CHAPTER 14
PROJECT COST ESTIMATE

14.1 Construction Cost

14.1.1 General

The project of "Upgrading Inter-urban Highway System along the Pan-Philippine Highway" (hereafter referred to as "the Project") consists of construction of three (3) bypasses namely Plaridel Bypass, Cabanatuan Bypass and San Jose Bypass. The road lengths of each bypass are 22.65km, 32.24km and 7.98km respectively. The bypasses will be constructed in two (2) stages, namely the initial stage and the ultimate stage. The project is planned to be divided into nine (9) construction packages in each stage considering the work volume, cost and construction period. The outline of the 9 packages is summarized in Table 14.1-1 below. The construction cost of each package shall be estimated considering the location characteristics of each package, such as minimum wages, mobilization and demobilization distances, haulage distance from the quarry site, etc.

TABLE 14.1-1 OUTLINE OF CONSTRUCTION PACKAGES

Bypass			Plaridel				Cabanatuan				San Jose
Package No.			1	2	3	4	1	2	3	4	1
Station	Start	m	33+025.000	39+625.000	47+400.000	49+625.000	100+480.000	109+920.000	119+000.000	121+600.000	155+828.866
	End	m	39+625.000	47+400.000	49+625.000	55+672.457	109+920.000	119+000.000	121+600.000	134+731.828	163+808.107
Construction Length		m	6,600.000	7,775.000	2,225.000	6,047.457	9,440.000	9,080.000	2,600.000	13,131.828	7,979.241
Province		-	Bulacan, Central Luzon				Nueva Ecija, Central Luzon				
Distance from Mnila		km	33.0	40.0	47.0	50.0	100.0	110.0	119.0	122.0	156.0
Construction Period		month	32.0	28.0	36.0	24.0	32.0	36.0	36.0	36.0	28.0
Minimum Wage for Labor		PP/day	228.50				224.50				224.50
Equipment Rental Extra out of Mnila		%	2.0%				2.0%				2.0%
Mobilization Distance		km	33.0	40.0	47.0	50.0	100.0	110.0	119.0	122.0	156.0
Hauling Distance from near by material source	Soil	km	24.6	22.1	15.4	5.7	17.4	18.7	22.6	24.0	7.0
	Sand	km	7.6	5.3	5.0	5.0	7.5	5.0	5.0	5.0	7.0
	Aggregate	km	7.6	5.3	5.0	5.0	7.5	5.0	5.0	5.0	7.0
	Gravel	km	7.6	5.3	5.0	5.0	7.5	5.0	5.0	5.0	7.0
Hauling Distance for disposal	Soil	km	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Debris	km	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average Distance for Batching Plant, Fabrication Yard (= 1/4 x Construction Length)		km	1.7	1.9	0.6	1.5	2.4	2.3	0.7	3.3	2.0

The construction cost of each packages are estimated in accordance with the DPWH Department Order No. 57 series of 2002 "Preparation of Approved Budget for the Contract".

14.1.2 Methodology

The construction cost consists of direct cost and indirect cost. The total estimated direct cost is the accumulation of direct costs of each pay item required for the construction as shown in the design drawings and as specified in the technical specification. The direct costs of each pay item are calculated by multiplication of its quantity and unit rate. The quantities of each item shall be obtained based on the design drawings and/or technical specification, while unit

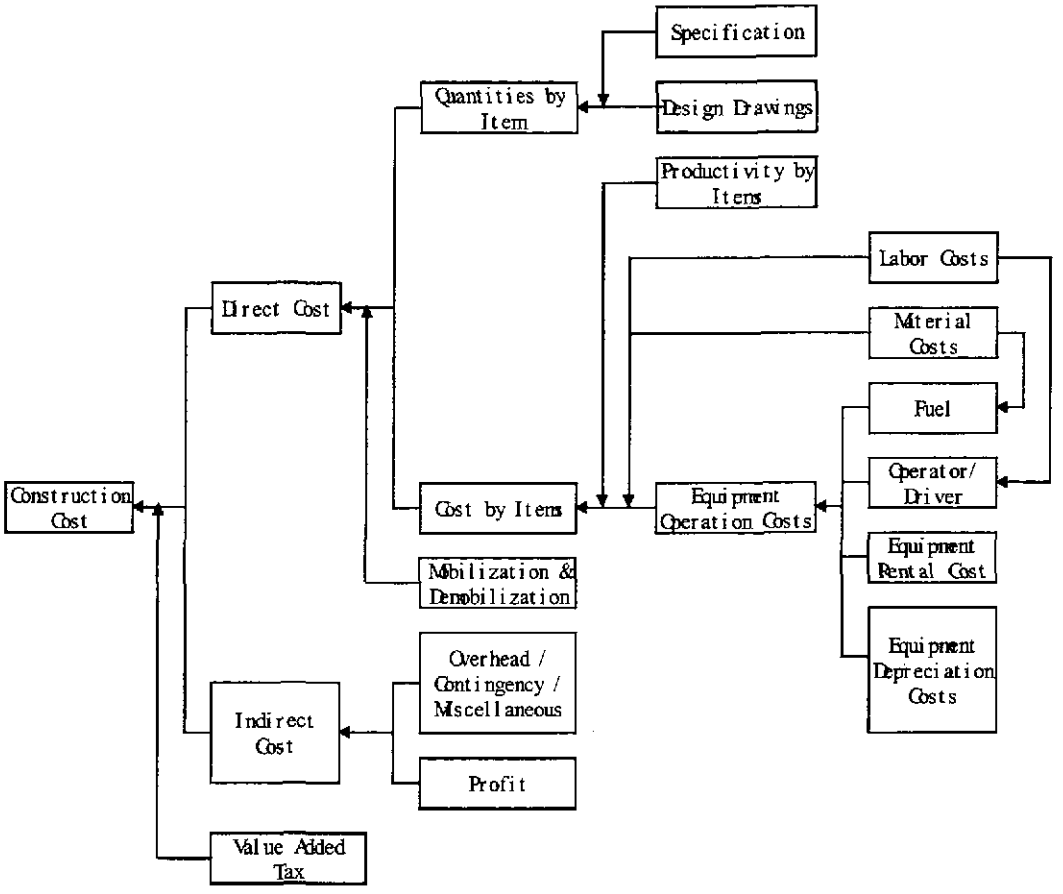
rates shall be obtained as the combination of labor costs, material costs and equipment costs depending on the productivity of the required work. The productivity of the work shall be based on the construction method and procedure.

Mobilization and demobilization cost shall be computed as direct cost considering the equipment requirements of the project but it shall not exceed the amount of 1.0% of the total estimated direct cost.

Indirect cost consists of OCM (overhead, contingencies and miscellaneous) and profits. The indirect costs are estimated as markups by the form of percentages to the estimated direct cost (EDC). The maximum percentage for the indirect cost varies in relation with the total amount of the estimated direct cost of the project.

Value added tax of 10% shall be applied to the total of the direct and indirect cost.

The construction cost estimation procedure specified in the Department Order No. 57/2002 of DPWH is summarized in Figure 14.1-1, and the composition of the basic costs which are labor cost, material cost and equipment cost are shown in Figure 14.1-2.



Cost Estimation Procedure based on Department Order No. 57/2002 of DPWH

FIGURE 14.1-1 COST ESTIMATION PROCESS

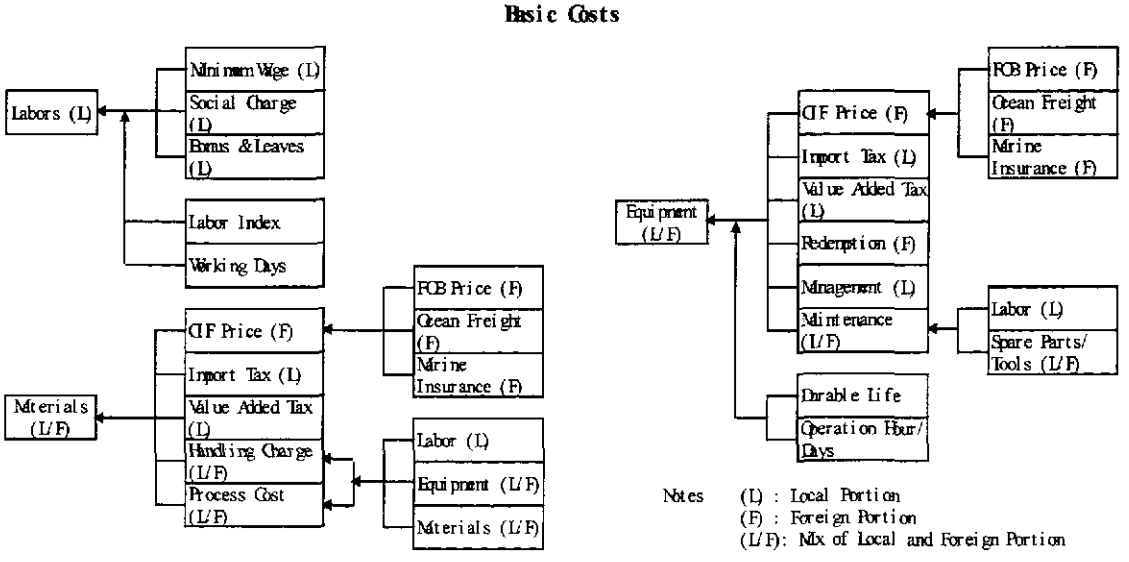


FIGURE 14.1-2 COMPOSITION OF BASIC COSTS

The costs are composed of foreign currency portion and local currency portion. The foreign currency portion is generally the CIF (Cost, Insurance and Freight) price of the imported goods and materials. The local currency portion consists of import tax, value added tax, domestic handling and transportation costs, local process costs, overhead and local sales and market costs, profits of local firms, etc. Imported equipment and materials used except for the domestic handling and transportation, local process, overhead, etc. shall be deemed to be foreign portion.

The proportion of the foreign and local currency will be estimated based on the following principle.

TABLE 14.1-2 FOREIGN AND LOCAL CURRENCY PORTION

Foreign Currency Portion	Local Currency Portion
- Wages of foreign personnel - Overheads and profits of foreign firms - CIF price of imported equipment, materials and supplies	- Wages of local personnel - Overheads and profits of foreign firms - Import tax, value added tax - Local components of equipment, materials and supplies

Foreign components will be expressed in Philippine Pesos (PP) converted by the current exchange rate. Adopted exchange rate for the cost estimation is US$1.00 = ₱52.28 = ¥120.12 as of 23 August 2002.

14.1.3 Direct Cost

Direct cost for each work item shall be calculated as the combination of basic labor cost, material cost and equipment cost based on the productivity of the work in relation to the construction method and procedure. Pay items, in principle, are based on the "Standard Specification, 1995" of DPWH which specifies the materials to be used, workmanship, methods of measurement and description of payment. The additional items and/or alternation to the "Standard Specification" shall be clearly mentioned in the Tender Document for the Project.

Mobilization and demobilization shall be computed on a case by case basis considering the equipment requirements of the project. The cost of mobilization and demobilization shall in no case exceed 1.0% of the total estimated direct cost. The mobilization and demobilization cost includes the cost for the disassembly and assembly of heavy equipment which cannot travel the public road, the haulage of such equipment, and establishing and evacuation of contractor's temporary site office and yards.

14.1.4 Indirect Cost

According to the Department Order No. 57/2002 of DPWH, the indirect cost consists of a) Overhead, b) Contingencies c) Miscellaneous and d) Profit as shown in Figure 14.1-3.

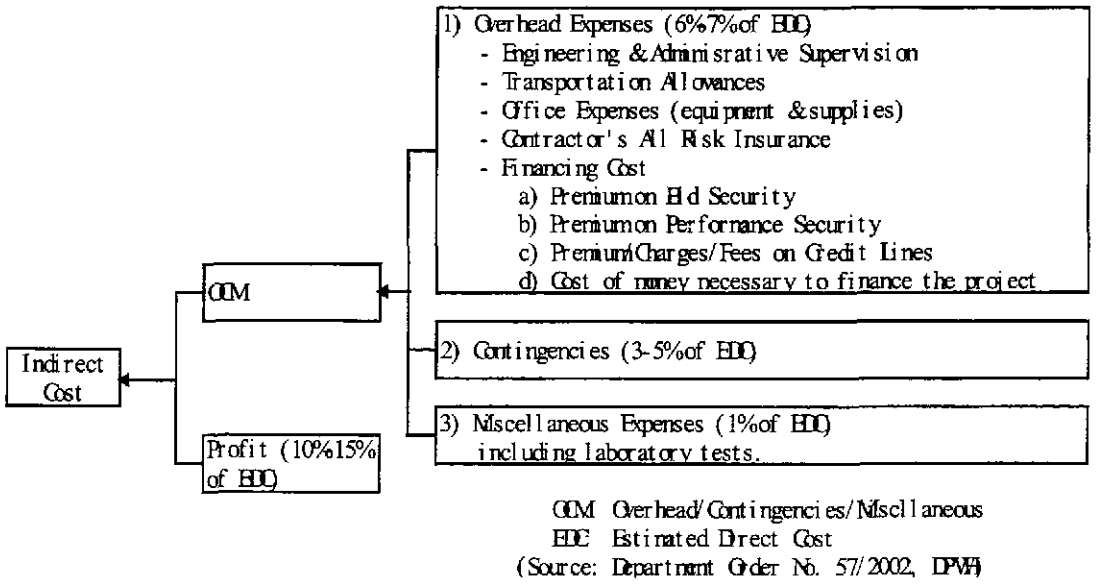


FIGURE 14.1-3 INDIRECT COST

Indirect costs are calculated as markups in the form of percentage to the estimated direct cost. The maximum percentages related to the total amount of the estimated direct cost are shown in Table 14.1-4.

TABLE 14.1-4 MAXIMUM PERCENTAGE OF MARKUPS

Total Estimated Direct Cost of the Project (PP)		Indirect Costs (maximum)		Mobilization/ Demobilization (maximum)	Markup Total (maximum)
Above	up to	OCM	Profit		
0	1,000,000	13.0%	15.0%	1.0%	29.0%
1,000,000	5,000,000	12.0%	14.0%	1.0%	27.0%
5,000,000	10,000,000	12.0%	13.0%	1.0%	26.0%
10,000,000	20,000,000	11.0%	12.0%	1.0%	24.0%
20,000,000	50,000,000	11.0%	11.0%	1.0%	23.0%
50,000,000		10.0%	10.0%	1.0%	21.0%

OCM: Overhead, Contingency and Miscellaneous
(Source: Department Order No. 57/2002, DPWH)

Based on the above, the actual markups applied for the cost estimation of each package are determined by the chart in Figure 14.1-4. The following formula are adopted and the coefficients are established by trial and error to suit with the maximum markups given in the department order.

$$OCM = a \cdot N^{b} = 0.2284 \times N^{-0.04660}$$

$$Profit = a + b \cdot \log(N) = 0.2813 - 0.02355 \times \log(N)$$

Where, N: Total estimated direct cost

a, b: Coefficients

Proposed Markups over 100 Million Pesos

OCM =	a·N^b	a =	0.2284	b =	-0.04660
Profit =	a + b·log(N)	a =	0.2813	b =	-0.02355

EDC (Million	Department Order			Proposed		
	OCM	Profit	Total	OCM-a	Profit-a	Total-a
0	13.0%	15.0%	28.0%			
1	13.0%	15.0%	28.0%	12.0%	14.0%	26.0%
1	12.0%	14.0%	26.0%	12.0%	14.0%	26.0%
5	12.0%	14.0%	26.0%	11.1%	12.4%	23.5%
5	12.0%	13.0%	25.0%	11.1%	12.4%	23.5%
10	12.0%	13.0%	25.0%	10.8%	11.6%	22.4%
10	11.0%	12.0%	23.0%	10.8%	11.6%	22.4%
20	11.0%	12.0%	23.0%	10.4%	10.9%	21.3%
20	11.0%	11.0%	22.0%	10.4%	10.9%	21.3%
50	11.0%	11.0%	22.0%	10.0%	10.0%	20.0%
50	10.0%	10.0%	20.0%	10.0%	10.0%	20.0%
100				9.7%	9.3%	19.0%
200				9.4%	8.6%	18.0%
300				9.2%	8.2%	17.4%
400				9.1%	7.9%	17.0%
500				9.0%	7.6%	16.6%
600				8.9%	7.5%	16.4%
700				8.8%	7.3%	16.1%
800				8.8%	7.2%	16.0%
900				8.7%	7.0%	15.7%
1,000				8.7%	6.9%	15.6%

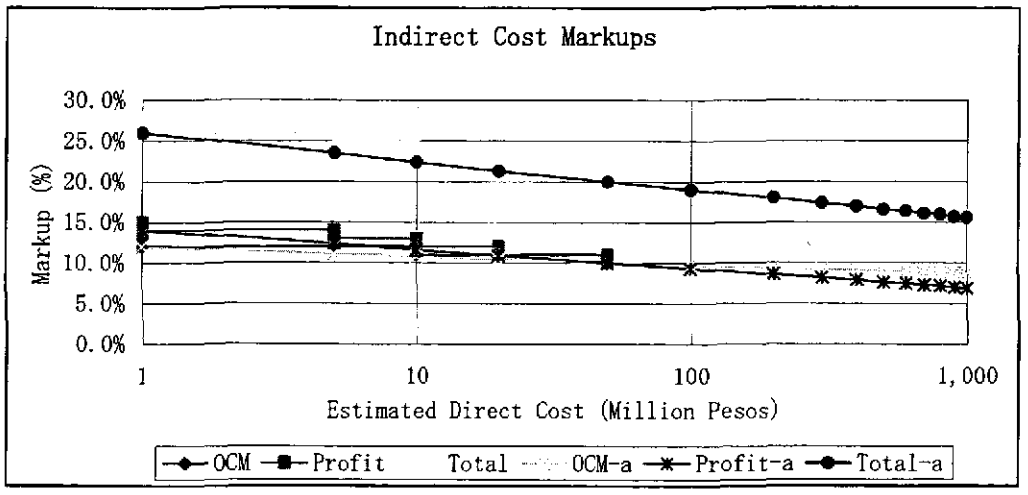


FIGURE 14.1-4 ADOPTED INDIRECT COST MARKUPS

The value added tax (VAT) of 10% shall be applied to the total of direct and indirect cost.

The general form for the calculation of indirect costs and the unit rates for the pay items are shown in Table 14.1-5.

TABLE 14.1-5 CALCULATION FORMAT FOR THE INDIRECT COST AND UNIT RATE OF PAY ITEM

Estimated Project Cost

Project: Upgrading Inter-Urban Highway System Along the Pan-Philippine Highway - Plraidel Bypass Pacakage 1

Location : 1 Manila, Southern Luzon and Central Luzon

Explanation of columns
①, ②, ③, ④, ⑤, ⑥, ⑦ = Input
⑧ = ⑤ + ⑥ + ⑦
⑨ = (⑤ + ⑦) x 10.0%
⑩, ⑪, ⑫ = percentage from the right table
⑬ = ⑩ + ⑪ + ⑫
⑭ = ⑧ x ⑬
⑮ = ⑨ + ⑭
⑯ = ⑧ + ⑮
⑰ = ⑯ ÷ ③

Percentage of Indirect Cost to the Estimated Direct Cost

Total Estimated Direct Cost of the Project (PP)		Indirect Costs		Mobilization/ Demobilization	Markup Total
Above	up to	OCM	Profit		
0	1,000,000	13.0%	15.0%	2.0%	30.0%
1,000,000	5,000,000	12.0%	14.0%	2.0%	28.0%
5,000,000	10,000,000	12.0%	13.0%	2.0%	27.0%
10,000,000	20,000,000	11.0%	12.0%	separate pay item	23.0%
20,000,000	50,000,000	11.0%	11.0%		22.0%
50,000,000		10.0%	10.0%		20.0%

Percentage of Mobilization and Demobilization

	Location of Project	Max. Percentage to
1.	Manila, Southern Luzon and Central Luzon	2%
2.	Northern Luzon and Bicol Provinces	4%
3.	Visayas and Island Provinces in Region IV-B	6%
4.	Mindanao Provinces	7%

Value Added Tax (VAT)
10.0% of the labor and euipment portion of Estimated Direct Cost (EDC).

Item No.	Description	Quantity	Unit	Estimated Direct Cost (PP)				VAT (PP)	Markups (%)			Total Markup		Total Indirect Cost (PP)	Total Cost (PP)	Unit Cost (PP)
				Labor	Material	Equipment	Total		OCM	Profit	Mob/ Demob	%	Value (PP)			
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰

Prepared/Submitted By:

Recommending Approval:

Approved:

14.1.5 Basic Cost

1) Labor Cost

Basic labor cost used for the cost estimation shall be estimated based on the minimum daily wage specified in the wage orders issued by the National Wages and Productivity Commission, Department of Labor and Employment. In accordance with the wage order (No. RBIII-09) for Region III Central Luzon (effective from Jan.16, 2002), the minimum wages adopted for each bypasses are as follows.

TABLE 14.1-6 MINIMUM LABOR WAGES

Bypass	Plaridel	Cabanatuan	San Jose
Province	Bulacan, Central Luzon	Nueva Ecija, Central Luzon	
Min. Daily Wage (PP)	228.50	224.50	

These values are for the non-agriculture labors (Establishment with total assets of 30 million Pesos or more).

Daily labor costs for the cost estimation are calculated considering the cost index for the occupation, working days, leaves and bonus, social contribution paid by the Employer, etc.

The annual workable days are calculated from the weekly working days, National holidays and rainy days of daily precipitation of 10mm and more.

Leaves and bonus equivalent to one (1) times the monthly salary each are taken into account.

Social contribution paid by the Employer in the Philippines consists of National Health Insurance Program (NHIP) and Social Security System (SSS). In accordance with the National Health Insurance Act (Article X, Ra 7875) and the SSC Resolution No. 900-s2001, both effective from January 1st 2002, the social contributions in relation with the monthly salary are shown in Table 14.1-7 and 14.1-8.

The construction work is planned to be carried out in the day time so that overtime extra for the night work was not taken in account.

The daily labor costs used in the cost estimation for each bypass are shown in Table 14.1-9.

TABLE 14.1-7 NATIONAL HEALTH INSURANCE

National Health Insurance Program (NHIP)

Monthly Salary Range		Salary Base (SB)	Monthly Contribution		
			Total = PS + ES	Personal Share (PS) = SBx1.25%	Employer Share (ES) = PS
0.00	3,499.99	3,000.00	75.00	37.50	37.50
3,500.00	3,999.99	3,500.00	87.50	43.75	43.75
4,000.00	4,499.99	4,000.00	100.00	50.00	50.00
4,500.00	4,999.99	4,500.00	112.50	56.25	56.25
5,000.00	5,499.99	5,000.00	125.00	62.50	62.50
5,500.00	5,999.99	5,500.00	137.50	68.75	68.75
6,000.00	6,499.99	6,000.00	150.00	75.00	75.00
6,500.00	6,999.99	6,500.00	162.50	81.25	81.25
7,000.00	7,499.99	7,000.00	175.00	87.50	87.50
7,500.00	7,999.99	7,500.00	187.50	93.75	93.75
8,000.00	8,499.99	8,000.00	200.00	100.00	100.00
8,500.00	8,999.99	8,500.00	212.50	106.25	106.25
9,000.00	9,499.99	9,000.00	225.00	112.50	112.50
9,500.00	9,999.99	9,500.00	237.50	118.75	118.75
10,000.00	and over	10,000.00	250.00	125.00	125.00

National Health Insurance Act (Art. X, RA 7875), effective from January 1, 2002

TABLE 14.1-8 SOCIAL SECURITY SYSTEM (SSS)

SSC Resolution No. 900-s2001, effective from January 1, 2002

Range of Compensation		Monthly Salary Credit	Social Security			EC	Total Contribution		
			Employer	Employee	Total	Employer	Employer	Employee	Combined
1,000.00	1,249.99	1,000.00	30.60	20.10	50.70	10.00	40.60	20.10	60.70
1,250.00	1,749.99	1,500.00	45.80	30.20	76.00	10.00	55.80	30.20	86.00
1,750.00	2,249.99	2,000.00	61.10	40.20	101.30	10.00	71.10	40.20	111.30
2,250.00	2,749.99	2,500.00	76.40	50.30	126.70	10.00	86.40	50.30	136.70
2,750.00	3,249.99	3,000.00	91.70	60.30	152.00	10.00	101.70	60.30	162.00
3,250.00	3,749.99	3,500.00	106.90	70.40	177.30	10.00	116.90	70.40	187.30
3,750.00	4,249.99	4,000.00	122.30	80.40	202.70	10.00	132.30	80.40	212.70
4,250.00	4,749.99	4,500.00	137.50	90.50	228.00	10.00	147.50	90.50	238.00
4,750.00	5,249.99	5,000.00	152.80	100.50	253.30	10.00	162.80	100.50	263.30
5,250.00	5,749.99	5,500.00	168.10	110.60	278.70	10.00	178.10	110.60	288.70
5,750.00	6,249.99	6,000.00	183.40	120.60	304.00	10.00	193.40	120.60	314.00
6,250.00	6,749.99	6,500.00	198.60	130.70	329.30	10.00	208.60	130.70	339.30
6,750.00	7,249.99	7,000.00	213.90	140.80	354.70	10.00	223.90	140.80	364.70
7,250.00	7,749.99	7,500.00	229.20	150.80	380.00	10.00	239.20	150.80	390.00
7,750.00	8,249.99	8,000.00	244.50	160.80	405.30	10.00	254.50	160.80	415.30
8,250.00	8,749.99	8,500.00	259.80	170.90	430.70	10.00	269.80	170.90	440.70
8,750.00	9,249.99	9,000.00	275.00	181.00	456.00	10.00	285.00	181.00	466.00
9,250.00	9,749.99	9,500.00	290.30	191.00	481.30	10.00	300.30	191.00	491.30
9,750.00	10,249.99	10,000.00	305.60	201.10	506.70	10.00	315.60	201.10	516.70
10,250.00	10,749.99	10,500.00	320.90	211.10	532.00	10.00	330.90	211.10	542.00
10,750.00	11,249.99	11,000.00	336.10	221.20	557.30	10.00	346.10	221.20	567.30
11,250.00	11,749.99	11,500.00	351.50	231.20	582.70	10.00	361.50	231.20	592.70
11,750.00	12,249.99	12,000.00	366.70	241.30	608.00	10.00	376.70	241.30	618.00
12,250.00	12,749.99	12,500.00	382.00	251.30	633.30	10.00	392.00	251.30	643.30
12,750.00	13,249.99	13,000.00	397.30	261.40	658.70	10.00	407.30	261.40	668.70
13,250.00	13,749.99	13,500.00	412.60	271.40	684.00	10.00	422.60	271.40	694.00
13,750.00	14,249.99	14,000.00	427.80	281.50	709.30	10.00	437.80	281.50	719.30
14,250.00	14,749.99	14,500.00	443.20	291.50	734.70	10.00	453.20	291.50	744.70
14,750.00	over	15,000.00	760.00	500.00	1,260.00	10.00	770.00	500.00	1,270.00

Note) *EC = Employee Compensation Contribution*

TABLE 14.1-9 BASIC LABOR COSTS FOR COST ESTIMATION

Unit (PP/day)

Labors	Plaridel	Cabanatuan	San Jose
Foreman	576.00	566.00	
Operator	429.00	421.00	
Driver	375.00	368.00	
Carpenter	451.00	444.00	
Re-Bar Worker	410.00	403.00	
Masonry	471.00	463.00	
Blaster	531.00	522.00	
Welder	509.00	500.00	
Painter	448.00	440.00	
Mechanic	451.00	444.00	
Electrician	429.00	421.00	
Skilled Labor	410.00	403.00	
Unskilled Labor	320.00	314.00	

2) Material Cost

The prevailing prices of March 2002 for the basic construction materials given in the "Construction Materials Price and Indices" issued by the Construction Industry Authority of the Philippines, Department of Trade and Industry (DTI) are basically adopted. Some adjustments such as follows were made for the convenience of cost estimation.

- Portland Cement

  135.00 PP / bag (40kg) is converted to 3,375 PP / ton.

- Reinforcing Steel

  The costs of 6.0m long bars for various diameters are converted to the cost per kg by calculating the average cost per kilogram.

- Lumber

  The cost per bdft (board feet) is converted to the cost per cubic meter applying 1.0 bdft = 144 cubic inches = 0.00236 m^3.

- Asphalt Oil (raw asphalt)

  The cost per drum is converted to the cost per ton by assuming the content of a drum is 200 liter and the specific gravity of the raw asphalt is 1.00.

The costs for those materials not indicated in the book are estimated from the local market survey, costs used in other projects or from the costs in Japan ("Kensetsu Bukka" or construction material price book).

The costs for the basic materials adopted for the cost estimation are shown in Table 14.1.10 below.

TABLE 14.1-10 BASIC MATERIAL COST FOR MAJOR ITEMS

Materials	Unit	Cost	Components (%)	
		(Pesos)	Foreign	Local
Diesel Oil	ltr	12.10	65.0%	35.0%
Gasoline	ltr	14.20	65.0%	35.0%
Heavy Oil	ltr	9.77	65.0%	35.0%
Reinforcing Bars, Grade 40	kg	16.00	65.0%	35.0%
Reinforcing Bars, Grade 60	kg	17.00	65.0%	35.0%
Structural Steel (Round Bar, SS400)	kg	21.80	70.0%	30.0%
Structural Steel (Flat Bar, SS400)	kg	22.70	70.0%	30.0%
Structural Steel (Shapes, SS400)	kg	17.60	70.0%	30.0%
Structural Steel (Plates, SS400)	kg	20.20	70.0%	30.0%
Structural Steel (Plates SMA490W)	kg	40.90	75.0%	25.0%
Quarry Royalty (Borrow Soil)	m3	15.00	0.0%	100.0%
Quarry Royalty (Sand, Pebbles))	m3	15.00	0.0%	100.0%
Quarry Royalty (Aggregate)	m3	15.00	0.0%	100.0%
Quarry Royalty (Gravel/Stone)	m3	15.00	0.0%	100.0%
Portland Cement, ordinary	t	3,375.00	60.0%	40.0%
Admixture	kg	118.00	70.0%	30.0%
Lumber	m3	14,800.00	10.0%	90.0%
Plywood, 6x1200x2400	m2	80.00	10.0%	90.0%
Prime Coat	t	22,635.00	65.0%	35.0%
Tack Coat	t	22,635.00	65.0%	35.0%
Asphalt Mixture	t	2,500.00	65.0%	35.0%
PVC Pipe, ϕ 50	m	66.70	50.0%	50.0%
PVC Pipe, ϕ 100	m	200.00	50.0%	50.0%
PVC Pipe, ϕ 150	m	432.00	50.0%	50.0%
Laminated Elastomeric Bearing Pad (400x300x50mm)	each	11,000.00	65.0%	35.0%
Laminated Elastomeric Bearing Pad (600x300x50mm)	each	15,800.00	65.0%	35.0%
PC Strand, T12.7	kg	113.00	70.0%	30.0%
PC Strand, T15.2	kg	119.00	70.0%	30.0%
PC Tendon, ϕ 32	kg	136.00	70.0%	30.0%
Concrete Hollow Block (load bearing) 4"x8"x16" (100x200x400mm)	each	10.00	25.0%	75.0%
Concrete Hollow Block (load bearing) 6"x8"x16" (150x200x400mm)	each	12.00	25.0%	75.0%

3) Equipment Cost

The equipment costs are estimated principally based on the rental costs given in the "Equipment Guidebook" issued by the Association of Carriers and Equipment Lessors (ACEL), Inc. (Nov. 1998) as specified in the Department Order No. 57/2002 (DPWH).

Rental rates of various kinds of equipment are given in the Guidebook in the forms of operated hour rental rates and/or bare month rental rates. Operated hour rental rates include the cost of operator, fuel and lubricants, and maintenance, while these are excluded in the bare month rental rates.

Based on the terms and conditions on rental cost, two types of contract are mentioned, namely operated equipment rental contract and bare equipment rental contract. Operated equipment rental contract can be either of day-to-day contract or month-to-month contract, while bare equipment rental contract will be month-to-month contract. The terms and condition on rental contract for each contract type are summarized in Table 14.1-11. Considering the scale of the project and the site location, day-to-day contract is not advantageous for most of the equipment. The month-to-month rental costs for both operated equipment rental contract and bare equipment rental contract are converted to the hourly (or daily) operation cost considering the working days, daily operation hours, operator/driver cost and fuel consumption cost by the following manner, and the minimum of the two for each equipment is adopted.

a) In case of Operated Equipment Rental Contract

$$OC = \frac{OH \times T \times (1 + \alpha)}{SO}$$

Where, OC: Hourly (or Daily) equipment operation cost
OH: Operated hour rental cost
T: Minimum monthly charged hours = 200 hr/month
α: Extra out of Metro Manila = 2.0%
SO: Standard monthly operation hours (or days)

b) In case of Bare Equipment Rental Contract

$$OC = \frac{BM \times (1 + \alpha) \times (1 + MR)}{SO} + OP + FC$$

Where, OC: Hourly (or Daily) operation cost
BM: Bare month rental cost
α: Extra out of Metro Manila = 2.0%
MR: Maintenance Rate
SO: Standard monthly operation hours (or days)
OP: Operator/Driver cost
FC: Fuel consumption cost

TABLE 14.1-11 SUMMARY OF TERMS AND CONDITION OF RENTAL COST AND CONSIDERATION

	Operated Equipment Rental Contract		Bare Month Rental Contract (Month to month contract)
	Day to day contract	Month to month contract	
Minimum Charge	Min. 10 hours/day (operating and/or standby) for the first shift + actual operating hour for the succeeding shift	Min. 200 hours/month for the first month + actual operating hour in excess of the first 200 hours	Min. 200 hours/month (use or non-use)
In case of idle due to lack of fuel / lubricant	10 hours / day will be charged	8 hours / day will be charged	-
In case of non-use (standby or waiting)	Minimum daily or monthly rental		-
In case of unworkable condition	500 PP/day or 2 hour rental whichever is higher		-
Operation on Holidays & Sundays		Min. 8 hours / day will be charged	Min. 8 hours / day will be charged
Charged Period	Duration between leaving from and returning to Lessor's yard		
Mobilization	Not Included (Lessee)		
Maintenance	Included (Lessor)		Not Included (Lessee)
Fuel	Included (Lessor), but the price difference with Metro Manila shall be borne by Lessee.		Not Included (Lessee)
Project Outside Metro Manila	Min. 2.0% extra outside Metro Manila		Case to case basis depending on the proximity or isolation of the project from Metro Manila
Monthly Rental Cost	(Hourly Cost x 10 hours/day x 30 days) x 1.02 (for outside Manila) = 306 x Hourly Cost	Hourly Cost x 200 hours/month x 1.02 (for outside Manila) = 204 x hourly Cost	Bare Month Cost x 1.02 (for outside Manila) = 1.02 x Bare Month Cost
Hourly Operation Cost	Monthly Rental Cost / Working Days / Daily Operation Hour		Monthly Rental Cost / Working Days / Daily Operation Hour + Operator + Maintenance + Fuel
Consideration	Not to be considered as obviously more expensive than month to month contract.	To be compared with Bare month contract	To be compared with month to month contract by hourly operated rental cost

Besides the above, equipment operation costs based on the equipment depreciation costs are estimated in order to cover the equipment not given in the ACEL's guidebook and to compare with the rental cost for reference. The equipment depreciation costs shall be estimated from the basic equipment costs, considering the import tax, value added tax, standard operation hours, standard working days, resumption rate, repair and maintenance rate and annual management rate. The hourly (or daily) equipment depreciation costs are calculated using the following equation.

$$DP = BP \times \left(\frac{RD + MT}{DY} + MN \right) \times \frac{1}{SO}$$

Where, DP: Hourly (or Daily) equipment depreciation cost

BP: Basic equipment cost = CIF price + Import tax + VAT

RD: Redemption rate = 1 – Resumption rate

MT: Maintenance and repair rate

MN: Annual management rate

DY: Durable years

SO: Standard annual operation hours (or days)

The CIF price of the equipment are taken as the equipment cost in Japan and 10% import tax and 10% value added tax was added for the basic equipment cost. Redemption rate, durable years and standard operation hours (or days) are taken as the same as in Japan, while maintenance and repair rate, and annual management rate are reduced to 75% and 50% respectively of those used in Japan to reflect the difference in personnel expenditure.

The hourly (or daily) equipment operation costs are calculated adding the operator/driver cost and the fuel consumption cost to the above depreciation costs. The operation costs for major equipment are summarized in the Table 14.1-12.

TABLE 14.1-12 MAJOR EQUIPMENT OPERATION COST

Items	Unit	Cost (pesos)	Components (%)	
			Foreign	Local
Tractor, crawler w/dozer (Bulldozer, 15t)	hr	2,700.00	53.6%	46.4%
Tractor, crawler w/dozer (Bulldozer, 21t)	hr	4,150.00	54.4%	45.6%
Backhoe, hydraulic, crawler, 0.35m3	hr	1,210.00	51.8%	48.2%
Backhoe, hydraulic, crawler, 0.61m3	hr	1,740.00	52.9%	47.1%
Crawler Drill	hr	518.00	54.3%	45.7%
Pneumatic Breaker, Handhold	day	457.00	54.3%	45.7%
Motor Grader, 3.71m	hr	2,230.00	53.2%	46.8%
Soil Stabilizer/Road Reclaimer	hr	5,840.00	54.0%	46.0%
Four Tamping Foot Wheels (Tire Roller) 16t	hr	1,970.00	52.7%	47.3%
Vibratory Tandem Smooth Drum 10.6t (Vibration Roller, tandem, 8~10t)	hr	2,030.00	53.2%	46.8%
Vibration Rammer, 6in	day	158.00	59.7%	40.3%
Plate Compactor	day	780.00	56.2%	43.8%
Crawler Crane, 31-35t	hr	1,680.00	52.9%	47.1%
Crawler Crane, 36-40t	hr	1,950.00	53.2%	46.8%
Crawler Crane, 41-45t	hr	2,120.00	53.4%	46.6%
Crawler Crane, 46-50t	hr	2,480.00	53.6%	46.4%
Truck Crane, Hydraulic 21-25t	hr	1,330.00	52.0%	48.0%
Truck Crane, Hydraulic 26-30t	hr	1,470.00	52.2%	47.8%
Truck Crane, Hydraulic 31-35t	hr	1,670.00	52.7%	47.3%
Truck Crane, Hydraulic 36-40t	hr	1,750.00	52.8%	47.2%
Truck Crane, Hydraulic 41-45t	hr	2,240.00	53.1%	46.9%
Truck Crane, Hydraulic 46-50t	hr	2,320.00	53.2%	46.8%
Truck Crane, Hydraulic 51-60t	hr	2,500.00	53.4%	46.6%
Truck Crane, Hydraulic 71-80t	hr	3,080.00	53.5%	46.5%
Truck Crane, Hydraulic 101-120t	hr	6,960.00	53.9%	46.1%
Truck Crane, Hydraulic 121-140t	hr	8,240.00	54.0%	46.0%
Truck Crane, Hydraulic 141-160t	hr	8,950.00	54.1%	45.9%
Diesel Hammer w/o Crane, 3.5t	hr	2,060.00	56.0%	44.0%
Diesel Hammer w/o Crane, 4.5t	hr	3,000.00	55.7%	44.3%
Vibratory Pile Driver, Electric 60kW w/o Genset	hr	733.00	49.1%	50.9%
All Casing Excavator, ϕ1200max	hr	6,200.00	55.4%	44.6%
All Casing Excavator, ϕ1500max	hr	8,630.00	55.3%	44.7%
Dump Truck, 3.0-6.0 cu-yds (2.3-4.6m3)	hr	446.00	49.0%	51.0%
Dump Truck, 6.0-9.0 cu-yds (4.6-6.9m3)	hr	603.00	50.8%	49.2%
Dump Truck, 9.0-12.0 cu-yds (6.9-9.2m3)	hr	756.00	51.9%	48.1%
Trailer 20t	hr	1,670.00	53.3%	46.7%
Truck Mixer 5.0-6.0 cu-yds (3.8-4.6m3)	hr	1,160.00	51.2%	48.8%
Concrete Batch Plant 40m3/hr with silo	hr	1,970.00	52.0%	48.0%
Concrete Pump Vehicle 100cu-yds/hr (76.5m3/hr)	hr	2,190.00	53.4%	46.6%
Concrete Paver/Finisher	hr	1,400.00	52.6%	47.4%
Asphalt Paver/Finisher, 4.7m	hr	2,420.00	53.1%	46.9%
Welding Machine 250A	day	588.00	58.6%	41.4%
Welding Machine 500A	day	1,470.00	60.6%	39.4%
Generator 51-100 kW	day	2,690.00	59.3%	40.7%
Generator 101-150 kW	day	3,610.00	59.9%	40.1%
Electric Water Pump 3 1/2 - 4 (88.9-101.6mm)	day	195.00	53.1%	46.9%
PC Bridge Cantilever Construction Form Traveler, W≦14m	day	16,700.00	60.9%	39.1%

14.1.6 Estimated Construction Cost

Construction cost by contract package is shown in Table 14.1-13.

TABLE 14.1-13 CONSTRUCTION COST

Unit: Million P at August 2002 Prices

Bypass	Contract Package	Phase I of Initial Stage	Phase II of Initial Stage	Ultimate Stage	Total
Plaridel Bypass	I	684.7	-		
	II	-	436.5		
	III	-	700.7		
	IV	-	251.9		
	Sub-total	684.7	1,389.1	1,404.3	3,478.1
Cabanatuan Bypass	I	-	486.5		
	II	723.3	-		
	III	734.9	-		
	IV	-	818.9		
	Sub-total	1,458.2	1,305.4	1,882.1	4,645.7
San Jose Bypass	I	-	431.9	257.0	688.9
Total		2,142.9	3,126.4	3,543.4	8,812.7

Note: Exchange Rate : US$ 1.00 = ₱52.28 = ¥ 120.18 as of 23 August 2002

14.2 Consultancy Services Cost

The Consultancy Services Costs for the Pre-construction and Construction Supervision Stage are detailed in Appendix 14.2-1 and summarized in Table 14.2-1.

TABLE 14.2-1 CONSULTANCY SERVICES COST

Construction Stage		Pre-Construction Stage	Construction Supervision Stage	Total
Initial Stage	Phase I	21.4	212.6	234.0
	Phase II	30.8	296.7	327.5
	Total	52.2	509.3	561.5
Ultimate Stage		34.1	319.3	353.4

14.3 ROW Acquisition Cost

14.3.1 Land Value

Land value for various land uses estimated by City/Municipal Appraisal Committees were collected and summarized in Table 14.3-1.

TABLE 14.3-1 FAIR LAND VALUE BY CITY/MUNICIPAL APPRAISAL COMMITTEE

Unit: ₱/sq.m at 2002 Prices

Bypass	City/Municipal Government	Land Use				
		Residential	Subdivision	Agricultural	Commercial	Industrial
Plaridel Bypass	Plaridel	650~970	800~950	40~60	640~1,300	340~720
	San Rafael	2,000~3,000	-	200~250	-	-
Cabanatuan Bypass	San Leonardo	300 (along PPH)	-	50~150	-	-
	Sta. Rosa	300	-	150	-	-
	Cabanatuan City	100~1,350	-	40~70	-	-
	Talavera	-	-	30~60	-	-
San Jose City	San Jose City	200~550	-	30~55	-	-

14.3.2 Compensation Cost

Compensation costs for the cost of improvement (structures, fences, etc.), fruit trees, trees and financial assistance to tenant farmers and lease farmers were estimated based on the field survey, interviews with residents and information from City / Municipal Appraisal Committee.

14.3.3 Estimated Land Acquisition Cost

Estimated land acquisition cost is shown in Table 14.3-2.

TABLE 14.3-2 ESTIMATED LAND ACQUISITION COST

Unit: Million ₱ at August 2002 Prices

Stage	Bypass	Contract Package	Land Area (ha.)	ROW Acquisition Cost (Million ₱)		
				Cost of Land	Compensation Cost	Total
Phase I of Initial Stage	Plaridel Cabanatuan	I	26.39	125.10	17.62	142.72
		II	45.93	143.76	23.90	167.66
		III	15.58	16.75	5.77	22.52
	Sub-total		77.90	285.61	47.29	332.90
Phase II of Initial Stage	Plaridel	II	25.96	51.97	6.95	58.92
		III	4.58	55.06	18.62	73.68
		IV	30.90	129.71	9.96	139.67
	Cabanatuan	I	32.31	60.83	6.56	67.39
		IV	44.35	47.96	32.26	80.22
	San Jose	I	32.41	31.78	17.85	49.63
	Sub-total		170.51	377.31	92.20	469.51
Total			248.41	662.92	129.49	802.41

Note: *1) The ROW acquisition will be completed in the Initial Stage.*
2) Land value based on the assessment of the respective LGU's estimating committee
3) Compensation cost includes cost of improvement (structures, fence, etc.), fruit trees, trees and financial assistance to tenant farmers and lease farmers.

14.4 Estimated Project Cost

Estimated project cost is shown in Table 14.4-1.

TABLE 14.4-1 ESTIMATED PROJECT COST

Unit: Million P at August 2002 Prices)

	Initial Stage		Ultimate Stage	Total
	Phase I	Phase II		
Construction Cost	2,142.9	3,126.4	3,543.4	8,812.7
Consultancy Services Cost	234.0	327.5	353.4	914.9
ROW Acquisition Cost	332.9	469.5	-	802.4
Total	**2,709.8**	**3,923.4**	**3,896.8**	**10,530.0**

CHAPTER 15
PREPARATION OF DRAFT TENDER DOCUMENTS

15.1 Organization of Draft Tender Documents

Draft tender documents consisting of the following are being prepared for each of 9 contract packages (4 for Plaridel Bypass, 4 for Cabanatuan Bypass and 1 for San Jose Bypass):

1) Prequalification Documents

a) Instructions and Conditions for Prequalification
- Introduction
- General Instructions and Conditions for Prequalification
- Instructions to Applicants for Prequalification
- Prequalification Forms

b) Contractor's Confidential Forms of Application for Prequalification
- Contractor's Letter of Application
- Statement of Applicant
  - General Information
  - Legal Aspect
  - Technical Aspect
    - General Experience
    - Particular Experience
    - Equipment Capability
    - Contractor's Organization
  - Financial Aspect

2) Tender Documents

a) Volume 1 Proposal Book
- Invitation for Bids
- Instructions for Bidders
- Form of Bid, Appendices to the Bid, Bid Schedule and Daywork Schedule
- Bill of Quantities (BOQ)
- Draft of Contract Agreement and Sample Forms

b) Volume II Conditions of Contracts
- Conditions of Contract for Construction Part I – General Conditions (FIDIC, First Edition, 1999) *
- Conditions of Contract: Part II – Conditions of Particular Applications

c) Volume III Technical Specifications
- Part I – DPWH Standard Specifications for Public Works and Highways, 1995 Edition: Volume II – Highways, Bridges and Airports *

- Part II Supplemental Specifications and Special Provisions

d) Volume IV Contract Plans and Drawings

e) Volume V Supplemental Notices/Addenda to the Bidding Documents

Note: * these documents are official publications which form a part of tender/contract documents.

15.2 Basis for Draft Tender Documents

In the preparation of draft tender documents, the following are used as a base (or guide) documents:

a) P.D. 1594 and its Implementing Rules and Regulations as amended May 24 and July 05, 2000.

b) Executive Order No. 40, Series of 2001, Consolidating Procurement rules and Procedures for all National Government Agencies, Government-Owned or-Controlled Corporations and Government Financial Institutions, and Requiring the Use of the Government Electronic Procurement System.

c) Memorandum Circular of the Department of Public Works and Highways.

d) Conditions of Contract for Construction – Federation Internationale des Ingeniurs-Conseils, (FIDIC), First Edition 1999.

e) Sample Prequalification Documents under JBIC ODA Loans, Procurement of Works, Major Equipment, Industrial Installations and Turnkey Contracts, Japan Bank for International Cooperation (JBIC), November 1999.

f) *Evaluation Guide for Prequalification* and Bidding under JBIC ODA Loans, Procurement of Goods and Services (except Consulting Services), Japan Bank for International Cooperation (JBIC), June 2000.

g) Sample Bidding Documents under the JBIC ODA Loans, Procurement of Civil Works, Japan Bank for International Cooperation (JBIC), November 1999.

h) Guidelines for Procurement under the JBIC ODA Loans, Japan Bank for International Cooperation (JBIC), October 1999.

i) Technical Specifications:
   - DPWH Standard Specifications for Public Works and Highways, 1995 Edition: *Volume II – Highways, Bridges and Airports.*

j) DOLE Department Order No. 13 Series of 1998 GUIDELINE GOVERNING OCCUPATIONAL SAFETY AND HEALTH IN THE CONSTRUCTION INDUSTRY and the Article "SAFETY AND HEALTH MANAGEMENT" *

k) Applicable DPWH Department Orders

PART VI

PROJECT EVALUATION AND IMPLEMENTATION PROGRAM

CHAPTER 16

ENVIRONMENTAL IMPACT ASSESSMENT

16.1 Project Scoping

16.1.1 Level I – Technical Scoping Meeting

The Technical Scoping (Level I) for the proposed Plaridel, Cabanatuan, and San Jose Bypasses was held in 28 May 2001 at the Environmental Management Bureau (EMB) Conference Room. The primary objective of Level I Scoping is to determine the appropriate scope and level of environmental assessment to be used for the Project, and also to ensure the project's compliance with the procedural requirements of the Department of Environment and Natural Resources (DENR) for the issuance of the Environmental Compliance Certificate (ECC). The members of the EIA Review Committee agreed to hold just one (1) Technical Scoping Meeting for the three (3) bypasses, but required separate Level II scoping meetings for each bypass. The following technical requirements were agreed upon with the EIARC:

I. BASELINE ENVIRONMENTAL CONDITION

A. Physical Environment

a. Geology
b. Pedology
c. Slope
d. Erosion
e. Hydrology
f. Water Quality
g. Meteorology
h. Ambient Air Quality and Noise Levels
i. Land Use
j. Strategic Agricultural and Fishery Development Zone

B. Biological Environment

a. Terrestrial Flora
b. Terrestrial Fauna
c. Aquatic Fauna

C. Socio-Economic Environment

a. Demography and Basic Information
b. Socio-Economic Characteristics
c. Available Skills in the Community

D. Social Acceptability

II. ENVIRONMENTAL IMPACT IDENTIFICATION, ASSESSMENT & MITIGATION

A. Land Features and Uses
B. Species and Ecosystems
C. Socio-Economic Considerations
D. Air and Water

III. ENVIRONMENTAL MANAGEMENT/MONITORING PLAN

16.1.2 Level II – Formal Scoping Session

Prior to each formal scoping session, which were all held in the afternoon, site inspection along each proposed alignment were jointly carried out in the morning by members of the EIARC, a representative of the EMB-DENR EIA Division, and the members of the EIA Team. The said Formal Coping Sessions were held on the following dates: 15 June, 2001, for the San Jose Bypass; 16 June 2001 for the Cabanatuan Bypass, and 23 June 2001 for the Plaridel Bypass.

The Formal Scoping Session (Level II) was held at the Bustos Multi-Purpose Gymnasium, Bustos, Bulacan for the Plaridel Bypass, at the Sangguniang Panlungsod (SP) Session Hall, Cabanatuan City for the Cabanatuan Bypass, and at the PAGASA Gymnasium, San Jose City for the San Jose Bypass.

All these scoping sessions were well represented and attended by the stakeholders in the respective impact areas. After the Open Forum, the Agreed Upon Studies To be Undertaken and Agreed Upon Issues to be Addressed by the EIA were signed by the stakeholders. As expected, key issues and concerns raised were very similar in all the three bypass sections. These are:

(i) Crossings for farmers, carabaos, and motorized hand tractors and motorized threshers, if the bypass will cross barangay roads and irrigation canals;

(ii) Target implementation schedule;

(iii) Basis of compensation for Right-of-Way (R-O-W) Acquisition (land and structures)

(iv) Ensure that irrigation system will not be cut nor disrupted for long periods of time;

(v) Ensure that access to existing roadways would continue even after the construction of the bypass

(vi) Compensation and entitlements for tenants, lessees, renters, and sharers

(vii) Apprehension regarding illegal conversion of prime agricultural land, once bypass becomes operational

(viii) Relocation site for informal settlers (squatters)

(ix) If the bypass would be fenced, and access controlled

16.2 Baseline Environmental Condition

16.2.1 Plaridel Bypass

16.2.1.1 Physico-Chemical Aspects

Pedology

The soils in Bulacan are classified into five (5) major types namely: the Soils of the Coastal Landscape, which are generally coarse loamy and clayey fluvio-marine deposits found in former tidal flats. Soil units categorized under this type include the Dolongan Variant, Matimbo Series, Obando Series, and the Masantol Series. Immediately adjacent to the coastal landscape are the Soils of the Alluvial Landscape, composed of six (6) soil series in the low alluvial terraces and four (4) series in the river terraces and levees. Soils of this category represent about 18% of the Province's total land area.

The third geomorphic soil classification is found in the Piedmont Landscape with a total of seven (7) soil series. These are: 1) Mysan; 2) Pulong Buhangin; 3) Batia; 4) Awayan; 5) Prensa; 6) Mahipon; and 7) Kalayakan. Soils of this type constitute about 20% of the provincial land area. The Hilly Landscape has four (4) soil series. The Miscellaneous Soil Type on the other hand includes the loamy tidal swamp, mucky tidal swamp, mountainous lands, and streams and rivers.

Slope

The Plaridel Bypass alignment generally traverses level to very gently sloping areas. The lowland landscape is concentrated along the western, northwestern, and southwestern municipalities of the province including Balagtas, Guiguinto, Plaridel, Bustos, and San Rafael. The rolling to hilly slopes of more than 18% but less than 30% are commonly found scattered on the eastern part of Bulacan. The slope range between 0-30% is considered the maximum limit for sustained agricultural production.

Areas with steep to very steep slopes and are concentrated in the eastern Municipality of Doña Remedios Trinidad. These areas are by nature of no agricultural potential and are either for rehabilitation to permanent cover or preservation of its present state.

Erosion

Bulacan Province is influenced by varying degrees of erosion. On the eastern and central parts, slight to severe erosion (cultivated) affects the Municipalities of Norzagaray, Doña Remedios Trinidad, and San Jose Del Monte.

Since the landscape of the western side of Bulacan is level to very gently sloping, it is not even affected by erosion. However, these areas of the Angat River in Bustos and San Rafael are affected by severe erosion due to cultivation along the vast floodplains.

Hydrology

River Morphology

The Angat River is a meandering river system where the active channel is confined within a meander belt like the Pampanga River. The meander belt is defined by steep scarps formed in the initial development of the river through lateral erosion.

The meander belt is blanketed with a sequence of 1.5 meter thick loose silty medium to fine sand overlying a thick poorly consolidated gravel bed with lenses of coarse to medium sand.

Geomorphic features of the river section upstream and down stream from the proposed corridor shows a broader lateral extent of the terraces at the southern bank compared to those on the northern bank. This may indicate that the channel may have also been migrating on the northerly direction.

The presence of the irrigation channel about 2 km upstream from the proposed by pass alignment had altered flow behavior of the Angat River. Erosional features are not so evident from the aerial photographs and at the site.

However, natural erosion process is replaced by active quarrying operation within the river segment from the upstream section of the irrigation dam to the proposed by pass alignment. Huge volume of loose aggregate materials present within the meander belt is extracted from pre-existing quarry site using heavy equipment such as pay loaders.

Based what could be observed at the site, *the rate of extraction* appears to outpace the rate in which the river could replenish the aggregate materials during flood period.

Water Quality

A total of eight sampling sites were established at the upstream and downstream sections of the Angat River, Maguinao Creek and Irrigation canals at in Brgy. Bulihan Plaridel and Brgy. Malamig Bustos. These are shown in **Table 16.2.1-1**.

TABLE 16.2.1-1 WATER QUALITY SAMPLING RESULTS, PLARIDEL BYPASS

		Parameters					
		pH	Temp . °C	5-day 20° BOD, (mg/L)	TSS, mg/L	Coliform, (MPN/100 ml) Fecal coliform	Color / Transparency
DENR Standard Class D Water		*6.0 to 9.0*	*Max. 3° inc.*	-	*Not more than 60 mg/L increase*	-	-
Sampling Station No.	Date & Time Sampled						
1	07/29/01	7.2	24°C	2.9	93.0	24,000 (+)	Brown, turbid
2	07/29/01	7.6	23°C	3.0	151.0	24,000 (+)	Brown, turbid
3	07/29/01	7.4	22°C	2.8	138.0	24,000 (+)	Brown, turbid
4	07/29/01	7.5	23°C	4.0	126.0	24,000 (+)	Brown, turbid
5	07/29/01	7.1	28°C	1.7	116.0	24,000 (+)	Brownish, turbid
6	07/29/01	7.3	27°C	2.3	122.0	24,000 (+)	Brownish, turbid
7	07/31/01	7.6	29°C	14.5	59.0	230,000 (+)	Dark brown, turbid
8	07/31/01	7.4	29°C	30.4	60.5	230,000 (+)	Dark brown, turbid

Station 1	NIA Sub-Irrigation Canal (DOWNSTREAM), Brgy. Bulihan, Plaridel, Bulacan (Approximately 100 m from the bypass alignment)
Station 2	NIA Sub-Irrigation Canal (UPSTREAM), Brgy. Bulihan, Plaridel, Bulacan (Approximately 100 m from the bypass alignment)
Station 3:	NIA Main Irrigation Canal (UPSTREAM), Brgy. Malamig, Bustos, Bulacan (Approximately 150 m from the bypass alignment)
Station 4:	NIA Main Irrigation Canal (DOWNSTREAM), Brgy. Malamig, Bustos, Bulacan (Approximately 150 m from the bypass alignment)
Station 5:	*Angat River* (UPSTREAM), Brgy. Bonga Menor, Bustos, Bulacan (Approximately 750 from bypass alignment)
Station 6:	*Angat River* (DOWNSTREAM), Brgy. Tanawan, Bustos, Bulacan (Approximately 500 from bypass alignment)
Station 7:	*Maguinao Creek* (UPSTREAM), Brgy. Maguinao, San Rafael, Bulacan (Approximately 100 m from the alignment)
Station 8:	*Maguinao Creek* (DOWNSTREAM), Brgy. Maguinao, San Rafael, Bulacan (Approximately 50 m from the alignment)

Based on the sampling results, the bacteriological content of the water samples collected from selected rivers, creeks, and irrigation canals crossed by alignment, specifically coliform exceeded the standard limit. This is an indication that the nutrient supporting these bacteria present along these waterways are adequate. This can be very well explained by the presence of agricultural lands with patches of human habitation that drain into these water bodies; i.e., from fertilizers and other organic wastes (human and animal excreta). Aside from fertilizers, other possible sources of nutrients are feeds from overflows of man-made aquaculture ponds, and domestic and animal wastes that are directly disposed into these water bodies. As observed during the conduct of sampling, these creeks and rivers have varying uses, such as for bathing (for carabaos, ducks, and humans as well), duck raising, fish pond propagation, and other activities that may have contribute to the high nutrient contents of these river systems.

Maguinao Creek is basically used as a source of irrigation water of adjacent non-irrigated rice paddies, especially during continuous precipitation periods. Based on local accounts, cattle, hog and poultry farms located farther upstream of the creek directly drain their wastes into the creek. The waste, which is composed of *a mixture of feeds and animal manure, come in the form of a white substance*, which makes the water sticky during summer. Furthermore, the color of the water resembles very much like that of cattle manure, which is dark brown

Generally, the waters in the sampling sites are turbid and are brownish in color.

Meteorology

The nearest synoptic meteorological station in the Province of Bulacan is located at the Science Garden in Quezon City. Based on the Modified Corona's Classification the climate in the project area is categorized under Type I characterized by two (2) pronounced seasons, the wet and the dry. The rainy season coincides with the Southwest Monsoon during the months of June to September. The month of August has the longest number of rainy days and it receives the maximum amount precipitation of 526.8 mm. The dry season is experienced from December to April, with the minimum rainfall amount of 8.9 mm in February.

The mean monthly temperature in the Bulacan changes from a minimum of 25.4°C in January to maximum of 29.3°C, which is usually experienced in May.

The annual average mean temperature is 28.0°C. The highest mean monthly relative humidity of 84% is felt in during the months of August and September, while the lowest is experienced in April, which is about 65%. The warmest months are from April to June with mean values ranging from 29.3°C to 28.2°C.

The principal air streams that are significantly affecting the study area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May. The Southwest Monsoon on the other hand prevails from June to September. The North Pacific Trades is the southern portion of the North Pacific anti-cyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

Ambient Air Quality

Three sampling stations were set up at the selected sites along the proposed Plaridel Bypass alignment. Ambient air quality at the sampling sites was monitored on a 1-hour basis as well as within a 24-hour average. Table 16.2.1-2 shows the results of the analysis for ambient air quality and noise levels.

TABLE 16.2.1-2 AIR QUALITY AND NOISE LEVEL SAMPLING RESULTS, PLARIDEL BYPASS

			Concentration in µg/Ncm							
			Sampling Results				DENR Standards			
Sta. No	Date & Time	Ave. Time	Noise Level	SO_X	NO_X	TSP	Noise Level	SO_X	NO_X	TSP
1	06/09/01 1930-2030	1 hr	52-57	7.89	13.60	208.67	70	340	260	300
2	06/09/01 1620-1720	1 hr	58-69	34.88	40.79	1,599.83	65	340	260	300
	1745, 06/09/01 to 1745, 06/10/01	24-Hrs Ave.	-	25.93	15.45	620.51	-	180	150	230
3	06/09/01 1445-1545	1 hr	48-53	7.41	12.69	187.40	65	340	260	300

Station 1 Along the San Jose-Liciada Road in Brgy. Camachilihan, Bustos, Bulacan (Approximately 50 m from the bypass alignment)

Station 2 Along the Gen. Alejo Santos Highway, Brgy. Bonga Menor, Bustos, Bulacan (Approximately 50 m from the alignment of the bypass)

Station 3: Along Francisco Viola St., Brgy. Caingin, San Rafael, Bulacan (Approximately 20 m from the bypass alignment)

The highest amount of suspended particulate matter based on a 1-hour observation was at recorded Sta. 2, at 1599.83 µg/Ncm, which is more than five times the standard TSP limit (300 µg/Ncm) set the DENR. The relatively high concentration of suspended particulate matter may be due by the high volume of

traffic along the highway and possibly the dispersion level in the area is at the minimum because it is densely populated. The result of the 24-hour air quality observation also exceeded the Hazardous Level (600 µg/Ncm) based on the Air Quality Indices. Monitoring results in other stations are way below the standard.

The observed levels of other air pollutants such as SOx and NOx both on a 1-hour and a 24-hour averaging time are well within permissible limits.

Noise Levels

The observed noise levels along the sampling stations slightly went beyond the permissible limits. Accordingly, the noise levels recorded were due to the instantaneous peaks generated by the vehicles passing by during the conduct of the sampling.

Land Use

General Land Uses

Agricultural is the predominant land use type in the host municipalities. These are mostly planted to rice, which is the primary crop grown in the entire province. Commercial zones are concentrated along existing highways and transport lines like the Tabang, Guiguinto area fronting the Rocka Village along the Cagayan Valley Road, Brgy. Cruz na Daan, San Rafael along the Maharlika Highway, and the intersection going to Poblacion, Plaridel where Chowking and Merced Drugstore are situated.

Silica, a very important raw material for cement production is commonly extracted along Maasim River. Gravel and sand also abound along riverbeds of Angat from Brgy. Pulo to Brgy. Tambubong, San Rafael. Marble, white and red clay deposits used for construction and decorative purposes are found in Brgy. Pasong Bangkal.

Numerous subdivisions augment to the areas devoted to residential uses. These are also mostly located along transport lines and roadways. Institutional areas accommodate the school buildings, government offices, churches, hospitals and health facilities, and sports centers.

The forest area in San Rafael is located in Brgy. Tukod near the Municipality of Doña Remedios Trinidad. It occupies close to 7,517.76 ha or 28.19% of San Rafael's total land area.

Strategic Agricultural and Fishery Development Zone (SAFDZ)

The present SAFDZs of Bulacan Province is approximately 124,922 ha. During the conduct of the study however, there is no available map to determine the location of the said zones. Accordingly, the SAFDZ Map of Region III was submitted to the Regional Office for updating.

The classified SAFDZs of Bulacan area as follows:

- Strategic crop sub-development zone (85,304 ha);
- Strategic livestock sub-development zone (14,034 ha);
- Strategic fishery sub-development zone (23,319 ha);
- Strategic crop/livestock sub-development zone (624 ha); and
- Strategic crop/fishery sub-development zone (1,641 ha)

The remaining Network of Protected Agricultural Areas and Agro-Industrial Development (NPAAAD) are about 85 ha.

16.2.1.2 Biological Aspects

Terrestrial Flora

The flora composition in the project area is classified under the primary vegetation, which can be divided into two (2) major types namely the (i) natural *vegetation and the (ii)* cultivated vegetation. The natural type consists mainly of the lowland grassland associated with shrubland. The cultivated type on the other hand is comprised of agricultural and built-up types.

A diverse species of common riceland and wasteland weeds, grass shrubs, and herbs characterize the lowland grassland vegetation type. Species belonging to different families such *Cyanotis axillaris* (alikbangon), *Chromolaena odorata* (hagonoy), *Echinochloa crus-galli* (dawa-dawa), *Saccharum spontaneum* (talahib) and *Imperata cylindrical* (cogon) were observed.

Sparse stands of trees were noted and are usually converged along the banks of rivers, creeks, and irrigation canals.

Palay (*Oryza sativa*) is the primary crop grown in the project area. The secondary crops cultivated during rainy season are corn (*Zea mays*), okra (*abelmoschus esculentus*), sitaw (*Vigna sesquipedalis*), and water melon (*Citrullus vulgaris*). Tomato (*Lycopersicon lycopersicum*), ampalaya (*Momordica charantia*), talong (*Solanum melongena*), calabasa (*Cucurbita maxima*), and onions (*Allium sepa*) on the other hand are the most popular crops planted during the dry season.

Built-up vegetation refers to ornamental plants found around settlement areas, as well as those along roadsides. The widely propagated among the ornamental plants observed is golden bush *(Duranta repens, c.v.)*, which is uniformly shaped in the front yards. Adding aesthetics to the area are the vibrant colors of the roses *(Rosa cvs. and hybrids)*, gumamelas *(Hibiscus rosa-sinensis cvs. and hybrids)*, Bougainvilleas *(Bougainvillea spectabilis cvs and hybrids)*. Complementing the abundantly cultured varieties of *Vanda* and *Dendrobium (Orchidaceae)* species and hybrids are the *Heliconias* (false bird's of paradise, hanging lobster claw, golden lobster claw, and parrots' flower).

There are no endangered, rare, or endemic flora species encountered along the bypass alignment.

Terrestrial Fauna

A total of eleven (11) species of amphibians and reptiles belonging to five (5) families was recorded from the study site. The most commonly observed among the four (4) amphibians noted are *Bufo marinus, Rana erythraea* and *Polypedates leucomysta.* While the seven (7) recorded reptiles are well represented by *Cosymbotus platyurus, Gehyra mutilata, Hemidactylus frenatus* and *Mabouya multifasciata.* All these species are known to tolerate and thus, characteristic of highly disturbed and non-forested habitats.

The bird survey recorded a total of thirty-five (32) species within eighteen (18) families, excluding three (3) individuals that were identified up to the genus level only. A low number of endemic species characterizes the birds documented. *Centropus viridis, Orthotomus derbianus* and *Diceum australe* (9.4%) are the only

endemic species noted out of the total number of individuals encountered. These species, although endemic, are expected to be present in the study site because they are adapted to grassland and agricultural types of habitat. There are also four (4) uncommon species included in the list namely, *Gallinago gallinago*, *Streptopelia bitorquata*, *Copsychus saularis*, *Acrocepha-lus stentoreus* and *Orthotomus cucullatus*. In general, the most commonly observed group in the site was family Sylviidae. It was represented by tailorbirds, warblers, grass birds and cisticola with a total of seven (7) species and an individual, which was identified up to the genus level

The calculated Bird Species Diversity (BSD) for the study site is 3.013447856, which is relatively high indicating complex composition as dictated by high species richness. But close examination of species will reveal that they are mostly common with wide range of distribution. Further, they are mostly resident breeding that are non-endemic, which can inhabit highly disturbed habitats such as grasslands, agricultural, residential, commercial, and industrial areas.

Seven (7) species of mammals was recorded in the study site based mainly on interviews, actual observations and trappings. This is comprised of three (3) bats and four (4) small non-volant forms within three (3) families. Captured bats are both fruit eating. Of the seven species recorded, *Ptenochirus jagori* is the only endemic species noted. The rest are non-endemic (i.e. *Cynopterus brachyotis*) and accidental introduced (i.e. *Suncus murinus, Rattus tanezumi, R. norvegicus, R. argentiventer,* and *Mus musculus*).

There are no recorded amphibian and reptilian species that are either threatened or near threatened, (RDB, 1997; Alcala and Custodio, 1997; Alcala and Brown, 1998; Alcala et al., 199) in the study site. Except for *N. philippinensis*, which is uncommon, based on Alcala, 1986, all recorded species are common. Actual observations and field interviews will support this population condition. The low record for snake species and uncommon status of *N. philippinensis* in the study site can be attributed to the attitude of people towards snakes. They are usually eliminated on sight for fear of deadly bites. As well, there are no mammalian species encountered categorized under rare and uncommon status.

Aquatic Fauna

Observation of the samples collected from the Angat River showed a very diverse phytoplankton composition. The average pH and temperature gathered from the said River also showed its physicochemical characteristics. Temperature and alkalinity dictate the composition of these organisms in aquatic ecosystems. Some species of diatoms dominate in lakes and rivers with high pH, while some in neutral pH such as the species under Division Chrysophyta. Angat River with relatively neutral pH value and low temperature is more conducive for the phytoplankton to thrive. Phytoplankters are producers and depend so much on light for reproduction. There are no indications of possible eutrophication in the river.

Nutrient level and composition of the aquatic ecosystem also dictate its biotic composition where in this case, the sources of these chemical characteristics are farmlands, and anthropogenic activities in the project area.

The zooplankton community on the other hand is not that diverse as the observed phytoplankton. The number of individuals was also fewer as observed under the microscope. Some of the zooplankton species identified include

Brachionus sp. 1, *Brachionus sp. 2*, *Trichocerca sp. 1*, *Trichocerca sp. 2*, *Lecane sp.*, *Lophocharis sp.*, *Rotifer*, and an *Unidentified* species.

16.2.1.3 Socio- Economic Aspects

The information discussed here are results of the actual perception survey conducted in the direct impact areas.

Demography and Basic Information

Household Size

The perception survey revealed that greater part of the PAPs (Project Affected Persons) per barangay have an average household size of "5-7" (35.4%) and "1 to 4" (47.8%). Only 5.6% have household size greater than 10.

Educational Attainment

About 31.3% of the female spouse respondents in the direct impact areas are elementary undergraduates. Only 21.7% are graduates. For the male spouses, majority are high school graduates (27.0%) and high school undergraduates and graduates (18.8%). Only a few attained college education. Between both sexes, low numbers in terms of higher levels of education make them less eligible and competitive in terms of landing jobs, particularly at more urbanized areas.

Socio-economic Characteristics

Primary Occupation

The PAPs' primary occupation is farming. Of the total respondents consulted, 38.5% are farmers. This is expected since Bulacan economy is still considered primarily agriculture-based.

Household Income

Approximately 57.0% of the surveyed households fall above P71,304, Region 3's annual poverty threshold for a family of six. Respondents who fall between P39, 240 and P71,304 comprise 18.6%. The percentage falling below the annual food threshold of P39, 239 (24.4%) represent the farmers in the DIA who would become highly vulnerable to impoverishment if their farm income are taken away from them.

If the income of the respondents would be derived from farming only, 33.7% would still be above Region 3's poverty threshold, and 59.3% would already fall below the threshold. If the respondents' incomes are solely obtained from non-farm sources such as those mentioned above, 54.1% would fall below the annual food threshold, and only 31.4% earn more than P71,304 per annum. These figures show the PAPs' dependence on both farming and non-farming as their major means of livelihood.

Household and Farm Expenditures

Food expenses accounts for the bulk (64.4%) of the respondents' total annual expenditures in all barangays. They also spend a big portion of their incomes for education (12.2%), electricity (9.3%), and medical expenses (7.5%). This indicates that crops obtained from the farmlands are not depended on as sustenance, but more of a source of income.

The respondents pay up to P677,515.65 for farm labor. Buying farm supplies and other implements such as seedlings (P289,365.20), fertilizers (P611,520.20), and pesticides (P436,731.20) also contribute to the bulk of farmer's expenditures. On the other hand, approximately 19.4% or P596,128.13 is spend for agro-industrial and aquaculture feeds.

Net Income

The respondents' total household income amounts to P28,193,032.00. More than 70% of this is spent on household expenditures, whereas around 20-25% goes to farm expenditures.

Tenure

In terms of land occupation, the survey showed that majority, or 33.6% are occupying lands with prior consent from the respective landowners, 29.6% are tenants, and 28.3% of the total project affected persons are landowners.

Availability of Basic Social Services

About 85.1% of the households consulted have access to electricity as a source of lighting. Only 6.4% still use kerosene for illuminating their homes.

Water Supply

In terms of source of water supply, majority or 55.3% of the respondents obtain their domestic water supply from artesian wells, whereas 23.4% are with piped connections

Sanitation Facilities

Other indicators of the standard of living are deficiencies in terms of sanitation facilities. As gathered from the survey, a high percentage of 63.8% of the residents at the host barangays use the semi flush type of toilet. Close to 13.8% on the other hand, use Antipolo type.

Cooking Fuel

Majority of the respondents (54.3%) are still using kerosene to cook their food. Those who are using LPGs in their kitchens consist of 23.4% of the total respondents. However, about 17.0% are still using wood as cooking fuel.

Available Skills in the Community

Nearly 37.6% of the female respondents asked during the survey have skill in cooking. Those with sewing expertise represent 32.5% of the total respondents. There are about 14.5% office personnel 10.5% factory workers in the project area.

Skilled drivers in the project area are approximately 41.3%. Laborers are next in rank with 27.5%. Other skills of male household members include carpentry (17.4%), masonry (8.2%), mechanic (4.6%), and heavy equipment operator (0.9%).

16.2.1.4 Social Acceptability

Based on a 100% interview of the directly affected communities, a very high 70.8% of the respondents expressed full support to the proposed Plaridel Bypass. Only 29.2% disapproved of the proposed undertaking.

When asked why they are in-favor of the Project, the top three (3) answers are because (i) it is a government project and they cannot do anything but accept it (*Others*, 43.7%), and (ii) the Bypass, will improve the quality of life of people, particularly those near the bypass (27.7%); and (ii) will improve accessibility (14.3%).

For those who do not favor the construction of the Bypass, the main reason is understandable; i.e., because it "*will displace people*".

16.2.2 Cabanatuan Bypass

16.2.2.1 Physico-Chemical Aspects

Pedology

There are five (5) soil types identified in the project area. These are commonly from complex materials and alluvial soil. The latter is good for agriculture.

Quingua Silt Loam is characterized by a heavy friable fine to a course granular surface soil to a depth ranging from 25-40 cm. This has a good drainage condition and is easily tilled. Quingua Clay Loam is type of soil consists of bright to chocolate-brown fine granular and friable surface clay loam ranging in depth from 35-40 cm. This soil type is best for agricultural purposes, especially for rice, because of its high productivity

Formed by the accumulation of fine sandy materials deposited by water during floods is the Quingua Fine Sand. Corn, vegetables, onion, watermelon and fruit trees such as santol, pomelo and other citrus species are cultivated in this type of soil. Prensa Silt Loam is light brown to light reddish brown friable, moderately loose and granular silt loam. The subsoil is brown to dark grayish brown to gray moderately compact numerous in this layer. This type of soil is suitable for lowland rice, vegetables, corn, camote and peanuts. The Bantog Clay Loam is a dark-brown clay loam, slightly sticky in consistency and fine in texture. The surface is nearly flat and is poorly drained internally and externally. It is during the rainy season when fine soil materials are drained into the surface.

Slope

The proposed Cabanatuan Bypass Alignment generally traverses a level to very gently sloping topography. The slope ranges between 0-3%.

Erosion

No apparent erosion (E_O) occurs in the areas crossed by the proposed bypass alignment, since the terrain is level to very gently sloping.

Hydrology

River Morphology

The Pampanga River exhibits a meandering feature where the active channel has a regular sinuous pattern. The meandering characteristics of the river reflect

the very low slope of the terrain. Features observed from the field showed that the river is in a continuous state of resculpturing its course within the meander belt. Within the pre-formed meander belt, the channel had gradually migrated on a northerly direction. This is reflected by a sequence of abandoned meander channels in the stretch from Bgy.Pangatian, Kalwayan and Pagas, located at the south bank of Pampanga River, east of Cabanatuan and the alignment. A number of abandoned channels were also noted at the southern bank of the main channel north of Cabanatuan proper and west of the alignment.

Within the pre-defined meander belt, the channel had also vertically incised through the channel floor that formed a sequence of two terraces forming a step like features at both banks of the meander belt. The terrace edges are marked by 2-meter high scraps. The terrace bordering the main channel rises about 1 to 1.5 meters above the main channel floor. As a general feature, the terraces at the southern bank have broader lateral extent as compared to those in the northern bank, a result of erosion during flood periods.

Based on the terrain features from aerial photos and those at the ground, the present course of the Talavera River segment within the alignment corridor is "geologically recent", a result of an avulsion from an original southerly direction to that of its present course. The avulsion point is in the river section between the barangays of Pantok Bulac and Caaninaplahan. From the avulsion point, the river originally flowed due south toward the direction of Brgy. Mabuhay, Dimasalang Norte in Talavera, and Buliran and Mayapyap North of Cabanatuan City where it originally joins the Pampanga River.

The original channel course exhibits two distinct features; that of a meandering channel in the area between Mabuhay and Vaca Dam and straight course from Vaca Dam to its confluence with Pampanga River. From the number of filled up ox-bow lakes, and cut-off meander bends, the meandering had also readjusted in three occasions. These are all confined with a defined meander belt marked by steep near vertical escarpments.

The river morphology changes from the area of Vaca Dam to its confluence with the Pampanga River. This section is relatively straight and confined within a vertically incised channel. Portion of this section was later used as a reservoir of the dam.

As a result of the avulsion, the present channel of the Talavera River had been progressively shifting to a northeasterly course. Evidences of the shifting are shown by a number of features in the river section between Barangay Pantac Bulac downstream to Barangay San Agustin.

Water Quality

A total of 12 sampling stations were established on the upstream and downstream portions of selected waterways traversed by the bypass alignment. The water samples collected from the rivers, creeks and irrigation canals were analyzed for parameters such as BOD, Bacteriology, and TSS. Please refer to Table 16.2.2-1 for the results of the analyses.

TABLE 16.2.2-1 WATER QUALITY SAMPLING RESULTS, CABANATUAN BYPASS

		Parameters					
		pH	Temp . °C	5-day 20° BOD, (mg/L)	TSS, mg/L	Coliform, (MPN/100 ml) Fecal coliform	Color/ Transpa-rency
DENR Standard Class C Water		6.8 to 8.5	Max. 3° inc.	7 mg/L	Not more than 30 mg/L increase	5,000 MPN/100 ml	n. a.
Sampling Station No.	Date & Time Sampled						
1	07/30/01 1215	7.3	28°C	4.2	102.0	16,000,000 (+)	Brownish, turbid
2	07/30/01 1310	7.1	29°C	2.0	100.0	24,000 (+)	Brownish, turbid
3	07/30/01 1600	7.3	35°C	1.4	98.5	24,000 (+)	Brownish, turbid
4	07/30/01 1630	7.4	33°C	3.6	99.5	160,000 (+)	Brownish, turbid
5	07/30/01 1800	7.3	28°C	1.2	133.0	≥16,000,000 (+)	Brownish, turbid
6	07/30/01 1835	7.6	29°C	1.5	118.0	130,000 (+)	Brownish, turbid
9	07/31/01 1605	7.1	36°C	5.4	89.0	16,000,000 (+)	Brownish, turbid
10	07/31/01 1630	7.4	37°C	5.4	139.0	130,000 (+)	Brownish, turbid
11	07/31/01 1725	7.6	32°C	2.3	424.0	170,000 (+)	Brownish, turbid
12	07/31/01 1742	7.8	33°C	2.6	262.0	13,000 (+)	Brownish, turbid
DENR Standard Class D Water		6.0 to 9.0	Max. 3° inc.	-	Not more than 60 mg/L increase	-	-
7	07/31/01 1455	7.6	29°C	2.8	128.0	3,000	Brownish, turbid
8	07/31/01 1510	7.4	29°C	2.9	121.0	≥16,000,000 (+)	Brownish, turbid

Station 1 *Tabuating River* (UPSTREAM) Brgy. Tagumpay, San Leonardo, Nueva Ecija (Approximately 350 from the bypass alignment)

Station 2 *Tabuating River* (DOWNSTREAM) Brgy. Tabuating, San Leonardo, Nueva Ecija (Approximately 100 from the bypass alignment)

Station 3: *San Gregorio Creek*, (DOWNSTREAM), (Approximately 50 m from the alignment)

Station 4: *San Gregorio Creek* (UPSTREAM), at Brgy. Soledad, Sta. Rosa, Nueva Ecija (Approximately 50 m from the bypass alignment)

Station 5: Upper Pampanga River (UPSTREAM), at Brgy. Obrero, Cabanatuan City, Nueva Ecija (Approximately 1000 m from the bypass alignment)

Station 6:	Upper Pampanga River (DOWNSTREAM), at Brgy. Daang Sarile, Cabanatuan City, Nueva Ecija (Approximately 1000 m from the bypass alignment)
Station 7:	NIA Main Irrigation Canal (UPSTREAM), at Brgy. Sapang, Cabanatuan City, Nueva Ecija (Approximately 200 m from the alignment)
Station 8:	NIA Main Irrigation Canal (DOWNSTREAM), at Brgy. Sapang, Cabanatuan City, Nueva Ecija (Approximately 100 m from the alignment)
Station 9:	*Pantoc Creek*, (DOWNSTREAM), Brgy. Paludpod, Talavera, Nueva Ecija (Approximately 500 m from the bypass alignment)
Station 10:	*Pantoc Creek*, (UPSTREAM), Brgy. Dimasalang Sur, Talavera, Nueva Ecija (Approximately 600 m from the bypass alignment)
Station 11:	Talavera River, (DOWNSTREAM), Brgy. Lomboy, Talavera, Nueva Ecija (Approximately 500 m from the alignment)
Station 12:	Talavera River, (UPSTREAM), Brgy. Sicsican Matanda, Talavera, Nueva Ecija (Approximately 500 m from the alignment)

The result showed that all samples analyzed for bacteriological content, specifically coliform exceeded the standard limit. This indicates that adequate supply of nutrient supporting the proliferation of such bacteria is present in the waterways. The relatively high nutrient content can be highly attributed to the agricultural lands with patches of human habitation draining into these water bodies; i.e., from fertilizers and other organic wastes (human and animal excreta). Aside from fertilizers, other possible sources of nutrients are feeds from overflows of man-made aquaculture ponds, and domestic and animal wastes that are directly disposed into these water bodies. As observed during the conduct of sampling, these creeks and rivers have varying uses, such as for bathing (for carabaos, ducks, and humans as well), duck raising, fish pond propagation, and other activities that may have contribute to the high nutrient contents of these river systems. The color of the water in the sampling sites is brownish.

It is also important to note here that extraction of aggregate materials along Talavera and Pampanga Rivers during summer is common.

Meteorology

The climate in the project area based on the Modified Corona's Classification belongs to Type I. This is characterized by two (2) very pronounced seasons, the wet and dry. All the three (3) municipalities and the City of Cabanatuan experience a relatively dry period during the months of November to April. Wet months on the other hand occur from June to October.

The project area receives an annual rainfall of about 1904.3 mm. The highest precipitation amount of 381.9 mm was recorded in August. This month also registered the longest number of rainy days with 23. The mean monthly temperature in the area varies from as low as 25.3°C in January to as high as 29.5°C, which is experienced in May. The annual average mean temperature is 28.0°C. The highest mean monthly high relative humidity of 87% is felt in August, *while the lowest are experienced during the months of February to April, which is* about 73%. The warmest months are from April to June with mean values ranging from 29.5°C to 28.8°C.

The principal air streams that are significantly affecting the study area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May. The Southwest Monsoon on the other hand prevails from June to September. The North Pacific

Trades is the southern portion of the North Pacific anti-clyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

Ambient Air Quality

Three sampling stations were established along the bypass alignment. The sites selected are representatives of areas with high-density population and vehicular traffic, medium density population and traffic, and low-density population and traffic. Table 16.2.2-2 shows the results of the ambient air quality and noise level sampling and analyses.

TABLE 16.2.2-2 AIR QUALITY AND NOISE LEVEL SAMPLING RESULTS, CABANATUAN BYPASS

			Concentration in µg/Ncm							
			Sampling Results				DENR Standards			
Sta. No	Date & Time	Ave. Time	Noise Level	SO_X	NO_X	TSP	Noise Level	SO_X	NO_X	TSP
1	06/09/01 1150-1250	1 hr	43-49	7.28	9.79	47.97	70	340	260	300
2	06/09/01 1000-1100	1 hr	45-54	12.13	14.40	110.61	65	340	260	300
3	06/09/01 1900-2000	1 hr	46-56	6.47	7.25	93.75	65	340	260	300
	2025 06/08/01 to 2025 06/09/01	24-Hrs Ave.		4.50	5.44	71.71	-	180	150	230

Station 1 Near the intersection of the Sta. Rosa-Fort Magsaysay Road and the proposed Cabanatuan Bypass alignment at Brgy. Soledad, Sta. Rosa, Nueva Ecija (Approximately 150 m from the bypass alignment)

Station 2 In front of the Sapang Barangay Hall, along the Cabanatuan-General Natividad Road, Cabanatuan City, Nueva Ecija (Approximately 50 m from the bypass alignment)

Station 3: Along the Calipahan-Campos Road in Brgy. Campos, Talavera, Nueva Ecija (Approximately 100 m from the bypass alignment)

The sampling results based on a 1-hour sampling showed that the observed level of air pollutants such as SO_x, NO_x, and particulate matters are way below the permissible limit. The result of the 24-hour averaging also proved the same. The recorded TSP and levels at 71.71 and 4.50 µg/Ncm, respectively based on the air quality indices presented in the DENR DAO 14 Series of 1993, can be considered within the good condition level (i.e. 0-80 µg/Ncm).

Noise Levels

The observed noise levels along the sampling stations are very well within the standard limit. The noise levels recorded were due to the instantaneous peaks generated by the vehicles passing by during the conduct of the sampling.

Land Use

San Leonardo has a total of five (5) general uses of land. Agricultural area represents the largest landmass of the municipality. Residential type accounts for about 52.59 ha or 9.47%, while the area devoted for commercial purposes comprises approximately 1.03 ha. Institutional area occupy about 0.98% of San Leonardo's total land area, whereas area used for parks and open spaces represents 4.50 ha. Only.

Much that Sta. Rosa is an agricultural town, more than seventy percent (70%) of its total land area is dedicated to farming. It has an overwhelming area of 18,000 ha out of 21,751.33 ha. Residential area of Sta. Rosa as of December 1999 totaled to 2,915.40 hectares. Residential houses are heavily converged along the existing Pan-Philippine Highway as well as on both urban and rural roads the on western and eastern flanks of the town.

Commercial area is located mostly in urban areas converged along the existing National Highway and transport lines. This constitutes an aggregate area of 199.42 or 0.92% of the total land area. Industrial type has the smallest area allotment of only about 20.18 ha, barely 0.09% of the town's land area. Grasslands and marshes occupy and area of approximately 1.88% (409 ha). Open space primarily consist of parks, utilities such as roads, bridges, cemeteries and playgrounds ranks second in terms of smallest area allotment

Agricultural area is almost equally distributed in all barangays of Talavera. This represents the biggest area among the other land use types encompassing about 79.24% or 11,295.78 ha of the Municipality's total land area of 14,255.54 ha. Bodies of water consist of rivers, swamps, creeks, irrigation reservoirs and canals, and man-made fishponds. The area represented by this type is roughly 343.14 ha or barely 2.41% of Talavera's total land area.

The quarrying areas located along the Talavera River are most prominently found in Brgy. Pantoc, Pantoc Bulac, basing Hamog, Tabacao, Sicsican Matanda, Lomboy, San Pascual, Cabubulaonan, Caputican, Caaninaplahan, Mabuhay, Collado, Valle, Campos, Burnay, Calipahan, Pulong San Miguel, Matias District, Pag-asa District, Maestrang Kikay, Poblacion Sur, Bantug, La Torre, and Mamadil. This constitutes about 1,832.92 ha. Plazas, playgrounds, cemeteries, dumpsites, landfills, and vacant areas occupy an of 6.39 ha.

Built-up area is subdivided into residential, commercial, institutional, agro-industrial, and industrial uses. The combined built-up areas of the municipality represent a total of 779.32 ha. These are mostly found in urban centers and major roads.

Cabanatuan City has a total land area of 19,228.63 ha, more than half of which is dedicated to general agricultural farming including poultry and livestock raising. Residential type mainly consists of urban and rural residential types comprising about 37.66% (7,250.47 ha) of the City's total land area. The urban type constitutes 2,534.20 ha of the total residential land area, while the rural accounts for 4,706.37 ha.

The commercial area ranks second lowest in terms of land allotment. This land use type is commonly found along existing transport lines and National Highway. A portion of the Cabanatuan manufacturing industry is associated with the commercial service areas, which is about 18.58 ha. These are mostly tricycle sidecar manufacturing, and hollow blocks and ceramic manufacturing which are converged along the existing Cagayan Valley Road (Pan-Philippine Highway) from Zulueta St. to General Luna St. As well, rice mills and lumber yards are operating in the City.

The government centers in Cabanatuan City are located in five clusters. The seat of the Provincial Government and other provincial branches of national agencies in the City are bounded by Brgy. Quezon District, Sangitan, Padre Burgos, and San Roque. The City Hall Compound, which covers three (3) ha of Kapitan Pepe Subdivision Phase II accommodates the executive and legislative branches of the Cabanatuan City Government.

The educational area, which comprises about 78.93 ha of the City's total land area, is well distributed in five clusters within the city. These are composed mainly of private educational institutions. The City's main recreational area is located in the City proper consists mainly of two (2) big parks namely, 1) Freedom Park and 2) Plaza Lucero. This represents roughly 0.83% or 160.42 ha of Cabanatuan City's the total land area.

Strategic Agricultural and Fishery Development Zone (SAFDZ)

The present SAFDZs in the Province of Nueva Ecija are approximately 291,360 ha. During the conduct of the study however, there is no available map to determine the location of the said zones. Accordingly, the SAFDZ Map of Region III was submitted to the Regional Office for updating.

The classified SAFDZs of Nueva Ecija area as follows:

Strategic crop sub-development zone, 241,450 ha;

Strategic livestock sub-development zone, 28,835 ha;

Strategic fishery sub-development zone 8,555 ha;

Strategic crop/livestock sub-development zone 4,805 ha; and

Strategic crop/fishery sub-development zone 7,715 ha

The remaining Network of Protected Agricultural Areas and Agro-Industrial Development (NPAAAD) are about 7,270 ha.

16.2.2.2 Biological Aspects

Terrestrial Flora

The flora composition in the project area is classified under the primary vegetation, which can be divided into two (2) major types namely the (i) natural vegetation and the (ii) cultivated vegetation. The natural type consists mainly of the lowland grassland associated with shrubland. The cultivated type on the other hand is comprised of agricultural and built-up types.

A diverse species of common riceland and wasteland weeds, grass shrubs, and herbs characterize the lowland grassland vegetation type. Species belonging to different families such *Cyanotis axillaris* (alikbangon), *Chromolaena odorata*

(hagonoy), *Echinochloa crus-galli* (dawa-dawa), *Saccharum spontaneum* (talahib) and *Imperata cylindrical* (cogon) were observed.

Sparse stands of trees were noted and are usually converged along the banks of rivers, creeks, and irrigation canals.

The project area's vast fertile ground, favorable climate condition, and irrigation facilities a wide variety of agricultural crops are abundantly grown and produced. Not to mention the flood plains, which are also utilized for farming.

Palay (*Oryza sativa*) is the primary crop grown in the project area. The secondary crops cultivated during rainy season are corn (*Zea mays*), okra (*abelmoschus esculentus*), sitaw (*Vigna sesquipedalis*), and water melon (*Citrullus vulgaris*). Tomato (*Lycopersicon lycopersicum*), ampalaya (*Momordica charantia*), talong (*Solanum melongena*), calabasa (*Cucurbita maxima*), and onions (*Allium sepa*) on the other hand are the most popular crops planted during the dry season.

High value crop such as mango (*Mangifera indica*) is also widely cultivated in the non-irrigated and tailend areas of the NIA.

Built-up vegetation here refers to ornamental plants found around settlement areas, as well as those along roadsides. Some of the ornamental plants species observed are *(Duranta repens* (golden bush), *Rosa cvs. and hybrids* (roses), *rosa-sinensis cvs. and hybrids* (gumamela), *Bougainvillea spectabilis cvs and hybrids* (bougainvillea), and varieties of *Vanda Dendrobium* and *Heliconias*.

There are no endangered, rare, or endemic flora species encountered along the bypass alignment.

Terrestrial Fauna

A total of 42 species was recorded within 3 days of fieldwork including one (1) bird species that was identified up to genus level only. It is comprised of three (3) species of amphibians, seven (7) species of reptiles, 25 species of birds and seven (7) species of mammals.

Endemic species for the four groups of wildlife studied is relatively low with three species or 7.14% of the total. Among the ten (10) species of amphibians and reptilian species recorded, *Naja philippinensis* (Philippine cobra) is the endemic species noted. The rest are either non-endemic or were accidentally introduced.

There are 25 bird species belonging to 16 families recorded in the area. Of the recorded species, *Centropus viridis* (Philippine coucal) is the only endemic species observed. There are also three (3) uncommon species noted. Estrilididae is the most dominant group observed with four (4) representative species. The Bird Species Diversity (BSD) computed for the site is 3.194677575.

Seven (7) species of mammals belonging to three (3) families, both volant and non-volant that were recorded in the study site. It consists of three (3) bats and four (4) small non-volant mammals. The captured bats are both fruit-eating.

The high degree of disturbance in the actual project site coupled with the absence of forest, natural marshes and other good quality wildlife habitats corresponds to the low species diversity, low incidence of endemism, single threatened species and abundance of generalist species.

There are no recorded amphibian and reptilian species that are either threatened or near threatened, (RDB, 1997; Alcala and Custodio, 1997; Alcala and Brown, 1998; Alcala et al., 199) in the study site. Except for *N. philippinensis*, which is uncommon, based on Alcala, 1986, all recorded species are common. Actual observations and field interviews will support this population condition. The low record for snake species and uncommon status of *N. philippinensis* in the study site can be attributed to the attitude of people towards snakes. They are usually eliminated on sight for fear of deadly bites. As well, there are no mammalian species encountered categorized under rare and uncommon status.

Aquatic Fauna

The average pH and temperature gathered from the Pampanga and Talavera Rivers (7.7/32.5, 7.45/28.5) showed the difference on their physico-chemical characteristics, which dictate the composition of the organisms in aquatic ecosystems in the sampling area.

As observed, Talavera River with a relatively high pH (7.7) and temperature (32.5) exhibited a very low diversity. This can also be attributed to the clarity of water, which is very turbid, allowing minimal amount of light penetration. Phytoplankters are producers and depend so much on light for reproduction. The high turbidity of the river hinders growth and propagation of phytoplankters. There is no indication of possible eutrophication in the river systems.

Nutrient level and composition of the aquatic ecosystem also dictate its biotic composition where in this case, the sources of these chemical characteristics are farmlands, and anthropogenic

Zooplankton community on the other hand is not as diverse as the phytoplankton community. Talavera River once again demonstrated a very low diversity compared to Pampanga River. The number of individuals were also few as observed under the microscope.

Other organisms found in the sampling areas are crabs or "talangka", shrimps or "ulang", *Tilapia* sp., mudfish or "dalag", carp, gurami, gobby or "biya", "lokaok" and other edible fishes.

16.2.2.3 Socio- Economic Aspects

The following socioeconomic information on the project-affected persons (PAPs) and families are based on the census and socioeconomic survey undertaken from 17 July to 16 August 2001. A total of 260 affected persons were interviewed.

Demography and Basic Information

Household Size

The household size of respondents on a per barangay basis have an average household size of "5-7" and "1 to 4". Only 2.5% have household size greater than 10.

Educational Attainment

Based on the survey conducted, majority or 27.0% of the male spouse respondents are elementary undergraduates. There are about 23.0% elementary graduates and 24.3% high school graduates. For the female spouses, a

relatively high percentage of 31.6% finished elementary education. Elementary undergraduates on the other hand represent nearly 18.4%, and high school graduates, 13.2%. In terms of college education, survey showed that there are more female spouses (10.5%) who went to college than male spouses (5.4%).

Socioeconomic Characteristics

The socioeconomic characteristics of the respondents described in this section are based on the results of the survey conducted. Their standard of living and socioeconomic status are evaluated using the following socio-economic indicators: (i) sources of income; (ii) household income and expenditures and type of; (iii) lighting, (iv) water supply, (iii) cooking fuel, and (iv) sanitation facilities.

Primary Occupation

Farming is the respondent PAPs' primary occupation. As culled from the survey, majority of the respondents are farmers (65.7%). This is expected since Nueva Ecija's economy is agriculture-based.

Household Income

Close to 69.9% of the surveyed households are above P71,304, Region 3's annual poverty threshold for a family of six (based on incidences in 1997, Philippine Statistical Yearbook, 2000). Those who fall between P39, 239 and P71,304 comprise only 7.4%. The percentage falling below the annual food threshold of P39, 239 (22.7%) represent the PAPs who would be highly vulnerable to impoverishment if their farm income are taken away from them.

Sources of Income

The respondents' income were classified into two; i.e., farm and non-farm income to understand the nature of the PAPs' source of livelihood. In all barangays, if the income of the respondents would be derived from farming only, 44.0% would still be above Region 3's poverty threshold, and 46.1% would already fall below the threshold. If the PAPs' incomes were solely obtained from non-farm sources, a higher majority of 56.4% would fall below the annual food threshold, and only 35.8% would earn more than P71,304 per annum. These figures reflect the PAPs' dependence on agriculture as their major means of livelihood. However it also indicates that the farmers also need other sources of income to augment their incomes.

Household Expenditures

The respondents in all barangays disclosed that food expenses represent bulk or 67% of their total annual expenditures. They also spend approximately 16.6%, 7.6%, and 1.2% of their income for education, electricity, and taxes, respectively. This indicates that crops obtained from the farmlands are more of a source of income, rather than as sustenance.

Aside from the household expenses mentioned above the respondents also allot significant amount of their income for buying farm supplies and implements such as seedlings, fertilizers, and pesticides as well as for paying farm labor which is approximately P1,126,408.00, equipment rental, which is close to P408,320.00, and at least P347,019.00 for irrigation costs.

Net Income

Almost 80% of respondents' total incomes are spent on household expenditures, whereas around 20% goes to farm expenses.

Tenure

In terms of tenurial status, majority of the respondent PAPs, or 46.8% are landowners, 30.0% are occupying lands with prior consent from the respective landowners, and 21.1% are tenants.

Availability of Basic Social Services

Among the households interviewed, a high percentage of 84.9% have access to electricity as a source of lighting. Only 10.9% still use kerosene for illuminating their houses.

Water Supply

In terms of source of water supply, majority or 65.6% of the respondents revealed that they obtain domestic water supply from artesian wells, 23.2% from pumped wells, whereas 5.6% have piped connections.

Sanitation Facilities

Another indicator of standard of living is deficiencies in terms of sanitation facilities. Most of the residents at the host barangays use the semi flush type (68.6%) of toilet. Others use the Antipolo type (16.1%).

Cooking Fuel

Majority of the respondent PAPs (71.8%) are still using kerosene to cook their food. Those who are using wood for cooking represent 15.3% of the respondents. However, 7.3% are already using LPGs in their kitchens.

Available Skills in the Community

A high of 105 or 48.8% of the female respondents disclosed that they have knowledge in cooking. More than 20% are skilled sewers. Office workers represents for 19.5% of the total respondents asked. Others said they work in factories (5.6%), while others offer utility services (3.7%).

Driving is the number one skill of male respondents in the direct impact areas. Of the 199 people interviewed, 78 or 39.2% are drivers, followed by the laborers 53 or 26.6%, and then by the carpenters 47 or 23.6%. Mechanics heavy equipment operators represent 3.5% of the total, while masons represent 3.0%.

16.2.2.4 Social Acceptability

Based on a 100% interview, a fairly high 70.8% of the respondents expressed that they are in favor of the proposed Cabanatuan Bypass, whereas 29.2% said that they are not in favor. When asked why they are in-favor of the Project, the top two (2) answers were because (i) *it will improve the quality of life of people, particularly those near the bypass* (45.8%) and (ii) *it is a government project and they cannot do anything but accept it* (*Others*, 24.9%). The second and third answers indicate that the communities believe that the construction of the road will bring about progress and development in the area, and that it will be felt in terms of improved quality of life.

For those who do not favor the construction of the Bypass, the main reasons *are*, (i) *because it "will displace people"* (30.5%), followed by (ii) *they might not be compensated properly as they have experienced before* (*Others*, 15.3%).

16.2.3 San Jose Bypass

16.2.3.1 Physico-Chemical Aspects

Pedology

The soil cover of San Jose City is generally classified into four (4) major types. Umingan Silt Loam covers majority of the City's land area. This soil type exhibits low fertility shallowness, and slight alkalinity and salinity. The Maligaya Silt Loam is predominantly found in the southeastern portions of the City. This is very ideal for cultivation of rice and onions. Maligaya Clay Loam is similar to the Maligaya silt type series. This type is mostly found in Brgy. Sto.Niño 3rd and portions of Brgy. Caanawan. The third type of soil, the Annam Clay Loam is a well-drained soil and shallow for cultivation, thus limited to pasture, tree farms or forests.

Slope

Level to very gently sloping topography predominates in San Jose City with slopes varying from 0-3%. This starts from the boundary between the City and the Municipality of Muñoz on the south and extends up to the urban center in Brgy. Poblacion to Brgy. Tayabo on the northeast. Undulating to rolling areas are found in the northern part of the City as well as the rolling to hilly terrain. Slopes ranges from 8-30%.

Erosion

The urban and sub-urban areas of the City experience no apparent erosion (E_0). These are situated on a flat to nearly level terrain and the slope under this class ranges from 0-3% with no gullying. Slight (E_1) to moderate (E_2) erosion occurs in the northeastern barangays of the City. Slope in these areas range from 3-8% and 8-30%, respectively.

The mountainous areas in the northern part of the City experience severe erosion (E_3). The slopes are steep to very steep and strongly slanting. Slopes having 30% or greater with severe dissection and shallow soil profile characterize this erosion.

Hydrology

Surface Water

The water resources in San Jose City consist primarily of the rivers and streams that originate from the Caraballo Mountains in the north and a few draining hills on the eastern flank of the City. There are no lakes or man-made reservoirs in the project area.

Talavera River is the only significant surface water body that can be tapped as a water supply source. This river stems from the Caraballo Mountains directly north of San Jose City near the boundary between Nueva Ecija and Nueva Vizcaya. It runs on a north to south direction cutting through the middle of the City.

Water Quality

A total of four (4) water sampling stations were established along the upstream and downstream portions of the selected waterways crossed by the bypass alignment. The water samples collected from the rivers, creeks and irrigation canals were analyzed for parameters such as BOD, Bacteriology (coliform), and TSS. Please see Table 16.2.3-1 for the results of the sampling and analyses.

TABLE 16.2.3-1 WATER QUALITY SAMPLING RESULTS, SAN JOSE BYPASS

		Parameters					
		pH	Temp. °C	5-day 20° BOD, mg/L	TSS, mg/L	Coliform, (MPN/100 ml) Fecal coliform	Transpa-rency
DENR Standard Class C Water		6.8 to 8.5	Max. 3° inc.	7 mg/L	Not more than 30 mg/L increase	5,000 MPN/100 ml	clear
Sampling Station No.	Date & Time Sampled						
1	08/01/01 0627	7.6	27°C	1.0	5.8	≥16,000,000 (+)	clear
2	08/01/01 0725	7.7	27°C	126.0	14.0	24,000 (+)	clear
3	08/01/01 0931	7.5	29°C	12.3	47.8	16,000,000 (+)	Turbid brown
4	08/01/01 1025	7.1	29°C	81.5	33.7	≥16,000,000 (+)	Turbid brown

Station 1 *Cabitbitnungan Creek* (UPSTREAM), at Brgy. Kita-Kita (Approximately 700 m from the bypass alignment)

Station 2 *Cabitbitnungan Creek* (DOWNSTREAM), at Brgy. Kita-Kita (Approximately 700 m from the bypass alignment)

Station 3: *Panlasian Creek* (UPSTREAM), at Brgy. Sto. Niño, 2nd (Approximately 600 m from the bypass alignment)

Station 4: *Panlasian Creek* (DOWNSTREAM), at Brgy. Abar 2nd (Approximately 350 m from the bypass alignment)

The result showed that all samples analyzed for bacteriological content, specifically coliform exceeded the standard limit. This indicates that adequate supply of nutrient supporting the proliferation of such bacteria is present in the waterways. The presence of the nutrients can be ascribed to the agricultural lands (fertilizers and organic wastes) and adjacent residential houses draining into these water bodies. Other potential sources of the nutrients are the sewage of agro-industrial farms such as poultry, piggery, and etc. that directly tapped in the waterways.

Meteorology

Based on the Modified Corona's Classification the climate in San Jose City belongs to Type I. This climate type is characterized by two (2) pronounced seasons – the wet and dry. The City experiences a relatively dry period during the months of November to April. Wet months on the other hand are from June to October.

The project area receives an annual rainfall of about 1904.3 mm. The highest precipitation amount of 381.9 mm was recorded in August. This month also registered the longest number of rainy days with 23. The mean monthly temperature in the area varies from as low as 25.3°C in January to as high as 29.5°C, which is experienced in May. The annual average mean temperature is 28.0°C. The highest mean monthly high relative humidity of 87% is felt in August, while the lowest are experienced during the months of February to April, which is about 73%. The warmest months are from April to June with mean values ranging from 29.5°C to 28.8°C.

The principal air streams that are significantly affecting the study area are the Northeast Monsoon, Southwest Monsoon, and the North Pacific Trades. The Northeast Monsoon predominates from October to May. The Southwest Monsoon on the other hand prevails from June to September. The North Pacific Trades is the southern portion of the North Pacific anti-clyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast

Ambient Air Quality

Three sampling stations were established along the bypass alignment. The sites selected are representatives of areas with high-density population and vehicular traffic, medium density population and traffic, and low-density population and traffic.

The sampling results based on a 1-hour sampling showed that the observed level of air pollutants such as SO_x, NO_x, and particulate matters are way below the permissible standard limit. The result of the 24-hour averaging also proved the same (Please refer to Table 16.2.3-2)

TABLE 16.2.3-2 AIR QUALITY & NOISE LEVEL SAMPLING RESULTS, SAN JOSE BYPASS

			Concentration in µg/Ncm							
			Sampling Results				DENR Standards			
Sta. No	Date & Time	Ave. Time	Noise Level	SO_X	NO_X	TSP	Noise Level	SO_X	NO_X	TSP
1	06/08/01 1710–1810	1 hr	67-85	60.66	41.96	1171.59	70	340	260	300
2	06/08/01 1400–1500	1 hr	56-64	6.07	10.88	121.20	65	340	260	300
3	06/08/01 1215–1315	1 hr	44-53	17.06	23.80	163.65	65	340	260	300
	06/08/01 1330–1330	24-Hrs Ave.	-	12.32	20.06	123.16	-	180	150	230

Station 1 Along the intersection of the Maharlika-Bonifacio St., Brgy. R. Rueda, San Jose City (Approximately 2.5 km from the bypass alignment)

Station 2 Along the San Jose-Lupao Road, Brgy. Sto. Niño 2nd, San Jose City (Approximately 50 m from the bypass alignment)

Station 3: Sitio BLISS, Brgy. Malasin, San Jose City (Approximately 100 m from the alignment)

Noise Level

The observed noise levels along the sampling stations are very well within the standard limit. The recorded noise levels were attributed to the instantaneous peaks generated by the vehicles passing by during the conduct of the sampling.

Land Use

General Land Uses

Urban development is marked by concentration of major infrastructure and investments in the core area of the urban zones and moderate level of services *and the sub-urban area.* The road-grid is subdivided into inter-link units of dependent streets with four major roadways and seven perpendicular connections including the Maharlika Highway. The grid of each unit is generally regular and rectangular in the Central Business District (CBD) where all roads are concrete. Concentration of commerce, administration, government institutions, two local colleges and numerous private schools characterize the CBD.

Approximately **70%** of the City's flat lands are used for agricultural purpose. The rural areas are generally flat. A highland agriculture practice also pervades the City's mountainous zones resulting to excessive soil erosion flash floods.

Strategic Agricultural and Fishery Development Zone (SAFDZ)

The present SAFDZs in the Province of Nueva Ecija are approximately 291,360 ha. During the conduct of the study however, there is no available map to determine the location of the said zones. Accordingly, the SAFDZ Map of Region III was submitted to the Regional Office for updating.

The classified SAFDZs of Nueva Ecija area as follows:

- Strategic crop sub-development zone, 241,450 ha;
- Strategic livestock sub-development zone, 28,835 ha;
- Strategic fishery sub-development zone 8,555 ha;
- Strategic crop/livestock sub-development zone 4,805 ha; and
- Strategic crop/fishery sub-development zone 7,715 ha

The remaining Network of Protected Agricultural Areas and Agro-Industrial Development (NPAAAD) are about 7,270 ha.

16.2.3.2 Biological Aspects

Flora

The flora composition in the project area is classified under the primary vegetation, which can be divided into two (2) major types namely the (i) natural vegetation and the (ii) cultivated vegetation. The natural type consists mainly of the lowland grassland associated with shrubland. The cultivated type on the other hand is comprised of agricultural and built-up types.

The common riceland and wasteland weeds, grass shrubs, and herbs characterize the lowland grassland type of vegetation. Representative species belonging to different families such spiderwort, grass, and soapberry were noted. These include *Cyanotis axillaris* (alikbangon), *Chromolaena odorata* (hagonoy), and *Echinochloa crus-galli* (dawa-dawa). Groves of *Saccharum spontaneum* (talahib) and *Imperata cylindrical* (cogon) are also common.

Sparse stands of trees were as well noted and are usually converged along the banks of creeks and irrigation canals.

Palay (*Oryza sativa*) is the primary agricultural crop grown in the project area. The secondary crops cultivated include a wide assortment of onions (*Allium sepa*) such as Yellow Granex, Red Shallot, and Red Creole as well as other high-yielding variety of vegetables such as garlic (*Allium savitum*), green corn (*Zea mays*), tomato (*Lycopersicon lycopersicum*), ampalaya (*Momordica charantia*), talong (*Solanum melongena*), calabasa (*Cucurbita maxima*).

Built-up vegetation refers to ornamental plants found in and around the settlement areas and those along the roadsides. Some of the ornamental plants observed are *Duranta repens, c.v.* (golden bush), *Rosa cvs. and hybrids* (rose), *Hibiscus rosa-sinensis cvs* (gumamela), and *Bougainvillea spectabilis cvs and hybrids* (bougainvillea), Complementing the abundantly cultured varieties of *Vanda* and *Dendrobium (Orchidaceae)* species and hybrids are the *Heliconias* (false bird's of paradise, hanging lobster claw, golden lobster claw, and parrots' flower).

There are no endangered, rare, or endemic flora species encountered along the bypass alignment.

Terrestrial Fauna

A total of 43 species was recorded within 3 days of fieldwork. It is comprised of three (3) species of amphibians, seven (7) species of reptiles, 26 species of birds and seven (7) species of mammals. The Bird Species Diversity (BSD) computed

for the site is 2.887202126. Endemic species for the four groups of wildlife studied is relatively low with three (3) species only or 7.14% of the total. These species are *Ptenochirus jagori* (musky fruit bat), *Naja philippinensis* (Philipine cobra), and *Anas luzonica* (Philippine duck). The high degree of disturbance in the actual project site coupled with the absence of forest, natural marshes and other good quality wildlife habitats corresponds to the low species diversity, low incidence of endemism, single threatened species and abundance of generalist species.

There are no recorded amphibian and reptilian species that are either threatened or near threatened, (RDB, 1997; Alcala and Custodio, 1997; Alcala and Brown, 1998; Alcala et al., 199) in the study site. Except for *N. philippinensis*, which is uncommon, based on Alcala, 1986, all recorded species are common. Actual observations and field interviews will support this population condition. The low record for snake species and uncommon status of *N. philippinensis* in the study site can be attributed to the attitude of people towards snakes. They are usually eliminated on sight for fear of deadly bites. As well, there are no mammalian species encountered categorized under rare and uncommon status.

16.2.3.3 Socio- Economic Aspects

The Host Barangays

The following socioeconomic information on the project-affected persons (PAPs) and families are based on the census and socioeconomic survey undertaken from 17 July to 16 August 2001. As previously mentioned, a 100% census was carried out for all PAPs. Based on the survey, there are a total of 94 affected persons and families and one (1) public infrastructure facilities (waiting shed).

Household Size

As gathered from the survey conducted, majority of the respondents have an average household size of "5-7" and "1 to 4". Only 5.3% have household size greater than 10. The household size of PAPs per barangay.

Education

About 34.8% of the total of the female spouses consulted are elementary undergraduates. Those who graduated represent approximately 21.7%. For the male spouses, 36.2% are high school graduates and while 21.3% are under-graduates. Only 4.3% and 8.7% male and female respondents respectively, finished college education.

Primary Occupation and Household Income

Farming is the primary occupation of the people in the direct impact areas. A high percentage of 81.6% of the respondents are farmers. This is not surprising since the economy of San Jose City is primarily agriculture-based.

In terms of household incomes, the survey results showed that majority are above P71,304, Region 3's annual poverty threshold for a family of six (based on incidences in 1997, Philippine Statistical Yearbook, 2000). Only 14.9% fall below the annual food threshold of P39, 239. Since the economy of San Jose is generally agriculture-based, it becomes necessary to assess the PAPs' dependence on land as a source of livelihood. The PAPs' household incomes are further subdivided into two (2) types: farm and non-farm incomes to better understand the effects of possible displacement. Farm income refers to

household earnings derived from farming and other related agricultural activities. Non-farm income pertains to salaries and wages from employment, profit from business operation, and remittances from working family members who do not live with the PAPs.

In all barangays, if the income of the respondents would be derived only from farming, 52.1% would still be above Region 3's poverty threshold and 28.7% would already fall below the threshold. If the PAPs' incomes were solely derived from non-farm sources such as those mentioned above, only a higher majority (62.8%) would fall below the annual food threshold, and only 16% earn more than P71,304 per annum. This clearly shows the PAPs' dependence on agriculture as their major means of livelihood.

Household Expenditure

The respondents revealed that food expenses comprise bulk of their total annual expenditures in all barangays with 74.5%. Other basic expenses are education (17.9%), electricity (5.4%), and taxes (1.5%). They also pay the sum of P569,995.00 or 22.4% of their total income for farm labor. The PAPs as well spend some percentage of their income for buying farm supplies and implements such as feeds (15.5%), seedlings (16.7%), fertilizers (23.6%), and pesticides (7.8%), and equipment rental (7.3%) and irrigation costs (3.4%).

In summation, nearly 60% of the PAPs' total incomes are spent on household expenditures, whereas around 20-25% goes to farm expenditures

Tenure

Almost half (46.1%) of the total project affected persons disclosed that they own the lands, 30.3% are tenants, and 13.5% are occupying lands with prior consent from the respective landowners.

Power and Water Supply

Of the households interviewed, a high percentage of 76.5% have access to electricity as a source of lighting. Barely 23.5% still use kerosene for illuminating their domiciles.

In terms of water source, almost 82.4% of the respondents get domestic water supply from artesian wells. This refers to water provided by the San Jose City Water District (SJCWD). The remaining 17.6% rely on pump wells or spring/river.

Sanitation Facilities

More than half (55.0%) of the residents in the host barangays use the semi flush type of toilet. A relatively high 35.0% who have none can be found in Brgy. Malasin.

Cooking Fuel

In terms of the type of fuel used for cooking, majority of the respondent PAPs (61.1%) stated that they are already using LPGs in their kitchens. However, others are still using wood for cooking food (22.2%)

Labor Skills

Driving (35.4%) is the number one skill among the male spouses interviewed. This followed by labor skills with 29.3%.

About 55.4% of the female spouses consulted have knowledge in cooking. Twenty percent (**20%**) are skilled sewers, whereas 14.1% are office workers.

16.2.3.4 Social Acceptability

Based on a 100% interview of the affected communities, a very high 90.9% of the respondents expressed that they are in favor of the proposed San Jose Bypass.

When asked why they are in-favor of the Project, the top two (2) answers were, (i) *the Bypass will improve the quality of life of people* in the City, particularly those near the bypass (36.3%); and (ii) *it will improve accessibility* (32.5%). These two (2) answers indicate that the communities believe that the construction of the road will bring about progress and development in the area, and that it will be felt in terms of improved quality of life. The second reason is obvious, since the bypass would enable the people, particularly those who frequently travel from Metro Manila and other southern Tagalog regions to reach their destinations without having to go through long queues of traffic.

The remaining 9.1% who do not favor the construction of the Bypass, the main reason is understandable; i.e., because it "*will entail losses in income and land*".

16.3 Environmental Impact Identification, Assessment, & Mitigation

The predicted environmental impacts, along with the mitigation (for negative impacts) and enhancement (for positive impacts) measures are presented in Table 16.3-1, Impacts and Mitigation/Enhancement Matrix.

16.4 Environmental Management / Monitoring Plan

The Environmental Management and Monitoring Plan is presented as Table 16.4-1.

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCTION PHASES PHYSICAL ENVIRONMENT			
Land	Construction of the bypass will inevitably reduce the area of productive farmlands along the alignment	*Long-term, negative*	• The construction of the bypass alignment along agricultural areas will be limited to the required ROW of **32 meters**; • Bypass sections with frontage or service roads are concentrated in areas designated or are planned by the respective city or municipality for commercialization; and • Fertile top soil which contain moisture-retaining organic humus will be transferred to other farmlands;
Hydrology	Improper and indiscriminate disposal of cut vegetation may impede the flow of the rivers, creeks, and irrigation canals crossed by the bypass alignments	*Short-term, negative*	• Since the alignment will generally traverse agricultural areas with sparse trees, vegetation cover to be cut is expected to be minimal; • Secondary cut logs will be properly surrendered to the nearest DENR Office; and • Small pieces of logs, twigs, shrubs, etc. will be disposed accordingly at DENR-approved disposal site/s
	Increase in the rate of siltation along the waterways crossed by the bypass alignments It is important to note here that the present the sources of siltation are: • Continuous extraction of aggregate materials during summer;	*Short-term, negative*	• Temporary sediment traps will be constructed at critical construction areas such as rivers, creeks and irrigation canals to prevent siltation of these waterways; • Excavated unsuitable materials, construction spoils, and fill materials for temporary stockpiling will be located in properly designated areas far from the waterways. These will be covered with tarpaulin, canvass or sack materials to prevent these materials from being carried away by run-off, particularly during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Water Quality	Bored piling at river bed for bridge substructure and alteration of stream/river flow to accommodate construction of works would increase the turbidity along major waterways crossed by the bypass alignments	*Short-term, negative*	This impact is unavoidable but temporary in nature. Condition of the waterways will be back to normal about a year or two after the construction works are completed
	Possible Increase in the bacteriological content, particularly coliform, of local surface water bodies due to domestic wastes generated by construction personnel	*Short-term-negative*	Temporary sanitation facilities such as portable toilets and garbage bins will be provided by the Contractors to ensure that domestic wastes generated by the construction personnel are properly handled and are not thrown directly into the waterways to prevent pollution of the surface water bodies
	Possible contamination of local surface waters due to washing of construction machinery and other mobile equipment such as transit mixers and dump trucks may contaminate local surface waters. As well, improper handling of chemicals such as lubricants, fuel, paint, and other solutions for routine vehicular operation may have similar effects	*Short-term-negative*	• Contractors will be prohibited from washing of construction vehicles and other mobile equipment along the waterways to prevent spillage of oil and grease and other contaminants to the receiving surface waters; and • Lubricants, fuel, paint, and other chemicals solutions utilized for routine vehicular operation will be carefully handled and properly stored in a temporary storage area far from the waterways to prevent possible contamination of rivers, creeks, and irrigation canals
Air Quality	Dozing, stripping, earth moving, and other related activities involved during the pre-construction and construction phases of the project may possibly add to the present level of suspended particulate matters within the construction and adjacent areas. Temporary stockpiles of excavated and surplus materials as well as fill and embankment materials may also add to the present TSP levels.	*Short-term-negative*	• Exposed and cleared construction areas will be regularly sprayed with water; • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s; and • Temporary stockpiles of fill and embankment materials will be covered with tarpaulin, canvass or sack materials to prevent re-suspension of particulate matters

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Air Quality	Possible increase in exhaust gas emission levels such as SO_X, NO_X, CO, and other hydrocarbons generated by the various pre-construction and construction equipment	*Short-term-negative*	• Contractors will be required to conduct daily routine equipment and machinery check-ups; and • Regular tune-up and maintenance of construction equipment and machinery will be strictly complied with
Noise Level	Possible increase in noise level generated by the various construction heavy equipment and machinery during the pre-construction and construction phases of the project	*Short-term-negative*	• Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain noise generated by the various heavy equipment and construction machinery at permissible limits; • Being direct receivers of the noise generated by the construction equipment and machinery, operators will be provided with earmuffs to avoid drastic effects; and • High-noise generating pre-construction and construction activities will be scheduled during daytime to minimize disturbance to surrounding residential areas;
BIOLOGICAL ENVIRONMENT			
Flora	Minimal loss of vegetation covers along the bypass alignments due to site clearing and grubbing	*Long-term, negative*	• This impact is considered minimal and insignificant, since the areas to be traversed by the alignments are mostly agricultural with sparse stands of trees usually concentrated along the banks of rivers, creeks, and irrigation canals; • Construction of the bypass alignment will be limited to the required ROW of **32 m** along prime agricultural areas and **50 m** along urbanized areas with frontage or service roads; and • Just compensations will be accorded to owners of damaged agricultural crops and fruit bearing trees in accordance with the existing DPWH ROW Acquisition Guidelines

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
BIOLOGICAL ENVIRONMENT			
Terrestrial Fauna	Actual displacement of wildlife species caused by the complete habitat transformation along the areas traversed by the bypass alignments It should be noted here that actual field survey along the project site revealed that the area is already highly disturbed. Critical habitats such as forests and natural marshes along the actual alignment and within a 2-3 kilometer perpendicular distance on both sides of the proposed bypasses are also absent. These significantly lower the projected negative effects. Moreover, most of the identified species particularly the amphibians, reptiles and mammals are common and non-threatened and sometimes considered commensals of people. In addition, all small non-volant mammals species recorded are considered pests, while the noted species endemic species for the four groups was low.	*Long-term, negative*	• The Multi-Partite Monitoring Team (MMT) that will be formed will conduct a periodic but continuous survey of wildlife vertebrates within and around the project site to obtain clearer picture of the wildlife composition. The main priority of this activity should be the endemic and threatened species; • The concerned government agency will initiate an information and education campaign in the project area. This is to disseminate the importance of conserving and protecting the remaining wildlife species as well as their habitats. The local community must be involved in this effort; and • The remaining critical wildlife habitats that will be intercepted by the alignment will be protected and conserved no matter how small in size
Aquatic Fauna	Bored piling and related bridge works along Angat River may contribute to the disturbance in the biotic community in the said waterway	*Short-term, negative*	• This impact is unavoidable but temporary in nature. Condition of the waterways will be back to normal about a year or two after the construction works are completed; and • The identified organisms are resilient and can adapt to physical changes in their environment. However, changes in the chemical characteristics of the river may be deleterious to the plankton community, the macro invertebrates and larger organisms, that is the increase in the amount of nutrient input to the river systems. It is also important to emphasize here that construction works along the river will have no significant effect on the species' food web

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Farmers may experience temporary difficulty in terms of accessibility to the farmland they *are cultivating*	*Short-term, negative*	Farmers will be provided with temporary and safe access roads and crossings for carabaos and other farm implements such as hand tractors and threshers
	Disruption of irrigation water services of farmlands adjacent to the construction areas due to construction of culverts and/or bridges. Improper disposal of surplus materials may also impede the flow of water.	*Short-term, negative*	• Temporary culverts and irrigation channels will be provided to the farmers to ensure continuous supply of irrigation water; • Temporary sediment traps will be constructed at critical construction areas such as irrigation canals to prevent siltation of said waterways; • Temporary stockpiles of excavated unsuitable materials and construction spoils will be located in designated areas to ensure that clogging of irrigation canals will not occur. These will be covered with tarpaulin, canvass or sack materials to prevent these materials from being carried away by run-off, particularly during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s
	Temporary stockpiles of stripped excavated materials, construction spoils, and fill and embankment materials may: • fill adjacent farmlands; and • cause local flooding	*Short-term, negative*	• Activities during pre-construction and construction phases will be restricted within the construction limit; • Temporary stockpiles of excavated unsuitable materials and construction spoils will be located in designated areas to ensure that clogging of irrigation canals will not occur. These will be covered with tarpaulin, canvass or sack materials to prevent local flooding, run-off and accidental filling-up of adjacent farmlands especially during high precipitation periods; and • Excavated unsuitable materials and construction spoils will be regularly hauled and disposed to the DENR-approved disposal site/s

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Construction of the bypass roads will entail: • minimal loss of properties; • permanent displacement of residential houses; and • loss/damage to means of livelihood, especially farmers	*Long-term, negative*	• Construction of the bypass alignment will be limited to the required ROW of **32 m** along prime agricultural areas and **50 m** along urbanized areas with frontage or service roads, thus permanent displacement of residential houses and damage to properties are expected to be minimal; • Just compensation will be accorded to landowners in harmony with the existing DPWH ROW Acquisition Guidelines. Agricultural tenants and lessees will be given financial assistance and disturbance compensation, respectively. These will also be in accordance with the existing DPWH ROW Acquisition Guidelines; • Depending on the discretion of owners, the DPWH may also offer the option to reconstruct a house exactly the same as the house to be affected in lot/s provided by the homeowners. The DPWH may also replace the affected land with public land of the same size available within the project area if the owner opted to have his property replaced; • Sound SDP packages will be designed according to the types and specific situations of population groups that may be displaced by the project. The DPWH must realize that the affected groups did not voluntarily put up their homes and properties for sale. As such, the guiding attitude should not only be towards offering acceptable packages but to open up opportunities for them to improve the affected communities' current situation; • The DPWH will provide alternative means of livelihood to severely project affected families, particularly those who will lose the entire parcel/s of land they are cultivating so that they can be assured of a continuous source of income; • The SDP will also include a plan that will encourage the active participation of women and other vulnerable groups (e.g. physically challenged, indigenous cultural communities, etc.); and • Informal settlers will be transferred to the designated relocation area/s provided by the host city. The DPWH through the help of the LGUs will provide basic social services such as water supply, electricity, health facilities, and means of transportation and communication

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Generation of temporary employment for qualified laborers within the host communities during the construction phase of the project	*Short-term, positive*	Qualified workers and laborers from the host communities will be given priority in hiring during the construction stage of the project
OPERATIONAL PHASE PHYSICAL ENVIRONMENT			
Air Quality	Using the vehicular emission factors and the projected traffic of the project, a ***Gaussian Dispersion Model*** was used to predict the contribution of the project to the 1-hour average ambient ground level concentrations in the area. The model results are presented in graphical outputs showing isolines of SO2, NO2, and TSP concentrations for four (4) most prevailing wind directions in the area. From these results, the maximum predicted GLCs are **156.8 µg/Ncm** for TSP, **71.29 µg/Ncm** for SO2, and **79.64 µg/Ncm** for NO2. The maximum observed ambient concentrations are **60.66 µg/Ncm** for SO2 and **41.9 µg/Ncm** for NO2. Superimposing these values to the predicted contribution of the project, the total predicted values are **131.95** µg/Ncm for SO2 and **121.54 µg/Ncm** for NO2. These are within the DENR ambient standards of 340 µg/Ncm for SO2 µg/Ncm and 260 µg/Ncm for NO2.	*Long-term, positive*	To further improve the quality of air along the existing Pan-Philippine Highway, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
PHYSICAL ENVIRONMENT			
Air Quality	The maximum observed background TSP concentration was **1599.8 µg/Ncm**. This already exceeds the DENR ambient standard of 300 µg/Ncm. However, when this project is completed the background concentrations are expected to improve and it is expected that the total predicted values will be within DENR ambient standard. As such, there would be a dramatic reduction in gaseous emissions in urban areas along the Pan-Philippine as a result of the diversion of thru traffic to the newly constructed bypass roads	*Long-term, positive*	To further improve the quality of air along the existing Pan-Philippine Highway, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations
Noise Level	There would be a significant reduction in the levels of noise in urban areas along the Pan-Philippine as a result of the diversion of thru traffic to the newly constructed bypass roads	*Long-term, positive*	To further improve the level of noise along the existing Pan-Philippine Highway to permissible limits, LGUs with relatively high local traffic volume (i.e. Plaridel, San Rafael, Gapan, Gapan, Sta. Rosa, Cabanatuan City, and San Jose City) will implement a sound traffic management plan and strictly enforce existing traffic rules and regulations
SOCIO-ECONOMIC ENVIRONMENT			
	Possible illegal conversion remaining productive agricultural lands adjacent to the newly constructed bypass roads into other uses	*Long-term, negative*	• The construction of the bypass roads along prime agricultural areas will be limited to the required ROW of **32 meters;** • Bypass sections along prime agricultural areas will be on embankment, thus providing a natural barrier discouraging commercialization of the areas fronting the newly constructed bypass roads; • Bypass sections with frontage or service roads are concentrated in areas designated or is planned by the respective city and municipality for commercialization; and

TABLE 16.3-1 IMPACTS AND MITIGATION MATRIX (CONTINUED)

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
SOCIO-ECONOMIC ENVIRONMENT			
	Possible illegal conversion remaining productive agricultural lands adjacent to the newly constructed bypass roads into other uses	*Long-term, negative*	The concerned Municipal Councils will pass a resolution or zoning ordinance prohibiting the conversion of prime agricultural areas along the newly constructed bypass roads into any other uses
	Property owners of adjacent lands to the newly constructed bypass roads will benefit from the significant increase in land values.	*Long-term, positive*	This is particularly true in sections immediately fronting service roads. Although the conversion of prime agricultural lands adjacent to the newly constructed bypass roads is illegal and ribbon-type of development is discouraged, property owners would still profit from the economic benefit that will accrue to each City/Municipality once it is traversed by a National Highway
	The newly constructed bypass roads will: • ensure continuous flow of commodity; • ease the traffic along the Pan-Philippine Highway, particularly in urban areas; and • reduce transport costs due to improved traffic flow	*Long-term, positive*	The DPWH will continuously keep its regular maintenance activities to ensure optimal service and benefits to the road users;
	Increase in employment opportunities as a result of urbanization and commercial development of non-agricultural and non-prime areas	*Long-term, negative*	• The respective LGUs will ensure that qualified members of the host community are given first priority in hiring of local labor force; and • The concerned LGUs. will wok hard towards achieving the development plans of the City or Municipality

TABLE 164-1 ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water Quality BOD, TSS, and oil and grease of surface water	All major bridge sites, RCBC, and RCPC sites	Quarterly during construction	Standard EMPASS-EQD water quality analysis.	*Class "C"* **BOD - <10 mg/L** **TSS- <30 mg/L increase** **Oil & Grease - <3mg/L**	DENR
BIOLOGICAL					
Tree Cutting	Entire alignment where there are trees to be cut	Daily	Monitoring team must ensure that tree cutting is limited within the required ROW only	N. A.	MMT
Waste management and disposal	All portions with excavation and fill activities	Weekly during construction	Site inspection	Based on EMP	DENR
SOCIAL					
Compliance of Contractor to occupational health and safety rules and regulation	All construction areas	Weekly	Site inspection of work areas including sanitation facilities	Based on EMP	MMT
Road Safety	Signalized intersections, merging lanes	Quarterly	Site inspection	Based on DPWH Standard Operating Procedures	DPWH
OPERATIONAL PHASE					
BIOLOGICAL					
Tree planting and its maintenance on both sides of the highway, and possibly at areas designated for Stage 2 construction	Designated environmental belts/zones, and R-O-W for Stage 2 construction	Monthly	Site inspection	Based on EMP	DENR MMT
SOCIAL					
Informal settling/squatting	Acquired R-O-W for Stage 2 Construction	Weekly	Site inspection	Based on EMP	LGUs, MMT
Illegal conversion of prime agricultural land	Areas adjacent to the Bypass	Weekly	Site inspection	Based on EMP	LGUs, MMT
Road condition	Bypass road, bridge, including pavement, drainage system, embankments	Based on standard DPWH maintenance procedures	Standard DPWH road and bridges maintenance works	Based on DPWH Standard Operating Procedures	DPWH

16.5 Right-of-Way Acquisition Plan

Impact on the stakeholders would mainly be in terms of loss of residential lots, idle open areas, and agricultural land. It is important to note that *names of landowners and lot numbers* reflected in the cadastral maps at the City/Municipal Assessor's Office do not match the names of the landowners obtained through interviews. As in other towns with vast agricultural lands, the discrepancy may have resulted from the partitioning of these lands into smaller parcels, either due to a natural course of action (e.g., subdivision of lots among the heirs of deceased persons), or as mandated by law (i.e., Comprehensive Agrarian Reform Law), which, were not properly updated in the records of the respective Register of Deeds. As such, a need to conduct parcellary survey prior to R-O-W acquisition is deemed important.

16.5.1 Project Affected Persons (PAPs)

16.5.1.1 Plaridel Bypass

There are a total of 210 Project Affected Persons (PAPs). Impact on the PAPs would be in terms of the need to demolish their houses and small sari-sari stores. The distribution of PAPs by barangay is shown in Table 16.5.1-1

TABLE 16.5.1-1 DISTRIBUTION OF PAPS BY BARANGAY, PLARIDEL BYPASS

Municipality	Barangay	No. of PAPs
Balagtas	Borol 2nd	4
	Sub - Total 1	*4*
Guiguinto	Tiaong	38
	Cutcut	15
	Sub - Total 2	*53*
Plaridel	Bulihan	14
	San Jose	11
	Sub - Total 3	*25*
Bustos	Cutcut	1
	Camachilihan	8
	Talampas	5
	Malamig	16
	Bonga Menor	67
	Sub Total	*97*
San Rafael	Tambobong	1
	Caingin	14
	San Roque	15
	Maguinao	1
	Sub - Total 4	*31*
	Total	**210**

16.5.1.2 Cabanatuan Bypass

There are a total of 282 PAPs at the proposed alignment of the Cabanatuan Bypass. The distribution of these PAPs in each affected barangay is given in Table 16.5.1-2.

TABLE 16.5.1-2 DISTRIBUTION OF PAPS BY BARANGAY, CABANATUAN BYPASS

City/Municipality	Barangay	No. of PAPs
San Leonardo	Magpapalayok	1
	Tabuating	1
	Sub - Total 1	*2*
Sta. Rosa	Soledad	8
	Sub - Total 2	*8*
Cabanatuan City	Sta. Arcadia	27
	Valle Cruz	36
	San Isidro	14
	Cruz Roja	41
	Sapang	24
	Buliran	5
	Pula	15
	Sub - Total 3	*162*
Talavera	Homestead I	17
	Paludpod	19
	Gulod	19
	Dimasalang Sur	6
	Bantug Hacienda	4
	Campos	11
	San Pascual	8
	Lomboy	26
	Sub - Total 4	*110*
	Total	**282**

16.5.1.3 San Jose Bypass

There are a total of 93 PAPs for the San Jose Bypass. Impact on the PAPs would be in terms of the need to demolish their houses and small sari-sari stores. The number of PAPs affected in each barangay are given in Table 16.5.1-3.

TABLE 16.5.1-3 DISTRIBUTION OF PAPS BY BARANGAY , SAN JOSE BYPASS

Barangay	PAPs
Abar 2nd	10
Sto. Niño 1st	19
Sto. Niño 2nd	16
Malasin	35
Kita-Kita	13
Total	**93**

16.5.2 Compensation and Entitlements

Computation of compensation rates and entitlements are based on existing guidelines on R-O-W Acquisition. For sections where there will be no land acquisition, payment to the **PAPs** will be in terms of improvements and disturbance compensation only. These include payments for: (i) structures (residential and commercial), (ii) fruit and forest trees, and (iii) disturbance compensation. Aside from financial compensation and assistance, the PAPs will also be entitled to the following:

(i) Subsistence allowance to those who have businesses affected due to severe impact on structure; estimated income loss provided in this report are subject to verification by the DPWH;

(ii) Priority in hiring of qualified workers during the construction period;

(iii) Provision of transportation assistance to PAPs who need to be relocated;

(iv) When relocation becomes necessary, secured tenure status for relocatees

Payment shall also include compensation to damages to improvements, which are mainly fences and trees, as well as transitional allowance to cover for income loss during the period the businesses were interrupted, without exceeding one (1) month. The amount of transitional allowance will later be determined by the DPWH.

CHAPTER 17
ECONOMIC EVALUATION

17.1 Traffic Demand Forecast

Future traffic demand forecasted in a form of OD distribution (years 2005, 2010, 2015 and 2020) was assigned on a road link network to estimate traffic volume on each bypass. The estimated traffic volume on each bypass for the cases of "without" and "with" the project are summarized in Table 17.1-1. Link traffic volume of each traffic assignment case is shown in Appendix 17.1-1.

Plaridel Bypass : After completion of Phase I of Initial Stage, it will attract about 16,800 pcu per day. Traffic volume of the existing Pan-Philippine Highway section will be reduced from 16,900 to 15,900 pcu per day. Phase I of Initial Stage will provide rather small impact on the existing section.

After completion of Phase II of Initial Stage, the bypass will attract about 26,000 pcu per day. Traffic volume of the existing section will be reduced from 20,100 to 11,900 pcu per day. Completion of Phase II of Initial Stage gives big impact on traffic.

After completion of Ultimate Stage, the bypass will attract about 42,000 pcu per day. Traffic volume of the existing section will be greatly reduced from 24,700 to 13,400 pcu per day.

Cabanatuan Bypass : Upon completion of Phase I of Initial Stage, the bypass will attract about 11,000 pcu per day. Traffic volume of the existing section will be reduced from 22,300 to 20,300 pcu per day. Traffic impact will not be so significant.

Upon completion of Phase II of Initial Stage, about 25,100 pcu per day will be attracted by the Bypass. Traffic congestion of the existing section will be greatly relieved as traffic volume will be reduced from 26,200 to 12,200 pcu per day.

In the Ultimate Stage, the bypass will attract about 35,400 pcu per day. Traffic volume of the existing section will be reduced from 31,000 to 12,200 pcu per day.

San Jose Bypass : Upon completion of the Initial Stage, the Bypass will attract about 19,800 pcu per day. Traffic volume of the existing section will be reduced from 37,400 to 19,700 pcu per day.

In year 2015, the bypass will attract about 24,600 pcu per day. Traffic volume of the existing section will be reduced from 44,000 to 21,700 pcu per day.

Table 17.1-1 Summary of Traffic Volume

(Unit: PCU)

Bypass	Case	Road		Year			
				2005 (Initial Stage, Phase I)	2010 (Initial Stage, Phase II)	2015 (Ultimate Stage)	2020 (Ultimate Stage)
Plaridel Bypass	Without	Along Existing PPH	*Range*	10,989 to 24,559	15,164 to 30,034	21,208 to 34,511	28,056 to 41,134
			Average	16,887	20,109	24,714	30,737
	With	Along Existing PPH	*Range*	9,765 to 20,710	5,999 to 24,193	6,787 to 25,939	8,517 to 31,121
			Average	15,922	11,946	13,898	17,174
		Bypass	*Range*	11,604 to 26,640	20,549 to 35,628	24,627 to 65,241	27,230 to 92,196
			Average	16,793	26,076	41,966	53,429
Cabanatuan Bypass	Without	Along Existing PPH	*Range*	13,238 to 39,556	19,243 to 49,173	20,104 to 51,987	21,034 to 56,137
			Average	22,318	26,242	30,990	36,837
	With	Along Existing PPH	*Range*	9,554 to 38,303	3,304 to 46,610	1,726 to 53,348	2,614 to 62,069
			Average	20,281	12,157	12,203	18,897
		Bypass	*Range*	3,113 to 16,631	18,277 to 28,635	25,804 to 40,839	31,466 to 47,298
			Average	11,042	25,126	35,422	41,586
San Jose Bypass	Without	Along Existing PPH	*Range*	29,402 to 35,993	32,926 to 42,201	37,654 to 50,871	43,416 to 62,113
			Average	32,575	37,391	44,016	52,416
	With	Along Existing PPH	*Range*	-	18,212 to 24,004	19,687 to 27,943	21,957 to 34,377
			Average	-	19,671	21,749	26,611
		Bypass	*Range*	-	18,197 to 22,657	22,634 to 27,648	27,736 to 33,804
			Average	-	19,848	24,613	30,054

Note: PPH = Pan-Philippine Highway

17.2 Economic Evaluation

Benefit quantified were as follows:

- Distance related vehicle operating cost savings
- Time related vehicle operating cost savings
- Travel time cost savings

Basic traffic costs are shown in Table 17.2-1. Traffic costs of "without" and "with" cases and traffic cost savings of Plaridel, Cabanatuan and San Jose Bypasses are shown in Figure 17.2-1, 2 and 3, respectively.

Cost-Benefit stream of 3 bypasses are presented in Appendix 17.2-1.

Economic analysis results are summarized in Table 17.2-2.

TABLE 17.2-2 SUMMARY OF ECONOMIC ANALYSIS

	EIRR (%)	B/C	NPV (Million ₱)
Plaridel Bypass	37.5	2.67	2,903
Cabanatuan Bypass	38.1	4.54	7,834
San Jose Bypass	76.4	9.76	2,507

The Project was evaluated economically highly feasible.

17.3 Effect of the Project

17.3.1 On Traffic

By the completion of a bypass, traffic on the existing Pan-Philippine Highway will be diverted to a bypass and road users will enjoy faster travel speed not only on a bypass but also on the existing sections of the Pan-Philippine Highway. Accordingly, travel time will be shortened to a great extent.

Table 17.3-1 shows travel speed on a bypass and the existing sections of Pan-Philippine Highway. Table 17.3-2 shows travel time and travel time reduction, and summarized below:

		Plaridel Bypass	Cabanatuan Bypass	San Jose Bypass
Upon completion of Initial Stage	Along Existing Section	15 min.	35 min.	26 min.
	Along Bypass	19 min.	38 min.	34 min.
Upon completion of Ultimate Stage	Along Existing Section	37 min.	66 min.	21 min.
	Along Bypass	58 min.	90 min.	27 min.

17.3.2 On Urban Amenity

Traffic volume along the existing section will be greatly reduced, therefore, noise level, air quality and vibration will be greatly improved. Through traffic will be diverted to a bypass, and incidence of traffic accidents will be reduced. Thus, urban amenity will be improved.

Table 17.2-1 Basic Traffic Cost And Traffic Cost By Travel Speed

Basic Traffic Cost

Vehicle Type	Running (P/km)	Fixed (P/min)	Time (P/min)
C/T/J/P/V	3.500	0.140	1.236
Jeepney	2.040	0.953	2.331
Buses	7.340	1.441	7.995
Trucks	6.310	0.445	0.000
Motorcycle	0.670	0.051	0.224
Tricycle	0.820	0.503	0.514

Traffic Costs By Travel Speed Per Mode

Car

Travel Speed (km/h)	VOCD (Pesos/km)	VOCT (Pesos/km)	TTC (Pesos/km)	Total (Pesos/km)
10.0	4.393	4.180	3.725	12.298
20.0	4.100	2.585	1.900	8.585
30.0	3.869	1.510	1.235	6.614
40.0	3.720	1.075	0.925	5.720
50.0	3.692	0.811	0.741	5.244
60.0	3.710	0.630	0.615	4.955
70.0	3.850	0.512	0.530	4.892
80.0	4.054	0.422	0.464	4.940
90.0	4.375	0.356	0.411	5.142

Jeepney

Travel Speed (km/h)	VOCD (Pesos/km)	VOCT (Pesos/km)	TTC (Pesos/km)	Total (Pesos/km)
10.0	2.409	2.405	3.667	8.481
20.0	2.200	1.400	1.833	5.433
30.0	2.070	0.932	1.220	4.222
40.0	1.993	0.700	0.913	3.607
50.0	1.970	0.559	0.732	3.261
60.0	1.977	0.460	0.609	3.046
70.0	2.029	0.391	0.522	2.942
80.0	2.137	0.338	0.457	2.933
90.0	2.329	0.299	0.407	3.035

Truck

Travel Speed (km/h)	VOCD (Pesos/km)	VOCT (Pesos/km)	TTC (Pesos/km)	Total (Pesos/km)
10.0	5.352	4.531	0.000	9.882
20.0	4.564	2.639	0.000	7.203
30.0	3.994	1.821	0.000	5.815
40.0	3.633	1.362	0.000	4.994
50.0	3.611	1.079	0.000	4.690
60.0	3.788	0.891	0.000	4.679
70.0	4.229	0.762	0.000	4.991
80.0	5.070	0.675	0.000	5.745
90.0	6.554	0.625	0.000	7.179

Bus

Travel Speed (km/h)	VOCD (Pesos/km)	VOCT (Pesos/km)	TTC (Pesos/km)	Total (Pesos/km)
10.0	3.889	3.689	12.486	20.064
20.0	3.615	2.211	6.243	12.069
30.0	3.453	1.611	4.161	9.224
40.0	3.382	1.251	3.122	7.754
50.0	3.490	1.022	2.497	7.008
60.0	3.679	0.864	2.082	6.625
70.0	4.001	0.754	1.783	6.537
80.0	4.535	0.678	1.561	6.774
90.0	5.455	0.633	1.386	7.474

Tricycle

Travel Speed (km/h)	VOCD (Pesos/km)	VOCT (Pesos/km)	TTC (Pesos/km)	Total (Pesos/km)
10.0	3.250	5.213	2.140	10.603
20.0	2.943	2.645	1.070	6.658
30.0	2.750	1.755	0.713	5.218
40.0	2.645	1.303	0.535	4.483
50.0	2.653	1.030	0.427	4.110
60.0	2.740	0.850	0.357	3.947
70.0	2.917	0.720	0.305	3.942
80.0	3.198	0.625	0.267	4.090
90.0	3.618	0.550	0.238	4.407

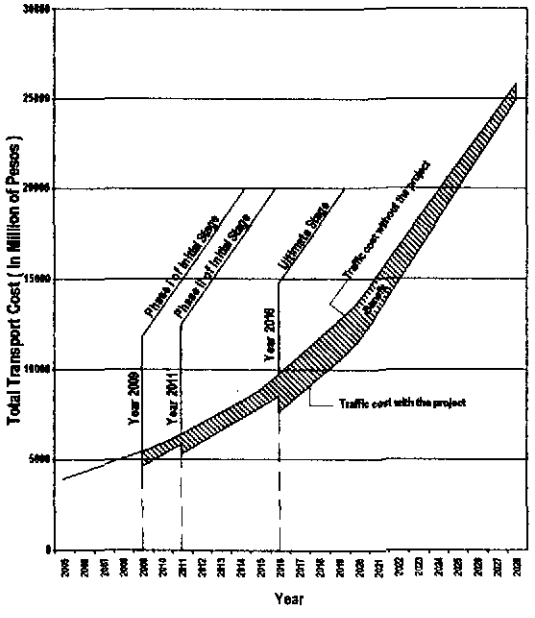


FIGURE 17.2-1 PLARIDEL BYPASS
TRAFFIC COST AND BENEFIT

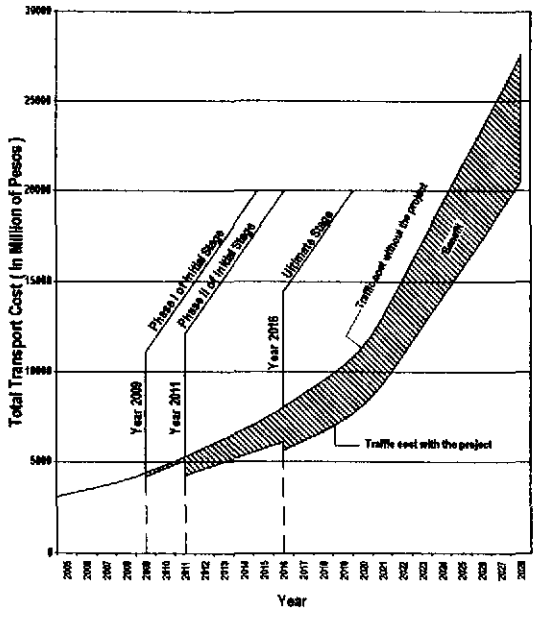


FIGURE 17.2-2 CABANATUAN BYPASS
TRAFFIC COST AND BENEFIT

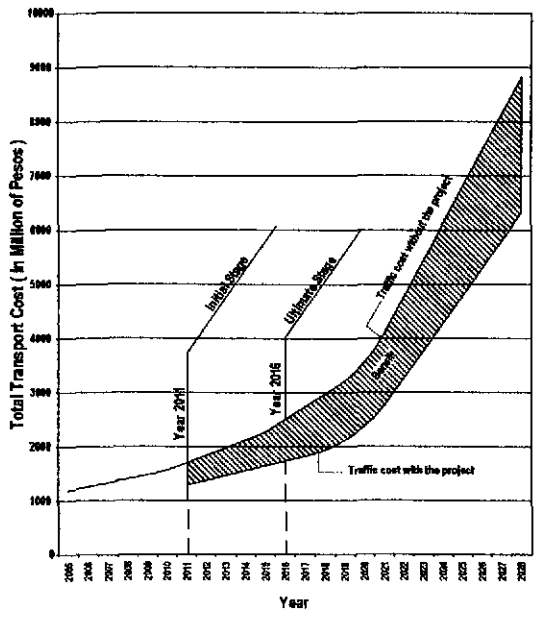


FIGURE 17.2-3 SAN JOSE BYPASS
TRAFFIC COST AND BENEFIT

Table 17.3-1 Summary of Travel Speed

(Unit: km/h)

Area	Case	Road		Year			
				2005 (Initial Stage, Phase I)	2010 (Initial Stage, Phase II)	2015 (Ultimate Stage)	2020 (Ultimate Stage)
Plaridel Bypass	Without	Along Existing PPH	*Range*	15.90 to 40.00	9.70 to 35.30	5.69 to 22.42	3.00 to 15.90
			Average	31.79	27.49	18.33	12.38
	With	Along Existing PPH	*Range*	19.20 to 40.00	16.30 to 40.00	12.71 to 40.00	8.50 to 40.00
			Average	32.80	36.12	33.22	30.55
		Bypass	*Range*	19.20 to 80.00	9.10 to 54.40	19.29 to 77.56	8.00 to 75.20
			Average	40.69	37.76	48.09	37.62
Cabanatuan Bypass	Without	Along Existing PPH	*Range*	11.10 to 35.20	4.00 to 30.00	4.00 to 29.65	3.00 to 29.30
			Average	24.55	19.94	13.74	10.00
	With	Along Existing PPH	*Range*	11.20 to 40.00	20.80 to 40.00	10.06 to 40.00	4.00 to 40.00
			Average	26.53	34.18	30.40	27.03
		Bypass	*Range*	11.20 to 80.00	23.60 to 61.20	41.60 to 74.19	31.30 to 68.80
			Average	41.59	37.58	57.13	48.70
San Jose Bypass	Without	Along Existing PPH	*Range*	4.00 to 32.20	4.00 to 29.10	10.00 to 24.06	4.00 to 19.90
			Average	15.09	11.66	12.40	5.86
	With	Along Existing PPH	*Range*	-	28.70 to 40.00	21.09 to 38.42	15.50 to 36.90
			Average	-	32.18	27.37	23.48
		Bypass	*Range*	-	48.00 to 61.40	26.47 to 44.55	14.60 to 32.80
			Average	-	56.45	37.60	25.84

Note: PPH = Pan-Philippine Highway

Table 17.3-2 Summary of Travel Time

(Unit: minutes)

Area	Case	Road Name	Year			
			2005 (Initial Stage, Phase I)	2010 (Initial Stage, Phase II)	2015 (Ultimate Stage)	2020 (Ultimate Stage)
Plaridel Bypass	Without	Along Existing NLE & PPH	42.99	51.50	83.87	133.12
	With	Along Existing NLE & PPH	35.26 (-7.73)	36.58 (-14.92)	46.88 (-36.99)	57.46 (-75.67)
		Bypass	38.33 (-4.66)	32.73 (-18.77)	25.70 (-58.17)	32.85 (-100.27)
Cabanatuan Bypass	Without	Along Existing PPH	67.31	82.86	120.28	165.18
	With	Along Existing PPH	62.28 (-5.03)	48.35 (-34.51)	54.36 (-65.92)	61.12 (-104.06)
		Bypass	49.06 (-18.25)	44.86 (-37.99)	29.51 (-90.77)	34.62 (-130.56)
San Jose Bypass	Without	Along Existing PPH	31.97	41.36	38.89	82.34
	With	Along Existing PPH	-	14.99 (-26.37)	17.62 (-21.27)	20.55 (-61.79)
		Bypass	-	7.87 (-33.50)	11.81 (-27.08)	17.18 (-65.15)

Notes: Figures in ( ) show travel time reduction
PPH = Pan-Philippine Highway

17.3.3 On Urbanization

Urbanization will be guided by new road network. The bypass is provided with a frontage road for a section planned for urbanization, therefore, bypass traffic will not be disturbed by local traffic, even when the abutting areas of the bypass are urbanized.

With new road network, sound urbanization will be achieved.

17.3.4 *On Regional Economy*

With the improved and reliable transportation facility, economic activities within the influence area (Region III) as well as inter-regional areas (between Region II and Metro Manila) will be stimulated. The Project will contribute to economic growth of not only Region III but also Region II and Metro Manila.