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 of the area served by the road.

Development Projects

In projects for providing all-weather access to areas that presently have either no motorized access or only seasonal access, the impact of the investment would affect not only the transport sector but also other sectors in the local economy, especially the agricultural sector.

Roads located in areas having a high agricultural potential and served by very rough but all-weather roads, were considered development project roads.

The project classification was determined during the field surveys. Major roads were generally classified as traffic projects, and the minor roads as development projects.

The evaluation methods for traffic and development projects differ as outlined below:

Traffic Projects

Traffic demand is analyzed as a component of the overall road network in the province. Economic analysis is focused on the quantification of road user cost savings and road maintenance cost changes.

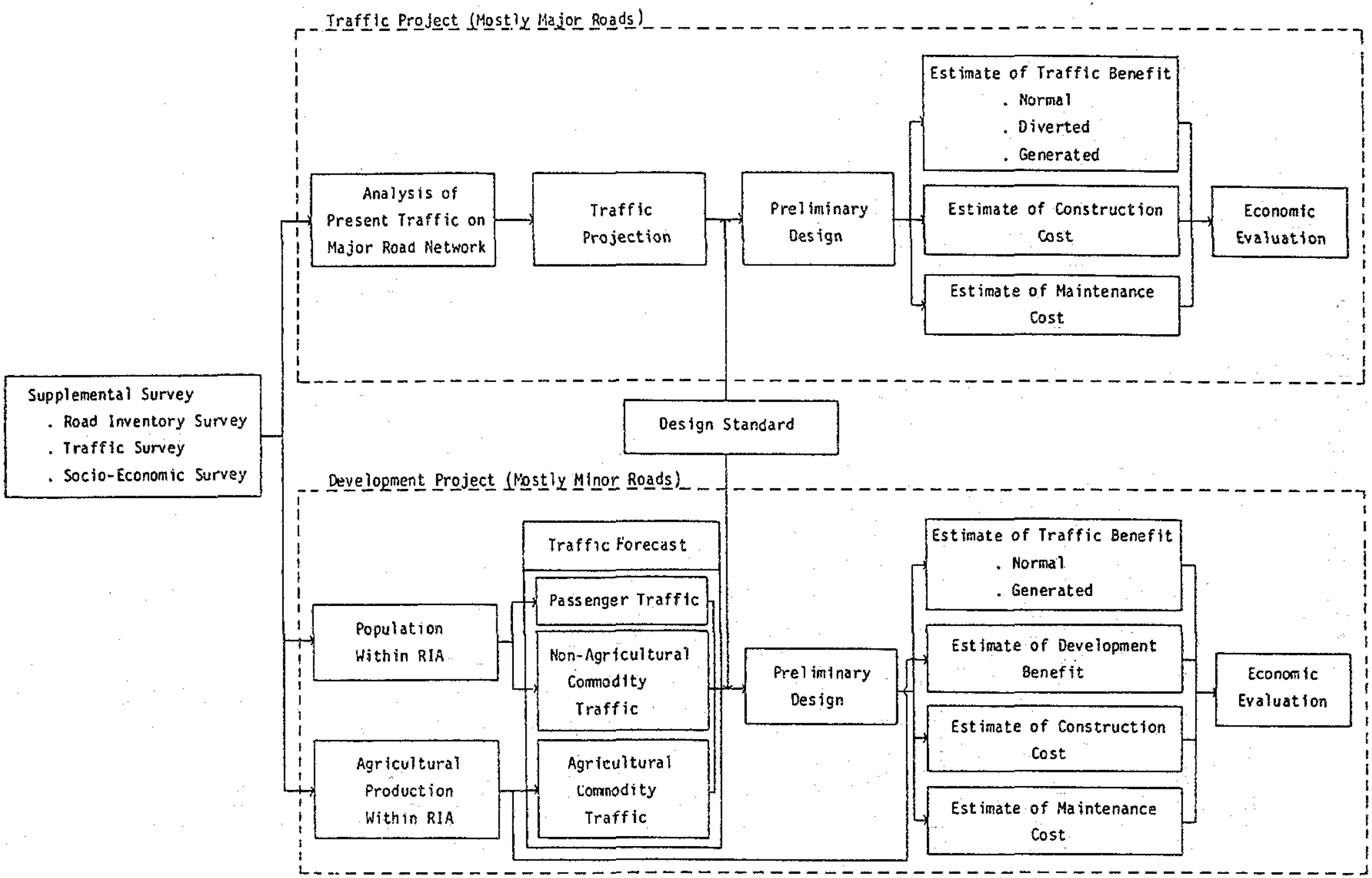


FIGURE 4.1-1 PROCEDURE FOR PROJECT EVALUATION

Development Projects

Traffic demand is analyzed independently as a feeder road based on the population and agricultural activities of the area served by the road. Economic evaluation deals with changes in transport mode and traffic costs as well as increased agricultural development.

4.1.2 Supplemental Surveys

The following surveys were conducted to obtain basic data for traffic forecast, preliminary design and economic analysis:

i) Road Inventory Survey
ii) Traffic Survey
iii) Socio-economic Survey

Data obtained by the supplemental surveys and their ways of usage are illustrated in Figure 4.1-2.

(1) Road Inventory Survey

The road inventory survey was conducted for 5,291.1 kms. of roads comprising 604 road links as shown in Table 4.1-1. In the course of the field survey, each road was divided into homogeneous subsections. Road conditions of each subsection and bridge conditions were surveyed for the items shown in Tables 4.1-2 and 4.1-3, respectively. Survey results were compiled in the diskettes for computer analysis and also presented in Drawing Volumes.

TABLE 4.1-1 ROAD LENGTH SUBJECTED TO FIELD SURVEY

Name of Province	No. of Road Links	Total Length (kms)	Name of Province	No. of Road Links	Total Length (kms)
La Union	45	313.7	Antique	49	400.0
Nueva Vizcaya	41	381.0	Samar	42	527.0
Nueva Ecija	66	692.0	Leyte	79	761.0
Rizal	26	178.8	Misamis Oriental	62	499.8
Occ. Mindoro	63	404.1	Davao del Norte	64	598.8
Albay	67	534.9			
			Total	604	5,291.1

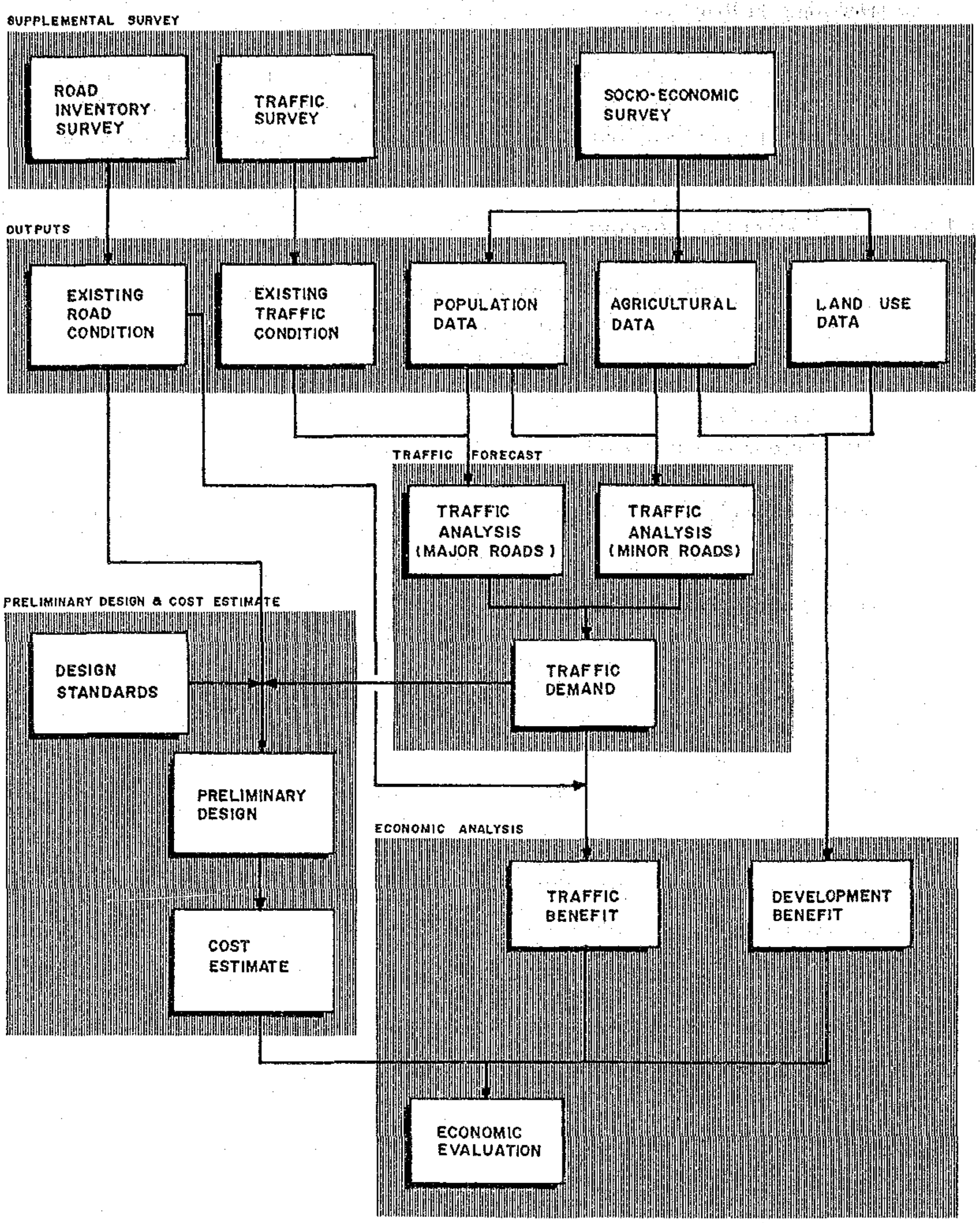


FIGURE 4.1-2 SUPPLEMENTAL SURVEY AND OUTPUT UTILIZATION

TABLE 4.1-2 ROAD INVENTORY SURUEY FORM

Form-1

Date ________

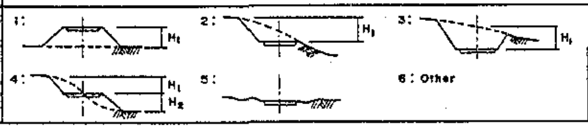
Item			1	2	3	4	5	6	7	8	9	10
Name of Road												
Road Number												
Sub-Section Number			1	2	3	4	5	6	7	8	9	10
Length of Sub-Section (Km)												
Road Width (m)	Total Road Width											
	Pavement Width											
Surface Type	P: PCC B: Bituminous G: Gravel E: Earth											
Surface Condition	G: Good F: Fair B: Bad V: Very Bad I: Impassable N: Not Existing											
Terrain	F: Flat R: Rolling M: Mountainous											
Cross Section	 1: H_1 2: H_1 3: H_1 4: H_1 H_2 5: 6: Other											
		Shape										
		H_1 (m)										
		H_2 (m)										
Length of Section with Steep Gradient (Km)												
Number of Sharp Curves												
Side Ditch	1: Good 2: Poor 3: None											
No. of Bridge	(Fill up Form-2 for each bridge)											
Motorized Access	Frequency of road impassable (time/year)											
	Average period of road impassable (days)											
	Cause	1: Flood 2: Muddy 3: Lack of Bridge 4: Slope Failure 5: Other ( )										
	If flood,	Length of Section flooded (Km)										
		Depth of flood (m)										
	If Slope failure,	Total Width of Cut Slope to be protected (m)										
		Total Width of embankment slope to be protected (m)										
Average Speed of Cars (Km/hour)												
Major Transport Means	1: Car/Jeep 2: Jeepney 3: Bus 4: Truck 5: Tricycle 6: Motorcycle 7: Carabao/Horse 8: Walking 9: Boat — Passenger	mostly										
		often										
		sometimes										
	Commodity	mostly										
		often										
		sometimes										
Major Crops Land Use	1: Irrigated Palay 2: Rainfed Palay 3: Upland Palay 4: Corn 5: Coconut 6: Sugarcane 7: Vegetables 8: Tuber Root/Bulb Crops 9: Banana 10: Other Crops ( ) 11: Built-up Area 12: Grass/Pasture/Fallow 13: Scrub/Bush 14: Forest 15: Swamp/Marsh 16: Others ( )	mostly										
		often										
		sometimes										
Name of Town/Barangay traversed and/or Name of road crossed												

TABLE 4.1-3 BRIDGE INVENTORY SURVEY FORM

Form − 2

Road Number			
Sub − Section Number			
Bridge Number			
Distance from the end of Sub − Section (Km)			
Existing Bridge	Bridge Type	1 : Ford Crossing 2 : Timber Bridge 3 : Bailey Bridge 4 : Concrete Bridge 5 : Steel Bridge 6 : Other ( )	
	Type of Deck Slab	1 : Timber 2 : Concrete 3 : Other ( )	
	Total Bridge Length (m)		
	Span Length (m)		@ @ @
	Width (m)	Carriageway	
		Sidewalk	@
	Deck Slab	1 : Good / Fair 2 : Needed to repair / improve	
	Super-Structure	1 : Good / Fair 2 : Needed to repair / improve	
	Sub- structure	1 : Good / Fair 2 : Needed to repair / improve	
	Bridge Approaches	1 : Good / Fair 2 : Needed to repair / improve	
		Length of Approaches to be repair / improve (m)	
Length of Proposed Bridge (m)			
Profile / Cross section			

(2) Traffic Survey

The traffic survey was conducted at 201 stations, whose provincial breakdown is shown in Table 4.1-4.

Traffic counts were carried out on two consecutive weekdays for 12 hours from 6:00 AM to 6:00 PM each day. Traffic volume was counted by direction and by vehicle type every hour. The vehicle type was classified as follows:

- Car
- Jeep
- Van
- Jeepney
- Bus (mini bus & large bus)
- Truck (including trailer)
- Motor-tricycle
- Motorcycle
- Animal drawn
- Pedestrian
- Others

Survey results were converted into Average Daily Traffic (ADT) by using the hourly factors based on the data obtained from the Nationwide Traffic Counts Program (NTCP). With consideration given to other factors such as market days, harvest season, rainy season, etc., the AADTs were estimated by vehicle type.

TABLE 4.1-4 NUMBER OF TRAFFIC COUNT STATIONS

Name of Province	No. of Stations	Name of Province	No. of Stations
La Union	15	Antique	16
Nueva Vizcaya	15	Samar	15
Nueva Ecija	26	Leyte	28
Rizal	19	Misamis Oriental	16
Occ. Mindoro	16	Davao del Norte	20
Albay	15	Total	201

(3) Socio-economic Survey

The road influence area of each road link was delineated considering the topography, road network, rivers, mountain ranges, location of barangays and land use. Then, a list of the barangays located within the road influence area for each road link was prepared.

The following data were collected for each barangay:

a) Location of barangay center
b) Population
c) Nearest market (name, location and market day)
d) Social facilities (schools and health facilities)
e) Land area (total, cultivated, uncultivated and potential area)
f) Road access
g) Agricultural data (cultivated area, average yield, farmgate price and production cost of major crops)

Major data sources were as follows:

- Provincial Planning & Development Office (PPDO)
- City/Municipal Planning & Development Office (CPDO/MPDO)
- Municipal Agricultural Office (MAO)
- Barangay

Collected data were compiled by road link for analysis by a computer.

4.1.3 Traffic Projection

(1) Traffic Projects

a) Analysis of Present Traffic

i) General Procedure

Present traffic on each major road network was analyzed according to the procedure shown in Figure 4.1-3.

The analysis is divided into three major steps:

Step I : Analysis of Traffic Survey Results

The number of passengers and commodity tonnage were obtained from the results of the traffic survey. These data are, however, available only on the surveyed road links and used for calibration purposes for the traffic model described below.

Step II : Analysis by Traffic Model

Traffic generation and attraction, in terms of passengers and commodity tons, were estimated based on population and per capita traffic generation factors; traffic distribution (OD distribution) was estimated by the gravity model; then, OD distribution was assigned to the major road network expressed by the node and link system.

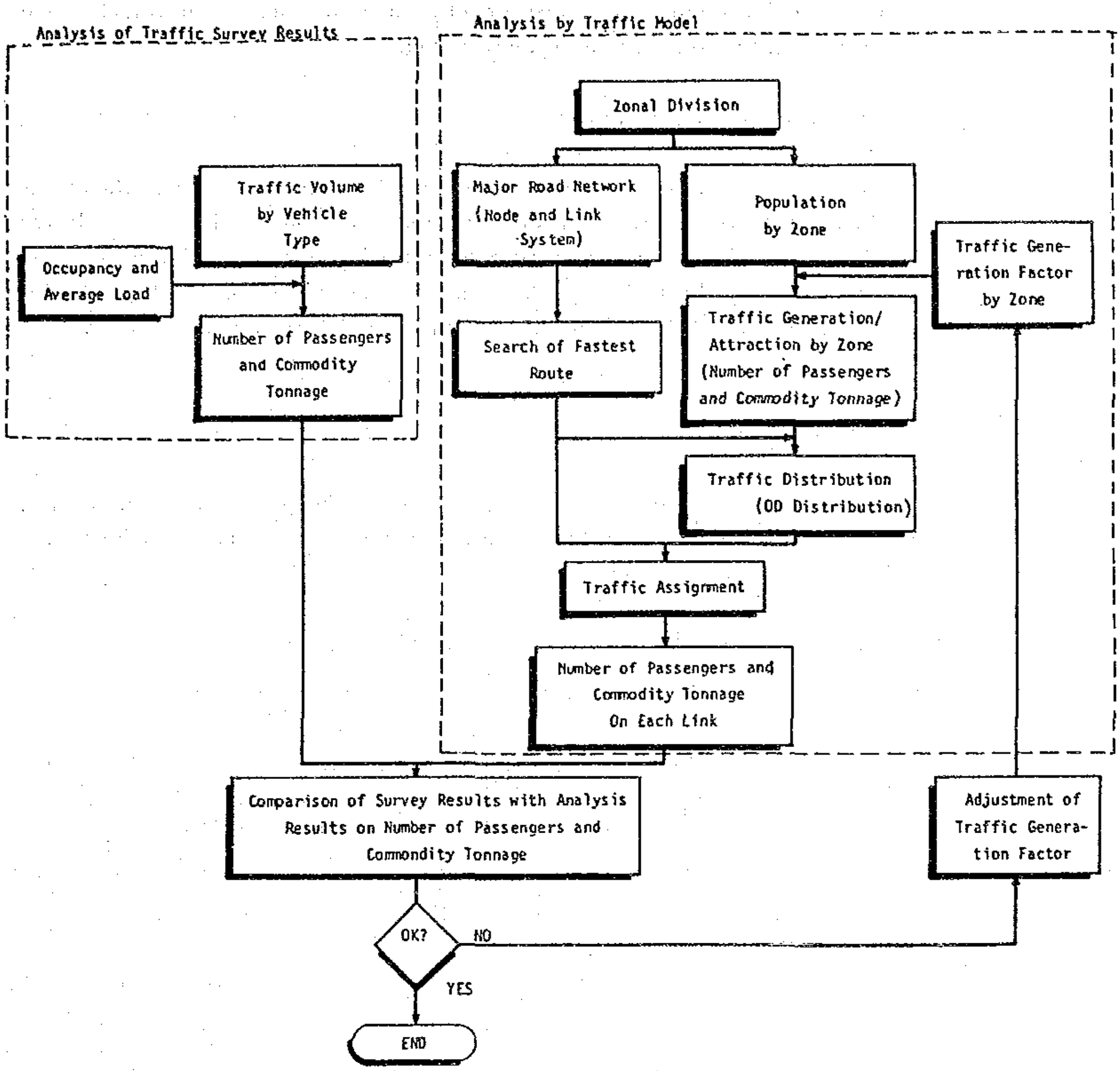


FIGURE 4.1-3 PROCEDURE OF ANALYSIS OF PRESENT TRAFFIC ON MAJOR ROAD NETWORK

In the analysis, since only traffic generation factors were unknown, assumed values were used for them in the first step.

Step III : Comparison of Both Figures

The number of passengers and commodity tonnage estimated by the traffic model were compared with those derived from the traffic survey. On the basis of the comparison, traffic generation factors were appropriately adjusted and the traffic model analysis was reiterated until the traffic model reflected the actual people and freight movements with a high accuracy.

ii) Analysis of Traffic Survey Results

Traffic volume by vehicle type counted in the traffic survey was converted to number of passengers and commodity tonnage using the occupancy and average load shown in Table 4.1-5.

TABLE 4.1-5 OCCUPANCY AND AVERAGE LOAD BY VEHICLE TYPE

Province	Occupancy (person/vehicle)								
	Car	Jeep	Van	Jeep-ney	Bus	Truck	Tri-cycle	M.Bi-cycle	Ani-mal
La Union	3.40	3.40	3.40	11.80	35.00	5.00	2.90	1.60	3.00
Nueva Vizcaya	3.40	3.40	3.40	11.80	25.30	5.00	2.90	1.60	3.00
Nueva Ecija	3.40	3.40	3.40	11.80	25.30	5.00	2.90	1.60	1.50
Rizal	3.40	3.40	3.40	11.80	30.90	4.00	2.50	1.60	1.50
Occ. Mindoro	3.40	3.40	3.40	11.80	25.30	5.00	2.90	1.60	3.00
Albay	3.00	3.00	3.00	13.00	30.00	3.00	4.00	1.50	1.50
Antique	3.40	3.40	3.40	11.80	25.30	5.00	2.90	1.60	3.00
Samar	3.50	3.00	4.00	18.00	40.00	6.00	3.00	3.00	3.00
Leyte	4.00	3.40	4.00	15.00	40.00	5.00	4.00	3.00	3.00
Misamis Ori.	3.00	3.40	3.40	20.00	30.00	4.00	3.00	1.50	2.00
Davao d. Norte	3.40	3.40	3.40	20.00	30.00	4.00	2.90	1.60	2.00

Province	Average Load (ton/vehicle)								
	Car	Jeep	Van	Jeep-ney	Bus	Truck	Tri-cycle	M.Bi-cycle	Ani-mal
La Union	1.00	1.00	1.00	1.00	1.00	5.00	0.30	0.10	0.15
Nueva Vizcaya	1.00	1.00	1.00	1.00	1.00	3.00	0.30	0.10	0.15
Nueva Ecija	1.00	1.00	1.00	1.00	1.00	4.00	0.30	0.10	0.15
Rizal	1.00	1.00	1.00	1.00	1.00	4.00	0.30	0.10	0.15
Occ. Mindoro	1.00	1.00	1.00	1.00	1.00	3.00	0.30	0.10	0.15
Albay	0.30	0.50	1.00	1.00	1.00	3.00	0.10	0.10	0.20
Antique	1.00	1.00	1.00	1.00	1.00	3.00	0.30	0.10	0.15
Samar	0.50	0.80	1.00	1.50	1.00	4.00	0.30	0.10	0.15
Leyte	0.50	0.80	1.00	1.00	1.00	4.00	0.30	0.10	0.15
Misamis Ori.	1.00	1.00	1.00	1.00	1.00	3.00	0.30	0.10	0.15
Davao d. Norte	1.00	1.00	1.00	1.00	1.00	3.00	0.30	0.10	0.15

iii) Analysis by Traffic Model

Zonal Division:

The province was divided into traffic zones corresponding to municipal divisions in principle.

Major Road Network:

The major road network was expressed by a node and link system. Each link was given length and average speed according to the actual road condition.

Search for the Fastest Route:

The fastest route for each zone pair was calculated by Moore's Method.

Traffic Generation Factor:

Per capita traffic generation factors (trip/person/day and ton/person/day) vary between zones even in the same province with many factors such as:

- Economic Activity
- Size of Population
- Distance from Provincial Capital
- Road Condition
- Other Physical Conditions

The generation factors which best illustrate the observed people and freight movement were estimated by the iterative method. The traffic generation factors thus estimated are summarized in Table 4.1-6.

TABLE 4.1-6 PER CAPITA TRAFFIC GENERATION FACTORS
(Major Road, 1990, W/O Project)

PROVINCE	Passenger (trip/person/day)		Commodity (kg/person/day)	
	Range	Mean	Range	Mean
La Union	0.077-0.770	0.591	26.5- 88.5	68.0
Nueva Vizcaya	0.042-0.209	0.148	4.8- 23.9	17.0
Nueva Ecija	0.050-0.250	0.216	5.7- 37.7	32.3
Rizal	0.117-0.780	0.364	15.3-101.9	47.6
Occ. Mindoro	0.014-0.045	0.030	2.0- 6.6	4.3
Albay	0.036-0.428	0.176	2.8- 33.4	13.9
Antique	0.014-0.147	0.071	3.3- 16.4	8.2
Samar	0.0001-0.002	0.0011	0.1- 0.8	0.5
Leyte	0.045-0.301	0.121	3.9- 25.9	10.7
Misamis Or.	0.056-0.281	0.228	5.9- 29.3	20.7
Davao del Norte	0.060-0.160	0.107	10.6- 33.6	21.7

Traffic Generation and Attraction by Zone:

Traffic generation and attraction were obtained in terms of passengers and commodity tonnage as the product by generation factors.

Traffic Distribution:

Traffic distribution (OD distribution) was estimated by the gravity model:

$$X_{ij} = k \frac{G_i \cdot A_j}{T_{ij}^2}$$

where, X_{ij} = Traffic from zone i to zone j
k = Parameter
G_i = Traffic generation in zone i
A_j = Traffic attraction in zone j
T_{ij} = Travel time from zone i to zone j along the fastest route

OD distribution was adjusted so as to satisfy the following conditions by the Frator Method:

$$G_i = \sum_{j=1}^{n} X_{ij}$$

$$A_j = \sum_{i=1}^{n} X_{ij}$$

where, n = Number of zones

Traffic Assignment:

Each OD traffic was assigned to the major road network expressed by the node and link system on an all-or-nothing basis. Thus, the number of passengers and commodity tonnage for each link were calculated.

(2) Traffic Forecast

Figure 4.1-4 illustrates the procedure of traffic forecast.

The traffic model prepared for the analysis of present traffic was basically used for forecasting future traffic on the major road network with the following additions/ modifications:

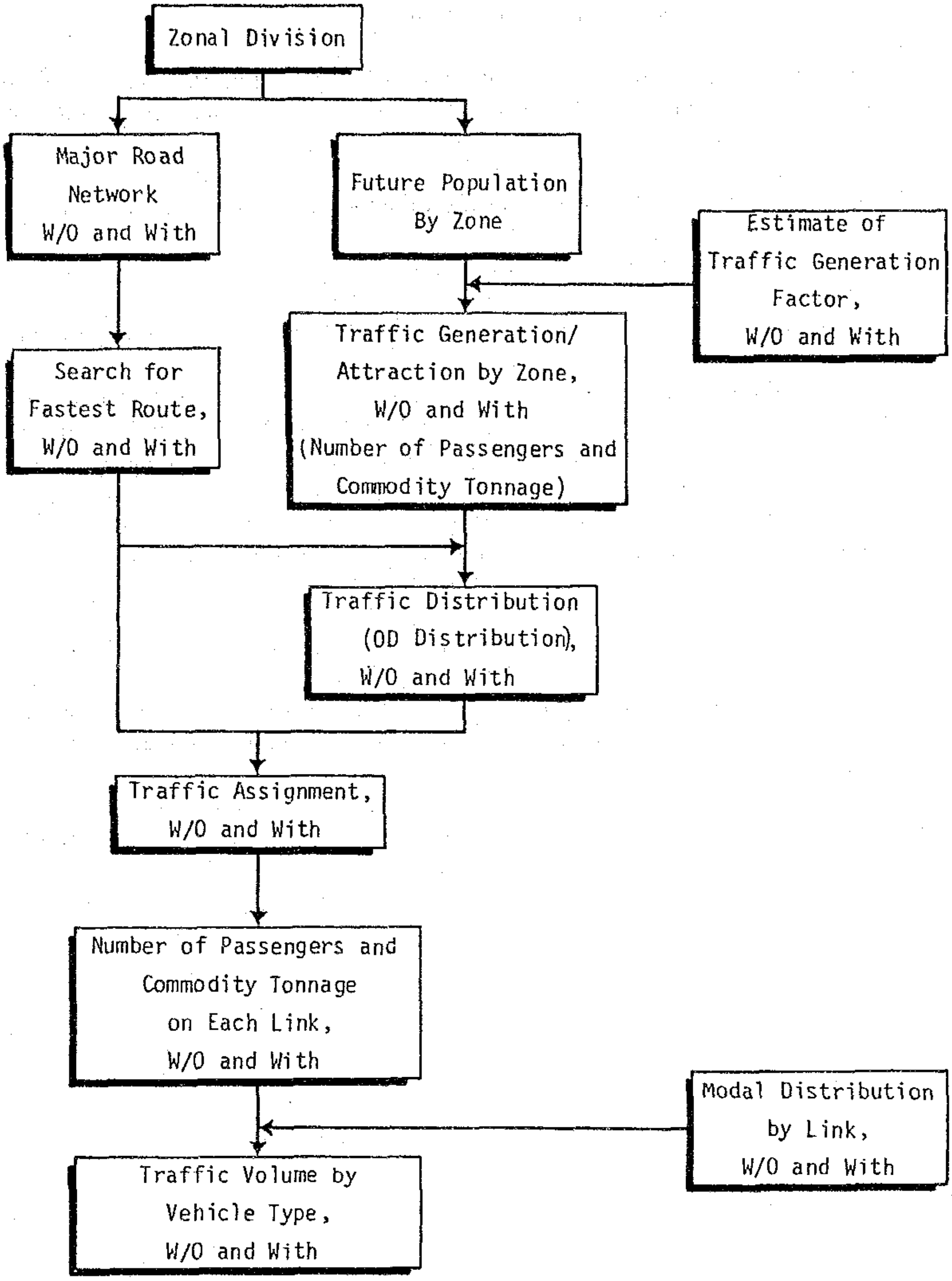


FIGURE 4.1-4 PROCEDURE OF FORECASTING TRAFFIC ON MAJOR ROAD NETWORK

a) Major Road Network and Fastest Route Search

The node and link system for the "with" case was prepared by changing the characteristics of the links included under this feasibility study as well as the links committed for improvement.

The fastest route search was carried out both in the "w/o" and "with" case networks.

b) Traffic Generation/Attraction and Distribution

The future population was based on the NCSO 1980 Census of Population and Housing.

Per capita traffic generation factors in the "with" case were estimated referring to the generated transport demand/transport cost reduction elasticity shown in "Highway Planning Manual, Volume 3, MPWH" and also based on the results of the analysis of present traffic. For instance, a zone showing a small generation factor at present due to poor road conditions is expected to increase the factor to some extent by road improvement, and the degree of increase can be estimated referring to other zones in similar situations but with better road conditions.

The traffic generation factors thus estimated are summarized in Table 4.1-7.

The transition period, i.e., the period which will elapse after opening of the improved road before the full impact on generation will take place, was assumed to be three years.

Traffic distribution for the "with" case was estimated by the same method used in the analysis of present traffic.

TABLE 4.1-7 PER CAPITA TRAFFIC GENERATION FACTORS
(Major Road, 1990, with Project)

PROVINCE	Passenger (trip/person/day) Range	Mean	Commodity (kg/person/day) Range	Mean
La Union	0.077-0.770	0.644	35.4- 88.5	74.0
Nueva Vizcaya	0.084-0.209	0.167	9.5- 23.9	19.1
Nueva Ecija	0.065-0.250	0.218	7.9- 37.7	32.5
Rizal	0.117-0.780	0.364	15.3-101.9	47.6
Occ. Mindoro	0.036-0.045	0.040	5.3- 6.6	5.8
Albay	0.071-0.428	0.180	4.2- 33.4	14.2
Antique	0.014-0.147	0.073	3.3- 16.4	8.4
Samar	0.0001-0.002	0.0012	0.5- 0.8	0.6
Leyte	0.045-0.301	0.124	3.9- 25.9	11.0
Misamis Or.	0.056-0.281	0.228	5.9- 29.3	20.7
Davao del Norte	0.060-0.160	0.108	10.6- 33.6	21.9

c) Traffic Assignment

The number of passengers and commodity tonnage on each link in the "with" case were estimated by assigning OD traffic to the major road network in the "with" case. They were converted to the number of vehicles using the modal distribution in the "with" case. Changes in modal distribution with changes in road condition were estimated referring to the present distribution in other road links in a similar situation but in the road condition. The transition period of a complete change in modal distribution was assumed to be three years.

The traffic in the "with" case was broken down into the following four categories for convenience of traffic benefit estimation:

i) Normal Traffic

Flow of passengers and freight which will occur even without road improvement. However, changes in the number of vehicles is possible due to changes in modal distribution.

ii) Diverted Traffic-1

Traffic which diverts to a certain road from other routes as a consequence of road improvement. This is usually called simply diverted traffic.

iii) Diverted Traffic-2

Traffic which changes destination as a consequence of road improvement but for the same trip purpose as in the "w/o" case. This is possible in the case of improvement of the access road to the nearest town which is at present barely accessible due to poor conditions. This traffic is called "Diverted Traffic-2" in this Study, distinguished from Diverted Traffic-1.

iv) Generated Traffic

Increased traffic brought about by road improvement.

(2) Development Projects

Traffic on development project roads was forecasted separately for passenger traffic, non-agricultural traffic and agricultural traffic. The number of passengers and commodity tonnage were estimated first, and then they were converted to the number of vehicles assuming modal distribution and occupancy/average load. Figure 4.1-5 shows the schematic diagram of traffic forecast for development project.

a) Passenger Traffic and Non-Agricultural Traffic

The population residing within the road influence area, which is defined as the area from which local existing or potential traffic using the road, was obtained mainly from distribution of barangays shown in 1:50,000 topographical maps and the NCSO 1980 Census of Population and Housing, and supplemented by information obtained from barangay interviews. The population forecasts were prepared using the NCSO report.

The number of passengers and non-agricultural commodity tonnage were obtained as the product of population by the per capita generation factor. Table 4.1-8 shows the generation factors commodity used in the analysis, which was derived mainly based on the traffic survey and referring to previous studies. In the case of particular roads where the common values were deemed inapplicable, specific values were used.

The modal distribution and the occupancy/average load used in the conversion to traffic volume by vehicle type were estimated individually for each road based on the road inventory survey and the traffic survey.

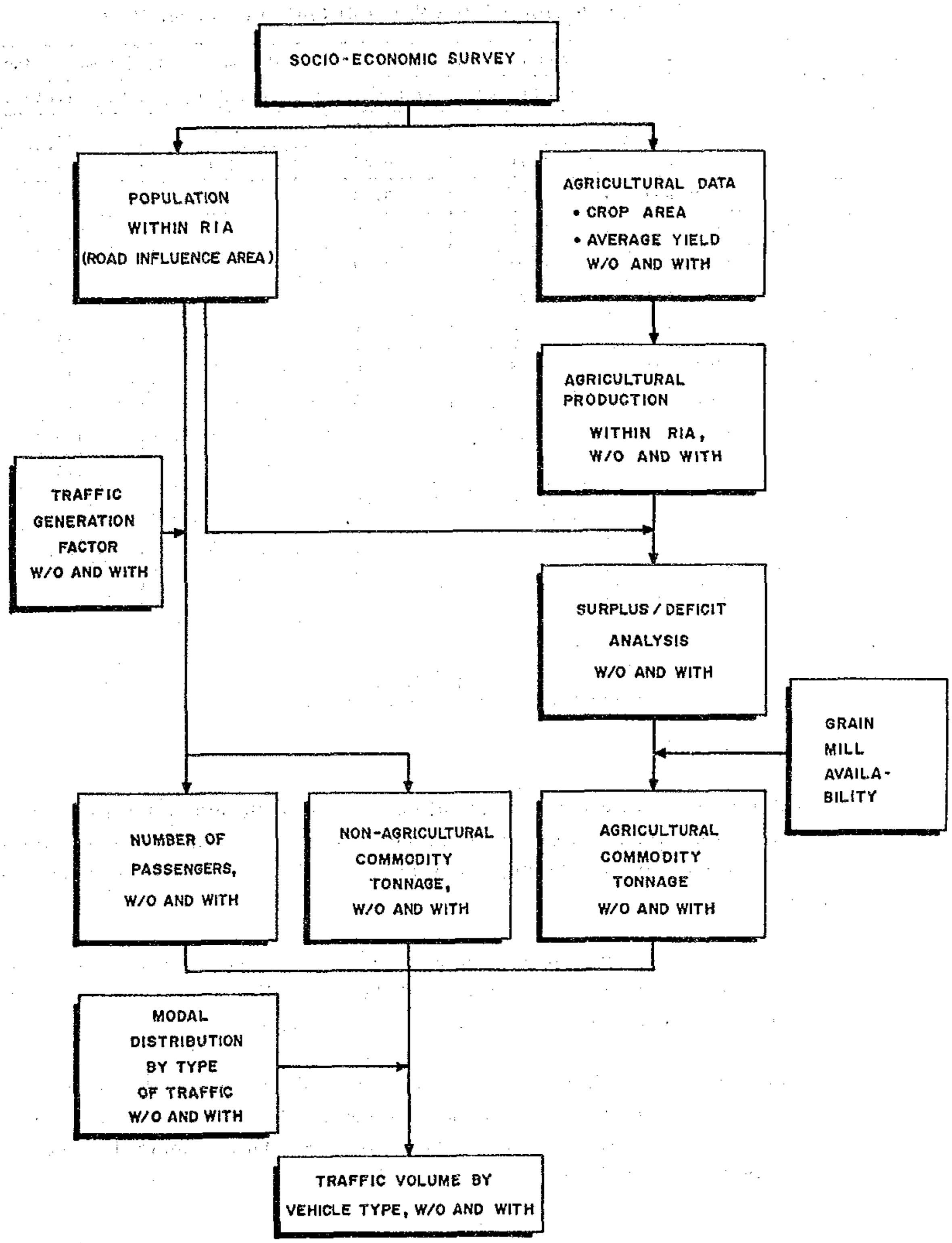


FIGURE 4.1-5 PROCEDURE OF TRAFFIC FORECAST FOR DEVELOPMENT PROJECTS

TABLE 4.1-8 PER CAPITA TRAFFIC GENERATION FACTORS (Minor Road)

Type	Existing Road Condition		Passenger Movement (trip)		Non-Agricult. Commodity (kg)	
			W/O Project	With Project	W/O Project	With Project
A	Paved or Gravel Road	Good/Fair	0.30	0.30	6.0	6.0
		Bad	0.25	0.28	4.8	5.4
		Very bad	0.20	0.28	1.8	3.0
	Earth Road		0.15	0.28	1.5	3.0
	Impassable to vehicle		0.03	0.10	1.2	3.0
B	Paved or Gravel Road	Good/Fair	0.06	0.06	2.0	2.0
		Bad	0.05	0.055	1.6	1.8
		Very bad	0.04	0.055	0.6	1.0
	Earth Road		0.015	0.03	0.5	1.0
	Impassable to vehicle		0.005	0.015	0.4	1.0
C	Paved or Gravel Road	Good/Fair	0.12	0.12	2.0	2.0
		Bad	0.10	0.11	1.6	1.8
		Very bad	0.08	0.11	0.6	1.0
	Earth Road		0.03	0.06	0.5	1.0
	Impassable to vehicle		0.01	0.03	0.4	1.0

NOTE : Type A - La Union, Rizal
Type B - Occidental Mindoro, Antique, Samar
Type C - Nueva Viscaya, Nueva Ecija, Albay
Leyte, Misamis Oriental, Davao del Norte

b) Agricultural Traffic

Agricultural commodity tonnage was estimated based on the agricultural production within the road influence area, taking into consideration i) home consumption and surplus/deficit and ii) availability of grain mill(s) in the road influence area, as regards food grain.

i) Home consumption of food grain was calculated as population times per capita grain consumption (assumed to be 130 kg in a milled form), and the surplus or deficit production was calculated based thereupon.

ii) In case of no mill in the road influence area, all net production is assumed to move out in the form of palay/unmilled corn. Milled grain products for home consumption are then transported back. An eventual deficit moves into the road influence area in the form of milled products.

In case one (1) or more mills exist in the road influence area, the transport flows are assumed as follows:

- Home consumption remains in the road influence area (no transport movement assumed).

- Surplus production would be transported out, traditionally in the form of unmilled food grains.

- Deficit production would be moved into the road influence area in milled form.

Agricultural commodity tonnage was converted to number of vehicles using the modal distribution and average load, which were estimated individually for each road considering the transport circumstances.

4.1.4 Preliminary Design and Cost Estimate

(1) Preliminary Design

a) Design Concept

There are two options for the design concept for rural road improvement, as shown below.

- Designing rural roads with optimum standards aiming at improving all aspects including horizontal and vertical alignments, which sometimes require massive earthworks and is costly.

- Designing rural roads by focusing on improving horizontal and vertical alignments, which is limited to the required minimum.

Rural roads are extensive in the number of road links as well as in length, but their present conditions are still at a poor level. Thus the need for rural road improvement is quite high, while financial resources are limited. Under these circumstances, the Study Team prioritized surface conditions of more roads. Preliminary design was undertaken in line with the concept of the second option.

b) Preliminary Design

Based on the findings of the road inventory survey, the type of improvement was determined for each subsection of road in accordance with the engineering standards and improvement criteria described in Sections 3.1.5 and 3.1.6, respectively.

Typical road sections for each type of improvement are summarized as shown in Table 4.1-9, and shown in Figures 4.1-6 through 4.1-11.

Special attention was given to steep gradient sections and flooded sections.

Type 6, i.e., PCC pavement for steep gradient section was applied to sections with steep gradients where gravel surfacing might otherwise be applied, as a counter-measure against excessive gravel losses during heavy rains and impossibility for vehicles to climb.

Type 7, i.e., grade raising in flooded areas, was applied to sections located in flooded areas.

(2) Cost Estimate

a) Unit Cost

Unit prices for construction equipment, materials and labor were obtained from the Associated Construction Equipment Lessors, Inc. (ACEL), the Price Monitoring Section of DPWH, and market price survey conducted by the Study Team and relevant studies. Based on the data collected, unit prices based on June 1988 prices were established. Exchange rates used were: ₱ 22.50 = US $ 1.00 = ¥ 155.

Hourly costs of major construction equipment, unit prices of main materials and labor cost are shown in Tables 4.1-10, 4.1-11 and 4.1-12.

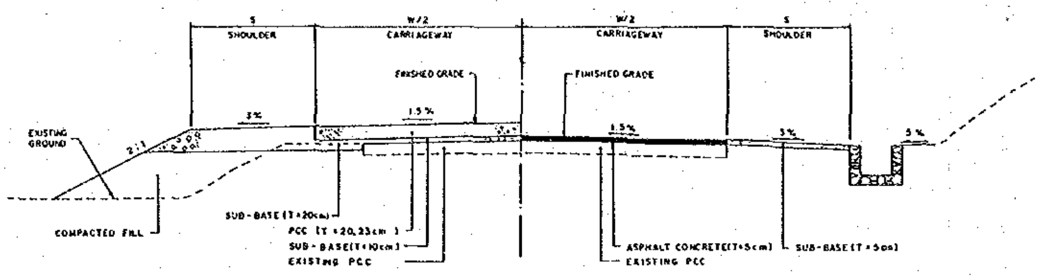
Based on these unit prices, price analyses were conducted to develop unit costs for major construction items, as shown in Table 4.1-13.

b) Construction Cost Estimate

Based on the results of the road inventory survey and proposed type of improvement, the quantity of each construction item was computed for each road link. Then the construction cost was estimated.

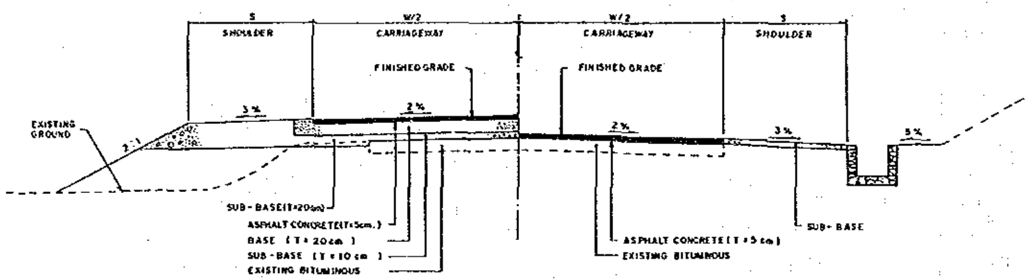
TABLE 4.1-9 TYPICAL ROAD SECTION

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	Bad/very bad	AC	5	20	10
	1 - 4	Bituminous	Bad/very bad	AC Overlay	5	-	-
	1 - 5	Bituminous	Bad/very bad	BMP/DBST	5.5/1.6	15	5
	1 - 6	Gravel	Bad/very bad	Gravel	15	-	10
Improvement - 1	2 - 1	Bituminous	Bad/very bad	PCC	20 - 23	-	10
	2 - 2	Gravel	Bad/very bad	PCC	20 - 23	-	20
	2 - 3	Gravel	Bad/very bad	AC	5	20	20
	2 - 4	Gravel	Bad/very bad	BMP/DBST	5.5/1.6	15	15
	2 - 5	Earth	Any condition	PCC	20 - 23	-	20
	2 - 6	Earth	Any condition	AC	5	20	20
	2 - 7	Earth	Any condition	BMP/DBST	5.5/1.6	15	15
	2 - 8	Earth	Any condition	Gravel	15	-	10
Improvement - 2	3 - 1	Bituminous	Good/Fair	PCC	20 - 23	-	10
	3 - 2	Gravel	Good/Fair	PCC	20 - 23	-	10
	3 - 3	Gravel	Good/Fair	AC	5	20	10
	3 - 4	Gravel	Good/Fair	BMP/DBST	5.5/1.6	15	5
Widening	4 - 1	PCC	Good/Fair	Widening W/PCC	20 - 23	-	20
	4 - 2	Bituminous	Good/Fair	Widening W/AC	5	20	20
	4 - 3	Bituminous	Good/Fair	Widening W/BMP/DBST	5.5/1.6	15	15
	4 - 4	Gravel	Good/Fair	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					



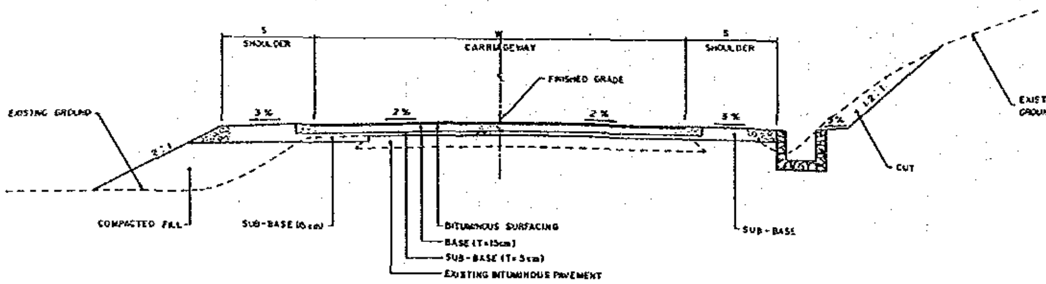
TYPE I-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : PCC (BAD / VERY BAD)

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

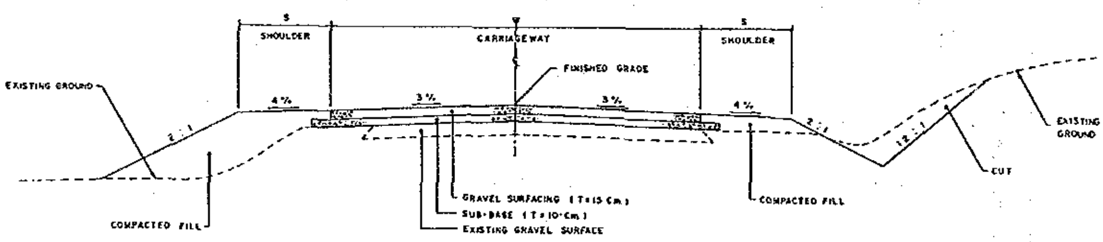


TYPE I-3
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : BITUMINOUS(BAD/VERY BAD)

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



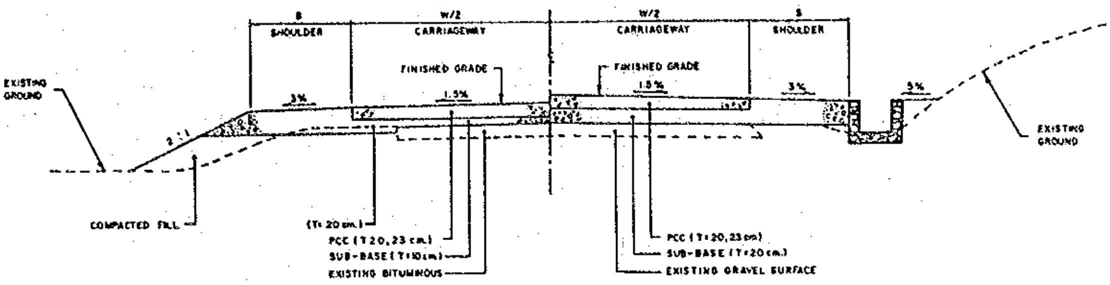
TYPE I-5
PROPOSED PAVEMENT : BITUMINOUS MACADAM/DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : BITUMINOUS (BAD/VERY BAD)



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

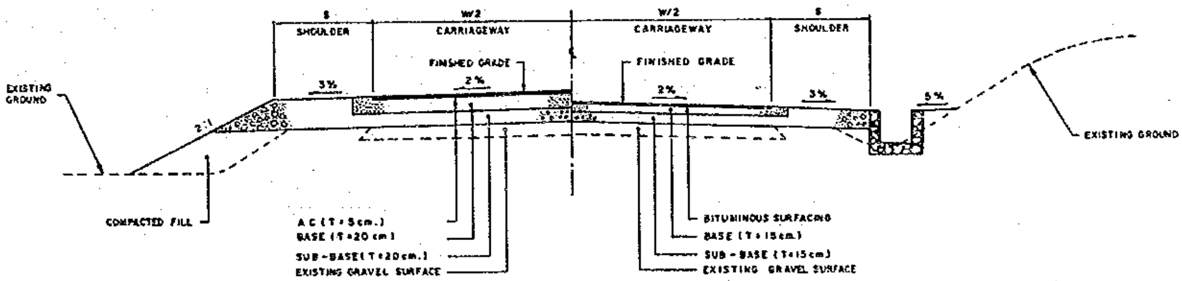
REHABILITATION

FIGURE 4.1-6 TYPICAL ROAD SECTIONS (1)



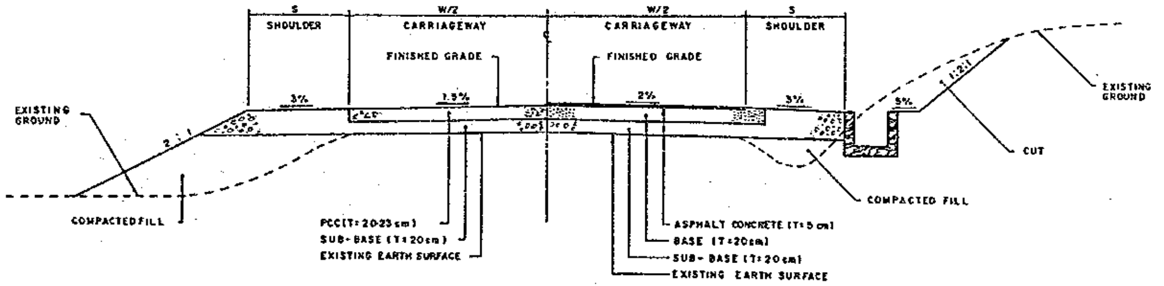
TYPE 2-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : BITUMINOUS (BAD/VERY BAD)

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



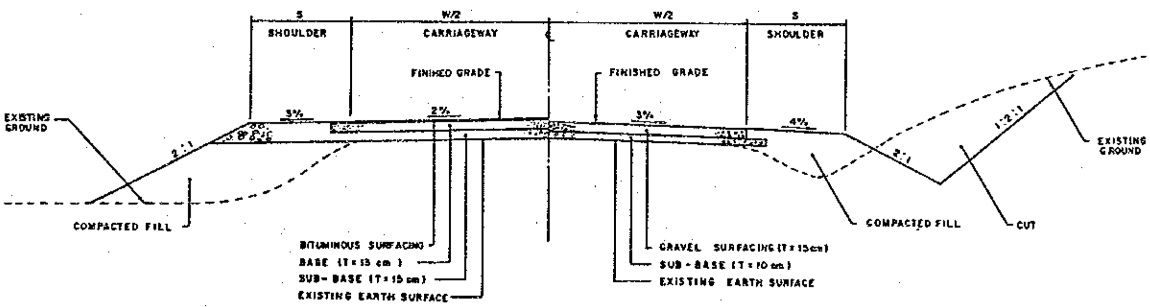
TYPE 2-3
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : GRAVEL SURFACING (BAD/VERY BAD)

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

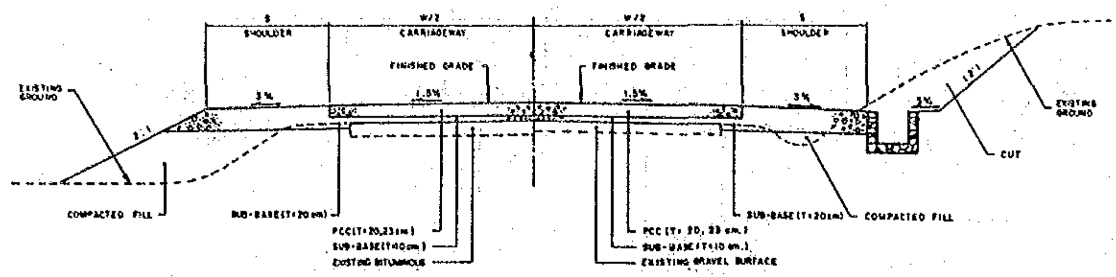


TYPE 2-7
PROPOSED PAVEMENT : BITUMINOUS MACADAM/ DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : EARTH SURFACE

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

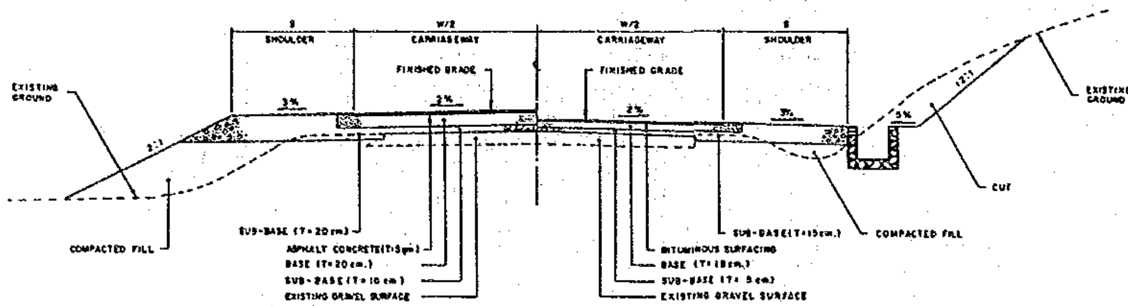
IMPROVEMENT - I

FIGURE 4.1-7 TYPICAL ROAD SECTIONS (2)



TYPE 3-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : BITUMINOUS (Good/Fair)

TYPE 3-2
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : GRAVEL SURFACING (Good/Fair)

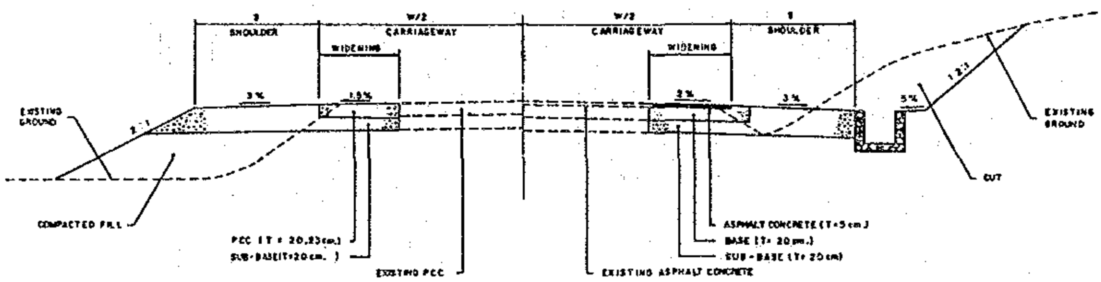


TYPE 3-3
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : GRAVEL SURFACING (Good/Fair)

TYPE 3-4
PROPOSED PAVEMENT : BITUMINOUS MACADAM/DOUBLE BITUMINOUS SURFACE TREATMENT
EXISTING PAVEMENT : GRAVEL SURFACING (Good/Fair)

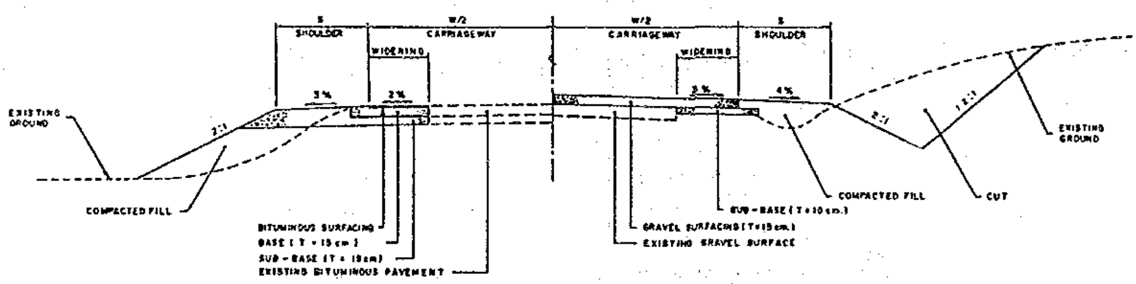
IMPROVEMENT-2

FIGURE 4.1-8 TYPICAL ROAD SECTION (3)



TYPE 4-1
PROPOSED PAVEMENT : PCC
EXISTING PAVEMENT : PCC

TYPE 4-2
PROPOSED PAVEMENT : ASPHALT CONCRETE
EXISTING PAVEMENT : ASPHALT CONCRETE

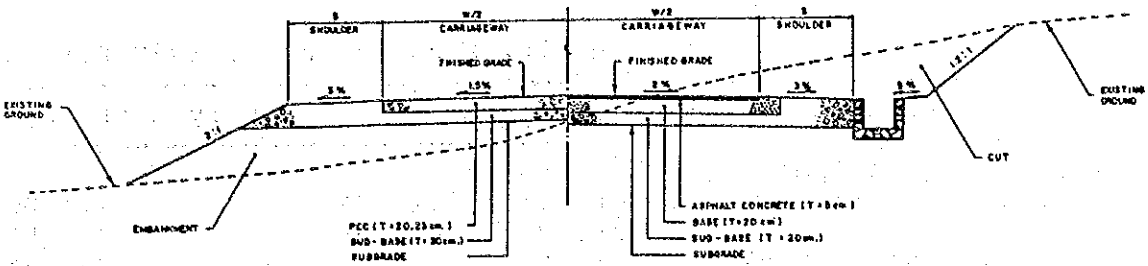


TYPE 4-3
PROPOSED PAVEMENT : BITUMINOUS MACADAM/
DOUBLE BITUMINOUS
SURFACE TREATMENT
EXISTING PAVEMENT : BITUMINOUS

TYPE 4-4
PROPOSED PAVEMENT : GRAVEL SURFACING
EXISTING PAVEMENT : GRAVEL SURFACING

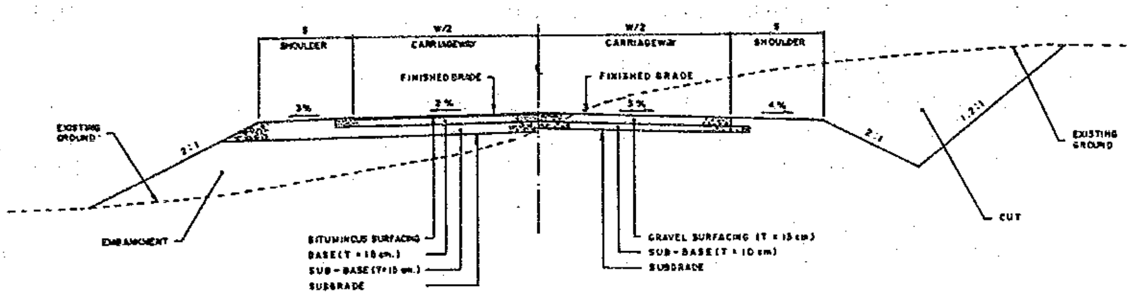
WIDENING

FIGURE 4.1-9 TYPICAL ROAD SECTIONS (4)



TYPE 5-1
PROPOSED PAVEMENT : PCC

TYPE 5-2
PROPOSED PAVEMENT : ASPHALT CONCRETE

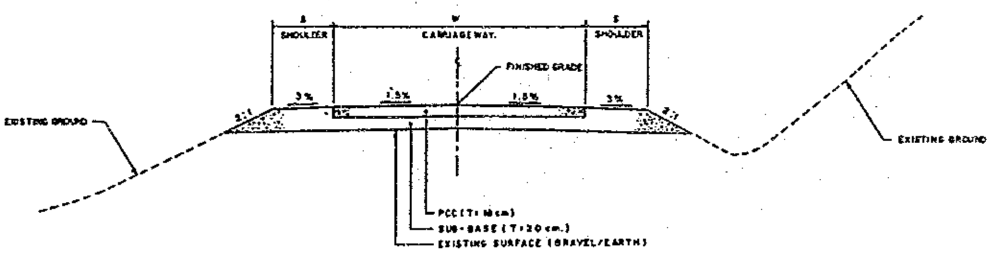


TYPE 5-3
PROPOSED PAVEMENT : BITUMINOUS MACADAM/
DOUBLE BITUMINOUS
SURFACE TREATMENT

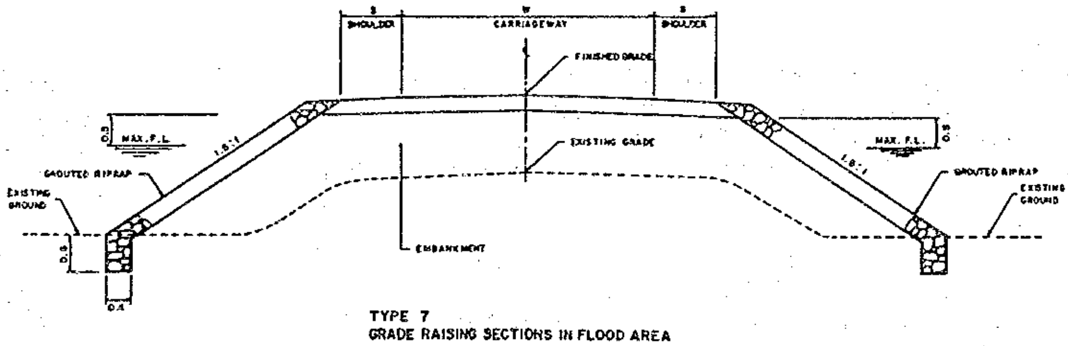
TYPE 5-4
PROPOSED PAVEMENT : GRAVEL SURFACING

NEW CONSTRUCTION

FIGURE 4.1-10 TYPICAL ROAD SECTIONS (5)



TYPE 6
PCC PAVEMENT FOR STEEP GRADIENT SECTIONS



TYPE 7
GRADE RAISING SECTIONS IN FLOOD AREA

FIGURE 4.1-11 TYPICAL ROAD SECTIONS (6)

TABLE 4.1-10 HOURLY COST OF CONDTRUCTION EQUIPMENT

Unit: Pesos at April 1990 Prices

Construction Equipment	Hourly Cost (₱)
A. Earthworking Equipment	
1. Tractor Crawler with Dozer, 11t., 110 HP	711.00
2. Tractor Crawler with Dozer, 21t., 200 HP	992.50
3. Wheel Loader, 0.57 m3, 3 HP	232.85
4. Wheel Loader, 1.24 m3, 80 HP	419.60
5. Wheel Loader, 1.91 m3, 100 HP	534.40
6. Motorized Grader, 10t, 115 HP	394.00
B. Excavating Equipment	
7. Backhoe Crawler, 0.08 m3, 21.3 HP	257.00
8. Backhoe Crawler, 0.4 m3, 82 HP	521.50
9. Backhoe Crawler, 0.5 m3, 100 HP	668.50
C. Hauling Equipment	
10. Dump Truck, 6.1 m3, 190 HP	428.50
D. Compaction Equipment	
11. Macadam Roller, 10-21t, 105 HP	418.50
12. Tandem Roller, 8t, 65 HP	388.00
13. Tandem Roller, 11t, 125 HP	581.00
14. Vibratory Roller, 15t, 175 HP	638.70
15. Pneumatic Roller, 15t, 106 HP	240.50
16. Sheepsfoot Roller, Towed Type, 35 HP	132.50
E. Concreting Equipment	
17. Transit Mixer, 5 m3, 190 HP	663.50
18. Concrete Vibrator for small works	39.50
19. Concrete Pavement Vibrator with Engine	212.50
20. Concrete Finisher/Paver, 120 HP	492.50
21. Concrete Saw, 180 kg, 5 HP	158.50
22. Mixer, 1 1/2 - 2 bagger	37.50
F. Asphalt Equipment	
23. Asphalt Sprayer, 90 HP	349.00
24. Asphalt Paver, 4.0 m, 52 HP	730.50
G. Plant	
25. Crushing Plant, 80-135 TPH, 110 HP	1,314.50
26. Screening and Washing Plant, 150 TPH, 24 HP	852.50
27. Batching Plant, 60 TPH	1,330.00
28. Asphaltic Concrete Plant, 50 TPH, 150 HP	1,793.00
H. Others	
29. Air Compressor, 325 CFM, 93 HP	270.50
30. Generator, 200 KW, 45 HP	238.00
31. Water Truck, 3000 gals., 120 HP	284.00
32. Water Pump	34.00

Note: Cost Components: 70% foreign, 15% local and 15% taxes, based on 10% custom duty, 10% advance taxes and 20% overhead and profit.

TABLE 4.1-11 UNIT PRICES OF MAIN MATERIALS

Unit: Pesos at April 1990 Prices

Main Materials	Unit	Unit Price	Component(%) F	L	T
A. Market Price of Purchase Materials					
Portland Cement	bag	100.00	55	30	15
Steel Reinforcement	kg	10.40	72	10	18
Plywood, 1/2"x4'x8'	each	280.00	25	60	15
Lumber, Yacal/Guijo	bd.ft.	20.00	25	60	15
Asphalt Cement Pen. 60-70	MT	10,232.00	65	6	29
Cutback, Asphalt MC-70	MT	10,250.00	65	6	29
Emulsified Asphalt SS-1	MT	10,300.00	65	6	29
B. Processed Materials					
Coarse Aggregate for Cement Concrete	m3	148.50	66	19	15
Fine Aggregate for Cement Concrete	m3	132.50	63	23	14
Crushed Aggregate for Base	m3	194.50	66	19	15
Coarse Aggregate for Subbase	m3	137.50	64	21	15
Concrete - Class A, delivered	m3	1,492.50	60	25	15
Concrete - Class B, delivered	m3	1,343.50	60	25	15

TABLE 4.1-12 LABOR COST

Labor Category	Hourly Rate	Daily Rate
Foreman	22.50	180.00
Assistant Foreman	19.00	152.00
Heavy Equipment Operator	17.00	136.00
Light Equipment Operator	16.00	128.00
Carpenter	16.00	128.00
Mason	16.00	128.00
Steelman	16.00	128.00
Skilled Laborer	16.00	128.00
Driver	15.00	120.00
Unskilled Laborer	14.00	112.00

TABLE 4.1-13 UNIT COST OF MAJOR CONSTRUCTION ITEMS

Unit: Pesos at April 1990 Prices

Item No.	Description	Unit	Unit Price
100	Clearing and Grubbing	sq.m.	2.10
102	Stripping	cu.m.	52.00
106	Roadway and Drainage Excavation	cu.m.	58.00
107	Borrowing	cu.m.	110.00
108	Aggregate Subbase	cu.m.	225.00
118-1	Preparation Of Previously Constructed Road (Gravel)	sq.m.	7.00
118-2	Preparation Of Previously Constructed Road (Asphalt)	sq.m.	8.00
118-3	Preparation of Existing Pavement Surface (PCC)	sq.m.	22.50
118-4	Preparation of Existing Pavement Surface (AC)	sq.m.	17.00
200	Crushed Aggregate Base Course	cu.m.	305.00
300	Crushed Aggregate Surface Course	cu.m.	305.00
302	Bituminous Prime Coat	MT	11,100.00
303	Bituminous Takt Coat	MT	11,500.00
306	Bituminous Macadam Pavement	sq.m.	95.00
310	Bituminous Concrete Surface Course	MT	1,350.00
314	Double Bituminous Surface Treatment	sq.m.	45.00
316-1	PCC Pavement (t = 23cm)	sq.m.	320.00
316-2	PCC Pavement (t = 20cm)	sq.m.	280.00
316-3	PCC Pavement (t = 18cm)	sq.m.	250.00
413-1	RCPC (Ø 910mm)	sq.m.	1,550.00
413-2	Headwall T for RCPC (Ø 910mm)	set	2,900.00
500	Grouted Riprap	sq.m.	625.00
517	Side Ditch (Grouted Riprap)	m	360.00
Bridge Cost			
	2-lane Superstructure	m	43,500.00
	Abutment for 2-lane bridge	each	330,000.00
	Pier for 2-lane bridge	each	285,000.00
	1-lane Superstructure	m	32,000.00
	Abutment for 1-lane bridge	each	230,000.00
	Pier for 1-lane bridge	each	200,000.00
Reinforced Concrete Box Culvert			
	1-Cell RCBC	m	20,600.00
	2-Cell RCBC	m	36,000.00
	Wing wall and Apron for 1-Cell RCBC	set	132,000.00
	Wing wall and Apron for 2-Cell RCBC	set	155,000.00
Spillway			
	2-lane Spillway	m	16,500.00
	1-lane Spillway	m	12,000.00
Slope Protection Cost			
	Cut Slope Protection	m	23,000.00
	Embankment Slope Protection	m	25,000.00

4.1.5 Economic Evaluation

(1) Basic Assumptions

The commonly used cost-benefit analysis was applied under the following basic assumptions:

Analysis Period

1991 – Detailed design
1992 – Construction
1993 – 2017 Project life (25 years)

Discount Rate:

15% p.a.

Quantified Cost

Initial construction/improvement costs
Periodic maintenance costs

Quantified Benefit

Traffic benefit
Development benefit (only for development projects)
Maintenance cost savings

The periodic maintenance costs, or rehabilitation costs, such as overlay, reconstruction and regravelling which will be needed after completion of the project to prolong the pavement life, were treated as project costs in this study, while the difference between routine maintenance costs and total maintenance costs in the "w/o" case was taken into account as a project benefit. In the case where the routine maintenance costs are higher than the "w/o" maintenance costs, the difference is considered as a negative benefit.

(2) Economic Costs

a) Initial Construction/Improvement Costs

The construction costs discussed in Section 4.1.4 are the financial costs and do not include the costs for detailed design and construction supervision. In the cost-benefit analysis, the following economic cost was used:

Construction Cost	100%
−Tax	−15%
+Detailed Design Cost	4%
+Construction Supervision Cost	6%
Total Economic Cost	95%

In the cost-benefit stream, 4% for detailed design cost was assumed to be spent in 1991 and the remaining 91% in 1992.

b) Periodic Maintenance Costs

Periodic maintenance, or rehabilitation, will be necessary when the riding quality of a pavement decreases to a certain minimum level of acceptability. Table 4.1-14 shows the periodic maintenance assumed in this Study.

TABLE 4.1-14 PERIODIC MAINTENANCE COST ASSUMED IN THE ANALYSIS

Surface Type	Periodic Maintenance Work	Timing	Financial1) Cost (M₱/Km)	Economic Cost
Gravel	10cm Regravelling	When thickness of gravel is reduced by 10cm, assuming 1.5cm loss annually from rainfall and 1.5cm loss for every 100,000 vehicles (2-6 years)	0.210 (Gravel 4.0m) 0.320 (Gravel 6.0m)	85% of Cost
BMP	5.5cm BMP Overlay	When pavement serviceability decreases to 2.0, assuming 85,000 ESAL or 350,000 vehicle repetitions (4-10 years)	0.830	85% of Cost
AC	5 cm AC Overlay	When pavement serviceability decreases to 2.0, assuming 800,000 ESAL or 2,300,000 vehicle repetitions (8-20 years)	0.170	85% of Cost
PCC	5 cm AC Overlay	When pavement serviceability decreases to 2.0, assuming 2,000,000 ESAL or 5,700,000 vehicle repetitions (10-25 years)	1.200	85% of Cost

Note: 1) As of April 1990

(3) Benefits

a) Traffic Benefits

i) Traffic Cost

Basic Traffic Costs

The basic traffic costs were provided by PMO-FS, as shown in Table 4.1-15.

TABLE 4.1-15 BASIC TRAFFIC COSTS EXCLUDING TAX (as of December 1989)

	Running Cost (₱/km)	Fixed Cost (₱/hour)	Time Cost (₱/hour)
Car/Van	1.75	6.30	17.70
Jeepney	1.12	23.76	26.40
Bus	2.81	35.64	95.04
Truck	3.48	38.88	0
Motor-tricycle	0.36	8.76	4.98
Motorcycle	0.31	0.72	8.34

Actual Traffic Costs

The actual traffic costs were estimated according to the dl-system concerning running costs and the dt-system with regard to fixed and time costs. The dl-values and operating speed for different surface conditions are shown in Tables 4.1-16 and 4.1-17, respectively.

TABLE 4.1-16 DL-VALUES IN KM PER ACTUAL KM

Surface Condition	Surface Type			
	PCC/AC	BMP/DBST	Gravel	Earth
Good	0	0.14	0.29	-
Fair	0.17	0.38	0.60	-
Bad	0.43	0.65	0.87	1.20
Very Bad	0.89	1.04	1.20	1.56
Impassable	1.73	1.73	1.73	1.73

TABLE 4.1-17 OPERATING SPEED IN KM/HOUR

Surface Condition	Surface Type: PCC/AC OV	TR	MC	BMP/DBST OV	TR	MC	Gravel OV	TR	MC	Earth OV	TR	MC
Good	65	40	60	63	38	55	60	35	50	-	-	-
Fair	55	35	50	53	33	45	50	30	40	-	-	-
Bad	30	20	20	30	20	20	30	20	20	20	10	10
Very Bad	20	10	10	20	10	10	20	10	10	10	5	5
Impassable	10	5	5	10	5	5	10	5	5	10	5	5

Note: OV = Car/Jeepney/Bus/Truck
TR = Motor-tricycle
MC = Motorcycle

Traffic Costs of Other Transport Modes

In addition to the land-based motorized vehicles, the traffic costs of other modes were estimated as shown in Table 4.1-18.

TABLE 4.1-18 TRAFFIC COST OF OTHER MODES
(Common to all Surface Types and Conditions)

Mode	Traffic Cost in ₱/Km
Animal Drawn	4.0
Walking (head loading)	1.2
Banca Boat	2.25

ii) Traffic Benefits in Traffic Projects

Traffic on the project roads was broken down into four categories: normal traffic, diverted traffic-1, diverted traffic-2 and generated traffic.

The traffic benefits were estimated as follows:

Normal Traffic

Difference in traffic costs between "w/o" and "with" cases. The change in traffic costs results not only from the improvement of surface type and condition but also from consequent change in modal distribution.

Diverted Traffic-1

Difference between traffic costs along the "w/o" route and those along the "with" route. Where diverted traffic passes through two or more project roads, the benefits were allocated to each road in proportion to length.

Diverted Traffic-2 and Generated Traffic

Half of the difference in traffic costs between "w/o" and "with" cases. This is the commonly used approximation.

Traffic costs were calculated assuming the following surface conditions:

"W/O" Case

Present surface condition is maintained.

"With" Case

Gravel/BMP are maintained in a fair condition.
AC/PCC are maintained in a good condition.

iii) Traffic Benefits in Development Projects

No diverted traffic is expected in most development projects. The benefits from normal traffic generated traffic were estimated in the same way as used for the traffic projects paying attention to the following:

- The travel distance, as considered in the benefit calculation, is the distance from the average gravity point of transport (gravity of population for passenger traffic and non-agricultural traffic and gravity of agricultural production for agricultural traffic) to the connecting point with a higher road.

- The benefit from generated agricultural traffic is not considered as a traffic benefit because it is included in the development benefit. Therefore, the generated traffic benefits are only those from passenger traffic and non-agricultural traffic.

b) Development Benefits

Development benefits were assessed using the producer surplus approach, under the hypothesis that substantial road improvement which removes constraints on development will permit and encourage farmers to adopt modern agricultural techniques and inputs. The development benefit consists of the difference in the net value of total production (farmgate value less production costs) between the "w/o" and "with" cases. Changes in the volume and value of agricultural production will be achieved by one or more of the following factors:

- Increase in cultivated area
- Increase in yield
- Increase in intensity of land use through increasing the number of harvest or inter-cropping
- Changes in the type of crop

Using the data obtained from the socio-economic survey, development benefits were calculated from the following equation:

$$\text{Benefit} = PROD_W (FGP_W - CP_W) - PROD_{W/O} (FGP_W - CP_{W/O})$$

where, $PROD_W$ = Production in metric tons, with
$PROD_{W/O}$ = Production in metric tons, w/o
FGP_W = Farmgate price in pesos per metric ton, with
CP_W = Production cost in pesos per metric ton, with
$CP_{W/O}$ = Production cost in pesos per metric ton, w/o

The increase in farmgate prices resulting from reduction in traffic cost is not included in the development benefits, because it is considered a part of the traffic benefits.

c) Maintenance Cost Savings

The difference in maintenance costs between the "w/o" and "with" cases is considered to be one of the benefits. Maintenance costs in the "w/o" case were estimated based on the current EMK system, while maintenance costs in the "with" case were estimated as shown below. It is noted that periodic maintenance costs in t he "with" case is not included in the calculation of maintenance cost savings, because it is treated as a part of the project costs.

In the case where the routine maintenance costs in the "with" case are higher than the maintenance costs in the "w/o" case (especially in the case of new construction, the maintenance cost in the "w/o" case is zero), the difference is considered to be a negative benefit.

Maintenance Cost in "w/o" Case

According to the current EMK system, the annual maintenance cost per km was estimated as being the basic maintenance cost of ₱ 17,143.00 /km times the EMK factor as shown in Table 4.1-19.

TABLE 4.1-19 EMK FACTOR FOR DIFFERENT SURFACING AND AADT

AADT	25	50	75	100	150	200	300	400	
Earth	0. 35	0. 40	0. 50						
Gravel	0. 40	0. 60	0. 90	1. 40	1. 90	2. 20	2. 40	2. 50	2. 60
AADT	400	600	1000	1500	2000	3000	5000	10000	
Bituminous	1. 10	1. 55	2. 10	2. 50	2. 60				
PCC	0. 50	0. 60	0. 80	0. 85	0. 90	0. 90	1. 10	1. 05	1. 10

Routine Maintenance Costs in "with" Case

The costs deemed necessary for maintaining the improved roads in a fair condition were estimated as shown in Table 4.1-20.

TABLE 4.1-20 ESTIMATED ROUTINE MAINTENANCE COSTS

Surface Type	Operation	Annual Cost (₱/km)
Gravel	Vegetation Control	1,150
	Ditch Cleaning	4.0 m Gravel: 2,650 + 40 AADT
	Grading	6.0 m Gravel: 3,000 + 45 AADT
	Pothole Repair	
	Total	4.0 m Gravel: 3,800 + 45 AADT 6.0 m Gravel: 4,150 + 45 AADT
BMP	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Patching	8,000 + 7.5 AADT
	Regravelling Shoulder	8,600
	Total	21,000 + 7.5 AADT
AC	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Crack and Joint Sealing	9,300
	Regravelling Shoulder	8,600
	Total	20,400
PCC	Vegetation Control	1,150
	Ditch Cleaning	1,100
	Shoulder Repair	2,150
	Crack and Joint Sealing	5,600
	Regravelling Shoulder	8,600
	Total	18,600

4.2 PROJECT EVALUATION IN THE STUDY PROVINCES

In accordance with the procedure and methodology discussed in Section 4.1, all road projects selected for feasibility studies were evaluated. Road length and estimated costs of road projects with IRR of more than 15% are summarized in Table 4.2-1, and road projects of IRR of more than 7.5% and less than 15% are in Table 4.2-2. Road length by range of IRR is given in Table 4.2-3.

More detailed discussions are presented in Volumes 4 through 14.

TABLE 4.2-1 SUMMARY OF ECONOMIC EVALUATION
- Road Projects with IRR of more than 15%-

Province	MAJOR ROADS		MINOR ROADS		TOTAL	
	Length (km)	Cost (MP)	Length (km)	Cost (MP)	Length (km)	Cost (MP)
La Union	68.0	172.4	40.9	49.8	108.9	222.2
Nueva Vizcaya	22.4	68.5	25.0	24.1	47.4	92.6
Nueva Ecija	214.2	761.1	131.4	209.3	345.6	970.4
Rizal	44.8	94.5	25.8	29.8	70.6	124.3
Occ. Mindoro	42.3	108.8	40.5	46.1	82.8	154.9
Albay	86.6	211.2	157.8	199.0	244.4	410.2
Antique	18.8	85.7	100.6	76.6	119.4	162.3
Samar	30.2	46.4	201.9	144.9	232.1	191.3
Leyte	85.6	163.5	162.5	193.8	248.1	357.3
Misamis Oriental	55.0	211.3	125.9	113.5	180.9	324.8
Davao del Norte	46.1	124.4	118.5	94.7	164.6	219.1
Total	714.0	2,047.8	1,130.8	1,181.6	1,844.8	3,229.4

Note : Length = Improvement Length

TABLE 4.2-2 SUMMARY OF ECONOMIC EVALUATION
- Road Projects with IRR of 7.5% TO 15%

Province	MAJOR ROADS		MINOR ROADS		TOTAL	
	Length (km)	Cost (MP)	Length (km)	Cost (MP)	Length (km)	Cost (MP)
La Union	17.9	11.7	79.8	76.9	97.7	86.6
Nueva Vizcaya	23.1	46.4	96.7	68.7	119.8	115.1
Nueva Ecija	49.4	122.5	61.9	84.7	111.3	207.2
Rizal	-	-	7.4	8.3	7.4	8.3
Occ. Mindoro	29.1	109.5	43.0	51.3	72.1	160.8
Albay	12.1	20.4	69.2	110.5	81.3	130.9
Antique	87.2	220.2	48.3	71.6	135.5	291.8
Samar	86.1	276.3	96.0	98.9	182.1	375.2
Leyte	99.5	266.1	175.2	215.8	274.7	481.9
Misamis Oriental	-	-	148.2	207.7	148.2	207.7
Davao del Norte	128.6	302.6	98.9	114.1	227.5	416.7
Total	533.0	1,375.7	924.6	1,108.5	1,457.6	2,484.2

Note : Length = Improvement Length

FABLE 4.2-3 ROAD LENGTH BY RANGE OF IRR

(Length in km)

Road Class	IRR Range	La Union	Nueva Vizcaya	Nueva Ecija	Rizal	Occ. Mindoro	Albay	Antique	Samar	Leyte	Misamis Ori.	Davao del N.	Total
Primary Major	15<	- (-)	- (-)	129.7 (8)	8.2 (2)	26.0 (1)	34.3 (2)	18.7 (1)	- (-)	- (-)	- (-)	- (-)	216.9 (14)
	10-15	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	33.0 (3)	- (-)	- (-)	- (-)	- (-)	33.0 (3)
	7.5-10	- (-)	- (-)	- (-)	- (-)	34.2 (1)	- (-)	17.7 (1)	62.3 (2)	- (-)	- (-)	- (-)	114.2 (4)
	<7.5	- (-)	- (-)	- (-)	- (-)	- (-)	16.8 (1)	46.3 (4)	20.1 (2)	- (-)	- (-)	- (-)	83.2 (7)
	Total	- (-)	- (-)	129.7 (8)	8.2 (2)	60.2 (2)	51.1 (3)	115.7 (9)	82.4 (4)	- (-)	- (-)	- (-)	447.3 (28)
Secondary Major	15<	90.1 (8)	29.8 (3)	181.9 (19)	71.1 (9)	16.3 (4)	106.0 (4)	18.8 (2)	30.2 (1)	97.3 (7)	70.0 (2)	46.1 (6)	757.6 (65)
	10-15	- (-)	5.8 (1)	35.4 (3)	- (-)	7.0 (1)	- (-)	37.6 (4)	32.2 (4)	48.0 (5)	- (-)	106.5 (9)	272.5 (27)
	7.5-10	21.5 (1)	18.2 (2)	15.4 (1)	- (-)	- (-)	12.1 (1)	- (-)	- (-)	56.0 (4)	- (-)	22.1 (3)	145.3 (12)
	<7.5	- (-)	- (-)	- (-)	32.2 (1)	60.8 (3)	56.1 (3)	74.0 (5)	36.7 (2)	98.5 (8)	4.2 (1)	63.2 (6)	425.7 (29)
	Total	111.6 (9)	53.8 (6)	232.7 (23)	103.3 (10)	84.1 (8)	174.2 (8)	130.4 (11)	99.1 (7)	299.8 (24)	74.2 (3)	237.9 (24)	1,601.1 (133)
Minor (National/ Prov'l)	15<	30.9 (3)	37.9 (3)	52.5 (6)	16.8 (4)	22.3 (2)	156.5 (23)	35.8 (9)	7.5 (1)	126.1 (13)	47.6 (6)	97.3 (11)	631.2 (81)
	10-15	3.9 (1)	72.7 (3)	39.3 (4)	4.5 (1)	22.2 (6)	38.2 (8)	18.8 (7)	16.0 (2)	101.0 (10)	69.7 (6)	36.2 (4)	422.5 (52)
	7.5-10	23.8 (3)	9.3 (1)	13.5 (2)	- (-)	8.0 (1)	12.9 (3)	22.5 (5)	2.3 (1)	54.7 (7)	39.9 (6)	43.9 (6)	230.8 (35)
	<7.5	38.2 (8)	151.8 (15)	54.6 (8)	13.4 (3)	94.4 (17)	49.9 (7)	4.4 (2)	39.7 (3)	61.8 (8)	114.0 (18)	86.1 (11)	738.3 (100)
	Total	96.8 (15)	271.7 (22)	189.9 (20)	34.7 (8)	146.9 (26)	257.5 (41)	81.5 (23)	65.5 (7)	343.6 (38)	271.2 (35)	263.5 (32)	2,022.8 (268)
Minor (Brangay)	15<	10.3 (2)	- (-)	96.2 (9)	13.0 (3)	18.2 (4)	26.8 (8)	65.4 (5)	196.0 (16)	70.6 (11)	81.6 (10)	22.4 (3)	600.5 (71)
	10-15	35.9 (6)	9.6 (1)	7.7 (1)	- (-)	8.2 (3)	17.0 (3)	7.0 (1)	45.4 (4)	- (-)	7.7 (2)	24.2 (1)	162.7 (22)
	7.5-10	19.1 (3)	5.1 (1)	15.1 (1)	4.6 (1)	11.4 (2)	2.5 (1)	- (-)	38.6 (4)	30.3 (3)	36.1 (6)	- (-)	162.8 (22)
	<7.5	40.0 (10)	40.8 (11)	20.7 (4)	15.0 (2)	75.1 (18)	5.8 (3)	- (-)	- (-)	16.7 (3)	29.0 (5)	50.8 (4)	293.9 (60)
	Total	105.3 (21)	55.5 (13)	139.7 (15)	32.6 (6)	112.9 (27)	52.1 (15)	72.4 (6)	280.0 (24)	117.6 (17)	154.4 (23)	97.4 (8)	1,219.9 (175)
Total	15<	131.3 (13)	67.7 (6)	460.3 (42)	109.1 (18)	82.8 (11)	323.6 (37)	138.7 (17)	233.7 (18)	294.0 (31)	199.2 (18)	165.8 (20)	2,206.2 (231)
	10-15	39.8 (7)	88.1 (5)	82.4 (8)	4.5 (1)	37.4 (10)	55.2 (11)	96.4 (15)	93.6 (10)	149.0 (15)	77.4 (8)	166.9 (14)	890.7 (104)
	7.5-10	64.4 (7)	32.6 (4)	44.0 (4)	4.6 (1)	53.6 (4)	27.5 (5)	40.2 (6)	103.2 (7)	141.0 (14)	76.0 (12)	66.0 (9)	653.1 (73)
	<7.5	78.2 (18)	192.6 (26)	105.3 (12)	60.6 (6)	230.3 (38)	128.6 (14)	124.7 (11)	96.5 (7)	177.0 (19)	147.2 (24)	200.1 (21)	1,541.1 (196)
	Total	313.7 (45)	381.0 (41)	692.0 (66)	178.8 (26)	404.1 (63)	534.9 (67)	400.0 (49)	527.0 (42)	761.0 (79)	499.8 (62)	598.8 (64)	5,291.1 (604)

Note. ( ) : Number of Road Links

CHAPTER 5
SIMPLIFIED EVALUATION METHOD

In general, roads covered by the rural road network development project are short in length but numerous in number. It will be quite costly and time consuming to conduct a detailed feasibility study for each component project. To facilitate the economic evaluation, the simplified evaluation method was developed in the Pilot Study for the Rural Road Network Development Project (referred to as the Pilot Study hereinafter), based on the statistical analysis using the data in the four (4) Pilot Provinces.

5

This Study provided data in the eleven (11) study provinces covering various natures and characteristics of province. Using the data provided in both studies, statistical analysis was made all over again to improve the simplified evaluation method to make it applicable nationwide.

5.1 STATISTICAL ANALYSIS

5.1.1 General

(1) Basic Considerations in Developing Simplified Evaluation Method

- To limit input data to those reliable and readily obtainable.

- To take step-by-step procedures following usual practice of project evaluation and to simplify calculation in each step, because not only final output like IRR but also intermediate outputs like cost and benefit are needed.

  Analysis is, therefore, focused on developing prediction models for various items.

- To break down objective variables (variables to be predicted) as necessary to obtain pure relationship between objective variables and predictor variables for higher accuracy.

(2) Selection of Objective Variables

- AADT in development project

  (AADT in traffic projects was treated as input data.)

- Road construction cost (including earthwork, pavement, drainage and miscellaneous)

- Slope protection cost

- Additional cost for grade raising in flood sections

- Structure cost (including bridge, spillway and RCBC)

- Normal and generated traffic benefits accruing from improvement of road surface (referred to as simply "traffic benefit" in this Chapter)

- Normal and generated traffic benefit accruing from bridge construction/replacement (referred to as "bridge benefit" in this Chapter)

- Diverted traffic benefit

- Development benefit

- Maintenance cost savings (including future rehabilitation cost as a negative benefit)

- Internal rate of return

(3) Analysis Methods Used

- Calculation of mean value of data belonging to the same category.

- Multiple Regression Analysis

  Based on values of predictor variables, value of objective variable is predicted as follows:

$$Y = \beta_o + \sum_i \beta_i \cdot X_i$$

where, Y = predicted value of objective variable
X_i = value of predictor variable i
β_o, β_i = constant term and coefficient of predictor variable i, obtained by the least square method.

- Quantification Theory, Class 1

  Based on categorized predictor variables, value of objective variable is predicted as follows:

$$Y = \beta_o + \sum_j W_{jk}$$

where, Y = predicted value of objective variable
β_o = constant term
W_{jk} = category weight of category k under which predictor variable j belongs. β_o, W_{jk} are derived by the least square method.

- *Combined Multiple Regression Analysis and Quantification Theory, Class 1*

  Value of objective variable is predicted based on values of quantity data and/or categories of quality data.

(4) Data Preparation

a) Updating of data of Pilot Study

Project evaluation was made at 1988 price level in the Pilot Study, while in this Study, all costs are at 1990 price level.

All road projects included in the Pilot Study were recalculated using updated costs.

b) Preparation of Data Files

Two kinds of data file were prepared, road basis file and subsection basis file.

The road basis file is a file of records by road, containing various information regarding road, traffic and socio-economic benefit components and economic indicators.

The subsection basis file is a file of records by subsection, containing various information regarding road, structure and traffic, cost components and benefit components.

The road basis file is used for analysis on AADT in development projects, development benefit and internal rate of return, while the subsection basis file is used for analysis on all other items.

The number of records is shown below.

NUMBER OF RECORDS

Provinces	Number of Records	
	Road Basis File	Subsection Basis File
Cavite	138	485
Masbate	61	311
Bohol	78	280
Agusan del Norte	52	162
La Union	45	189
Nueva Vizcaya	41	192
Nueva Ecija	66	527
Rizal	26	170
Occidental Mindoro	63	219
Albay	67	297
Antique	49	277
Samar	42	285
Leyte	79	728
Misamis Oriental	62	428
Davao del Norte	64	424
Total	933	4,974

(5) Province Group

The trip rate (per capita traffic generation) and unit benefits vary much from province to province due to different characteristics in socio-economic and other factors. It is deemed practical to classify provinces into several groups of similar nature regarding traffic and benefit generation and to develop prediction models for each group. From this point of view, preliminary analysis was conducted and the following grouping was found to be appropriate in terms of similarity in traffic and benefit generation.

A = Cavite, La Union
B = Rizal
C = Masbate, Occidental Mindoro, Samar
D = Davao del Norte, Agusan del Norte
E = Nueva Ecija, Leyte, Misamis Oriental
F = Albay, Antique
G = Nueva Vizcaya, Bohol

Figure 5.1-1 shows the location of provinces as regards the incidence of poverty vs. road density. Since the provinces belonging to the same group are located relatively close to each other, the location on this sketch was used as a basis for grouping provinces when developing prediction models. Table 5.1-1 shows the province groups formed in this way.

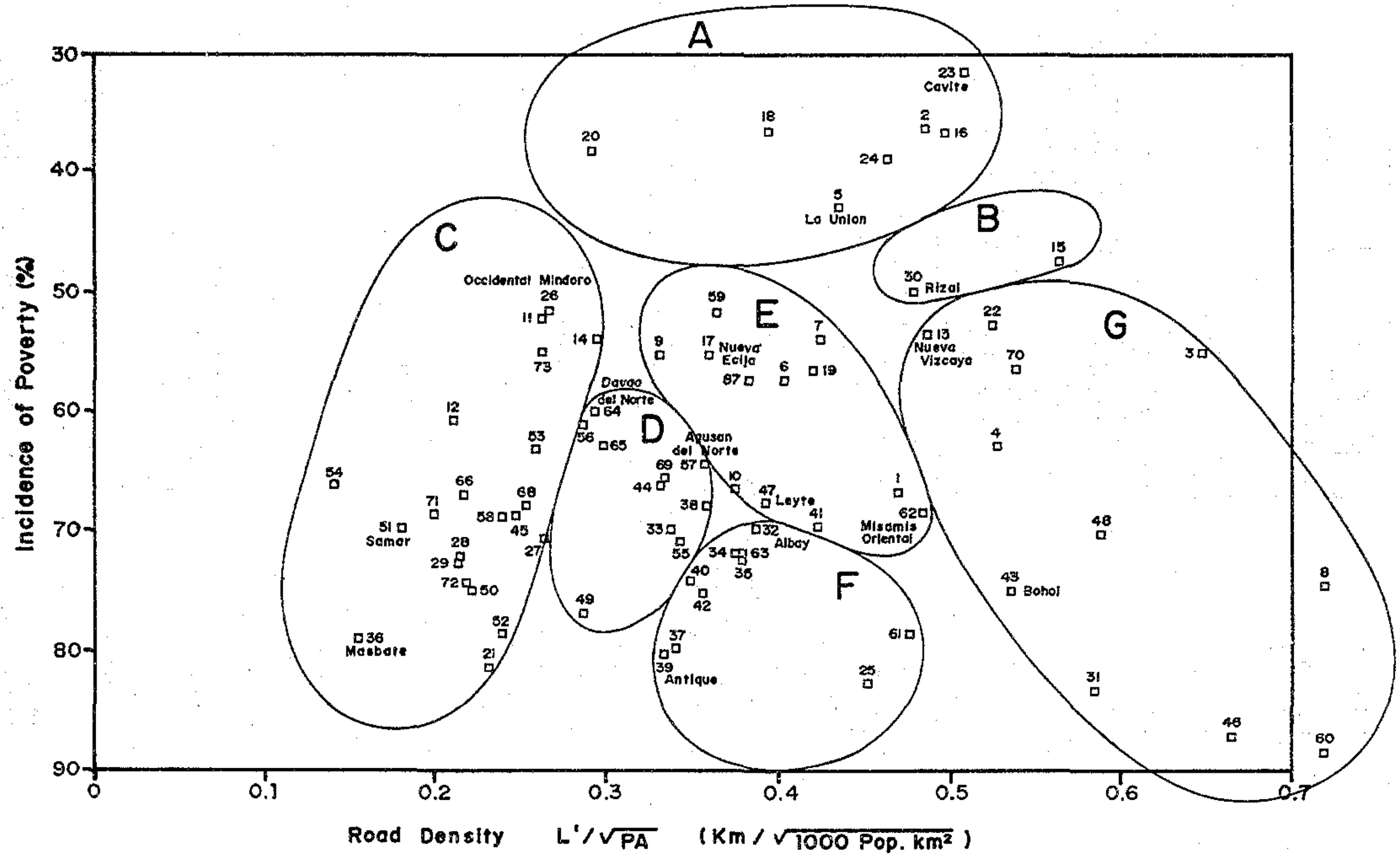


FIGURE 5.1-1 PROVINCE GROUP

TABLE 5.1-1 PROVINCE GROUP

Group	Province					
A	(1) Benguet	2	(3) Zambales	20		
	(1) La Union	5	(4) Cavite	23		
	(3) Bulacan	16	(4) Laguna	24		
	(3) Pampanga	18				
B	(3) Bataan	15				
	(4) Rizal	30				
C	(2) Isabela	11	(5) Masbate	36	(11) Davao Oriental	66
	(2) Kalinga Apayao	12	(7) Negros Oriental	45	(11) Surigao del Sur	68
	(2) Quirino	14	(8) Northern Samar	50	(12) Maguindanao	71
	(2) Aurora	21	(8) Samar	51	(12) North Cotabato	72
	(4) Occidental Mindoro	26	(9) Basilan	52	(12) Sultan Kudarat	73
	(4) Orriental Mindoro	27	(9) Sulu	53		
	(4) Palawan	28	(9) Tawi-Tawi	54		
	(4) Quezon	29	(10) Agusan del Sur	58		
D	(5) Camarines Norte	33	(11) Davao del Sur	65		
	(6) Aklan	38	(12) Lanao del Norte	69		
	(7) Cebu	44				
	(8) Eastern Samar	49				
	(9) Zamboanga del Norte	55				
	(9) Zamboanga del Sur	56				
	(10) Agusan del Norte	57				
	(11) Davao del Norte	64				
E	(1) Abra	1	(6) Iloilo	41		
	(1) Mountain Province	6	(8) Leyte	47		
	(1) Pangasinan	7	(10) Bukidnon	59		
	(2) Cagayan	9	(11) South Cotabato	67		
	(2) Ifugao	10				
	(3) Nueva Ecija	17				
	(3) Tarlac	19				
F	(4) Marinduque	25	(6) Capiz	40		
	(5) Albay	32	(6) Negros Occ.	42		
	(5) Camarines Sur	34	(10) Misamis Occ.	61		
	(5) Catanduanes	35	(10) Surigao del Norte	63		
	(5) Sorsogon	37				
	(6) Antique	39				
G	(1) Ilocos Norte	3	(7) Siquijor	46		
	(1) Ilocos Sur	4	(8) Southern Leyte	48		
	(2) Baler	8	(10) Camiguin	60		
	(2) Nueva Vizcaya	13	(12) Lanao del Sur	70		
	(4) Batangas	22				
	(4) Romblon	31				
	(7) Bohol	43				

Note: ( ) : Region Number
Number at the end of province name: corresponding number in Figure 5.1-1

5.1.2 Analysis for Prediction Model Development

(1) AADT in Development Project

The AADT prediction model was developed by multiple regression analysis, conducted by using the population within road influence areas (RIA) as a predictor variable. The model is expressed as follows:

$$AADT = \beta_1 \cdot P + \beta_2 \cdot P^2 + \beta_3 \cdot P^3 + \beta_4 \cdot P^4$$

where, AADT = AADT in the opening year
P = population within RIA
$\beta_1, \beta_2, \beta_3, \beta_4$ = coefficients shown in Table 5.1-2

TABLE 5.1-2 COEFFICIENTS IN THE EQUATION FOR AADT PREDICTION

		Province Group						
		A	B	C	D	E	F	G
Coefficient	β_1	0.369×10^{-1}	0.320×10^{-1}	0.963×10^{-2}	0.182×10^{-1}	0.151×10^{-1}	0.733×10^{-2}	0.107×10^{-1}
	β_2	-0.618×10^{-5}	0.241×10^{-6}	-0.218×10^{-5}	-0.380×10^{-5}	-0.178×10^{-6}	-0.392×10^{-6}	-0.362×10^{-6}
	β_3	0.104×10^{-8}	0.915×10^{-10}	0.270×10^{-9}	0.573×10^{-9}	0	0.372×10^{-10}	0
	β_4	-0.433×10^{-13}	-0.648×10^{-14}	-0.903×10^{-14}	-0.229×10^{-13}	0	-0.638×10^{-15}	0
Multiple Corralation Coefficient		0.907	0.939	0.856	0.905	0.914	0.964	0.928

(2) Road Construction Cost

Prediction models of road construction cost including earthwork, pavement, drainage and miscellaneous were established in accordance with the following procedures:

Unit cost per km was calculated for each subsection.

- Subsections were categorized by the following five (5) factors; type of improvement, proposed pavement type, carriageway width category, shoulder width category and terrain.

- The mean value of unit costs of the subsections belonging to each category was calculated.

- The above mean value is considered as the standard unit cost for the specific category.

The results are shown in Table 5.1-3.

TABLE 5.1-3 UNIT ROAD CONSTRUCTION COST

(unit : Mp/km)

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

(unit : Mp/km)

Type of Improvement	Proposed Pavement Type	Carriage-way Width (m)	Shoulder Width (m)	Terrain Flat	Terrain Rolling	Terrain Mountain's
Rehabilitation/ Improvement/ Widening	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	2.698	2.846	-
			2.0	2.884	-	-
	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	-	-

(3) **Slope Protection Cost**

The slope protection cost is estimated using the unit cost shown in Table 4.1-13.

(4) **Additional Cost for Grade Raising in Flood Section**

Additional unit cost per km for grade raising in flood sections was analyzed by multiple regression analysis based on the flood depth and road width. The following equation was used:

$$FSC_u = 1.976 \cdot D_f + 0.173 \cdot W_r - 0.850$$

where, FSC_u = unit additional cost, in MP/km

D_f = flood depth, in m

W_r = road width, in m

Multiple correlation coefficient r is 0.970.

(5) **Structure Cost**

The structure costs, including construction costs of bridge, spillway and RCBC are estimated using the unit costs shown in Table 4.1-13.

(6) **Traffic Benefit**

Traffic benefit prediction models were established separately for traffic projects and development projects.

a) Traffic Benefits in Traffic Projects

Traffic benefits in traffic projects were analyzed as follows:

<u>Analyzing Method</u>

By combining multiple regression on analysis with the quantification theory, class 1

<u>Objective Variable</u>

Total discounted traffic benefit for 27-year analysis period per km per vehicle,

<u>Predicator Variables</u>

Percentage of heavy vehicles (quantify)
Existing surface type and condition (category), and terrain (category)
Proposed pavement type (category)

The results of the analysis are shown in Table 5.1-4.

TABLE 5.1-4 COEFFICIENTS AND CATEGORY WEIGHTS IN THE EQUATION FOR PREDICTING TRAFFIC BENEFIT (M₱/km/Veh) IN TRAFFIC PROJECT

				Province Group						
				A	B	C	D	E	F	G
Constant Term			β_0	0.706×10^{-2}	0.491×10^{-2}	0.990×10^{-2}	0.755×10^{-2}	0.415×10^{-2}	0.398×10^{-2}	0.937×10^{-2}
Coefficient for percent heavy vehicle			β_1	0.172×10^{-3}	0.133×10^{-3}	0.355×10^{-4}	0	0.830×10^{-4}	0.596×10^{-4}	0
Category Weights	Existing Surface Type and Condition	Gravel-Good Fair	W_{11}	-0.209×10^{-2}	0.271×10^{-2}	-0.519×10^{-2}	-0.146×10^{-2}	-0.809×10^{-3}	-0.430×10^{-3}	0.105×10^{-3}
		Paved-Bad	W_{12}	-0.318×10^{-2}	-0.143×10^{-2}	-0.703×10^{-2}	-0.183×10^{-2}	-0.274×10^{-2}	-0.140×10^{-2}	-0.170×10^{-2}
		Gravel-Bad	W_{13}	-0.190×10^{-2}	0.301×10^{-2}	-0.467×10^{-2}	-0.109×10^{-2}	-0.723×10^{-3}	-0.391×10^{-3}	0.117×10^{-3}
		Earth-Bad	W_{14}	0.494×10^{-2}	0.516×10^{-2}	0.512×10^{-2}	0.314×10^{-2}	0.618×10^{-2}	0.531×10^{-2}	0.666×10^{-2}
		Paved-Very Bad	W_{15}	0.101×10^{-2}	0.260×10^{-2}	0.229×10^{-2}	0.296×10^{-2}	0.311×10^{-2}	0.309×10^{-2}	0.407×10^{-2}
		Gravel-Very Bad	W_{16}	0.102×10^{-2}	0.414×10^{-2}	0.312×10^{-2}	0.420×10^{-2}	0.495×10^{-2}	0.426×10^{-2}	0.591×10^{-2}
		Earth-Very Bad	W_{17}	0.988×10^{-2}	0.103×10^{-1}	0.117×10^{-1}	0.764×10^{-2}	0.124×10^{-1}	0.106×10^{-1}	0.133×10^{-1}
	Terrain	Flat	W_{21}	0.336×10^{-3}	-0.683×10^{-3}	0.286×10^{-3}	0.130×10^{-3}	0.124×10^{-3}	-0.178×10^{-3}	-0.199×10^{-2}
		Rolling	W_{22}	-0.178×10^{-3}	0.333×10^{-3}	-0.387×10^{-3}	-0.119×10^{-3}	-0.347×10^{-3}	0.208×10^{-3}	-0.156×10^{-3}
		Mountainous	W_{23}	0.847×10^{-4}	0.107×10^{-2}	0.166×10^{-3}	-0.678×10^{-3}	-0.377×10^{-3}	0.139×10^{-2}	0.166×10^{-2}
	Proposed Pavement Type	PCC/AC	W_{31}	0.429×10^{-3}	0	0.213×10^{-2}	0.126×10^{-2}	0.190×10^{-2}	0.191×10^{-2}	0.108×10^{-2}
		BMP	W_{32}	-0.888×10^{-3}	-0.182×10^{-2}	0.105×10^{-2}	0.220×10^{-3}	-0.553×10^{-3}	-0.660×10^{-4}	0.908×10^{-4}
		Gravel	W_{33}	-0.127×10^{-2}	-0.253×10^{-2}	-0.844×10^{-3}	-0.553×10^{-3}	-0.138×10^{-2}	-0.592×10^{-3}	-0.242×10^{-4}
Multiple Correlation Coefficient				0.944	0.982	0.994	0.906	0.970	0.909	0.752

$$Y = \beta_0 + \beta_1 X_1 + \sum_j W_i K$$

b) Traffic Benefits in Development Projects

The population distribution pattern along the project roads which is categorized as shown in Table 5.1-5 was taken into consideration in the analysis of traffic benefits in development projects. Analysis was made separately for each population distribution pattern. The analysis is summarized below:

Analyzing Method

By combining multiple regression analysis with quantification theory, class 1.

Objective Variable

Total discounted traffic benefit for 27-year analysis period per km per vehicle.

Predicator Variables

1/AADT (quantity)
Existing surface type and condition (category).

The results of the analysis are shown in Table 5.1-6.

TABLE 5.1-5 POPULATION DISTRIBUTION PATTERN

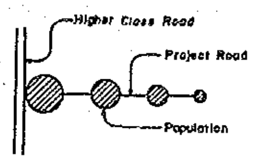
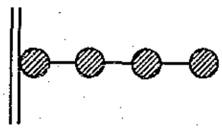
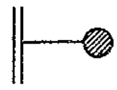
POPULATION DISTRIBUTION PATTERN	A	Population is distributed, gradually decreasing from the connection point with a higher class road as it moves toward the terminal. The average travel distance of road users is about one third of the entire length of the road.	 Pattern-A: Gradually Decreasing Pattern
	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-B: Evenly Distributing 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.	 Pattern-C: Tip Concentration

TABLE 5.1-6 COEFFICIENTS AND CATEGORY WEIGHTS IN THE EQUATION IN PREDICTING TRAFFIC BENEFIT (MP/km/veh) IN DEVELOPMENT PROJECT

(MP/km/veh)

Population Distribution Pattern					Province Group						
					A	B	C	D	E	F	G
Pattern A	Constant Term			β_0	0.444×10^{-2}	0.271×10^{-2}	0.166×10^{-1}	0.523×10^{-2}	0.250×10^{-2}	0.317×10^{-2}	0.690×10^{-2}
	Coefficient for 1/AADT			β_1	0.165×10^{-1}	0.147	0.317×10^{-2}	0.105	0.790×10^{-1}	0.930×10^{-1}	0.265×10^{-1}
	Category Weights	Existing Surface Type and Condition	Gravel-Good Fair	W_1	-0.190×10^{-2}	-0.800×10^{-3}	-0.826×10^{-2}	-0.330×10^{-3}	-0.165×10^{-2}	-0.104×10^{-2}	-0.325×10^{-2}
			Paved-Bad	W_2	-0.275×10^{-2}	-0.650×10^{-3}	-0.900×10^{-2}	-0.300×10^{-2}	-0.145×10^{-2}	-0.120×10^{-2}	-0.370×10^{-2}
			Gravel-Bad	W_3	-0.171×10^{-2}	-0.456×10^{-2}	-0.751×10^{-2}	-0.131×10^{-3}	-0.124×10^{-3}	-0.763×10^{-3}	-0.292×10^{-2}
			Earth-Bad	W_4	-0.633×10^{-3}	0.100×10^{-3}	0.170×10^{-2}	0.100×10^{-2}	0.200×10^{-4}	0.466×10^{-2}	-0.283×10^{-2}
			Paved-Very Bad	W_5	-0.233×10^{-2}	0.677×10^{-2}	-0.580×10^{-2}	0.700×10^{-4}	0.484×10^{-3}	-0.590×10^{-3}	-0.260×10^{-2}
			Gravel-Very Bad	W_6	-0.527×10^{-3}	0.135×10^{-2}	-0.233×10^{-2}	0.260×10^{-3}	0.948×10^{-3}	0.948×10^{-3}	-0.230×10^{-2}
			Earth-Very Bad	W_7	0.118×10^{-2}	0.220×10^{-2}	0.232×10^{-2}	0.300×10^{-2}	0.468×10^{-2}	0.530×10^{-2}	0.347×10^{-2}
			Impassable/None	W_8	0.100×10^{-1}	0.460×10^{-2}	0.703×10^{-2}	0.631×10^{-2}	0.639×10^{-2}	0.678×10^{-2}	0.668×10^{-2}
	Multiple Correlation Coefficient				0.709	0.844	0.617	0.831	0.821	0.871	0.858
Pattern B	Constant Term			β_0	0.845×10^{-2}	0.925×10^{-3}	0.230×10^{-1}	0.966×10^{-2}	0.496×10^{-2}	0.111×10^{-1}	0.173×10^{-1}
	Coefficient for 1/AADT			β_1	0.420×10^{-1}	0.345	0.829×10^{-2}	0.476×10^{-1}	0.362×10^{-1}	0.140	0.420×10^{-2}
	Category Weights	Existing Surface Type and Condition	Gravel-Good Fair	W_1	-0.513×10^{-2}	0.290×10^{-3}	-0.882×10^{-2}	-0.240×10^{-2}	-0.256×10^{-2}	-0.610×10^{-2}	-0.418×10^{-2}
			Paved-Bad	W_2	-0.407×10^{-2}	0.470×10^{-3}	-0.140×10^{-1}	-0.500×10^{-2}	-0.284×10^{-2}	-0.647×10^{-2}	-0.489×10^{-2}
			Gravel-Bad	W_3	-0.784×10^{-2}	0.750×10^{-3}	-0.769×10^{-2}	-0.217×10^{-2}	-0.197×10^{-2}	-0.304×10^{-2}	-0.389×10^{-2}
			Earth-Bad	W_4	-0.154×10^{-3}	0.245×10^{-2}	0.402×10^{-2}	0.310×10^{-2}	0.149×10^{-2}	0.798×10^{-2}	0.460×10^{-2}
			Paved-Very Bad	W_5	-0.900×10^{-2}	0.210×10^{-2}	-0.600×10^{-2}	-0.100×10^{-2}	-0.142×10^{-2}	-0.153×10^{-2}	-0.368×10^{-2}
			Gravel-Very Bad	W_6	-0.647×10^{-3}	0.270×10^{-2}	-0.553×10^{-2}	0.182×10^{-3}	0.693×10^{-3}	0.259×10^{-4}	-0.260×10^{-2}
			Earth-Very Bad	W_7	0.200×10^{-2}	0.340×10^{-2}	0.466×10^{-2}	0.681×10^{-2}	0.508×10^{-1}	0.858×10^{-2}	0.660×10^{-2}
			Impassable/None	W_8	0.632×10^{-2}	0.660×10^{-2}	0.120×10^{-1}	0.880×10^{-2}	0.806×10^{-1}	0.117×10^{-1}	0.127×10^{-3}
	Multiple Correlation Coefficient				0.695	0.625	0.652	0.648	0.719	0.848	0.717
Pattern C	Constant Term			β_0	0.158×10^{-1}	0.556×10^{-3}	0.295×10^{-1}	0.157×10^{-1}	0.410×10^{-2}	0.259×10^{-1}	0.271×10^{-1}
	Coefficient for 1/AADT			β_1	0.284×10^{-1}	0.685	0.775×10^{-2}	0.604×10^{-1}	0.292	0.838×10^{-1}	0.664×10^{-1}
	Category Weights	Existing Surface Type and Condition	Gravel-Good Fair	W_1	-0.790×10^{-2}	0.100×10^{-3}	-0.129×10^{-1}	-0.550×10^{-2}	-0.179×10^{-2}	-0.910×10^{-2}	-0.138×10^{-1}
			Paved-Bad	W_2	-0.820×10^{-2}	0.470×10^{-3}	-0.174×10^{-1}	-0.760×10^{-2}	-0.228×10^{-2}	-0.970×10^{-2}	-0.144×10^{-1}
			Gravel-Bad	W_3	-0.769×10^{-2}	0.680×10^{-3}	-0.102×10^{-1}	-0.506×10^{-2}	-0.130×10^{-2}	-0.844×10^{-2}	-0.735×10^{-2}
			Earth-Bad	W_4	-0.243×10^{-2}	0.247×10^{-2}	0.808×10^{-2}	-0.100×10^{-2}	0.180×10^{-2}	0.160×10^{-1}	-0.600×10^{-2}
			Paved-Very Bad	W_5	-0.860×10^{-2}	0.210×10^{-2}	-0.109×10^{-1}	-0.309×10^{-2}	0.300×10^{-3}	-0.720×10^{-2}	-0.110×10^{-1}
			Gravel-Very Bad	W_6	-0.560×10^{-2}	0.275×10^{-2}	-0.900×10^{-2}	0.139×10^{-2}	0.658×10^{-3}	-0.539×10^{-3}	-0.675×10^{-2}
			Earth-Very Bad	W_7	0.440×10^{-2}	0.360×10^{-2}	0.118×10^{-1}	0.166×10^{-1}	0.886×10^{-2}	0.182×10^{-1}	0.150×10^{-1}
			Impassable/None	W_8	0.194×10^{-1}	0.534×10^{-2}	0.218×10^{-1}	0.224×10^{-1}	0.108×10^{-1}	0.215×10^{-1}	0.184×10^{-1}
	Multiple Correlation Coefficient				0.755	0.994	0.881	0.779	0.845	0.689	0.847

$Y = \beta_0 + \beta_1 \cdot X_1 + W_K$

(7) **Bridge Benefits**

Bridge benefits were analyzed by multiple regression analysis with the following result:

$$BRB_u = 0.0660 \cdot TRB_u - 0.000351$$

where, BRB_u = Total discounted bridge benefits for 27-year analysis period, in MP/veh/m of bridge.

TRB_u = Total discounted traffic benefits for 27-year analysis period, in MP/veh/km of road.

The multiple correlation coefficient r is 0.917.

(8) **Diverted Traffic Benefits**

Diverted traffic benefits were derived from the following equation:

$$DTB = \sum_{vt} (TC'_{vt} - TC_{vt}) \cdot L \cdot Q + \sum_{vt} TC'_{vt} \cdot (L'-L) \cdot Q_{vt}$$

where, DTB = diverted traffic benefits.
TC'_{vt} = unit traffic cost/km/veh, of vehicle type vt, on the road from which traffic diverts.
TC_{vt} = unit traffic cost/km/veh, of vehicle type vt, on the project road with improvement.
L = length of the project road.
L' = length of the road from which traffic diverts.
Q_{vt} = diverted traffic of vehicle type vt.

The first term is obtained by applying the ordinary method of traffic benefit estimation wherein the surface type and condition of the road from which traffic diverts are regarded as the existing surface type and condition of the project road.

The second term was calculated by analyzing the unit traffic costs/km/veh in terms of total discounted cost for the 27-year analysis period as shown in Table 5.1-7.

(9) **Development Benefit**

Development benefit was analyzed as follows:

Analyzing Method

Combined multiple regression analysis and quantification theory, class 1.

Objective Variable

Total discounted traffic benefit for 27-year analysis period per km.

TABLE 5.1-7 UNIT TRAFFIC COST (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	.0105	.0032	.0059
Gravel	Good	.0070	.0060	.0152	.0135	.0023	.0015			
	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	.0645	.0352	.0098	.0070			
Earth	Bad	.0133	.0131	.0334	.0252	.0057	.0042			
	Very Bad	.0181	.0207	.0532	.0336	.0096	.0068			
	Impassable	.0189	.0212	.0645	.0352	.0098	.0070			

Predicator Variables

Population within RIA per km of road (quantity)
Cultivated area within RIA per km of road (quantity)
Existing surface type and condition (category)
Terrain (category)

The results of the analysis are shown in Table 5.1-8.

TABLE 5.1-8 COEFFICIENTS AND CATEGORY WEIGHTS IN THE EQUATION FOR PREDICTING DEVELOPMENT BENEFIT (MP/km)

				Province Group						
				A	B	C	D	E	F	G
Constant Term			β_0	0.522×10^{-1}	0.353×10^{-1}	0.143	0.282×10^{-2}	0.226	0.203	0.975×10^{-2}
Coefficients	Population/Km		X_1	-0.127×10^{-4}	-0.133×10^{-3}	-0.773×10^{-4}	0.109×10^{-3}	0.187×10^{-4}	-0.578×10^{-4}	-0.168×10^{-4}
	Cultivated Area/Km		X_2	0.581×10^{-3}	0.766×10^{-2}	0.112×10^{-2}	0.312×10^{-3}	0.127×10^{-2}	0.261×10^{-2}	0.262×10^{-3}
Category Weights	Existing Surface Type and Condition	Gravel-Good Fair	W_{11}	-0.231×10^{-1}	-0.147×10^{-1}	0.169×10^{-1}	-0.222×10^{-1}	-0.132	0.179	-0.118
		Paved-Bad	W_{12}	0.914×10^{-1}	0.800	0.419×10^{-2}	-0.244×10^{-1}	-0.882	-0.866×10^{-1}	-0.234×10^{-1}
		Gravel-Bad	W_{13}	-0.519×10^{-1}	-0.544×10^{-1}	0.937×10^{-2}	-0.131×10^{-1}	0.387	-0.238×10^{-1}	-0.213×10^{-1}
		Earth-Bad	W_{14}	-0.152×10^{-1}	0.401	-0.106	0.237×10^{-1}	-0.399×10^{-1}	0.178	-0.227×10^{-1}
		Paved-Very Bad	W_{15}	0.147	0.375	0.875×10^{-2}	-0.261×10^{-1}	-0.540	0.271×10^{-1}	-0.131×10^{-1}
		Gravel-Very Bad	W_{16}	-0.349×10^{-1}	0.751	0.175×10^{-1}	-0.278×10^{-1}	-0.160	-0.181	0.262×10^{-2}
		Earth-Very Bad	W_{17}	0.216×10^{-1}	0.891	-0.189	0.592×10^{-1}	-0.275	-0.332	0.870×10^{-1}
		Earth-Very Bad	W_{18}	0.681×10^{-1}	0.861	0.519×10^{-1}	0.829×10^{-1}	-0.186	0.134	0.475×10^{-1}
	Terrain	Flat	W_{21}	-0.155×10^{-1}	-0.800×10^{-1}	0.461×10^{-1}	-0.616×10^{-1}	0.308×10^{-1}	0.106	-0.290×10^{-2}
		Rolling	W_{22}	0.118×10^{-1}	-0.155	-0.222×10^{-1}	0.160	-0.287×10^{-1}	-0.154	0.114×10^{-1}
		Mountainous	W_{23}	-0.964×10^{-2}	0.504	-0.860×10^{-1}	-0.342×10^{-1}	-0.366×10^{-1}	-0.861×10^{-1}	-0.229×10^{-1}
Multiple Correlation Coefficient				0.662	0.969	0.706	0.680	0.592	0.760	0.742

$$Y = \beta_0 + \sum_i \beta_i \cdot X_i + \sum_j W_{jk}$$

(10) Maintenance Cost Savings

In the project evaluation in Chapter 4, future rehabilitation costs were treated as project costs, while the difference in routine maintenance costs between "w/o" case and "with" case was considered as maintenance cost savings.

To simplify the evaluation process, the maintenance cost savings as defined above minus future rehabilitation costs was defined here as maintenance cost savings. As a result, maintenance cost savings have a negative value in most cases.

Maintenance cost savings were analyzed as follows:

<u>Analyzing Method</u>

Multiple regression analysis

<u>Objective Variable</u>

Total discounted value for 27-year analysis period, of maintenance cost savings per km.

<u>Predicator Variables</u>

AADT, $AADT^2$, and $AADT^3$ (AADT in the opening year)

The results of the analysis are shown in Table 5.1-9.

TABLE 5.1－9 COEFFICIENTS IN THE EQUATION FOR PREDICTING MAINTENANCE COST SAVINGS (MP/km)

		Proposed Pavement Type							
		PCC	AC	BMP	BMP (New Const.)	6.0m Gravel	6.0m Gravel (New Const.)	4.0m Gravel	4.0m Gravel (New Const.)
Constant Term β_0		-0.488×10^{-1}	0.580×10^{-1}	-0.214	-0.254	-0.163	-0.216	-0.110	-0.137
Coefficient	AADT β_1	0.112×10^{-3}	-0.211×10^{-3}	0.157×10^{-2}	-0.230×10^{-2}	-0.396×10^{-3}	0.416×10^{-3}	-0.114×10^{-2}	-0.129×10^{-3}
	$AADT^2$ β_2	-0.108×10^{-6}	0.326×10^{-7}	-0.118×10^{-4}	0.340×10^{-4}	-0.318×10^{-8}	-0.185×10^{-4}	0.199×10^{-4}	-0.117×10^{-4}
	$AADT^3$ β_3	0.173×10^{-10}	-0.133×10^{-11}	0.140×10^{-7}	-0.127×10^{-6}	-0.546×10^{-8}	0.122×10^{-7}	-0.916×10^{-7}	0.380×10^{-7}
Multiple Correlation Coefficient		0.671	0.752	0.873	0.994	0.700	0.930	0.687	0.980

$$Y = \beta_0 + \sum_i \beta_i \cdot X_i$$

(11) Internal Rate of Return (IRR)

The IRR prediction model was developed by multiple regression analysis conducted using the B/C ratio as a predictor variable.

$$IRR = \beta_0 + \beta_1 \cdot (B/C) + \beta_2 \cdot (B/C)^2 + \beta_3 \cdot (B/C)^3 + \beta_4 \cdot (B/C)^4$$

where, IRR = Internal Rate of Return in %
B/C = B/C Ratio
$\beta_0 \sim \beta_4$ = Coefficients shown in Table 5.1-10

TABLE 5.1-10 COEFFICIENTS IN THE EQUATION FOR IRR PREDICTION

		Proposed Pavement Type			
		PCC	AC	BMP	Gravel
Coefficients	β_0	-0.208	0.138	-0.212	-0.129
	β_1	0.177×10^2	0.141×10^2	0.202×10^2	0.188×10^2
	β_2	-0.288	-0.462	0.309	-0.263
	β_3	0.434			
	β_4	-0.227×10^{-1}	0	0	0.130
Multiple Correlation Coefficient		0.994	0.996	0.994	0.988

5.1.3 Cost and Benefit Component Analysis

All monetary data used in the analysis are at 1990 price level. When applying the simplified evaluation method in the future, it will be necessary to update the costs and benefits according to the price level prevailing then. To facilitate updating, costs and benefits were broken down into their components so that the adjustment factors could be easily derived based on the escalation rates of individual components.

Construction costs were broken down into costs of material, equipment and labor (see Table 5.1-11).

Traffic benefits were broken down into running cost, fixed cost, time cost and nonmotorized transport cost (see Table 5.1-12).

Breakdown of bridge benefits, development benefits and maintenance cost savings was not conducted, since adjustment factors for bridge benefits and maintenance cost savings are analogized from the adjustment factors for traffic benefits and construction cost, respectively. The adjustment factor for development benefits is estimated based on the producer price index for agricultural products.

TABLE 5.1-11 CONSTRUCTION COST COMPONENTS

		Material fm	Equipment fe	Labor fe
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

TABLE 5.1-12 TRAFFIC BENEFIT COMPONENTS

	Running Cost fr	Fixed Cost ff	Time Cost ft	Non-Motorized Transport Cost fm
Traffic Project	0.49	0.25	0.26	-
Development Project	0.25	0.21	0.25	0.29

5.2 PROPOSED SIMPLIFIED EVALUATION METHOD

A simplified evaluation method was developed in which the prediction models established above are expressed in easily applicable forms. Major considerations given in developing the method are shown below.

i) Prediction models for AADT, traffic benefits and development benefits differ with province groups. To avoid confusion, worksheets, equations and all necessary information must be prepared separately for each province group, although there are duplications among groups as regards information commonly applicable to all groups.

ii) After selecting all input data necessary for project evaluation, an input data sheet must be prepared.

iii) Tables and charts for obtaining unit costs and unit benefits shall be prepared so as to allow identification of the units by users to enable them to readily obtain costs and benefits, and do simple multiplications.

iv) To have worksheets provided for computational procedure and summarizing computations. Instructions showing how to obtain entry shall be attached to each corresponding column.

According to the above consideration, an input data sheet and worksheets were designed as shown in Tables 5.2-1 through 5.2-3. General procedures in the simplified evaluation method are as shown in Figure 5.2-1.

To show how the simplified evaluation method is applied, the "Guide for Simplified Project Evaluation" was prepared which includes step-by-step instructions and all necessary information.

TABLE 5.2-1 INPUT DATA SHEET FOR PROJECT EVALUATION

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/Rl/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/Bail/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.

TABLE 5.2-2 PROJECT EVALUATION WORK SHEET (Traffic Project)

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 ((1) x 1.03 n)	(3)
	TOTAL (1)	VEH.	100 %			

3) PROPOSED IMPROVEMENT AND COST (ROAD)

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

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

			No.							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 (MP) SUPER STRUCTURE	UNIT COST/M (REF. A.I-5)	(23)							
		COST ((23)x(21))	(24)							
	COST (MP) ABUTMENT	UNIT COST/EACH (REF. A.I-5)	(25)							
		COST ((25)x2)	(26)							
	COST (MP) PIER	UNIT COST/EACH (REF. A.I-5)	(27)							
		COST ((27)x((22)−1))	(28)							
	TOTAL COST (24+(26)+(28))		(29)							
SPILLWAY	NO. OF LANES									
	LENGTH (M)		(30)							
	COST (MP)	UNIT COST/M (REF. A.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. A.I-6)	(34)							
		COST ((34)x(33))	(35)							
	WINGWALL & APRON (REF. A.I-6)		(36)							
	TOTAL COST ((35)+(36))		(37)							
COST (MP) ((29)+(32)+(37))										(38)

5) BENEFIT

			No.							
AADT IN OPENING YEAR ((3))			(3)							
PERCENT HEAVY VEHICLES ((2))			(2)							
BRIDGE LENGTH (M) ((21)+(30))			(39)							
BENEFIT	TRAFFIC BENEFIT	CONSTANT "K" (REF. A.I-7)	(40)							
		UNIT BENEFIT/KM/VEH. ((40)+0.000172x(2))	(41)							
		BENEFIT ((41)x(4)x(3))	(42)							
	BRIDGE BENEFIT	UNIT BENEFIT/M/VEH. (0.066x(41)−0.000351)	(43)							
		BENEFIT ((43)x(39)x(3))	(44)							
	MAINTENANCE COST SAVINGS	UNIT BENEFIT/KM (REF. A.I-8)	(45)							
		BENEFIT ((45)x(4))	(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

TABLE 5.2-3 PROJECT EVALUATION WORKSHEET (Development Project)

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)

			No.							TOTAL
SUBSECTION NO.										
LENGTH OF SUBSECTION (KM)			(7)							(8)
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)	(9)							
		EMBANKMENT SLOPE LENGTH (M)	(9)							
	FLOOD SECTION	FLOOD DEPTH (M)	(10)							
		FLOOD SECTION LENGTH (M)	(11)							
PROPOSED PAVEMENT	TYPE (PCC/AC/SMP/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 (MP)	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)							
		CUT SLOPE: COST ((17) x (9))	(18)							
		EMBANK SLOPE: UNIT COST/M. (REF. A.II-5)	(19)							
		EMBANK SLOPE: COST ((19) x (9))	(20)							
	FLOOD SECTION	UNIT COST/KM. (1.578·(10)+0.173·(14)−0.250)	(21)							
		COST ((21) x (11))	(22)							
	TOTAL COST ((16) + (18) + (20) + (22))									(23)

4) PROPOSED IMPROVEMENT AND COST (STRUCTURE)

				No.							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 (MP)	SUPER-STRUCTURE	UNIT COST/M (REF. A.II-7)	(26)							
			COST ((24) x (26))	(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 ((30) x((25) −1))	(31)							
		TOTAL COST ((27) + (29) + (31))		(32)							
SPILLWAY	NO. OF LANES										
	LENGTH (M)			(33)							
	COST (MP)	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 (MP)	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 (MP) ((32) + (35) + (40))											(41)

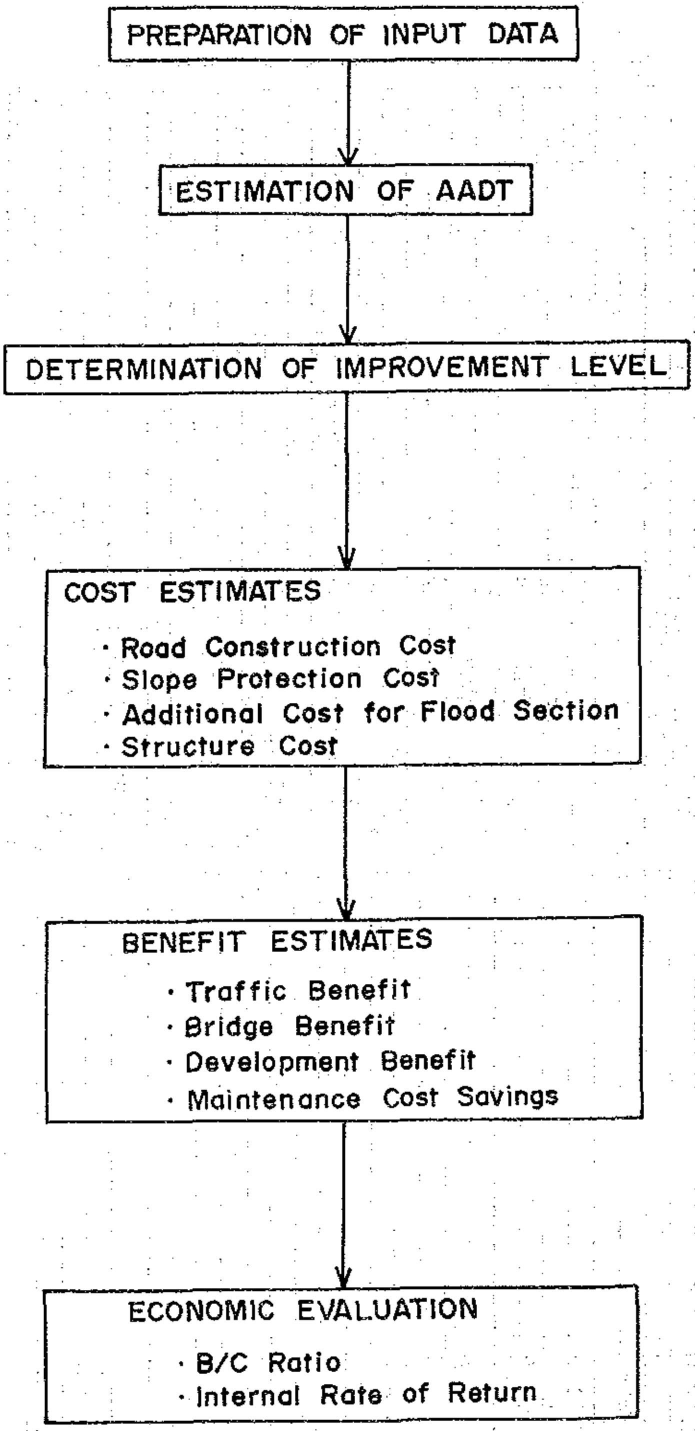
5) BENEFIT

			No.							TOTAL
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. (0.068 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+0.00068 x (4)−0.000003 x (5))	(48)							
		BENEFIT ((48) x (7))	(49)							
	MAINTENANCE 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



FIGRE 5.2-1 GENERAL PROCEDURES IN SIMPLIFIED EVALUATION METHOD

5.3 ACCURACY OF THE METHOD

The proposed simplified evaluation method was tested for application to all projects on which feasibility studies had been conducted under the Pilot Study and to those of this study.

Figure 5.3-1 shows the relationship between corresponding feasibility study results and simplified evaluation results on AADT, cost, benefit and IRR. Table 5.3-1 shows the correlation coefficients.

TABLE 5.3-1 CORRELATION COEFFICIENTS BETWEEN F/S RESULTS AND SIMPLIFIED EVALUATION RESULTS

	Traffic Project	Development Project	Total
AADT	-	0.925	0.925
Cost	0.994	0.991	0.993
Benefit	0.989	0.763	0.940
IRR	0.991	0.817	0.944

Traffic projects are superior to development projects in accuracy on benefits and IRR accordingly.

Distributions of error are plotted in Figure 5.3-2; the error rate and error are defined as follows:

$$\text{Error Rate} = \frac{|\bar{v}' - \bar{v}|}{\bar{v}} \times 100 \quad \text{(applied to AADT, cost and benefit)}$$

$$\text{Error} = |\bar{v}' - \bar{v}| \quad \text{(applied to IRR)}$$

where, $\bar{v}'$ = simplified evaluation result

$\bar{v}$ = F/S result

It can be seen from Figure 5.3-2 that:

Cost

- About 70% of data are within the 10% error range.
- About 90% of data are within the 20% error range.

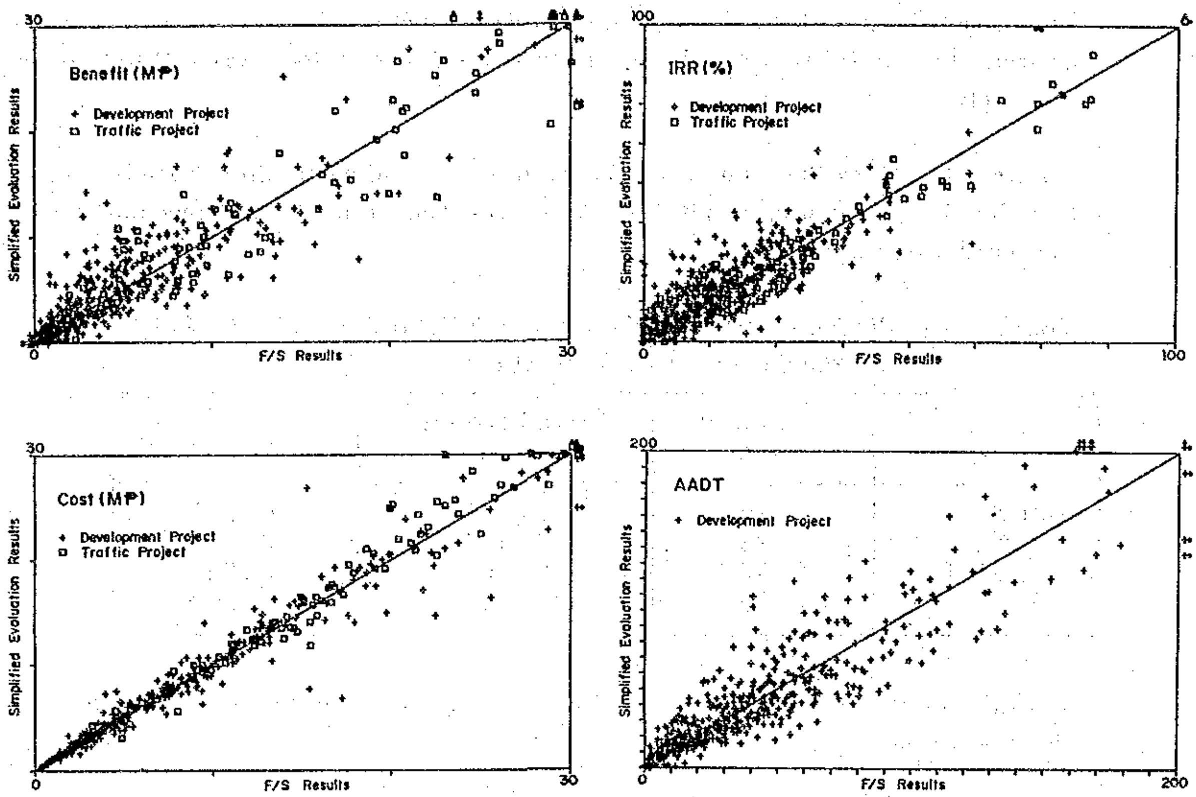


FIGURE 5.3-1 RELATIONSHIP BETWEEN F/S RESULTS AND SIMPLIFIED EVALUATION RESULTS

IRR

The simplified evaluation method is not very accurate in terms of IRR estimation especially for development projects. Economic evaluations, however, are by nature not very accurate, since they are made on some assumptions on such uncertain factors as future traffic and development impact. Thus considered, the proposed simplified evaluation method seems fit for to practicable application.

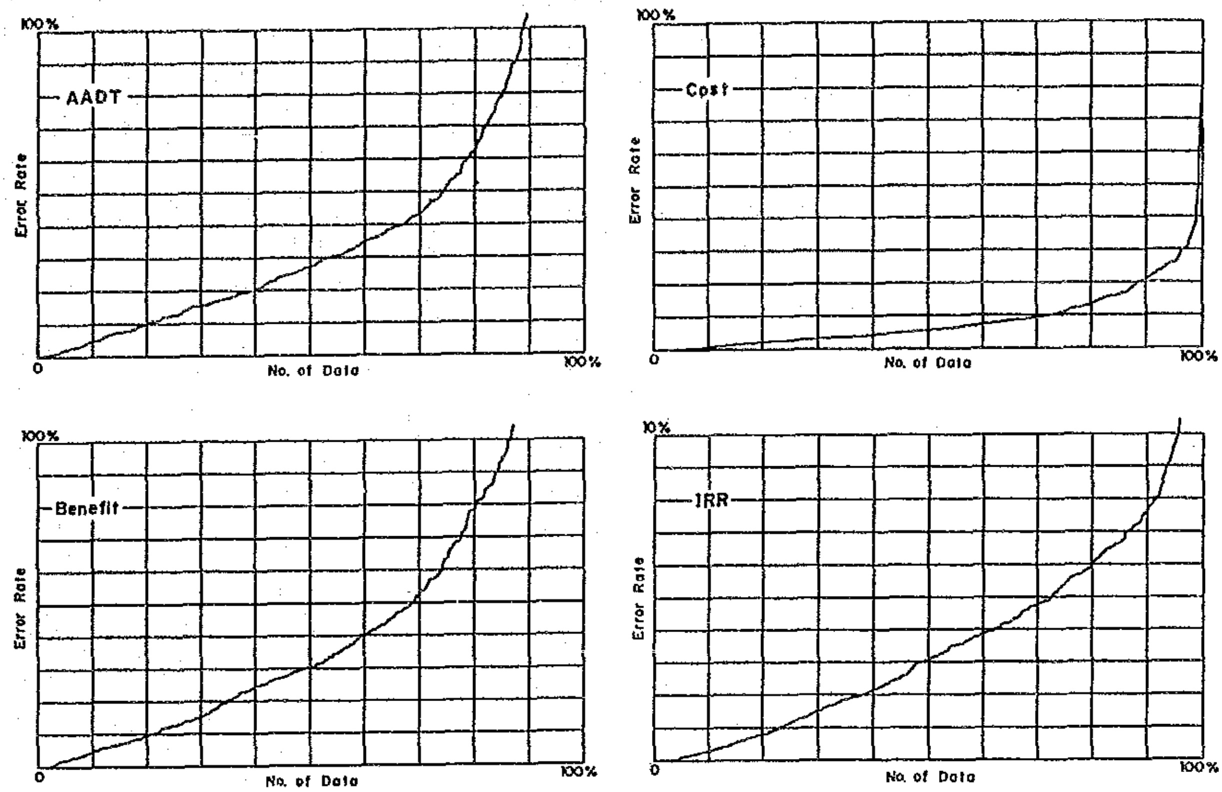


FIGURE 5.3-2 ERROR DISTRIBUTION

CHAPTER 6

IMPLEMENTATION PROGRAM

Project implementation for the rural road development project was discussed based on the study outputs for the four (4) provinces surveyed in the Pilot Study for the Rural Road Network Development Project (February 1989), which has preceded this Study. The Pilot Study covers the following subjects, among others:

* National Highway Development Plan
* Implementation Strategy and Plan of the Project
* Project Institution
* Project Implementation Procedures/Details
    - Sub-project Identification
    - Sub-project Appraisal/Prioritization
    - Fund Preparation (Sector Loan System)
    - Detailed Engineering
    - Tendering
    - Construction
    - Maintenance

Chapter 6, therefore, has the objective of updating data and summarizing the discussion on project implementation based on the study outputs for the eleven (11) provinces covered in this Study (Phase II) including the four (4) taken up in the preceding study.

6.1 RURAL ROAD DEVELOPMENT PROGRAM

6.1.1 Highway Development Plan

(1) Development Policies

In line with the development policy envisaged in the Medium-Term Philippine Development Plan, increased emphasis was placed on the highway development plan to rehabilitate, improve and expand the feeder and secondary network, which consists mainly of farm-to-market roads. The program seeks to convert these roads into all-weather transportfacilities. Emphasis will be placed on these roads particularly for economically depressed areas with low road densities to spur production. Feeder and secondary roads will also be improved in corridors of main highways which have just been improved or are programmed for improvement. This will provide for a more efficient network to collect and distribute traffic from and to the hinterlands.

Rehabilitation and improvement of major roads will be selectively carried out particularly for sections that can no longer economically service the present and immediate future traffic volume, and where transport costs are excessively high so as to restrain production and marketing, especially in Mindanao and the Visayas.

Temporary or weak bridges will be replaced with permanent structures. Measures will be introduced to stabilize road slopes and embankments, and to strengthen pavements so as to minimize road disasters and closures. This will be completed by schemes, both structural and non-structural, to reduce the rate of accidents and improve road traffic safety. Road maintenance activities will be reinforced in order to defer the huge investments in roads, lengthen their service lives, reduce transport operating costs and minimize public inconvenience. For this purpose, the inspection, monitoring, and accounting system for maintenance will be strengthened.

(2) Investment Level

The updated medium term public investment program for 1988-1992 was approved in July 1988. Accordingly, the 1988-1992 infrastructure program of the DPWH has been updated as shown in Table 6.1-1.

The investment for highways for 1991, for example, was raised to ₱12,156.4 million or 34% from ₱9,058 million appropriated in the previous Medium-Term Development Plan. The amount of ₱8,087.5 million or 66.5% of the investment requirement of ₱12,156.4 million will be financed by local funds and the remaining ₱4,068.9 million ($191,027) or 33.5% from foreign sources. (See Table 6.1-2).

6.1.2 Rural Road Development Program

(1) Project Components

The program covers the road improvement projects identified by the Pilot Study for the Rural Road Network Development Project (the previous study) and this study (Project Component I) as well as by the relevant studies (Project Component II). The relevant studies justified the urgent need of improvement of rural roads linking agricultural production areas to main roads (Type A) and arterial roads linking urban centers to rural areas (Type B), in the provinces not covered by the Pilot Study.

Both project components are included in this Study for the purpose of establishing an overall program for rural road development.

(2) Fund Requirements

Table 6.1-3 summarizes the roughly estimated project costs identified in the studies. Among the total cost of ₱29,602.9 million, the project component I of the Pilot study is established to be ₱22,379.6 million and the project component II of the relevant studies to be ₱7,223.3 million.

TABLE 6.1-1 1988-1992 INFRASTRUCTURE PROGRAM
SUMMARY OF INVESTMENTS,BY CATEGORY

(Unit: Thousand Pesos)

Category	1988	1989	1990	1991	1992	1988-92	1993-Up
1. Highways	5,577,559	8,105,033	10,553,437	12,156,400	13,575,900	49,968,329	20,829,682
2. Ports	413,830	712,550	454,000	663,000	777,100	3,020,480	1,581,341
3. Flood Control and Drainage	933,913	1,390,705	1,518,295	1,646,000	1,782,000	7,270,913	13,572,023
4. Rural Water Supply/Sewerage	506,516	800,000	1,900,000	2,100,000	2,380,000	7,686,516	637,599
5. School Buildings	916,000	1,300,000	1,501,000	1,864,000	1,974,000	7,555,000	0
6. National Buildings	16,000	36,000	228,000	268,000	309,000	857,000	0
7. Urban Infrastructure	232,652	376,000	350,110	391,000	309,000	1,744,762	503,986
Total	8,596,470	12,720,288	16,504,842	19,088,400	21,193,000	78,103,000	37,124,631

* As of July 5, 1988
Source: *Updated 1988 1992 DPWH Infrastructure Program*

TABLE 6.1-2 HIGHWAY INVESTMENT

(Unit: In Thousand Pesos Constant 1988 Prices)

Project Title		Total Project Cost	Cumm. Exp. (as of 1987)	Investment Requirements 1988	1989	1990	1991	1992	Later Years
Total	TP	76,496,576	5,698,565	5,577,559	8,105,033	10,553,437	12,156,400	13,375,900	20,829,682
	P	51,824,219	3,747,610	4,485,832	6,339,738	7,356,946	8,087,525	9,141,751	12,664,817
	$	1,160,458	94,708	51,987	81,163	150,070	191,027	208,176	383,327
On-Going	TP	14,935,527	5,698,865	2,736,446	3,108,049	2,075,426	936,237	195,090	185,714
	P	9,589,194	3,747,610	1,712,696	1,783,039	1,413,507	551,538	195,090	185,714
	$	253,515	94,708	48,750	60,920	31,075	18,061	0	0
New/Proposed	TP	61,561,049		2,841,113	4,996,984	8,478,011	11,220,163	13,380,810	20,643,968
	P	42,235,025		2,773,136	4,556,699	5,943,439	7,535,987	8,946,661	12,479,103
	$	906,943		3,237	20,243	118,994	172,966	208,176	383,327

Source: *Updated 1988 - 1992 DPWH Infrastructure Program*
List of Agency Projects

Note : *TP:* Total pesos
P: Peso portion of project cost
$: Foreign currency portion of project cost ($1 = P21)

TABLE 6.1-3 FUND REQUIREMENTS

Unit: Million Pesos, 1990 Price

		Construction Cost	Engineering Services	Total
Project Component I	JICA-F/S			
	4 - Provinces	950.9		
	11 - Provinces	3,229.9		
	Sub-Total	4,180.1		
	Average 1-Province	278.7		
	73 - Provinces	20,345.1 1/	2,034.5	22,379.6
Project Component II	Relevant Studies			
	Type A	3,570.0	305.5	3,875.5
	Type B	2,984.1	363.7	3,347.8
	Sub-Total	6,554.1 1/	669.2	7,223.3
Grand Total Project Component I and II		26,899.2	2,703.7	29,602.9

1/ Improvement cost of roads with IRR more than 15%.

(3) Fund Sources

According to the Highway Investment Plan shown in Table 6.1-2, the investment for the highway sector in 1991 is as follows:

TABLE 6.1-4 HIGHWAY INVESTMENT IN 1991

Unit: Million Pesos

Total Investment	12,156.0
Locally Funded	5,331.0
Rural Roads	1,853.0
Other than Rural Roads	3,478.0
Foreign Assisted	6,825.0
Rural Roads	3,147.0
Other than Rural Roads	3,678.0

The fund available for rural road improvement may be roughly estimated to be P5,000 million per year based on the 1991 Highway Investment Plan.

TABLE 6.1-5 AVAILABLE ANNUAL FUND FOR RURAL ROAD DEVELOPMENT PROGRAM

Unit: Million Pesos

Total Investment	5,000.0
Locally Funded	1,853.0
Foreign Assisted	3,147.0

(4) Overall Implementation Schedule

By taking into consideration the fund requirements and fund available for the rural road development, a 6-year program as an overall implementation schedule is proposed as shown in Table 6.1-6.

- Total Fund Requirements : ₱29,602.9 M
- Available Fund : ₱ 5,000 M/year
- No. of Years Required : 6 years

TABLE 6.1-6 OVERALL IMPLEMENTATION SCHEDULE OF RURAL ROAD DEVELOPMENT PROGRAM

	Annual Fund	No. of Provinces Covered	Annual Average Fund per Provinces	Initial Improvement Stage IRR>15%						Secondary Improve-ment Stage 15>IRR>7.5
				1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	
Locally Funded Projects	P1,853 M	73	P25.4 M	← 6-year Total P11,118 M →						
Foreign Assisted Projects	P3,147 M	73	P43.1 M	← P18,882 M →						
Total	P5,000 M	73	P68.5 M	← P30,000 M →						
Locally Funded Projects										←
Foreign Assisted Projects										←
Total										

6.2 IMPLEMENTATION STRATEGY

6.2.1 Implementation Policy

In implementing the Rural Road Development Program, the following policies are recommended:

(1) **Project Institution**

One of the policies being pursued by the present administration is a decentralization of the government agencies' function.

In line with this policy, a project management office for the Rural Road Development Program consisting of the DPWH's regional district offices and local government units (LGU's) is recommended.

(2) **Community Participation System**

The Medium-Term Philippine Development Plan emphasizes that participation will be encouraged from traditional structures like private business and non-government organizations (NGO's) as well as from genuine community organizations at the grass-roots level.

Greater involvement of the people will be promoted not only in service delivery and implementation but also in program/project identification and in the decision-making process. In this regard, community organizations as a strategy for people mobilization will be emphasized.

In line with the policy, community participation for the project is recommended along each process of project implementation from project identification to road maintenance stages.

(3) **Labor-based/Equipment-supported (LB-ES) Construction System**

The Medium-Term Philippine Development Plan stresses the adoption of an employment-oriented and rural-based strategy.

Consistent with this national policy, community construction teams for small-size projects is recommended.

Community construction teams will be organized by mobilization of community/ barangay groups to provide labor services through the "Pakyaw" system.

(4) **Coordination between International Lending Agencies for Project Implementation**

Presently, highway projects in the Philippines are partly financed by several international lending agencies such as IBRD, ADB, OECF, etc.

The coordination of these agencies, therefore, are required to pursue systematic implementation with standardized technology.

To achieve a well-coordinated implementation, the following two methods may be proposed.

Method 1: One province vs. one lending agency

Under this method, rural highway development project in one province shall be financed by only one international lending agency.

The provinces covered by each international agency shall be predetermined and specified in accordance with amounts and timing of their fundings.

Method 2: One province vs. several lending agencies

Under this method, rural highway development projects in one province can be funded by any international lending agency based on project priority and political environment.

The disadvantages of Method 1 are difficulty in pre-determination of provinces specified for each international lending agency and expected unbalance in project implementation although the advantage in project implementation is clearly distinction.

The advantages of Method 2 are that any pre-arrangement between international lending agencies may not be required and projects will be implemented in accordance with project priority of the Government of the Philippines and funds extended by lending agencies. However, due to investing several funds in a single province, confusion is expected to be disadvantageous for project implementation.

Taking into consideration the advantages and disadvantages of both methods, Method 2 is recommended.

(5) Project Types

To pursue the community participation system and LB-ES construction system, the implementation methods by sub-project types are being studied as briefly discussed hereunder.

a) Administrative Type Sub-project

The construction of this Sub-project type may be undertaken by community construction teams particularly organized under the supervision of a project management office with the guidance of professional consultants. Detailed engineering shall, however, be conducted by professional consultants.

This Sub-project type is defined as follows:

- A sample topographic and geotechnical survey may be enough for detailed design.

- Construction works are relatively easy and require only ordinary construction equipment.

- Project size in terms of construction cost is relatively small.

b) Contract Type Sub-project

The present procedure adopted by the DPWH will be basically followed for the execution of this type of project.

Detailed engineering and construction supervision will be undertaken by professional consultant under the guidance of a project management office.

(6) Sector Loan

The rural road development program is recognized as the integration of individual rural road improvement/construction projects. For foreign-assisted projects, two types of loan are applicable, project loans and sector loans. A sector loan system is recommended for the rural road development program due to its characteristics of covering numerous roads with a short length. The sector loan system is discussed below.

- A project under one loan package consists of many candidate sub-projects (roads) which shall be specified and listed in the loan agreement.

- The implementation priority of sub-projects among candidate projects should be decided by the executing agency in accordance with the implementation criteria mutually agreed upon by the lending institution and the executing agency.

- The selection, formulation and appraisal of candidate sub-projects are generally the responsibility of the executing agency.

- The criteria for the selection and appraisal of candidate sub-projects should, however, be specified in advance and mutually agreed upon between the lending institution and the executing agency.

- The degree of involvement of the lending institution in the selection and appraisal of sub-projects may depend upon the maturity and capability of the executing agency. Generally, prior approval of the lending institution may be necessary for relatively large sub-projects, while for smaller sub-projects, the lending agency will review, on a selective basis, the technical and financial/economic viability with a view to ensuring compliance with the mutually-agreed criteria.

6.2.2 Implementation Priority of Provinces

(1) Study Procedure

The implementation priority of provinces was evaluated taking into consideration the following factors as shown in Figure 6.2-1.

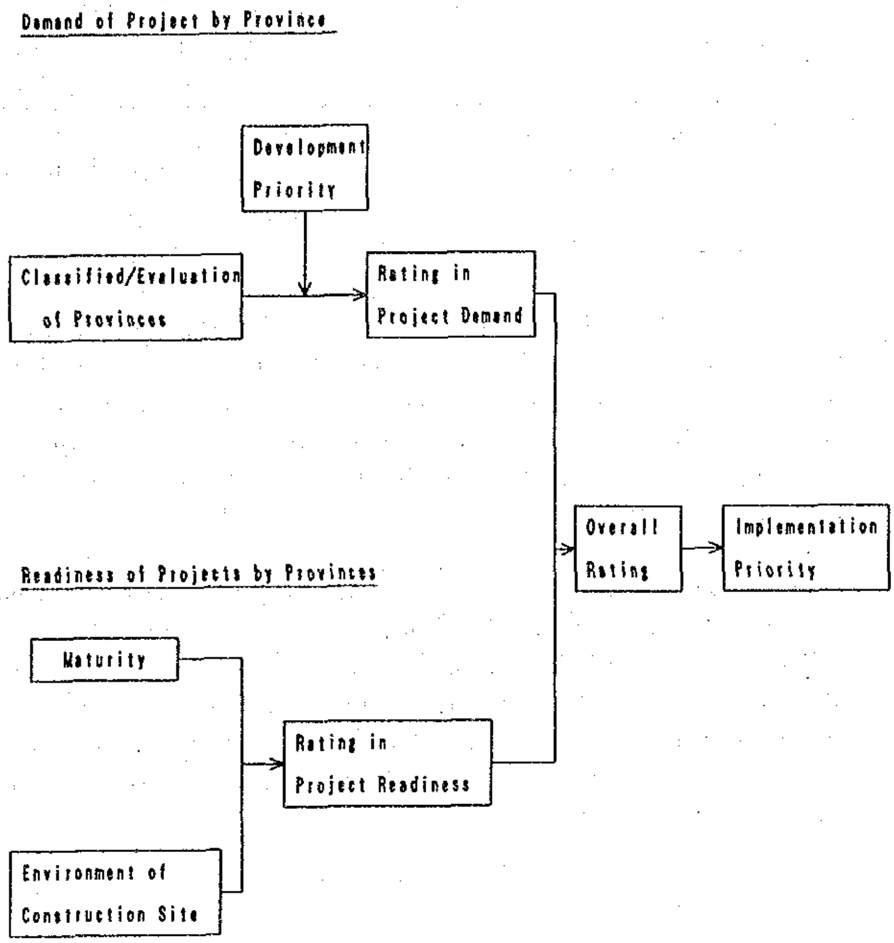


FIGURE 6.2-1 STUDY FLOW FOR EVALUATION OF IMPLEMENTATION OF PROVINCES

(2) Classification/Evaluation of Provinces

The characteristics of all provinces in the country were classified under the Pilot Study for Rural Road Network Development Project. The overall classification/evaluation of all provinces was made employing the two principal representing indicators, namely; incidence of poverty and road density, representing socio-economic development and adequacy of roads, respectively.

TABLE 6.2-1 CLASSIFICATION/EVALUATION OF PROVINCES

		Adequacy of Road (Road Density)		
		Bad	Average	Good
Socio-Economic Development	Developed	-	AD (D)	-
(Incidence of Poverty)	Less Developed	BL (A)	AL (B)	GL (C)

Note) A: 1 point C: 0.6 point
B: 0.8 point D: 0.4 point

(3) Development Priority

The Medium-Term Philippine Development Plan stresses that the fundamental goal of regional development is the minimization of disparities, without prejudice to the optimum realization of the regions' growth potentials. The implementation of the rural based strategy - particularly the provision of infrastructure and the generation of employment in rural areas - will strengthen efforts to promote balanced growth among the regions.

Faster growth is planned during the period for the less developed regions and for regions with large resource potentials. Cagayan Valley (II) and Eastern Visayas (VIII) will post the highest growth rates followed by Northern Mindanao (X), Ilocos (I), Bicol (V) and Western Mindanao (IX). The National Capital Region which currently accounts for a large 29.9 percent of the country's output will register moderate growth, and this is consistent with the current strategy to balance the development of regions.

TABLE 6.2-2 GROSS REGIONAL DOMESTIC PRODUCT, 1987-1992
(in Million Pesos at 1972 prices)

Region	1987	1992	Average Annual Growth Rates 1987-1992
PHIL	96,935	135,331	6.9
NRC	28,208	37,607	5.9
I	4,265	6,099	7.4
II	2,714	3,916	7.7
III	8,530	12,152	7.3
IV	13,862	19,662	7.2
V	3,296	4,753	7.4
VI	7,755	10,923	7.0
VII	6,785	9,452	6.9
VIII	2,423	3,511	7.7
IX	3,490	5,024	7.4
X	4,944	7,109	7.6
XI	6,689	9,452	7.3
XII	3,974	5,671	7.3

Source: NEDA Regional Offices

The Rural Road Development Program shall be implemented in line with this policy, the minimization of regional disparities, which is assessed by the proposed annual growth rates and categorized as follows.

TABLE 6.2-3 DEVELOPMENT PRIORITY OF REGIONS

Category	Average Annual Growth Rates	Regions
A	7.6, 7.7	II, VIII, X
B	7.3, 7.4	I, III, V, IX, XI, XII
C	7.0, 7.2	IV, VI
D	6.9	VII

Note) A: 1 point C: 0.8 point
B: 0.9 point D: 0.7 point

(4) Rating in Project Demand

For the assessment of project demand of each province, each province was given the point (0.4 to 1 point) as shown in the foot note of Table 6.2-1 in accordance with the classification/evaluation of provinces. Similarly, points (0.7 – 1 point) in terms of development priority was also given as shown in the foot note of Table 6.2-3.

The combined evaluation for rating in project demand was made giving the weight of 70 points to classification/evaluation of provinces and 30 points to development priority.

The analysis results are summarized in Table 6.2-4.

(5) Implementation Priority of Provinces

In assessing implementation priority of provinces, other factors such as the equal distribution to regions, maturity (project preparation) environment of construction site and the likes shall be considered. Since those factors, however, are changeable, no definite priority can be given. Therefore, the actual implementation priority of provinces shall be assessed every year based on the project demand with the consideration of factors mentioned above.

TABLE 6.2-4 (1) IMPLEEMENTATION PRIORITY IN DEMAND OF PROJECTS

	PROVINCE	REGION	Demand of Projects by Province (1) Classification/ Evaluation	(2) Development Priority	(3) Rating in Demand	
X	Kalinga-Apayao	2	1	1	100	
0	Samar	8	1	1	100	
	Eastern Samar	8	1	1	100	
	Northern Samar	8	1	1	100	(1)
	Isabela	2	1	1	100	
0	Agusan del Sur	10	1	1	100	
0	Davao del Norte	11	1	0.9	97	
0	Masbate	5	1	0.9	97	
	Surigao del Sur	11	1	0.9	97	
	Davao del Sur	11	1	0.9	97	
	Tawi-Tawi	9	1	0.9	97	
	Basilan	9	1	0.9	97	(2)
	Sultan Kudarat	12	1	0.9	97	
	Sulu	9	1	0.9	97	
	Maguindanao	12	1	0.9	97	
	Zamboanga del Sur	9	1	0.9	97	
	Davao Oriental	11	1	0.9	97	
	Lanao del Sur	12	1	0.9	97	
	North Cotabato	12	1	0.9	97	
0	Occidental Mindoro	4	1	0.8	94	
	Oriental Mindoro	4	1	0.8	94	
	Palawan	4	1	0.8	94	
	Aurora	4	1	0.8	94	
	Quezon	4	1	0.8	94	
	Negros Oriental	7	1	0.7	91	
0	Leyte	8	0.8	1	86	
0	Misamis Oriental	10	0.8	1	86	(3)
	Agusan del Norte	10	0.8	1	86	
	Bukindon	10	0.8	1	86	
	Surigao del Norte	10	0.8	1	86	
	Quirino	2	0.8	1	86	
	Ifugao	2	0.8	1	86	
	Cagayan	2	0.8	1	86	
	Southern Leyte	8	0.8	1	86	
X	Tarlac	3	0.8	0.9	83	
0	Nueva Ecija	3	0.8	0.9	83	
0	Albay	5	0.8	0.9	83	
X	Camarines Sur	5	0.8	0.9	83	
X	Mountain Province	1	0.8	0.9	83	
	Catanduanes	5	0.8	0.9	83	
	South Cotabato	11	0.8	0.9	83	
	Sorsogon	5	0.8	0.9	83	(4)
	Camarines Norte	5	0.8	0.9	83	
	Pangasinan	1	0.8	0.9	83	

TABLE 6.2-4 (2) IMPLEMENTATION PRIORITY IN DEMAND OF PROJECTS

	PROVINCE	REGION	Demand of Projects by Province			
			(1) Classification/ Evaluation	(2) Development Priority	(3) Rating in Demand	
	Pangasinan	1	0.8	0.9	80	
	Zamboanga del Norte	9	0.8	0.9	80	
0	Rizal	4	0.8	0.8	80	
0	Antique	6	0.8	0.8	80	
	Marinduque	4	0.8	0.8	80	
	Aklan	6	0.8	0.8	80	
	Iloilo	6	0.8	0.8	80	
	Capiz	6	0.8	0.8	80	
	Negros Occidental	6	0.8	0.8	80	
	Cebu	7	0.8	0.7	77	
0	Nueva Vizcaya	2	0.6	1	72	
	Batanes	2	0.6	1	72	
	Camiguin	10	0.6	1	72	(5)
	Misamis Occidental	10	0.6	1	72	
X	Abra	1	0.6	0.9	69	
X	Ilocos Norte	1	0.6	0.9	69	
X	Ilocos Sur	1	0.6	0.9	69	
	Bataan	3	0.6	0.9	69	
	Lanao del Norte	12	0.6	0.9	69	
	Batangas	4	0.6	0.8	66	
	Romblon	4	0.6	0.8	66	
0	Bohol	7	0.6	0.7	63	
	Siquijor	7	0.6	0.7	63	
X	Benguet	1	0.4	0.9	55	(6)
0	La Union	1	0.4	0.9	55	
	Bulacan	3	0.4	0.9	55	
	Zambales	3	0.4	0.9	55	
	Pampanga	3	0.4	0.9	55	
0	Cavite	4	0.4	0.8	52	
	Laguna	4	0.4	0.8	52	

0 JICA-assisted F/S
X Relevant Studies

6.3 IMPLEMENTATION ARRANGEMENT

(1) Project Institution

A project management office for the rural road development project is proposed to be created in the central office of the DPWH. The new office will be under the supervision and control of the Secretary of the DPWH, in the same way as the existing project management offices presently work. This office should act as the coordination and core agency of implementation of the whole project and at the same time be directly responsible for detailed engineering, tendering and construction supervision of the project.

To cope with implementation of the special project, organization of a part of the existing line agencies, particularly that of regional offices, district offices and provincial government may be strengthened or re-organized. The organization of existing regional offices need not be changed except to add one division - Rural Road Development Division – which will exclusively work for the Project. Similarly, one section – Rural Road Development Section – will be newly set up within the existing district offices which presently consist of eight (8) sections.

(2) Sub-project Identification/Selection of Sub-project

This was discussed in Chapters 3 and 5.

(3) Fund Preparation

The rural road development project is recognized as the integration of individual rural road improvement/construction projects. A sector loan system is recommended for the project due to its characteristics of covering numerous roads with a short length.

The general concepts of the sector loan system are as follows:

- The executing agency shall list up the candidate sub-project, the location, existing conditions, improvement type of which shall be identified.

- The selection, formulation and appraisal of sub-projects for implementation are generally the responsibility of the executing agency.

- The criteria for the selection and appraisal of sub-projects should, however, be specified in advance and mutually agreed upon between the lending institution and the executing agency.

- The degree of involvement of the lending institution in the selection and appraisal of sub-projects may depend upon the maturity and capability of the executing agency.

Generally, prior approval of the lending institution may be necessary for relatively large sub-projects, while for smaller sub-projects, the lending agency will review, on a selective basis, the technical and financial/economic viability with a view to ensuring compliance with the mutually-agreed criteria.

(4) Detailed Engineering

The detailed engineering design of this project is recommended to be undertaken by the Project Management Office for Rural Road Projects. The present procedure will be followed. PMO will hire consulting firms for detailed engineering services. Reviews of designs prepared by the consulting firms will be made by the PMO and the Bureau of Design.

In line with the schedule of construction, hiring consulting firms, detailed engineering periods and review periods should be properly scheduled. As many consulting firms will be expected to be involved, standardization of design criteria for various classes of roads should be established. To expedite review works, proper coordination should be maintained between PMO and the Bureau of Design.

(5) Tendering

a) Administrative Type Sub-projects

Since this type of project is proposed to be undertaken by administration at the regional or district/city offices, no tendering is required, except in the case of contracting a supply of laborers (Pakyaw contract).

b) Contract Type Sub-project

For this type of project, it is recommended that the present tendering procedure be followed. Tendering is to be undertaken at different levels of agencies depending on the size of the project and the sources of funds.

Shortening the time required for tendering is one of the key factors to expedite implementation of the projects. It is recommended that the Government make all possible efforts to shorten the time for evaluation of prequalification documents and bids submitted by contractors as well as the time for approval.

(6) Construction

a) Administrative Type Sub-projects

This type of project is recommended to be undertaken by administration and implemented by regional and district/city utilizing labor sources from the respective provinces, under the supervision of professional consultants.

However, some essential construction activities for road construction, such as compaction and rolling, need support of equipment. Therefore, this type of project is recommended to be carried out by a labor-based/equipment-supported construction method.

b) Contract Type Sub-projects

This type of project is recommended to be undertaken by the Project Management Office for the Rural Road Project. These sub-projects should be constructed by contractors and supervised by professional consultants under the management of PMO.

Several sub-projects should be packaged in one (1) contract in order to facilitate project implementation and to reduce administrative overhead. In the case of foreign assisted projects, which will require international bidding and take a long time for tendering, proper scheduling is required.

(7) Maintenance

It is recommended that community lend participation in maintenance, since residents using the road are more concerned about the condition of the road. They can actively participate in maintenance in the following aspects:

a) Monitoring

A system should be established for monitoring road conditions by residents, and a representative selected from residents should report any deficiency or defects of road conditions to the respective agency.

b) Maintenance of Barangay Roads

A system should be established for maintenance of barangay roads aimed at the active participation of barangay people, thus creating continuous jobs for them.