PART V PROJECT IMPLEMENTATION

CHAPTER 14

HIGHWAY DEVELOPMENT PLAN

The policy and strategy for transport development, including the highway sub-sector, in the country have been firmly established and are being pursued.

Undoubtedly, the proposed rural road network development project should be implemented in full compliance with the policy and strategy established in the national development plan.

This chapter involves a discussion of rural road development plan; therefore, it describes a brief outline of the development framework for highway development formulated in the following papers:

- Medium-Term Philippine Development Plan, 1987-1992, 1986
- 1988 DPWH Infrastructure Program, November 1987
- Updated 1988-1992 DPWH Infrastructure Program, July 1988

14.1 Medium-Term Philippine Development Plan 1987-1992

14.1.1 National Development Strategies and Policies

1) Objectives

The Medium-Term Philippine Development Plan, covering 1987 to 1992, addresses the fundamental problems of the people: persistence of poverty and income inequity, high unemployment and underemployment and urban/rural and regional disparties.

The national development efforts in 1987-92, therefore, will be principally directed towards the following goals: (a) alleviation of poverty, (b) generation of more productive employment, (c) promotion of equity and social justice and (d) the attainment of sustainable economic growth.

2) Policies and Strategies

To address the foregoing problems and challenges and to attain the development objectives, the following strategies and policies are emphasized in the Plan:

The strategy for the short term will be to stimulate recovery by inducing demand through increased incomes, especially in the rural areas. To achieve this objective, the government has launched a Community Employment and Development Program (CEDP) which will provide more employment opportunities in the rural areas through the construction of small-scale, labor-intensive infrastructure projects such as feeder roads, communal irrigation systems, school buildings and rural water supply.

In the medium-term, an employment-oriented, rural-based development strategy will be implemented. This approach will directly address the goals of poverty alleviation and equitable distribution of benefits. A rural-based strategy is necessary because two-thirds of the population live in the rural areas and are largely dependent on agriculture for their livelihood.

The implementation of essential and consistent policy will enable the economy to recover and sustain respectable growth during the period 1987-92 while maintaining internal and external stability.

3) Target

Table 14.1-1 presents the national targets in terms of the real Gross National Product (GNP) and per capita GNP during the Plan period. GNP or the sum of goods and services produced by the country is targeted to increase by 6.8% on the average.

TABLE 14.1-1 GROSS NATIONAL PROJECT AND PER CAPITA GNP, 1986-92 [1)]

	Estimate	Targets						Annual Average
	1986	1987	1988	1989	1990	1991	1992	1987-92
Gross National Product(in billion pesos, at constant 1972 prices)	89.4	95.3	101.9	108.6	116.2	124.3	132.7	113.2
Growth Rate (%)	1.1	6.5	6.9	6.7	7.0	6.9	6.7	6.8
Gross National Product(in billion pesos, at current prices)	619.6	697.3	811.8	927.3	1,057.7	1,253.2	1,438.0	1,033.9
Inflation Rate (%)	2.0	5.2	8.7	7.0	8.3	8.9	7.4	7.6
Per Capita GNP (in pesos, at constant 1972 prices)	1,597	1,661	1,734	1,808	1,891	1,977	2,064	1,856
Growth Rate (%)	-1.3	4.0	4.4	4.3	4.6	4.5	4.4	4.4
Per Capita GNP (in pesos at current prices)	11,063	12,157	13,825	15,430	17,497	19,934	22,378	16,870

Note: 1) Estimates and targets as of 5 November 1986.
Sources: NEDA and NCSO Medium Term Philippine Development Plan, 1987-1992.

14.1.2 Infrastructure Development Plan

1) Objectives

The government aims to enlarge and reinforce the physical foundation of the economy to support the overall development thrust of sustained economic growth and social justice. Specifically, the Government will install and improve the essential transport, water resources, energy, communications and social overhead facilities, particularly in the rural areas.

2) Policies and Strategies

To effectively attain the above objectives, rural-based, small- and medium-sized, short-gestating and labor-based projects will be given emphasis. These will include farm-to-market roads, secondary roads, and feeder ports, communal irrigation, drainage and rural electrification – all designed to promote increased agricultural production and marketing, encourage small and medium industries, support land reform and increase rural incomes on a wide scale.

Priority will be given to the maintenance of existing and soon-to-be completed infrastructures to prolong their useful lives, reduce costs to the users and postpone huge investments for their major rehabilitation or replacement. Rehabilitation and restoration, as well as improvement and upgrading of existing facilities, will take precedence over replacement and new construction as low-cost measures to provide acceptable levels of infrastructure services.

Special attention will be given to the completion of on-going projects that are consistent with development thrusts in order to realize the benefits from their early operation and to avert investment losses. New infrastructure projects will therefore be selectively undertaken, mainly when they are needed to eliminate the critial bottlenecks that hinder the programmed expansion of production and the provision of basic human needs. For this purpose, small and medium high-impact projects will be emphasized. Priority will be given to projects which manifest high indices of socio-economic benefits in relation to their costs.

The institutional set-up for the infrastructure sectors will be streamlined to promote cost-effectiveness, decentralization, efficiency of frontline services, accountability and private initiative. Overlaps and duplication of functions among agencies in the provision of infrastructure will also be eliminated.

Broader participation will be promoted and self-reliance among community beneficiaries, local governments and the private sector will be encouraged in the planning, financing, construction, installation, operation and maintenance of infrastructure facilities. The implementation of the infrastructure plan will be made to conform with the different regional development investment programs.

3) Targets

Table 14.1-2 summarizes the investment requirement by sector under the Government Infrastructure Program. The program during the Plan period will entail a total public investment of ₱257.6 billion or an annual average of ₱42.9 billion.

TABLE 14.1-2 GOVERNMENT INFRASTRUCTURE PROGRAM INVESTMENT REQUIREMENT BY SECTOR 1986-92

(Unit: in million pesos at current price)

Sector	Program 1986	Projections[1] 1987	1988	1989	1990	1991	1992	1987-92 Total	1987-92 Percent to Total
ENERGY	6,578	7,472	7,368	10,011	15,036	17,594	13,502	70,983	27.6
Power	5,700	5,354	4,489	7,956	13,070	15,327	11,697	57,893	
Rural Electrification	300	533	946	813	1,040	1,212	1,008	5,552	
Energy Resource Development	371	871	1,389	1,039	754	870	609	5,531	
Downstream Activities	207	714	545	203	172	185	188	2,007	
TRANSPORT	5,813	7,241	8,667	9,818	11,655	12,586	13,321	63,288	24.6
Highways	4,544	5,356	6,008	6,587	8,418	9,058	9,301	44,728	
Ports	944	1,194	1,559	1,674	1,588	1,638	2,005	9,658	
Urban Transport	186	251	183	142	469	1,039	1,298	3,382	
Railways	69	282	561	556	555	574	600	3,128	
Airports and Airnavs	70	158	356	859	625	277	117	2,392	
WATER RESOURCES	4,715	7,626	8,465	9,686	10,500	9,996	9,309	55,590	21.6
Water Supply, Sewerage and Sanitation	2,115	3,811	4,472	5,486	5,835	4,997	4,470	29,071	
Irrigation	1,931	2,474	2,927	3,166	3,437	3,657	3,347	19,008	
Flood Control, Drainage and Shore Protection	669	1,341	1,066	1,034	1,236	1,342	1,492	7,511	
SOCIAL INFRASTRUCTURE	1,523	2,491	2,840	3,312	3,610	3,846	4,342	20,441	7.9
School Buildings	701	1,051	1,267	1,420	1,646	1,826	2,167	9,377	
Health Facilities	115	389	633	909	1,118	1,280	1,332	5,661	
Urban Community Infrastructure	696	991	871	892	675	488	532	4,449	
National Buildings	11	60	69	91	171	252	311	954	
COMMUNICATIONS	266	973	3,222	4,711	4,472	3,381	1,637	18,396	7.1
Telecommunications	227	650	2,920	4,643	4,390	3,100	1,430	17,133	
Postal Communications	39	323	302	68	82	281	207	1,263	
OTHERS[2]	-	1,830	1,865	1,585	2,225	5,830	15,589	28,924	11.2
TOTAL	18,895	27,633	32,427	39,123	47,506	53,233	57,700	257,622	100.0
Percent Share to GNP	3.1	4.0	4.0	4.2	4.4	4.2	4.0		

Note: 1) Includes proposed projects which are still subject to evaluation.
2) Covers RDIP projects and projects that will be identified later on from a Shopping List of Projects including contingency allowance for physical and financial variations.

Sources : Infrastructure ministries, major public infrastructure corporations, other agencies and NEDA.
(as of 25 November 1986) Medium-Term Philippine Development plan 1987-1992.

14.1.3 Highway Development Plan

1) Objectives

The transport sector will support nationwide efforts to stimulate agricultural production and increase rural income by orienting transport infrastructure toward rural areas. It aims to reduce interregional socio-economic gaps to strengthen interregional linkages by providing for the more efficient movement of products from excess production areas to deficit/market areas.

The Medium-Term Philippine Development Plan revealed the following main deficiencies of the highway network:

a) Less than 50% of the total network may be considered as all-weather roads. Only about 44% of the national road network is paved with concrete or asphalt.

b) The condition of many roads, especially barangay (feeder) and provincial (secondary) roads and even some national road sections, is poor because of initial low design standards relative to traffic volume, substandard construction, inadequate maintenance and damage from overloaded vehicles.

c) Missing or weak bridges diminish the usefulness of many existing roads.

d) In some remote areas, access roads are scarce.

2) Policies and Strategies

Based on these findings, the highway development policies and strategies in the Plan are the following:

In line with the stress on the development of the rural-agricultural sector, increased emphasis will be given to the rehabilitation, improvement and expansion of the feeder and secondary network, which consists mainly of farm-to-market roads. The program seeks to convert these roads into all-weather transport facilities. These roads will be underscored particularly in 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 or are programmed to be improved; 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 in 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 useful lives, reduce transport operating costs and minimize public inconvenience. For this purpose, the inspection, monitoring, and accounting system for maintenance will be strengthened.

3) Target

As shown in Table 14.1.3, the highway development program will improve the road density by 1992 to 0.57 km per square kilometer of land area and maintain the ratio of 3.02 km per 1,000 population, increase the percentage of all-weather roads to about 60% and raise the percentage of paved national roads to about 55%.

TABLE 14.1-3 HIGHWAYS DEVELOPMENT PROGRAM [1]
PHYSICAL TARGETS 1986-92

	Program	Targets						1987 - 92	
	1986	1987	1988	1989	1990	1991	1992	Total	%
Roads (in km)	6,475	9,319	10,100	10,536	11,708	12,704	13,711	68,078	100.0
Feeder Roads (including barangay roads)	4,072	6,876	7,458	7,610	8,551	9,255	9,963	49,713	73.0
Secondary roads (including national roads)	1,263	1,403	1,545	1,712	1,856	2,052	2,270	10,838	15.9
Major Roads	510	1,040	1,097	1,214	1,301	1,397	1,478	7,527	11.1
Bridges (in meters)	4,899	5,059	5,624	6,219	6,870	7,683	8,465	39,920	

Note: 1) Restoration, rehabilitation, improvement and construction
Sources: MPWH,MLG, Medium-Term Philippine Development Plan

14.2 1988 DPWH INFRASTRUCTURE PROGRAM

1) 1988 DPWH Infrastructure Program

In line with the national development policy, the program of the DPWH for 1988 has been formulated to support the development thrusts of the new Government towards the twin mission of economic recovery in the short run and sustainable growth and equity in the long term.

The proposed 1988 DPWH Infrastructure calls for a total funding of ₱8,596,470,000 in order to achieve the physical targets as well as to meet funding requirements (See Table 14.2-1). The projects embodied in the proposed 1988 DPWH Infrastructure Program have been selected in accordance with the concerned Municipal/City Provincial/Regional Development Councils to ensure their conformity with regional/local development.

TABLE 14.2-1 PHYSICAL TARGETS AND FUNDING REQUIREMENT BY PROJECT CATEGORY, 1988 DPWH INFRASTRUCTURE PROGRAM

Category	Physical Target	Funding (In thousand Pesos)	Share (%)
Highway	8,945 km	5,577,559	64.9
Ports	487	413,830	4.8
Flood Control & Seawalls	1,049	933,913	10.9
Water Supply		506,516	5.9
School Buildings		916,000	10.6
National Buildings		16,000	0.2
Urban Community Infrastructure		232,652	2.7
Total		8,596,470	100.0

2) 1988 DPWH Highway Program

The Philippines has a road network of about 162,325 km, of which the majority are surfaced with gravel or earth (see Table 14.2-2).

There is a need, therefore, to rectify the poor or substandard condition of substantial portions of the existing network, particularly about half of the barangay (feeder) roads and 40% of the provincial (secondary) roads. Because of this situation, rural production has been restricted in many places as farmers and enterpreneurs find transport costs excessive and do not have easy access to farm inputs and to markets for their produce.

The 1988 highway program addresses these needs in order to bring down transport costs and stimulate widespread production. Thus, the program seeks to rehabilitate/improve or construct about 6,517 km of feeder (barangay) roads, and 1,304 km of secondary (national/provincial) roads, together with 1,124 km of arterial (national) roads and rehabilitation/reconstruction of 10,023 m of bridges with a total outlay of ₱5,557,559,000 (see Table 14.2-2).

TABLE 14.2-2 EXISTING ROAD CONDITION AND PROPOSED IMPROVEMENT INVESTMENT 1988 DPWH HIGHWAY PROGRAM

Administration Road Classification [1]	Existing Road Length (km)	Existing Condition Gravel/Earth	1988 DPWH Highway Program Fund	
			Physical Target (km)	(In thousand pesos)
National (major) Roads	26,230	55%	1,124[2]	3,486,795
National (minor) Roads			503	497,404
Provincial (secondary) Roads	28,334	88%	801	521,214
City & Municipal (urban) Roads	16,882	-	-	-
Barangay (tertiary or feeder) Roads	90,879	100%	6,507	1,072,146
Total	162,235		8,945	5,577,559

Note: 1) Administrative road classification does not necessarily tally with the functional classification adopted in the Study.
2) The proposed improvement of 10,023 LM bridges is excluded.

14.3 UPDATED 1988-1992 DPWH INFRASTRUCTURE PROGRAM

1) Updated 1988-1992 DPWH Infrastructure Program

The updated medium term public investment program for 1988-1992 was approved in July 1988. Accordingly, 1988-1992 infrastructure program of the DPWH has been updated as shown in Table 14.3-1. Figure 14.3-1 show the past and future highway investment from 1975 to 1992.

The investment requirement 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 14.3-2).

2) Rural Road Development Program in Updated DPWH

The program covers the list of on-going agency projects and new/proposed projects. Therefore, the investment for rural related road projects and other projects such as primary major national roads and transportion projects in urban areas were classified as shown in Table 14.3-3 and Figure 14.3-2. Table 14.3-4 and Figure 14.3-3 show the investment in 1988 under the similar classification with that in 1991 for comparison.

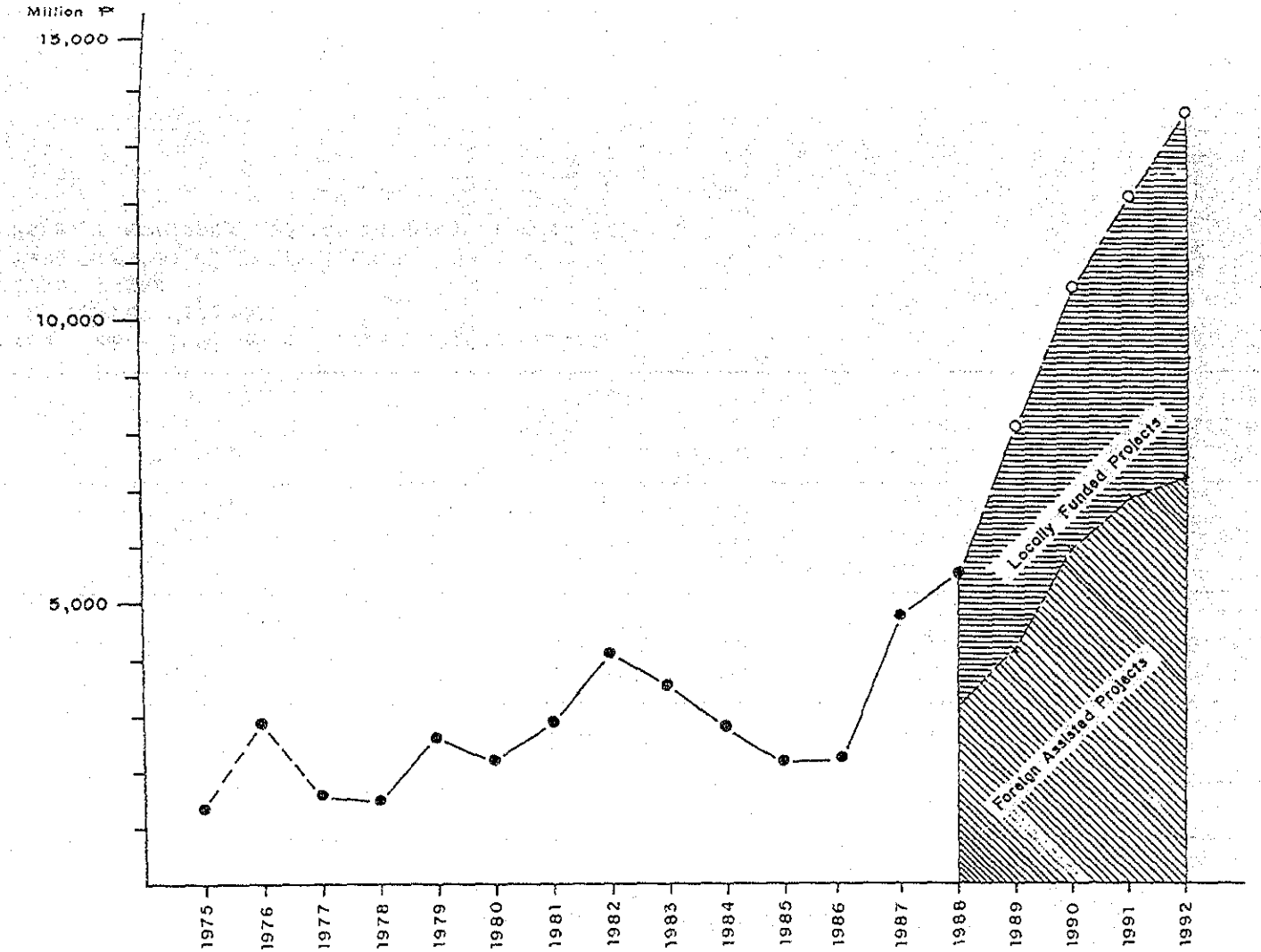
According to this table, locally funded projects in 1991 will account for ₱5,331M or 43.9% and the total of foreign assisted projects will amount to ₱6,825M or 56.1%, of which rural road types will be ₱3,147M or 25.9% and others ₱3,678M or 30.2%.

TABLE 14.3-1 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 & 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



Note : Capital outlays for 1976 covers 18 months from July 1975 to December 1976
Source: Planning Service, DPWH

FIGURE 14.3-1 CAPITAL OUTLAYS FOR HIGHWAYS

TABLE 14.3-2 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 14.3-3 1991 HIGHWAY PROGRAM

(Unit: Thousand Pesos)

	Foreign Assisted	Locally Funded	T o t a l
Rural Related Roads	3,147,403	5,331,070	8,478,473
Other Roads	3,677,929	-	3,677,929
T o t a l	6,825,332	5,331,070	12,156,402

Source: Updated 1988 - 1992 DPWH Infrastructure Program

TABLE 14.3-4 1988 HIGHWAY PROGRAM

(Unit: Thousand Pesos)

	Foreign Assisted	Locally Funded	T o t a l
National Roads			
Major Roads	2,436,251	1,050,544	3,486,795
Minor Roads	575,431	65,333	640,764
Provincial Roads	-	450,000	450,000
Barangay Roads	-	1,000,000	1,000,000
T o t a l	3,011,682	2,565,877	5,577,559

Source: Highlights of 1988 DPWH Infrastructure Program

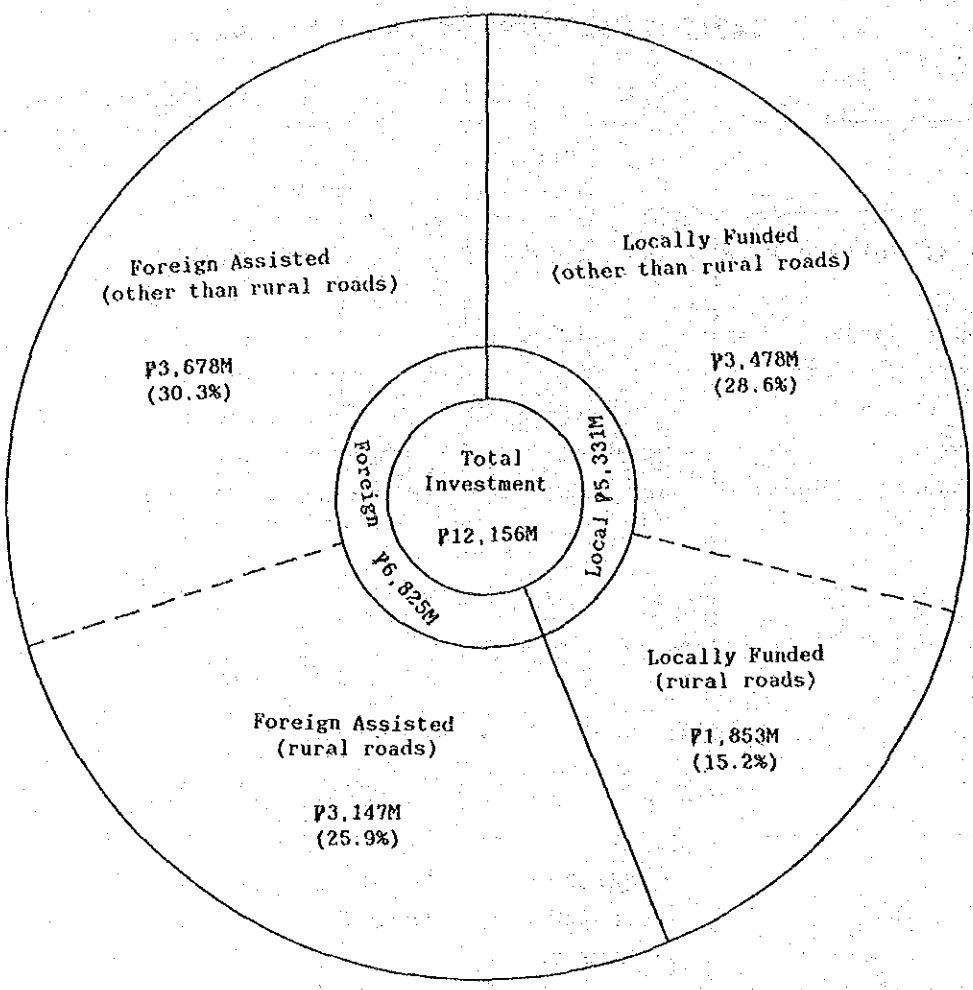


FIGURE 14.3-2 1991 HIGHWAY INVESTMENT

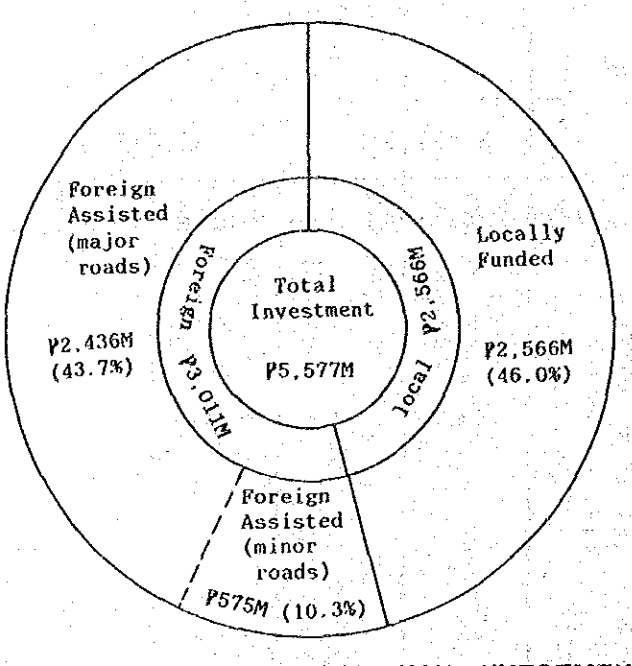


FIGURE 14.3-3 1988 HIGHWAY INVESTMENT

CHAPTER 15

IMPLEMENTATION STRATEGY AND PLAN OF THE PROJECT

The implementation strategies to be adopted for the rural road network development projects are discussed in this Section, including the following:

- Investment Size to Rural Road Development
- Balanced Investment to Regions/Provinces
- Sector Loan System
- Labor-based Construction System
- Community Participation System

Also discussed is the implementation plan which was proposed based on the following assumptions:

- Annual investment in 1991 for the project is assumed to be ₱5,000M.
- Commencement of the project implementation is expected in 1991, simultaneously in all 73 provinces.

15.1 IMPLEMENTATION STRATEGY

The following strategies will be adopted for implementation of the project:

1) Investment Size to Rural Road Development

It is assumed that this rural road development project will be commenced in 1991 after the required process of financial negotiations with international lending institutions. Therefore, the program will start after 1991 in compliance with the updated DPWH program.

As discussed in Chapter 14.3, of the total highway budget of ₱12,156M in 1991, foreign assisted projects will account for about ₱6,825 million or 56%, of which ₱3,147 million or 64% will be allotted for rural road type projects. Rural road type projects consist of road rehabilitation/improvement projects, except for those related to primary national highways and those in urban areas.

In addition to these foreign assisted projects, locally funded projects are also expected to contribute to rehabilitation/improvement of rural road type projects.

It is, therefore, assumed that an annual budget of more than ₱5000 million will be appropriated for the rehabilitation/improvement of rural road type projects (see Figure 14.3-1 and 2).

2) Balanced Investment to Regions/Provinces

The Medium-Term Philippine Development Plan 1987-1992 revealed urban/rural and regional disparities as one of the problems in the country and emphasized the promotion of balanced growth among regions. The regional development objective, therefore, is to accelerate the growth of less developed regions/areas and achieve a more balanced spatial development.

For this purpose, the National Economic and Development Authority (NEDA), the Department of Budget and Management (DBM) and the Department of Public Works and Highways (DPWH) have developed jointly the Fund Allocation Formula for Infrastructure.

The factors considered in the Formula are:

- Road condition (paved/unpaved)
- Barangay (number, average size)
- Arable land area
- Gross value added in agriculture
- Population
- Poor families falling under the poverty line
- Implementation difficulty (accessibility, terrain)

This Study intends to follow the policy of the balance investments to regions/provinces. As an example, the fund allocation to regions and provinces are shown in Table 15.1-1 in the case of the following assumptions:

Total Fund for Rural Road Development Project	₱5,000M per year
Rehabilitation/Improvement	
National Roads	₱2,000M (40%)
Provincial Roads	₱1,000M (20%)
Barangay Roads	₱1,300M (26%)
New Construction	
Barangay Roads	₱ 700M (14%)

The share of each road was divided in accordance with "Estimates on the Indicator of Needs" developed by the DPWH.

3) Sector Loan System

Rural road development projects are intended to cover a considerable number of roads with a short length, e.g., an average of 20 roads with an average road length of 6 km in one province. Therefore, the application of the usual loan system - project type loan - may not be practical for the projects.

Instead, a sector load system is recommended which is applicable to any project consisting of a considerable number of subprojects with the same purpose.

A detailed discussion of the sector load system is presented in Chapter 18.

4) Labor-based Construction System

The Medium-Term Plan stressed the adoption of an employment-oriented, rural-based strategy.

Consistent with national policies, the Study is favorably inclined to adopt a labor-based construction system to the fullest extent possible.

Chapter 21 presents the methodology for practical application of the method.

5) Community Participation System

The Medium-Term Plan emphasizes that participation will be encouraged from traditional structures like private business and non-government organizations 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 was studied along each process of project implementation from project identification to road maintenance stages.

TABLE 15.1-1 ESTIMATED FUND ALLOCATION TO PROVINCES IN 1991

(unit : million pesos)

Province	National Rd. Rehab./Impr.	Provincial Rd. Rehab./Impr.	Barangay Rd. New Const.	Barangay Rd. Rehab./Impr.	Total
Region I	150.2	79.9	28.6	111.8	370.5
Abra	12.4	9.9	2.8	12.1	37.1
Benguet	20.8	7.6	2.6	10.0	41.0
Ilocos Norte	19.4	10.5	3.9	18.5	52.3
Ilocos Sur	20.6	9.4	3.2	17.1	50.2
La Union	16.4	9.2	5.6	11.0	42.2
Mountain Province	11.8	5.0	2.1	2.9	21.8
Pangasinan	48.8	28.3	8.4	40.3	125.8
Region II	128.6	59.8	31.2	80.6	300.2
Batanes	2.2	1.0	1.6	.9	5.7
Cagayan	35.2	17.1	6.9	23.8	83.0
Ifugao	10.2	3.6	2.1	4.9	20.8
Isabela	37.4	21.5	9.0	28.7	96.7
Kalinga-Apayao	18.2	5.5	4.5	7.8	35.7
Nueva Vizcaya	15.0	8.3	2.8	11.8	37.9
Quirino	10.4	2.8	4.3	3.0	20.5
Region III	153.0	83.2	46.0	111.3	393.5
Bataan	14.4	7.1	4.7	7.9	34.1
Bulacan	29.2	16.5	4.7	23.2	73.6
Nueva Ecija	40.0	21.6	18.6	28.0	108.1
Pampanga	30.6	15.1	5.5	22.2	73.4
Tarlac	22.2	15.3	4.9	19.4	61.8
Zambales	16.6	7.6	7.6	10.6	42.5
Region IV	297.4	144.0	108.7	168.7	718.8
Aurora	17.2	7.0	21.1	8.0	53.3
Batangas	37.4	18.6	8.1	27.7	91.8
Cavite	22.4	12.5	4.8	13.9	53.6
Laguna	28.0	12.8	6.5	16.3	63.6
Marinduque	12.0	5.4	8.3	4.7	30.5
Occidental Mindoro	21.4	9.8	7.3	11.2	49.6
Oriental Mindoro	25.4	18.7	12.8	13.0	69.9
Palawan	40.4	18.3	11.4	22.7	92.8
Quezon	57.8	24.7	17.1	29.0	128.6
Rizal	19.8	8.9	6.1	13.1	47.9
Romblon	15.6	7.3	5.2	9.1	37.2
Region V	163.4	80.3	74.0	93.1	410.8
Albay	31.0	15.1	10.3	17.7	74.1
Camarines Norte	16.0	7.8	13.7	9.2	46.7
Camarines Sur	44.2	24.2	10.9	29.9	109.2
Catanduanes	14.0	6.4	7.1	5.5	33.1
Masbate	34.0	14.4	19.5	17.7	85.6
Sorsogon	24.2	12.4	12.4	13.0	62.0
Region VI	213.8	94.9	103.9	134.2	546.8
Aklan	14.8	9.4	5.9	10.6	40.7
Antique	24.0	8.7	8.4	12.6	53.7
Capiz	25.8	13.0	9.6	16.1	64.6
Iloilo	64.8	29.7	18.3	38.3	151.1
Negros Occidental	84.4	34.1	61.7	56.4	236.6
Region VII	142.0	71.2	38.2	91.2	342.6
Bohol	42.0	25.0	5.5	30.5	103.0
Cebu	60.8	27.0	10.1	37.3	135.2
Negros Oriental	35.0	15.8	19.1	21.8	91.7
Siquijor	4.2	3.4	3.5	1.7	12.8
Region VIII	139.6	60.8	66.4	78.5	345.3
Leyte	61.4	24.2	18.9	33.2	137.8
Southern Leyte	16.6	8.2	6.2	9.5	40.5
Eastern Samar	20.2	9.9	7.2	13.1	50.4
Northern Samar	21.8	9.1	16.1	11.9	59.0
Samar	19.6	9.4	17.9	10.8	57.6
Region IX	127.8	72.9	49.9	91.6	342.2
Basilan	10.4	7.7	8.9	7.5	34.5
Sulu	16.4	9.3	9.3	10.5	45.5
Tawi-Tawi	8.6	3.6	8.6	4.7	25.5
Zamboanga del Norte	33.8	22.5	8.6	25.6	90.5
Zamboanga del Sur	58.6	29.8	14.6	43.3	146.3
Region X	161.0	82.2	43.8	111.1	398.0
Agusan del Norte	14.8	6.3	6.3	9.3	36.7
Agusan del Sur	24.6	12.4	9.5	15.0	61.4
Bukidnon	47.0	25.2	5.0	33.7	111.0
Camiguin	3.2	2.0	1.4	1.8	8.5
Misamis Occidental	18.4	11.7	7.5	15.6	53.2
Misamis Oriental	31.4	14.3	7.2	24.0	76.9
Surigao del Norte	21.6	10.3	6.9	11.6	50.3
Region XI	185.8	98.6	37.9	128.1	450.4
Davao del Norte	38.0	24.3	6.6	26.6	95.6
Davao del Sur	46.2	16.4	7.3	33.6	103.5
Davao Oriental	29.6	17.6	10.0	15.1	72.3
South Cotabato	46.2	28.0	7.0	38.1	119.3
Surigao del Sur	25.8	12.3	6.9	14.7	59.7
Region XII	137.4	72.2	71.5	99.8	380.9
Lanao del Norte	23.6	9.3	15.3	16.5	64.7
Lanao del Sur	22.8	12.3	4.8	26.9	66.8
Maguindanao	25.4	13.1	31.7	17.5	87.7
North Cotabato	41.6	19.7	10.2	21.0	92.5
Sultan Kudarat	24.0	17.8	9.5	17.9	69.2
T o t a l	2000.0	1000.0	700.0	1300.0	5000.0

15.2 IMPLEMENTATION PLAN

1) Proposed Improvement Types, Road Length and Cost

For the Feasibility Study, the following improvement works were proposed, as shown in Table 15.2-1:

TABLE 15.2-1 PROPOSED TYPES OF IMPROVEMENT

Type	Existing Pavement Type	Existing Surface Condition	Proposed Type of Improvement
1. Rehabilitation	Standard or Superior	Bad or Very Bad	Improvement of Surface Condition
2. Improvement-1	Substandard	Bad or Very Bad	Improvement of Surface Condition to Standard Type
3. Improvement-2	Substandard	Good or Fair	Upgrading of Pavement Type to Standard Type
4. New Construction	Abandoned/Non-Existing		Construction of New Road
5. Widening	Carriageway is Less than the Standard		Widening of Existing Road

Identified bridges were classified either as "rehabilitation" when only improvement of a bridge is needed (bridge project only) or corresponding type of improvement of a road section when improvement of a bridge is a part of it.

For the major roads, all types of improvement works were proposed, while for the minor roads Improvement-2 and Widening Works were not considered.

The Study on road improvement in the selected four (4) pilot provinces identified a road improvement length of 1,323.0 km with a capital investment requirement of ₱1,560.1 million (see Table 15.2-2).

TABLE 15.2-2 IMPROVEMENT LENGTH AND COST BY CATEGORY

		National Road [1]			Provincial Road			Barangay Road			Total [2]		
		Existing Length (km)	Proposed Length [3] (km)	Estimated Cost [3] (MP)	Existing Length (km)	Proposed Length (km)	Estimated Cost (MP)	Existing Length (km)	Proposed Length (km)	Estimated Cost (MP)	Existing Length (km)	Proposed Length (km)	Estimated Cost (MP)
4-Pilot Provinces	IRR ≥15%	1005.2	125.7 (17.5%)	209.5	1,668.5	344.2 (20.6%)	553.7	4,488.1	231.3 (5.1%)	188.0	7,161.8	701.2 (9.8%)	951.0
	7.5% ≤IRR <15%		120.5 (17.0%)	207.2		182.3 (10.9%)	200.8		219.0 (4.9%)	201.2		521.8 (7.3%)	609.1
	Total	1005.2	246.2 (34.5%)	416.7	1,668.5	526.5 (31.5%)	754.5	4,488.1	450.3 (10.0%)	389.2	7,161.8	1,223.0 (17.1%)	1,560.4
73- Provinces	IRR ≥15%	1,6703.8	3,613.7 (21.6%)	5,921.1	28,424.6	7,428.6 (26.1%)	8,807.2	89,978.8	9,481.8 (10.5%)	8,889.6	135,107.2	20.524.2 (15.2%)	23,618.0
	7.5% ≤IRR <15%		5,727.5 (34.3%)	9,085.4		3,866.6 (13.6%)	4,299.3		9,383.3 (10.4%)	8,726.8		18,977.4 (14.0%)	22,111.5
	Total	1,6703.8	9,341.2 (55.9%)	15,066.6	28,424.6	11,295.2 (39.7%)	13,106.5	89,978.8	18,865.2 (21.0%)	17,616.4	135,107.2	39,501.6 (29.2%)	45,729.5
Average Province	IRR ≥15%	228.8	49.5 (21.6%)	81.1	389.4	101.8 (26.1%)	120.6	1,232.6	129.9 (10.5%)	121.8	1,850.8	281.2 (15.2%)	232.5
	7.5% ≤IRR <15%		78.5 (34.3%)	124.5		52.9 (13.6%)	58.9	58.9	128.5 (10.4%)	119.5		260.0 (14.0%)	302.9
	Total	228.8	128.0 (55.9%)	205.6	389.4	154.7 (39.7%)	179.5	1,232.6	258.4 (21.0%)	241.3	1,850.8	541.1 (29.2%)	526.4

Note: 1) Excluding primary national roads
2) Excluding primary national, city and Municipal roads
3) Including UNDP Project in Masbate

In proportion to these figures, the road length and construction cost for the 73 provinces was roughly estimated arriving at the length of 39,501.6 km and the cost of ₱45,729.5 million (see Table 15.2-3). The estimated length and cost for the 73 provinces are summarized in Appendix 15-1.

The average length and cost per province are 541.1 km and ₱626.4 million (see Table 15.2-2).

These road lengths are classified into two (2) types in terms of the internal rate of return (IRR), one where IRR is equal to or more than 15%, the other where IRR is between 7.5% and 15%. With regard to the 73 provinces, the road length and cost are as follows:

TABLE 15.2-3 ROAD LENGTH AND COST FOR 73 PROVINCES

Identified	Road Length Identified	Cost
IRR $\geq$ 15%	20,524.2 km	₱23,618.07M
7.5% $\leq$ IRR < 15%	18,977.4 km	₱22,111.5 M
Total	39,501.6 km	₱45,729.57M

Multipurpose Pavement

The Government is now pursuing the implementation of a multipurpose pavement project which aims to pave a low traffic road section with PCC within the central barangay zone, thus providing barangay people with a community plaza. A road section paved with PCC can be utilized not only for traffic purposes but also for community gathering, playing basketball and other sports, drying palay, etc.

The project can be implemeted by a labor-based construction method, therefore, it will create a lot of job opportunities for barangay people even in remote barangays, thus stimulating barangay economy. After the completion of the project, the road section will be utilized for various social purposes, thus social activities in a barangay will be more active and ties among barangay people will be strengthened.

In view of above, the multipurpose pavement project should be further promoted for the benefits of barangay people.

2) Implementation Phasing

As discussed in the previous chapter, the fund available for rural road improvement was roughly estimated to be ₱5,000 million per year. With the fund, the implementation period required for the 73 provinces was predicted as shown in Table 15.2-4.

TABLE 15.2-4 NO. OF YEARS REQUIRED FOR PROJECT ASSUMPTION ANNUAL BUDGET ₱5,000M

Economic Indicator	Road Length Identified	Cost	Required Years
IRR ≥ 15%	20,524.2 km	₱23,618.0M	4.7 (Phase I)
7.5% ≤ IRR < 15%	18,977.4 km	22,111.5M	4.4 (Phase II)
Total	39,501.6 km	₱45,729.57M	9.1

Within the first 5 years (Phase I), improvement of the roads which were at present evaluated IRR more than 15% will be implemented. The second 5 years (Phase II) will cover the roads with IRR of 7.5% to 15%.

It is, however, noted that roads proposed for the project will be classified into Phase I or II based not only on IRR values but also on socio-economic impact and related development program as well as fund allocated to provinces.

3) Implementation Plan

A considerable number of highway development projects will be implemented simultaneously in the provinces, e.g., locally funded or foreign assisted, and major roads or minor roads. An example of the funds allocated for those projects in an average and typical province is shown in Table 15.2-5.

TABLE 15.2-5 EXAMPLE OF PROJECT FUND IN AVERAGE PROVINCE (1991 BUDGET)

	National Total (73 provinces)	Average Province
Rural Roads		
Locally Funded	1,853.0	25.4
Foreign Assisted	3,147.0	43.1
	₱5,000.0M	₱68.5M
Other than Rural Roads (73 Provinces & Metro Manila)		
Locally Funded	3,478.0	33.9
Foreign Assisted	3,678.0	36.7
	₱7,156.0M	₱70.6M
Total	₱12,156.0M	₱139.1M

Foreign assisted rural road projects will be implemented by the Project Management Office created for the Project (see Chapter 16), while other projects, including locally funded rural roads, will be implemented following present DPWH procedures and methods.

The implementation schedule for rural road development projects is shown in Figure 15.2-1.

Projects will be projected to commence in 1991, simultaneously for all 73 provinces.

FIGURE 15.2-1 IMPLEMENTATION SCHEDULE FOR RURAL ROAD DEVELOPMENT PROJECT (73 PROVINCES)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Foreign Assisted Rural Roads	₱3,147M	Phase I (annual)						Phase II		
Locally Funded Rural Roads	₱1,853M	(annual)								
Total Budget for Rural Roads	₱5,000M	(annual fund ₱5,000M estimated)								
Total Budget for Highways	₱12,156M	₱13,575M	(not planned)							

15.3 IMPLEMENTATION PROCEDURE

The project work will take place in several distinct stages. These stages are commonly referred to as the "project cycle" to make the point that they are closely linked to each other and follow a logical progression. It is advisable to discuss the implementation procedures of the project according to the project cycle.

The implementation cycle for the rural road network development is described in Table 15.3-2 and illustrated in Figure 15.3-1. In each stage of the cycle, the responsible agencies, executing and coordinating, which will be clearly assigned, should be responsible for producing objective outputs within a designated period, which should be prepared in compliance with guidelines, criteria formats, etc. adopted for the project.

Table 15.3-1 summarizes the executing and coordinating agencies for stages from subproject identification up to construction.

It is particularly recommended in the Study that a project management office created for the project be responsible for design, tendering and construction of "Contract Type Subprojects", while the existing regional offices do so for "Administration Type Subprojects". The definition of project type is discussed in the following section.

TABLE 15.3-1 PROJECT CYCLES AND AGENCIES

	Project Cycle	Executing Agency	Coordinating Agency
1.	Subproject Identification	. Barangay Development Council	. Project Management Office
2.	Appraisal/ Prioritization of Subprojects	. City/Municipal Development Council . Provincial Development Council . Regional Development Council	. City Municipal Office . DPWH District Office . DPWH Regional Office . Project Management Office
3.	Final Approval of Subprojects	. NEDA Board	. DPWH Central Office . Project Management Office
4.	Fund Preparation	. NEDA	. DPWH Central Office . Project Management Office
5.	Design		
	Contract Type Subprojects	. Project Management Office	(. Professional Consultant)
	Administrative Type Subprojects	. Regional Office	. District Office . City/Municipal Office
6.	Tendering		
	Contract Type Subprojects	. project Management Office	-----
	Administration Type Subprojects	. Regional Office	-----
7.	Construction		
	Contract Type Subproject	. (Professional Contractor)	. project Management Office
	Administrative Type Subprojects	. Community Construction Team	. District Office

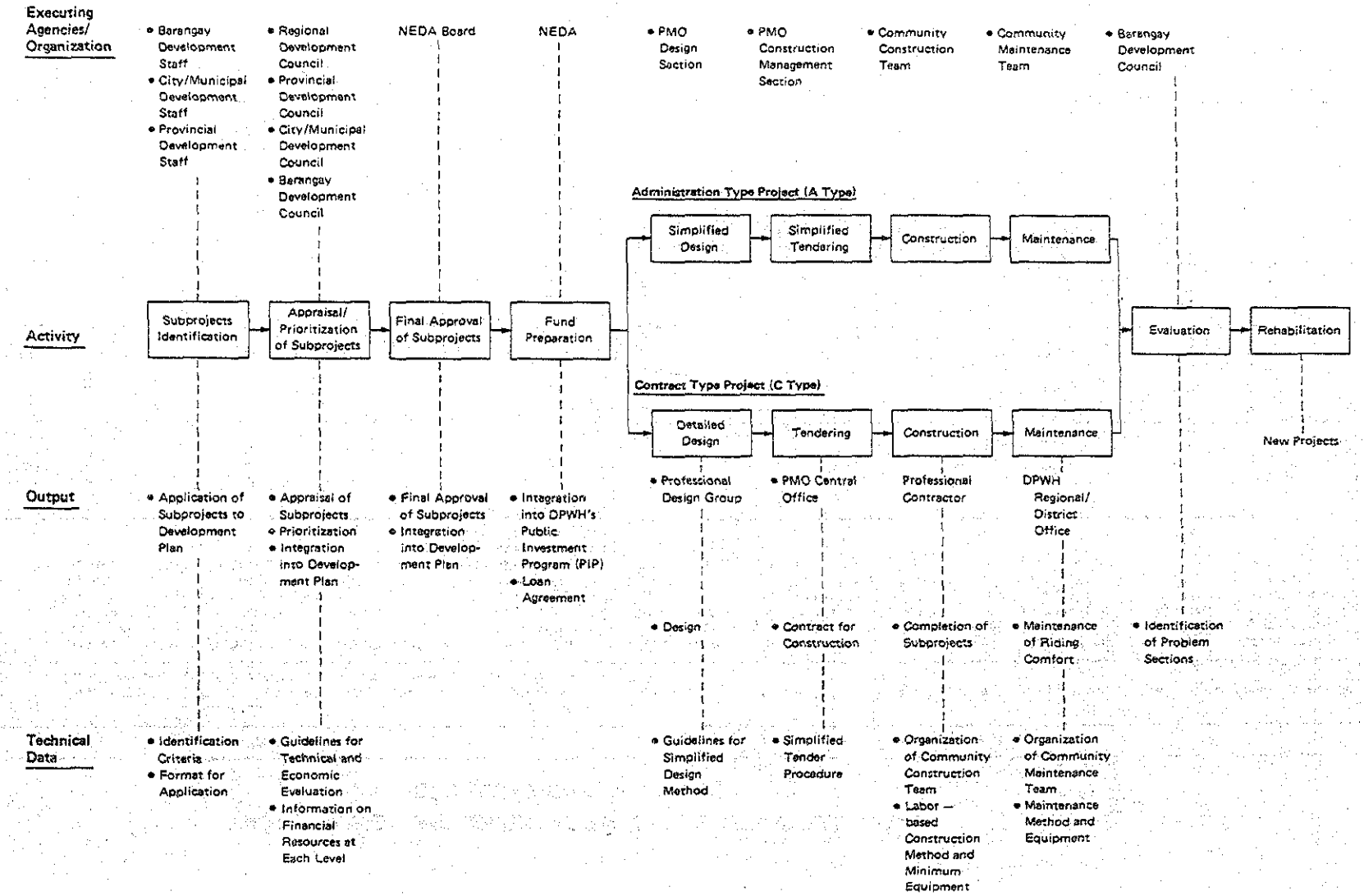
TABLE 15.3-2 IMPLEMENTATION CYCLE OF RURAL ROAD DEVELOPMENT PROJECT

	National/Program Level				Project Level					
Project Cycle	Sub-Project Identification	Appraisal/ Prioritization of Sub-Projects	Final Approval of Sub-projects	Fund preparation	Design	Tendering	Construction	Maintenance	Evaluation	Rehabilitation
Main Works	.Data collection .Site investigation .Preparation of Application Format	.Technical and Economic Evaluation .Prioritization in Comparison with Fund	.Final Decision	.Preparation of DPWH's Public Investment Program (PIP) .Loan Negotiation	.Preparation of Design .Cost Estimate	.Specification .Contract Documents .Qualification of contractors	.Construction Schedule and Operation .Quality Control	.Standard and Schedules .Maintenance Operation and Equipments	.Periodic Monitoring .Evaluation Record	.Problem Definition .Potential Program Solutions
NEDA Board			●	●						
Regional Development Council		●								
Provincial Development Council		●								
City/Municipal Development council		●								
Barangay Development Council	●								●	
DPWH Central Office			○	○						
Regional Office		○			○(A Type) ●(A Type)	●(A Type)	○(A Type)	●(C Type) ●(C Type)		
District Office		○			●(A Type)		○(A Type)	●(C Type)		
City/Municipal Office		○			●(C Type)	●(C Type)	○(C Type)			
Project Management Office	○	○	○	○						
Professional Contractor							●(C Type) ●(A Type)			
Community Construction Team										
Community Maintenance Team								●(A Type)		
Technical Data	.Identification Criteria .Format for Application	.Guidelines for Technical and Economic Evaluation .Information on Financial Resources at Each Level			.Guidelines for Simplified Design Method	.Simplified Tender Procedure	.Organization of Community Construction Team .Labor-Intensive Construction Method and Minimum Equipment	.Organization of Community Maintenance Team .Maintenance Method and Equipment		

NOTE: ● Excuting Agency
○ Coordinating Agency

C Type : Contract Type Project
A Type : Administrative Type Project

FIGURE 15.3-1 IMPLEMENTATION CYCLE OF RURAL ROAD DEVELOPMENT PROJECT



15.4 PROJECT TYPES

As the Medium-Term Plan emphasizes, greater involvement of the people at the grass-roots level in project implementation will be promoted. In line with this policy, the Study recommends the system that small-size subprojects be constructed by community construction teams particularly organized for the specified subprojects which are called "Administration Type Subprojects".

The administration type subprojects are defined as follows:

1) Detailed topographic survey and geotechnical investigation may not be required for detailed design.

2) Detailed engineering can be done without expert engineering knowledge.

3) Construction work is relatively easy and requires only ordinary construction equipment.

4) project size in term of construction cost is relatively small.

However, administration type subprojects should be selected taking into consideration the capacity of the executing agencies, the regional and district offices, which are responsible for detailed engineering, tendering and construction supervision of the projects. The capability of community construction teams who are responsible for actual construction work should be also considered.

projects other than administration type subprojects are called "Contract Type Subprojects" which are proposed to be implemented under jurisdiction of the project management office.

CHAPTER 16
PROJECT INSTITUTION

16.1 PRESENT ORGANIZATION OF THE DPWH

The Department of Public Works and Highways (DPWH) will be the implementing agency of the project.

Under Executive Order No. 710, dated 27 July 1981, the Ministry of Public Works and Highways (MPWH) was created. However, under Executive Order No. 124, dated 30 January 1987, MPWH was reorganized in accordance with the provisions of this Executive Order. With the adoption of a new Constitution which provides for a presidential form of government, the MPWH is now called the Department of Public Works and Highways (DPWH).

1) Central Office

The DPWH is headed by a Secretary who is assisted by five Undersecretaries and six Assistant Secretaries. In the Department proper, there are six Service Offices -- Planning, Comptrollership & Financial Management, Administration & Manpower Management, Legal, Monitoring & Information, and Internal Audit; and five Bureaus - Design, Construction, Maintenance, Equipment, and Research & Standards (see Appendix 16-1, Figure 1).

The five bureaus have the following major functions:

- Bureau of Design

  To ascertain that all government infrastructure project implementation plans and designs are consistent with current standards and guidelines.

- Bureau of Construction

  To provide technical services on construction works for infrastructure projects and facilities.

- Bureau of Maintenance

  To provide technical services on the maintenance and repair of infrastructure projects and facilities.

- Bureau of Equipment

  To provide technical services on the management of construction and maintenance equipment and ancillary facilities.

- Bureau of research and Standard

  To develop and set effective standards and reasonable guidelines to ensure the safety of all infrastructure facilities in the country and to assure efficiency and proper quality in the construction of government public works. In pursuit of this task, the Bureau will engage in research and development on all major areas pertinent to infrastructure development.

2) Regional Offices

Fourteen (14) regional offices are responsible for highways, flood control and water resource development systems and other public works within the region. Each regional office is headed by a regional director who is responsible for efficiently and effectively carrying out the duties and responsibilities of the regional office. Toward this end, and in line with the policy of decentralization, within his defined powers, he exercises functional and administrative supervision over district offices within the region, including the authority to commit their resources and personnel to integrated province or city-wide development thrusts (see Appendix 16-1, Figure 2).

The duties and responsibility of the regional offices are as follows:

a) Undertake and evaluate the planning, design, construction and works supervision functions of the Department for the abovementioned infrastructure within the region;

b) Undertake the maintenance of the abovementioned infrastructure within the region and supervise the maintenance of such local roads and other infrastructure receiving national government financial assistance as the Secretary may determine;

c) Ensure the implementation of laws, policies, programs, rules and regulations regarding the abovementioned infrastructure as well as all public and private physical structures;

d) Provide technical assistance related to their functions to other agencies within the region especially the local government units;

e) Coordinate with other departments, agencies, institutions and organizations, especially local government units within the region in the planning and implementation of infrastructure projects;

f) Conduct continuing consultations with the local communities, take appropriate measures to make the services of the Department responsive to the needs of the general public, compile and submit such information to the central office, and recommend such appropriate actions as may be necessary.

g) Perform such other related duties and responsibilities as may be assigned or delegated by the Secretary or as may be required by law.

The Department will retain and have such project management offices as may be required which will be under the supervision and control of the appropriate regional director, unless otherwise determined by the Secretary for reasons of supra-regional scope, magnitude and multi-functional coverage.

The regional equipment services, including regional depots and area shops are hereby reorganized to undertake the management, repair, maintenance and rehabilitation of construction and maintenance equipment. Each depot or shop will be operated, to the extent practicable, as a profit center. The regional equipment services are under the administrative supervision of the regional director and the technical supervision of the Bureau of Equipment.

In general, a regional office consists of the following seven (7) divisions:

- Planning and Design Division
- Construction Division
- Maintenance Division
- Material and Quality Division
- Financial Division
- Administrative Division
- Comptrollership Division

3) District Offices

There is a district office in each of the provinces and cities throughout the country headed by a district engineer appointed by the Secretary. A province or city may, however, be divided into two (2) or more engineering districts, upon determination and issuance of an administrative order by the Secretary. The district office is responsible for all highways, flood control and water resource development systems, and other public works within the district. The district engineer of or within a province or city is accountable for the efficient and effective conduct of the duties and responsibilities of the district office of which he is the head. Within his defined powers, he exercises functional and administrative supervision over district operations, including the authority to recommend that field resources and personnel be committed to integrated district-wide development thrusts (see Appendix 16-1, Figure 3 and 4).

The duties and responsibilities of the district offices are as follows:

a) Undertake and evaluate the planning, design, construction and works supervision functions of the Department for the abovementioned infrastructure in the district.

b) Undertake the maintenance of the abovementioned infrastructure within the district and supervise the maintenance of such local roads and other infrastructure receiving national government financial assistance as the Secretary may determine;

c) Coordinate with other departments, agencies, institutions and organizations, especially local government units within the district in the planning and implementation of infrastructure projects;

d) Provide technical assistance to other agencies at the local level on public works planning, design, construction, maintenance and other engineering matters including securing assistance from the regional office or, through the same office, assistance from the Department proper or Bureaus;

e) Conduct continuing consultations with the local communities, take appropriate measures to make the services of the Department responsive to the needs of the general public, compile and submit such information to the regional office and recommend such appropriate actions as may be necessary;

f) Perform such other related duties and responsibilities as may be assigned or delegated by the Secretary or as may be required by law.

The district office, in general, consists of the following eight (8) sections:

- Planning and Design Section
- Construction Section
- Materials Quality Control Section
- Building code Section
- Administrative Section
- Finance and Management Section
- Comptrollership Section

The standard works and the average number of personnel of these sections are presented in Appendix 16-2.

16.2 COMMON PROBLEMS FACING PROJECT INSTITUTIONS

The outcome of development projects is dependent on the quality of the institutions responsible for projects. Among the problems that arise in executing projects, institutional or managerial difficulties (the terms are used interchageably) are frequently cited as the most important causes. Developing strong institutions, then, is a primary means of ensuring efficient implementation of projects.

Institutional problems do not, of course, always occur in the same form; they tend to change over time and to different sectors. They are sometimes identified in superficial terms, which may misdirect the search for solutions. Technical and managerial competence must be improved gradually to bring about 1) effective policy planning, 2) work programming, 3) financial management, 4) personnel management and 5) all the other essential functions of modern organizations.

In this chapter, common problems facing project implementation are reviewed as cited in the report entitled "Investing in Development" published in 1985 by the World Bank.

1) Policy Environment

High-level government interest has often declined sharply once project funds have been disbursed or even once they are committed, and project managers find themselves starved for operating resources. Shifting political forces - or even a change of individuals at the ministerial level - can also drastically affect the fortunes of a project and the capacity and morale of its staff. Sometimes, government intervention or controls may interfere with the ability of managers to carry out their responsibility, especially when intervention or controls may be inconsistently applied, often by several different agencies. Therefore, the project implementation should be supported with the sustained effort of high-level government official.

2) Complex Objectives

The means of reaching the objective in social or people-oriented projects are usually complex and uncertain. In some cases, the objectives facing institutional managers may be specific enough, but there may be too many objectives. A common feature of these projects is that large numbers of components, often well beyond the coordinating or executing capacities of the agencies concerned, are tacked onto projects in an attempt to address all these objectives simultaneously.

The project is planned to be implemented with the community participation system adopting the labor-intensive construction method. However, it should be clearly recognized that the objective of the project is the successful completion of road development or improvement.

3) Overemphasis on Short-Term Implementation and Neglect of Postinvestment

The implementation program of the project should be established in compliance with the institutional capability of the agencies. The overabundant expectation that the project can be completed in a short term should not be made.

There is often greater concentration on the investment phase than on the subsequent phase of maintenance. A consequence of neglecting the postinvestment phase of a project is that too little attention is paid, in institutional design, to the costs and benefits of road maintenance.

In this project, specific stretches of road are planned to be subcontracted to private sector maintenance companies, with specified standards and rates of payment. Another approach is that road maintenance of some stretches still remains the responsibility of a public agency but is allocated to foremen and crews from "Training Production Units" who are responsible.

4) Management and Staff Development

As a general rule, creating new organizations in the field where old ones are already in place should be done sparingly. Instead, maximum emphasis needs to be placed on improving the capacity of existing line agencies, with independent project units being used exclusively to develop new types of activity, to coordinate activities or to serve as a training ground for agency staff.

The management and staff development is important to the effective functioning of project institutions. A shortage of managers and skilled staff are an almost universal characteristic of underdevelopment. The primary issue is incentives - for all staff, but particularly for managers and technicians whose performance has the most decisive impact on institutional efficiency. Managers and staff respond to work incentives as well as material incentives, to being given responsibility, to being judged fairly on their performance and to working in a good institution.

Management and staff need training and skill development. The need for skilled people remains urgent, and so the search for training strategies relevant to institutional needs must continue.

Recently, "Action-Learning" or "Action-Research" approaches to training as well as on-the-job training have been experimented with.

For complex projects, specialized skills from outside the public sector, or from outside the country, may be needed. Consultants who are familiar with the country and can provide the mix of reputation, technical skills and international experience that is needed, should be selected. When expatriate consultants are used, two additional but important tasks should be assigned to them: helping to build up a local consultancy and training local officials as counterparts to the foreign advisor.

5) Improving Management Controls

Properly organized financial management can form the basis of a streamlined management information system. Careful design of such a management information system with a well-established accounting function at its core, clear definition of the scope of management's decision making authority, and set procedures and criteria for those decisions that lie outside management's control are essential ingredients for efficient management of projects.

Especially, strict programming of field work, careful record keeping and debriefing and close managerial control within an administrative structure of clearly defined responsibilities can greatly contribute to improvement of discipline and morale of personnel engaged in projects.

6) Implementation Schemes

In some projects, it may be preferable to embark on a series of pilot projects, to be expanded according to a set timetable if specified results are achieved, rather than on a large project with its heavier institutional demands.

An alternative to such pilot projects is to subcontract small sub-projects to community groups, with the government providing funds and technical assistance without major bureaucratic commitment.

Another variant is to include in a project an experimental component in which new approaches can be tested.

16.3 PROPOSED PROJECT INSTITUTION

1) Principles in Organizing

The review of current institutional problems in the foregoing section suggests the fundamental ideas on establishing institutional organization for project implementation. Based on these ideas, the following principles were employed in proposing the project institution:

- To minimize creation of new organizations in order to avoid confrict with existing agencies/offices.
- To establish only one project management office as the coordination agency.
- To strengthen or improve a part of the existing organization of line agencies, particularly that of regional offices and district offices, to cope with implementation of this special project.
- To adopt the "Experimental Component Implementation Scheme" in which new approaches in terms of both implementation method and technical aspects can be tested.
- To create "Community Construction Units" to inspire participation of community people in the project and to generate job opportunities.
- To employ the "Action-Learning System" to foster skilled staff.

2) Proposed Organization

A project management office for the rural road development project is proposed to be newly 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 that 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 "Contract Type Projects (C-Type Projects)" (see Figure 16.3-1).

The organization of existing regional offices, consisting of seven (7) divisions, 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.

These newly created rural road development divisions and sections will be directly responsible for conducting topographic survey and soil investigation, preparing

detailed engineering, tendering, arranging and maintaining construction equipment operational and technical guidance and construction supervision of "Administration Type Projects (A-Type Projects)" (see Figure 16.3-1).

3) Organization of Project Management Office

An organization similar to the existing project office such as the Philippine-Japan Highway Loan Office is proposed for the Project Management Office for the rural road development project.

The office will consist of four (4) divisions: Planning & Design, Construction, Financial and Administrative. Each division will have two (2) or three (3) sections assigned for special tasks (see Figure 16.3-2).

The number of staff and personnel should be decided taking into consideration the magnitude of assigned works which is estimated to be about 3,147 million pesos in 1991 (only foreign assisted rural road projects) including C-type (assumed 80% or 2,500 million pesos) and A-type contracts (assumed 20% or 650 million pesos) projects.

The rural road development divisions and sections newly created in the regional offices and district offices respectively, could have three (3) sections: Planning, Design and Construction, as illustrated in Figure 16.3-2. On average, the division in a regional office may handle about P50 million in 1991 which covers only A-type projects (assuming 20% of foreign assisted rural road projects), while a section in a district office may manage 9 million pesos in the same year.

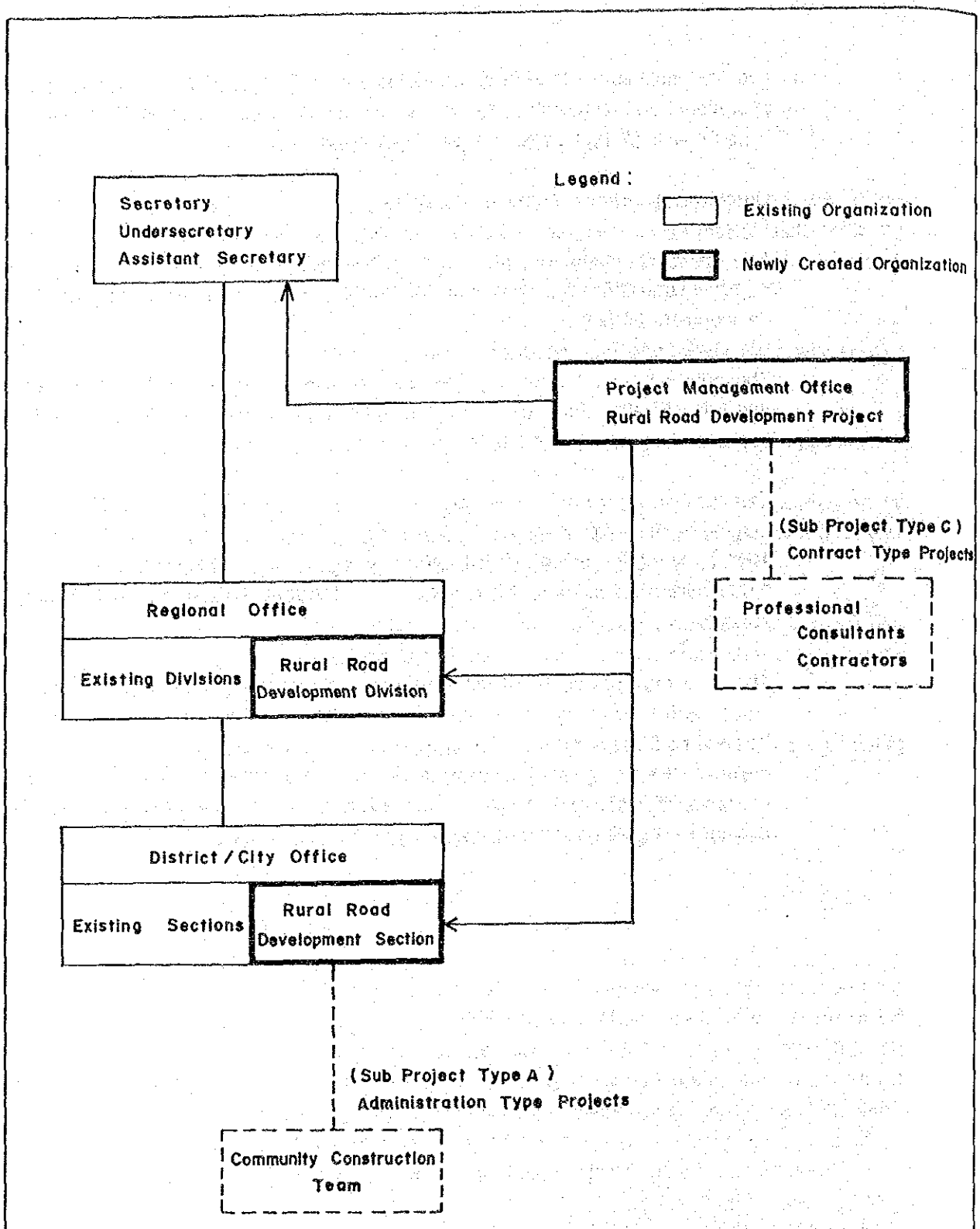


FIGURE 16.3-1 PROPOSED ORGANIZATION FOR RURAL ROAD DEVELOPMENT PROJECT

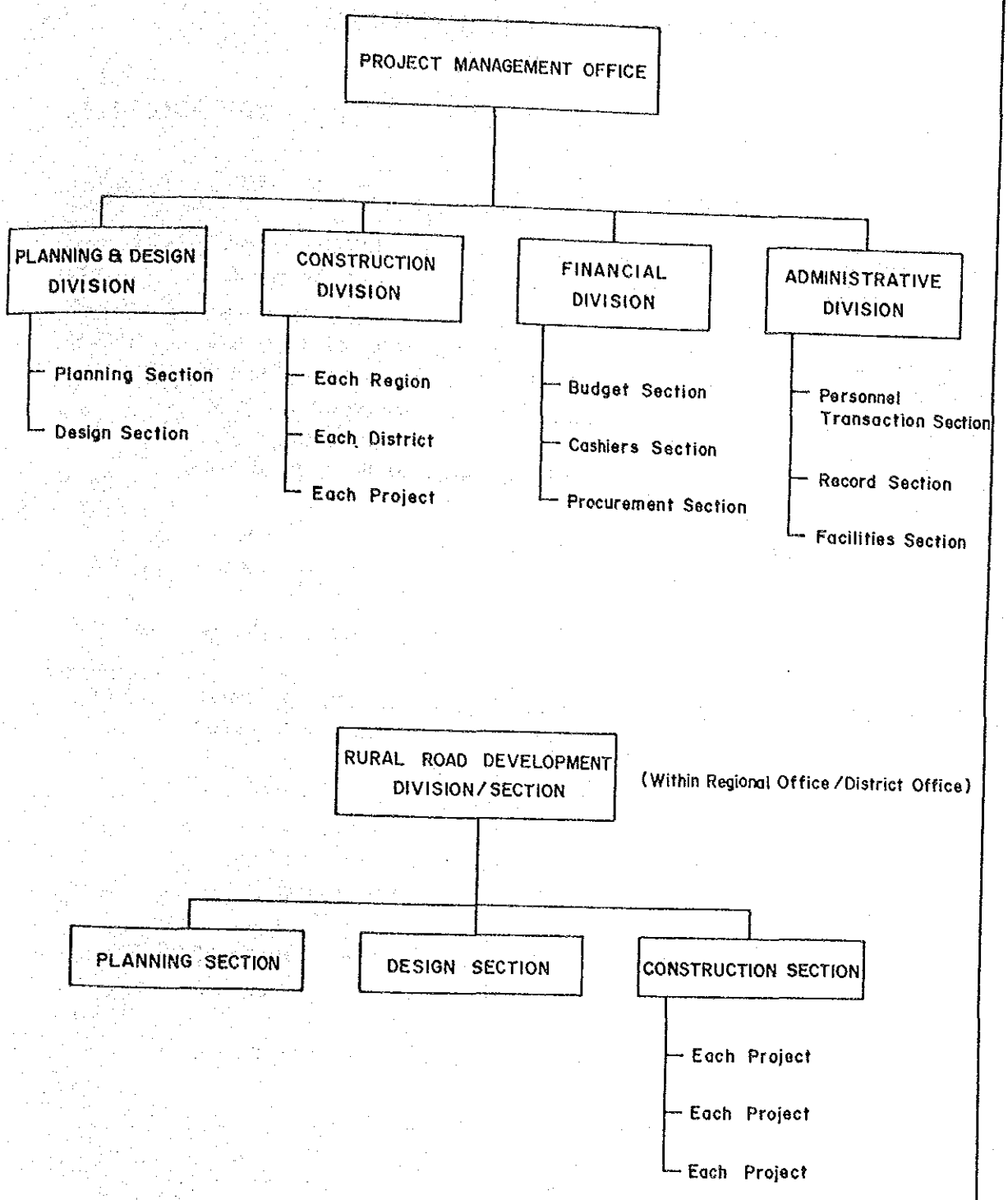


FIGURE 16.3-2 PROPOSED ORGANIZATION CHART FOR PROJECT MANAGEMENT OFFICE AND DIVISION

CHAPTER 17

SUBPROJECT IDENTIFICATION

17.1 PRESENT CRITERIA FOR SUBPROJECT IDENTIFICATION

1) Process

In line with DPWH operational policy to encourage greater participation of the people in infrastructure development, the so-called bottom-up project selection process as shown in Figure 17.1-1 is applied to initial identification and listing of projects for inclusion in the DPWH infrastructure program. Accordingly, subprojects are initially identified by barangay/community, then assessed/reviewed successively by the Municipal Development Council, the Provincial Development Council and the Regional Development Council and finally integrated/consolidated in the regional proposal for inclusion in the DPWH infrastructure program.

Sometimes in foreign assisted projects, the subproject identification is conducted jointly by consultants and local government unit/DPWH/DLG staff.

2) Identification Criteria

Department Order No. 17 as amended, Series of 1982, prescribes the following criteria for project acceptability:

- The project must be economically feasible.
- The project must be technically sound.
- The project must be included as a priority project in the Regional Development Investment Program.

Specifically for barangay roads, the guidelines and criteria for selection are prescribed in Department Order No. 4, Series of 1987, as follows:

a) Improvement of Existing Barangay Roads

- The barangay road project proposed must be included in the municipal development plan and be recommended by the Municipal Development Council.
- The road must be a classified barangay road and included in the official list of barangay roads of the Ministry.
- The road must be in a poor state that requires improvement.
- The road should connect a populated cluster of at least three barangays to another road of equal or higher standard and in better condition.

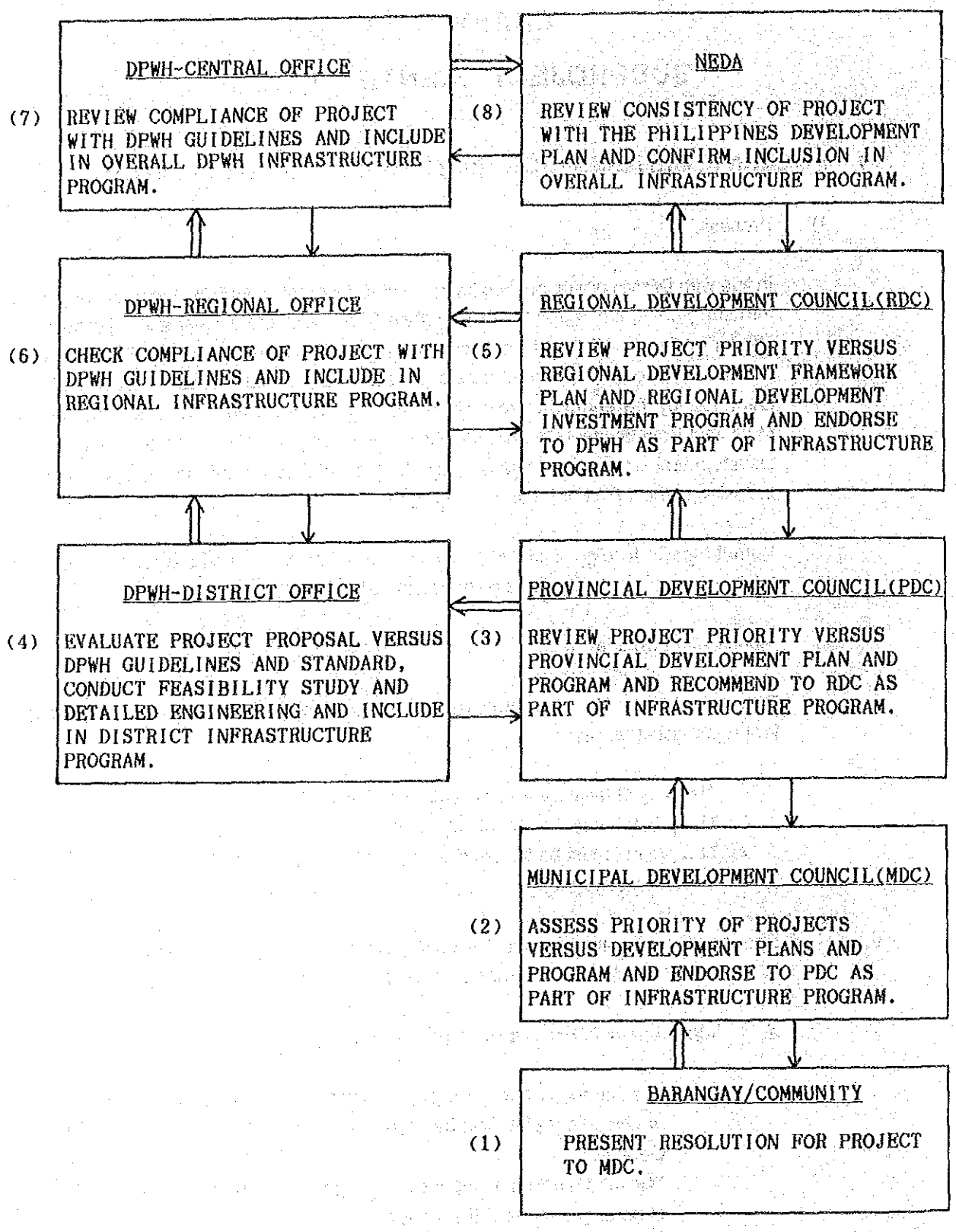


FIGURE 17.1-1 BOTTOM-UP PROJECT SELECTION PROCESS

- The road must provide road connection between production and processing areas, population concentrations and consumption centers/take-off points for surpluses.
- The road must not be less than 3.0 km long and not less than 5.0 km distant, along its entire length, from any adjacent road, except where there exists a wide body of water, a mountain or any other physical barrier in between.
- The road should promote continuity in the existing road network.

b) Construction of New Barangay Roads

- The barangay road project proposed must be included in the municipal development plan and be recommended by the Municipal Development Council.
- The road should connect a populated cluster of at least three barangays to another road of equal or higher standard and in better condition.
- The road must provide road connection between production and processing areas, population concentrations and consumption centers/take-off points for surpluses.
- The road must not be less than 3.0 km long and not less than 5.0 km distant, along its entire length, from any adjacent road, except where there exists a wide body of water, a mountain or any other physical barrier in between.
- The road should promote continuity in the existing road network.

In the IBRD-assisted Rural Roads Development Program, the following project identification criteria were adopted:

- The road must be functionally classified as either a secondary road (defined as a road linking municipalities with each other or to the provincial capital or to the primary network) or as tertiary road (defined as a road linking barangays to the municipal towns and to the primary or secondary road network).
- Committed projects are excluded.
- Roads which need no improvement other than ordinary routine and periodic maintenance, particularly regravelling, are excluded.
- The road must primarily serve the smallholder farming sector.
- The road must exceed 3 km in length.
- The road must not be located within 5 km of an existing parallel road.

17.2 PROPOSED CRITERIA FOR SUBPROJECT IDENTIFICATION

Based on the findings from the study in the pilot provinces as well as a review of the present system, the following identification criteria are proposed:

1) Procedure

a) Subprojects should be initially identified at barangay/municipal level in conformity with DPWH policy.

b) At the provincial level, the following activities should be conducted:

- Formulation of major road network in the province
- Review of proposed projects versus the identification criteria
- Proposal of additional projects if necessary from the aspect of overall provincial road network development, e.g., construction/improvement of missing/substandard link necessary to complete the major road network
- Consolidation/adjustment of projects and preparation of the list of candidate projects for appraisal/rating

2) Formulation of Major Road Network

To attain a systematic development of a road network, it is necessary to draw up the major road network (basic road network) in the province based on functional road classification. A major road network is basically composed of major interprovincial roads and major intraprovincial roads linking municipal towns with each other, from which minor roads branch off. The criteria for formulation of the major road network is discussed in Section 7.3.2 and exemplified in Chapters 10 to 13 for the pilot provinces.

3) Application Format

Table 17.2-1 shows the proposed format for application. These data are used not only for subproject identification but also for succeeding subproject appraisal/prioritization.

4) Identification Criteria

Table 17.2-2 shows the proposed criteria for subproject identification.

Each subproject should have independent effects and be homogeneous in terms of characteristics and function. If necessary, proposed project(s) should be integrated or subdivided.

TABLE 17.2-1 PROPOSED FORMAT FOR APPLICATION

SUBPROJECT PROPOSAL FORM

1. Name of Road _____
2. Location : Province _____ City/Municipality _____
3. Administrative Classification of Project Road _____
4. Total Length _____km
5. Road Data

Station	Length of Sub-section (km)	Terrain	Cross-Section		Surface Type	Surface Condition	Possibility of Rehabilitating by AC Overlay	Flood Section		Length of Steep Gradient Section (m)	Remarks
			Carriageway (m)	Shoulder (m)				Length (km)	Water Depth (m)		
–											
–											
–											
–											
–											

6. Bridge Date

Station	Bridge Type	Length (m)	Width (m)	Structural Condition	Proposed Bridge Length (m)	Remarks
–						
–						
–						
–						
–						

7. Traffic Data (omissible for minor road)

	Present Traffic	Potential Traffic Diverted	Total
Car/Van			
Jeepney			
Bus			
Truck			
Total			

Date of Survey _____
Name of Road from which diversion is expected _____

8. Socio-economic Date (omissible for major road, except average household income)

	Total for entire road
Population Served	
Cultivated Area Within Road Influence Area (ha)	
Average Household Income per Month (Peso)	

9. General Remarks _____

Note: Attach map indicating general location of proposed project preferably in 1:50,000 topographic map.

TABLE 17.2-1 (Continued)

Instruction for subproject Proposal Form

3. Administrative Classification of Project Road : National, Provincial, City, Municipal, Barangay

5. Road Data

Project roads shall be divided into subsections, each of which is homogeneous in terrain, cross-section, surface type and condition.

Terrain

Flat	:	Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars.
Rolling	:	Any combination of grades and horizontal and vertical alignment causing heavy vehicles to reduce their speed substantially below that of passenger cars, but not causing heavy vehicles to operate at crawl speed for any significant length of time.
Mountainous:		Any combination of grades and horizontal and vertical alignment causing heavy vehicles to operate at crawl speed for significant distances or at frequent intervals.

Surface Type

PCC	:	Portland Cement Concrete Pavement
AC	:	Asphalt Concrete Pavement
BST	:	Bituminous Surface Treatment
G	:	Gravel Surface
E	:	Earth Road

Surface Condition

Good	:	No potholes or rutting or corrugation. Less than 5 potholes per 1000 meters. Cracking which does not affect driving condition may be ignored.
Fair	:	More than 5 but less than 20 potholes per 1000 meters and/or slight cracking and/or rutting and/or corrugated (less than 50% of the section length). Passenger car speed will exceed 30 km per hour.
Bad	:	More than 20 potholes per 1000 meters and/or slightly rutted and/or corrugated (more than 50% of the section length) and/or corrugated over approximately the entire length. Pavements, if any, starting to break up. Maximum comfortable travel speed (car) is 30 km/hr.
Very Bad	:	Pavement breaking up and gravel surface deteriorated into numerous potholes. Just passable for cars. Maximum comfortable travel speed (car) is about 20 km/hr.
Impassable	:	Impassable to motorized vehicles at all times, or in the wet season, or non-existing.

Possibility of Rehabilitating by AC Overlay

Yes	:	Subgrade, subbase and drainage are in sound condition and pavement distress is primarily caused by traffic and by surface course material.
No	:	Other than above

Length of Steep Gradient Sections

Steep gradient section is defined as a portion of a road where motorized vehicles cannot climb up in muddy condition.

6. Bridge Data

Bridge Type

Steel Bridge
Concrete Bridge
Bailey Bridge
Timber Bridge
Concrete Spillway
Ford

Structural Condition

Good	:	Bridges that have been carrying normal traffic for a longer length of time, no sign of distress/deterioration and their load carrying capacity is considered adequate; no work or improvement to be done.
Fair	:	Bridges that show signs of deterioration on the superstructure and substructure such as spalling on concrete deck, light cracks on concrete surfaces, rusty steel trusses, scouring on piers, damaged slope protection.
Bad	:	Bridges that show signs of heavy deterioration on the structure such as showing heavy longitudinal cracks/random cracks, splitting of concrete at tension reinforcement level, heavy spalling of concrete surfaces, exposed rusty reinforcing bars at girders and bridges that are extensively damaged and structurally unsafe for vehicular traffic.
Very Bad	:	Bridges incapable of carrying future traffic, structurally and hydraulically deficient, and liable to collapse.

TABLE 17.2-2 PROPOSED CRITERIA FOR SUBPROJECT IDENTIFICATION

A. One or more of the following conditions should be met:

	Major Road	Minor Road
(1) Existing Link		
- Carriageway Width	Below 6.0 meters	-
- Pavement Type	Inferior to recommended type (Table 18.1-2)	Inferior to gravel
- Surface Condition	Bad or worse	Bad or worse
(2) New Link	Impassable/ Non-existing	
(3) Bridges	Ford Spillway Timber bridge Bailey bridge	Ford Spillway in structural-unsound condition Timber bridge Bailey bridge serving AADT more than 300

B. (1) In case of major road presently in good/fair condition, AADT in the opening year should be more than 150.

(2) In case of major road presently in bad or worse condition, AADT in the opening year should be more than 100.

(3) In case of minor road, population served per km of road should be more than 300.

CHAPTER 18

SUBPROJECT APPRAISAL/PRIORITIZATION

18.1 TECHNICAL EVALUATION

Subprojects should be technically sound in preliminary design and cost estimate. This Section discusses the procedure for appropriate design and cost estimate.

1) Design Concept

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

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

2) Type of Improvement

The road improvement works are categorized into five types as shown in Table 18.1-1.

TABLE 18.1-1 TYPE OF IMPROVEMENT

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

3) Pavement Type

The pavement types commonly used in the Philippines are as follows:

- Crushed gravel surfacing (Gravel)
- Double bituminous surface treatment (DBST)
- Bituminous macadam pavement (BMP)
- Asphalt concrete pavement (AC)
- Portland cement concrete pavement (PCC)

Based on the discussion described in Section 7.4.2 6), the recommendation for the selection of pavement type was made as shown in Table 18.1-2. It should be noted that, since pavement performance depends greatly on various factors such as traffic loading, roadbed soil, construction materials, drainage, shoulder design, etc., Table 18.1-2 shows the standard type applicable under normal conditions in the Philippines.

TABLE 18.1-2 RECOMMENDED TYPE OF PAVEMENT

AADT in Opening Year	Recommended Type of Pavement
Over 1,000	PCC
400 - 1,000	AC
200 - 400	BMP/DBST[1)]
Under 200	BMP/DBST[1)] for Primary Major Roads with AADT > 100 Gravel for Other Roads

Note: 1) DBST is applicable under the following conditions:
- m (layer drainage coefficient)[2)] = 0.9, CBR $\geq$ 10
- m (do) = 1.0, CBR $\geq$ 8

Otherwise, BMP is recommended.

2) Recommended m value is given as follows:

Quality of Drainage	Percent of Time Pavement Structure is Exposed to Moisture Levels Approaching Saturation			
	Less than 1%	1-5%	5-25%	Greater than 25%
Excellent	1.40 - 1.35	1.35 - 1.30	1.30 - 1.20	1.20
Good	1.35 - 1.25	1.25 - 1.15	1.15 - 1.00	1.00
Fair	1.25 - 1.15	1.15 - 1.05	1.00 - 0.80	0.80
Poor	1.15 - 1.05	1.05 - 0.80	0.80 - 0.60	0.60
Very Poor	1.05 - 0.95	0.95 - 0.75	0.75 - 0.40	0.40

4) Construction/Replacement of Bridges

The recommended improvement criteria are shown in Table 18.1-3.

TABLE 18.1-3 IMPROVEMENT CRITERIA FOR BRIDGES

Existing Bridge Type	Proposed Improvement	
	Major Road	Minor Road
Ford Crossing	2-lane Permanent Bridge	Carriageway width in abutting road section 4.0 m : 1-lane Spillway[1)] Carriageway width in abutting road section 6.0 m : 2-lane Spillway[1)]
Spillway	2-lane Permanent Bridge	No Improvement[2)]
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 timber bridges.

2) When the existing spillway is structurally sound and traffic disturbance is estimated less, the existing spillway can be utilized. Under other conditions, a permanent bridge should be planned in accordance with the criteria for timber bridges.

5) Special Treatment

Special considerations should be given to steep gradient sections and flood sections, where otherwise all-weather access is not ensured for motor vehicles.

For steep gradient sections with gravel surfacing where motor vehicles have difficulty in climbing up due to slippery road surfaces during the wet season, partial paving with PCC is recommended (refer to Figure 9.4-6 (6)).

In flood sections, grade raising is required. Embankments with slope protection by grouted riprap against scouring are recommended (refer to Figure 9.4-6 (6)).

6) Construction Cost Estimate

Construction costs vary depending on various factors such as type of improvement, existing and proposed pavement types, terrain, etc. In order to give the guideline for cost estimates necessary for project evaluation and budgetary purposes, the results of the studies made in the pilot provinces were analyzed and summarized in the form of a table. Table 18.5-7 shows the approximate road construction cost per kilometer by improvement type, carriageway width and terrain, while Table 18.5-8 shows the average additional cost necessary for grade raising in flood sections. Table 18.5-9 shows the approximate bridge construction cost by structure.

7) Procedure for preliminary design and cost estimate

A simplified method for preliminary design and cost estimate was developed based on the above discussion. It is incorporated in the proposed procedure of subproject evaluation/rating presented in Section 18.5.

18.2 ECONOMIC EVALUATION

18.2.1 Analysis of Evaluation Results in the Pilot Provinces

Subprojects are in general short in length and numerous in number. It will be quite costly and time consuming to conduct a detailed feasibility study for each subproject. To facilitate the economic evaluation, the evaluation results in the pilot provinces were statistically analysed with the objective of developing a series of estimation models to be used for estimating the economic indicators based on easily obtainable data. The analysis was made on the following five subjects:

	Variable to be estimated	Given variables	Analysis method
(1)	Traffic benefit	A set of road data	Quantification theory, class 1
(2)	Development benefit	A set of road/ economic data	Quantification theory, class 1
(3)	AADT in minor road	Province type, population and cultivated area	Regression analysis
(4)	Maintenance cost savings	Traffic benefit	Regression analysis
(5)	Economic internal rate of return	Benefit cost ratio	Regression analysis

1) Estimation of Traffic Benefit

Quantification theory, class 1 is a statistical method to formulate an estimation model to be used for estimating a variable (criterion variable) based on given variables (predictor variables). Each predictor variable is classified into categories. Category weights and a constant term are obtained by the least squares method. The value of a criterion variable is estimated as the total of category weights of predictor variables and constant term:

$$V = \sum_{i} W_{ik} + C$$

where, V : Estimated value of criterion variable
W_{ik} : Category weight of category k of predictor variable i
C : Constant term

The general procedure of the quantification theory, class 1 is as follows:

i) Expression of criterion variable
ii) Selection of predictor variables
iii) Categorization of selected predictor variables
iv) Selection of samples
v) Formulation of estimation model (calculation of category weights and constant term)
vi) Interpretation of category weights
vii) Tabulation of values of criterion variable

Expression of criterion variable

The criterion variable was determined as follows:

$$\text{Criterion variable} = \frac{TB}{L \times AADT}$$

where, TB : Total discounted traffic benefit for 25 years (1992 - 2016) expressed by 1990 value in thousand pesos

$$TB = \sum_{y=1992}^{2016} ATB / (1 + r/100)^{y-1990}$$

ATB : Annual traffic benefit in thousand pesos
r : Discount rate in % (r = 15)
y : Year
L : Improvement length of road in km
AADT : AADT in the opening year (1992)

Selection of predictor variables

The following considerations were given in selection of predictor variables:

- Explanatory of traffic benefit
- Not very correlative with other predictor variables
- Easily obtainable
- Reliable in accurary

In view of those considerations, the following predictor variables were selected:

- Province type
- Existing pavement type
- Existing surface condition
- Proposed pavement type
- Road type

Other related variables were excluded from the analysis for the following reasons:

- Terrain : In the preliminary analysis, significant differences in traffic benefit depending on terrain were not found.
- Modal distributions before and after road improvement:
  These factors were found to be closely correlated with the selected predictor variables, especially with province type, existing surface condition and road type. In addition, these data are difficult to prepare.

Categorization of Selected Predictor Variables

The selected predicator variables were categorized as follows:

a. Province Type : In accordance with the classification of provinces discussed in Section 5.3:

1. AD (Cavite type, i.e., province with average road density and economically well developed)
2. BL (Masbate type, i.e., province with low road density and economically less developed)
3. GL (Bohol type, i.e., province with high road density and economically less developed)
4. AL (Agusan del Norte type, i.e., province with average road density and economically less developed)

b. Existing Pavement Type

1. Paved
2. Gravel
3. Earth

c. Existing Surface Condition

1. Good or Fair
2. Bad
3. Very Bad
4. Impassable

d. Proposed Pavement Type

1. PCC or AC
2. BMP or DBST
3. Gravel

e. Road Type

1. Minor Road: 1-direction access (minor road connected to higher standard road at one end)
2. Minor Road: 2-direction access (minor road connected to higher standard roads at both ends)
3. Major road: (component of major road network in the province serving predominantly through traffic)

Selection of Samples

All road projects subjected to feasibility study were used as samples except the following:

- Projects serving predominantly diverted traffic
- Projects containing only bridge construction/replacement
- Projects characterized by two or more different conditions, where predominant category cannot be specified

As a result, 308 samples out of 329 road projects were selected for the analysis.

Formulation of Estimation Model

The result of the analysis is given in Table 18.2-1.

TABLE 18.2-1 RESULT OF ANALYSIS

Predictor Variable	Category Weight				Range of Category Weight	Partial Correlation Coefficient
	1	2	3	4		
Province Type	AD -8.718	BL 5.371	GL 11.885	AL -0.359	20.603	0.479
Existing Pavement Type	Paved -6.991	Gravel -4.667	Earth 5.176	-	12.167	0.282
Existing Surface Condition	Good/Fair -10.321	Bad -4.120	Very bad 0.109	Impassable 14.247	24.567	0.382
Proposed Pavement Type	PCC/AC 8.318	BMP/DBST 6.912	Gravel -1.492	-	9.810	0.209
Road Type	Minor: 1-dir. 3.156	Minor: 2-dir. -4.550	Major -1.722	-	7.706	0.241
Constant Term			18.229			

Number of Samples $n = 308$
Multiple Correlation Coefficient $R = 0.702$
Coefficient of Determination $R^2 = 0.493$

Existing surface condition is the most contributive factor followed by province type. "Impassable" of existing condition is given the highest category weight and "Good/Fair" of existing condition is given the highest negative category weight.

Interpretation of Category Weights

Category weights are interpreted as follows:

a. Province Type

In a Cavite type province (AD), which is economically developed, future economic growth is anticipated to be relatively low and consequently traffic growth is also low; therefore, this type of province is given the lowest category weight.

On the other hand, a Masbate type province (BL) and a Bohol type province (GL) are economically less developed. In such provinces, road improvement is expected to have a relatively high impact on economic development resulting in

a high rate of traffic growth. This is the interpretation of high category weights to be assigned. Between these two categories, a Bohol type province, which has a higher development potential, is given a higher category weight.

An Agusan del Norte type province, (AL) which lies midway in economic development, is given a middle category weight.

b. Existing Pavement Type

The higher category weight is assigned to the project with the higher traffic cost in the "w/o" case. Earth, Gravel and Paved are in the decending order of category weight.

c. Existing Surface Type

Likewise, category weight is reasonably assigned according to traffic cost in "w/o" case, i.e., in the order of Impassable, Very Bad, Bad and Good/Fair.

d. Proposed Pavement Type

A higher category weight is given to a project with the lower traffic cost in the "with" case. PCC/AC, BMP/DBST and Gravel are in the descending order of category weight.

e. Road Function

The travel distance in Minor Road: 1-direction access is generally longer than that in Minor Road: 2-direction access. Therefore, the category weight of the former is higher.

On the other hand, travel distance in Major Road is the longest as the full length of the project road is usually considered in the benefit calculation. Nevertheless, the category weight of Major Road is lower than that of Minor Road: 1-direction access, because the change in model distribution due to road improvement is less.

Tabulation of Values of Criterion Variable

Based on the category weights shown in Table 18.2-1, values of the criterion variable, i.e., total discounted traffic benefit per km per vehicle, were calculated for all cases of predictor variables. With minor adjustments to avoid unrealistic values, these values were tabulated as shown in Table 18.5-10.

2) Estimation of Development Benefit

The development benefit estimation model was formulated also by the quantification theory, class 1.

Expression of Criterion Variable

The criterion variable was determined as follows:

$$\text{Criterion Variable} = \frac{DB}{L}$$

where, DB : Total discounted development benefit for 25 years (1992 - 2016) expressed by 1990 value in thousand pesos:

$$DB = \sum_{y=1992}^{2016} ADB / (1 + r/100)^{y-1990}$$

ADB : Annual development benefit in thousand pesos
r : Discount rate in % (r = 15)
y : year
L : Improvement length of road in km

Selection of Predictor Variables

The factors directly related to development benefit are agricultural production volume, production cost and farmgate price by crop and by "w/o" and "with" cases. Instead of those data which are difficult to obtain, the following data were selected as predictor variables considering the correlation with development benefit:

- Province type
- Existing surface condition
- Terrain
- Cultivated area within road influence area

Since a significant difference in development benefit depending on population was not found by the preliminary analysis, population was not included in the analysis.

Categorization of Selected Predictor Variables

The selected variables were categorized as follows:

a. Province Type : Same categorization as used in traffic benefit estimation model

1. AD
2. BL
3. GL
4. AL

b. Existing Surface Condition

1. Bad
2. Very Bad
3. Impassable

c. Terrain

1. Flat
2. Rolling
3. Mountainous

d. Cultivated Area within Road Influence Area per Km of Road

1. Below 50 ha/km
2. 50 - 100 ha/km
3. 100 - 150 ha/km
4. 150 - 200 ha/km
5. Above 200 ha/km

Selection of Samples

All development projects subjected to feasibility study were selected as samples except such projects that serve the area with non-agricultural development plans like mining projects. As a result, 241 samples were selected for the analysis.

Formulation of Estimation Model

The result of the analysis is summarized in Table 18.2-3.

TABLE 18.2-3 RESULT OF ANALYSIS

Predictor Variable	Category Weight					Range of Category Weight	Partial Correlation Coefficient
	1	2	3	4	5		
Province Type	AD -9.831	BL 10.273	GL 11.645	AL -4.855	-	21.476	0.160
Existing Surface Condition	Bad -26.374	Very Bad 7.859	Impassable 47.059	-	-	73.434	0.423
Terrain	Flat -15.671	Rolling 13.650	Mountainous -13.243	-	-	29.321	0.237
Cultivated Area	Below 50 -34.724	50-100 -12.551	100-150 -1.697	150-200 16.692	Above 200 36.688	71.412	0.335
Constant Term			119.788				

Number of Samples $n = 241$
Multiple Correlation Coefficient $R = 0.586$
Coefficient of Determination $R^2 = 0.344$

Existing surface condition is the most contributive factor followed by cultivated area. "Impassable" of existing condition is given the highest category weight, while "below 50 ha/km" of cultivated area is given the highest negative category weight.

Imterpretation of Category Weights

a. Province Type

The distribution of category weights shows the same pattern as that in the traffic benefit estimation model. This is due to the correlation between development potentiality and traffic growth.

b. Existing Surface Condition

A higher category weight is assigned to a project with a worse surface condition. This is due to the fact that, in an area presently with poor access, a greater development impact is expected by removing such constraints.

c. Terrain

The highest category weight is given to Rolling, with lower weights to Flat and Mountainous. This is interpreted as follows:

- Flat areas generally have less development potential due to the presence of fewer constraints on development, resulting in a low category weight.
- Mountainous areas generally have less development potential due to the limited available land for cultivation, also resulting in a low category weight.
- As a consequence, Rolling is given the highest category weight.

d. Cultivated Area

Category weight is reasonably assigned according to cultivated area, which is directly correlated with the possibility of increasing agricultural production.

Tabulation of Values of Criterion Variable

The values of the criterion variable, i.e., total discounted development benefit per km of road, were calculated for all cases of predictor variables and tabulated as shown in Table 18.5-11.

3) Estimation of AADT in Minor Roads

The following considerations were given in selection of predictor variables:

- Passenger traffic and non-agricultural traffic are, generally, related to the population residing within the road influence area.
- Agricultural traffic is related to both agricultural production and population, because the generative source of this traffic is surplus and deficit production.
- Traffic generation factor and model distribution vary depending on development level of the area.

In view of the above, the analysis was made by the regression analysis using AADT in the opening year as the criterion variable and population and cultivated area as the predictor variables. For the development level of the area to be taken into account, the estimation model was formulated individually for each province type. The results are as follows:

Province Type	Number of Samples	Multiple Correlation Coefficient	Estimation Model
AD	99	0.900	AADT=0.031P+0.015A-2.4
BL	42	0.723	AADT=0.003P+0.002A+2.4
GL	63	0.986	AADT=0.014P+0.007A-8.1
AL	46	0.922	AADT=0.011P+0.008A+1.8

where, AADT : AADT in the opening year (1992)
P : Population within the road influence area
A : Cultivated area within the road influence area in ha

4) Estimation of Maintenance Cost Savings

In the feasibility study for the pilot provinces, periodic maintenance costs in the "with" case were treated as project costs, while the difference between routine maintenance costs in the "with" case and total maintenance costs in the "w/o" case was considered as project benefit.

To simplify the evaluation process, the definition of maintenance cost savings was, however, changed to be the difference of total maintenance costs between the "w/o" and "with" cases. In most cases, the "with" maintenance costs were higher than the "w/o" maintenance costs. In this case, the difference was considered as negative benefit. Total discounted maintenance cost savings per km per vehicle according to new definition were selected as the criterion variable.

Total discounted traffic benefit per km per vehicle was selected as the predictor variable, due to its correlation with maintenance cost savings.

The relation between the two variables is shown in Figure 18.2-1. The estimation formula was obtained by regression analysis as follows:

$$\left(\frac{MS}{L \times AADT}\right) = -3.87 - 0.162 \left(\frac{TB}{L \times AADT}\right) \quad \text{(correlation coefficient } y=-0.81\text{)}$$

where, MS : Total discounted maintenance cost savings for 25 years (1992 - 2016) in thousand pesos
TB : Total discounted traffic benefit for 25 years (1992 - 2016) in thousand pesos
L : Improvement length of road in km
AADT : AADT in the opening year (1992)

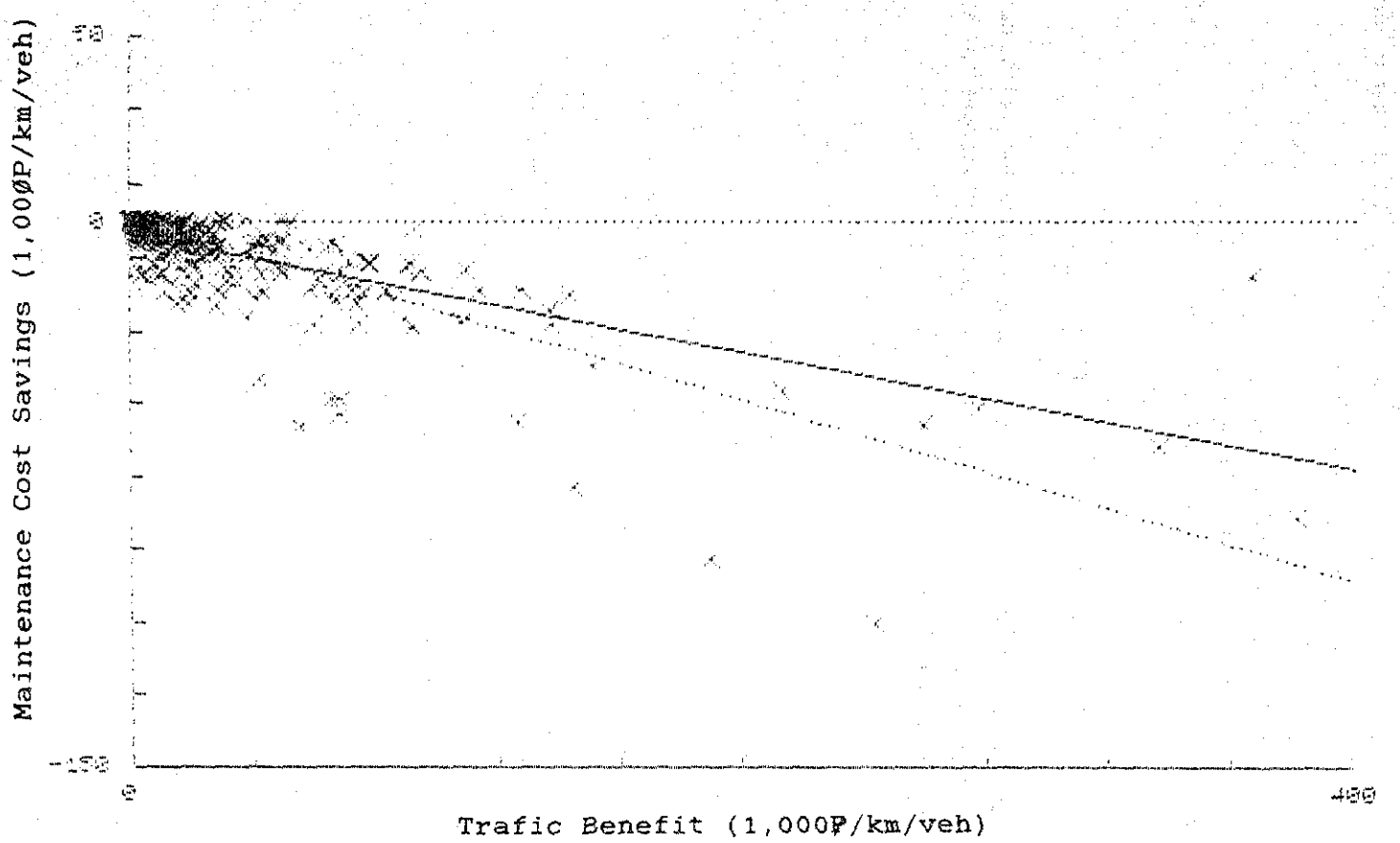


FIGURE 18.2-1 TRAFFIC BENEFIT VS. MAINTENANCE COST SAVINGS

5) Estimation of Economic Internal Rate of Return

The economic internal rate of return is estimated from the benefit cost ratio. Figure 18.2-2 shows the relation between the two variables. The estimation formula was introduced by regression analysis as follows:

B/C ≥1 : IRR = 1.676 + 13.324 × B/C
(Correlation coefficient r =0.981)
B/C <1 : IRR = -3.018 + 18.018 × B/C
(correlation coefficient r =0.985)

18.2.2 Procedure of Simplified Economic Evaluation

A simplified economic evaluation method was developed based on the findings described in the previous section. It is incorporated in the proposed procedure for subproject evaluation/rating presented in Section 18.5.

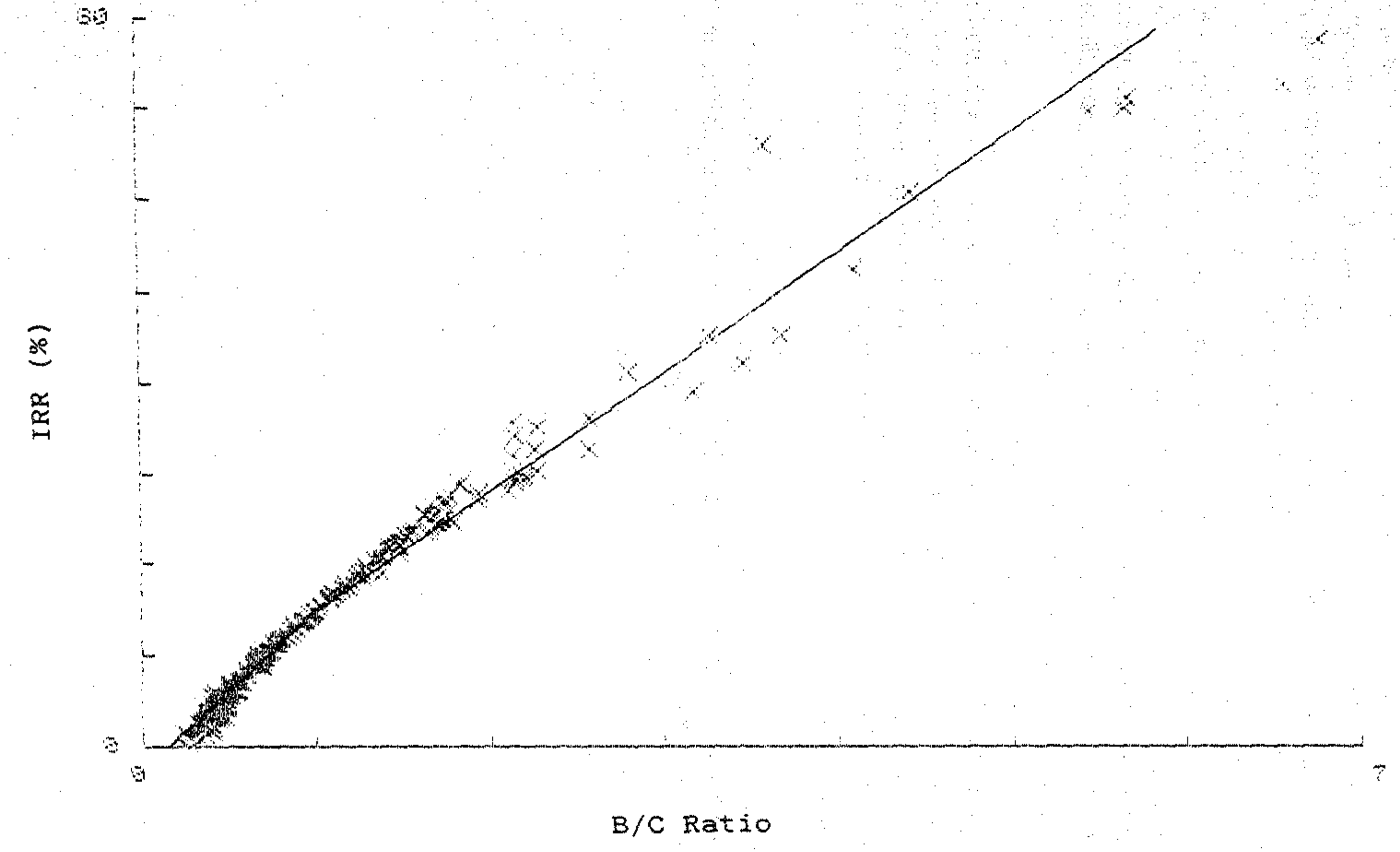


FIGURE 18.2-2 B/C RATIO VS. IRR

18.3 SOCIO-ECONOMIC CONSIDERATIONS

The national development goals formulated in the Medium-Term Philippine Development Plan, 1987-1992 are (a) alleviation of poverty, (b) generation of more productive employment, (c) promotion of equity and social justice and (d) attainment of sustainable economic growth. The rural road network development project aims to support these goals by providing all-weather access to depressed areas.

Poor areas should be given priority in rural road development in view of the first three goals: alleviation of poverty, generation of employment and social justice, while the effect of the project on the fourth goal: attainment of economic growth, is directly reflected in the economic evaluation. Thus, an important factor to be considered in addition to economic evaluation is the degree of poverty of the area.

As shown in Chapter 19, the fund allocation formulae for roads prepared by DPWH are expressed by road adequacy, gross value added, population and incidence of poverty. The first three factors are considered to be related to economic viability, while the last one is independent thereof. Thus, incidence of poverty is taken into account in the allocation of fund to provinces.

In the guidelines and formulas for ranking projects established by DPWH, household income level and social benefit are included in addition to the economic viability. Inclusion of these factors complies with the national development goals.

18.4 RATING

1) DPWH Criteria

The Planning Service of the DPWH established the criteria in ranking projects as follows:

a) National Road/Bridge Projects

PR = 70% FYB/C + 20% HI + 10% SB

where:
- PR = Project rating
- FYB/C = Merit points of first year benefit cost ratio
- HI = Merit points of household income
- SB = Merit points of social benefits

i) First Year Benefit Cost Ratio (FYB/C)	**Merit Points (MP)**
Equal to 10%	50
Between 10% and 30%	$50 + \frac{(FYB/C-10) \times 50}{20}$
Equal to or more than 30%	100

Note : Required minimum FYB/C = 10%

ii) Household Income per Month (HI)	**Merit Points (MP)**
₱5,000 and above	25
Between ₱2,000 and ₱5,000	$150 - \frac{HI}{40}$
Below ₱2,000	100

iii) Social Benefits (SB)

	Merit Points (MP)
High	100
Medium	65
Low	30

High - The road project will contribute considerably to the promotion of health, education, communication, safety, security and preservation of environment in the influence area of the project.

Medium - The road project will contribute moderately to the promotion of the above services in the influence area of the project.

Low - The road project will contribute in a minor degree to the promotion of the above services in the influence area of the project.

b) National Road/Bridge Projects (Alternative II)

PR = 70% PC/TV + 20% HI + 10% SB

PC = Project Cost

TV = Annual average daily traffic (AADT)

HI = Household income

SB = Social benefits

i) Project Cost per Unit AADT (PC/TV)

Project Cost/AADT (₱/unit AADT)				
Gravel (₱200,000 - ₱500,000/km)	DBST (₱800,000 - ₱1,200,000/km)	AC (₱1,500,000 - ₱2,200,000/km)	PC (₱2,000,000 - ₱3,000,000/km)	Merit Points
1000/over	2000/over	5000/over	6000/over	10
900	1800	4500	5400	20
800	1600	4000	4800	30
700	1400	3500	4200	40
600	1200	3000	3600	50
500	1000	2500	3000	60
400	800	2000	2400	70
300	600	1500	1800	80
200	400	1000	1200	90
100	200	500	600	100

ii) Household income (HI) = as in a) above

iii) Social Benefits (SB) = as in a) above

c) Barangay Road/Bridge Projects (Rehabilitation and Improvement)

PR = 40% PCC + 40% PCA + 20% ERC

where: PR = Project rating

PCC = Merit points of project cost per capita, i.e., the ratio of the project cost in thousand pesos to the population served within the influence area

PCA = Merit points of project cost per arable area, i.e., the ratio of the project cost in thousand pesos to the arable land in hectares within the influence area

ERC = Merit points of existing road condition

i) Project Cost Per Capita (PCC)	**Merit Points (MP)**
10 and below	100
Between 10 to 55	120 - 2 PCC
55 and above	10

ii) Project Cost Per Arable Area (PCA) **Merit Points (MP)**

10 and below	100
Between 10 to 55	120 - 2 PCA
55 and above	10

iii) Existing Road Condition (ERC) **Merit Points (MP)**

Good	30
Fair	65
Bad	100

d) Barangay Road/Bridge Projects (New Construction)

PR = 40% PCC + 40% PCA + 20% SB

i) Project cost per capita (PCC) = as in c) above

ii) Project cost per arable area (PCA) = as in c) above

iii) Social benefits (SB) **Merit Points (MP)**

High	100
Medium	65
Low	30

2) Proposed Alternative Ranking Criteria

The formula in the DPWH criteria are summarized as follows:

a) National Road/Bridge Projects

The three factors employed for ranking projects are:

- Economic viability expressed by first year benefit cost ratio (70% weight)
- Average household income level (20% weight)
- Social benefits evaluated by degree of contribution of the project to improvement of social welfare (10% weight)

b) National Road/Bridge Projects (Alternative II)

As in a) above, except that economic viability is expressed by PC/TV (project cost divided by AADT). This is based on the fact that project benefit is closely correlated to traffic volume.

c) Barangay Road/Bridge Projects (Rehabilitation and Improvement)

The three factors used for ranking projects are:

- Project cost per capita (40% weight)
- Project cost per arable area (40% weight)
- Existing road condition (20% weight)

The first two factors are considered to represent the economic viability, while the last factor is related to both economic viability and social benefits.

d) Barangay Road/Bridge Projects (New Construction)

As in c) above, except that existing road condition is replaced with social benefits.

For proposing the alternative ranking method, the following considerations were given:

- Internal rate of return (IRR) can be easily estimated in accordance with the procedure described in Section 18.5. IRR is considered a more reliable economic indicator commonly available to every class of road.
- In line with the national development goals, the DPWH criteria take into account average household income level and social benefits. Since this is the Government policy, these factors and respective weight should be respected.
- Uniform expression for every class of road is preferable for direct comparison and ranking.

Based on the above considerations, the alternative ranking criteria are proposed as follows:

$$PR = 70\%\ MP(IRR) + 20\%\ MP(HI) + 10\%\ MP(SB)$$

where: PR = Project rating
MP(IRR) = Merit points of economic internal rate of return (IRR)
MP(HI) = Merit points of average household income per month (HI)
MP(SB) = Merit points of social benefits (SB)

i) IRR

IRR	MP(IRR)
Less than 40%	$\frac{20 + 2IRR}{100}$
Equal to or more than 40%	

ii) **HI** **MP(HI)**

₱5,000 and above	25
Between ₱2,000 and ₱5,000	150 - HI/40
Below ₱2,000	100

iii) **SB** **MP(SB)**

High	100
Medium	65
Low	30

High - The road project will contribute considerably to the promotion of health, education, communication, safety, security and preservation of environment in the influence area of the project.

Medium - The road project will contribute moderately to the promotion of the above services in the influence area of the project.

Low - The road project will contribute in a minor degree to the promotion of the above services in the influence area of the project.

18.5 PROPOSED PROCEDURE OF SUBPROJECT EVALUATION/RATING

This section presents the worksheets for subproject evaluation/rating and step-by-step instructions for their use and interpretation.

18.5.1 Major Road Subproject

The computation for evaluating/rating major road subproject is conducted and/or summarized on the worksheet shown in Table 18.5-1, using the Subproject Proposal Form (Table 17.2-1, hereinafter referred to simply as the Proposal) as basic input data.

1) Name of Road and 2) Province

These are taken directly from the Proposal.

3) AADT in Opening Year

AADT in the opening year is calculated assuming 3% annual traffic growth rate based on present traffic shown in the Proposal.

AADT in Opening Year = present AADT x 1.03 n
where, n : Number of years to the opening year

4) Construction Cost

Road

- Length of subsection, terrain, and existing pavement type and condition are taken directly from the Proposal.
- Proposed pavement type and width are obtained from Table 18.5-4.
- Type of improvement is obtained from Table 18.5-5.
- Construction cost per km is found by looking up Table 18.5-7.
  Construction cost per subsection is obtained by multiplying the construction cost per km by length of subsection.
- For subsection including flood sections, additional cost necessary for grade raising is calculated as average additional cost per km times flood section length shown in the Proposal. The average additional cost per km is obtained from Table 18.5-8.
- Total cost of the subsection is computed as the sum of construction cost and additional cost for flood sections.
- Length and total cost of the subsection to be improved are summed up and entered in respective columns. Total length does not include the length of no-improvement subsections.

Bridge

- Existing bridge type is obtained from the Proposal.
- Proposed bridge type and number of lanes is obtained from Table 18.5-6.
- Length of bridge is obtained from the Proposal.
- Number of spans should be decided based on site conditions. The standard number of spans is given by dividing bridge length in meters by 20 and rounding, unless site conditions indicate that another value is appropriate. In the case of a spillway, the number of spans is one (1).
- Unit costs of superstructure, abutment and pier are obtained from Table 18.5-9. In the case of a spillway, unit costs of abutment and pier are both 0.
- Total costs are computed as follows:

  Superstructure : Unit cost per m times length
  Abutment : Unit cost times 2
  Pier : Unit cost times (number of spans - 1)
  Total : Sum of above three items

Total Construction Cost

This is computed as the sum of total road cost and total bridge cost.

5) Economic Evaluation

Benefit

- Province type is found from Table 18.5-3.
- Existing pavement type and condition are represented by these predominating in the whole subproject road.
- Proposed pavement type is as decided above.
- Traffic benefit per km per vehicle is obtained by looking up Table 18.5-10. It is multiplied by total improvement length and by AADT to get traffic benefit.
- Maintenance cost savings per km per vehicle is computed as:

  $MS' = -3.87 - 0.162 \times TB'$

  where, MS' : Maintenance cost savings in thousand peso per km per veh
  TB' : Traffic benefit in thousand peso per km per veh

  It is multiplied by total improvement length and by AADT to get total savings. Maintenance cost savings are always a negative value.
- Total benefit is computed as the sum of traffic benefit and maintenance cost savings.
- Economic cost is computed as total construction cost times 0.831, under the following assumptions:

Year	Item	Economic Cost	Discounted Economic Cost
1st year	Detailed Engineering	0.04C	0.04C
2nd year	Construction	0.85C	$\frac{0.85+0.06}{1.15}C=0.791C$
	Construction Supervision	0.06C	
Total			0.831C

Note: C = Total construction cost

- B/C ratio is computed by dividing total benefit by economic cost.
- IRR is computed as :

  B/C ≥1 : IRR = 1.676 + 13.224 × B/C

  B/C < 1 : IRR = -3.018 + 18.018 × B/C

6) Rating

Project rating is computed as follows:

PR = 70% MP(IRR) + 20% MP(HI) + 10% MP(SB)

where, PR : Project rating
MP(IRR) : Merit points of economic internal rate of return (IRR)
MP(HI) : Merit points of household income per month (HI)
MP(SB) : Merit points of social benefits (SB)

- Economic internal rate of return (IRR):
  IRR is as decided above. Merit points are computed as follows:

IRR	MP (IRR)	70% MP (IRR)
IRR < 40	20 + 2 x IRR	14 + 1.4 x IRR
IRR ≥ 40	100	70

- Household income per month (HI):
  HI is taken from the Proposal. Merit points are computed as follows:

HI	MP (HI)	20% MP (HI)
₱ 5,000 or above	25	5
₱ 2,000 - 5,000	150-HI/40	30-HI/200
below ₱ 2,000	100	20

- Social benefit (SB)
  Social benefit is evaluated as either High, Medium or Low, according to the degree of contribution of the subproject to the promotion of health, education communication, safety, security and preservation of environment in the influence area of the subproject. Merit points are obtained as follows:

SB	MP(SB)	10% MP(SB)
High	100	10
Medium	65	6.5
Low	30	3

18.5.2 Minor Road Sub-project

The worksheet for evaluating/rating minor road subprojects is presented in Table 18.5-2. The Subproject Proposal Form (Table 17.2-1, hereinafter referred simply as the Proposal) is used as basic input data.

1) Name of Road and 2) Province

These are taken directly from the Proposal. Province type is decided from Table 18.5-3.

2) AADT in Opening Year

Population served (P) and cultivated area within road influence area (A) are taken from the Proposal. AADT in the opening year is estimated as follows, depending on province type:

Province Type	Equation
AD	AADT = 0.031P + 0.015A - 2.4
BL	AADT = 0.003P + 0.002A + 2.4
GL	AADT = 0.014P + 0.007A - 8.1
AL	AADT = 0.011P + 0.008A - 1.8

3) Construction Cost

Construction cost is computed in the same manner as used for major road subproject.

4) Economic Evaluation

Category

- Province type is as decided above.
- Road type is selected between the following two:
  1-direction access : connected to a higher standard road at one end
  2-direction access : connected to a higher standard roads at both ends
  The location map attached to the Proposal is referred to in the selection.
- Existing pavement type and condition are represented by these predominating in the whole subproject road.
- Proposed pavement type is as decided above.
- Terrain is that predominating in the whole subproject road.
- Cultivated area within road influence area used for estimating AADT is again entered and divided by the total improvement length.

Benefit

- Traffic benefit per km per vehicle is obtained by looking up Table 18.5-10. It is multiplied by total improvement length and by AADT to get traffic benefit.
- Development benefit per km is obtained by looking up Table 18.5-11. It is multiplied by total improvement length to get development benefit.
- Maintenance cost savings is computed in the same manner as used for major road subprojects.
- Total benefit is computed as the sum of traffic benefit, development benefit and maintenance cost savings.
- Economic cost, B/C ratio and IRR are computed in the same manner as used for major road subprojects.

Rating

Project rating is conducted in the same manner as used for major road subprojects.

TABLE 18.5-1 WORKSHEET FOR EVALUATING/RATING MAJOR ROAD SUBPROJECT

SUBPROJECT EVALUATION/RATING SHEET (MAJOR ROAD)

1) Name of Road _____

2) Province _____

3) AADT in Opening Year = Present AADT _____ x 1.03 ^{n} = ① _____ (n: Number of years to the opening year = ___)

4) Construction Cost

Road

Subsection No.	② Length of Subsection (km)	Terrain	Existing Pavement: Type	Existing Pavement: Condition	Proposed Pavement: Type (Table 18.5-4)	Proposed Pavement: Width (m)	Type of Improvement (Table 18.5-5)	Construction Cost (1,000 ₱): ③ Cost per km (Table 18.5-7)	Construction Cost (1,000 ₱): ④ Cost (② x ③)	Additional Cost for Flood Section (1,000 ₱): ⑤ Flood Section Length (km)	Additional Cost for Flood Section (1,000 ₱): ⑥ Add. Cost per km (Table 18.5-8)	Additional Cost for Flood Section (1,000 ₱): ⑦ Add. Cost (⑤ x ⑥)	Total Cost (1,000 ₱) (④ + ⑦)
1													
2													
3													
4												Total	⑨
	⑧ ← Total Improvement Length (excluding no-improvement subsection)												

Bridge

No.	Existing Bridge Type	Proposed Bridge: Type (Table 18.5-6)	Proposed Bridge: No. of Lanes	⑩ Length (m)	⑪ No. of Spans (⑩ /20 & round)	Unit Cost (1,000 ₱): ⑫ Superstruct. per m	Unit Cost (1,000 ₱): ⑬ Abutment (Table 18.5-9)	Unit Cost (1,000 ₱): ⑭ Pier	Cost (1,000 ₱): ⑮ Superstruct. (⑩ x ⑫)	Cost (1,000 ₱): ⑯ Abutment (2 x ⑬)	Cost (1,000 ₱): ⑰ Pier ((⑪ -1) x ⑭)	Total (⑮ + ⑯ + ⑰)
1												
2												
3												
4												
											Total	⑱

Total Construction Cost = ⑨ + ⑱ = ⑲ _____ x 1,000 ₱

5) Economic Evaluation

Benefit

Province Type (Table 18.5-3)	Existing Pavement Type (Predominant)	Existing Surface Condition (Predominant)	Proposed Pavement Type	Traffic Benefit (1,000 ₱): ⑳ Benefit per km per veh (Table 18.5-10)	Traffic Benefit (1,000 ₱): ㉑ Benefit (⑳ x ⑧ x ①)	Maintenance Cost Savings (1,000 ₱): ㉒ Benefit per km per veh (-3.87-0.162 x ⑳)	Maintenance Cost Savings (1,000 ₱): ㉓ Benefit (㉒ x ⑧ x ①)	㉔ Total Benefit (1,000 ₱) (㉑ + ㉓)

Economic Cost = ⑲ x 0.831 = ㉕ _____ x 1,000 ₱

B/C Ratio = ㉔ / ㉕ = ㉖ _____

IRR = 1.676 + 13.324 x ㉖ (㉖ ≥ 1) } = ㉗ _____ %

= -3.018 + 18.018 x ㉖ (㉖ < 1) }

6) Rating

	IRR _____ % (㉗)	Household Income per Month (HI) _____ ₱	Social Benefit (SB) _____	Project Rating
Formula	IRR < 40 : 14 + 1.4 x IRR IRR ≥ 40 : 70	HI ≥ 5,000 : 5 2,000 < HI < 5,000 : 30-HI/200 HI ≤ 2,000 : 20	High : 10 Medium : 6.5 Low : 3	㉘ + ㉙ + ㉚
Merit Points x Weight	㉘	㉙	㉚	

TABLE 18.5-1 WORKSHEET FOR EVALUATING/RATING MINOR ROAD SUBPROJECT

SUBPROJECT EVALUATION/RATING SHEET (MINOR ROAD)

1) Name of Road _____

2) Province _____ Province Type (Table 18.5-3) _____

3) AADT in Opening Year

Population Served (P) _____

Cultivated Area within Road Influence Area (A) _____ ha

AADT in Opening Year ① _____

AADT = 0.031P + 0.015A – 2.4 (Province Type MR)
AADT = 0.003P + 0.002A + 2.4 (Province Type BP)
AADT = 0.014P + 0.007A – 8.1 (Province Type GP)
AADT = 0.011P + 0.008A – 1.8 (Province Type MP)

4) Construction Cost

Road

Subsection No.	② Length of Subsection (km)	Terrain	Existing Pavement		Proposed Pavement		Type of Improvement (Table 18.5-5)	Construction Cost (1,000 ₱)		Additional Cost for Flood Section (1,000 ₱)			Total Cost (1,000 ₱) (④ + ⑦)
			Type	Condition	Type (Table 18.5-4)	Width (m)		③ Cost per km (Table 18.5-7)	④ Cost (② × ③)	⑤ Flood Section Length (km)	⑥ Add. Cost per km (Table 18.5-8)	⑦ Add. Cost (⑤ × ⑥)	
1													
2													
3													
4													
	⑧	← Total Improvement Length (excluding no-improvement subsection)										Total	⑨

Bridge

No.	Existing Bridge Type	Proposed Bridge				Unit Cost (1,000 ₱)			Cost (1,000 ₱)			
		Type (Table 18.5-6)	No. of Lanes	⑩ Length (m)	⑪ No. of Spans (⑩ /20 & round)	⑫ Superstruct. per m	⑬ Abutment (Table 18.5-9)	⑭ Pier	⑮ Superstruct. (⑩ × ⑫)	⑯ Abutment (2 × ⑬)	⑰ Pier ((⑪ -1) × ⑭)	Total (⑮ + ⑯ + ⑰)
1												
2												
3												
4												
											Total	⑱

Total Construction Cost = ⑨ + ⑱ = ⑲ _____ x 1,000 ₱

5) Economic Evaluation

Category

Province Type	Road Type	Existing Pavement Type (Predominant)	Existing Surface Condition (Predominant)	Proposed Pavement Type	Terrain (Predominant)	Cultivated Area within RIA	
						⑳ Area (ha)	Area per km (⑳ / ⑧)

Benefit

Traffic Benefit (1,000 ₱)		Development Benefit (1,000 ₱)		Maintenance Cost Savings (1,000 ₱)		㉗ Total Benefit (1,000 ₱) (㉒ + ㉔ + ㉖)
㉑ Benefit per km per veh (Table 18.5-10)	㉒ Benefit (㉑ × ⑧ × ①)	㉓ Benefit per km (Table 18.5-11)	㉔ Benefit (㉓ × ⑧)	㉕ Benefit per km per veh (–3.87 –0.162 × ㉑)	㉖ Benefit (㉕ × ⑧ × ①)	

Economic Cost = ⑱ x 0.831 = ㉘ _____ x 1,000 ₱

B/C Ratio = ㉗ / ㉘ = ㉙ _____

IRR = 1.676 + 13.324 × ㉙ (㉙ ≥ 1) } = ㉚ _____ %
= –3.018 + 18.018 × ㉙ (㉙ < 1) }

6) Rating

	IRR _____ % (㉚)	Household Income per Month (HI) _____ ₱	Social Benefit (SB) _____	Project Rating
Formula	IRR < 40 : 14 + 1.4 × IRR IRR ≥ 40 : 70	HI ≧ 5,000 : 5 2,000 < HI < 5,000 : 30–HI/200 HI ≦ 2,000 : 20	High : 10 Medium : 6.5 Low : 3	㉛ + ㉜ + ㉝
Merit Points x Weight	㉛	㉜	㉝	

TABLE 18.5-3 PROVINCE TYPE

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

TABLE 18.5-4 PROPOSED PAVEMENT TYPE AND WIDTH

Major Road

AADT in Opening Year	Primary Major [1]		Secondary Major [1]	
	Pavement Type[2]	Width (m)	Pavement Type[2]	Width (m)
Over 2,000	PCC [4]	6.7	PCC [4]	6.7
1,000 - 2,000				6.0
400 - 1,000	AC [4]	6.7	AC [4]	6.0
200 - 400	BMP [3] [4]	6.0	BMP [3] [4]	6.0
100 - 200			Gravel	6.0
Under 100	Gravel	6.0		

Minor Road

AADT in Opening Year	Collector Road [1]		Feeder Road [1]	
	Pavement Type[2]	Width (m)	Pavement Type[2]	Width (m)
Over 400	AC [4]	6.0	AC [4]	6.0
200 - 400	BMP [3] [4]	6.0	BMP [3] [4]	6.0
50 - 200	Gravel	6.0	Gravel	4.0
Under 50		4.0		

Note : 1) Classification is made in accordance with Table 7.3-2. For minor road, national/provincial/city roads are, generally classified as collector roads and barangay roads as feeder roads.

2) Where existing pavement type is superior to that proposed above, the former should be used.

3) BMP is replaced by DBST as the case may be (Refer to Section 18.1 3)). It is, however, recommended to assume BMP for budgetary and evaluating purposes.

4) AC overlay is applied where existing pavement type is equivalent or superior to that proposed above and existing conditions warrant the use of AC overlay. The possibility of AC overlay is indicated in the Proposal.

TABLE 18.5-5 TYPE OF IMPROVEMENT

Surface Condition \ Road Class / Existing Pavement Type		Major Road		Minor Road	
		Standard	Substandard	Standard	Substandard
Good/Fair	Wc[1] < 6.0 m	Widening	Improvement-2	-	-
	Wc ≥ 6.0 m	-			
Bad/Very Bad		Rehabilitation	Improvement-1	Rehabilitation	Improvement-1
Impassable		New Construction			

Note : 1) Wc = Existing carridgeway width

TABLE 18.5-6 PROPOSED BRIDGE TYPE AND NUMBER OF LANES

Existing Bridge Type	Proposed Improvement	
	Major Road	Minor Road
Ford Crossing	2-lane Permanent Bridge	Carridgeway Width in Abutting Road Section 4.0 m : 1-lane Spillway [1] Carridgeway Width in Abutting Road Section 6.0 m : 2-lane Spillway [1]
Spillway	2-lane Permanent Bridge	No Improvement [2]
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 timber bridges.

2) When the existing spillway is structurally sound and traffic disturbance is estimated less, the existing can be utilized. Under other conditions, a permanent bridge should be planned in accordance with the criteria for timber bridges.

TABLE 18.5-7 CONSTRUCTION COST BY TYPE OF IMPROVEMENT
(Thousand Pesos per km in 1988 Price)

Type of Improvement	Road Sect. Type	Existing Pavement		Proposed Pavement		Terrain		
		Type	Condition	Type	Width	Flat	Rolling	Mountain
Rehabilitation	1-1	PCC	Bad/V.Bad	PCC	6.7 m.	2,839	2,886	2,974
	1-1	PCC	- do -	PCC	6.0 m.	2,613	2,639	2,762
	1-2	PCC	- do -	Overlay	6.7 m.	1,333	1,314	1,295
	1-2	PCC	- do -	Overlay	6.0 m.	1,207	1,188	1,169
	1-3	Bitum.	- do -	AC	6.7 m.	2,432	2,573	2,646
	1-3	Bitum.	- do -	AC	6.0 m.	2,246	2,365	2,473
	1-4	Bitum.	- do -	Overlay	6.7 m.	1,296	1,277	1,258
	1-4	Bitum.	- do -	Overlay	6.0 m.	1,174	1,155	1,136
	1-5	Bitum.	- do -	BMP/DBST	6.0 m.	1,547	1,672	1,982
	1-6	Gravel	- do -	Gravel	6.0 m.	658	736	1,073
	1-6	Gravel	- do -	Gravel	4.0 m.	440	459	482
Improvement-1	2-1	Bitum.	Bad/V.Bad	PCC	6.7 m.	2,863	2,921	3,219
	2-1	Bitum.	- do -	PCC	6.0 m.	2,624	2,659	2,907
	2-2	Gravel	- do -	PCC	6.7 m.	3,006	3,077	3,336
	2-2	Gravel	- do -	PCC	6.0 m.	2,765	2,813	3,078
	2-3	Gravel	- do -	AC	6.7 m.	2,597	2,764	3,006
	2-3	Gravel	- do -	AC	6.0 m.	2,395	2,539	2,790
	2-4	Gravel	- do -	BMP/DBST	6.0 m.	1,692	1,843	2,297
	2-5	Earth	Any	PCC	6.7 m.	3,006	3,077	3,336
	2-5	Earth	- do -	PCC	6.0 m.	2,765	2,813	3,078
	2-6	Earth	- do -	AC	6.7 m.	2,597	2,764	3,006
	2-6	Earth	- do -	AC	6.0 m.	2,395	2,539	2,790
	2-7	Earth	- do -	BMP/DBST	6.0 m.	1,692	1,843	2,297
	2-8	Earth	- do -	Gravel	6.0 m.	671	771	1,133
	2-8	Earth	- do -	Gravel	4.0 m.	440	478	526
Improvement-2	3-1	Bitum.	Good/Fair	PCC	6.7 m.	2,863	2,921	3,219
	3-1	Bitum.	- do -	PCC	6.0 m.	2,624	2,659	2,907
	3-2	Gravel	- do -	PCC	6.7 m.	2,863	2,969	3,247
	3-2	Gravel	- do -	PCC	6.0 m.	2,623	2,704	2,994
	3-3	Gravel	- do -	AC	6.7 m.	2,455	2,656	2,916
	3-3	Gravel	- do -	AC	6.0 m.	2,255	2,430	2,706
	3-4	Gravel	- do -	BMP/DBST	6.0 m.	1,555	1,733	2,213
Widening	4-1	PCC	Good/Fair	PCC	6.7 m.	1,420	1,552	1,790
	4-1	PCC	- do -	PCC	6.0 m.	1,174	1,279	1,540
	4-2	Bitum.	- do -	AC	6.7 m.	1,262	1,441	1,664
	4-2	Bitum.	- do -	AC	6.0 m.	1,054	1,206	1,452
	4-3	Bitum.	- do -	BMP/DBST	6.0 m.	753	914	1,274
	4-4	Gravel	- do -	Gravel	6.0 m.	607	747	1,082
	4-4	Gravel	- do -	Gravel	4.0 m.	344	385	434
New Construction	5-1	-	-	PCC	6.7 m.	3,552	3,610	3,918
	5-1	-	-	PCC	6.0 m.	3,327	3,386	3,694
	5-2	-	-	AC	6.7 m.	3,165	3,305	3,602
	5-2	-	-	AC	6.0 m.	2,979	3,119	3,415
	5-3	-	-	BMP/DBST	6.0 m.	2,300	2,462	2,862
	5-4	-	-	Gravel	6.0 m.	1,079	1,160	1,514
	5-4	-	-	Gravel	4.0 m.	562	585	624

TABLE 18.5-8 ADDITIONAL COST FOR FLOOD SECTION
(Thousand Pesos per km In 1988 Price)

Road Class	Pavement Width	Additional Cost
Primary Major Road	6.7 m	2,600
	6.0 m	2,400
Secondary Major Road	6.7 m	1,700
	6.0 m	1,500
Minor Road	6.0 m	1,300
	4.0 m	1,100

TABLE 18.5-9 BRIDGE CONSTURCTION COST
(Thousand Pesos In 1988 Price)

Bridge Type		Unit	Cost
2-lane Bridge	Supersturcture	Lin.M	40.2
	Abutment	Each	288.0
	Pier	Each	258.5
1-lane Bridge	Supersturcture	Lin.M	30.3
	Abutment	Each	202.4
	Pier	Each	181.6
2-lane Spillway		Lin.M	15.4
1-lane Spillway		Lin.M	11.4

TABLE 18.5-10 STANDARD TRAFFIC BENEFIT (1,000/km/veh)

Minor Road: 1-direction Acess

Existing Pavement Condition	Province AD			Province BL			Province GL			Province AL		
	Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type		
	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel
Paved (Bad)	9.874	8.468	.064	23.963	22.557	14.153	30.477	29.071	20.667	18.233	16.827	8.423
(Very Bad)	14.103	12.697	4.293	28.192	26.786	18.382	34.706	33.300	24.896	22.462	21.056	12.652
(Impassable)	28.241	26.835	18.431	42.330	40.924	32.520	48.844	47.438	39.034	36.600	35.194	26.790
Gravel (Good/Fair)	5.997	4.591	-	20.086	18.680	-	26.600	25.194	-	14.356	12.950	-
(Bad)	12.198	10.792	2.388	26.287	24.881	16.477	32.801	31.395	22.991	20.557	19.151	10.747
(Very Bad)	16.427	15.021	6.617	30.516	29.110	20.706	37.030	35.624	27.220	24.786	23.380	14.975
(Impassable)	30.565	29.159	20.755	44.654	43.248	34.844	51.168	49.762	41.358	38.924	37.518	29.114
Earth (Bad)	22.041	20.635	12.231	36.130	34.724	26.320	42.644	41.238	32.834	30.400	28.994	20.590
(Very Bad)	26.270	24.864	16.460	40.359	38.953	30.549	46.873	45.467	37.063	34.629	33.223	24.819
(Impassable)	40.408	39.002	30.598	54.497	53.091	44.687	61.011	59.605	51.201	48.767	47.361	38.957

Minor Road: 2-direction Acess

Existing Pavement Condition	Province AD			Province BL			Province GL			Province AL		
	Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type		
	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel
Paved (Bad)	2.168	.752	0.003	16.257	14.851	6.447	22.771	21.365	12.961	10.527	9.121	.717
(Very Bad)	6.397	4.991	0.020	20.486	19.080	10.676	27.000	25.594	17.190	14.756	13.350	4.946
(Impassable)	20.535	19.129	10.725	34.624	33.218	24.814	41.138	39.732	31.328	28.894	27.488	19.084
Gravel (Good/Fair)	0.067	0.046	-	12.380	10.974	-	18.894	17.488	-	6.650	5.244	-
(Bad)	4.492	3.086	0.249	18.581	17.175	8.771	25.095	23.689	15.285	12.851	11.445	3.041
(Very Bad)	8.721	7.315	0.590	22.810	21.404	13.000	29.324	27.918	19.514	17.080	15.674	7.270
(Impassable)	22.859	21.453	13.049	36.948	35.542	27.138	43.462	42.056	33.652	31.218	29.812	21.408
Earth (Bad)	14.335	12.929	4.525	28.424	27.018	18.614	34.938	33.532	25.128	22.694	21.288	12.884
(Very Bad)	18.564	17.158	8.754	32.653	31.247	22.843	39.167	37.761	29.357	26.923	25.517	17.113
(Impassable)	32.702	31.296	22.892	46.791	45.385	36.981	53.305	51.899	43.495	41.061	39.655	31.251

Major Road

Existing Pavement Condition	Province AD			Province BL			Province GL			Province AL		
	Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type			Proposed Pavement Type		
	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel	PCC/AC	BMP/DBST	Gravel
Paved (Bad)	3.996	2.590	0.020	18.085	16.679	8.275	24.599	23.193	14.789	12.355	10.949	2.545
(Very Bad)	8.225	6.819	0.053	22.314	20.908	12.504	28.828	27.422	19.018	16.584	15.178	6.774
(Impassable)	22.363	20.957	12.553	36.452	35.046	26.642	42.966	41.560	33.156	30.722	29.316	20.912
Gravel (Good/Fair)	.119	0.093	-	14.208	12.802	-	20.722	19.316	-	8.478	7.072	-
(Bad)	6.320	4.914	0.397	20.409	19.003	10.599	26.923	25.517	17.113	14.679	13.273	4.869
(Very Bad)	10.549	9.143	.739	24.638	23.232	14.828	31.152	29.746	21.342	18.908	17.502	9.098
(Impassable)	24.687	23.281	14.877	38.776	37.370	28.966	45.290	43.884	35.480	33.046	31.640	23.236
Earth (Bad)	16.163	14.757	6.353	30.252	28.846	20.442	36.766	35.360	26.956	24.522	23.116	14.712
(Very Bad)	20.392	18.986	10.582	34.481	33.075	24.671	40.995	39.589	31.185	28.751	27.345	18.941
(Impassable)	34.530	33.124	24.720	48.619	47.213	38.809	55.133	53.727	45.323	42.889	41.483	33.079

TABLE 18.5-11 DEVELOPMENT BENEFIT (1,000 ₱/km)

Terrain	Existing Surface Condition	Cultivated Area (ha./km) 0-50	50-100	100-150	150-200	200-
Flat	Bad	59.6	81.7	92.6	111.0	131.0
	Very Bad	67.4	89.6	100.4	118.8	138.8
	Impassable	106.6	128.8	139.6	158.0	178.0
Rolling	Bad	88.9	111.1	121.9	140.3	160.3
	Very Bad	96.7	118.9	129.8	148.2	168.2
	Impassable	135.9	158.1	169.0	187.4	207.4
Mountainous	Bad	62.0	84.2	95.0	113.4	133.4
	Very Bad	69.8	92.0	102.9	121.3	141.3
	Impassable	109.0	131.2	142.1	160.5	180.5

Province Type BL

Terrain	Existing Surface Condition	Cultivated Area (ha./km) 0-50	50-100	100-150	150-200	200-
Flat	Bad	79.7	101.8	112.7	131.1	151.1
	Very Bad	87.5	109.7	120.6	138.9	158.9
	Impassable	126.7	148.9	159.8	178.1	198.1
Rolling	Bad	109.0	131.2	142.0	160.4	180.4
	Very Bad	116.8	139.0	149.9	168.3	188.3
	Impassable	156.0	178.2	189.1	207.5	227.5
Mountainous	Bad	82.1	104.3	115.1	133.5	153.5
	Very Bad	90.0	112.1	123.0	141.4	161.4
	Impassable	129.2	151.3	162.2	180.6	200.6

Province Type GL

Terrain	Existing Surface Condition	Cultivated Area (ha./km) 0-50	50-100	100-150	150-200	200-
Flat	Bad	81.0	103.2	114.1	132.5	152.4
	Very Bad	88.9	111.1	121.9	140.3	160.3
	Impassable	128.1	150.3	161.1	179.5	199.5
Rolling	Bad	110.4	132.5	143.4	161.8	181.8
	Very Bad	118.2	140.4	151.2	169.6	189.6
	Impassable	157.4	179.6	190.4	208.8	228.8
Mountainous	Bad	83.5	105.6	116.5	134.9	154.9
	Very Bad	91.3	113.5	124.4	142.7	162.7
	Impassable	130.5	152.7	163.6	181.9	201.9

Province Type AL

Terrain	Existing Surface Condition	Cultivated Area (ha./km) 0-50	50-100	100-150	150-200	200-
Flat	Bad	64.5	86.7	97.6	116.0	135.9
	Very Bad	72.4	94.6	105.4	123.8	143.8
	Impassable	111.6	133.8	144.6	163.0	183.0
Rolling	Bad	93.9	116.0	126.9	145.3	165.3
	Very Bad	101.7	123.9	134.7	153.1	173.1
	Impassable	140.9	163.1	173.9	192.3	212.3
Mountainous	Bad	67.0	89.1	100.0	118.4	138.4
	Very Bad	74.8	97.0	107.9	126.2	146.2
	Impassable	114.0	136.2	147.1	165.4	185.4