### 12.2.6 Project Cost

Based on December 1992 price level, the total project cost is about 154.5 billion pesos. As shown in Table 12.2-9, it is the summation of the individual construction costs, engineering services costs, and land acquisition costs of the ninety one (91) road projects.

Remarkably high is the Manila-Bataan Coastal Road where the construction cost is 18.974 billion pesos or 14% of the total construction cost. Simply because, soft ground treatment was assumed for about 70% of the total road length.

In terms of ROW cost, the Pasig-Binangonan Road is the costliest at 312.3 million pesos or 19% of the total ROW cost because the entire road length passes through the commercial/industrial district of Rizal.

Likewise, the disaster prevention costs of Kennon Road and Baguio-Bontoc Road are the most expensive at 3.297 billion pesos and 2.327 billion pesos or about 23% and 16% of the total disaster prevention cost respectively.

TABLE 12.2-9 PROJECT COST (1)

(Million Pesos)

| Proj. No. | Project Name | Construction Cost | | | Eng'g Cost | ROW Cost (B) | Project Cost (C) |
|---|---|---|---|---|---|---|---|
| | | Rd & Brdg | Disaster (A) | Sub-Total | | | |
| 1 | North Luzon Expressway | 3,165.5 | 0.0 | 3,165.5 | 379.8 | 0.0 | 3,545.3 |
| 2 | New North Luzon Expressway | 10,606.4 | 0.0 | 10,606.4 | 1,272.7 | 137.7 | 12,016.8 |
| 3 | Manila North Rd, Rosario-Laoag | 6,146.2 | 71.3 | 6,217.5 | 746.1 | 91.9 | 7,055.5 |
| 4 | Pan-Phil H'way, Sta.Rita-San Jose | 2,987.5 | 4.3 | 2,991.8 | 359.2 | 114.2 | 3,465.2 |
| 5 | Pan-Phil H'way, San Jose-Magapit | 342.3 | 796.1 | 1,138.4 | 136.7 | 0.0 | 1,275.1 |
| 6 | Laoag-Magapit Rd | 339.1 | 142.7 | 481.8 | 57.8 | 7.4 | 547.0 |
| 7 | Manila-Bataan Coastal Rd, North | 2,525.7 | 0.0 | 2,525.7 | 303.0 | 28.2 | 2,856.9 |
| 8 | Manila-Bataan Coastal Rd, South | 16,448.3 | 0.0 | 16,448.3 | 1,973.8 | 73.1 | 18,495.2 |
| 9 | Dinalupihan-Olongapo Rd | 778.8 | 0.0 | 788.8 | 94.7 | 2.9 | 886.4 |
| 10 | Dinalupihan-Mariveles-Bagac Rd | 1,771.2 | 0.0 | 1,771.2 | 212.5 | 12.4 | 1,996.1 |
| 11 | Baliuag-San Jose Del Monte Rd | 46.4 | 0.0 | 46.4 | 5.6 | 0.0 | 52.0 |
| 12 | Baliuag-Sta.Ana Rd | 54.1 | 0.0 | 54.1 | 6.5 | 0.0 | 60.6 |
| 13 | Mabalacat-Capas Rd | 70.1 | 0.0 | 70.1 | 8.4 | 0.0 | 78.5 |
| 14 | Capas-Botolan Rd | 715.3 | 0.0 | 715.3 | 85.8 | 7.3 | 808.4 |
| 15 | Sta.Rosa-Tarlac Rd | 32.5 | 0.0 | 32.5 | 3.9 | 0.0 | 36.4 |
| 16 | Cabanatuan-Baler Rd | 970.0 | 0.0 | 970.0 | 116.4 | 1.2 | 1,087.6 |
| 17 | Palayan-Dingalan Rd | 345.4 | 0.0 | 345.4 | 41.5 | 0.2 | 387.1 |
| 18 | San Jose-Bongabon Rd | 177.2 | 205.9 | 383.1 | 46.0 | 1.1 | 430.2 |
| 19 | Rosales-Baloc Rd | 112.4 | 0.0 | 112.4 | 13.5 | 0.0 | 125.9 |
| 20 | Rosales-San Jose Rd | 51.2 | 0.0 | 51.2 | 6.1 | 0.0 | 57.3 |
| 21 | Rosales-Sta.Fe Rd | 694.9 | 0.0 | 694.9 | 83.4 | 4.5 | 782.8 |
| 22 | Carmen-Bautista Rd | 65.1 | 0.0 | 65.1 | 7.8 | 0.0 | 72.9 |
| 23 | Camiling-Binmaley Rd | 50.9 | 0.0 | 50.9 | 6.1 | 0.0 | 57.0 |
| 24 | Burgos-Bani Rd | 93.7 | 2.9 | 96.6 | 11.6 | 0.1 | 108.3 |
| 25 | Aritao-Maddela Rd | 1,373.5 | 407.9 | 1,781.4 | 213.8 | 4.8 | 2,000.0 |
| 26 | Maddela-Dinalongan Rd | 749.6 | 0.0 | 749.6 | 90.0 | 1.1 | 840.7 |
| 27 | Cordon-Maddela Rd | 45.2 | 0.0 | 45.2 | 5.4 | 0.0 | 50.6 |
| 28 | Kennon Rd | 14.5 | 3,296.8 | 3,311.3 | 397.3 | 0.0 | 3,708.6 |
| 29 | Rosario-Pugo-Baguio Rd | 64.1 | 645.4 | 709.5 | 85.2 | 0.5 | 795.2 |
| 30 | Naguilian Rd | 93.2 | 318.8 | 412.0 | 49.4 | 6.0 | 467.4 |
| 31 | Aritao-Baguio Rd | 1,350.0 | 1,757.0 | 3,107.0 | 372.8 | 2.0 | 3,481.8 |
| 32 | Baguio-Bontoc Rd | 822.3 | 2,326.6 | 3,148.9 | 377.9 | 2.0 | 3,528.8 |
| 33 | Bokod-Abatan Rd | 1,093.2 | 184.2 | 1,277.4 | 153.3 | 1.9 | 1,432.6 |
| 34 | Tagudin-Sabangan Rd | 1,515.5 | 292.8 | 1,808.3 | 217.0 | 3.3 | 2,028.6 |
| 35 | Cervantes-Abatan Rd | 471.6 | 172.4 | 644.0 | 77.3 | 0.8 | 722.1 |
| 36 | Bagabag-Bontoc Rd | 723.7 | 429.0 | 1,152.7 | 138.3 | 1.2 | 1,292.2 |
| 37 | Santiago-Sta.Maria Rd | 451.8 | 86.2 | 538.0 | 64.5 | 0.1 | 602.6 |
| 38 | Ramon-Banaue Rd | 1,636.8 | 1,815.3 | 3,452.1 | 414.2 | 3.0 | 3,869.3 |
| 39 | Naguilian-Palanan Rd | 1,148.9 | 0.0 | 1,148.9 | 137.9 | 7.4 | 1,294.2 |
| 40 | Lubuagan-Bontoc Rd | 1,131.6 | 1,043.8 | 2,175.4 | 261.1 | 2.2 | 2,438.7 |
| 41 | Cabagan-Solana Rd | 487.8 | 0.0 | 487.8 | 58.5 | 0.0 | 546.3 |
| 42 | Enrile-Lubuagan Rd | 497.1 | 340.1 | 837.2 | 100.5 | 0.7 | 938.4 |
| 43 | Narvacan-Lubuagan Rd | 2,096.0 | 14.2 | 2,110.2 | 253.2 | 3.7 | 2,367.1 |
| 44 | Abbut-Tabuk Rd | 480.4 | 0.0 | 480.4 | 57.7 | 1.1 | 539.2 |
| 45 | San Nicolas-Abbut Rd | 2,581.4 | 2.9 | 2,584.3 | 310.1 | 11.9 | 2,906.3 |
| 46 | Solana-Piat Rd | 98.7 | 0.0 | 98.7 | 11.8 | 0.0 | 110.5 |
| 47 | Nassiping-Abbut Rd | 544.2 | 18.6 | 562.8 | 67.5 | 0.2 | 630.5 |
| 48 | Magapit-Sta.Ana Rd | 549.3 | 0.0 | 549.3 | 65.9 | 0.0 | 615.2 |
| 49 | Infanta-Dingalan Rd | 2,043.2 | 0.0 | 2,043.2 | 245.2 | 14.3 | 2,302.7 |
| 50 | Dingalan-Baler Rd | 2,559.1 | 0.0 | 2,559.1 | 307.1 | 17.8 | 2,884.0 |

- continued -

TABLE 12.2-9 PROJECT COST (2)

(Million Pesos)

| Proj. No. | Project Name | Construction Cost | | | Eng'g Cost | ROW Cost (B) | Project Cost (C) |
|---|---|---|---|---|---|---|---|
| | | Rd & Brdg | Disaster (A) | Sub-Total | | | |
| 51 | Baler-Dinalongan Rd | 368.7 | 0.0 | 368.7 | 44.2 | 6.3 | 419.2 |
| 52 | Dinalongan-Palanan Rd | 2,461.4 | 0.0 | 2,461.4 | 295.3 | 23.0 | 2,779.7 |
| 53 | Palanan-Sta.Ana Rd | 4,248.5 | 0.0 | 4,248.5 | 509.8 | 29.5 | 4,787.8 |
| 54 | South Luzon Expressway | 511.9 | 0.0 | 511.9 | 61.4 | 0.0 | 573.3 |
| 55 | S.Luzon Expwy Ext, Batangas Line | 2,894.2 | 0.0 | 2,894.2 | 347.4 | 107.4 | 3,349.0 |
| 56 | S.Luzon Expwy Ext, Lucena Line | 3,464.5 | 0.0 | 3,464.5 | 415.6 | 143.0 | 4,023.1 |
| 57 | Pan-Phil H'way, Lucena-Calauag | 2,783.6 | 5.9 | 2,789.5 | 334.7 | 25.9 | 3,150.1 |
| 58 | Pan-Phil H'way, Calauag-Sipocot | 76.2 | 2.9 | 79.1 | 9.5 | 0.0 | 88.6 |
| 59 | Calauag-Sipocot Diversion Rd | 4,236.0 | 0.0 | 4,236.0 | 508.3 | 37.5 | 4,781.8 |
| 60 | Sipocot-Putiao Diversion Rd | 3,453.8 | 0.0 | 3,453.8 | 414.6 | 96.8 | 3,965.2 |
| 61 | Manila-Cavite Expressway | 1,243.5 | 0.9 | 1,243.5 | 149.2 | 21.2 | 1,413.9 |
| 62 | Bacoor-Tagaytay-Tanza Rd | 1,614.4 | 0.0 | 1,614.4 | 193.7 | 66.5 | 1,874.6 |
| 63 | Calamba-Tagaytay Rd | 180.6 | 0.0 | 180.6 | 21.7 | 2.4 | 204.7 |
| 64 | Tagaytay-Talisay Rd | 95.4 | 0.0 | 95.4 | 11.5 | 0.2 | 107.1 |
| 65 | Talisay-Lemery Rd | 315.5 | 0.0 | 315.5 | 37.9 | 9.9 | 363.3 |
| 66 | Naic-Nasugbu Rd | 842.5 | 0.0 | 842.5 | 101.1 | 6.2 | 949.8 |
| 67 | Nasugbu-Lemery Rd | 93.4 | 0.0 | 93.4 | 11.2 | 0.0 | 104.6 |
| 68 | Marikina-Infanta Rd | 1,104.6 | 4.2 | 1,108.8 | 133.0 | 5.6 | 1,247.4 |
| 69 | Pasig-Binangonan Rd | 416.8 | 0.0 | 416.8 | 50.0 | 312.3 | 779.1 |
| 70 | Famy-Infanta Rd | 504.0 | 0.0 | 504.0 | 60.5 | 2.0 | 566.5 |
| 71 | Calamba-Pagsanjan Diversion Rd | 1,334.8 | 0.0 | 1,334.8 | 160.2 | 77.9 | 1,572.9 |
| 72 | San Pablo-Mauban Rd | 366.2 | 0.0 | 366.2 | 43.9 | 1.0 | 411.1 |
| 73 | Pagsanjan-Lucena Rd | 192.2 | 0.0 | 192.2 | 23.1 | 0.7 | 216.0 |
| 74 | Tignuan-Atimonan Rd | 2,611.8 | 0.0 | 2,611.8 | 313.4 | 17.2 | 2,942.4 |
| 75 | Batangas-San Juan Rd | 55.6 | 0.0 | 55.6 | 6.7 | 0.0 | 62.3 |
| 76 | Batangas-San Juan Coastal Rd | 694.4 | 0.0 | 694.4 | 83.4 | 19.3 | 797.1 |
| 77 | Malicboy-Mulanay Rd | 568.9 | 0.0 | 568.9 | 68.3 | 4.1 | 641.3 |
| 78 | Mulanay-Panagon-Jinabaan Rd | 1,717.6 | 0.0 | 1,717.6 | 206.1 | 8.4 | 1,932.1 |
| 79 | Mulanay-San Francisco-Panagon Rd | 1,736.8 | 0.0 | 1,736.8 | 208.4 | 9.4 | 1,954.6 |
| 80 | San Miguel-Tagkawayan Rd | 442.2 | 0.0 | 442.2 | 53.1 | 3.2 | 498.5 |
| 81 | Parigsa-Goa Rd | 543.3 | 0.0 | 543.3 | 65.1 | 5.0 | 613.4 |
| 82 | Tigaon-Lagonoy Rd | 22.7 | 0.0 | 22.7 | 2.7 | 0.0 | 25.4 |
| 83 | Lagonoy-Caramoan Rd | 1,420.4 | 0.0 | 1,420.4 | 170.4 | 2.5 | 1,593.3 |
| 84 | Lagonoy-Presentacion-Caramoan Rd | 1,062.4 | 0.0 | 1,062.4 | 127.5 | 4.0 | 1,193.9 |
| 85 | Lalud-Garchitorena Rd | 1,508.0 | 0.0 | 1,508.0 | 181.0 | 9.5 | 1,698.5 |
| 86 | Legaspi-Tigaon Rd | 507.7 | 0.0 | 507.7 | 60.9 | 0.7 | 569.3 |
| 87 | Ligao-Tabaco Rd | 70.7 | 0.0 | 70.7 | 8.5 | 0.8 | 80.0 |
| 88 | Legaspi-Manito-Sorsogon Rd | 727.5 | 10.7 | 738.2 | 88.6 | 3.9 | 830.7 |
| 89 | Matacong-Putiao Rd | 1,048.0 | 4.2 | 1,052.2 | 126.3 | 5.0 | 1,183.5 |
| 90 | Abuyog-Bulusan-Iroshin Rd | 266.4 | 42.9 | 309.3 | 37.1 | 2.9 | 349.3 |
| 91 | Juban-Magallanes Rd | 611.1 | 0.0 | 611.1 | 73.3 | 1.1 | 685.5 |
| | Total | 121,641.1 | 14,446.0 | 136,087.1 | 16,330.4 | 1,640.5 | 154,058.0 |

# CHAPTER 13

# IMPLEMENTATION SCHEDULE

## 13.1 PROCEDURE OF SCHEDULING

### 13.1.1 Procedure

Prior to scheduling the projects, future budgetary framework was set up, based on the actual road investment in the past and the planned road investment in the MTPIP. Then, all the LISR projects were prioritized and arranged in the descending order of the priority. Scheduling was done, basically, by selecting projects in the order of their priority for the earlier 6-year program, as long as the budgetary framework allows.

To put a priority on the LISR project, two alternative scenarios were prepared as to the future road development strategy: one is the "economic return oriented scenario" where only the benefit-cost ratio (B/C) was taken account for as the ranking factor. The other one is called "the regional development scenario", where several factors other than the B/C ratio were considered, such as road function, improvement needs in terms of population in the influenced area of a road and expected development impact. Finally, the both schedules developed on the respective scenarios are synthesized into one, taking into consideration additional factors such as project maturity, regional balance of budget allocation and engineering difficulty of a project. This compromised alternative is called the "balanced development oriented scenario", and adopted as the LISR Schedule.

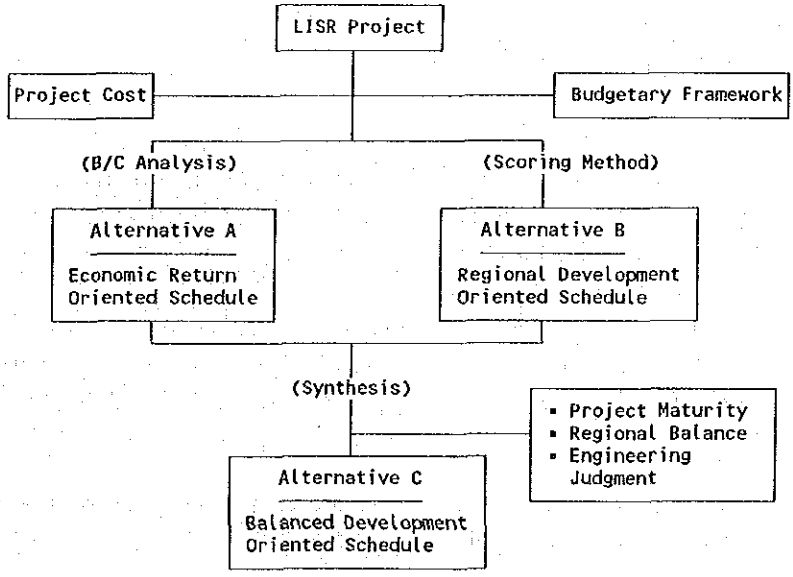


FIGURE 13.1-1 WORK-FLOW FOR SCHEDULING OF LISR PROJECT

### 13.1.2 Budgetary Framework

In order to make a masterplan an effective and useful one, the scale of investment must be determined in a reasonable range. If the total amount is far beyond the financial capacity of the Government, the masterplan shall result in a mere dream. On the other hand, a master plan has the nature of a long-term goal to be targeted. In this sense, a masterplan should aim at the maximum possible investment, taking future economic growth and budget increase into consideration.

The Philippine Government invested about 14.0 billion pesos to the road sector in 1991, about 30% of which was allocated to the Luzon island. In the Medium-Term Public Investment Program (MTPIP), DPWH envisages a sum of 112.5 billion pesos of road investment for the coming 6 years (1993-1998) and about 32% of the total is allocated to the Luzon island, 26.2 billion pesos of investment for national arterial road, 2.4 billion pesos for national secondary road, 7.0 billion pesos for expressway and then, 35.6 billion pesos in total.

In the Study Area, the regional economy is forecast to grow at average rate of 4.8% per annum until 2020. Assuming that the national budget also grow at this rate, the next 6-year program (1999-2004) will allot about 47.2 billion pesos to the national road in the Luzon island, ant the third program (2005-2010) 62.6 billion pesos. Comparing to the past performance, these targets are still in a plausible range, although ambitious.

As the conclusion, The LISR Schedule should be developed, keeping in mind a sum of 35 to 40 billion pesos for the First 6-year Program, 45 to 50 billion pesos for the Second 6-year Program and 60 to 65 billion pesos for the Third 6-year Program, respectively.

## 13.2 ECONOMIC EVALUATION

When financial resources is limited, economic feasibility will be a key criterion among others, to determine the priority of a project. Therefore, cost-benefit analysis on each project is made as the first approach for scheduling.

Definitions and calculating method of cost and benefit are the same as those used for the project evaluation stated in chapter 14. However, as the implementation schedule is not fixed yet in this stage, cost and benefit is compared by the following simplified way:

1) The annual cost and benefit entailed in the year 2020 are compared, adopting so called single-year-evaluation method.

2) Annual cost is defined by the following formula.

$$C = P ( 1/n + i/2 )$$

where, P : Project cost
n : Project life (30 years)
i : interest rate ( = discount rate : 30%)

3) For simplification, economic cost of a project is assumed to be 80% of its financial cost.

4) Benefit of a project will vary by whether other projects are implemented or not. Here, traffic assignment on the existing network with a project to evaluate is called "Plus Case" and on the LISR network without the project is called "Minus Case". B/C is calculated for both cases and the average is used, finally.

5) As using the benefit after 30 years instead of the intermediate year, a project with B/C ratio higher than 1.3 is regarded as feasible one, instead of 1.0.

The results is shown in Table 13.2-1. Using the budgetary shield of each 6 years Program, 34 projects are selected for the first Program, 28 project for the second, 13 project for the third, and 16 projects are carried over beyond the year 2010 because of their low economic viability (Table 13.2-2).

## 13.3 ALTERNATIVE SCHEDULING SCENARIO

### 13.3.1 Regional Development Oriented Schedule

1) Basic Idea

In Luzon island, only few roads have heavy traffic to cause a congestion. Then, planning should focus to compose a widely spread and solid network to support regional development. From this, higher priority should be given to a road, hierarchically highly ranked but badly conditioned. Even if the rank is low, priority is to be given to such a road in a area with many inhabitants and high development potentiality.

2) Rating System

The following criteria are used for scoring on the projects. Scoring rates are set up according to the Study Team's judgment.

A. Importance of Road Function

## TABLE 13.2-1 ECONOMIC EVALUATION BY SIMPLIFIED METHOD

| No. | Project Name | Cost | Economic Benefit | | | | | B/C |
|---|---|---|---|---|---|---|---|---|
| | | | VOC saving | Develop -ment B. | less Detour | less Restore. | Total | |
| 1 | North Luzon Expressway | 3,545.3 | 374.7 | 1,017.6 | 0.0 | 0.0 | 1,392.3 | 4.53 |
| 2 | New North Luzon Expressway | 12,016.8 | 1,230.9 | 3,445.9 | 0.0 | 0.0 | 4,676.8 | 4.49 |
| 3 | Manila North Rd, Rosario-Laoag | 7,055.5 | 507.5 | 559.2 | 279.6 | 4.5 | 1,350.7 | 2.21 |
| 4 | Pan-Phil H'way, Sta.Rita-San Jose | 3,465.2 | 776.8 | 1,321.1 | 8.8 | 0.3 | 2,106.9 | 7.02 |
| 5 | Pan-Phil H'way, San Jose-Magapit | 1,275.1 | 566.7 | 1,109.5 | 404.7 | 49.9 | 2,130.9 | 19.28 |
| 6 | Laoag-Magapit Rd | 547.0 | 101.4 | 20.4 | 9.3 | 9.0 | 140.0 | 2.95 |
| 7 | Manila-Bataan Coastal Rd, North | 2,856.9 | 475.6 | 859.7 | 0.0 | 0.0 | 1,335.2 | 5.39 |
| 8 | Manila-Bataan Coastal Rd, South | 18,495.2 | 297.4 | 2,608.2 | 0.0 | 0.0 | 2,905.6 | 1.81 |
| 9 | Dinalupihan-Olongapo Rd | 886.4 | 60.0 | 118.8 | 0.0 | 0.0 | 178.8 | 2.33 |
| 10 | Dinalupihan-Mariveles-Bagac Rd | 1,996.1 | 323.4 | 187.9 | 0.0 | 0.0 | 511.3 | 2.96 |
| 11 | Baliuag-San Jose Del Monte Rd | 52.0 | 24.7 | 126.5 | 0.0 | 0.0 | 151.2 | 33.57 |
| 12 | Baliuag-Sta.Ana Rd | 60.6 | 67.0 | 21.6 | 0.0 | 0.0 | 88.5 | 16.86 |
| 13 | Mabalacat-Capas Rd | 78.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 |
| 14 | Capas-Botolan Rd | 808.4 | 118.3 | 59.0 | 0.0 | 0.0 | 177.3 | 2.53 |
| 15 | Sta.Rosa-Tarlac Rd | 36.4 | 25.6 | 12.9 | 0.0 | 0.0 | 38.5 | 12.19 |
| 16 | Cabanatuan-Baler Rd | 1,087.6 | 149.8 | 494.8 | 0.0 | 0.0 | 644.6 | 6.84 |
| 17 | Palayan-Dingalan Rd | 387.6 | 48.0 | 0.0 | 0.0 | 0.0 | 48.0 | 1.43 |
| 18 | San Jose-Palayan Rd | 430.2 | 67.8 | 38.6 | 0.3 | 12.9 | 119.6 | 3.21 |
| 19 | Rosales-Baloc Rd | 125.9 | 64.0 | 40.9 | 0.0 | 0.0 | 104.8 | 9.60 |
| 20 | Rosales-San Jose Rd | 57.3 | 47.3 | 39.5 | 0.0 | 0.0 | 86.8 | 17.50 |
| 21 | Rosales-Sta.Fe Rd | 782.8 | 167.6 | 134.5 | 0.0 | 0.0 | 302.2 | 4.45 |
| 22 | Carmen-Bautista Rd | 72.9 | 16.7 | 15.5 | 0.0 | 0.0 | 32.2 | 5.11 |
| 23 | Camiling-Binmaley Rd | 57.0 | 107.4 | 116.2 | 0.0 | 0.0 | 223.6 | 45.34 |
| 24 | Burgos-Bani Rd | 108.3 | 11.3 | 2.7 | 0.0 | 0.2 | 14.1 | 1.51 |
| 25 | Aritao-Maddela Rd | 2,000.0 | 70.3 | 7.6 | 0.1 | 25.6 | 103.5 | 0.60 |
| 26 | Maddela-Dinalongan Rd | 840.7 | 12.4 | 22.8 | 0.0 | 0.0 | 35.1 | 0.48 |
| 27 | Cordon-Maddela Rd | 50.6 | 1.3 | 0.0 | 0.0 | 0.0 | 1.3 | 0.29 |
| 28 | Kennon Rd | 3,708.6 | 124.1 | 186.6 | 8.5 | 206.8 | 525.9 | 1.64 |
| 29 | Rosario-Pugo-Baguio Rd | 795.2 | 28.1 | 0.0 | 0.6 | 40.5 | 69.2 | 1.00 |
| 30 | Naguilian Rd | 467.4 | 87.6 | 51.0 | 8.7 | 20.0 | 167.3 | 4.13 |
| 31 | Aritao-Baguio Rd | 3,481.8 | 382.4 | 86.5 | 6.0 | 110.2 | 585.1 | 1.94 |
| 32 | Baguio-Bontoc Rd | 3,528.8 | 228.1 | 75.2 | 73.0 | 145.9 | 522.2 | 1.71 |
| 33 | Bokod-Abatan Rd | 1,432.6 | 149.9 | 3.8 | 0.1 | 11.6 | 165.4 | 1.33 |
| 34 | Tagudin-Sabangan Rd | 2,028.6 | 178.3 | 50.9 | 8.7 | 18.4 | 256.2 | 1.46 |
| 35 | Cervantes-Abatan Rd | 722.1 | 33.1 | 0.0 | 1.6 | 10.8 | 45.5 | 0.73 |
| 36 | Bagabag-Bontoc Rd | 1,292.2 | 31.7 | 28.6 | 27.8 | 26.9 | 115.1 | 1.03 |
| 37 | Santiago-Sta.Maria Rd | 602.6 | 235.3 | 239.9 | 5.9 | 5.4 | 486.5 | 9.32 |
| 38 | Ramon-Banaue Rd | 3,869.3 | 194.4 | 0.0 | 0.0 | 113.9 | 308.2 | 0.92 |
| 39 | Naguilian-Palanan Rd | 1,294.2 | 306.6 | 30.6 | 0.0 | 0.0 | 337.2 | 3.01 |
| 40 | Lubuagan-Bontoc Rd | 2,438.7 | 125.8 | 28.6 | 9.8 | 65.5 | 229.6 | 1.09 |
| 41 | Cabagan-Solana Rd | 546.3 | 103.7 | 44.8 | 0.0 | 0.0 | 148.5 | 3.14 |
| 42 | Enrile-Lubuagan Rd | 938.4 | 100.0 | 40.8 | 19.2 | 21.3 | 181.3 | 2.23 |
| 43 | Narvacan-Lubuagan Rd | 2,367.1 | 434.7 | 80.8 | 58.0 | 0.9 | 574.4 | 2.80 |
| 44 | Tuao-Tabuk Rd | 539.2 | 53.2 | 6.5 | 0.0 | 0.0 | 59.6 | 1.28 |
| 45 | San Nicolas-Tuao Rd | 2,906.3 | 1,823.0 | 319.6 | 36.7 | 0.2 | 2,179.5 | 8.65 |
| 46 | Solana-Piat Rd | 110.5 | 9.1 | 0.0 | 0.0 | 0.0 | 9.1 | 0.94 |
| 47 | Nassiping-Abbut Rd | 630.5 | 92.9 | 13.6 | 0.4 | 1.2 | 108.0 | 1.98 |
| 48 | Magapit-Sta.Ana Rd | 615.2 | 141.7 | 22.6 | 0.0 | 0.0 | 164.2 | 3.08 |
| 49 | Infanta-Dingalan Rd | 2,302.7 | 220.8 | 37.7 | 0.0 | 0.0 | 258.5 | 1.30 |
| 50 | Dingalan-Baler Rd | 2,884.0 | 325.2 | 0.0 | 0.0 | 0.0 | 325.2 | 1.30 |
| 51 | Baler-Dinalongan Rd | 419.2 | 126.4 | 42.1 | 0.0 | 0.0 | 168.5 | 4.64 |
| 52 | Dinalongan-Palanan Rd | 2,779.7 | 313.5 | 37.7 | 0.0 | 0.0 | 351.2 | 1.46 |
| 53 | Palanan-Sta.Ana Rd | 4,787.8 | 296.9 | 4.4 | 0.0 | 0.0 | 301.2 | 0.73 |
| 54 | South Luzon Expressway | 573.3 | 98.1 | 645.9 | 0.0 | 0.0 | 744.0 | 14.97 |
| 55 | S.Luzon Expwy Ext, Batangas Line | 3,349.0 | 474.0 | 617.3 | 0.0 | 0.0 | 1,091.2 | 3.76 |
| 56 | S.Luzon Expwy Ext, Lucena Line | 4,023.1 | 467.8 | 1,314.7 | 0.0 | 0.0 | 1,782.5 | 5.11 |
| 57 | Pan-Phil H'way, Lucena-Calauag | 3,150.1 | 547.1 | 1,049.7 | 55.8 | 0.4 | 1,653.0 | 6.05 |

## TABLE 13.2-1 ECONOMIC EVALUATION BY SIMPLIFIED METHOD

| No. | Project Name | Cost | Economic Benefit | | | | | B/C |
|---|---|---|---|---|---|---|---|---|
| | | | VOC saving | Develop -ment B. | less Detour | less Restore. | Total | |
| 58 | Pan-Phil H'way, Calauag-Sipocot | 88.6 | 223.8 | 309.9 | 80.3 | 0.2 | 614.2 | 79.99 |
| 59 | Calauag-Sipocot Diversion Rd | 4,781.8 | 855.1 | 1,517.7 | 0.0 | 0.0 | 2,372.8 | 5.73 |
| 60 | Sipocot-San Vicente Diversion Rd | 3,965.2 | 556.7 | 619.7 | 0.0 | 0.0 | 1,176.4 | 3.42 |
| 61 | Manila-Cavite Expressway | 1,413.9 | 459.3 | 927.0 | 0.0 | 0.0 | 1,386.4 | 11.31 |
| 62 | Bacoor-Tagaytay-Tanza Rd | 1,874.6 | 267.6 | 423.1 | 0.0 | 0.0 | 690.6 | 4.25 |
| 63 | Calamba-Tagaytay Rd | 204.7 | 174.0 | 30.1 | 0.0 | 0.0 | 204.1 | 11.50 |
| 64 | Tagaytay-Talisay Rd | 107.1 | 42.3 | 31.4 | 0.0 | 0.0 | 73.7 | 7.95 |
| 65 | Laurel-Lemery Rd | 363.3 | 159.1 | 38.6 | 0.0 | 0.0 | 197.7 | 6.28 |
| 66 | Naic-Nasugbu Rd | 949.8 | 150.4 | 0.0 | 0.0 | 0.0 | 150.4 | 1.83 |
| 67 | Nasugbu-Lemery Rd | 104.6 | 71.4 | 28.2 | 0.0 | 0.0 | 99.5 | 10.99 |
| 68 | Marikina-Infanta Rd | 1,247.4 | 240.4 | 140.4 | 0.0 | 0.3 | 381.1 | 3.53 |
| 69 | Pasig-Binangonan Rd | 779.1 | 218.4 | 1,726.0 | 0.0 | 0.0 | 1,944.3 | 28.79 |
| 70 | Famy-Infanta Rd | 566.5 | 261.1 | 180.1 | 0.0 | 0.0 | 441.2 | 8.99 |
| 71 | Calamba-Pagsanhan Diversion Rd | 1,572.9 | 436.7 | 0.0 | 0.0 | 0.0 | 436.7 | 3.20 |
| 72 | San Pablo-Mauban Rd | 411.1 | 259.7 | 58.0 | 0.0 | 0.0 | 317.7 | 8.92 |
| 73 | Pagsanhan-Lucena Rd | 216.0 | 99.8 | 60.2 | 0.0 | 0.0 | 159.9 | 8.54 |
| 74 | Tignuan-Atimonan Rd | 2,942.4 | 322.9 | 15.9 | 0.0 | 0.0 | 338.8 | 1.33 |
| 75 | Batangas-San Juan Rd | 62.3 | 140.8 | 22.2 | 0.0 | 0.0 | 162.9 | 30.19 |
| 76 | Batangas-San Juan Coastal Rd | 797.1 | 360.0 | 14.5 | 0.0 | 0.0 | 374.6 | 5.42 |
| 77 | Malicboy-Mulanay Rd | 641.3 | 277.9 | 437.0 | 0.0 | 0.0 | 714.9 | 12.86 |
| 78 | Mulanay-Panagon-Jinabaan Rd | 1,932.1 | 234.8 | 74.4 | 0.0 | 0.0 | 309.1 | 1.85 |
| 79 | Mulanay-San Francisco-Panagon Rd | 1,954.6 | 377.1 | 40.0 | 0.0 | 0.0 | 417.1 | 2.46 |
| 80 | San Miguel-Tagkawayan Rd | 498.5 | 41.3 | 0.0 | 0.0 | 0.0 | 41.3 | 0.96 |
| 81 | Calabanga-Goa Rd | 613.4 | 127.0 | 24.9 | 0.0 | 0.0 | 151.9 | 2.86 |
| 82 | Tigaon-Lagonoy Rd | 25.4 | 15.6 | 0.0 | 0.0 | 0.0 | 15.6 | 7.03 |
| 83 | Lagonoy-Caramoan Rd | 1,593.3 | 474.2 | 19.9 | 0.0 | 0.0 | 494.1 | 3.58 |
| 84 | Lagonoy-Presentacion-Caramoan Rd | 1,193.9 | 315.1 | 25.9 | 0.0 | 0.0 | 341.0 | 3.30 |
| 85 | Lalud-Garchitorena Rd | 1,698.3 | 179.8 | 14.0 | 0.0 | 0.0 | 193.7 | 1.32 |
| 86 | Legaspi-Tigaon Rd | 569.3 | 144.0 | 12.5 | 0.0 | 0.0 | 156.5 | 3.17 |
| 87 | Ligao-Tabaco Rd | 80.0 | 79.7 | 21.0 | 0.0 | 0.0 | 100.6 | 14.52 |
| 88 | Legaspi-Manito-Sorsogon Rd | 830.7 | 198.0 | 1.1 | 0.0 | 0.7 | 199.7 | 2.77 |
| 89 | Polangui-Pilar Rd | 1,183.5 | 324.3 | 17.8 | 0.0 | 0.3 | 342.4 | 3.34 |
| 90 | Abuyog-Bulusan-Iroshin Rd | 349.3 | 31.7 | 1.1 | 0.1 | 2.7 | 35.5 | 1.17 |
| 91 | Juban-Bulan-Gate Rd | 685.5 | 125.5 | 0.5 | 0.0 | 0.0 | 126.0 | 2.12 |
| | Total | 154,057.9 | 21,691.2 | 24,274.2 | 1,104.1 | 906.1 | 47,975.6 | - |

## Table 13.2-2 SCHEDULING BY SCENARIO A

| Period | Project | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Program I (1993-98) | 1 | 4 | 5 | 7 | 11 | 12 | 15 | 16 | 19 | 20 |
| | 22 | 23 | 37 | 45 | 51 | 54 | 56 | 57 | 58 | 59 |
| | 61 | 63 | 64 | 65 | 67 | 69 | 70 | 72 | 73 | 75 |
| | 76 | 77 | 82 | 87 | | | | | | |
| Program II (1999-2004) | 2 | 3 | 6 | 9 | 10 | 14 | 18 | 21 | 30 | 39 |
| | 41 | 42 | 43 | 47 | 48 | 55 | 60 | 62 | 68 | 71 |
| | 79 | 81 | 83 | 84 | 86 | 88 | 89 | 91 | | |
| Program III (2005-2010) | 8 | 17 | 24 | 28 | 31 | 32 | 33 | 34 | 52 | 66 |
| | 74 | 78 | 85 | | | | | | | |
| Later Period (2011- ) | 13 | 25 | 26 | 27 | 29 | 35 | 36 | 38 | 40 | 44 |
| | 46 | 49 | 50 | 53 | 80 | 90 | | | | |

## TABLE 13.3-1 PRIORITY AND RANKING OF LISR PROJECT BY SCENARIO B

| Sq. No. | Project No. | Name | DPWH Arterial Rd. Plan | LISR Category | Impro-vement Need | Economic Impact | Total Score | Project Cost | Project Cost (Accum.) |
|---|---|---|---|---|---|---|---|---|---|
| Program I (1993-98) | | | | | | | | | |
| 1 | 68 | Marikina-Infanta Rd | 30.0 | 10.0 | 21.8 | 10.0 | 71.8 | 1,247.5 | 1,247.5 |
| 2 | 30 | Naguilian Rd | 30.0 | 20.0 | 10.4 | 10.0 | 70.4 | 467.4 | 1,714.9 |
| 3 | 31 | Aritao-Baguio Rd | 30.0 | 20.0 | 14.9 | 0.0 | 64.9 | 3,481.7 | 5,196.6 |
| 4 | 5 | Pan-Phil H'way, San Jose-Magapit | 40.0 | 20.0 | 4.7 | 0.0 | 64.7 | 1,275.0 | 6,471.6 |
| 5 | 43 | Narvacan-Lubuagan Rd | 30.0 | 20.0 | 12.9 | 0.0 | 62.9 | 2,367.1 | 8,838.7 |
| 6 | 6 | Laoag-Magapit Rd | 40.0 | 20.0 | 2.8 | 0.0 | 62.8 | 547.0 | 9,385.7 |
| 7 | 83 | Lagonoy-Caramoan Rd | 30.0 | 10.0 | 22.3 | 0.0 | 62.3 | 1,593.3 | 10,979.0 |
| 8 | 39 | Naguilian-Palanan Rd | 30.0 | 10.0 | 21.3 | 0.0 | 61.3 | 1,294.2 | 12,273.2 |
| 9 | 58 | Pan-Phil H'way, Calauag-Sipocot | 40.0 | 20.0 | 1.1 | 0.0 | 61.1 | 88.6 | 12,361.8 |
| 10 | 41 | Cabagan-Solana Rd | 30.0 | 20.0 | 1.0 | 10.0 | 61.0 | 546.3 | 12,908.1 |
| 11 | 14 | Capas-Botolan Rd | 30.0 | 10.0 | 20.1 | 0.0 | 60.1 | 808.4 | 13,716.5 |
| 12 | 13 | Mabalacat-Capas Rd | 40.0 | 20.0 | 0.0 | 0.0 | 60.0 | 78.5 | 13,795.0 |
| 13 | 63 | Calamba-Tagaytay Rd | 30.0 | 10.0 | 19.7 | 0.0 | 59.7 | 204.8 | 13,999.8 |
| 14 | 42 | Enrile-Lubuagan Rd | 30.0 | 20.0 | 8.7 | 0.0 | 58.7 | 938.5 | 14,938.3 |
| 15 | 73 | Pagsanhan-Lucena Rd | 30.0 | 20.0 | 7.4 | 0.0 | 57.4 | 216.1 | 15,154.4 |
| 16 | 87 | Ligao-Tabaco Rd | 30.0 | 10.0 | 6.7 | 10.0 | 56.7 | 80.0 | 15,234.4 |
| 17 | 32 | Baguio-Bontoc Rd | 20.0 | 20.0 | 15.9 | 0.0 | 55.9 | 3,528.8 | 18,763.2 |
| 18 | 26 | Maddela-Dinalongan Rd | 30.0 | 20.0 | 5.9 | 0.0 | 55.9 | 840.7 | 19,603.9 |
| 19 | 34 | Tagudin-Sabangan Rd | 20.0 | 10.0 | 15.3 | 10.0 | 55.3 | 2,028.7 | 21,632.6 |
| 20 | 25 | Aritao-Maddela Rd | 30.0 | 10.0 | 15.1 | 0.0 | 55.1 | 2,000.0 | 23,632.6 |
| 21 | 16 | Cabanatuan-Baler Rd | 30.0 | 20.0 | 3.4 | 0.0 | 53.4 | 1,087.5 | 24,720.1 |
| 22 | 48 | Magapit-Sta.Ana Rd | 30.0 | 10.0 | 2.7 | 10.0 | 52.7 | 615.2 | 25,335.3 |
| 23 | 40 | Lubuagan-Bontoc Rd | 20.0 | 20.0 | 12.7 | 0.0 | 52.7 | 2,438.8 | 27,774.1 |
| 24 | 72 | San Pablo-Mauban Rd | 30.0 | 10.0 | 11.7 | 0.0 | 51.7 | 411.1 | 28,185.2 |
| 25 | 59 | Calauag-Sipocot Diversion Rd | 20.0 | 10.0 | 21.0 | 0.0 | 51.0 | 4,781.7 | 32,966.9 |
| 26 | 76 | Batangas-San Juan Coastal Rd | 20.0 | 10.0 | 20.2 | 0.0 | 50.2 | 797.1 | 33,764.0 |
| 27 | 15 | Sta.Rosa-Tarlac Rd | 30.0 | 20.0 | 0.0 | 0.0 | 50.0 | 36.4 | 33,800.4 |
| 28 | 77 | Malicboy-Mulanay Rd | 20.0 | 10.0 | 9.1 | 10.0 | 49.1 | 641.3 | 34,441.7 |
| 29 | 29 | Rosario-Pugo-Baguio Rd | 20.0 | 20.0 | 8.5 | 0.0 | 48.5 | 795.2 | 35,236.9 |
| 30 | 80 | San Miguel-Tagkawayan Rd | 20.0 | 10.0 | 17.7 | 0.0 | 47.7 | 498.6 | 35,735.5 |
| Program II (1999-2004) | | | | | | | | | |
| 31 | 86 | Legaspi-Tigaon Rd | 20.0 | 10.0 | 5.7 | 10.0 | 45.7 | 569.2 | 36,304.7 |
| 32 | 28 | Kennon Rd | 20.0 | 10.0 | 14.8 | 0.0 | 44.8 | 3,708.8 | 40,013.5 |
| 33 | 21 | Rosales-Sta.Fe Rd | 20.0 | 10.0 | 14.5 | 0.0 | 44.5 | 782.9 | 40,796.4 |
| 34 | 78 | Mulanay-Panagon-Jinabaan Rd | 0.0 | 10.0 | 22.6 | 10.0 | 42.6 | 1,932.1 | 42,728.5 |
| 35 | 46 | Solana-Piat Rd | 20.0 | 10.0 | 0.0 | 10.0 | 40.0 | 110.5 | 42,839.0 |
| 36 | 50 | Dingalan-Baler Rd | 0.0 | 10.0 | 30.0 | 0.0 | 40.0 | 2,884.0 | 45,723.0 |
| 37 | 82 | Tigaon-Lagonoy Rd | 30.0 | 10.0 | 0.0 | 0.0 | 40.0 | 25.5 | 45,748.5 |
| 38 | 74 | Tignuan-Atimonan Rd | 0.0 | 10.0 | 29.7 | 0.0 | 39.7 | 2,942.4 | 48,690.9 |
| 39 | 45 | San Nicolas-Tuao Rd | 0.0 | 10.0 | 19.6 | 10.0 | 39.6 | 2,906.3 | 51,597.2 |
| 40 | 85 | Lalud-Garchitorena Rd | 0.0 | 10.0 | 29.4 | 0.0 | 39.4 | 1,698.5 | 53,295.7 |
| 41 | 89 | Polangui-Pilar Rd | 0.0 | 10.0 | 17.4 | 10.0 | 37.4 | 1,183.6 | 54,479.3 |
| 42 | 49 | Infanta-Dingalan Rd | 0.0 | 10.0 | 26.2 | 0.0 | 36.2 | 2,302.7 | 56,782.0 |
| 43 | 84 | Lagonoy-Presentacion-Caramoan Rd | 0.0 | 10.0 | 25.3 | 0.0 | 35.3 | 1,194.0 | 57,976.0 |
| 44 | 20 | Rosales-San Jose Rd | 20.0 | 10.0 | 5.3 | 0.0 | 35.3 | 57.2 | 58,033.2 |
| 45 | 79 | Mulanay-San Francisco-Panagon Rd | 0.0 | 10.0 | 23.9 | 0.0 | 33.9 | 1,954.5 | 59,987.7 |
| 46 | 67 | Nasugbu-Lemery Rd | 20.0 | 10.0 | 3.8 | 0.0 | 33.8 | 104.5 | 60,092.2 |
| 47 | 91 | Juban-Bulan-Gate Rd | 0.0 | 10.0 | 13.6 | 10.0 | 33.6 | 685.5 | 60,777.7 |

TABLE 13.3-1 PRIORITY AND RANKING OF LISR PROJECT BY SCENARIO B (con't...)

| Sq. No. | Project No. | Name | DPWH Arterial Rd. Plan | LISR Category | Impro-vement Need | Economic Impact | Total Score | Project Cost | Project Cost (Accum.) |
|---|---|---|---|---|---|---|---|---|---|
| Program II (1999-2004) (con't...) | | | | | | | | | |
| 48 | 44 | Tuao-Tabuk Rd | 20.0 | 10.0 | 3.4 | 0.0 | 33.4 | 539.3 | 61,317.0 |
| 49 | 51 | Baler-Dinalongan Rd | 0.0 | 20.0 | 12.7 | 0.0 | 32.7 | 419.2 | 61,736.2 |
| 50 | 10 | Dinalupihan-Mariveles-Bagac Rd | 0.0 | 20.0 | 10.7 | 0.0 | 30.7 | 1,996.0 | 63,732.2 |
| 51 | 38 | Ramon-Banaue Rd | 0.0 | 10.0 | 20.7 | 0.0 | 30.7 | 3,869.2 | 67,601.4 |
| 52 | 65 | Laurel-Lemery Rd | 0.0 | 10.0 | 20.2 | 0.0 | 30.2 | 363.3 | 67,964.7 |
| 53 | 9 | Dinalupihan-Olongapo Rd | 0.0 | 20.0 | 0.0 | 10.0 | 30.0 | 886.4 | 68,851.1 |
| 54 | 55 | S.Luzon Expwy Ext, Batangas Line | 0.0 | 20.0 | 0.0 | 10.0 | 30.0 | 3,349.0 | 72,200.1 |
| 55 | 81 | Calabanga-Goa Rd | 0.0 | 10.0 | 19.7 | 0.0 | 29.7 | 613.5 | 72,813.6 |
| 56 | 88 | Legaspi-Manito-Sorsogon Rd | 0.0 | 10.0 | 19.4 | 0.0 | 29.4 | 830.8 | 73,644.4 |
| 57 | 36 | Bagabag-Bontoc Rd | 0.0 | 20.0 | 9.1 | 0.0 | 29.1 | 1,292.2 | 74,936.6 |
| 58 | 70 | Famy-Infanta Rd | 0.0 | 10.0 | 17.9 | 0.0 | 27.9 | 566.5 | 75,503.1 |
| 59 | 35 | Cervantes-Abatan Rd | 0.0 | 10.0 | 17.0 | 0.0 | 27.0 | 722.1 | 76,225.2 |
| 60 | 66 | Naic-Nasugbu Rd | 0.0 | 10.0 | 17.0 | 0.0 | 27.0 | 949.8 | 77,175.0 |
| 61 | 33 | Bokod-Abatan Rd | 0.0 | 10.0 | 15.9 | 0.0 | 25.9 | 1,432.6 | 78,607.6 |
| 62 | 47 | Nassiping-Abbut Rd | 0.0 | 10.0 | 3.3 | 10.0 | 23.3 | 630.3 | 79,237.9 |
| 63 | 52 | Dinalongan-Palanan Rd | 0.0 | 10.0 | 12.4 | 0.0 | 22.4 | 2,779.8 | 82,017.7 |
| 64 | 37 | Santiago-Sta.Maria Rd | 0.0 | 10.0 | 2.3 | 10.0 | 22.3 | 602.5 | 82,620.2 |
| Program III (2005-2010) | | | | | | | | | |
| 65 | 53 | Palanan-Sta.Ana Rd | 0.0 | 10.0 | 11.6 | 0.0 | 21.6 | 4,787.8 | 87,408.0 |
| 66 | 18 | San Jose-Palayan Rd | 0.0 | 10.0 | 11.5 | 0.0 | 21.5 | 430.2 | 87,838.2 |
| 67 | 12 | Baliuag-Sta.Ana Rd | 0.0 | 10.0 | 10.5 | 0.0 | 20.5 | 60.6 | 87,898.8 |
| 68 | 60 | Sipocot-San Vicente Diversion Rd | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 3,965.3 | 91,864.1 |
| 69 | 61 | Manila-Cavite Expressway | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 1,413.9 | 93,278.0 |
| 70 | 4 | Pan-Phil H'way, Sta.Rita-San Jose | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 3,465.1 | 96,743.1 |
| 71 | 1 | North Luzon Expressway | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 3,545.2 | 100,288.3 |
| 72 | 2 | New North Luzon Expressway | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 12,016.6 | 112,304.9 |
| 73 | 7 | Manila-Bataan Coastal Rd, North | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 2,857.0 | 115,161.9 |
| 74 | 54 | South Luzon Expressway | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 573.3 | 115,735.2 |
| 75 | 69 | Pasig-Binangonan Rd | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 779.1 | 116,514.3 |
| 76 | 8 | Manila-Bataan Coastal Rd, South | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 18,495.3 | 135,009.6 |
| 77 | 71 | Calamba-Pagsanhan Diversion Rd | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 1,572.9 | 136,582.5 |
| 78 | 56 | S.Luzon Expwy Ext, Lucena Line | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 4,023.0 | 140,605.5 |
| 79 | 57 | Pan-Phil H'way, Lucena-Calauag | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 3,150.0 | 143,755.5 |
| 80 | 27 | Cordon-Maddela Rd | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 50.5 | 143,806.0 |
| Later Period (2010 - ) | | | | | | | | | |
| 81 | 3 | Manila North Rd, Rosario-Laoag | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 | 7,055.5 | 150,861.5 |
| 82 | 64 | Tagaytay-Talisay Rd | 0.0 | 10.0 | 9.6 | 0.0 | 19.6 | 107.0 | 150,968.5 |
| 83 | 24 | Burgos-Bani Rd | 0.0 | 10.0 | 8.3 | 0.0 | 18.3 | 108.3 | 151,076.8 |
| 84 | 17 | Palayan-Dingalan Rd | 0.0 | 10.0 | 6.5 | 0.0 | 16.5 | 387.0 | 151,463.8 |
| 85 | 23 | Camiling-Binmaley Rd | 0.0 | 10.0 | 5.7 | 0.0 | 15.7 | 56.9 | 151,520.7 |
| 86 | 75 | Batangas-San Juan Rd | 0.0 | 10.0 | 5.6 | 0.0 | 15.6 | 62.3 | 151,583.0 |
| 87 | 90 | Abuyog-Bulusan-Iroshin Rd | 0.0 | 10.0 | 5.5 | 0.0 | 15.4 | 349.3 | 151,932.3 |
| 88 | 19 | Rosales-Baloc Rd | 0.0 | 10.0 | 4.3 | 0.0 | 14.3 | 126.0 | 152,058.3 |
| 89 | 11 | Baliuag-San Jose Del Monte Rd | 0.0 | 10.0 | 3.9 | 0.0 | 13.9 | 52.0 | 152,110.3 |
| 90 | 22 | Carmen-Bautista Rd | 0.0 | 10.0 | 2.0 | 0.0 | 12.0 | 72.8 | 152,183.1 |
| 91 | 62 | Bacoor-Tagaytay-Tanza Rd | 0.0 | 10.0 | 0.0 | 0.0 | 10.0 | 1,874.6 | 154,057.7 |

A-1 Classification in the DPWH Arterial Road Plan

| | |
|---|---|
| North-South Backbone | 40 points |
| East-West Lateral | 30 |
| Other Strategic Road | 20 |
| not listed | 0 |

A-2 Category in LISR

| | |
|---|---|
| Inter-Provintial-Capital Road | 20 points |
| Inter- Major-Activity-Center Road | 10 |
| Agricultural Development Support Road | 10 |
| National Integration Road | 10 |

B. Improvement Needs

$$\text{Point} = 30 \times f_1 \times f_2$$

$$f_1 = 0 \times (G + F) + 0.5 \times B + 0.75 \times V + 1.0 \times I$$
$$f_2 = 1.0 \quad (P >= 100{,}000)$$
$$= P/100{,}000 \quad (P < 100{,}000)$$

where, $f_1$ : Road condition factor
$f_2$ : Population coverage factor
G, F, B, V, I : Percentage of road extension conditioned good, fair, bad, very bad and impassable, respectively, in total length of a project
P : Population in the influenced area of a project

C. Impact on Regional Development

| | |
|---|---|
| Direct impact expected | 10 points |
| No direct impact | 0 |

3) Result

Table 13.3-1 presents the projects in the descending order of priority. All the projects(30) designated in the first 6 year Program are Arterial roads in DPWH Plan, while most of the latter half of the second and the third Program are the Inter-Provincial-Capital Roads in the LISR network, but not the Arterial.

## 13.3.2 Balanced Development Oriented Scenario

Based on the outputs of the aforementioned two scenarios, the third schedule is developed, compromising the antecedent two schedules. In this case, scheduling is done not by project, but by project segment, so that the scheduling work is done more flexibly.

In this case, it is noted to program for the projects with high maturity ( already committed or detail-deigned) to come into the earlier stage. Also, an attention is paid to the regional balance, avoiding remarkable imbalance among regions and excessive concentration to a certain region in one Program period. The result is shown in Table 13.3.2.

## TABLE 13.3-2 PROPOSED SCHEDULE BY SCENARIO C

| Project No. | Schedule (X-th Program) | | Alternative C | | |
|---|---|---|---|---|---|
| | Alt. A | Alt. B | Segment Code | Schedule | Const. Period |
| 1 | 1 | 3 | 1 -1 | 2 | 3 |
| | | | 1 -2 | 2 | 3 |
| | | | 1 -3 | 1 | 3 |
| 2 | 2 | 3 | 2 -1 | 1 | 3 |
| | | | 2 -2 | 1 | 3 |
| | | | 2 -3 | 1 | 3 |
| | | | 2 -4 | 2 | 3 |
| | | | 2 -5 | 2 | 4 |
| | | | 2 -6 | 2 | 3 |
| | | | 2 -7 | 3 | 3 |
| 3 | 2 | 4 | 3 -1 | 3 | 3 |
| | | | 3 -2 | 3 | 3 |
| | | | 3 -3 | 3 | 3 |
| | | | 3 -4 | 3 | 4 |
| | | | 3 -5 | 3 | 4 |
| 4 | 1 | 3 | 4 -1 | 1 | 3 |
| | | | 4 -2 | 1 | 3 |
| | | | 4 -3 | 1 | 2 |
| | | | 4 -4 | 2 | 2 |
| | | | 4 -5 | 2 | 3 |
| | | | 4 -6 | 2 | 2 |
| 5 | 1 | 1 | 5 -1 | 1 | 3 |
| | | | 5 -2 | 1 | 1 |
| | | | 5 -3 | 1 | 1 |
| | | | 5 -4 | 1 | 2 |
| | | | 5 -5 | 1 | 1 |
| | | | 5 -6 | 1 | 1 |
| | | | 5 -7 | 1 | 1 |
| | | | 5 -8 | 1 | 1 |
| | | | 5 -9 | 1 | 1 |
| 6 | 2 | 1 | 6 -1 | 1 | 2 |
| | | | 6 -2 | 1 | 2 |
| 7 | 1 | 3 | 7 -1 | 1 | 2 |
| | | | 7 -2 | 1 | 3 |
| | | | 7 -3 | 1 | 2 |
| 8 | 3 | 3 | 8 -1 | 4 | - |
| | | | 8 -2 | 4 | - |
| | | | 8 -3 | 4 | - |
| 9 | 2 | 2 | 9 -1 | 1 | 3 |
| 10 | 2 | 2 | 10 -1 | 2 | 3 |
| | | | 10 -2 | 2 | 3 |
| | | | 10 -3 | 1 | 2 |
| 11 | 1 | 4 | 11 -1 | 2 | 1 |
| 12 | 1 | 3 | 12 -1 | 2 | 1 |
| 13 | 4 | 1 | 13 -1 | 1 | 1 |
| 14 | 2 | 1 | 14 -1 | 3 | 3 |
| 15 | 1 | 1 | 15 -1 | 1 | 1 |
| 16 | 1 | 1 | 16 -1 | 1 | 1 |
| | | | 16 -2 | 1 | 1 |
| | | | 16 -3 | 1 | 3 |
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| 22 | 1 | 4 | 22 -1 | 2 | 1 |
| 23 | 1 | 4 | 23 -1 | 2 | 1 |
| | | | 23 -2 | 2 | 1 |
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| 25 | 4 | 1 | 25 -1 | 3 | 3 |
| | | | 25 -2 | 3 | 3 |
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| | | | 29 -2 | 1 | 1 |
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| | | | 31 -2 | 2 | 3 |
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| | | | 34 -2 | 2 | 3 |
| 35 | 4 | 2 | 35 -1 | 3 | 3 |
| 36 | 4 | 2 | 36 -1 | 3 | 1 |
| | | | 36 -2 | 3 | 3 |
| 37 | 1 | 2 | 37 -1 | 1 | 1 |
| | | | 37 -2 | 1 | 2 |
| | | | 37 -3 | 1 | 2 |
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| | | | 42 -2 | 1 | 3 |
| 43 | 2 | 1 | 43 -1 | 1 | 2 |
| | | | 43 -2 | 1 | 3 |
| | | | 43 -3 | 1 | 3 |
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| | | | 45 -2 | 2 | 3 |
| | | | 45 -3 | 2 | 3 |
| 46 | 4 | 2 | 46 -1 | 2 | 1 |
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| | | | 48 -2 | 2 | 2 |
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| | | | 52 -2 | 3 | 3 |
| 53 | 4 | 3 | 53 -1 | 3 | 3 |
| | | | 53 -2 | 4 | 3 |
| 54 | 1 | 3 | 54 -1 | 1 | 2 |
| | | | 54 -2 | 1 | 2 |
| 55 | 2 | 2 | 55 -1 | 1 | 3 |
| | | | 55 -2 | 1 | 3 |
| | | | 55 -3 | 1 | 1 |
| 56 | 1 | 3 | 56 -1 | 2 | 2 |
| | | | 56 -2 | 2 | 3 |
| | | | 56 -3 | 2 | 3 |
| | | | 56 -4 | 2 | 3 |
| 57 | 1 | 3 | 57 -1 | 2 | 3 |
| | | | 57 -2 | 2 | 3 |
| | | | 57 -3 | 2 | 3 |
| 58 | 1 | 1 | 58 -1 | 1 | 1 |
| 59 | 1 | 1 | 59 -1 | 3 | 2 |
| | | | 59 -2 | 3 | 3 |
| | | | 59 -3 | 1 | 2 |
| | | | 59 -4 | 3 | 3 |
| 60 | 2 | 3 | 60 -1 | 2 | 2 |
| | | | 60 -2 | 2 | 3 |
| | | | 60 -3 | 2 | 3 |
| | | | 60 -4 | 2 | 3 |
| | | | 60 -5 | 2 | 3 |
| 61 | 1 | 3 | 61 -1 | 1 | 3 |
| 62 | 2 | 4 | 62 -1 | 2 | 2 |
| | | | 62 -2 | 2 | 3 |
| | | | 62 -3 | 2 | 2 |
| | | | 62 -4 | 3 | 2 |
| | | | 62 -5 | 3 | 1 |
| 63 | 1 | 1 | 63 -1 | 1 | 2 |
| 64 | | 4 | 64 -1 | 1 | 1 |
| 65 | 1 | 2 | 65 -1 | 1 | 2 |
| 66 | 3 | 2 | 66 -1 | 3 | 3 |
| 67 | 1 | 2 | 67 -1 | 1 | 1 |
| 68 | 2 | | 68 -1 | 2 | 3 |
| 69 | 1 | 3 | 69 -1 | 1 | 2 |
| 70 | 1 | 2 | 70 -1 | 1 | 3 |
| | | | 70 -2 | 1 | 3 |
| 71 | 2 | 3 | 71 -1 | 2 | 3 |
| 72 | 1 | 1 | 72 -1 | 1 | 2 |
| | | | 72 -2 | 1 | 1 |
| 73 | 1 | 1 | 73 -1 | 1 | 2 |
| | | | 73 -2 | 1 | 1 |
| 74 | 3 | 2 | 74 -1 | 3 | 3 |
| | | | 74 -2 | 3 | 3 |
| 75 | 1 | 4 | 75 -1 | 2 | 1 |
| 76 | 1 | 1 | 76 -1 | 1 | 2 |
| | | | 76 -2 | 2 | 3 |
| 77 | 1 | 1 | 77 -1 | 1 | 2 |
| | | | 77 -2 | 1 | 3 |
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| | | | 78 -2 | 3 | 3 |
| 79 | 2 | 2 | 79 -1 | 3 | 3 |
| | | | 79 -2 | 3 | 3 |
| 80 | 4 | 1 | 80 -1 | 1 | 2 |
| 81 | 2 | 2 | 81 -1 | 2 | 2 |
| | | | 81 -2 | 3 | 3 |
| | | | 81 -3 | 3 | 1 |
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| 83 | 2 | 1 | 83 -1 | 1 | 1 |
| | | | 83 -2 | 1 | 1 |
| 84 | 2 | 2 | 84 -1 | 2 | 3 |
| | | | 84 -2 | 3 | 3 |
| 85 | 3 | 2 | 85 -1 | 3 | 3 |
| 86 | 2 | 2 | 86 -1 | 2 | 2 |
| | | | 86 -2 | 2 | 2 |
| 87 | 1 | 1 | 87 -1 | 1 | 1 |
| 88 | 2 | 2 | 88 -1 | 2 | 2 |
| 89 | 2 | 2 | 89 -1 | 2 | 3 |
| | | | 89 -2 | 2 | 3 |
| 90 | 4 | 4 | 90 -1 | 3 | 3 |
| | | | 90 -2 | 3 | 3 |
| 91 | 2 | 2 | 91 -1 | 3 | 3 |
| | | | 91 -2 | 3 | 3 |

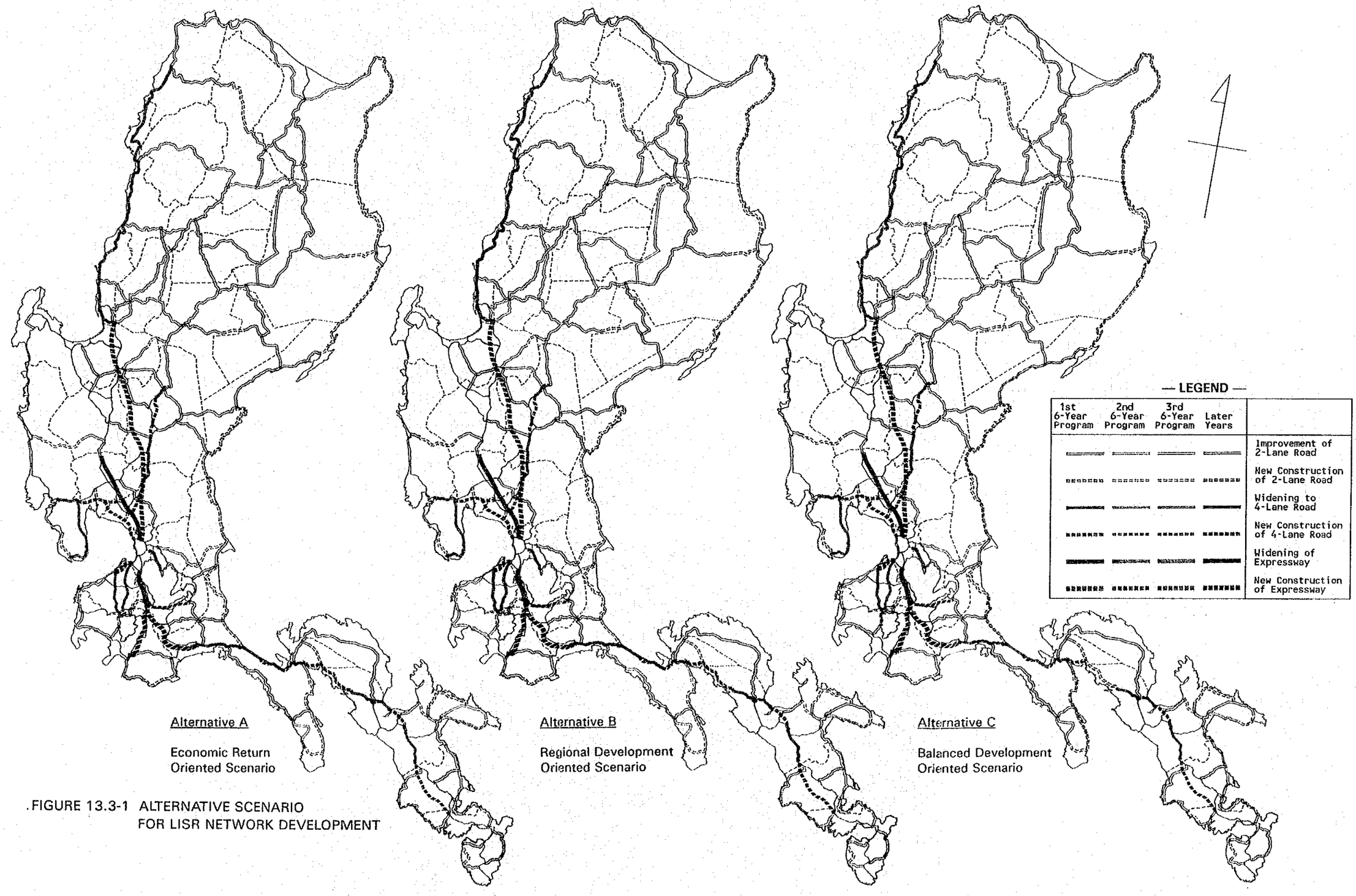



FIGURE 13.3-1 ALTERNATIVE SCENARIO FOR LISR NETWORK DEVELOPMENT

## 13.4 ANNUAL SCHEDULE

### 13.4.1 Basic Idea of Annual Scheduling

The recommended LISR network is composed of 9,090.5 Km road sections, of which 7,274.4 km are designated as the project sections. Taking account of already good or fair conditioned segments in the project sections, net con struction length is 5,468.5 Km in total.

The said 7,274.4 km road sections are divided into 91 projects and they are further sub-divided into 178 segments. This project segment is the basic component to be scheduled. Every segment has been already classified by the "Balanced development Scenario" into three groups: the first, the second and the third 6-year program. Due to the financial constraint, two projects (four segments) are carried over to the period after 2010, those are Manila-Bataan Coastal road, South (8-1, 8-2, 8-3) and Palanan-Sta. Ana road (53-2).

The following items are paid attention to, when planning the starting year and the completion year of a project segment:

a) To set the starting year so to complete the project in the designated program period, taking the construction period into account.

b) To make an increasing trend of annual investment amount without remarkable fluctuation.

c) To implement a set of projects closely related each other in the same period, in order to economize the cost.

d) To schedule the detail design, just before the implementation of a project. However, for several segments in one project, they should be done together.

### 13.4.2 Implementation Period

Standard size of one annual contract is assumed to be 60 million pesos as a rule of thumb. And in general, one segment is possibly completed within four years. Accordingly, construction period of a project is defined by the project cost as shown in Table 13.4-1.

TABLE 13.4-1 STANDARD CONSTRUCTION PERIOD

| Construction Cost (Million P) | No. of Contract | Construction Period (Year) |
|---|---|---|
| 0 - 60 | 1 | 1 |
| 60 - 120 | 1 | 1 |
| 120 - 240 | 2 | 2 |
| 240 - 360 | 3 | 2 |
| 360 - 480 | 4 | 2 |
| 480 - 3,000 | - | 3 |
| 3,000 - | - | 4 |

As for the detail design work, one year will be enough for each 100 km of ordinary road. In case of expressway, to design 30 km will take one year.

### 13.4.3 Proposed Schedule

After repetitive works by trial and error, annual schedule was finalized as shown in Table 13.4-2. This proposed schedule mostly satisfies the conditions stated in 13.4.1. Main projects to be implemented in each 6-year Program period are as follows:

1) Program I (1993 - 1998)

A. Expressway

- Widening of North Luzon Expressway, San Fernando-Mabalacat (1-3)
- First phase of new North Luzon Expressway detouring the area affected by Pinatubo (2-1,2,3)
- Widening of South Luzon Expressway, Sta Rita-San Jose (54-1,2)
- Extention of South Luzon Expressway to Batangas (55-1,2,3)

B. North-South Axis

- Improvement of North Pan-Philippine Highwat, Sta Rita-Gattaran section except Dalton Pass section (4-1,2,3, 5-1,2,3,4,5,6,7,8,9)
- Improvement of South Pan-Philippine Highway, Calauag-Sipcot (58-1)

C. Lateral Axis

- Improvement of Laoag-Gattaran Road (6-1,2)
- Improvement of Narvacan-Lubuagan Road (43-1,2,3)
- Improvement of Cabanatuan-Baler Road (16-1,2,3)
- Improvement of Malicboy-Mulanay Road (77-1,2)
- Construction of Batangas-San Juan Coastal Road (76-1,2)

2) Program II (1999 - 2004)

A. Expressway

- Completion of widening of South Luzon Expressway (54-2)
- Extention of South Luzon Expressway to Lucena (56-1.2.3,4)

B. North-South Axis

- Widening of Pan-Philippine Highway, Lucena-Calauag (57-1,2,3)
- Construction of Sipcot-San Vicente Diversion Road (60-1,2,3,4)
- Improvement and Construction of San Nicholas-Tuao Road (45-1,2,3)
- Improvement of Tagudin - Sabangan Road (34-1,2)

C. Lateral Axis

- Widening of Dinalupihan-Mariveres-Bagac Road (10-1,2)
- Construction of Marikina-Infanta Road (68-1)

3) Program III (2005 - 2010)

A. Expressway

- Completion of New North Luzon Expressway to Rosario (2-5,6,7)

B. North-South Axis

- Widening of Manila North Road (3-1,2,3,4,5)

C. Lateral Axis

- Construction of Trans-Sierra Madre roads, Aritao-Maddela (25-1), Maddela - Dinalongan(26-1) and Cordon - Maddela(27-1)

- Strengthening of circuit roads in Peninsulars, Bondoc (79-1,2), Camarines Sur (85-1) and Sorsogon ( 90-1,2, 91,1,2)

According to the proposed schedule, the LISR network will be completed by 49% in the year 1998, 74% in 2004 and 98% in 2010 in terms of extension, with the total investment amount of 131.7 billion pesos at 1992 price. Figure 13.4-1 shows how the LISR network is developed by the three 6-year Programs.

## 13.5 FINANCIAL REQUIREMENT

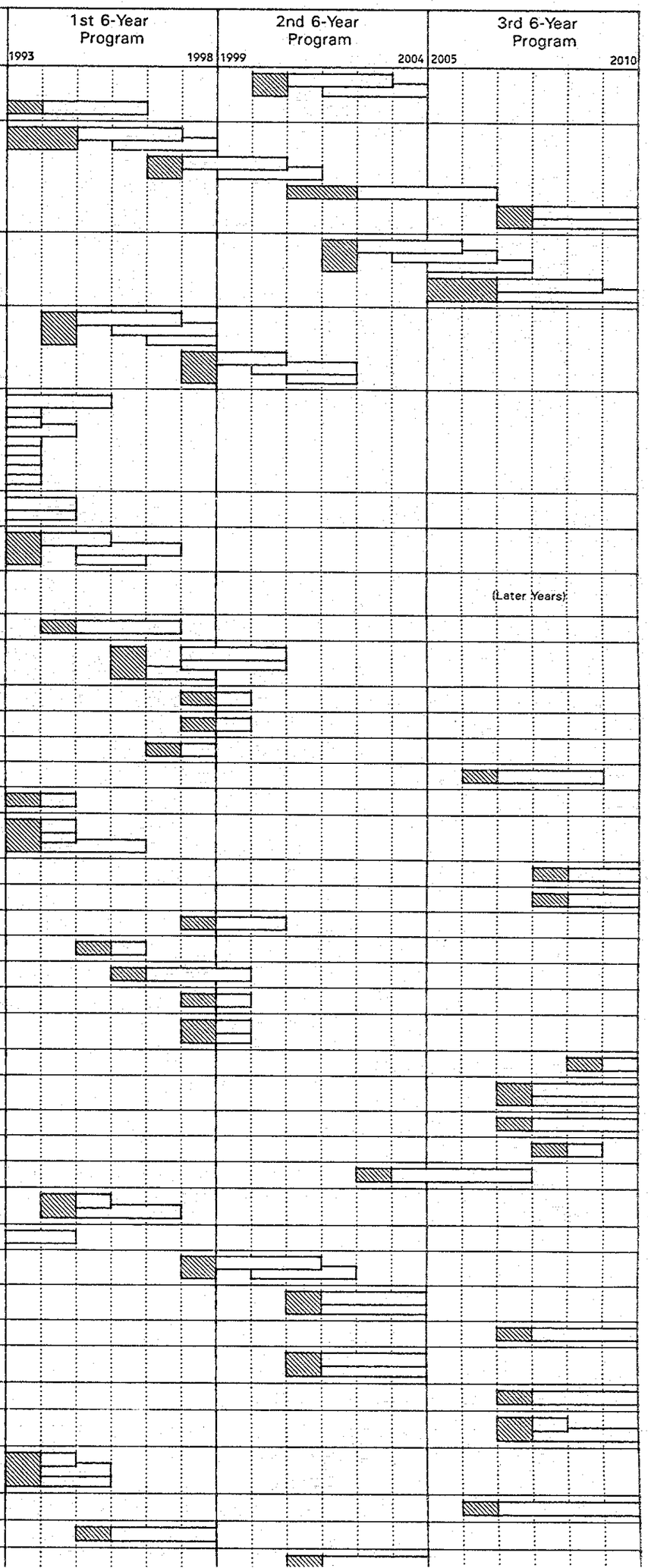
Out of the total cost of the 91 LISR projects of P 154.1 billion, P 131.2 billion will be required during the period of 1993 to 2010; 26% of which is scheduled for the Program I (1993-98), 37 % for the Program II (1999-04) and 37% for the Program III (2005-10), respectively.

The average investment amount is P 7.3 billion per annum, equivalent to 1.5 times of the actual investment achieved in 1992 to the trunk road in the Luzon island (Figure 13.5-1). The planned investment is considered still to be in the possible range when taking into account the future economic growth of 4.8 % per annum, even though some policy measures would be needed to expand the financial sources.

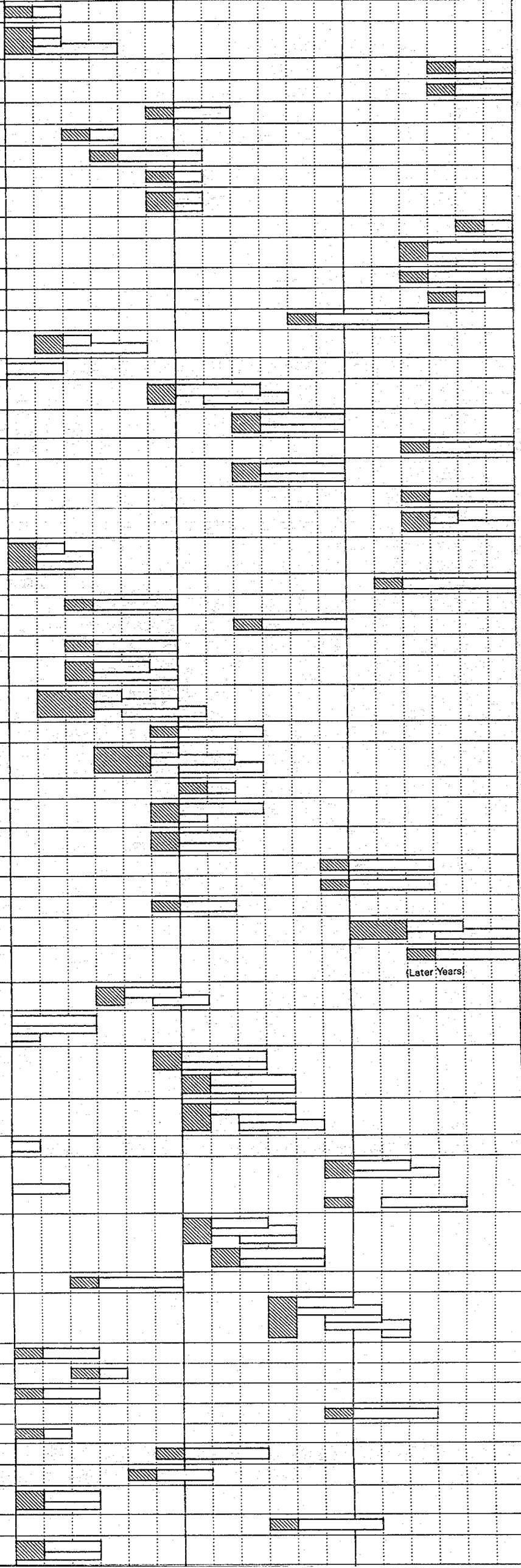
Looking for the financial resources for road development, such systems as objective taxes and toll facilities should be carefully revised based on the "beneficiaries to pay" principle and "causers to pay" principle (Section 16.3).

TABLE 13.4-2 ANNUAL IMPLEMENTATION SCHEDULE OF LISR PLAN

| | Project | Segment | Cost (₱ million) |
|---|---|---|---|
| 1 | North Luzon Expressway | 1-1 | 1262.8 |
| | | 1-2 | 1559.8 |
| | | 1-3 | 722.7 |
| 2 | New North Luzon Expressway | 2-1 | 2137.4 |
| | | 2-2 | 1049.8 |
| | | 2-3 | 1525.8 |
| | | 2-4 | 1254.1 |
| | | 2-5 | 3501.7 |
| | | 2-6 | 1341.7 |
| | | 2-7 | 1206.3 |
| 3 | Manila North Rd, Rosario-Laoag | 3-1 | 538.0 |
| | | 3-2 | 795.8 |
| | | 3-3 | 1602.0 |
| | | 3-4 | 1495.5 |
| | | 3-5 | 2624.2 |
| 4 | Pan-Phil H'way, Sta.Rita-San Jose | 4-1 | 1005.7 |
| | | 4-2 | 742.3 |
| | | 4-3 | 271.3 |
| | | 4-4 | 423.0 |
| | | 4-5 | 619.0 |
| | | 4-6 | 403.9 |
| 5 | Pan-Phil H'way, San Jose-Magapit | 5-1 | 872.8 |
| | | 5-2 | 60.3 |
| | | 5-3 | 32.3 |
| | | 5-4 | 179.9 |
| | | 5-5 | 75.2 |
| | | 5-6 | 1.6 |
| | | 5-7 | 16.1 |
| | | 5-8 | 17.1 |
| | | 5-9 | 19.8 |
| 6 | Laoag-Magapit Rd | 6-1 | 281.1 |
| | | 6-2 | 265.9 |
| 7 | Manila-Bataan Coastal Rd, North | 7-1 | 395.4 |
| | | 7-2 | 2251.4 |
| | | 7-3 | 210.1 |
| 8 | Manila-Bataan Coastal Rd, South | 8-1 | 1192.2 |
| | | 8-2 | 17196.2 |
| | | 8-3 | 106.8 |
| 9 | Dinalupihan-Olongapo Rd | 9-1 | 886.4 |
| 10 | Dinalupihan-Mariveles-Bagac Rd | 10-1 | 557.2 |
| | | 10-2 | 954.4 |
| | | 10-3 | 484.5 |
| 11 | Baliuag-San Jose Del Monte Rd | 11-1 | 52.0 |
| 12 | Baliuag-Sta.Ana Rd | 12-1 | 60.6 |
| 13 | Mabalacat-Capas Rd | 13-1 | 78.5 |
| 14 | Capas-Botolan Rd | 14-1 | 808.4 |
| 15 | Sta.Rosa-Tarlac Rd | 15-1 | 36.4 |
| 16 | Cabanatuan-Baler Rd | 16-1 | 21.6 |
| | | 16-2 | 11.8 |
| | | 16-3 | 1054.2 |
| 17 | Palayan-Dingalan Rd | 17-1 | 387.1 |
| 18 | San Jose-Bongabon Rd | 18-1 | 430.2 |
| 19 | Rosales-Baloc Rd | 19-1 | 125.9 |
| 20 | Rosales-San Jose Rd | 20-1 | 57.3 |
| 21 | Rosales-Sta.Fe Rd | 21-1 | 782.8 |
| 22 | Carmen-Bautista Rd | 22-1 | 72.9 |
| 23 | Camiling-Binmaley Rd | 23-1 | 35.1 |
| | | 23-2 | 21.9 |
| 24 | Burgos-Bani Rd | 24-1 | 108.3 |
| 25 | Aritao-Maddela Rd | 25-1 | 880.3 |
| | | 25-2 | 1119.7 |
| 26 | Maddela-Dinalongan Rd | 26-1 | 840.7 |
| 27 | Cordon-Maddela Rd | 27-1 | 50.6 |
| 28 | Kennon Rd | 28-1 | 3708.6 |
| 29 | Rosario-Pugo-Baguio Rd | 29-1 | 34.0 |
| | | 29-2 | 761.2 |
| 30 | Naguilian Rd | 30-1 | 467.4 |
| 31 | Aritao-Baguio Rd | 31-1 | 940.5 |
| | | 31-2 | 2541.3 |
| 32 | Baguio-Bontoc Rd | 32-1 | 2076.3 |
| | | 32-2 | 1452.5 |
| 33 | Bokod-Abatan Rd | 33-1 | 1432.6 |
| 34 | Tagudin-Sabangan Rd | 34-1 | 1111.7 |
| | | 34-2 | 916.9 |
| 35 | Cervantes-Abatan Rd | 35-1 | 722.1 |
| 36 | Bagabag-Bontoc Rd | 36-1 | 116.9 |
| | | 36-2 | 1175.3 |
| 37 | Santiago-Sta.Maria Rd | 37-1 | 7.0 |
| | | 37-2 | 304.6 |
| | | 37-3 | 291.0 |
| 38 | Ramon-Banaue Rd | 38-1 | 3869.3 |
| 39 | Naguilian-Palanan Rd | 39-1 | 1294.2 |
| 40 | Lubuagan-Bontoc Rd | 40-1 | 2438.7 |



| | | | |
|---|---|---|---|
| 15 | Sta.Rosa-Tarlac Rd | 15-1 | 36.4 |
| 16 | Cabanatuan-Baler Rd | 16-1 | 21.6 |
| | | 16-2 | 11.8 |
| | | 16-3 | 1054.2 |
| 17 | Palayan-Dingalan Rd | 17-1 | 387.1 |
| 18 | San Jose-Bongabon Rd | 18-1 | 430.2 |
| 19 | Rosales-Baloc Rd | 19-1 | 125.9 |
| 20 | Rosales-San Jose Rd | 20-1 | 57.3 |
| 21 | Rosales-Sta.Fe Rd | 21-1 | 782.8 |
| 22 | Carmen-Bautista Rd | 22-1 | 72.9 |
| 23 | Camiling-Binmaley Rd | 23-1 | 35.1 |
| | | 23-2 | 21.9 |
| 24 | Burgos-Bani Rd | 24-1 | 108.3 |
| 25 | Aritao-Maddela Rd | 25-1 | 880.3 |
| | | 25-2 | 1119.7 |
| 26 | Maddela-Dinalongan Rd | 26-1 | 840.7 |
| 27 | Cordon-Maddela Rd | 27-1 | 50.6 |
| 28 | Kennon Rd | 28-1 | 3708.6 |
| 29 | Rosario-Pugo-Baguio Rd | 29-1 | 34.0 |
| | | 29-2 | 761.2 |
| 30 | Naguilian Rd | 30-1 | 467.4 |
| 31 | Aritao-Baguio Rd | 31-1 | 940.5 |
| | | 31-2 | 2541.3 |
| 32 | Baguio-Bontoc Rd | 32-1 | 2076.3 |
| | | 32-2 | 1452.5 |
| 33 | Bokod-Abatan Rd | 33-1 | 1432.6 |
| 34 | Tagudin-Sabangan Rd | 34-1 | 1111.7 |
| | | 34-2 | 916.9 |
| 35 | Cervantes-Abatan Rd | 35-1 | 722.1 |
| 36 | Bagabag-Bontoc Rd | 36-1 | 116.9 |
| | | 36-2 | 1175.3 |
| 37 | Santiago-Sta.Maria Rd | 37-1 | 7.0 |
| | | 37-2 | 304.6 |
| | | 37-3 | 291.0 |
| 38 | Ramon-Banaue Rd | 38-1 | 3869.3 |
| 39 | Naguilian-Palanan Rd | 39-1 | 1294.2 |
| 40 | Lubuagan-Bontoc Rd | 40-1 | 2438.7 |
| 41 | Cabagan-Solana Rd | 41-1 | 546.3 |
| 42 | Enrile-Lubuagan Rd | 42-1 | 319.9 |
| | | 42-2 | 618.5 |
| 43 | Narvacan-Lubuagan Rd | 43-1 | 21.2 |
| | | 43-2 | 1100.6 |
| | | 43-3 | 1245.3 |
| 44 | Abbut-Tabuk Rd | 44-1 | 539.2 |
| 45 | San Nicolas-Abbut Rd | 45-1 | 3.2 |
| | | 45-2 | 1462.8 |
| | | 45-3 | 1440.3 |
| 46 | Solana-Piat Rd | 46-1 | 110.5 |
| 47 | Nassiping-Abbut Rd | 47-1 | 579.9 |
| | | 47-2 | 50.6 |
| 48 | Magapit-Sta.Ana Rd | 48-1 | 310.6 |
| | | 48-2 | 304.6 |
| 49 | Infanta-Dingalan Rd | 49-1 | 2302.7 |
| 50 | Dingalan-Baler Rd | 50-1 | 2884.0 |
| 51 | Baler-Dinalongan Rd | 51-1 | 419.2 |
| 52 | Dinalongan-Palanan Rd | 52-1 | 413.0 |
| | | 52-2 | 2366.7 |
| 53 | Palanan-Sta.Ana Rd | 53-1 | 915.1 |
| | | 53-2 | 3872.7 |
| 54 | South Luzon Expressway | 54-1 | 150.3 |
| | | 54-2 | 423.0 |
| 55 | S.Luzon Expwy Ext, Batangas Line | 55-1 | 2007.9 |
| | | 55-2 | 1276.3 |
| | | 55-3 | 64.8 |
| 56 | S.Luzon Expwy Ext, Lucena Line | 56-1 | 961.9 |
| | | 56-2 | 970.7 |
| | | 56-3 | 1046.0 |
| | | 56-4 | 1044.5 |
| 57 | Pan-Phil H'way, Lucena-Calauag | 57-1 | 1167.9 |
| | | 57-2 | 325.1 |
| | | 57-3 | 1657.1 |
| 58 | Pan-Phil H'way, Calauag-Sipocot | 58-1 | 88.6 |
| 59 | Calauag-Sipocot Diversion Rd | 59-1 | 128.5 |
| | | 59-2 | 1793.1 |
| | | 59-3 | 1317.6 |
| | | 59-4 | 1542.6 |
| 60 | Sipocot-Putiao Diversion Rd | 60-1 | 340.4 |
| | | 60-2 | 638.8 |
| | | 60-3 | 465.5 |
| | | 60-4 | 620.5 |
| | | 60-5 | 1900.0 |
| 61 | Manila-Cavite Expressway | 61-1 | 1413.9 |
| 62 | Bacoor-Tagaytay-Tanza Rd | 62-1 | 344.9 |
| | | 62-2 | 526.8 |
| | | 62-3 | 265.0 |
| | | 62-4 | 600.8 |
| | | 62-5 | 137.1 |
| 63 | Calamba-Tagaytay Rd | 63-1 | 204.7 |
| 64 | Tagaytay-Talisay Rd | 64-1 | 107.1 |
| 65 | Talisay-Lemery Rd | 65-1 | 363.3 |
| 66 | Naic-Nasugbu Rd | 66-1 | 949.8 |
| 67 | Nasugbu-Lemery Rd | 67-1 | 104.6 |
| 68 | Marikina-Infanta Rd | 68-1 | 1247.4 |
| 69 | Pasig-Binangonan Rd | 69-1 | 779.1 |
| 70 | Famy-Infanta Rd | 70-1 | 436.4 |
| | | 70-2 | 130.1 |
| 71 | Calamba-Pagsanjan Diversion Rd | 71-1 | 1572.9 |
| 72 | San Pablo-Mauban Rd | 72-1 | 203.9 |
| | | 72-2 | 207.2 |



| | | | |
|---|---|---|---|
| 46 | Solana-Piat Rd | 46-1 | 110.5 |
| 47 | Nassiping-Abbut Rd | 47-1 | 579.9 |
| | | 47-2 | 50.6 |
| 48 | Magapit-Sta.Ana Rd | 48-1 | 310.6 |
| | | 48-2 | 304.6 |
| 49 | Infanta-Dingalan Rd | 49-1 | 2302.7 |
| 50 | Dingalan-Baler Rd | 50-1 | 2884.0 |
| 51 | Baler-Dinalongan Rd | 51-1 | 419.2 |
| 52 | Dinalongan-Palanan Rd | 52-1 | 413.0 |
| | | 52-2 | 2366.7 |
| 53 | Palanan-Sta.Ana Rd | 53-1 | 915.1 |
| | | 53-2 | 3872.7 |
| 54 | South Luzon Expressway | 54-1 | 150.3 |
| | | 54-2 | 423.0 |
| 55 | S.Luzon Expwy Ext, Batangas Line | 55-1 | 2007.9 |
| | | 55-2 | 1276.3 |
| | | 55-3 | 64.8 |
| 56 | S.Luzon Expwy Ext, Lucena Line | 56-1 | 961.9 |
| | | 56-2 | 970.7 |
| | | 56-3 | 1046.0 |
| | | 56-4 | 1044.5 |
| 57 | Pan-Phil H'way, Lucena-Calauag | 57-1 | 1167.9 |
| | | 57-2 | 325.1 |
| | | 57-3 | 1657.1 |
| 58 | Pan-Phil H'way, Calauag-Sipocot | 58-1 | 88.6 |
| 59 | Calauag-Sipocot Diversion Rd | 59-1 | 128.5 |
| | | 59-2 | 1793.1 |
| | | 59-3 | 1317.6 |
| | | 59-4 | 1542.6 |
| 60 | Sipocot-Putiao Diversion Rd | 60-1 | 340.4 |
| | | 60-2 | 638.8 |
| | | 60-3 | 465.5 |
| | | 60-4 | 620.5 |
| | | 60-5 | 1900.0 |
| 61 | Manila-Cavite Expressway | 61-1 | 1413.9 |
| 62 | Bacoor-Tagaytay-Tanza Rd | 62-1 | 344.9 |
| | | 62-2 | 526.8 |
| | | 62-3 | 265.0 |
| | | 62-4 | 600.8 |
| | | 62-5 | 137.1 |
| 63 | Calamba-Tagaytay Rd | 63-1 | 204.7 |
| 64 | Tagaytay-Talisay Rd | 64-1 | 107.1 |
| 65 | Talisay-Lemery Rd | 65-1 | 363.3 |
| 66 | Naic-Nasugbu Rd | 66-1 | 949.8 |
| 67 | Nasugbu-Lemery Rd | 67-1 | 104.6 |
| 68 | Marikina-Infanta Rd | 68-1 | 1247.4 |
| 69 | Pasig-Binangonan Rd | 69-1 | 779.1 |
| 70 | Famy-Infanta Rd | 70-1 | 436.4 |
| | | 70-2 | 130.1 |
| 71 | Calamba-Pagsanjan Diversion Rd | 71-1 | 1572.9 |
| 72 | San Pablo-Mauban Rd | 72-1 | 203.9 |
| | | 72-2 | 207.2 |
| 73 | Pagsanjan-Lucena Rd | 73-1 | 130.3 |
| | | 73-2 | 85.7 |
| 74 | Tignuan-Atimonan Rd | 74-1 | 2117.8 |
| | | 74-2 | 824.6 |
| 75 | Batangas-San Juan Rd | 75-1 | 62.3 |
| 76 | Batangas-San Juan Coastal Rd | 76-1 | 250.9 |
| | | 76-2 | 546.2 |
| 77 | Malicboy-Mulanay Rd | 77-1 | 507.4 |
| | | 77-2 | 133.9 |
| 78 | Mulanay-Panagon-Jinabaan Rd | 78-1 | 568.4 |
| | | 78-2 | 1363.7 |
| 79 | Mulanay-San Francisco-Panagon Rd | 79-1 | 341.0 |
| | | 79-2 | 1613.6 |
| 80 | San Miguel-Tagkawayan Rd | 80-1 | 498.5 |
| 81 | Parigsa-Goa Rd | 81-1 | 145.5 |
| | | 81-2 | 385.2 |
| | | 81-3 | 82.7 |
| 82 | Tigaon-Lagonoy Rd | 82-1 | 25.4 |
| 83 | Lagonoy-Caramoan Rd | 83-1 | 857.6 |
| | | 83-2 | 735.7 |
| 84 | Lagonoy-Presentacion-Caramoan Rd | 84-1 | 592.4 |
| | | 84-2 | 601.5 |
| 85 | Lalud-Garchitorena Rd | 85-1 | 1698.5 |
| 86 | Legaspi-Tigaon Rd | 86-1 | 122.5 |
| | | 86-2 | 446.8 |
| 87 | Ligao-Tabaco Rd | 87-1 | 80.0 |
| 88 | Legaspi-Manito-Sorsogon Rd | 88-1 | 830.7 |
| 89 | Matacong-Putiao Rd | 89-1 | 699.4 |
| | | 89-2 | 484.1 |
| 90 | Abuyog-Bulusan-Iroshin Rd | 90-1 | 190.1 |
| | | 90-2 | 159.2 |
| 91 | Juban-Magallanes Rd | 91-1 | 169.5 |
| | | 91-2 | 516.0 |

(Later Years)

LEGEND: Detailed Engineering Construction

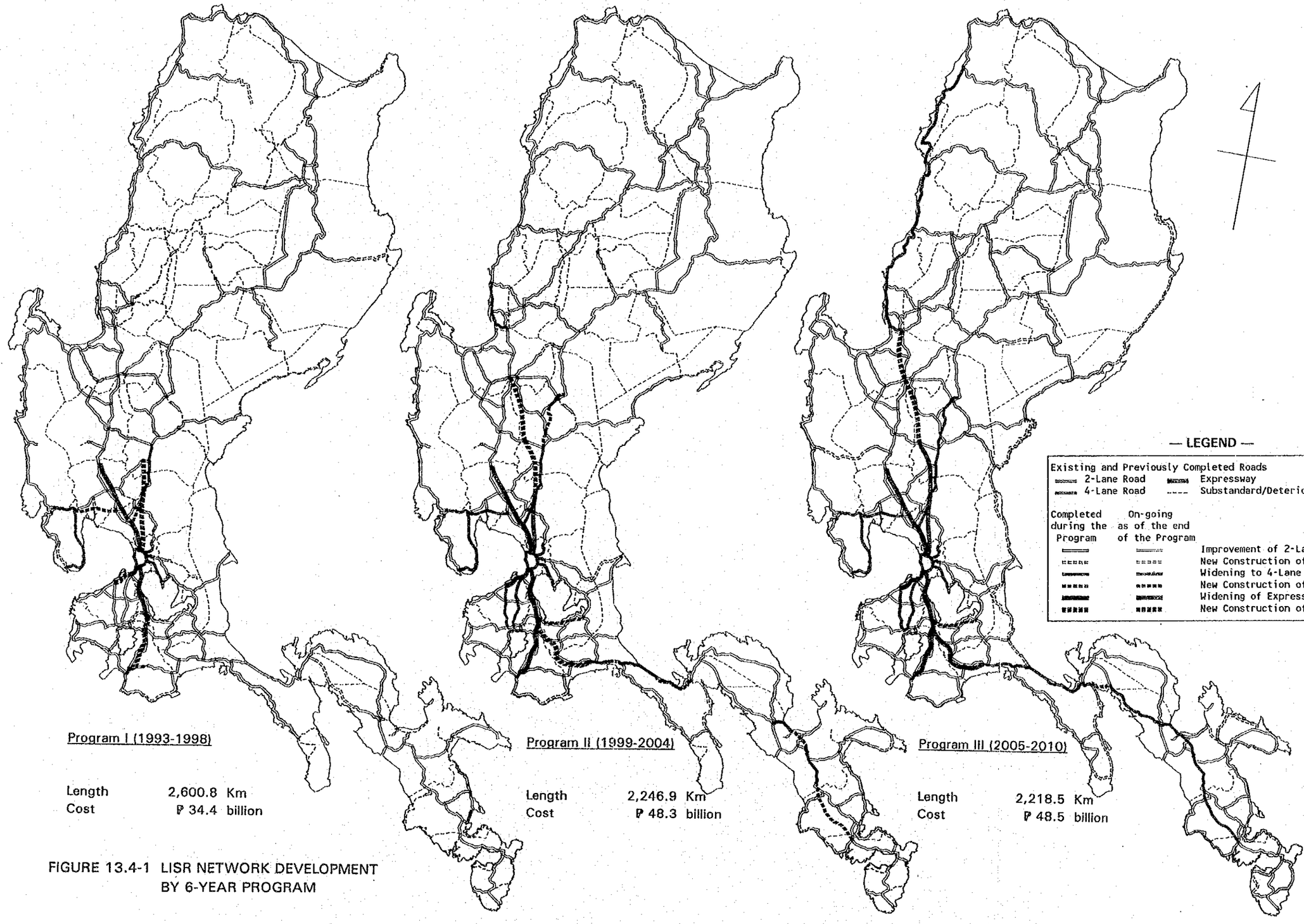
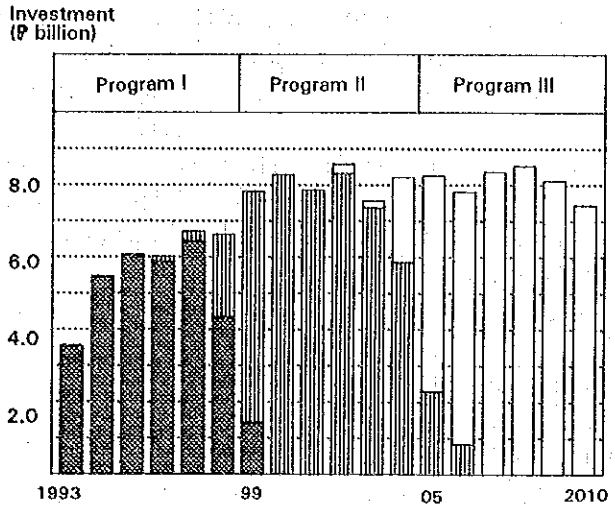



FIGURE 13.4-1 LISR NETWORK DEVELOPMENT BY 6-YEAR PROGRAM




| Year | Annual Fund (₱ billion) | 6-Year Total (₱ billion) |
|---|---|---|
| 1993 | 3.556 | |
| 1994 | 5.467 | |
| 1995 | 6.070 | 34.430 |
| 1996 | 6.014 | |
| 1997 | 6.705 | |
| 1998 | 6.618 | |
| 1999 | 7.811 | |
| 2000 | 8.277 | |
| 2001 | 7.854 | 48.281 |
| 2002 | 8.576 | |
| 2003 | 7.556 | |
| 2004 | 8.207 | |
| 2005 | 8.255 | |
| 2006 | 7.811 | |
| 2007 | 8.360 | 48.510 |
| 2008 | 8.526 | |
| 2009 | 8.117 | |
| 2010 | 7.441 | |
| Total | 131.221 | 131.221 |

Note: The following costs are not included:
- Detailed engineering for projects 5, 6, 30, 55, 58, 59-3 and 80 amounting of ₱ 0.469 billion which were expended before 1993.
- Cost of the projects 8 and 53-2 which are not included in the program up to 2010 and amounting of ₱ 22.368 billion.

FIGURE 13.5-1 ANNUAL FUND REQUIREMENT FOR LISR PLAN

Presently, main sources of the Government revenue in the road transport sector are fuel tax and vehicle tax. Future revenue from these taxes are projected as follows:

- In 1992, PNOC produced and sold about 50 million barrels of petro-products and estimated sales amounted to 61.2 billion pesos at pump price, of which 7.5 billion pesos came into the national budget account as tax revenue (Table 13.5-1).

- Assuming that 60% of the petro-products were consumed in the road transport sector, 4.5 billion pesos accrued from taxes on fuels for vehicles. According to 1991 data, 80% of the vehicle fleet were registered in Luzon island. Thus, the total amount of fuel tax collected in Luzon Island is estimated to be approximately 3.6 billion pesos in 1992.

- Traffic assignment results show that the total vehicle performance in Luzon Island is 22.6 billion-km in 1990 and it will increase in 2010 by 1.84 times to 41.6 billion-km. The tax revenue will also increase as the transport demand increases. During the period of 1993 - 2010, total fuel tax revenue will amount to 78.8 billion pesos in accumulation.

- Provided that the vehicle fleet will increase in proportion to the total vehicle-km (actually, would increase more than that), the fleet in Luzon Island will be 1,876,000 units in number, as increased by 855,000 units. The replacement demand will be more than this new demand, reaching 2.2 million units even by this conservative estimate. By this increase in the fleet units, vehicle tax will be accumulated to 269 billion pesos at the current tax rate (Table 13.5-2).

TABLE 13.5-1 FUEL TAX REVENUE IN THE PHILIPPINES - 1992

| Fuel Type | Consumption in 1992 (1000 Bar.) | Total Sales (million P) | Pump-Price (Peso/l) | Tax (Peso/l) | Gross tax Revenue (million P) |
|---|---|---|---|---|---|
| Extra | 9,160 | 14,564.4 | 10.00 | 2.52 | 3,670.2 |
| Regular | 3,236 | 4,887.9 | 9.50 | 2.28 | 1,173.1 |
| Diesel | 37,527 | 41,767.5 | 7.00 | 0.45 | 2,685.1 |
| Total | 49,923 | 61,219.8 | - | - | 7,528.4 |

Source: Department of Energy

TABLE 13.5-2 PROJECTION OF VEHICLE TAX REVENUE IN LUZON ISLAND

| Vehicle Type | Vehicles in Luzon (1000 unit) | | Demand (1993-2010) (1000 unit) | | | Vehicle Price (1000P) | Vehicle Tax Rate (%) | Vehicle Tax Revenue (billion P) |
|---|---|---|---|---|---|---|---|---|
| | 1992 | 2010 | Newly | Replace | Total | | | |
| Car | 394 | 724 | 330 | 480 | 810 | 350 | 25.7 | 72.9 |
| Jeepney | 521 | 959 | 437 | 1,434 | 1,871 | 125 | 21.7 | 50.8 |
| Truck | 16 | 30 | 14 | 38 | 51 | 1,300 | 24.1 | 16.1 |
| Bus | 89 | 164 | 75 | 218 | 293 | 1,800 | 24.5 | 129.3 |
| Total | 1,021 | 1,876 | 855 | 2,171 | 3,026 | - | - | 269.0 |

- Accordingly, the accumulated total of the said two tax revenues will reach approximately 350 billion pesos by the year 2010. This amount will meet the budgetary demand if it is totally and exclusively allocated to the road development in Luzon Island. The LISR network, with a cost of about 150 billion pesos, can be completed by spending 43 % of the 350 billion pesos of tax revenues.

# CHAPTER 14

# EVALUATION OF LISR PLAN

## 14.1 METHODOLOGY

### 14.1.1 General

Evaluation of the Masterplan/projects is done in the two stages of the planning process with different purposes: one is in the stage of the investment schedule planning to determine the relative priority among projects and the other is in this chapter to evaluate economic viability of the Plan. In both cases, economic evaluation is made by comparing costs to benefits. General approach of the cost-benefit analysis is shown in Figure 14.1-1.

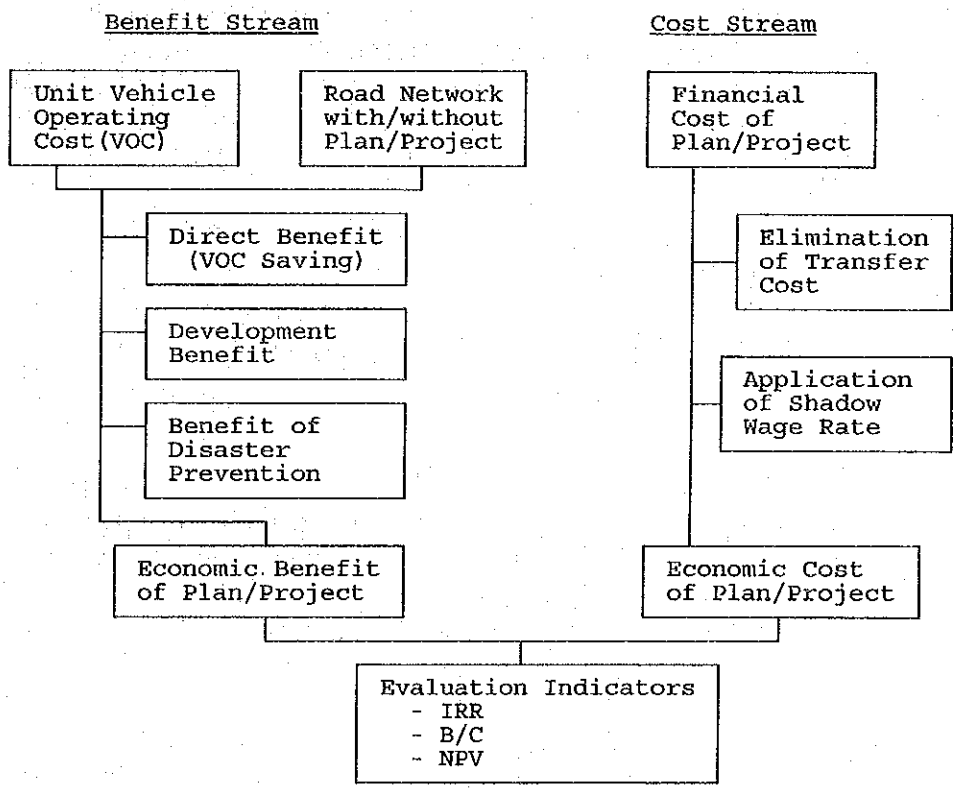



FIGURE 14.1-1 WORK-FLOW OF PLAN/PROJECT EVALUATION

The cost and benefit accruing from a project are measured in terms of economic price. Comparison is made between the benefit which will contribute to the national or regional economy and the cost which is the monetary expression of real consumption of goods and services needed to implement the project. For this purpose, all the transfer costs (taxes and subsidies) are deducted from the cost. In addition, the shadow wage rate is applied to estimate the economic cost of unskilled labor force.

By implementing a road project, a broad variety of benefits can be expected such as improvement safety and comfort, encouragement of inter-regional trade and regional development in the long run, as well as mitigation of traffic congestion. To define and quantify the benefit in this Study, however, a rather conservative approach is taken, limiting the benefit to three items; savings in vehicle operating cost, regional development effect and benefits by disaster prevention.

### 14.1.2 Direct Benefit

Construction of a new road will provide a shorter route to some O-D trips and improvement of roads will give better conditions to the traffic on them, which will undoubtedly reduce the vehicle operating cost (VOC) of the traffic. This cost saving is one of the most direct benefits of a road project.

This benefit is estimated through the so-called "with" and "without" comparison. Based on the results of traffic assignment to a network with the project in question and also to the same network without the project, total VOC is calculated for each case. And then, the direct benefit of the project is obtained as the difference between "with" and "without" case.

Total VOC in a network is the sum of VOCs in each link which is the product of assigned traffic volume and link VOC spent to pass the link. To calculate this, unit VOC, which is the vehicle operating cost per kilometer by type of vehicle and by type of road conditions, is prepared (see 14.2).

### 14.1.3 Development Benefit

New construction and improvement of a trunk road would accelerate the economic growth of the region, by expanding its market, changing cropping patterns and encouraging industrial investment, etc. A potential model is developed to measure this regional development benefit.

According to the official data in 1990, the province-wise labor productivities (GRDP per capita) distributed in a wide range from 4,000 pesos to 30,000 pesos in the Study Area and the productivity in Metro-Manila amounting to 43,600 pesos, more than 3.0 times of that in the Study Area average (13,600 pesos). In general, relatively high productivities are observed in provinces near Metro-Manila and provinces where highways are well developed.

The basic assumption to make the potential model is that the most essential factors to determine the productivity of a region be the market size (population) and accessibility to the market (transportation cost). The data in 1990 is used in order to verify the hypothesis that the easier to access the bigger market, the higher the productivity of the region.

The development potential of a zone is defined as the summation of population of all the zones in the Study Area discounted by the economic distance from the zone in question to the market zone, that is:

$$LPi = \alpha \cdot POTi + ß$$

$$POTi = \sum_{j} ( Pi / Dij^{\tau} )$$

where;

| | | |
|---|---|---|
| | $LPi$ | : Labor productivity in zone $i$ |
| | $POTi$ | : Development potential in zone $i$ |
| | $Pj$ | : Population of zone $j$ |
| | $Dij$ | : Economic distance (transportation cost) between zone $i$ and zone $j$ |
| | $\alpha$, ß, $\tau$ | : constant |

By the least square method, values of the parameters are determined as follows:

$\alpha$ = 0.01438
ß = 4.1629
$\tau$ = 0.62
Regression coefficient r = 0.862

The relationship between the productivity and the potential of each zone is shown in Figure 14.1-2 and Table 14.1-1.

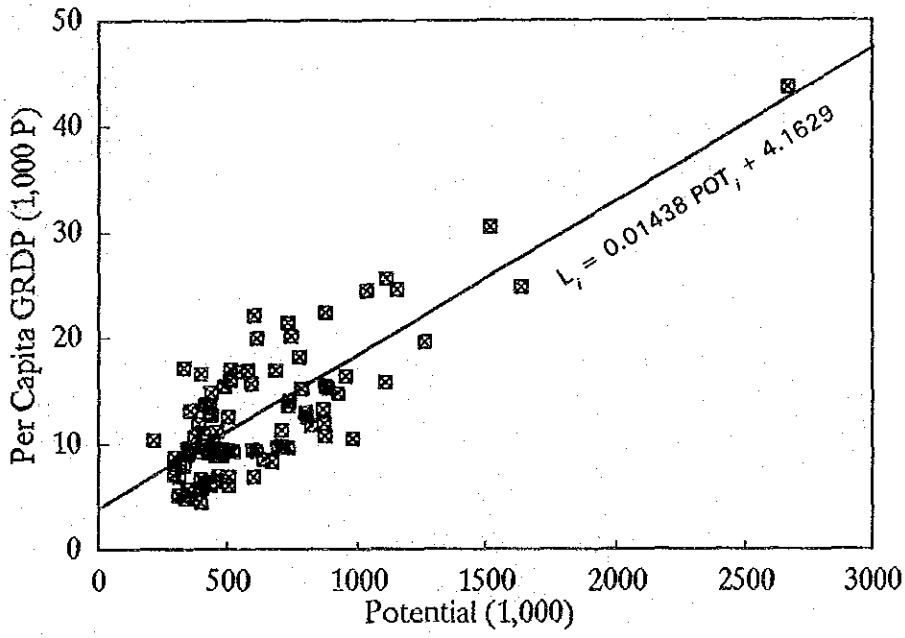



FIGURE 14.1-2 RELATIONSHIP BETWEEN LABOR PRODUCTIVITY AND POTENTIAL

TABLE 14.1-1 PRODUCTIVITY AND DEVELOPMENT POTENTIAL BY ZONE

| Zone | Population(000) | GRDP (million) | GRDP p.c. (000 P) | Potential (million) | Zone | Population(000) | GRDP (million) | GRDP p.c. (000 P) | Potential (million) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 7929 | 345841.3 | 43.6 | 2668.1 | 51 | 787 | 12377.2 | 15.7 | 1103.4 |
| 2 | 156 | 1964.3 | 12.6 | 437.1 | 52 | 144 | 1952.1 | 13.6 | 728.5 |
| 3 | 29 | 199.6 | 6.8 | 314.2 | 53 | 223 | 3380.0 | 15.2 | 778.8 |
| 4 | 69 | 928.4 | 13.5 | 428.0 | 54 | 493 | 5281.7 | 10.7 | 868.8 |
| 5 | 64 | 818.9 | 12.8 | 430.7 | 55 | 92 | 1152.1 | 12.5 | 499.9 |
| 6 | 353 | 7797.1 | 22.1 | 599.8 | 56 | 102 | 1709.0 | 16.8 | 542.9 |
| 7 | 87 | 1451.1 | 16.6 | 394.4 | 57 | 369 | 7894.5 | 21.4 | 727.2 |
| 8 | 29 | 342.7 | 11.8 | 387.6 | 58 | 36 | 624.1 | 17.2 | 330.9 |
| 9 | 147 | 2187.2 | 14.9 | 435.1 | 59 | 103 | 2427.9 | 23.5 | 446.0 |
| 10 | 75 | 766.7 | 10.3 | 212.1 | 60 | 272 | 2250.0 | 8.3 | 668.2 |
| 11 | 49 | 234.8 | 4.8 | 337.1 | 61 | 284 | 2735.1 | 9.6 | 691.3 |
| 12 | 88 | 1153.1 | 13.1 | 354.3 | 62 | 411 | 6069.4 | 14.8 | 915.0 |
| 13 | 60 | 578.4 | 9.6 | 356.9 | 63 | 399 | 5185.3 | 13.0 | 795.9 |
| 14 | 138 | 1527.8 | 11.0 | 407.2 | 64 | 95 | 642.3 | 6.8 | 597.8 |
| 15 | 144 | 952.0 | 6.6 | 396.1 | 65 | 622 | 15435.6 | 24.8 | 1633.2 |
| 16 | 119 | 745.7 | 6.3 | 410.7 | 66 | 196 | 4784.1 | 24.4 | 1028.4 |
| 17 | 295 | 2604.7 | 8.8 | 474.2 | 67 | 149 | 1977.7 | 13.3 | 859.7 |
| 18 | 97 | 924.4 | 9.5 | 477.0 | 68 | 185 | 4133.6 | 22.3 | 870.9 |
| 19 | 129 | 769.4 | 6.0 | 503.6 | 69 | 626 | 15400.8 | 24.6 | 1144.8 |
| 20 | 268 | 2514.2 | 9.4 | 594.3 | 70 | 368 | 5654.6 | 15.4 | 870.6 |
| 21 | 280 | 2612.9 | 9.3 | 605.9 | 71 | 251 | 7428.8 | 29.6 | 804.3 |
| 22 | 108 | 1831.8 | 17.0 | 509.9 | 72 | 125 | 2516.6 | 20.1 | 739.9 |
| 23 | 580 | 3608.8 | 6.2 | 752.1 | 73 | 74 | 1018.0 | 13.7 | 413.1 |
| 24 | 596 | 5817.0 | 9.8 | 704.3 | 74 | 139 | 2357.4 | 16.9 | 573.4 |
| 25 | 439 | 4243.5 | 9.7 | 728.3 | 75 | 411 | 5754.5 | 14.0 | 731.5 |
| 26 | 271 | 2294.8 | 8.5 | 636.8 | 76 | 104 | 2061.0 | 19.9 | 608.6 |
| 27 | 180 | 1420.3 | 7.9 | 331.0 | 77 | 139 | 2130.4 | 15.4 | 483.8 |
| 28 | 142 | 807.5 | 5.7 | 348.1 | 78 | 204 | 3259.5 | 16.0 | 507.5 |
| 29 | 260 | 2657.5 | 10.2 | 412.9 | 79 | 140 | 1494.2 | 10.7 | 374.5 |
| 30 | 79 | 610.4 | 7.8 | 293.4 | 80 | 65 | 1233.3 | 19.0 | 358.2 |
| 31 | 159 | 749.2 | 4.7 | 379.6 | 81 | 357 | 10858.1 | 30.4 | 1513.2 |
| 32 | 154 | 2097.7 | 13.6 | 412.9 | 82 | 515 | 13211.7 | 25.6 | 1101.8 |
| 33 | 364 | 4066.3 | 11.2 | 456.2 | 83 | 107 | 3036.4 | 28.2 | 835.2 |
| 34 | 492 | 4574.7 | 9.3 | 516.7 | 84 | 152 | 1397.1 | 9.2 | 387.9 |
| 35 | 70 | 610.5 | 8.7 | 293.5 | 85 | 247 | 1479.1 | 6.0 | 436.0 |
| 36 | 207 | 1418.4 | 6.9 | 504.3 | 86 | 426 | 3730.3 | 8.8 | 452.9 |
| 37 | 94 | 419.8 | 4.5 | 510.4 | 87 | 52 | 494.3 | 9.6 | 344.8 |
| 38 | 79 | 715.2 | 9.0 | 429.6 | 88 | 198 | 1270.3 | 6.4 | 450.3 |
| 39 | 35 | 153.5 | 4.4 | 395.9 | 89 | 193 | 1960.9 | 10.1 | 443.2 |
| 40 | 297 | 4506.6 | 15.2 | 876.8 | 90 | 148 | 1423.4 | 9.6 | 420.8 |
| 41 | 129 | 2006.3 | 15.6 | 587.3 | 91 | 108 | 763.0 | 7.0 | 295.7 |
| 42 | 1086 | 21271.6 | 19.6 | 1253.7 | 92 | 181 | 1027.5 | 5.7 | 402.5 |
| 43 | 419 | 4946.2 | 11.8 | 864.0 | 93 | 511 | 4780.6 | 9.4 | 499.4 |
| 44 | 523 | 5875.0 | 11.2 | 705.6 | 94 | 357 | 2481.3 | 7.0 | 462.7 |
| 45 | 173 | 3154.5 | 18.2 | 770.5 | 95 | 114 | 648.6 | 5.7 | 344.2 |
| 46 | 217 | 2719.9 | 12.5 | 800.7 | 96 | 187 | 1654.8 | 8.9 | 347.4 |
| 47 | 206 | 2393.5 | 11.6 | 816.2 | 97 | 131 | 1076.4 | 8.2 | 316.6 |
| 48 | 194 | 3263.8 | 16.9 | 682.2 | 98 | 91 | 468.2 | 5.1 | 311.5 |
| 49 | 426 | 6942.5 | 16.3 | 949.6 | | | | | |
| 50 | 319 | 3330.4 | 10.4 | 976.5 | Total | 30588 | 657504.1 | 1273.5 | 60186.5 |

Using this potential model, development benefit (increment of GRDP) by a road project can be estimated: provided that the transportation cost between zone *i* and *j* be reduces by dD*ij* and thereby the potential of zone *i* be increased by dPOT, expected benefit in the year *t* ($B^t$) would be:

$$B^t = \sum_i P^t i \cdot dLi = \sum_i \alpha \cdot P^t i \cdot dPOTi$$

$$dPOTi = \sum_i P^t i \,/\, (Dij - dDij)^\tau$$

It is not reasonable, however, to consider that all the development benefit be attributed to the road project. Although in many cases, a road project could be a trigger of development, other investment projects in infrastructure such as power supply and irrigation and also in manufacturing facilities would be

required to raise the productive capacity in a region.

Laborious works will be needed to clarify the contribution of the road project in general. In order to simplify this difficult problem, one assumption is introduced: in the Philippines, the road investment has accounted for 10 to 25% in the total government capital formation, but for several years when the shares are exceptionally low. The average share of road investment is about 15% in the past 19 years. Thus, the same percent of the total development benefit could be regarded as the contribution of a road project (Table 14.1-2).

In a masterplan study where the main objective of economic evaluation is to examine the overall viability of the plan and to justify the scale of planned investment as a target, the macro-economic approach mentioned above will be practical. In the feasibility stage, development benefit will need more de tailed analysis, taking local conditions into consideration.

TABLE 14.1-2 SHARE OF ROAD INVESTMENT IN GOVERNMENT CAPITAL FORMATION

| Year | Fixed Capital Formation | | (C)of which, Road Investment | Share of Road(%) | |
|---|---|---|---|---|---|
| | (A)Total | (B)Government | | (C)/(A) | (C)/(B) |
| 1976 | 33,693 | 8,306 | 1,880 | 5.58 | 22.63 |
| 1977 | 36,440 | 9,489 | 1,788 | 4.91 | 18.84 |
| 1978 | 42,305 | 10,632 | 1,973 | 4.66 | 18.56 |
| 1979 | 56,306 | 14,475 | 2,190 | 3.89 | 15.13 |
| 1980 | 67,723 | 16,056 | 2,130 | 3.15 | 13.27 |
| 1981 | 79,285 | 20,017 | 2,118 | 2.67 | 10.58 |
| 1982 | 86,026 | 21,993 | 2,308 | 2.68 | 10.49 |
| 1983 | 95,254 | 19,751 | 2,812 | 2.95 | 14.24 |
| 1984 | 100,095 | 20,107 | 1,818 | 1.82 | 9.04 |
| 1985 | 89,974 | 18,696 | 1,472 | 1.64 | 7.87 |
| 1986 | 80,817 | 18,148 | 2,153 | 2.66 | 11.86 |
| 1987 | 101,781 | 20,516 | 2,996 | 2.94 | 14.60 |
| 1988 | 126,413 | 22,739 | 1,062 | 0.84 | 4.67 |
| 1989 | 193,181 | 33,159 | 5,544 | 2.87 | 16.72 |
| 1990 | 234,249 | 46,850 | 6,390 | 2.73 | 13.64 |
| 1991 | 246,440 | 56,103 | 14,080 | 5.71 | 25.10 |
| Total | 1,669,982 | 357,037 | 52,714 | 3.16 | 14.76 |

Source: National Statistic Coordination Board and NEDA

### 14.1.4 Benefit by Disaster Prevention

Disaster prevention projects will reduce the frequency of road damages by disaster and then imply apparently two kinds of direct benefit: (i) Savings in VOC of trips which would be forced to detour by road cut and (ii) Savings in costs for disaster restoration.

The VOCs increased by detour while a road section is cut are estimated by network simulation in the same way as direct benefit estimation stated in section 14.1.2. Every disaster protection project is composed of several weak sections to be protected and it is assumed that each weak section would become impassable for 2 days in a year without the protection work,

but a project section as a whole would be cut for maximum 15 days a year.

Based on the past data, annual restoration cost is assumed to be 7% of the protection project cost. Under 15% of discount rate, present value of saved restoration cost during 20 years is equivalent to 50% of the project cost, in other words, every disaster prevention project imply at least 4% of internal rate of return, taking only this benefit into consideration.

## 14.2 VEHICLE OPERATING COST AND TRAVEL TIME COST

Saving in the vehicle operating cost (VOC) is one of the most direct and visible benefits brought about by a road improvement project and a new road construction project. In order to estimate this direct benefit, the basic VOCs per unit distance or time are required.

In this study, the VOC estimation depends basically on the method described in the DPWH Highway Planning Manual and the data annually updated by DPWH. The Study Team only extrapolated the VOC data to the future and also to the worse conditioned roads.

### 14.2.1 Basic Vehicle Operating Cost

Basic vehicle operating costs are, by definition, those incurred on a road with the following conditions:

a) reasonably good paved surface;
b) at least 6.00m carriageway width and shoulders of 2.00m;
c) smooth gradient less than one per cent;
d) design speed of not less than 70 km/hr for cars and 60 km/hr for trucks;
e) minimum roadside friction and low traffic volume with no effect on driver behavior;
f) average Philippine driver behavior.

The basic VOC is divided into three main components: (i) basic running cost, (ii) basic fixed costs, and (iii) basic time costs.

Basic running costs are related to the distance traveled and composed of fuel costs, lubricant costs, tire costs, maintenance and repair costs and a part of depreciation costs (i.e. distance related). Basic fixed costs are composed of time-related depreciation costs, capital cost, crew costs and overhead costs.

Basic time cost are defined as those person-time costs which are incurred by drivers and vehicle passengers. Time saved by passengers is allocated a monetary value for those "at work" and traveling "to/from work" and time saved during trips for other purposes is assigned zero monetary value. The unit Basic VOCs provided by DPWH are as shown in Table 14.2-1.

TABLE 14.2-1 BASIC VEHICLE OPERATING COSTS AS OF MARCH, 1992

| Vehicle Type | Running Cost (P/km) | Fixed Cost (P/min) | Time Cost (P/min) |
|---|---|---|---|
| Financial Cost | | | |
| Car/van | 3.570 | 0.183 | 0.501 |
| Jeepney | 1.910 | 0.616 | 0.735 |
| Bus | 4.400 | 0.891 | 2.545 |
| Truck | 5.650 | 0.978 | 0.000 |
| Economic Cost | | | |
| Car/van | 2.290 | 0.119 | 0.501 |
| Jeepney | 1.500 | 0.591 | 0.735 |
| Bus | 3.370 | 0.810 | 2.645 |
| Truck | 4.300 | 0.870 | 0.000 |

Source : DPWH

## 14.2.2 Vehicle Operating Cost by Road Condition

As previously stated, the Basic VOC is the cost on a good conditioned paved road in a moderate terrain. Where road conditions are worse, VOC becomes higher. Data shown in Table 14.2-2 are prepared for the adjustment of unit VOC according to various road conditions. The running cost coefficient in the table is multiplied to the basic running cost. Each running speed is used to calculate travel time to pass a road section, prior to estimate fixed cost and person-time cost. For a road in a hilly area and mountainous area, the estimated unit VOC is readjusted by multiplying 1.1 and 1.2, respectively.

TABLE 14.2-2 VOC COEFFICIENT BY ROAD CONDITION

| Road Surface | Condition | Running Cost Coefficient | | | | Maximum Running Speed (Km/hr) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Car | Jeepney | Bus | Truck | Car | Jeepney | Bus | Truck |
| Express-way | Good | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| | Fair | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| | Bad | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| | Very bad | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| | Impassable | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| | Non-Exist | 0.85 | 0.85 | 0.90 | 0.90 | 110 | 110 | 100 | 100 |
| Paved Road | Good | 1.00 | 1.00 | 1.00 | 1.00 | 70 | 70 | 60 | 60 |
| | Fair | 1.20 | 1.20 | 1.30 | 1.30 | 60 | 60 | 50 | 50 |
| | Bad | 1.40 | 1.40 | 1.60 | 1.60 | 40 | 40 | 40 | 40 |
| | Very bad | 1.60 | 1.60 | 1.90 | 1.90 | 30 | 30 | 30 | 30 |
| | Impassable | 3.20 | 3.20 | 3.80 | 3.80 | 4 | 4 | 4 | 4 |
| | Non-Exist | 6.40 | 6.40 | 7.60 | 7.60 | 2 | 2 | 2 | 2 |
| Gravel Road | Good | 1.15 | 1.15 | 1.25 | 1.25 | 60 | 60 | 50 | 50 |
| | Fair | 1.30 | 1.30 | 1.50 | 1.50 | 50 | 50 | 40 | 40 |
| | Bad | 1.60 | 1.60 | 1.90 | 1.90 | 40 | 40 | 30 | 30 |
| | Very bad | 1.90 | 1.90 | 2.30 | 2.30 | 30 | 30 | 30 | 30 |
| | Impassable | 3.80 | 3.80 | 4.60 | 4.60 | 4 | 4 | 4 | 4 |
| | Non-Exist | 7.60 | 7.60 | 9.20 | 9.20 | 2 | 2 | 2 | 2 |
| Earth Road | Good | 1.50 | 1.50 | 1.75 | 1.75 | 35 | 35 | 30 | 30 |
| | Fair | 2.00 | 2.00 | 2.50 | 2.50 | 30 | 30 | 25 | 25 |
| | Bad | 3.00 | 3.00 | 4.00 | 4.00 | 20 | 20 | 20 | 20 |
| | Very bad | 4.00 | 4.00 | 7.00 | 7.00 | 10 | 10 | 10 | 10 |
| | Impassable | 8.00 | 8.00 | 14.00 | 14.00 | 4 | 4 | 4 | 4 |
| | Non-Exist | 16.00 | 16.00 | 28.00 | 28.00 | 2 | 2 | 2 | 2 |

Source: DPWH, collaborated by the JICA Study Team

### 14.2.3 Time Cost by Year

As the time value is calculated based on the average labor productivity in the Philippines, it will change year by year even at constant price basis. In the socio-economic framework for this Study (Chapter 7), GRDP in the Study Area is assumed to grow 4.12 times during 1990 to 2020, while the population increase is forecast at 1.56 times during the same period. Thus, labor productivity will rise by 2.56 times, i.e. 3.2% per annum. Therefore, time value of drivers and passengers is reasonably assumed to increase at the same rate.

## 14.3 ECONOMIC COST OF PROJECT

Project cost is estimated, at first, at market price in ordinary way. This cost represent the amount actually needed at implementation and is called financial cost of the project. In order to convert the financial cost to the economic cost used in the economic evaluation, two procedures are taken. One is elimination of transfer cost and the other is application of shadow wage rate.

From the viewpoint of national or regional economy, tax is not actual consumption of goods and services, but only a monetary transfer. Therefore, taxes included in the financial cost such as import duty, value added tax and consumption tax are to be deducted from the construction materials and equipment. These taxes account for 16 to 18% of the project cost.

In the society with surplus labor force and suffering from high unemployment rate, labor cost in the project cost does not duly reflect value of labor in the free market. Economic value of unskilled workers (shadow wage rate: SWR) may be lower than the wage rate in the market in such a case. According to the Haveman's formula, the SWR under a 12% unemployment rate is estimated empirically as follows:

$$SWR = (\text{wage rate in market}) \times (1.25 - \text{unemployment rate} / 0.2)$$

According to the Philippine Government, recent unemployment rate is reported to be 6.8% and then the SWR of the Philippines is estimated at 0.91, by applying the above formula. This conversion rate is multiplied to the unskilled labor cost included in the project cost.

Taking the procedures mentioned above, financial cost of each project is converted into economic cost as shown in Table 14.3-1. The total economic cost of the LISR projects is amounted to 123.9 billion pesos, which corresponds to about 80% of the financial cost.

TABLE 14.3-1 ECONOMIC COST OF LISR PROJECT

| No. | Project Name | Financial Cost | Economic Cost |
|---|---|---|---|
| 1 | North Luzon Expressway | 3,545.2 | 2,836.2 |
| 2 | New North Luzon Expressway | 12,016.9 | 9,640.8 |
| 3 | Manila North Rd, Rosario-Laoag | 7,055.2 | 5,662.8 |
| 4 | Pan-Phil H'way, Sta.Rita-San Jose | 3,465.0 | 2,795.1 |
| 5 | Pan-Phil H'way, San Jose-Magapit | 1,275.0 | 1,020.0 |
| 6 | Laoag-Magapit Rd | 547.1 | 439.1 |
| 7 | Manila-Bataan Coastal Rd, North | 2,856.9 | 2,291.2 |
| 8 | Manila-Bataan Coastal Rd, South | 18,495.3 | 14,810.9 |
| 9 | Dinalupihan-Olongapo Rd | 886.4 | 709.7 |
| 10 | Dinalupihan-Mariveles-Bagac Rd | 1,996.0 | 1,599.3 |
| 11 | Baliuag-San Jose Del Monte Rd | 52.0 | 41.6 |
| 12 | Baliuag-Sta.Ana Rd | 60.6 | 48.5 |
| 13 | Mabalacat-Capas Rd | 78.5 | 62.8 |
| 14 | Capas-Botolan Rd | 808.4 | 648.2 |
| 15 | Sta.Rosa-Tarlac Rd | 36.4 | 29.1 |
| 16 | Cabanatuan-Baler Rd | 1,087.5 | 870.2 |
| 17 | Palayan-Dingalan Rd | 387.0 | 309.6 |
| 18 | San Jose-Palayan Rd | 430.2 | 344.4 |
| 19 | Rosales-Baloc Rd | 125.9 | 100.8 |
| 20 | Rosales-San Jose Rd | 57.2 | 45.8 |
| 21 | Rosales-Sta.Fe Rd | 782.9 | 627.2 |
| 22 | Carmen-Bautista Rd | 72.8 | 58.2 |
| 23 | Camiling-Binmaley Rd | 56.9 | 45.5 |
| 24 | Burgos-Bani Rd | 108.3 | 86.7 |
| 25 | Aritao-Maddela Rd | 2,000.0 | 1,601.0 |
| 26 | Maddela-Dinalongan Rd | 840.6 | 672.7 |
| 27 | Cordon-Maddela Rd | 50.5 | 40.4 |
| 28 | Kennon Rd | 3,708.7 | 2,967.0 |
| 29 | Rosario-Pugo-Baguio Rd | 829.1 | 663.5 |
| 30 | Naguilian Rd | 467.4 | 375.1 |
| 31 | Aritao-Baguio Rd | 3,481.7 | 2,785.8 |
| 32 | Baguio-Bontoc Rd | 3,528.7 | 2,823.4 |
| 33 | Bokod-Abatan Rd | 1,432.6 | 1,146.5 |
| 34 | Tagudin-Sabangan Rd | 2,028.6 | 1,623.5 |
| 35 | Cervantes-Abatan Rd | 722.1 | 577.8 |
| 36 | Bagabag-Bontoc Rd | 1,292.2 | 1,034.0 |
| 37 | Santiago-Sta.Maria Rd | 602.7 | 482.0 |
| 38 | Ramon-Banaue Rd | 3,869.3 | 3,096.0 |
| 39 | Naguilian-Palanan Rd | 1,294.2 | 1,036.8 |
| 40 | Lubuagan-Bontoc Rd | 2,438.6 | 1,951.4 |
| 41 | Cabagan-Solana Rd | 546.3 | 437.0 |
| 42 | Enrile-Lubuagan Rd | 938.4 | 750.9 |
| 43 | Narvacan-Lubuagan Rd | 2,367.1 | 1,894.4 |
| 44 | Tuao-Tabuk Rd | 539.2 | 431.7 |
| 45 | San Nicolas-Tuao Rd | 2,906.2 | 2,327.4 |
| 46 | Solana-Piat Rd | 110.5 | 88.4 |
| 47 | Nassiping-Abbut Rd | 630.3 | 504.3 |
| 48 | Magapit-Sta.Ana Rd | 615.2 | 492.2 |
| 49 | Infanta-Dingalan Rd | 2,302.7 | 1,845.0 |
| 50 | Dingalan-Baler Rd | 2,883.9 | 2,310.8 |
| 51 | Baler-Dinalongan Rd | 419.2 | 336.6 |
| 52 | Dinalongan-Palanan Rd | 2,779.8 | 2,228.4 |
| 53 | Palanan-Sta.Ana Rd | 4,787.8 | 3,836.1 |
| 54 | South Luzon Expressway | 573.3 | 458.6 |
| 55 | S.Luzon Expwy Ext, Batangas Line | 3,349.0 | 2,700.8 |
| 56 | S.Luzon Expwy Ext, Lucena Line | 4,022.8 | 3,247.0 |
| 57 | Pan-Phil H'way, Lucena-Calauag | 3,150.1 | 2,525.2 |
| 58 | Pan-Phil H'way, Calauag-Sipocot | 88.5 | 70.8 |
| 59 | Calauag-Sipocot Diversion Rd | 5,188.8 | 4,158.5 |
| 60 | Sipocot-San Vicente Diversion Rd | 3,965.3 | 3,191.7 |
| 61 | Manila-Cavite Expressway | 1,413.9 | 1,135.4 |
| 62 | Bacoor-Tagaytay-Tanza Rd | 1,874.6 | 1,513.0 |
| 63 | Calamba-Tagaytay Rd | 204.8 | 164.3 |
| 64 | Tagaytay-Talisay Rd | 107.1 | 85.7 |
| 65 | Laurel-Lemery Rd | 363.2 | 292.6 |
| 66 | Naic-Nasugbu Rd | 949.9 | 761.1 |
| 67 | Nasugbu-Lemery Rd | 104.5 | 83.6 |
| 68 | Marikina-Infanta Rd | 1,247.4 | 999.1 |
| 69 | Pasig-Binangonan Rd | 779.1 | 685.7 |
| 70 | Famy-Infanta Rd | 566.6 | 453.6 |
| 71 | Calamba-Pagsanhan Diversion Rd | 1,572.9 | 1,273.9 |
| 72 | San Pablo-Mauban Rd | 411.1 | 329.1 |
| 73 | Pagsanhan-Lucena Rd | 216.0 | 173.0 |
| 74 | Tignuan-Atimonan Rd | 2,942.4 | 2,357.4 |
| 75 | Batangas-San Juan Rd | 62.3 | 49.8 |
| 76 | Batangas-San Juan Coastal Rd | 797.1 | 641.6 |
| 77 | Malicboy-Mulanay Rd | 641.2 | 513.9 |
| 78 | Mulanay-Panagon-Jinabaan Rd | 1,932.2 | 1,547.4 |
| 79 | Mulanay-San Francisco-Panagon Rd | 1,954.5 | 1,565.5 |
| 80 | San Miguel-Tagkawayan Rd | 498.5 | 399.5 |
| 81 | Calabanga-Goa Rd | 613.4 | 491.7 |
| 82 | Tigaon-Lagonoy Rd | 25.5 | 20.4 |
| 83 | Lagonoy-Caramoan Rd | 1,593.4 | 1,275.1 |
| 84 | Lagonoy-Presentacion-Caramoan Rd | 1,194.0 | 956.0 |
| 85 | Lalud-Garchitorena Rd | 1,698.4 | 1,360.7 |
| 86 | Legaspi-Tigaon Rd | 569.2 | 455.5 |
| 87 | Ligao-Tabaco Rd | 80.0 | 64.2 |
| 88 | Legaspi-Manito-Sorsogon Rd | 830.8 | 665.4 |
| 89 | Polangui-Pilar Rd | 1,183.5 | 947.9 |
| 90 | Abuyog-Bulusan-Iroshin Rd | 349.3 | 280.0 |
| 91 | Juban-Bulan-Gate Rd | 685.6 | 548.6 |
| | Total | 154,497.4 | 123,926.8 |

## 14.4 ECONOMIC EVALUATION RESULTS

### 14.4.1 Economic Evaluation of Overall Plan

To assess the LISR projects as a whole, benefits are estimated by comparing two cases: the LISR case where every project are implemented according to the proposed schedule and the "Do-nothing" case where the present network and its conditions remain as they are.

The accumulated amount of direct benefit (VOC savings) will reach 348.2 billion pesos in the year 2020. Development benefit (GRDP increase) will accumulate 221.0 billion pesos. Savings by disaster prevention projects (savings in VOC of traffic forced to detour and in disaster restoration cost) will amount to 33.8 billion pesos in accumulation (Table 14.4-1).

By comparing the benefit to the cost annually, evaluation indicators are calculated as shown in the Table 14.4-2. Here, in order to calculate the Benefit to Cost ratio (B/C) and the Net Present Value (NPV), the discount rate was assumed to be 15% which is commonly used to evaluate a project in the Philippines.

The internal rate of return (IRR) implied in the LISR plan is as high as 23.0%, B/C is 1.68 and NPV amounts to 21.4 billion pesos, all of which assure high economic returns derived by the LISR Plan implementation.

Project groups in each 6 year Program are evaluated in the same manner. It reveals that the earlier Program, the higher economic return. This shows that the investment schedule has been prepared reasonably from the economic point of view.

TABLE 14.4-1 COST-BENEFIT CASH FLOW OF LISR MASTERPLAN

| Year | Economic Cost | Economic Benefit | | | | | Cash Flow (B-C) | |
|---|---|---|---|---|---|---|---|---|
| | | Direct Benefit (VOC Saving) | Develop-ment Benefit | Disaster Prevention | | Total | | Discounted by 15% |
| | | | | VOC Saving | Restoration | | | |
| 1992 | 402.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | (402.6) | (402.6) |
| 1993 | 2,858.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | (2,858.6) | (2,485.7) |
| 1994 | 4,389.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | (4,389.2) | (3,318.9) |
| 1995 | 4,862.3 | 240.3 | 152.5 | 32.2 | 22.8 | 447.7 | (4,414.6) | (2,902.7) |
| 1996 | 4,815.8 | 597.6 | 379.3 | 85.6 | 60.6 | 1,123.1 | (3,692.7) | (2,111.3) |
| 1997 | 5,439.1 | 1,731.6 | 1,098.9 | 88.9 | 62.9 | 2,982.3 | (2,456.8) | (1,221.5) |
| 1998 | 5,323.1 | 2,163.5 | 1,373.0 | 137.7 | 97.4 | 3,771.7 | (1,551.4) | (670.7) |
| 1999 | 6,275.4 | 3,228.7 | 2,049.0 | 161.0 | 114.0 | 5,552.6 | (722.8) | (271.7) |
| 2000 | 6,635.4 | 4,501.2 | 2,856.5 | 165.1 | 116.9 | 7,639.7 | 1,004.3 | 328.3 |
| 2001 | 6,286.6 | 5,547.8 | 3,520.7 | 169.2 | 119.8 | 9,357.6 | 3,071.0 | 873.0 |
| 2002 | 6,903.9 | 7,127.0 | 4,522.9 | 193.3 | 136.8 | 11,979.9 | 5,076.0 | 1,254.7 |
| 2003 | 6,045.7 | 8,682.4 | 5,510.0 | 311.3 | 220.3 | 14,724.0 | 8,678.3 | 1,865.4 |
| 2004 | 6,580.4 | 10,033.5 | 6,367.4 | 318.5 | 225.5 | 16,944.9 | 10,364.5 | 1,937.2 |
| 2005 | 6,610.6 | 11,209.2 | 7,113.5 | 611.6 | 432.9 | 19,367.3 | 12,756.7 | 2,073.3 |
| 2006 | 6,259.5 | 12,669.8 | 8,040.4 | 626.1 | 443.1 | 21,779.4 | 15,519.9 | 2,193.4 |
| 2007 | 6,704.3 | 13,871.3 | 8,802.9 | 639.6 | 452.7 | 23,766.5 | 17,062.2 | 2,096.9 |
| 2008 | 6,821.7 | 15,584.5 | 9,890.1 | 927.6 | 656.6 | 27,058.9 | 20,237.2 | 2,162.6 |
| 2009 | 6,493.4 | 17,546.3 | 11,135.1 | 954.6 | 675.7 | 30,311.7 | 23,818.3 | 2,213.3 |
| 2010 | 5,953.2 | 18,640.0 | 11,829.2 | 974.2 | 689.5 | 32,132.9 | 26,179.7 | 2,115.5 |
| 2011 | | 19,742.8 | 12,529.0 | 1,280.1 | 906.1 | 34,458.1 | 34,458.1 | 2,421.2 |
| 2012 | | 20,129.4 | 12,774.3 | 1,305.2 | 906.1 | 35,115.0 | 35,115.0 | 2,145.5 |
| 2013 | | 20,515.9 | 13,019.6 | 1,330.3 | 906.1 | 35,771.9 | 35,771.9 | 1,900.6 |
| 2014 | | 20,902.4 | 13,264.9 | 1,355.3 | 906.1 | 36,428.8 | 36,428.8 | 1,683.0 |
| 2015 | | 21,288.9 | 13,510.2 | 1,380.4 | 906.1 | 37,085.6 | 37,085.6 | 1,489.9 |
| 2016 | | 21,675.5 | 13,755.5 | 1,405.4 | 906.1 | 37,742.5 | 37,742.5 | 1,318.5 |
| 2017 | | 22,062.0 | 14,000.8 | 1,430.5 | 906.1 | 38,399.4 | 38,399.4 | 1,166.5 |
| 2018 | | 22,448.5 | 14,246.1 | 1,455.6 | 906.1 | 39,056.3 | 39,056.3 | 1,031.7 |
| 2019 | | 22,835.1 | 14,491.4 | 1,480.6 | 906.1 | 39,713.2 | 39,713.2 | 912.2 |
| 2020 | | 23,221.6 | 14,736.7 | 1,505.7 | 906.1 | 40,370.1 | 40,370.1 | 806.3 |
| 2021 | (47,668.9) | | | | | | 47,668.9 | 827.9 |
| Total | 57,991.9 | 348,197.0 | 220,969.9 | 20,325.7 | 13,588.5 | 603,081.1 | 545,089.2 | 21,431.8 |

TABLE 14.4-2 ECONONIC EVALUATION RESULT

| | IRR (%) | B/C | NPV (million P) |
|---|---|---|---|
| Masterplan | 23.0 | 1.68 | 21,431.8 |
| Program I (1993-1998) | 32.7 | 2.11 | 4,702.4 |
| Program II (1999-2004) | 24.4 | 1.71 | 7,602.8 |
| program III (2005-2010) | 18.0 | 1.68 | 4,418.9 |

## 14.4.2 Project Evaluation

Each project is evaluated in the same way as a feasibility study, by comparing its economic cost with the said three kinds of economic benefit generated year by year according to the planned schedule. Results are shown in Figure 14.4-1 and Table 14.4-3.

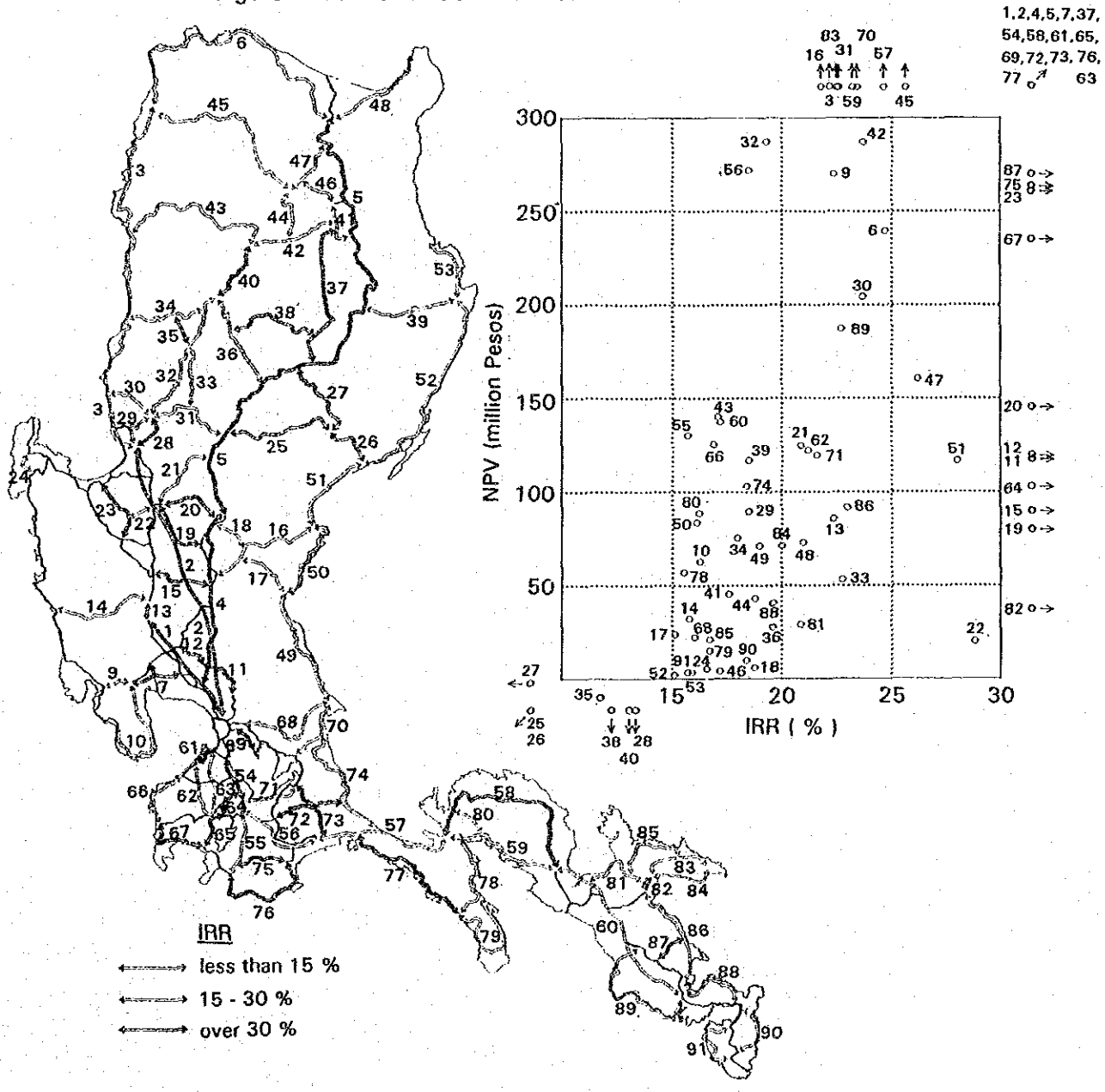



FIGURE 14.4-1 PROJECT EVALUATION RESULT

## TABLE 14.4-3 ECONOMIC EVALUATION INDICATORS OF LISR PROJECT

| Pro. No. | Project Name | IRR (%) | B/C | NPV (P.mill.) | Pro. No. | Project Name | IRR (%) | B/C | NPV (P.mill.) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | North Luzon Expressway | 0.379 | 3.27 | 2044.9 | 47 | Nassiping-Abbut Rd | 0.262 | 1.96 | 160.8 |
| 2 | New North Luzon Expressway | 0.366 | 3.04 | 5893.8 | 48 | Magapit-Sta.Ana Rd | 0.210 | 1.43 | 73.2 |
| 3 | Manila North Rd, Rosario-Laoag | 0.222 | 1.56 | 376.8 | 49 | Infanta-Dingalan Rd | 0.190 | 1.29 | 71.4 |
| 4 | Pan-Phil H'way, Sta.Rita-San Jose | 0.486 | 4.60 | 4472.1 | 50 | Dingalan-Baler Rd | 0.161 | 1.11 | 84.0 |
| 5 | Pan-Phil H'way, San Jose-Magapit | 1.043 | 12.63 | 9422.4 | 51 | Baler-Dinalongan Rd | 0.280 | 1.99 | 116.8 |
| 6 | Laoag-Magapit Rd | 0.247 | 1.66 | 239.6 | 52 | Dinalongan-Palanan Rd | 0.151 | 1.01 | 2.3 |
| 7 | Manila-Bataan Coastal Rd, North | 0.400 | 3.89 | 4023.4 | 53 | Palanan-Sta.Ana Rd | 0.159 | 1.06 | 3.6 |
| 8 | Manila-Bataan Coastal Rd, South | 0.000 | 0.00 | 0.0 | 54 | South Luzon Expressway | 0.422 | 3.55 | 493.2 |
| 9 | Dinalupihan-Olongapo Rd | 0.224 | 1.66 | 270.1 | 55 | S.Luzon Expwy Ext, Batangas Line | 0.157 | 1.06 | 130.6 |
| 10 | Dinalupihan-Mariveles-Bagac Rd | 0.163 | 1.10 | 63.0 | 56 | S.Luzon Expwy Ext, Lucena Line | 0.185 | 1.27 | 272.3 |
| 11 | Baliuag-San Jose Del Monte Rd | 1.158 | 8.54 | 117.0 | 57 | Pan-Phil H'way, Lucena-Calauag | 0.246 | 1.77 | 514.5 |
| 12 | Baliuag-Sta.Ana Rd | 1.094 | 7.58 | 119.1 | 58 | Pan-Phil H'way, Calauag-Sipocot | 1.045 | 8.13 | 816.9 |
| 13 | Mabalacat-Capas Rd | 0.224 | 1.58 | 85.7 | 59 | Calauag-Sipocot Diversion Rd | 0.232 | 1.60 | 733.0 |
| 14 | Capas-Botolan Rd | 0.158 | 1.03 | 32.3 | 60 | Sipocot-San Vicente Diversion Rd | 0.172 | 1.17 | 137.8 |
| 15 | Sta.Rosa-Tarlac Rd | 0.749 | 5.04 | 89.2 | 61 | Manila-Cavite Expressway | 0.354 | 2.96 | 1124.9 |
| 16 | Cabanatuan-Baler Rd | 0.218 | 1.62 | 360.7 | 62 | Bacoor-Tagaytay-Tanza Rd | 0.212 | 1.47 | 122.5 |
| 17 | Palayan-Dingalan Rd | 0.151 | 1.01 | 23.8 | 63 | Calamba-Tagaytay Rd | 0.604 | 5.12 | 482.5 |
| 18 | San Jose-Palayan Rd | 0.188 | 1.23 | 6.1 | 64 | Tagaytay-Talisay Rd | 0.461 | 3.09 | 102.3 |
| 19 | Rosales-Baloc Rd | 0.460 | 3.26 | 79.3 | 65 | Laurel-Lemery Rd | 0.354 | 2.66 | 347.3 |
| 20 | Rosales-San Jose Rd | 0.952 | 6.52 | 144.9 | 66 | Naic-Nasugbu Rd | 0.169 | 1.15 | 125.6 |
| 21 | Rosales-Sta.Fe Rd | 0.209 | 1.46 | 124.8 | 67 | Nasugbu-Lemery Rd | 0.660 | 4.69 | 234.6 |
| 22 | Carmen-Bautista Rd | 0.288 | 1.93 | 20.2 | 68 | Marikina-Infanta Rd | 0.160 | 1.07 | 22.6 |
| 23 | Camiling-Binmaley Rd | 1.536 | 15.75 | 260.4 | 69 | Pasig-Binangonan Rd | 0.514 | 5.39 | 1318.5 |
| 24 | Burgos-Bani Rd | 0.166 | 1.12 | 5.6 | 70 | Famy-Infanta Rd | 0.234 | 1.63 | 743.6 |
| 25 | Aritao-Maddela Rd | 0.079 | 0.57 | -57.2 | 71 | Calamba-Pagsanhan Diversion Rd | 0.216 | 1.51 | 119.8 |
| 26 | Maddela-Dinalongan Rd | 0.013 | 0.23 | -43.4 | 72 | San Pablo-Mauban Rd | 0.483 | 3.87 | 671.3 |
| 27 | Cordon-Maddela Rd | 0.042 | 0.41 | -2.0 | 73 | Pagsanhan-Lucena Rd | 0.682 | 6.00 | 631.7 |
| 28 | Kennon Rd | 0.133 | 0.89 | -49.6 | 74 | Tignuan-Atimonan Rd | 0.184 | 1.23 | 103.3 |
| 29 | Rosario-Pugo-Baguio Rd | 0.185 | 1.26 | 89.8 | 75 | Batangas-San Juan Rd | 1.286 | 12.09 | 263.2 |
| 30 | Naguilian Rd | 0.237 | 1.66 | 204.7 | 76 | Batangas-San Juan Coastal Rd | 0.326 | 2.53 | 382.3 |
| 31 | Aritao-Baguio Rd | 0.226 | 1.62 | 516.4 | 77 | Malicboy-Mulanay Rd | 0.411 | 3.66 | 925.7 |
| 32 | Baguio-Bontoc Rd | 0.109 | 0.74 | -152.3 | 78 | Mulanay-Panagon-Jinabaan Rd | 0.155 | 1.01 | 57.3 |
| 33 | Bokod-Abatan Rd | 0.228 | 1.56 | 53.4 | 79 | Mulanay-San Francisco-Panagon Rd | 0.167 | 1.11 | 15.6 |
| 34 | Tagudin-Sabangan Rd | 0.180 | 1.22 | 75.7 | 80 | San Miguel-Tagkawayan Rd | 0.162 | 1.11 | 89.1 |
| 35 | Cervantes-Abatan Rd | 0.117 | 0.80 | -9.9 | 81 | Calabanga-Goa Rd | 0.209 | 1.40 | 29.5 |
| 36 | Bagabag-Bontoc Rd | 0.196 | 1.13 | 28.0 | 82 | Tigaon-Lagonoy Rd | 0.542 | 3.75 | 36.8 |
| 37 | Santiago-Sta.Maria Rd | 0.408 | 3.15 | 736.2 | 83 | Lagonoy-Caramoan Rd | 0.225 | 1.57 | 345.3 |
| 38 | Ramon-Banaue Rd | 0.122 | 0.81 | -52.3 | 84 | Lagonoy-Presentacion-Caramoan Rd | 0.200 | 1.35 | 71.5 |
| 39 | Naguilian-Palanan Rd | 0.185 | 1.22 | 117.2 | 85 | Lalud-Garchitorena Rd | 0.167 | 1.12 | 21.6 |
| 40 | Lubuagan-Bontoc Rd | 0.130 | 0.87 | -55.0 | 86 | Legaspi-Tigaon Rd | 0.230 | 1.57 | 91.9 |
| 41 | Cabagan-Solana Rd | 0.176 | 1.21 | 45.7 | 87 | Ligao-Tabaco Rd | 0.890 | 6.53 | 269.6 |
| 42 | Enrile-Lubuagan Rd | 0.237 | 1.74 | 287.3 | 88 | Legaspi-Manito-Sorsogon Rd | 0.196 | 1.34 | 41.0 |
| 43 | Narvacan-Lubuagan Rd | 0.171 | 1.16 | 140.5 | 89 | Polangui-Pilar Rd | 0.227 | 1.59 | 187.6 |
| 44 | Tuao-Tabuk Rd | 0.188 | 1.31 | 43.4 | 90 | Abuyog-Bulusan-Iroshin Rd | 0.184 | 1.28 | 10.2 |
| 45 | San Nicolas-Tuao Rd | 0.256 | 1.74 | 497.5 | 91 | Juban-Bulan-Gate Rd | 0.157 | 1.05 | 3.7 |
| 46 | Solana-Piat Rd | 0.172 | 1.15 | 4.3 | | | | | |

Granting a project with IRR higher than 15% as a feasible one, all the projects except seven are economically justified. Especially, 27 projects out of 90 show very high economic return over 30%. Unfeasible ones are mountain road projects in the northern regions, aiming at regional development.

## 14.5 TIME-DISTANCE REDUCTION

Figure 14.5-1 illustrates the Luzon island drawn in terms of travel time from

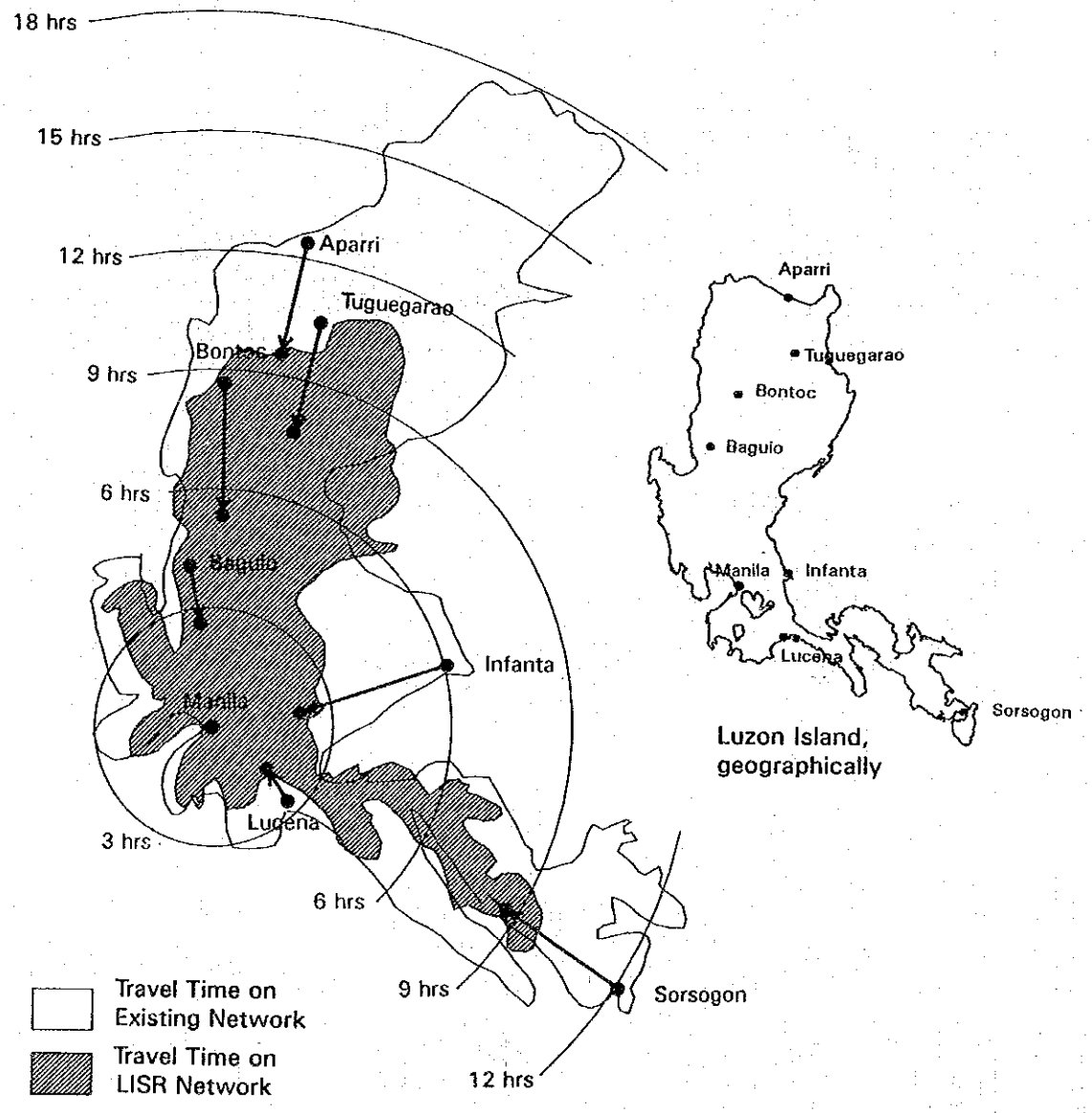



FIGURE 14.5-1 TIME-DISTANCE MAP OF LUZON ISLAND

Metro-Manila. It is about 550 km from Manila to Aparri, the northernmost town of Luzon island in road distance and 630 km to the southernmost Sorsogon. On the present network, it will take 12.6 hours and 12.0 hours, respectively, to reach there by car even running without a rest. The most remote area from Manila in terms of travel time is the east coast of Cagayan and Isabela, taking more than 18 hours.

Development of LISR network will reduce significantly these time-distances in Luzon island. From Manila, it will become possible to reach Aparri in 9.5 hours and Sorsogon in 9.1 hours. Travel time to Infanta will also be shortened from current 6.0 hours to 2.2 hours. Bontoc in the north and Naga in the south will come into the 5 hour sphere from Manila, where a round trip in a day may be practical.

## 14.6 IMPACT ON REGIONAL ECONOMY

### 14.6.1 General

In long terms, dynamic socio-economic changes will accrue to the regions from the LISR development. Especially on regional and agro-industry, the following changes will be expected as a result of accessibility improvement to markets, reduction of transport costs, time and losses:

(1) Improving the marketing of farm-inputs such as seed, fertilizers, agro-chemicals, farm tools and machines and reducing their prices;
(2) Increasing farmers bargaining power and farm gate prices;
(3) Increasing trading prices by reduction of transport quantitative and qualitative losses;
(4) Promoting production intensification, i.e., expanding cropping area or reduction of fallow land, increase in cropping intensity, and increase in yield and productivity;
(5) Promoting production diversification changing from mono-cropping to;
- Introducing vegetable and fruit production
- Integrating crop production with livestock production

(6) Expanding agricultural markets to more remote areas;
(7) Promoting farmers and cooperatives' own marketing activities such as direct marketing to big retailers (super markets), consumers (restaurants), regional or Manila terminal markets;
(8) Expanding inter-regional traders' activities to producing areas;
(9) Promoting agro-processing industry such as;
- Rice mills
- Feed mills (corn and other grains)
- Storage and processing facilities for vegetables and fruits
- Processing facilities for other local delicacy

(10) Promoting farmers' organization set-up such as multi-purpose and marketing cooperatives.

### 14.6.2 Impact on Commodity Price

According to the official data, commodity prices differ significantly by location. In general, agro-product prices in Manila are much higher than in rural provinces and vice versa in case of industrial products, because of distributor's margins and costs for storage, handling, losses and transportation.

Comparing wholesale prices of rice in Manila to farm-gate prices in Cagayan province, for example, the former is higher than the latter by 1.8 times. The difference is 4.52 pesos/kg. On the other hand, net transportation cost from Cagayan to Manila is estimated to be 1.70 pesos/kg, 38% of the difference, excluding handling cost and transporter's margins (Table 14.6-1).

By completion of the proposed LISR network, the said transportation cost, 1.70 pesos is expectedly reduced to 1.27 pesos. The saved 0.43 pesos/kg accounting for 7.8% of the farm-gate price, will result in lower retail price or higher income of farmers and traders. This impact is bigger on commodities with lower price per unit weight (Table 14.6-2).

TABLE 14.6-1 PRICE DIFFERENCE BETWEEN METRO-MANILA AND REGION

| Region/ Crops | V | II | IV | III |
|---|---|---|---|---|
| 1) Farmgate Price and Wholesale price and Metro-Manila (P/kg) | | | | |
| Rice | 4.68 | 4.42 | 3.43 | 3.27 |
| Yellow Corn | 1.38 | 1.19 | 1.96 | 1.02 |
| Ampalaya | 1.79 | 6.76 | 1.38 | 2.45 |
| Tomato | 1.76 | 3.21 | 1.44 | 1.69 |
| Eggplant | 2.95 | 3.11 | 0.10 | 2.55 |
| Banana/Lakatan | 0.48 | 0.57 | 0.52 | - |
| Hog | 8.05 | 3.07 | 4.64 | 0.85 |
| 2) Retail Price of Industrial Goods (Region - Metro-Manila) (Peso) | | | | |
| Powdered Milk (400g) | 55.11 | 78.99 | 50.53 | 52.72 |
| Salt (kg) | 3.43 | 6.80 | 6.20 | 10.68 |
| Ajinomoto (100g) | 18.50 | 10.68 | 6.25 | 10.13 |
| Cooking Oil (pint) | 15.80 | 10.58 | 9.31 | 11.67 |
| G.I.Sheet 1.79 | 28.34 | 28.55 | 27.92 | 26.06 |
| Gasoline 1.76 | 11.92 | 11.56 | 10.79 | 10.77 |

TABLE 14.6-2 COMMODITY PRICE REDUCTION BY LISR PLAN

| Commodity | Price (P/Kg) | Cost Reduction (%) |
|---|---|---|
| Rice | 5.50 | 7.6 |
| Corn | 5.10 | 8.4 |
| Tomato | 5.75 | 7.5 |
| Onion | 6.38 | 6.7 |
| Banana | 4.30 | 10.0 |
| Hog | 41.70 | 1.0 |

### 14.6.3 Impact on Population Redistribution

In many countries, it is observed that the capital region is suffering from the burden of rapid population growth, hardly coping with increasing demand for houses, power, water and transportation facilities, while rural economies are deteriorated, losing young labor forces. This is true also in Luzon Island. The current MTPDP is emphasizing that regional development is one of the key targets.

In order to stop or mitigate the trans-migration from rural region to NCR, it will be essential to create job opportunities and raise the income level in the rural regions, as to curtail the economic and cultural gaps between local regions and NCR.

Highway development can be a trigger for regional development in many cases, by providing better conditions for marketing and industrial location, and better access to urban facilities.

As shown in the previous section (14.5), Luzon Island will become much smaller in terms of travel time by LISR network development. Most parts of the island will come into the one-day-activity sphere of Metro Manila, which will undoubtedly result in a significant impact on the distribution of industries and population, comparing to the case of no-road investment.

LISR network is expected to raise the GRDP in Luzon Island by an additional 80.0 billion pesos in 2010 (15% of which is regarded as direct contribution of LISR projects in Table 14.4-1). Subtracting 25.6 billion pesos, which is the development benefit expected in NCR, the balance of 54.4 billion pesos will be generated in the Study Area as regional development benefit. Dividing this amount by future GRDP per capita (32,300 pesos per annum as shown in Chapter 7), this amount of 54.4 billion pesos is equivalent to the value added produced by 1,684,000 population, which corresponds to 23.3% of population increase during 1990 to 2010. This suggests that LISR development will contribute to human settlement in the region by sustaining one-fourth of the target population increase.

# CHAPTER 15

# ENVIRONMENTAL CONSIDERATIONS

With the rapid development and increased consumption of the natural resources, it became necessary that the activities of man should be monitored and regulated to insure that environmental changes do not result in long-term harmful effects and to promote a rational theme between population growth, economic development and the protection of the environment.

## 15.1 PHILIPPINE ENVIRONMENTAL LAWS

Environmental management in the Philippines, as a governmental policy, is not long ago. It was only recently that ecosystem management became a topic of concern not only for specialized scientific community but also to the large population as well. As a necessary consequence, environmental laws were passed and became the guideposts of law enforcement agencies as well as the citizens in the proper management of the environment.

One of the early moves to update Philippine Environmental Law was made when the President of the Republic of the Philippine issued Letter of Instruction (LOI) No. 422 directed all agencies involved in environmental protection to be organized as one coordinating body to assess the current efforts and programs involving environmental protection. This presidential directive resulted in the creation of the Inter-Agency Committee on Environmental Protection (IACEP). The IACEP, meanwhile, strongly endorsed to the president the creation of the National Environmental Protection Council (NEPC) which was subsequently established according to the Presidential Decree (P.D.) No. 1121 on April 1977.

The P.D. No. 1121 created the NEPC as a central agency that will oversee, unify and integrate the planning, management and implementation of the government's environmental programs. This central agency shall be under the supervision and control of the President and is empowered to protect, conserve, maintain and enhance the environment quality of the nation.

The establishment of an appropriate mechanism to evaluate the environmental consequences of land development and resource exploitation was declared by the LOI No. 549 and P.D. No. 1151 on June 6, 1977. LOI No. 549 included instructions for the establishment of an administrative system for Environmental Impact Assessment (EIA). And the legal framework for EIA originated with the enactment of P.D. No. 1151 which declared the Philippine Environmental Policy. In identifying the Philippine Environmental Policy, four significant statements were set-forth:

1) National Environmental Policy: To create, develop, maintain and improve conditions under which man and nature can thrive in productive harmony, and to fulfill the social, economic and other requirements of present and future generations of the country.

2) National Environmental Goal: The nation may: a) recognize and fulfill the responsibilities of each generation as trustee and guardian of the environment; b)encourage the widest exploitation of the environment without degrading it; and c) attain a rational balance between population and resource use as well as preserving important historic and cultural aspects of the Philippine heritage.

3) Right to a Healthy Environment: The Government recognizes the right of the people to a healthy environment. It shall be the duty of each individual to contribute to the preservation and enhancement of the environment.

4) Environmental Impact Statement: All governmental and private agencies, corporations, firms and entities shall prepare, file and include in every project, which significantly affects the quality of the environment, a detailed statement on: a) the environmental impact of the proposed project; b) unavoidable adverse environmental effect; c) alternatives; d) used environmental resources; and e) mitigating measures.

On the same day of June 6, 1977, the Philippine Environment Code was embodied under the P.D. No. 1152 . The code identifies fourteen areas or sectors which should have special emphasis in the matter of environmental protection and management. These are the following: air quality, water quality, land-use, fisheries and aquatic resources, wildlife, forestry and soil conservation, flood control and natural calamities, energy development, mineral resources, waste management, population, environmental education, environmental research and the preservation of historic and cultural resources.

To contain the increasing problems of environmental disturbance throughout the country, P.D. No. 1160 was declared on June 8, 1977 vesting authority in Barangay Captains to enforce pollution and environmental control national and local laws.

The establishment of an Environmental Impact Statement (EIS) System including other environmental management related measures was enacted under the P.D. No. 1586 on June 11, 1978. However, the publication of the EIS Rules and Regulations in the Official Gazette in June 21, 1982, Vol. 78 No. 25, marked the formal adoption and implementation of the EIS System of the nation. EIS rules and regulations, which were revised in the Council Resolution No. 4 Series 1984, apply to projects which fall within the definition of an Environmentally Critical Projects or which will be located within an Environmentally Critical Area declared by P.D. No. 1586 and as defined technically in Proclamation No. 2146 issued on November 7, 1983.

## 15.2 ENVIRONMENTAL IMPACT STATEMENT SYSTEM

The Philippine Environmental Impact Statement (EIS) System, as established in P.D. No. 1586 and based on the environmental impact statement required under P.D. 1151, applies to projects planned by any government agency or instrumentality including government-owned or controlled corporations, private corporations, firms, individuals or other entities, which fall within the definition of an Environmentally Critical Project (ECP) or which will be located within an Environmentally Critical Area (ECA). ECP and ECA are defined as follows.

a. Environmentally Critical Project (ECP)

Major infrastructure projects including those of major roads and bridges are considered as Environmentally Critical Projects (ECP). ECPs include also projects of heavy industries and resource extractive industries.

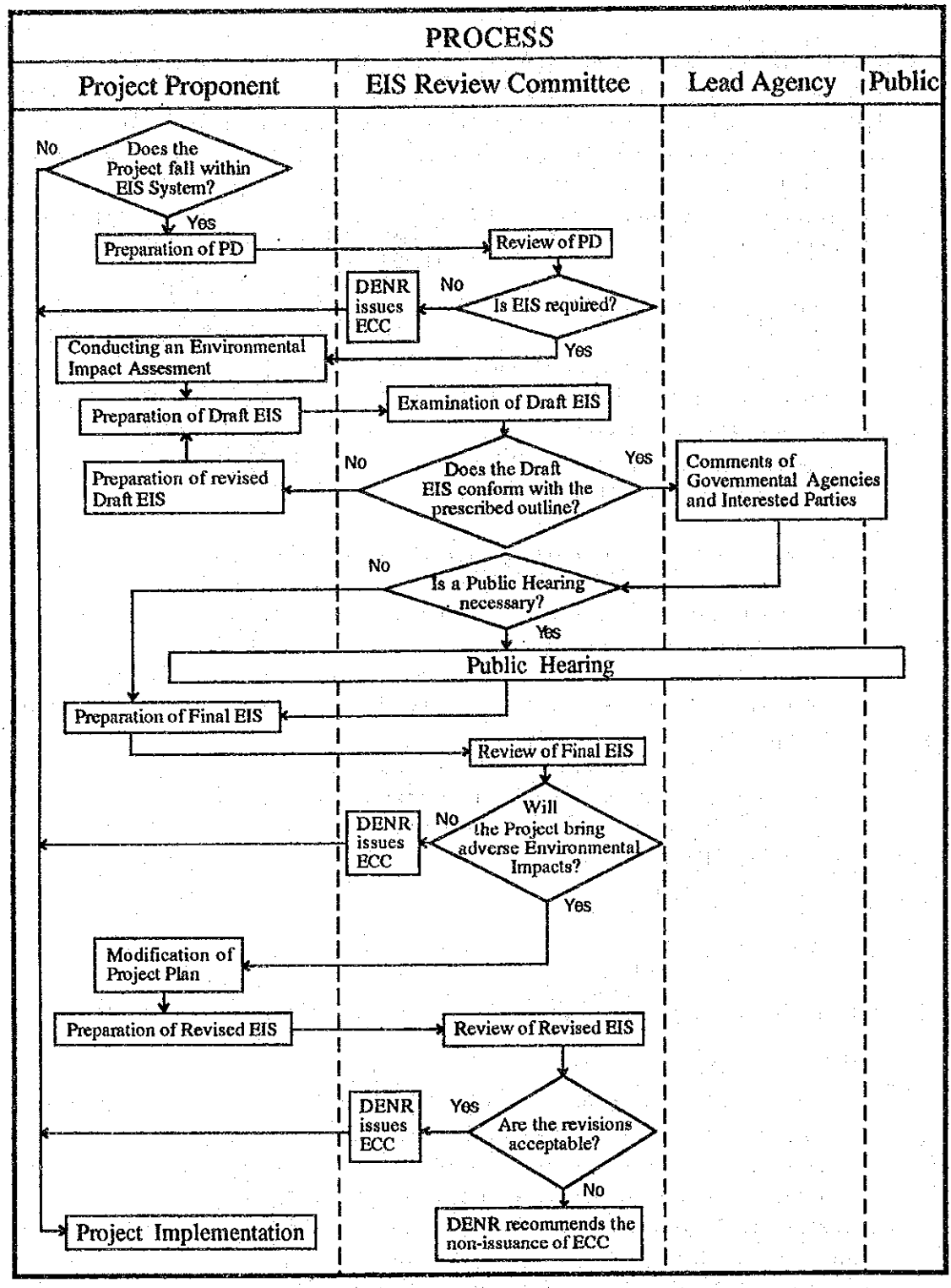
b. Environmentally Critical Area (ECA)

Areas which are considered as environmentally critical are:

- Areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries
- Areas set aside as aesthetic potential tourist spots
- Areas which constitute the habitat for any endangered or threatened species
- Areas of unique historic, archeological or scientific interests
- Areas traditionally occupied by cultural communities or tribes
- Areas classified as prime agricultural lands
- Recharged areas of aquifers, waterbodies, mangrove areas and coral reefs

By law, all projects falling within that scope of the EIS System must obtain an Environmental Compliance Certificate (ECC) before project implementation can begin, exclusive of other government permits or licenses which may be required.

Basically, a Project Description (PD) including the Initial Environmental Examination (IEE) is required first to evaluate the project environmentally. Negative determination for the project means that, based on the IEE, it shall not significantly affect the environment and there is no need for an environmental impact assessment. On the other hand, positive determination means that the project shall have significant environmental impact and an Environmental Impact Assessment (EIA) along with an Environmental Impact Statement (EIS) are required and should be submitted to the Environmental Management Bureau (EMB). The procedural flow of the EIS System is clarified in Figure 6.2-1. The definitions and explanations of the different components required in the procedure of the EIS System are as follows.




LEGEND:

| | |
|---|---|
| EIS | Environmental Impact Statement |
| PD | Project Description |
| DENR | Department of Environment and Natural Resources |
| ECC | Environmental Compliance Certificate |

FIGURE 15.2-1 PROCEDURAL FLOW OF EIS SYSTEM

1) Project Description (PD)

It refers to the document submitted by the project proponent describing the proposed project particularly those sectors which will likely cause adverse environmental impact. The description will include the type and purpose of the project, environmental setting, socioeconomic indicators, sources of environmental impact and proposed environmental management measures.

2) Initial Environmental Examination (IEE)

IEE is essentially a checklist of the probable environmental effect of a proposed project. The checklist includes the different environmental aspects either physically or socioeconomically. Depending on the IEE, it will be decided whether a more detailed statement on the environmental impact of the project shall be required or not.

3) Environmental Impact Assessment (EIA)

The environmental impact assessment is a procedure conducted in order to determine possible environmental impacts of the project and to preserve the environment and fulfill the public demands who expect projects to provide harmony with environment. In this stage, the existing physical and socioeconomical environment should be firstly examined. Next, proper assessment of the impacts of a proposed project should be predicted taking into consideration the two cases of "with project" and "without project". Schemes to mitigate the project impact should be provided for each of the different environmental aspects.

4) Environmental Impact Statement (EIS)

EIS is a result of an EIA on the environmental impact of the project. The statement elaborates on and is therefore much more detailed than the IEE. It refers to the documentation of the studies of the environmental impact of a project including a discussion on the direct and indirect consequences and impacts upon human welfare and ecological and environmental integrity. The statement should contain all relevant environmental information and details about the project. Providing baseline data and mappings for the different environmental aspects is one of the important activities relative to the preparation of an EIS.

5) Public Participation

The EIS System includes provisions for public participation, in the review and assessment of project proposals, through a public hearing process. In this process, citizens are given the chance to review and discuss the proposed project with concerned agencies. The primary benefit of such an exercise is the exchange of information and views and the resolution of conflicts in order to provide a venue to understand community values.

6) Endorsement from Local Government Unit (LGU)

An endorsement should be obtained from the LGU duly notarized attesting that the endorsee has understood the implications of the project on the environment and that a consultation has been done with the constituents of the area and there are no any violent objections on the project.

7) Ocular Inspection

An ocular inspection report is prepared by the Department of Environment and Natural Resources (DENR) for the project site and the environmentally critical areas including interview of residents who may be affected.

8) Environmental Compliance Certificate (ECC)

The certificate of compliance serves as the go-signal for the implementation of the project according to approved guidelines. It is issued by the President or his duly authorized representative certifying that the project under consideration will not bring about an unacceptable environmental impact.

Regarding major projects of roads and bridges, the physical environment which should be examined include generally the aspects of climate, topography, geology, natural hazards, soils, materials, hydrology, air, noise, waste disposal and ecosystems in the project area. Socioeconomical environment includes the aspects of land-use and settlement pattern, demography, employment and income, public services, transportation, traffic buildup and the archaeological and historical sites.

## 15.3 ENVIRONMENTAL CHARACTERISTICS OF LUZON ISLAND

As new road construction projects require environmental impact assessment which is carried out in details during the feasibility study and detailed design stages, the general, and to some extent critical, environmental characteristics of Luzon Island are presented in this section. Other physical and socioeconomical characteristics of the island are presented in Chapters 1 and 2.

Considering the criteria of the environmentally critical areas, Luzon Island has multi-environmental characteristics which should be taken into consideration during the assessment of the environmental impact. Available data on the main environmental items of the national parks, virgin forests, tourist spots and ethnic groups in Luzon Island are collected and classified on provincial base. Table 15.3-1 presents the area and location of forests and national parks in Luzon Island, while Table 15.3-2 includes the main tourist spots in the island. Population and location of each of the ethnic groups is given in Table 15.3-3, and Table 15.3-4 presents the protected areas according to the community forest stewardship agreements in the island.

TABLE 15.3-1 FORESTS AND NATIONAL PARKS IN LUZON ISLAND (Area: hectares, 1991)

| Region / Province | Total Forests Area | Virgin Forests (1981) | Classified Forests and National Parks | | |
|---|---|---|---|---|---|
| | | | Name | Location | Area |
| Region I: | | | | | |
| Ilocos N. | 194,986 | 28,874 | Paoay Lake N.P. | Paoay | 340 |
| Ilocos S. | 119,546 | 2,348 | Besang Pass National Shrine | Cervantes | 304 |
| | | | Northern Luzon Heroes Hill | Santa & Narvacan | 1,316 |
| La Union | 29,002 | 389 | Agoo-Damortis N.P. | Agoo & Sto. Tomas | 10,947 |
| Pangasinan | 130,423 | 2,105 | Manleluang N.P. | Mangatarem | 92 |
| Region II: | | | | | |
| Cagayan | 547,006 | 127,810 | Callao Cave N.P. | Penablanca | 192 |
| Isabela | 606,790 | 195,731 | Fuyot Springs N.P. | Ilagan | 819 |
| N. Vizcaya | 301,466 | 21,000 | Mt. Pulog | Kayapa | 2,662 |
| Quirino | 254,868 | 53,401 | | | |
| Region III: | | | | | |
| Bataan | 67,971 | 2,642 | Bataan N.P. | Hermosa, Balanga, Morong, Abucay, Orani, Samal & & Bagac | 23,688 |
| | | | Roosevelt N.P. | Dinalupihan & Hermosa | 1,335 |
| Bulacan | 77,167 | 30,697 | Biak-na-Bato N.P. | San Miguel | 2,117 |
| N. Ecija | 197,448 | 13,412 | Minalungao N.P. | Gapan & Gen. Tinio | 2,018 |
| Pampanga | 53,156 | | Mt. Arayat N.P. | Arayat & Magalang | 3,715 |
| Tarlac | 120,370 | 6,390 | Capas Death March Movement | Capas | 2 |
| Zambales | 255,062 | 10,685 | Olongapo Naval Base | Olongapo City | 9 |
| Region IV: | | | | | |
| Aurora | 191,946 | 38,583 | Aurora Memorial Park | San Luis | 4,190 |
| Batangas | 51,162 | | Taal Volcano Island | Taal Lake | 4,537 |
| Cavite | 28,205 | | Mt. Palaypalay-Mataas na Gulod | Ternate, Maragundon (Cavite) & Nasugbu (Batangas) | 4,000 |
| Laguna | 41,253 | 933 | Mt. Banahaw-San Cristobal | San Pablo City, Rizal, Nagcarlan, Liliw & Majayjay | 2,754 |
| Quezon | 398,299 | 44,819 | Quezon Memorial Park | Atimonan, Padre Burgos & Pagbilao | 983 |
| Rizal | 67,003 | 2,935 | | | |
| Region V: | | | | | |
| Albay | 49,052 | 104 | Mayon Volcano | Albay, Camalig, Ligao, Tobaco Malilipot & Guinobatan | 5,459 |
| Camarines N | 71,219 | 3,503 | Bicol N. P. | Basud & Daet | 2,840 |
| Camarines S | 161,131 | 5,245 | Libmanan Caves | Libmanan | 19 |
| | | | Caramoan N. P. | Caramoan | 347 |
| | | | Mt. Isarog | Naga, Calabanga, Tinambac, Goa, Tigaon & Pili | 10,112 |
| Sorsogon | 40,579 | | Bulusan Volcano | Casiguran, Juban, Bulusan, Irosin, Sorsogon & Barcelona | 3,673 |
| CAR: | | | | | |
| Abra | 299,135 | 46,196 | Casamata Hill | Bangued | 57 |
| Benguet | 177,641 | | Mt. Pulog N. P. | Buguiras, Kabayan, Benguet & Kianga | 8,888 |
| | | | Mt. Data N. P. | Atok, Amposunga, Kabayan, kibungan, Munkayan, Tublay, Bokod, (Benguet) & Hundagua (Ifugao) | 5,512 |
| Ifugao | 226,369 | 88 | | | |
| Kalinga | 624,085 | 168,605 | Balbasang-Balbalan | Balbalan | 1,338 |
| Mt.Province | 161,482 | 2,613 | Halsema N. P. | Sagada | |

TABLE 15.3-2 TOURIST SPOTS IN LUZON ISLAND (1/2)

| Region/Province | Location | Tourist Spot |
|---|---|---|
| Region I: | | |
| Ilocos Norte | Laoag City | Ermita Hill - Tobacco Monopoly Monument - Sinking Tower - Fort Ilocandia Resort - Monro Island - Bantay Bimmaboy |
| | Bacarra | Leaning Bell Tower - Natba Beach Watch Tower |
| | Paoay | Suba Sports Complex - Paoay Church - Suba Beach |
| | Currimao | La Playa Beach - D' Coral Beach |
| | Badoc | Badoc Island - Luna Museum |
| | Sarrat | Bato River Resort - Marcos Museum |
| | Vintar | Vintar Dam River Resort |
| | Pagudpud | Pasaleng Beach - Bagong Lipunan Lodge - Banua Resort - White Sand Beach |
| | Burgos | Imelda Garden Caves - Cape Bojeador Light House |
| Ilocos Sur | Vigan | The Ancestral Homes of Vigan - The Catheral Plaza Complex |
| | Sta. Maria | Sta. Maria Church - Pinsal Falls |
| | Sinait | Sinait Church |
| La Union | Bauang | Bauang Beach - White Sand Beach |
| | San Fernando | Bacsil Ridge - Battle of San Fernando Marker - Tomb of the Unknown Soldier |
| | Agoo | San Nicolas Beach |
| Pangasinan | Dagupan | Tondaligan Bonuan Beach |
| | San Fabian | San Fabian Beach - White Beach |
| | Agno | Agno Umbrella Rocks |
| | Lingayen | Lingayen Beach & Promonade Capital - Lingayen Beach - Limahong Channel |
| | Bolinao | Lighthouse Bolinao Museum - Cape Bolinao Lighhouse Station - Church of St. James - Santiago Island |
| | Manaoag | Manaoag Church & Shrine |
| | Sual | Sual Port |
| | Alaminos | Hundred Island |
| Region II: | | |
| Cagayan | Claveria | Claveria Surfing Beach - Mabnang and Kilkiling Falls - Punta Lakay-lakay, Baket-baket |
| | Pamplona | Magaburan Beach - Malagabaui Falls - Minanga Beach |
| | Sta. Praxedes | Macatel Falls - Mengay Beaches & Falls - Napudot Hot Spring |
| | Aparri | Fuga Island |
| Isabela | Ilagan | Sta. Victoria Caves |
| | Divilican | Divilican Beach - Honeymoon Island |
| | Echague | San Miguel Caves - Mandadamian Waterfalls |
| Nueva Viscaya | Bambang | Pensal Falls - Salinas Salt Spring |
| | Bayombong | Viernes Falls - Nuestra Sra. Falls |
| | Sta. Fe | Perez Park |
| | Dupax del Norte | Naruro Falls |
| Quirino | Aglipay | Aglipay Caves |
| | Diffun | Nagbukel Caves |
| | Nagtipunan | Picnic Site - Governor's Rapids - Nagtipunan Waterfalls |
| Region III: | | |
| Bataan | Dinalupihan | First line of Defense Marker - Mt. Malasimbo |
| | Limay | Death March Marker - Lamao World War II Marker |
| | Mariveles | Bataan Export Processing Zone - Talaga Beach |
| | Pilar | Shrine of Valor - Flaming Sword - Battle of Trail - Dumsalan Falls - Sitio Diwa |
| | Bagac | Bagac Beach & Resorts |
| Bulacan | Malolos | Barasoian Church |
| | San Miguel | Madlum Cave |

TABLE 15.3-2 TOURIST SPOTS IN LUZON ISLAND (2/2)

| Region/Province | Location | Tourist Spot |
|---|---|---|
| Nueva Ecija | Cabanatuan City | Camp Pangatian - Gen. Luna Statue & Marker |
| | San Jose City | Diamond Park |
| Pampanga | San Fernando | Archdiocesian Museum & Archives - Death March Marker |
| | Angeles City | Casino Filipino |
| Tarlac | Capas | Camp O' Donnel - Bueno Hot Spring |
| | Bamban | Bamban caves & Park |
| Zambales | Subic | White Rock - Palibunin Tourist Spot - Wilderness Lane Resort |
| | Olongapo | Subic Bay Lighthouse - Enchanted Castle |
| Region IV: | | |
| Aurora | Baler | Wildlife Reservation - Villa Ma. Aurora - Star of Baler - Baler Catholic Church |
| | Dipaculao | Dipaculao Spring |
| | Dingalan | Dingalan Beaches |
| Batangas | Lemery | White Beach |
| | Mabini | Mabini Dive Camp - Aguila Beach - Ligaya Beach - Filipinas Scuba Haven - Riverside Resort - Divemaster Seafari |
| | Lobo | Submarine Garden - Gertel Beach |
| | Lipa | Tagbakin Beach |
| | Nasugbu | White Sand Beach - Fortune Island - Cliff View |
| | Calatagan | Punta Baluarte-Calatagan Golf Club |
| Cavite | Ternate | Ternate Beach |
| | Tanza | Tanza Beach |
| | Tagaytay City | Tagaytay Ridge Vista |
| | Noveleta | Noveleta Beach |
| | Naic | Naic Beach |
| | Amadeo | Haliff Natural Falls - Ilayang Ilog Natural Falls |
| Laguna | Calamba | Batu - Bato - Club Solivento - El Pansolito - Crystal Springs - La Vista Pansol - Garden Resort |
| | Pagsanjan | Pagsanjan Rapids & Falls - Pagsanjan Tropical Resort |
| | Los Banos | Libis ng Nayon - Makiling Lodge |
| | Liliw | Liliw Resort - Corcega Resort |
| | Majayjay | Imelda Falls - Macatunao Resort - Dalitiwan Resort |
| | Paete | Benditang Tubig - Matabungcacalis - Tatlong Krus |
| | Cavinti | Dos Lagos |
| Quezon | Lucena City | Dalahican Beach and Talao - Talao |
| | Sariaya | Talaan Beach - Tayabas Beach |
| | Calauag | Yaganak Caves & Waterfalls - Pulong Pasig |
| Rizal | Antipolo | Valley Golf Club - Green Valley & Bahay Cogon - Hinulugang Taktak |
| | Montalban | Wawa Dam - Rolling Hills Resort |
| | Binangonan | Gardenville Resort |
| | Cardona | Bulaburan Hot Spring |
| Region V: | | |
| Albay | Legaspi City | Hoyop - Hoyopan Cave |
| | Tiwi | Tiwi Hot Spring |
| Camarines Sur | Naga City | University of Nueva Caceres Musuem |
| Sorsogon | Sorsogon | Bulusan Volcano |
| CAR: | | |
| Benguet | Baguio City | Burmham Park - Mines View Park - Wright Park - Camp John Hay Air Station - Baguio Botanical Garden |
| | Buguias | Sinipsip View |
| Ifugao | Banaue | Banaue Rice Teracces |
| | Kaingan | Yamashita Shrine - Ambuwaya Lake |
| Mt. Province | Sagada | Sagada Caves |
| | Bontoc | Mainit and Sadanga Hot Spring - Maligcong Rice Terrace |

TABLE 15.3-3 DISTRIBUTION OF ETHNIC GROUPS IN LUZON ISLAND - 1986

| REGION | ETHNIC GROUP | POPULATION | LOCATION |
|---|---|---|---|
| I & CAR | Bontoc, Balangao | 189,520 | Mt. Province |
| | Isneg, Tinggian | 56,345 | Apayao, Abra, Ilocos Sur |
| | Kalanyuya | 69,149 | Benguet, Abra |
| | Kankanai | 160,067 | Benguet, Pangasinan, Mt. Province |
| | Ibaloi (Negrito) | 119,088 | Mt. Province, Pangasinan |
| | Bago | 47,533 | Mt. Province, Pangasinan |
| | Aplai (Negrito) | 32,014 | Pangasinan, Ilocos, Mt. Province, Abra |
| | Sub-Total | 673,716 | |
| II | Bugkalot (Ilongot) | 36,790 | Nueva Vizcaya, Quirino |
| | Dumagat, Agta (Negrito) | 5,123 | Isabela, Cagayan Valley |
| | Kalinga | 136,736 | Kalinga-Apayao |
| | Gaddang | 55,257 | Nueva Vizcaya, Cagayan |
| | Ikalahan | 38,417 | Nueva Vizcaya |
| | Ibanag | 429,978 | Cagayan |
| | Isanai | 35,073 | Nueva Vizcaya |
| | Ivatan | 24,330 | Batanes |
| | Itawis | 12,807 | Batanes |
| | Agaytanon | 12,807 | Cagayan |
| | Ilanum | 132,536 | Kalinga-Apayao |
| | Ifugao | 230,495 | Nueva Vizcaya, Ifugao, Quirino, Baguio City, Benguet |
| | Apayao, Balangao | 520,215 | Kalinga-Apayao |
| | Sub-Total | 1,670,564 | |
| III | Aborlin, Baluga Dumagat, Abiyan (Negrito & Aeta) | 83,234 | Zambales, Bataan, Tarlac, Bulacan |
| | Ibaloi, Kankanaey, Kalalaya | 25,610 | Nueva Ecija, Zambales |
| | Sub-Total | 108,844 | |
| IV | Remontado,Dumagat | 9,527 | Rizal, Quezon, Laguna |
| | Sub-Total | 9,527 | |
| V | Pullon Mayon, Isarog, Abiyan (Negrito, Aeta) | 38,417 | Camarines Norte |
| | Sub-Total | 38,417 | |
| T O T A L | | 2,501,068 | |

TABLE 15.3-4 COMMUNITY FOREST STEWARDSHIP AGREEMENTS - 1990

| Region | Name of Foundation / Group | Ethnic Group | Location | Area (ha.) | Beneficiaries |
|---|---|---|---|---|---|
| II | Kalahan Educational Foundation | Ikalahans | Imugan (Nueva Vizcaya) & San Nicolas (Pangasinan) | 14,730 | 3,000 |
| | Bayagong Association for Community Development, Inc. | Ibaloy, Kankanai, Ikalahan | Bayagong, Canarem, Aritao (Nueva Vizcaya) | 1,213 | 250 |
| III | Organization of Siglakas Negrito of Canawan | Negrito | Canawan, Binaritan, Morong (Bataan) | 165 | 103 |
| IV | Huyon-Uyon Mabuhay Association, Inc. | Tagalog | Huyon-Uyon, San Francisco (Quezon) | 512 | 130 |

Locations of national parks, virgin forests, tourist spots and ethnic groups in the island are shown on Figure 15.3-1. Virgin forests are concentrated in the northern areas particularly on the eastern side while ethnic groups are scattered in most of the mountainous areas. National parks, which are areas of public domain to exclusively preserve the natural historic objects, wildlife and scenery and have been withdrawn from settlement or occupancy, are distributed mostly in the mountainous areas. Tourist spots are mainly in the coastal and natural beauty areas and historical sites all over the island. Locations of other associated major development projects which may have impacts on the road environment, such as main industrial, agricultural and irrigation projects are clarified in Chapter 6, Figure 6.3-1.

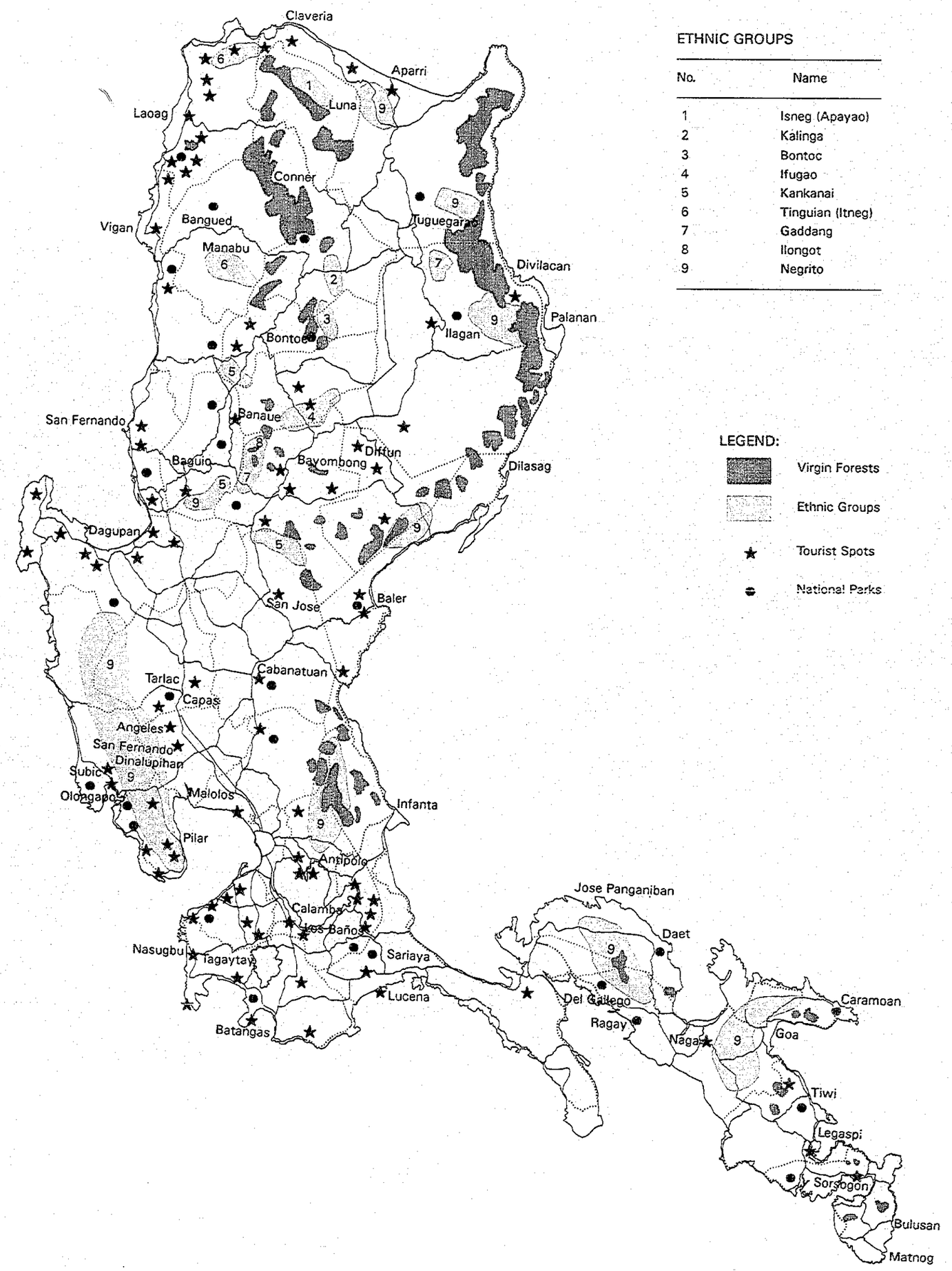
## 15.4 INITIAL IMPACT ASSESSMENT

Road construction may have its effect on a part of the environment within the project area during the construction stage and/or after implementation, therefore, every reasonable precaution and countermeasure should be taken to minimize any negative impacts and to help the speed recovery of the disturbed areas. The initial impact assessment is the first step in the environmental assessment procedure, and depending on this assessment, it can be decided whether a more detailed statement on the environmental impact of the project shall be required or not.

For the initial and tentative assessment and screening, the checklist presented in Table 15.4-1, which identifies and briefly describes the many various impacts which are expected to result from a road project, is used. For any particular road project, only a few of these impacts may be significant, and the purpose of this checklist is to identify those likely to be significant for that particular project. Environmental aspects in the checklist are grouped into the two parts of the physical and socioeconomical environment. The physical environment includes the natural aspects expected to be affected by the project, while the socioeconomical environment is as important as the natural environment since it includes the human-related factors. The check list is designed so that it can be readily screened to identify and delineate the significant environmental impacts and thus eliminate the others from further consideration. Main mitigating measures for the negative impacts expected to significantly affect the environment by the project are also proposed.

New road projects identified in LISR plan have a total of 36 projects and the results of the initial assessment, done through different available information and the environmental profiles of provinces and regions in Luzon Island, are presented in Appendix 15.1. Rehabilitation, pavement and widening projects are not included since that works are mostly implemented within the right-of-way of existing roads.

Preliminary screening reveals that most of the physical environmental aspects




ETHNIC GROUPS

| No. | Name |
|---|---|
| 1 | Isneg (Apayao) |
| 2 | Kalinga |
| 3 | Bontoc |
| 4 | Ifugao |
| 5 | Kankanai |
| 6 | Tinguian (Itneg) |
| 7 | Gaddang |
| 8 | Ilongot |
| 9 | Negrito |

LEGEND:

- Virgin Forests
- Ethnic Groups
- Tourist Spots
- National Parks

FIGURE 15.3-1 ENVIRONMENTAL CHARACTERISTICS IN LUZON ISLAND

## TABLE 15.4-1 CHECK LIST FOR INITIAL ENVIRONMENTAL ASSESSMENT

| Project No. - Project Name | | | |
|---|---|---|---|
| Segment | Province | Length (km) | Terrain | Project Type |
| | | | | |

| Check Item | | During Construction | | After Completion | | Remarks |
|---|---|---|---|---|---|---|
| | | Assessment | Mitigating Measures | Assessment | Mitigating Measures | |
| Physical Environment | Air Pollution | | | | | |
| | Water Pollution | | | | | |
| | Noise Pollution | | | | | |
| | Vibration | | | | | |
| | Soil Contamination | | | | | |
| | Land Subsidence | | | | | |
| | Soil Erosion | | | | | |
| | Ecosystems | | | | | |
| Socio-economical Environment | Population Change | | | | | |
| | Resettlement | | | | | |
| | Ethnic Groups | | | | | |
| | Community Cohesion | | | | | |
| | Land-use Pattern | | | | | |
| | Industrial Activity | | | | | |
| | Employment & Income | | | | | |
| | Traffic Build-up | | | | | |
| | Traffic Safety | | | | | |
| | Archaeology | | | | | |

Assessment:
A : High Positive Impact
B : Low Positive Impact
C : No Impact
D : Low Negative Impact
E : High Negative Impact

may be subject in general to low negative impact specially during construction stage. Air quality will be affected by fugitive dust as a result of the different activities of construction. Effects on crops and people living near most of the new roads are expected to be relatively minor. After construction, negative impact and pollution are expected also to affect the air quality due to increased vehicular traffic and urbanization, specially at new expressways and 4-lane roads. Air quality at other existing alternative roads, however, will be improved with lower share of future traffic demand. As for the water quality, road projects have no direct impact on both surface and underground waters as activities in the streams are minimized to some protection works. Indirect impact occurs as a result of the anticipated urban development growth along corridors of main roads. Noise pollution and vibration are expected also to cause some negative impact in populated areas along roads with heavy traffic.

Construction related negative impacts on soil erosion and contamination are the result of improper recognition of these dangers, and temporary control methods should be applied to help speed recovery of the disturbed areas. Roads constructed at soft ground areas, such as some areas in the province of Pampanga, are subject to land subsidence unless appropriate treatment and stabilization are performed. Ecosystems at a few project locations along the mountainous portions may have negative impact. Forests and several species of plants and animals could be significantly disturbed or displaced by the post-construction activities and increased access to such areas.

Road projects in general have their positive impact on the economical indicators such as income, employment and development in the sectors of construction, agriculture, industry, commerce and tourism. Most of the negative impact of new roads is expected to be in the social and ecological aspects. Socially, new roads may cause the resettlement of people affected within the right-of-way which requires compensations and relocation schemes. Expressways and main roads may divide the community cohesion in their areas and crossing facilities should be provided in accordance with the adequate requirements. Few roads are planned to be within areas where ethnic groups have their society, culture and history. Protection plans for the ethnic groups and their ancestral lands should be considered in the route alignment stages in addition to providing educational programs and adequate relocation schemes.

Indirect impacts include the improvement in living conditions of people who have access to the new roads by promoting new activities and opportunities for higher income. The land-use pattern will be changed in some areas where urbanization and attracted population will be introduced. Traffic build-up and safety problems may be experienced during construction at heavy traffic locations and crossings with main roads. After completion, however, the road network will provide higher level-of-service and safety.

Access to archaeological and historical sites all over the island will be improved and no negative impact is expected as long as the new roads do not traverse directly with these sites.

## 15.5 MITIGATING MEASURES

As road construction may affect a part of the physical or socioeconomical environment within the project influential area, every reasonable precaution should be taken to minimize the adverse effects and to help speed recovery of the disturbed areas not only within the right-of-way, but also on adjacent land that may be affected. Appropriate recognition of these impacts is established through project specifications, regulations, permits or otherwise to safeguard against negative impacts. Mitigating measures for major environmental impacts are summarized as follows.

### 15.5.1 Physical Environment

1) Air Quality

Air quality along the alignment of the roads is temporarily affected by fugitive dust as a result of the construction activities. Effects on crops and people living near the road are expected to be relatively minor. In areas where fugitive dust becomes a local problem, measures are applied to control and mitigate fugitive dust impacts. Such measures include covering stored materials and trucks hauling materials, spraying exposed areas and minimizing traffic over freshly exposed surfaces. In addition, grading and compacting are done periodically during construction to minimize aggregate segregation.

Using the existing roads to handle the future high traffic demand, without constructing new roads, will concentrate and increase the air pollution impact on the existing network. With new roads, the future air quality may be affected directly by increased vehicular traffic and indirectly by the expected overall urbanization impact of the project.

Air pollution concentrations are significantly affected by topography, physical characteristics of the road facilities and adjacent development, and also the meteorological conditions such as wind direction, wind speed and stability class together with the ambient temperature and humidity. Accordingly, it can be said that air quality is not the predominant problem after constructing new roads, however, to mitigate the impacts due to smog and exhaust gases, plantation of buffer zones on both sides of the roads improves the air quality in the area. Other national control measures may include inspection and maintenance programs and alternative fuels or engines.

2) Water Quality

The construction of the different elements of road projects, in general, has no direct impact on the quality of both surface and underground

waters. As activities in streams are minimized to the extent possible, unavoidable activities occur during seasons of low flow. There could be some indirect impact, however, due to the anticipated industrial or commercial urban growth along the corridors of main roads and expressways. The accelerated urbanization will put additional stress on the limited ground water resources. Overpumping of ground water may result in salt-water intrusion unless alternate sources of water are introduced. Drainage due to the increased urbanization will also utilize the river systems as receiving water of industrial effluents and domestic wastes. These anticipated indirect impacts require proper management in the urban planning of the new activities in the area.

3) Noise Pollution

Reductions of the undesirable effects of roadway-generated noise involves a comprehensive approach which includes the vehicle-noise reduction, improved roadway design, and land-use control. The first component is addressed on the national level to reduce vehicle-engine and exhaust noise. The third component is the responsibility of local governments to discourage the development of noise-sensitive land uses (such as homes, schools and hospitals) in roadway noise-impacted areas.

Improving the roadway design involves greater attention to noise impact in selecting the alignment taking into consideration the existing land-use activities. The right-of-way, with plantation on both sides, is functioning as a buffer zone with attenuation effects to counter not only noise, but also air pollution and vibration. In the future, and with increasing volumes of traffic specially on expressways, locations of high noise levels can be protected by installing noise barriers and/or mound-earth banks.

4) Soil Contamination

Construction related impacts to land resources and soil contamination could occur as a result of improper disposal of solid waste and accidental spills of environmentally harmful materials such as petroleum products. It should be mandatory during construction to develop and implement a solid waste management plan for the duration of all activities that ensure safe and appropriate handling of all solid wastes. The dumping place for excavated materials should be carefully selected to protect streams and vegetation.

To insure stability, disposal sites should be treated in a manner similar to that for borrow pits including grading and contouring to conform to surrounding topography and revegetation. In addition, environmentally hazardous materials, such as motor oil used during construction are stored in designated areas which have been improved to accept such storage and in containers designed to contain spills and minimize contaminated runoff.

5) Soil Erosion and Slope Protection

Temporary erosion control methods help considerably in protecting nearby waterways from silt. The use of ditches, temporary sedimentation basins in ditch lines and energy dissipaters in ditches with steep grades are often effective in this regard. The use of flatter than normal fill and cut slopes, rounding of the top of cut slopes, and contour grading, where possible, may be beneficial in providing a more natural base for plant life to become established. A comprehensive progressive revegetation program is practically important in the prevention of slope erosion. The erosion control procedures which are applied during the construction of road projects can be summarized as:

a. Vegetation: Ground cover is maintained whenever possible; temporarily devegetated areas are mulched and reseeded or sodded in a timely manner with plant species appropriate to soil and climatic conditions.

b. Slope Protection: The volume of soil removed during excavation is minimized. In addition, slopes are stabilized by use of vegetation cover, contouring and provision of drainage structures.

c. Stream Protection: Activities in streams should be minimized to the extent possible; unavoidable activity occurs during seasons of low flow. Slope protection works are applied in areas of bridge constructions. Riprap or gabion baskets are used to stabilize banks in areas subject to scouring.

d. Drainage: Drainage structures including ditches, culverts, pipe drains are installed to divert and disperse surface water flows in a matter to prevent erosion and to protect slopes. Structures are lined with rock or concrete, as appropriate, based on flow rates, and employ energy dissipators at discharge points to avoid erosion. Drainage is periodically maintained to remove sediment and ensure their proper functioning.

e. Air Quality: Exposed surfaces should be wetted or sprayed. Stored soils or borrow materials should be stabilized. Traffic over freshly exposed surfaces should be minimized. Grading and compacting is done periodically during construction to minimize aggregate segregation.

### 15.5.2 Socioeconomical Environment

1) Land-use and Settlement

Roads have various and far-reaching impacts on a variety of individuals and economic sectors not only in areas where they are constructed but also in the regional and national development activities. Viewed of terms of the national development planning, promotion of development in rural areas is an important issue, and roads play a major role toward this end by

promoting several industrials and improving living conditions. Vicinity of main roads is an attractive location for manufacturing industries and commercial and agricultural activities. Other expected indirect impacts in the area include the improvement in living conditions by promoting new activities and opportunities for higher income. The improvement in transport conditions with the road network may also help people in local areas in utilizing and gaining access to such social service facilities as hospitals, schools, government offices, among others.

Environmental management is a very important component of the development projects being carried out in the island. The high economic growth envisioned cannot be sustained without having the simultaneous proper management of the environment. Land development pattern is influenced by the accessibility provided by the road network. High-intensity development of roadside activities is frequently stimulated specially at expressway interchanges. The lack of land-use control along the new expressway may result in adverse impact on the development of a quality environment.

2) Displacement and Relocation

Road construction activities may necessitate the relocation of residents living on the existing right-of-way. Compensation and relocation scheme of the DPWH are applied on the affected people. The procedures for right-of-way acquisition are as follows:

1. By donation - the owner donates the property to the government.
2. Easement - this refers to a situation wherein the owner allows passage through his property without transfer of ownership. This is usually resorted to in cases wherein only a small area is affected so that the cost of survey is higher than the cost of the land itself.
3. Quiet claim - under Commonwealth Act 141, public land acquired under free patent on or before January 7, 1975, 20 meters from the limit may be taken by the government free. After this date, 60 instead of 20 meters may be taken by the government.
4. Barter - this is best illustrated wherein an existing road is realigned, so that the land occupied by the abandoned road may be exchanged with the new right-of-way required.
5. Purchase - transfer of property by a deed of sale.
6. Expropriation - this is a last resort if all other methods fail. By this procedure, the transfer will be affected by cost order, under expropriation proceeding.

2) Employment and Income

In the short term of the construction stage, road projects provide opportunities to work in the site. The construction works of the road network is expected to continue for years. In addition, employment opportunities in

new activities expected to be introduced in the affected areas will decrease the unemployment rate and improve the average income not only for individuals but also for the government. Productivity of traditional activities in the island such as agriculture and fishery will increase due to the wider market to be reached by the roads either locally or for export purposes. Improved mobility and higher income of people living in rural areas widen their life opportunities. They can commute to works and schools far from their residence. Furthermore, they will be able to enjoy the other activities of urban areas. This means that people will be offered a wider variety of life without changing their residences which will consequently reduce migration from rural areas to central cities.

3) Traffic Build-up

For the expected traffic build-up during the construction stage, enough space should be provided at construction sites for the existing traffic to pass through well-planned detours and not to be interrupted. Traffic build-up after the completion of construction works is not expected since the network will handle, in a higher level of service, a large portion of traffic volumes on existing alternative roads.

4) Archaeological and Historical Sites

The impact of road projects on the historical sites and landscape features is expected to be positive when the roads' alignment does not traverse directly with these sites. As the tourism industry is also one of the most important sectors in the regional development, roads enhance tourism activities all over the island. Favorable transportation conditions, especially of land, are indispensable to increasing number of visitors.

# CHAPTER 16

# RECOMMENDATIONS ON IMPLEMENTATION SYSTEM

## 16.1 PRESENT ORGANIZATION

Pursuant to Executive Order No. 124, dated 30 January 1987, the Department of Public Works and Highways (DPWH) is mandated as "the state's engineering and construction arm" responsible for the planning, design, construction and maintenance of infrastructure facilities especially national highways, flood control, water resource development systems and other public works in accordance with the national development objectives.

Designated to carry out this mandate is the Department Secretary who shall have the supervision and control over the Department. Advising and assisting the Secretary in the formulation and implementation of Department policies, plans, programs and projects are four (4) Undersecretaries and four (4) Assistant Secretaries who are likewise responsible for the Internal Audit Services, Monitoring and Information Service, Planning Service, Comptrollership and Financial Management Service, Legal Service and Administrative and Manpower Management Service. Moreover, five (5) Bureaus namely: Bureau of Construction, Bureau of Research and Standards, Bureau of Design, Bureau of Equipment and Bureau of Maintenance were also strengthened to be more efficient and effective in carrying out the assigned task of their respective Bureaus.

At the field level, responsible for the program and project execution are the Regional Offices (15) and their respective District Offices (117) and City Engineering Offices (55), Regional Equipment Services (15) and Area Equipment Shops (74). In addition, the Department has twenty seven (27) special Project Management Offices handling foreign-assisted projects.

Agencies attached to the Department for policy coordination are the National Irrigation Administration (NIA), Metropolitan Waterworks and Sewerage System (MWSS), Local Water Utilities Administration (LWUA), National Water Resources Board (NWRB) and Toll Regulatory Board (TRB).

The present organization of the Department is presented in Figure 16.1-1.

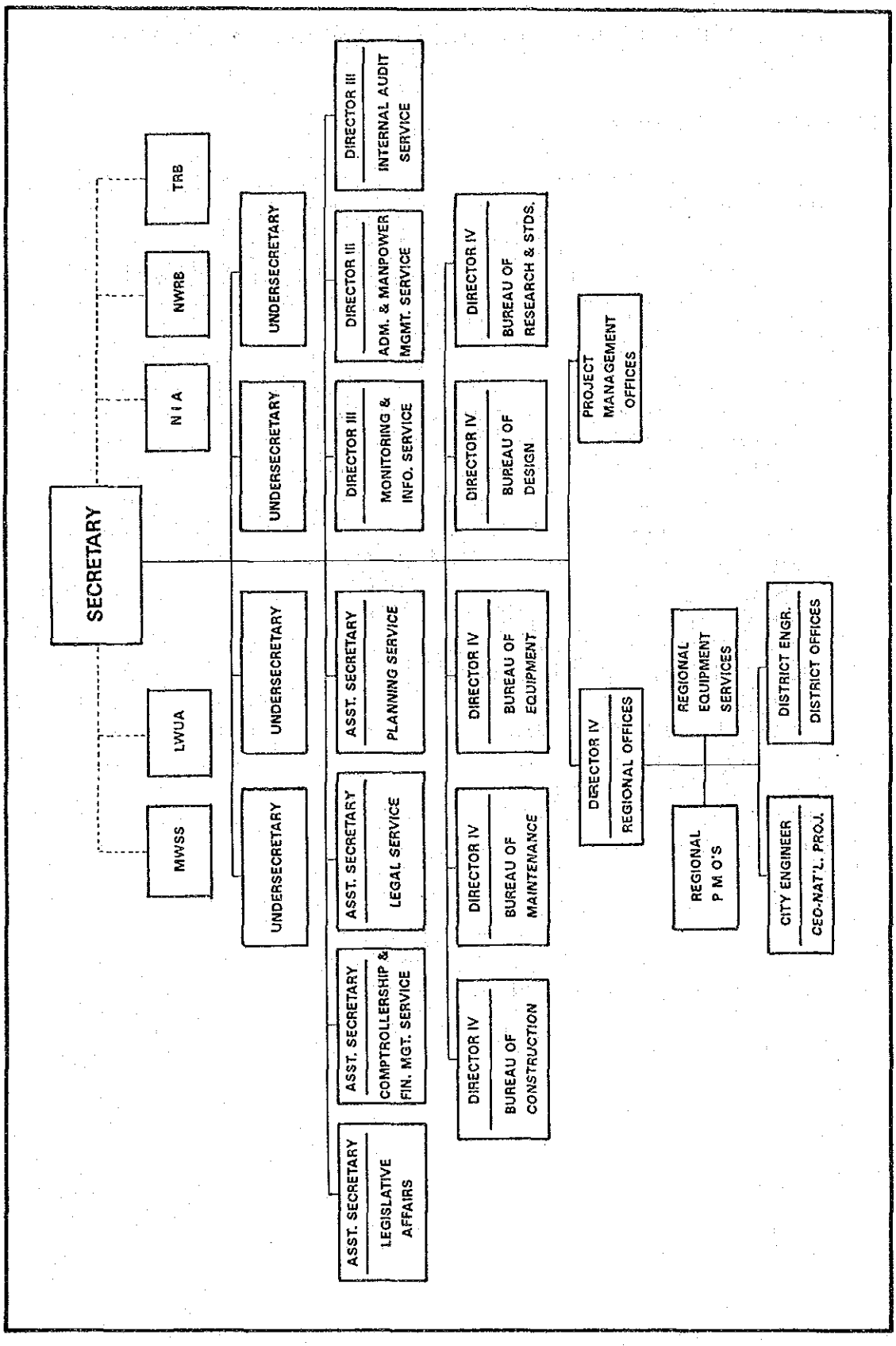



FIGURE 16.1-1 PRESENT ORGANIZATION OF DPWH

## 16.2 RECOMMENDATION ON IMPLEMENTATION SYSTEM

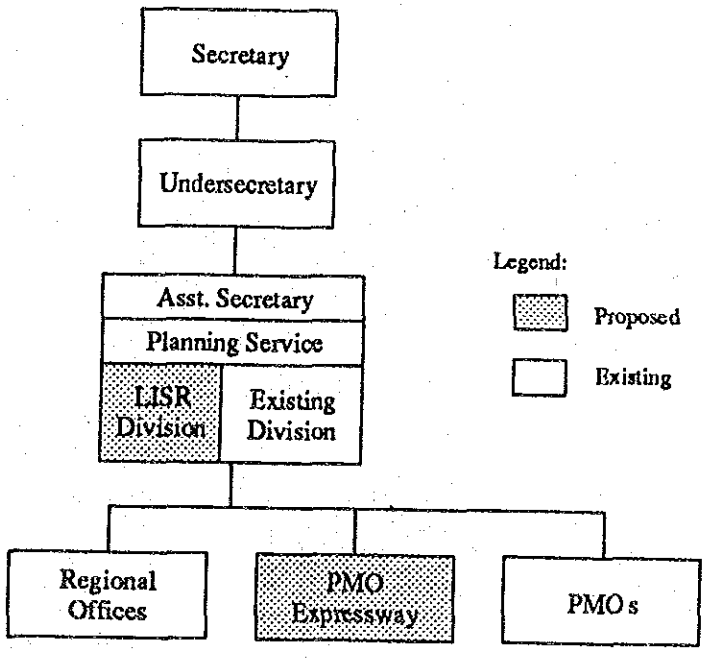
### 16.2.1 Strengthening Present Organization

The LISR Network is composed of ninety one (91) road projects covering an aggregate length of 5,427 kilometers with a total project cost of 154.5 billion pesos. It is envisioned to be implemented into three (3) stages as discussed in Chapter 13. However, a development plan of this magnitude calls for an efficient organization and sufficient funding to assure the successful implementation of the projects. In this regard, it is therefore recommended to strengthen the present organization of the DPWH as follows:

Establishment of Organization for LISR Plan Management: The execution of LISR Plan will involve various offices/agencies. For the systematic and successful implementation of the projects, control, planning and coordination are important. Therefore, an organization to carry out these tasks is recommended to be established. Such body may be created as a new division in the existing Planning Service, to be exclusively responsible for LISR Plan management including planning, coordinating and monitoring.

Establishment of Organization for Expressway Projects: Expressway projects, as government projects, are handled by PMO-URPO, and currently limited within and near Metro Manila. The LISR Plan, however, includes 311.3 km of expressway construction projects, and 106.3 km of expressway widening projects extending over Regions I, III and IV. For effective implementation, a new agency is proposed to be established. It can be, for instance, a new PMO for only expressway projects.

The proposed organizational set-up is presented below.



### 16.2.2 Institutional Reinforcement

In project implementation, frequent problems are observed to be mainly due to insufficient field data and information, lack of proper plan and design criteria, sub-standard quality of construction and maintenance works and inadequacy of traffic safety considerations and measures. In order to attain the most effective procedure for future project implementation, the following items should be observed and realized.

1. Planning and Design

- Accurate data collection on road and structure condition
- Suitable alignment based on topographical and geological maps.
- Appropriate design of road disaster prevention works, especially for roads passing through fault zones, with the following considerations:
  · Route selection avoiding large-scale cut/embankment slopes
  · Slope protection by vegetation in general, or by structures if required
  · Prudent drainage works
  · Application of new techniques/materials such as reinforced earth, gabion, crib, etc.
- Due considerations on traffic safety by applying appropriate roadway design standards, proper installation of road signs and safety devices, and establishment of traffic accident recording system
- Due considerations on environmental impacts

2. Construction

- Reasonable project cost
- Proper quality control and construction workmanship
- Environmental impact and traffic safety considerations during construction

3. Maintenance

- Preparation of updated road and bridge data and maintenance manual
- Establishment of proper maintenance management system with periodical inspection and maintenance records indicating date, location, type of work, materials, etc.

## 16.3 FUNDING FOR ROAD DEVELOPMENT

The LISR Plan requires an average of 300 kms of road development every year. Although the national budget allocates a sizable percentage to the road sector, the present level of road budget is still insufficient to meet the demand. In addition, financial cost on road maintenance increases, as the total extension of road network becomes longer. Likewise, present road maintenance works are neither sufficient in quantity nor in quality and must be improved on the

long-term economic point of view. However, this will entail a massive amount of investment.

Until now, major part of road financing depends on foreign loans, which need to repay sooner or later. On the long-term perspective, the Philippine Government should make efforts to expand the financial resources for road investment of its own, paying attention to the following points.

1) Principles

Main resources of the transportation-related national budget are fuel tax, vehicle tax, vehicle import duty and income from expressways. Comparing to the financial needs in road maintenance and investment, the current tax rates and toll rates are seemingly too low, except the rate of vehicle import duty. They should be carefully reviewed and revised, based on the principles of "beneficiaries to pay" and "causers to pay".

2) Consensus

Before revising the rates of taxes and tolls to a reasonable level, sufficient discussions and public consultations should be made in a proper way, to get the people's consensus. Moreover, all the revenue derived from the objective taxes and tolls must be spent exclusively for road maintenance and development. To ensure this, an institutional arrangement will be needed to monitor the cash flow.

3) Financing by Private Sector

Financing by private sector can be expected on some income-generating projects such as expressways, toll bridges and terminals. In various countries, there are successful examples of transportation projects implemented by the third sector organizations, utilizing the merits of both the Government (low-interest fund procurement, administrative control from public point of view and capacity to guarantee, etc. ) and the private sector ( active, flexible and profit-oriented nature, cost consciousness, stock of know-how, etc.).

Recently, in anticipation of the "Build-Operate-and-Transfer(BOT)" method, many transportation projects were planned all over the world. However, it must be underlined that private capitalization would only flow to projects profitably viable. As for the transportation infrastructure sector where few projects are financially profitable, the Government must partly invest, subsidize or guarantee an acceptable level of financing to the undertaking body in most cases.

## 16.4 EFFICIENT ROAD MAINTENANCE MANAGEMENT AND EARLY PROJECT EXECUTION

### 16.4.1 Rating System

Inadequacy in road maintenance due to insufficient fund, poor condition of equipment, unavailability of some materials, etc., is an oftenly pointed-out problem. For a more effective maintenance system and to maintain roads functioning properly, it is recommended to establish a "road condition rating system" and criteria for applying measures based on this system.

### 16.4.2 Development of Database

Well arranged basic information such as road condition and traffic data is necessary to develop appropriate plans, implement projects systematically and maintain roads properly. The government effort to develop a computerized database system is expected to be materialized soon, and it is recommended to be an easy updatable system with minimum required information.

### 16.4.3 Early Execution of Feasibility Studies

To implement projects as scheduled, feasibility studies, especially those projects included in the 1st 6-Year Program and planned to be implemented in early stage, should be conducted immediately. Studies should include route selection and environmental assessment as well as technical, economical and financial analysis.

Major projects to be studied immediately are:

- Enrile - Lubuagan - Narvacan Road Improvement;
- Cabanatuan - Baler Road Improvement;
- Rosales - Sta. Fe Road Improvement;
- Pan-Philippine Highway Upgrading, Sta. Rita - San Jose Section;
- Calamba - Tagaytay - Talisay - Lemery Road Improvement;
- Malicboy - Mulanay Road Improvement.