CHAPTER 8

MEASURES FOR UPGRADING HIGHWAY SYSTEM

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8.1 DEVELOPMENT PATTERN AND OPTIONS OF HIGHWAY

8.1.1 Development Pattern of the Highway

Urbanization in the country has been expanding along major arterial roads, particularly along the Pan-Philippine Highway with no development regulations. Urbanization pattern, therefore, is a natural growth of land along arterial roads as a ribbon type development.

Such urbanization has necessitated improvement of arterial roads as development progressed, as illustrated in Figure 8.1-1.

Step 1: Urbanization at populated area.

Step 2: Construction of bypass roads and widening in highly urbanized areas. At present, the following cities have constructed bypass or widening.

Bypass : Plaridel, Baliuag, San Miguel, Cabanatuan

Widening : San Jose

Step 3: Congestion on inter-urban section, and need of construction of bypass roads in other highly urbanized area. At present, the following cities need the improvement.

Bypass : Plaridel, Baliuag, Cabanatuan, San Jose

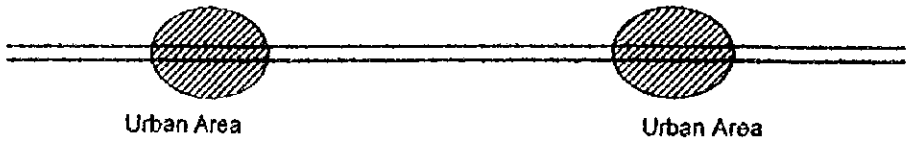
Widening : Almost all sections.

Step 4: Construction of Parallel Road

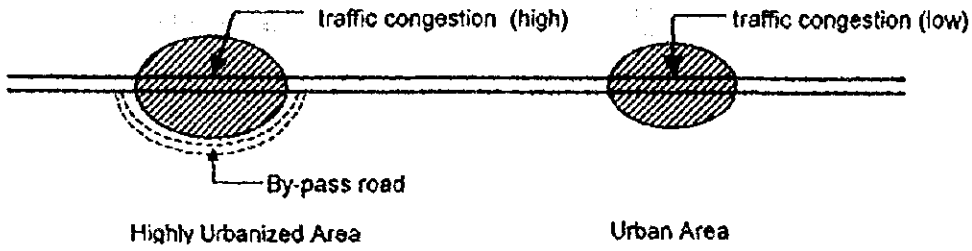
All sections of the Study may need the parallel road in the near future.

It is observed that the development program of urbanization of the Study Road may be in the Stage of Step 3, at this stage, thus construction of bypass road is highly appreciated. In planning a bypass, development patterns of the highway to be implemented in future shall be taken into consideration, such as Step 4 illustrated in Figure 8.1-1.

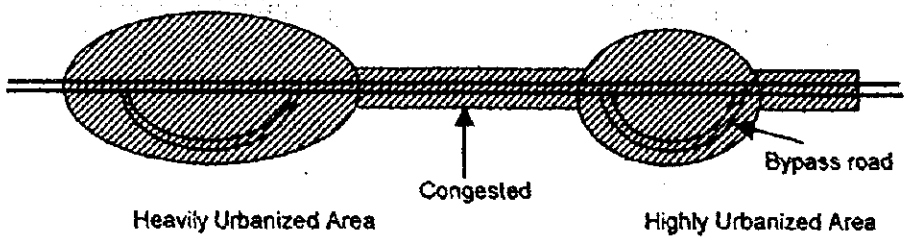
Step 1 : Urbanization taking place portion by portion along the road



Step 2 : Construction of bypass roads and widening to relieve the congestion of highly urbanized areas

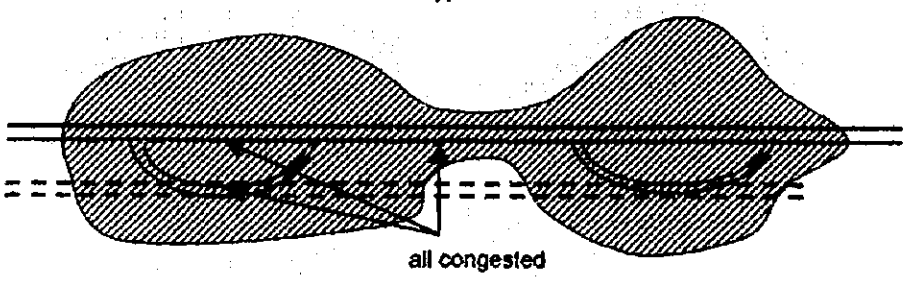


Step 3 : Congestion on inter-urban section due to development of commercial/residential area along the road, and need of construction of bypass road in other highly urbanized area



Step 4 : Contruction of parallel road when all sections, including by-pass section and inter-urban section , are congested (existing road no longer perform the function as arterial road in terms of mobility)

Method 1: Connection of Bypass



Method 2: Construction of Parallel Road

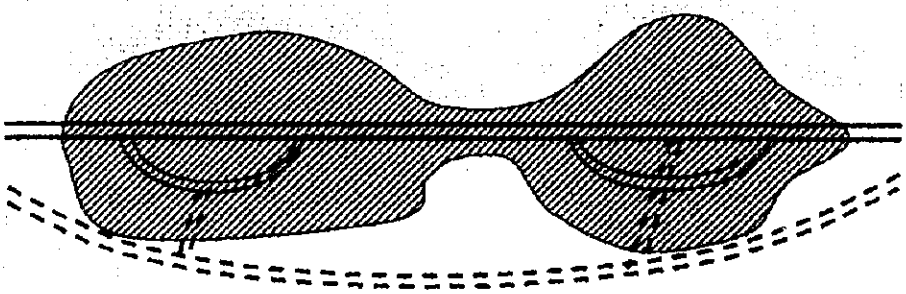


FIGURE 8.1-1 DEVELOPMENT PATTERN OF ARTERIAL ROADS

8.1.2 Development Options

In the influence area of the Study Road, several studies were conducted recommending the development programs. The main studies are as follows:

- Master Plan Study for Central Luzon Development Program (CLDP) 1995, JICA

  The Study recommended Sierra Madre Highway Project which is outlined as follows:

  Alignment

  The project is a new road linking Central Luzon with Metro Manila and the Cagayan Valley.

  It will start from a segment of the planned C-5 road in Quezon City, Metro Manila and runs northward to San Jose del Monte and Angat both in the province of Bulacan. Then it runs parallel to the Pan-Philippine Highway, traversing on the foot of the Sierra Madre Mountains. The new expressway will be about 15 km to the east of the Pan-Philippine Highway and serves towns and villages along the existing national road, such as San Ildefonso, San Miguel, Gapan, Sta. Rosa and Magasawang near Cabanatuan City. The expressway goes further northward up to San Jose City.

  Standard Typical Cross-Section

  The project road is proposed to be constructed as a 4-lane divided highway with 60.0m right-of-way, typical cross-section elements for the project road are as follows:

  - Carriageway : 4-lane divided
  - Lane width : 3.65m
  - Outer shoulder : 3.00m
  - Inner shoulder : 1.00m
  - Median : 12.00m
  - Right-of-Way : 60.00m

- Transport Infrastructure and Capacity Development Project 1999, ADB

  The Study aims at developing the transport policy action plan including toll road projects and PNR restructuring / privatization, with the emphasis of attracting greater private sector participation.

The Study includes the North Luzon Expressway East which is almost the same alignment with Sierra Madre Highway.

- Location : Bulacan, Nueva Ecija, Nueva Vizcaya
- Proponent : -
- Length : 250 km
- Estimated Cost : P15.8 Billion
- Description : Extension to Cagayan Valley
- Status : Under preparation
- Comments : BOT

- Development Options: This Study

In order to propose upgrading inter-urban highway system of the Study Road, the following two (2) development options are prepared as shown in Figure 8.1-2.

Option 1 : 2nd Pan-Philippines Highway

- Stage 1 : Construction of bypass at highly urbanized areas
- Stage 2 : Construction of 2nd Pan-Philippines Highway (4-lane), connecting with bypass under Stage 1. An alignment of the Highway will be near and almost parallel to the existing Pan-Philippine Highway.

Option 2 : Expressway

- Stage 1 : Construction of bypass at highly urbanized areas
- Stage 2 : Construction of Expressway (4-lane)
  Parallel to the existing Pan-Philippines Highway.
  An alignment of the Expressway will be far, but almost parallel to the existing Pan-Philippines Highway.

It is noted that construction of a local road (2-lane) may be required to boost a regional development of Sierra Madre area.

It was concluded through the series of discussion with the technical working group and agreed by the steering committee for the Study that Option 2; Expressway was preferable in line with the policy of the Philippine Government to enhance the involvement of private sectors and toll systems for road development.

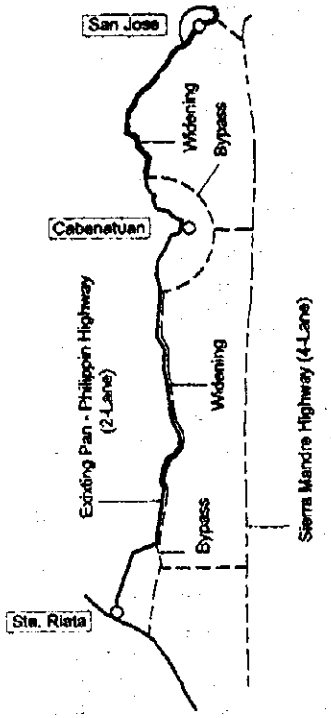
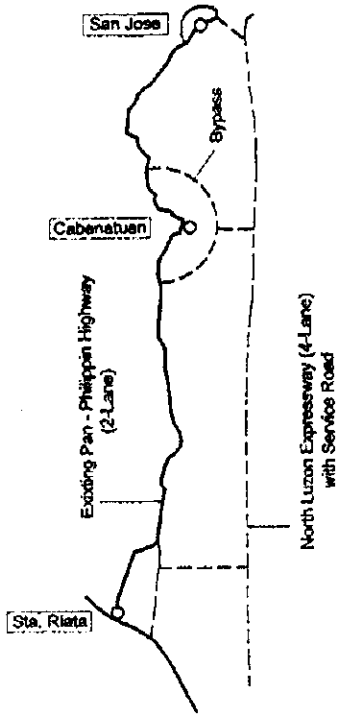
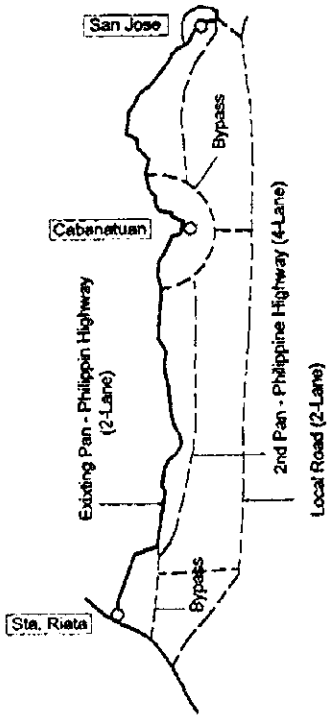
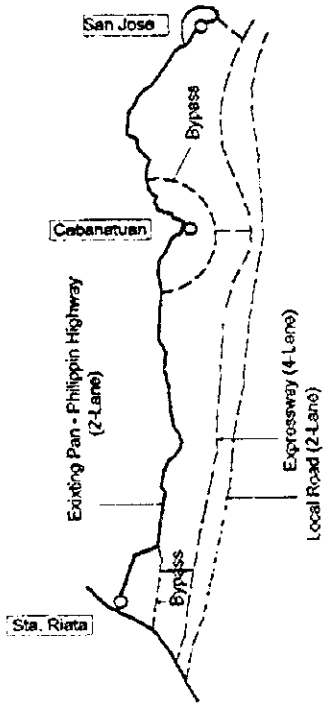
Option	Sierra Madre Highway (Regional Development Oriented)	North Luzon Expressway (Traffic Oriented)	Option 1 2nd Pan-Philippine Highway (Traffic and Regional Development Oriented)	Option 2 Expressway (Traffic and Regional Development Oriented)
Schematic Diagram				
Desired Implementation Schedule	• Sierra Madre Highway is not included in 1999 DPWH Program • The Study by JICA	• Bypass : 2005 • North Luzon Expressway - 2-lane : 2010 - Widening to 4-lane : 2020 • The study by ADB	• Bypass : 2005 • 2nd Pan - Philippine Highway - 2-lane : 2010 - Widening to 4-lane : 2020 • Local Road (2-Lane) : Depending on Regional Development	• Bypass : 2005 • Expressway - 2-lane : 2010 - Widening to 4-lane : 2020 • Local Road (2-Lane) : Depending on Regional Development

FIGURE 8.1-2 DEVELOPMENT OPTIONS

8.2 PROPOSED IMPROVEMENT MEASURES

8.2.1 Identification of Critical Sections

As discussed in Chapter 3, the traffic analysis revealed that operational conditions of the Study Road are the forced or breakdown flow (LOS F) at most intersections and almost unstable flow (LOS, early stage of E) at inter-city sections as shown in Figure 8.2-1.

Intersections

LOS C	:	San Miguel
LOS F	:	Plaridel, Baliuag, Gapan, Sta. Rosa, Cabanatuan, San Jose

Inter-city Sections

LOS B	:	After San Jose
LOS D	:	Between Gapan and Sta. Rosa Between Talavera and San Jose
LOS E	:	Between Baliuag and Gapan Between Cabanatuan and Talavera

Geometric

Sharp Curve	:	Between Baliuag and San Miguel

8.2.2 Proposed Improvement Measures

Improvement measures are discussed based on present traffic operational conditions as well as future demand, and classified into three (3) time spans as follows. See Figure 8.2-1.

Short Term (2000 ~ 2005)

1) Construction of Bypass Road

- Section from Plaridel to after Baliuag
  Km 39 ~ Km 59, L = 20 km
- Section from Sta. Rosa to Talavera including Cabanatuan
  Km 104 ~ Km 132, L = 28 km
- San Jose City Section
  Km 154 ~ Km 162, L = 8 m

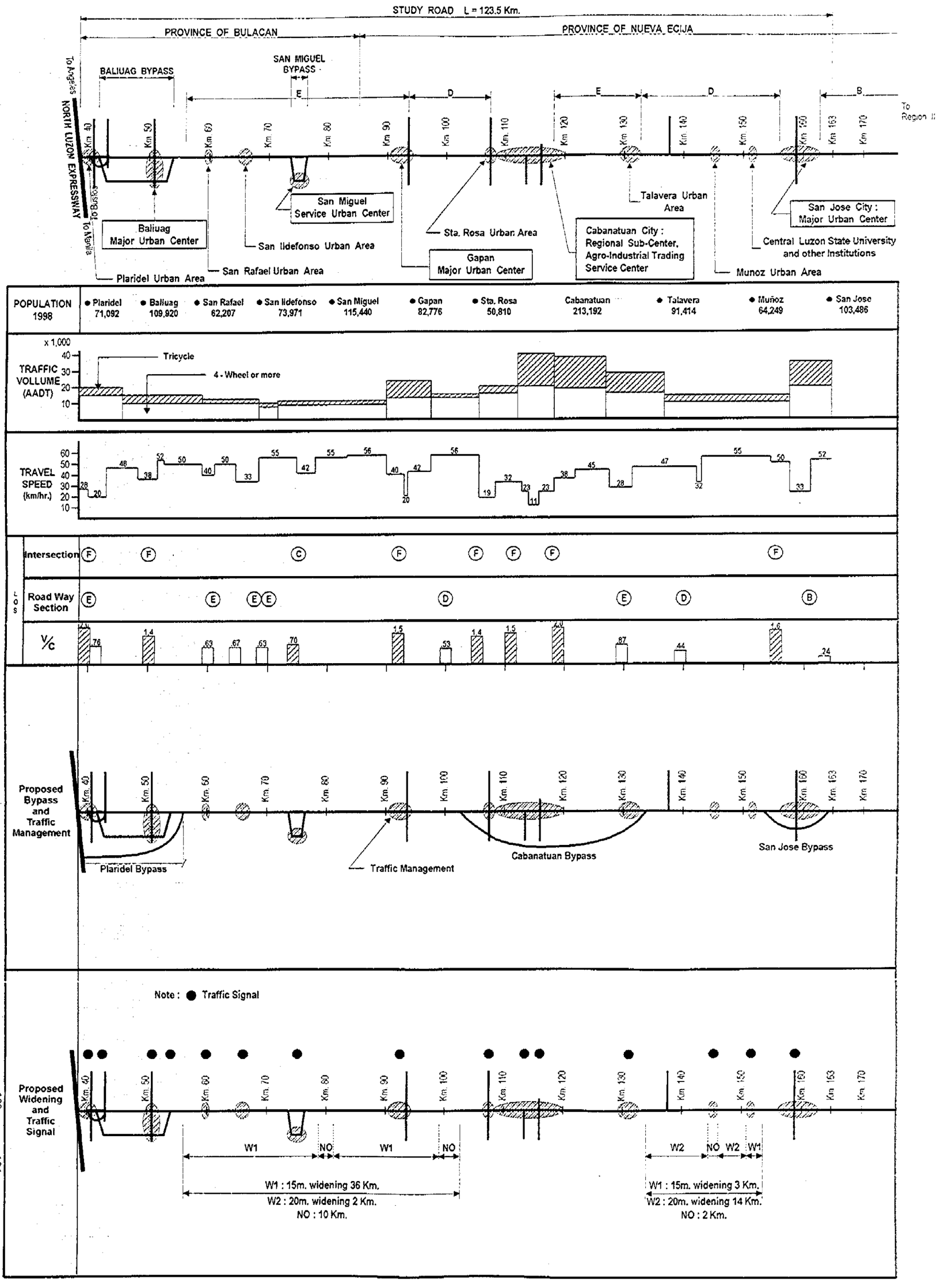


FIGURE 8.2-1 Proposed Improvement Measures

2) Enforcement of Traffic Management

- Gapan

3) Widening of Existing Pan-Philippine Highway

- For low speed vehicles (Jeepney and Tricycle); Widening W=1.65m x 2
- For ordinary vehicles; Widening W=4.15m x 2

4) Installation of Traffic Signal

- 15 locations

5) Improvement of Flood Areas

- Section before San Miguel
- Section between Sta. Rosa and Cabanatuan

Medium Term (2006 ~ 2010)

- Widening of Bypasses (to 4-lane)
- Construction of Expressway (2-lane)

Long Term (2011 ~ 2020)

- Widening of Expressway (to 4-lane)

In the chapters 8.3, 8.4 and 8.5, the following items are future discussed.

- Development of possible bypass routes
- Enforcement of traffic management
- Widening of the existing Highway

8.3 DEVELOPMENT OF POSSIBLE BYPASS ROUTES

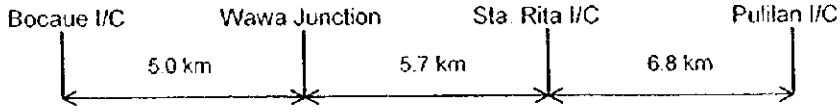
8.3.1 Plaridel – Baliuag Bypass

(1) Possible Bypass Routes

Major factors considered in preparing alternative routes were as follows:

- Location of an interchange (I/C) with North Luzon Expressway (NLE)

  Existing interchanges or junction along NLE in the area are as follows:



- Linkage with Metro Manila (the shorter, the better for long distance thru traffic on the Pan-Philippine Highway).
- Access to proposed industrial areas in Plaridel and Guiguinto and Baliuag Urban Center.
- Bridge location to span over Angat River.

The following four (4) alternative routes were proposed for the comparative study (see Figure 8.3-1):

Route No.	Planning Concepts	Route Length	Route Alignment
Route-1	• New interchange between Bocaue I/C and Wawa Junction. • Shortest linkage with Metro Manila. • To provide direct access to proposed Guiguinto Industrial area.	22.5 km	This route starts at the halfway of existing Bocaue Interchange and Wawa Junction of the North Luzon Expressway. It runs northward through the eastside of the proposed Pulang Lupa urban area and existing Malawak Town, and crosses Angat River at Bonga Mayon. It joins with Pan-Philippine Highway at San Roque (km 59).
Route-2	• Existing Wawa Junction is to be converted to an interchange. • Second shortest linkage with Metro Manila. • To provide better access to proposed Plaridel Industrial area and Baliuag Urban Center.	22.0 km	This route starts at the existing Wawa Junction, and runs northward, then turns to north-eastward parallel to Angat River, and crosses the River at Tamboung. It connects with Pan-Philippine Highway at San Roque (km 59).
Route-3	• Almost the same concept as Route-2, except that new interchange is provided between Wawa Junction and Sta. Rita I/C.	20.3 km	This route starts at the middle of the existing Wawa Junction and Sta. Rita Interchange. It runs north-eastward through the eastside of the proposed Plaridel Industrial Area, then proceeds parallel to Angat River with the same alignment with Route-2.
Route-4	• The only route considered at west of the existing Pan-Philippine Highway. • To utilize existing Pulilan I/C. • Though this route is the longest linkage with Metro Manila, a bridge over Angat River can be avoided.	16.8 km	This route starts at the existing Pulilan Interchange, and runs north-eastward cossing Highway No. 359 at Santo Nino, then runs parallel to Pan-Philippine Highway until it links with it at Capihan (km 57).

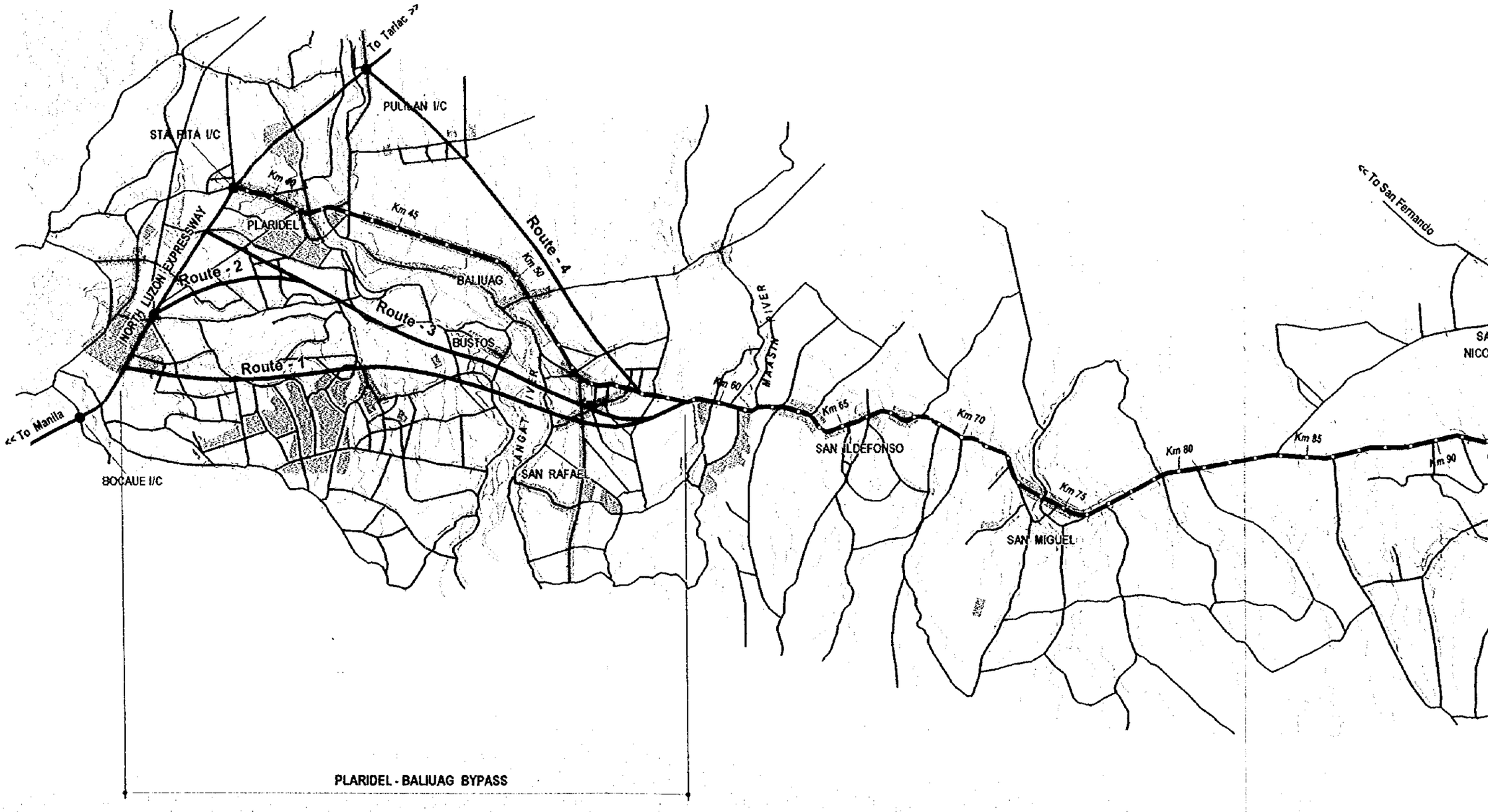


FIGURE 8.3 - 1 PROPOSE

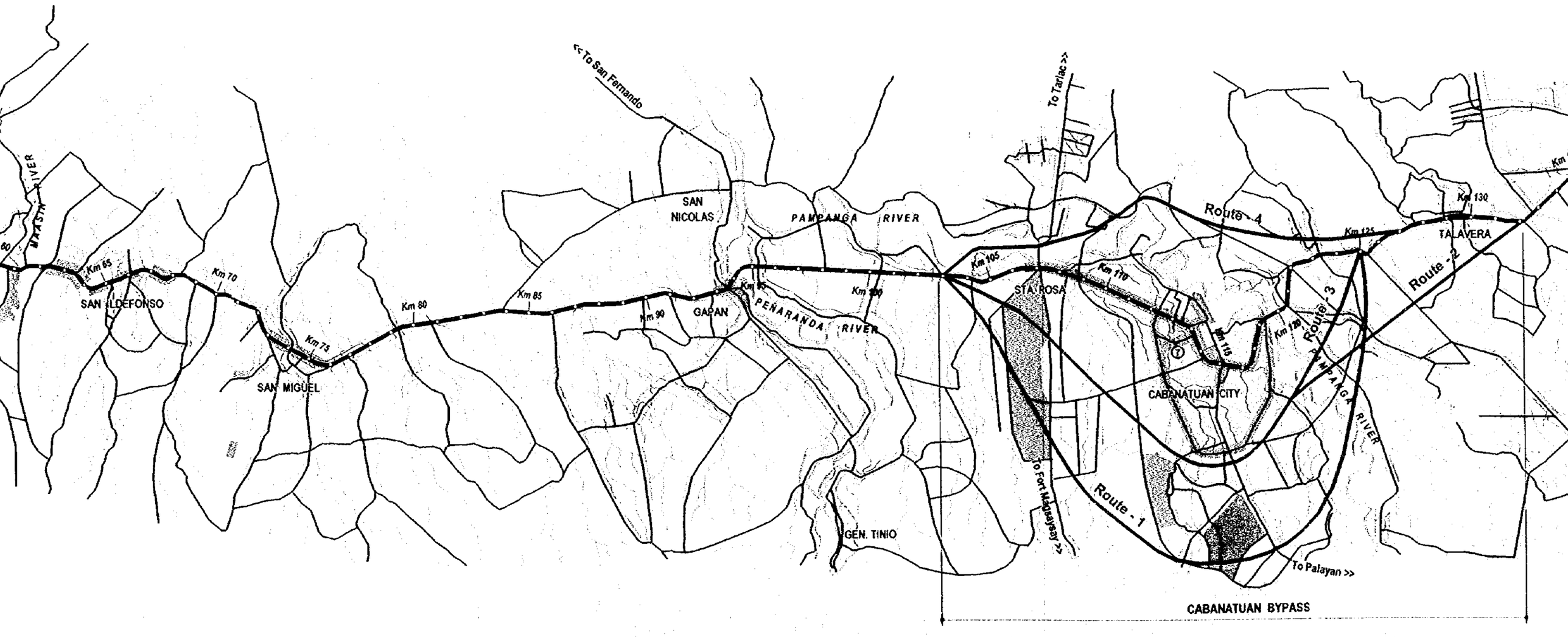


FIGURE 8.3 - 1 PROPOSED BYPASS ROUTE ALTERNATIVES

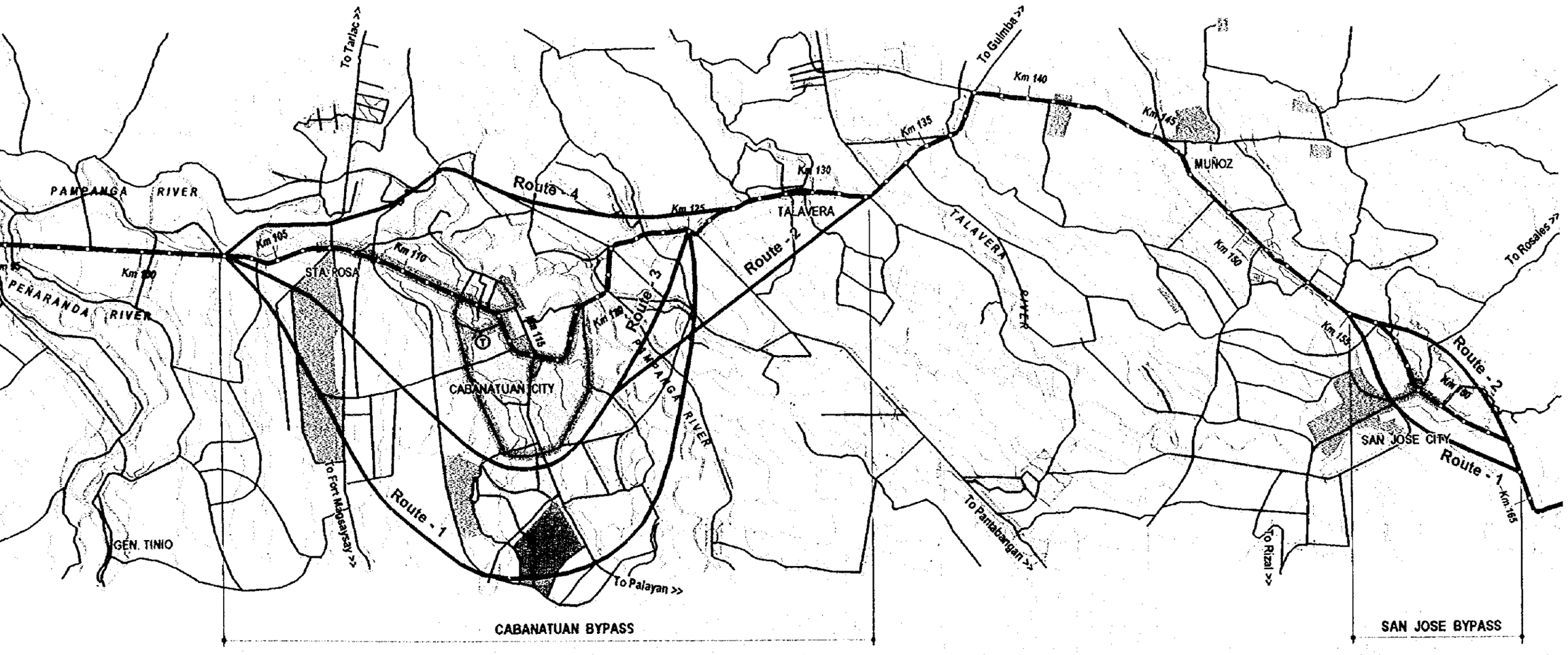
LEGEND :

- Existing Pan-Philippine Highway
- Existing Expressway
- Existing Road
- Proposed Bypass Route Alternatives

Future Land Use

- Commercial Area
- Residential Area
- Industrial Area
- Institutional Area

N



YPASS ROUTE ALTERNATIVES

(2) Proposed Access Roads

Figure 8.3-2 graphically shows the access points and proposed access roads as well existing roads to be utilized as access roads. Table 8.3-1 shows the comparison of access roads for each bypass route

Route–1:	6 access points -	5 existing roads 1 new access road
Route–2:	6 access points -	4 existing roads 2 new access roads
Route–3:	6 access points -	4 existing roads 2 new access roads
Route–4:	4 access points -	3 existing roads 1 new access

(3) Improvement of Burol Interchange (Wawa Junction)

Rout-2 requires the improvement of the existing Burol Interchange Wawa Junction to connect the new bypass (Route-2) with the existing North Luzon Expressway.

Table 8.3-2 shows the comparative evaluation on improvement method, and recommend Scheme-4.

(4) Traffic Plan on Burol Interchange Vicinity

Figure 8.3-3 shows the traffic flow near Burol Interchange for Scheme-3 and 4 which services for the following turning traffics are not provided in new interchange system,

- Left turn from Tarlac to San Jose
- Right turn from San Jose to Tarlac
- Left turn traffic from Malolos to Tarlac
- Right turn traffic from Tarlac to Malolos

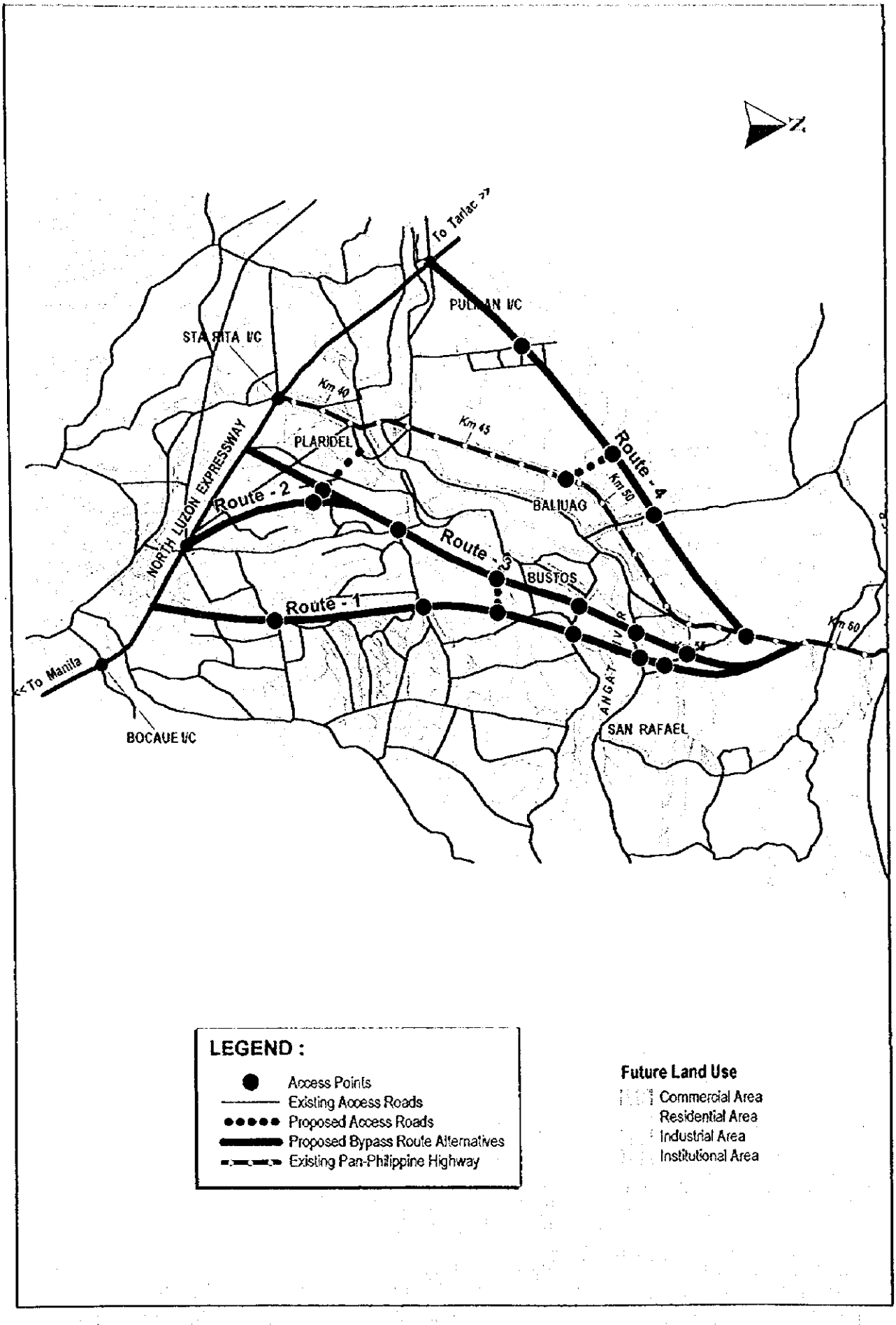
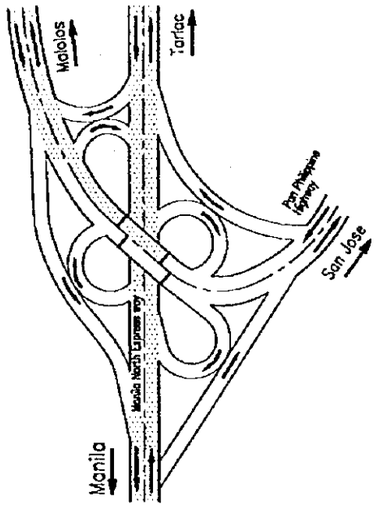
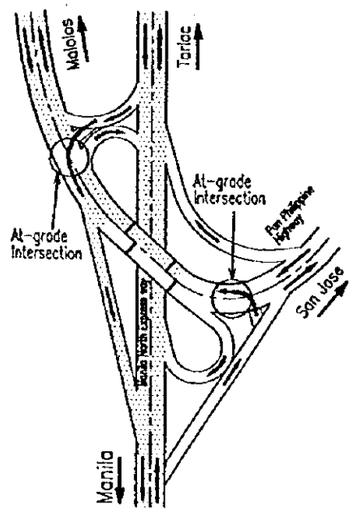
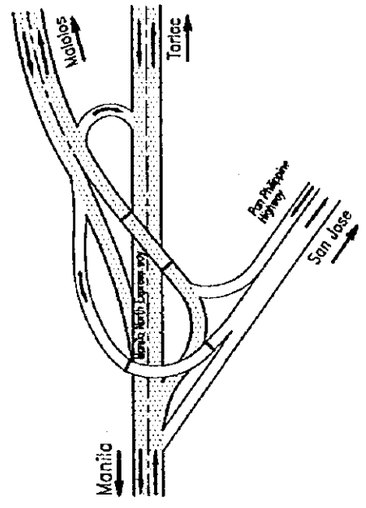
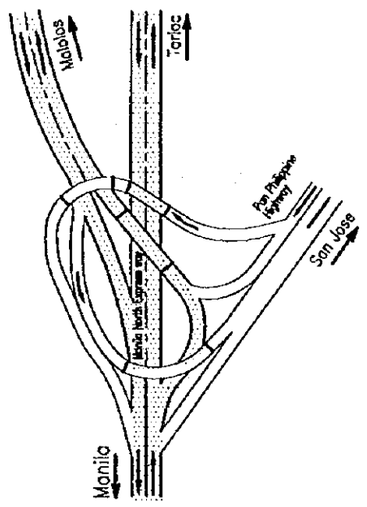
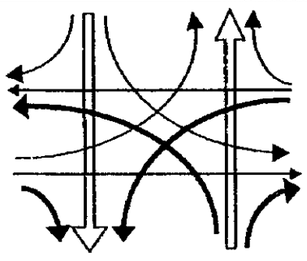
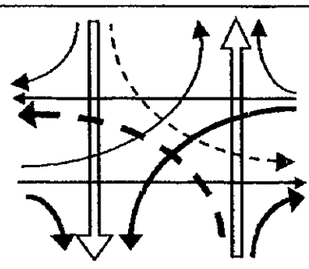
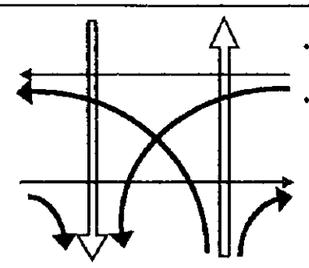
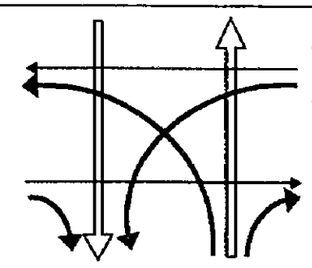


FIGURE 8.3 - 2 PROPOSED ACCESS ROADS PLARIDEL - BALIUAG BYPASS

TABLE8.3-1 COMPARISON ON THE ACCESS ROADS OF PLARIDEL-BALIUAG BYPASS ROUTES

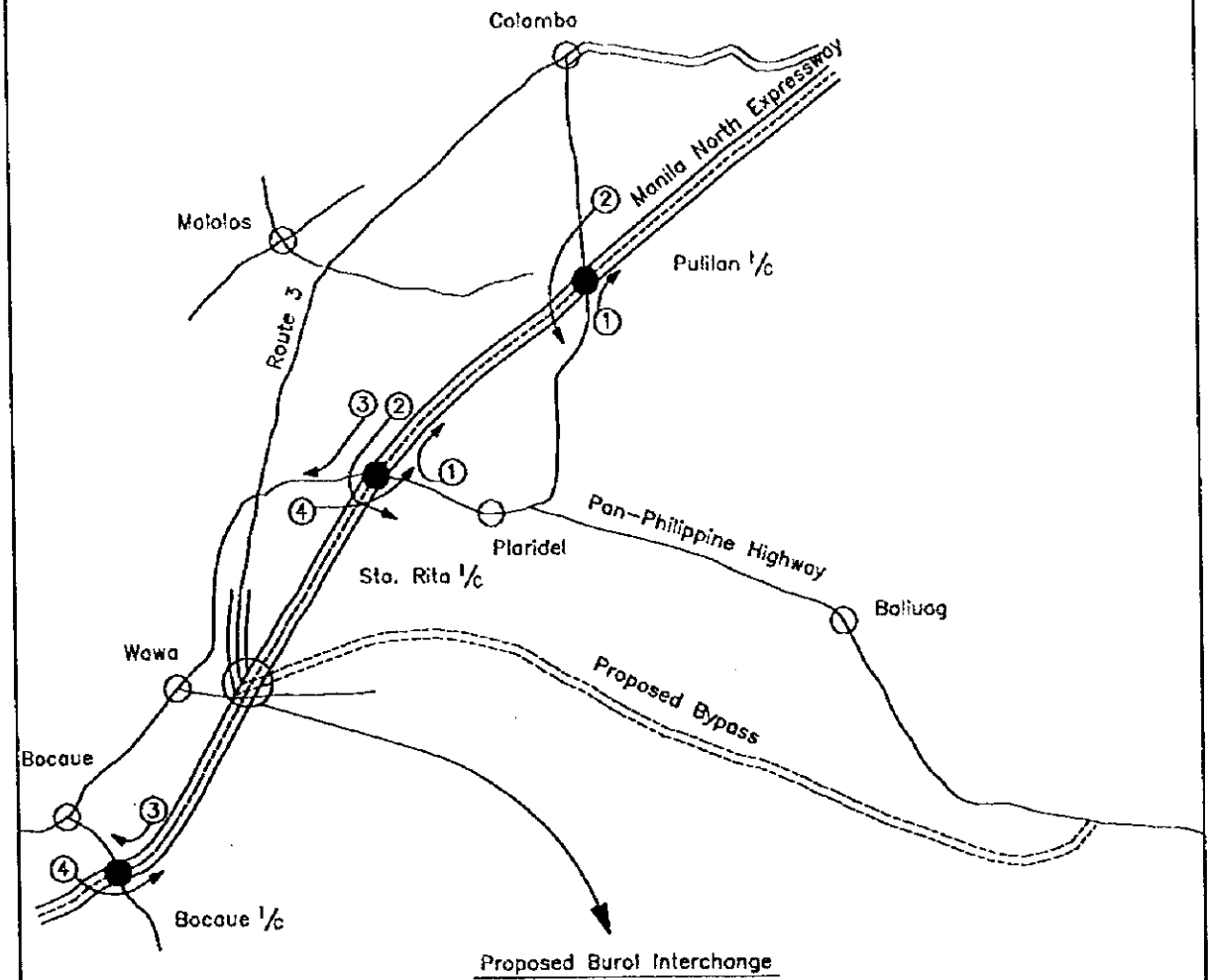
Bypass Route No.	Number of Connecting points with Existing Road	Number of New Access Road	Average Distance to the Urban Center from Bypass Route	Description
R-1	5	1	11.7km to Paridel 8.0km to Baliuag	· Total six access roads are required for expected traffic volume. (Spaces between access roads are 1.0~4.8km) · Number of lane is two. · One of routes is directly connected to the Urban center.
R-2	4	2	9.3km to Plaridel 6.3km to Baliuag	· Total six access roads are required for expected traffic volume. (Spaces between access roads are 1.7~4.0km) · Number of lane is two. · One of new access routes is through the proposed inter-industrial area. · One of routes is directly connected to the Urban center.
R-3	4	2	9.2km to Plaridel 6.2km to Baliuag	· Total six access roads are required for expected traffic volume. (Spaces between access roads are 1.7~3.5km) · Number of lane is two. · One of new access routes is through the proposed inter-industrial area. · One of routes is directly connected to the Urban center.
R-4	2	1	9.2km to Plaridel 7.1km to Baliuag	· Total four access roads are required for expected traffic volume.(Spaces between access roads are 2.3~4.3km) · Number of lane is two. · One of routes is directly connected to the Urban center. · Two of routes are directly connected to the Pan-Philippine Highway.

Table 8.3-2 Comparative Evaluation on Improvement of Burol Interchange (WaWa Junction)

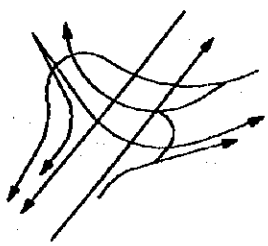
	Scheme-1 Full Cloverleaf Type	Scheme-2 Partial Cloverleaf Type: with at-grade Intersection	Scheme - 3 One Quadrant Type with Long and Direct Connection	Scheme - 4 Turbine Type with Direct Connection
				
Traffic Flow				
Characteristics	x Major traffic from Manila to Malolos and from San Jose to Manila are on sharp loops, thus low level of functionality. Δ Weaving will occur on the viaducts. xx Capacity of the existing viaduct may not be able to cope with three (3) major traffic (one through and two left turns). x Collector-distributor roads may be required on the existing expressway, but construction is difficult because of the limited space. x High construction cost.	xx Major traffic from Manila to Malolos is on at-grade intersection, and from San Jose to Manila is on sharp loop, thus lower level of functionality. O No weaving will occur on the viaducts. xx Capacity problem of the existing viaduct is same as Scheme-1. x Widening for entrance from ramp maybe required, but construction is difficult because of the limited space. Δ Reasonable constructions cost.	Δ Major traffic from San Jose to Manila is on sharp loop. Δ No weaving will occur on the viaduct. xx Capacity problem of the existing viaduct is same as Scheme-1. O Widening along the existing expressway is easy. Δ Reasonable construction cost. (PM134)	O Major traffic are on directional ramps. O No weaving will occur on the viaduct. Δ Capacity of the existing viaduct may be able to cope with major traffic (one through and one left turn) with two major traffic (one through and one left turn) O Widening along the existing expressway is easy. x High construction cost. (PM193)
Evaluation	Not Recommendable	Not Recommendable	Not Recommendable	Recommendable

Legend:

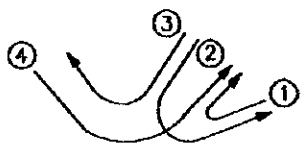
O - Good x - Bad
Δ - Fair xx - Very Bad



Services Provided



Services Terminated



NOTE : Services Terminated can be provided at other interchanges as shown in the plan, such as ① and ② ; Sta. Rita I/C , Pulilan I/C ③ and ④ ; Sta. Rita I/C , Bocaue I/C

FIGURE 8.3-3 Traffic Flow on Burol Interchange Vicinity Scheme 3 and 4

8.3.2 Cabanatuan Bypass

(1) Possible Bypass Routes

Major factors considered in preparing alternative routes were as follows:

- Expansion of future urban areas. In line with the future land use plan, inner and outer circumferential roads are proposed.
- To bypass Talavera Urban Center or not.
- Access to Cabanatuan Urban Center
- Connection with proposed Sierra Madre Highway (or North Luzon Expressway East).

The following four (4) alternative routes were proposed for the comparative study (see Figure 8.3-1):

Route No.	Planning Concepts	Route Length	Route Alignment
Route-1	• To be provided at the outer most area of future urban area, thus avoid to pass through within the proposed urban area. • To follow the proposed outer circumferential road proposed by the City Government of Cabanatuan, thus Talavera Urban Center is not bypassed. • Future connection with Sierra Madre Highway (or NLEE).	35.0 km	The route starts from Tagumpay, Sta. Rosa and connects with the Pan-Philippine Highway at Pinagpanan. An alignment of this route is almost the same as that of the outer circumferential road proposed in the Cabanatuan Urban Development Plan. It is located at the east side of Cabanatuan Urban Center, about 9 km far from the center.
Route-2	• To bypass three urban centers, Sta. Rosa, Cabanatuan and Talavera. • To be provided at the outside existing urban area, but pass through about the middle portion of future urban area. • To be provided particularly along the proposed inner circumferential road proposed by the City Government. • Accessibility to the Cabanatuan Urban Center.	29.5 km	This route starts at the Tagumpay and links at Quezon after Talavera. This route runs between the urban area and the industrial zone that is proposed in the Cabanatuan Urban Development Plan. It is about 3 km east from the Cabanatuan Urban Center.
Route-3	• Almost the same concept as Route-2, except that it ends before Talavera Urban Center.	24.0 km	The route starts at Tagumpay and ends at Pinagpanan, following the same alignment as Route-2, except end section.
Route-4	• To be provided at the western area of Cabanatuan Urban Center and Pampanga River. • The route is intended for mainly Cabanatuan City through traffic. • Due to Pampanga River and the heavily built-up Urban Centers, access from the Bypass to Cabanatuan Urban Center is difficult.	19.5 km	This route which is about 5.5 km west of Cabanatuan City, starts at Tagumpay and will end at Pinagpanan. This route has almost the same alignment with the west side of the proposed Cabanatuan City Circumferential Road. It crosses the Pampanga River and its branches at several points.

(2) Proposed Access Roads

Figure 8.3-4 shows the access points and proposed access roads as well as existing roads to the utilized as access roads. Table 8.3-3 shows the comparison of access roads for each bypass routes.

Route 1: 6 access points -- 4 existing roads
2 new access road

Route 2: 6 access points -- 6 existing roads
1 new access road

Route 3: 6 access points -- 5 existing roads
1 new access roads

Route 4: 5 access points -- 4 existing roads
1 new access roads

TABLE8.3-3 COMPARISON ON THE ACSESS ROADS OF CABANATUAN BYPASS ROUTES

Bypass Route No.	Number of Conne-cting points with Existing Road	Numbe r of New Access Road	Average Distance to the Urban Center from Bypass Route	Description
R-1	4	2	11.3km	· Total six access roads are required for expected traffic volume. (Spaces between access roads are 2.0~8.0km) · Number of lane is two. · Two of routes are directly connected to the Urban center. · Two new access roads are conform to the proposed roads of region-plan. · Five access roads are directly connected to the Pan-Philippine Highway · Four of access roads are along the proposed industrial area and one of them is through the proposed inter-industrial area
R-2	6	1	9.4km	· Total seven access roads are required for expected traffic volume.(Spaces between access roads are 2.0~5.5km) · Number of lane is two. · One new access road is conform to the proposed roads of region-plan · One of new access routes is along the proposed inter-industrial area. · One of routes is directly connected to the Urban center. · All access roads are directly connected to the Pan-Philippine Highway
R-3	5	1	8.2km	· Total six access roads are required for expected traffic volume.(Spaces between access roads are 1.6~5.0km) · Number of lane is two. · One new access road is conform to the proposed roads of region-plan · One of new access routes is along the proposed inter-industrial area. · All routes are not directly connected to the Urban center. · Four of access roads are directly connected to the Pan-Philippine Highway
R-4	4	1	11(km)	· Total five access roads are required for expected traffic volume.(Spaces between access roads are 2.5~4.5km) · Number of lane is two. · Four of access routes are directly connected to the Urban center. · Two of routes are directly connected to the Pan-Philippine Highway.

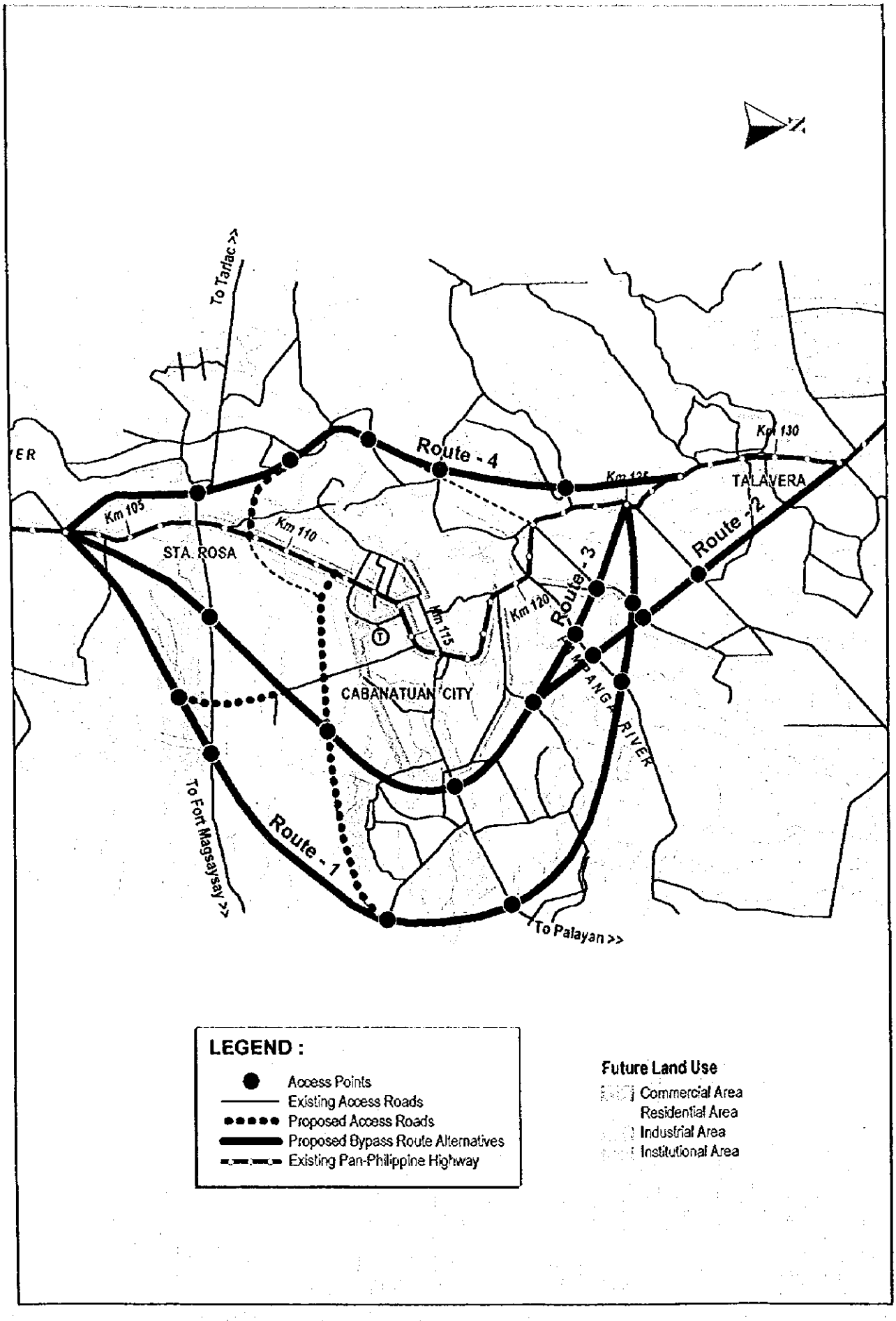


FIGURE 8.3 - 4 PROPOSED ACCESS ROADS CABANATUAN BYPASS

8.3.3 San Jose Bypass

(1) Possible Bypass Routes

Major factors considered in preparing alternative routes were as follows:

- Expansion of future urban area.
- Proposed industrial area.
- One route each for the east and the west of the existing Pan-Philippine Highway.

The following two (2) alternative routes were proposed for the comparative study (see Figure 8.3-1):

Route No.	Planning Concepts	Route Length	Route Alignment
Route-1	• To be located at the eastern area of the existing Pan-Philippine Highway. • To provide direct access to the proposed industrial area.	9.0 km	This route runs the east side of the San Jose urban center, starting at Sinipit-Bubon and ending at Kita-Kita
Route-2	• To be located at the western area of the existing Pan-Philippine Highway. • The route will delineate the border of future urban center.	6.5 km	This route runs at the west side of San Jose urban center, starting at Abar and ending at Blanca. It runs along the foot of Mount Regal. Outskirt of urban / residential area proposed in the San Jose Urban Development Plan.

(2) Proposed Access Roads

Figure 8.3-5 presents the number of access points and proposed access roads as well as existing roads to be utilized as access roads. Table 8.3-4 shows the comparison of access roads for each bypass route.

Route – 1: 2 points - 1 existing road
1 new access road

Route – 2: 2 points - 1 existing road
1 new access road

TABLE8.3-4 COMPARISON ON THE ACSESS ROADS OF SAN JOSE BYPASS ROUTES

Bypass Route No.	Number of Connecting points with Existing Road	Number of New Access Road	Distance to the Urban Center from Bypass Route	Description
R-1	1	1	2.6km	• Total two access roads are enough for expected traffic volume. (Spaces between access roads are 1.2~2.5km). • Number of lane is two. • One of routes is directly connected to the Urban center. • All access roads are directly connected to the Pan-Philippine Highway
R-2	1	1	2.0km	• Total two access roads are enough for expected traffic volume. (Spaces between access roads are 2.1~3.5km) • Number of lane is two. • One of routes is directly connected to the Urban center. • All access roads are directly connected to the Pan-Philippine Highway

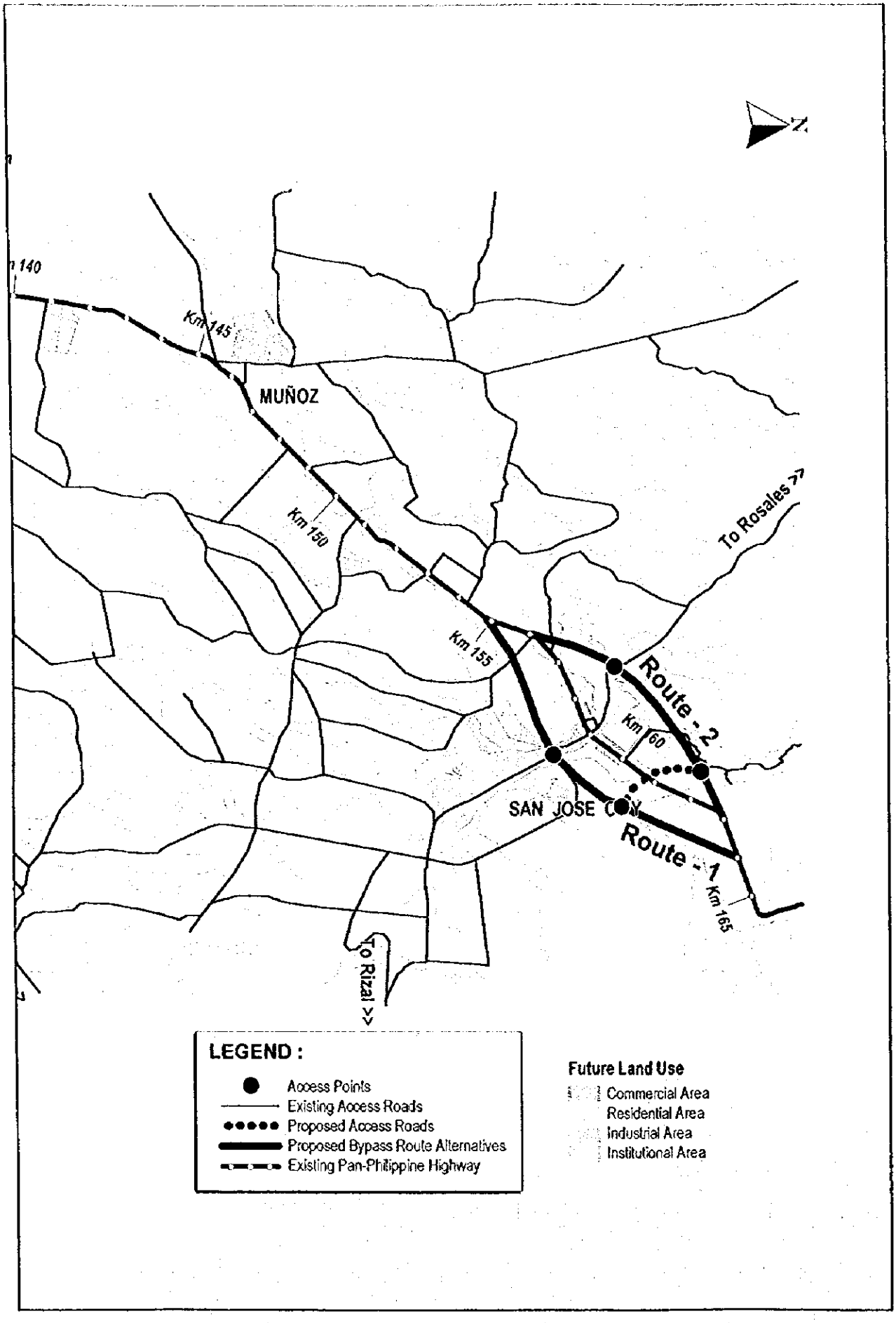


FIGURE 8.3 - 5 PROPOSED ACCESS ROADS SAN JOSE BYPASS

8.4 ENFORCEMENT OF TRAFFIC MANAGEMENT

As shown in Figure 8.4-1, the urbanized area of Gapan City has been developed along Penaranda River in a very rectangular form, about 1.5 km in width. The Pan-Philippine Highway passes through crossing the city with a section of about 1.5 km. which was a only congested area.

To solve the traffic congestion along the Pan-Philippine Highway, the following three (3) options were discussed.

Option 1 : Construction of Bypass parallel to Pan-Philippine Highway
- Bypass length: 5 km including 1.0 km of bridge
- Right-of-way acquisition: urbanized area 1.0 km.
  rice field 3.0 km.

Option 2 : Construction of Bypass parallel to Tino Street
- Bypass length: 10 km along irrigation canal
- Right-of-way acquisition: sub-urban area 10 km.

Option 3 : Enforcement of Traffic Management
- Promulgation of traffic rules and regulations
- Installation of traffic signal

Through discussions with the mayor and officials of Gapan City, Option 3 was recommended taking into consideration the huge investment cost of Option 1 and the effectiveness for traffic improvement along Pan-Philippine Highway of Option 2.

Moreover, Option 3 is in line with the policy of Gapan City who has promulgated the traffic rules and regulation as the ordinance. This ordinance is known as the "Gapan Traffic Code" which includes the followings:

- Direction of traffic : designate streets for 2-way and one-way operation
- No parking, Loading and Unloading area: designate streets and areas.
- Speed Limit / No overtaking zone: speed limit of 30 kph on almost all city street
- Blowing of Horns
- Traffic Obstruction
- Re-routing : during special event or occasion
- Traffic Violation and their corresponding penalty

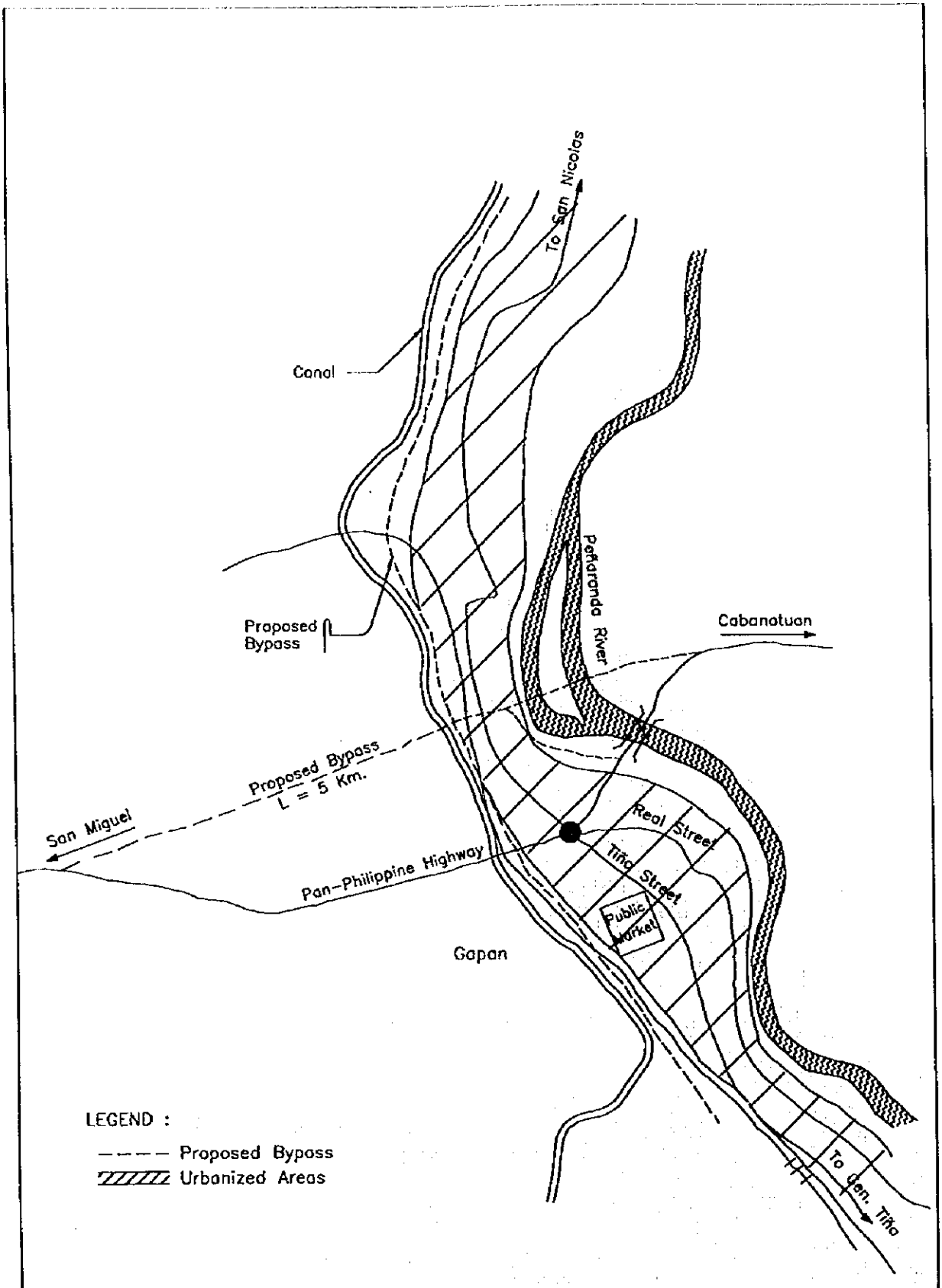


FIGURE 8.4-1 Schematic View of Gapan

8.5 PLANNING OF WIDENING

The existing roadway widths are variable, but about 11.7m with 6.7m of pavement and 2.5m of shoulder in almost all sections. However, according to the Cadastre Maps, the right of way of the existing Highway are either 15m or 20m.

If widening of the existing highway is considered possible up to the extent of right of way, the following three (3) cases may be proposed as shown in Figure 8.5-1.

Case 1 : ROW 15m; Widening 1.65m x 2 = 3.3m
- Carriageway 3.35m x 2 for ordinary vehicles
- Carriageway 2.65m x 2 for low speed vehicles

Case 2 : ROW 20m; Widening 4.15m x 2 = 8.3m
- Carriageway 3.35m x 4 for all vehicles

Case 3 : No widening
- Widening may not be practical because of establishments along the roadsides.

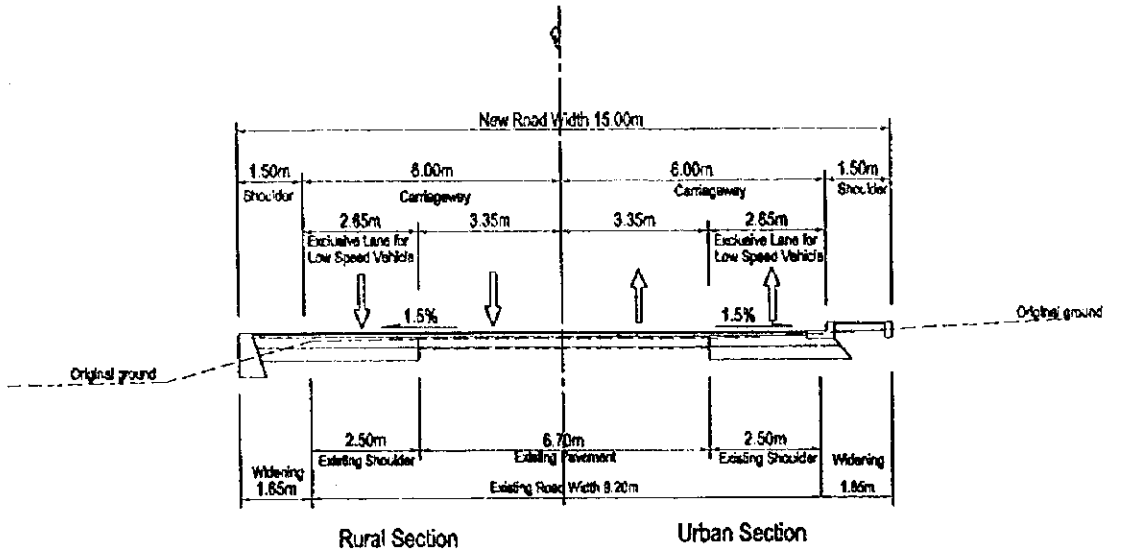
Sections preliminary proposed for Case 1,2 and 3 are shown in Figure 8.2-1.

Table 8.5-1 and 2 show the number of obstacles within 15m (Case 1) and 20m (Case 2).

Case 1
- Total number of houses affected : 84
- Total number of Sari-sari stores / Temporary building affected : 119
- Total number of big trees affected : 575

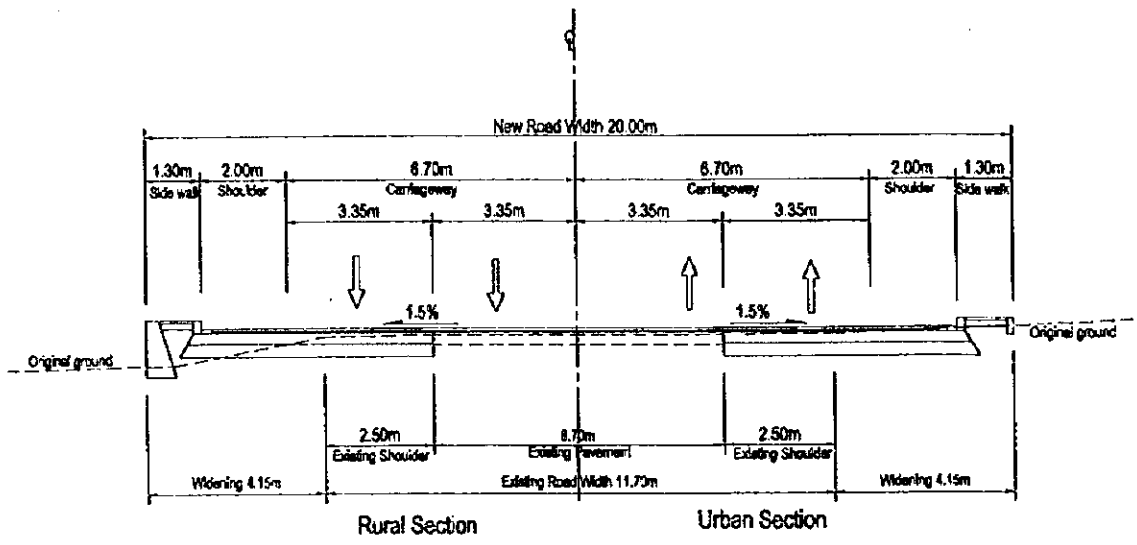
Case 2
- Total number of houses affected : 277
- Total number of Sari-sari stores / Temporary building affected : 323
- Total number of big trees affected : 797

Through discussions with the Government officials concerned, it was agreed that acquisition of road right of way and relocation of houses and establishments affected by road widening were so sensitive that the central government shall undertake a widening project with the positive involvement of local government units.



Widening Case 1 : In case of ROW 15.0m

Scale 1 : 150



Widening Case 2 : In Case of ROW 20m

Scale 1 : 150

FIGURE 8.5-1 STANDARD CROSS SECTIONS FOR WIDENING

TABLE 8.5-1 NUMBER OF OBSTACLES EXISTING IN 1.65m WIDENING AREA (Widening Case 1)

Section	Kilopost	Conc. Bldg			Conc. House			Wooden House			Sarisari Store			Temp. Bldg			Big Tree			Total of Houses
		Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	
Plaridel	39 - 42	2	7	9	5	7	12	4	1	5	6	0	6	1	4	5	6	5	11	26
Baliuag	42 - 55	0	0	0	0	0	0	0	0	0	2	1	3	2	0	2	8	87	95	0
Baliuag - San Rafael	55 - 59	0	0	0	0	0	0	0	0	0	4	9	13	0	1	1	8	0	8	0
San Rafael	59 - 60	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	0	0	0
San Rafael-San Ildefonso	60 - 65	1	0	1	0	0	0	0	0	0	0	0	0	1	3	4	0	8	8	1
San Ildefonso	65 - 67	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	2	0
San Miguel	67 - 84	0	0	0	0	0	0	3	0	3	0	0	0	1	1	2	3	3	6	3
San Miguel - Gapan	84 - 92	0	0	0	0	0	0	0	0	0	5	1	6	1	1	2	14	21	35	0
Gapan	92 - 94	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	6	0	6	0
Gapan - Sta Rosa	94 - 106	0	0	0	0	0	0	15	10	25	2	5	7	1	1	2	54	9	63	25
Sta Rosa	106 - 108	0	0	0	0	0	0	2	0	2	0	0	0	1	0	1	0	1	1	2
Sta Rosa - Cabanatuan	108 - 112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	0
Cabanatuan	112 - 117	1	1	2	0	8	8	0	0	0	0	3	3	4	8	12	2	1	3	10
Cabanatuan - Talavera	117 - 129	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	18	30	48	0
Talavera	129 - 131	0	0	0	0	3	3	1	2	3	5	0	5	2	3	5	0	0	0	6
Talavera - Munoz	131 - 144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	84	130	0
Munoz	144 - 146	0	0	0	0	0	0	5	4	9	3	3	6	0	0	0	11	13	24	9
Munoz - San Jose	146 - 151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	54	109	0
San Jose	151 - 161	0	1	1	0	0	0	0	1	1	10	15	25	1	0	1	8	1	9	2
San Jose - End Section	161 - 162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	11	0
Total		13			23			48			76			43			575			84

Note: Total of Houses = Conc. Bldg + Conc. House + Wooden House
Sarisari Store : Very small grocery store.
Temp. Bldg : Roofing or flooring for temporary store, parking, etc.

TABLE 8.5-2 NUMBER OF OBSTACLES EXISTING IN 4.15m WIDENING AREA (Widening Case 2)

Section	Kilopost	Conc. Bldg			Conc. House			Wooden House			Sarisari Store			Temp. Bldg			Big Tree			Total of Houses
		Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	Left	Right	Both	
Plaridel	39 - 42	9	15	24	15	16	31	4	10	14	6	0	6	7	11	18	6	5	11	69
Baliuag	42 - 55	1	0	1	3	7	10	0	4	4	2	5	7	9	5	14	20	92	112	15
Baliuag - San Rafael	55 - 59	0	1	1	0	0	0	0	0	0	4	9	13	3	1	4	20	6	26	1
San Rafael	59 - 60	2	0	2	2	9	11	0	0	0	0	2	2	1	2	3	0	0	0	13
San Rafael-San Ildefonso	60 - 65	1	0	1	0	0	0	0	0	0	0	0	0	1	3	4	5	8	13	1
San Ildefonso	65 - 67	2	2	4	3	8	11	0	0	0	0	0	0	3	4	7	3	1	4	15
San Miguel	67 - 84	0	0	0	5	7	12	0	8	8	0	0	0	13	11	24	37	23	60	20
San Miguel - Gapan	84 - 92	0	0	0	0	6	6	0	0	0	5	2	7	2	1	3	14	21	35	6
Gapan	92 - 94	1	1	2	0	1	1	1	8	9	4	0	4	0	1	1	10	3	13	12
Gapan - Sta Rosa	94 - 106	0	0	0	0	1	1	5	3	8	2	5	7	1	1	2	61	9	70	9
Sta Rosa	106 - 108	0	0	0	2	1	3	2	2	4	0	0	0	5	9	14	10	1	11	7
Sta Rosa - Cabanatuan	108 - 112	2	0	2	0	0	0	0	0	0	0	0	0	1	0	1	6	3	9	2
Cabanatuan	112 - 117	8	2	10	5	10	15	0	1	1	0	3	3	11	28	39	6	1	7	26
Cabanatuan - Talavera	117 - 129	0	0	0	1	0	1	0	1	1	0	2	2	39	3	42	18	55	73	2
Talavera	129 - 131	0	5	5	5	11	16	1	4	5	5	0	5	18	12	30	0	2	2	26
Talavera - Munoz	131 - 144	0	1	1	0	0	0	0	0	0	0	0	0	5	2	7	46	84	130	1
Munoz	144 - 146	0	0	0	0	0	0	13	9	22	3	3	6	0	0	0	27	14	41	22
Munoz - San Jose	146 - 151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	113	45	158	0
San Jose	151 - 161	4	16	20	3	6	9	0	1	1	18	15	33	9	6	15	8	3	11	30
San Jose - End Section	161 - 162	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	11	0
Total		73			127			77			95			228			797			277

Note: Total of Houses = Conc. Bldg + Conc. House + Wooden House
Sarisari Store : Very small grocery store.
Temp. Bldg : Roofing or flooring for temporary store, parking, etc.

PART IV

SELECTION OF THE BEST BYPASS ROUTE

CHAPTER 9

INITIAL ENVIRONMENTAL EXAMINATION

CHAPTER 9

INITIAL ENVIRONMENTAL EXAMINATION

9.1 ENVIRONMENTAL LEGISLATION

9.1.1 Environmental Impact Assessment System

There are thirteen (13) laws that instituted the implementation of the environmental Impact Assessment (EIS) System for proposed projects in the Philippines. Presidential Decree 1151, also known as the "Philippines Environment Policy" declared in 1997, is the first policy issuance on the EIS System in the country . Presidential Decree 1586 in 1978 reiterated the policy statement of PD 1151 and at the same time introduced the concept of Environmentally Critical Projects (ECPs) and projects within Environmentally Critical Areas (ECAs) as projects that requires the submittal of an "Environmental Impact Assessment" or EIS. It further stated that "no person, partnership, or corporation shall undertake or operate any such declared ECP or project within an ECA without first securing an Environmental Compliance Certificate (ECC)".

The major categories of ECPs and projects within ECAs were stipulated in Proclamation No.2146, series of 1981. These categories were later clarified by the Environmental Management Bureau's (EMB) predecessor agency, the National Environmental Protection Council (NEPC) through Office Circular No. 3, series of 1983. Based on these proclamations, all new , major roads and bridges are considered ECPs, and thus, are required an EIS to merit an ECC.

Since then, the Philippines EIS System has undergone several refinements to make it a more effective in dealing with environmental issues in the country. The latest of these is the formulation of the DENR Administrative Order No.37, Series of 1996, more commonly known as DAO 96-37. This superceded the previous DAO 21, Series of 1992. Stipulated in DAO 96-37 are the coverage , objectives, and the description of the EIA process, along with the penalties to those who will not abide by it. As an improvement of the previous guidelines, it seeks to address the following objectives:

(i) Ensure that environmental consideration are incorporated at the earliest possible stage of project development;

(ii) Further streamline the current procedures in the conduct of the Environmental Impact Assessment (EIA) in order to improve its effectiveness as a planning, regulatory and management tool;

(iii) Enhance maximum public participation in the EIA process to validate the social acceptability of the project or undertaking so as to ensure the fullest consideration of the environmental impact of such project or undertaking.

9.1.2 Laws on Relocation of Communities

The relocation of people or communities are based on the Implementing Rules and Regulation (IRR) issued by the Department of Interior and Local Government (DILG) and the Housing and Urban Development Coordinating Council (HUDCC) on 24th of September, 1992. The said IRR are in accordance with Article XII, Section 44 and Article VII, Section 28 of Republic Act No.7279, also known, as the "Urban Development and Housing Act of 1992. The main objective of the IRR is to ensure that the relocation and resettlement procedure are properly and humanely carried out.

The Proponent Government Agency (PGA) shall strictly observe the following procedures:

(i) Pre-Relocation Phase

Identification of resettlement site

- Negotiation and arrangement are finalized between the PGA and the recipient LGU regarding the resettlement site and their corresponding roles and responsibilities.

Pre-census

- PGA prepares all necessary documents such as copies of Titles and/or Tax Declaration.
- PGA conducts meetings with the concerned families to explain the government's shelter program, the need to relocate, procedures and guidelines, and schedule of census and tagging operation.

Census

- PGA determines physical boundary of the land to be cleared of squatters, and attached a tag card to every structure for identification, inventory, and control;
- The PGA, in coordination with community leaders come up with a preliminary listing of names of owners/households of the affected houses/structures.
- PGA prepares a structural map;
- PGA conducts actual "house to house "census to determine actual number of occupants/households and their possible resettlement options;

Census data evaluation/processing and master list preparation

- PGA evaluates data gathered and determine qualified families;

- PGA comes up with a master list and forward it to the recipient LGU or to the National Housing Authority (NHA) for review and pre-qualification;
- Final master list is prepared by duly authorized officials, a copy of which is posted on conspicuos places in the area.
- All qualified and disqualified families shall be individually informed.

Information drive on resettlement site

- PGA meets with affected families and inform them about the families and services available in the resettlement site and their obligations and responsibilities.

Issuance of 30 days notice

- PGA issues written notice to affected persons/families.
- PGA displays posters in the community about the schedule of the demolition.

Consultation proper

- PGA conducts consultation meetings with affected communities to discuss about necessity of demolition, possible relocation sites, mode of payment, dismantling and resettlement prccedures, and other important process;
- PGA summarizes proceedings of consultation and gives copies to the affected families.

Inter-Agency Meeting Coordination

- PGA convenes other concerned government agencies to discuss details of actual relocation such as resettlement site, relocation/demolition team, logistical requirements such as trucks, tents, first aid and communication facilities, security (Philippines National Police, PNP), and other relocation documentation.

(ii) Relocation Phase

- PGA confirms actual date of relocation to the affected families three (3) days before the relocation;
- PGA supervises actual dismantling of structures/ movement of families;
- Resettlement project team accompany the resettled families to their assigned lots, and help in the transfer of families' materials.

(iii) Post Relocation Phase

Place of Origin

- PGA requires property owner or concerned government agencies to clear, secure, and undertake development of the vacated property;
- PGA takes after operation pictures of the site;
- PGA issues letter to the owner that the area has been cleared.

Resettlement Site

- PGA ensures that organized community-based structures are strengthened to facilitate the delivery of services to the site;
- Adequate social services such as health, nutrition, education, responsible parenthood, environmental sanitation, etc, shall be provided to the resettlement site by the PGA in coordination with other concerned government agencies;
- PGA must provide alternative sources of livelihood to the resettlement families.

9.2 ENVIRONMENTAL CHARACTERISTICS ALONG THE STUDY ROAD

9.2.1 Socio-economic Environment

(1) Land Use

The main land uses identified along the Study Road are: (i) Agricultural and (ii) Built-up Areas, based on field reconnaissance and secondary data such as the Provincial Physical Framework Plans (PPFP) of Bulacan (1998-2007) and Nueva Ecija (1993-2002).

Bulacan Province

- Agricultural Areas

All agricultural areas found in the western municipalities of Bulacan including the whole stretch of the study area, except those in Calumpit and Malolos, are declared by the provincial government of Bulacan as Environmentally Critical Areas (ECAs). These agricultural lands are mostly dedicated to the cultivation of palay (rice). Angat River is the primary source of Irrigation water provided by the National Irrigation Authority (NIA). If storms or typhoons do not pass these areas, farmers can enjoy up to three cropping per year.

- Built-up Areas

Based on the Regional Physical Framework Plan (1993-2003) of Central Luzon (Region III), Bulacan has the largest urbanized area with 24,021 hectares under intensive urban use. This may be due to its proximity to Metro Manila, as a result of a spill-over of population from Metro Manila. The extent of urbanization has encroached prime agricultural lands that were "irregularly" converted to numerous housing subdivisions, industrial parks, memorial parks, recreational areas, and other non-agriculture related uses. Table 9.2-1 shows the 1995 and projected (2007) hierarchy of urban centers along the Study Road in Bulacan.

TABLE 9.2-1 1995 AND PROJECTED HIERARCHY OF URBAN CENTERS ALONG THE STUDY ROAD

Level in Urban Hierarchy	1995	2007
Major Urban Center	Baliuag	Baliuag
	Plaridel	Plaridel
		Pulilan
Secondary Urban Center	Pulilan	San Miguel
	San Miguel	San Ildefonso
Medium Town/Non-Central Places	San Rafael	San Rafael
	San Ildefonso	

Source: *Provincial Physical Framework Plan, Province of Bulacan (1998-2007)*

The projected hierarchy of urban centers for year 2007 is expected to remain the same except for the municipalities of Pulilan which is expected to become a major urban center, and San Ildefonso, a Secondary Urban Center.

Nueva Ecija Province

- Agricultural Areas

Nueva Ecija is considered as the rice granary of Region III. Irrigated rice paddies and freshwater fishponds are the most suitable type of land use in this province. These lands are classified under the province's Physical Framework Plan as Highly Restricted Network of Protected Agricultural Areas/Network of Areas for Agricultural Development (NPAA/NAAD). Areas of good quality agricultural land that are restricted from conversion to non-agricultural forms fall under this classification. The whole western section of Nueva Ecija, including the study area belong to this category.

- Built-up Areas

In Nueva Ecija, the increase in rural-urban migration in the past decade came about as a result of the people's aspiration for an increase in income. Higher income can be achieved faster in urban centers, given its remarkable increase in economic growth rate. Another factor is the disturbing peace and order situation in the rural areas.

In terms of hierarchy of urban centers along the Study Road, the 1993 PPFP of Nueva Ecija shows that the status of cities and municipalities would be the same up to year 2002, except for Talavera and Muñoz, which are expected to be elevated to the Medium Town category based on its development potentials and economic activities. Table 9.2-2 shows the hierarchy of urban centers along the Study Road.

TABLE 9.2-2 1993 AND PROJECTED HIERARCHY OF URBAN CENTERS ALONG THE STUDY ROAD

Level in Urban Hierarchy	1993	2002
Large Town (Primary Urban Center A)	Cabanatuan City	Cabanatuan City Gapan Talavera San Jose City
Medium Town (Secondary Urban Center A)	Gapan Talavera San Jose City	Muñoz Sta. Rosa
Small Town (Secondary Urban Center B)	Muñoz Sta. Rosa	–

Source: Draft Provincial Physical Framework Plan/Comprehensive Provincial Land Use Plan, Province of Nueva Ecija, 1993-2002

Based on these information on land and resource use one can infer that land use planning and environmental concerns are interrelated. If the environmental concerns are not seriously considered during the planning stage of the future land use of an area, the chance of a decrease in sustainability will be high. For example, if an area is already declared as an environmentally critical area such as prime agricultural land, planning a mix-commercial/residential use in that area would be counter productive.

9.2.2 Natural Environment

(1) Biology

The plant species found along the Study Road can be classified as the Built-up Area Type of vegetation. Most of the tree species observed were planted by the residents and some government agencies concerned along the shoulder of the said Highway.

Trees such as acacia (*Samanea saman Jacq. Merr.*), narra (*Pterocarpus indicus subsp. Indicus Willd.*), and neem (*Azidarachta indica A. Juss*) are lined along the shoulders of Pan-Phil Highway, particularly in the Municipality of Muñoz, Nueva Ecija. These trees provide shades to the vehicles passing the highway, and also serve as sound barriers and settling receptacles of dusts and other particulates such as soot and oil.

Table 9.2-3 shows the main types of trees / vegetation found along the Study Route.

TABLE 9.2-3 MAIN TYPE OF VEGETATION

Common Name	Scientific Name	Family
Acacia (rain tree)	*Samanea saman (Jacq.) Merr.*	Leguminosae
Fire tree	*Delonix regia (Bojer.) Raf.*	Leguminosae
Ilang-ilang	*Cananga odorata (Lamk.) King*	Annonaceae
Ipil-ipil	*Leucaena leucocephala (lamk.) de Witt.*	Leguminosae
Japanese acacia	*Acacia auriculiformis A. Cunn. Ex Benth.*	Leguminosae
Narra	*Pterocarpus indicus subsp. Indicus Willd..*	Leguminosae
Neem tree	*Azidarachta indica A. Juss.*	Meliaceae
Niyog (coconut)	*Cocos nucifera L.*	Palmae
Saging (banana)	*Musa sp. Andr.*	Musaceae

(2) Air Quality Sampling

Table 9.2-4 shows the results of the ambient air quality, sampling being conducted on January 05-06, 1999 at the following stations:

Sta. 1 Plaridel Ontersection to Bustos, Bulacan, Along Pan-Phil Highway

Sta. 2 Brgy. Tambo, San Leonardo, Nueva Ecija (Fronting Tambo Elementary School)

Sta. 3 Cabanatuan City, Nueva Ecija Intersection to Palayan City, Nueva Ecija (Along Pan-Phil Highway)

Sta. 4 Purok 6, Barangay San Isidro, Cabanatuan City, Neuva Ecija

TABLE 9.2-4 AMBIENT AIR QUALITY

Station	Date &Time	Ave. Time	GLC Concentration in µg/Ncm					
			Sampling Results			DENR Standards		
			SO_2	NO_2	TSP	SO_2	NO_2	TSP
1	10:00-11:00 05 Jan. 1999	1 hr	84.928	56.200	263.346	340	260	300
2	13:40-14:40 05 Jan. 1999	1 hr	22.748	16.995	41.339	340	260	300
3	1625,05 Jan. 99 1625,06 Jan. 99	24 hrs	89.446	72.702	145.639	180	150	230
4	10:10-11:10 06 Jan. 1999	1 hr	20.221	7.554	81.825	340	260	300

The results show that:

- the ambient air quality on all the sampling sites are below the DENR standard
- values at major intersections are higher than those obtained at inter-urban sections

(3) Noise Level Sampling

Table 9.2-5 shows the results of the ambient noise level sampling conducted on January 05-06, 1999 at the same stations with the air quality sampling. The results show that:

- Readings from all stations exceeded the DENR standard ambient noise levels for both residential and commercial areas
- In Plaridel, readings were significantly higher during the evening

Relatively high noise level values obtained may be explained by the fact that these areas are directly fronting roads that are used 24 hours of the day. In the case of Plaridel, the high evening values reflect readings from vehicles that mostly consist of cargo trucks coming from areas farther north. The concentration of these heavy vehicles at Plaridel may be explained by the fact that most rice mill owners prefer to schedule their deliveries during night time.

Based on interviews with owners of rice mills in Bulacan and Nueva Ecija, they follow this schedule because of the following reasons: (I) to avoid traffic congestion along major intersections; and (ii) to avoid tire breakdown due to excessive heat and friction between the tire and the pavement.

TABLE 9.2-5 AMBIENT NOISE LEVELS

Station	Noise Levels in dB (A)			
	Morning (0500-0900HR)	Daytime (0900-1800HR)	Evening (1800-2200HR)	Nighttime (2200-0500HR)
DENR Standard for Residential Areas	50	55	50	45
DENR Standard for Commercial Areas	60	65	60	55
1	76-78	74-76	88-90	74-76
2	70-72	70-72	76-78	72-74
3	70-72	78-80	72-74	70-72
4	68-70	62-64	68-70	60-62

9.2.3 Historical Sites and Protected Areas

Table 9.2-6 and Figure 9.2-1 show proclaimed historical and protected areas in Bulacan and Nueva Ecija. None of these are located within the Study Area.

TABLE 9.2-6 LIST OF PROTECTED AREAS IN BULACAN AND NUEVA ECIJA

Protected Area	Location	Proclamation No. / Date	Area (Ha)
1. Minalungao National Park	Gapan And Gen. Tinio, Nueva Ecija	R. A. 5100/06-11-97	2,018.00
2. Biak-Na-Bato National Park	San Miguel and Dona Remedios Trinidad, Bulacan	Proc. 223/11-16-37 Proc. 2204/06-05-82 Proc. 84/03-09-87 Proc. 401/4-11-89	2,117.00 330.62 2,117.00 658.85
3. Aurora Memorial Park	Bongabon, Nueva Ecija	Proc. 220/11-11-37	2,356.00
4. Angat Watershed Forest Reserve District (Metro Water District)	Montalban, Rizal, Norzagaray, Angat, San Rafael, and San Jose del Monte, Bulacan	Proc. 71/03-10-27 Proc. 391/04-30-68	55,709.10
5. Angat Watershed and Forest Range (Pilot)	Montalban, Rizal, Norzagaray, and San Jose del Monte, Bulacan	Proc. 391/04-30-68	6,600.00
6. Talavera Watershed Reservation	Carranglan, Lupao, San Jose, and Pantabangan, Nueva Ecija, and Sta. Fe, Nueva Viscaya	Proc. 350/12-28-38	37,156.00
7. Pantabangan-Carranglan Watershed Reservation	Pantabangan and Carranglan, Nueva Ecija	Proc. 561/05-21-69	84,500.00
8. Dona Remedios Trinidad /Gen.Tinio Watershed	Dona Remedios Trinidad, Bulacan, and Gen. Tinio, Nueva Ecija	Proc. 230/03-23-88	20,760.00

Source: DENR-PAWB, 1999. List of Protected Areas in the Philippines

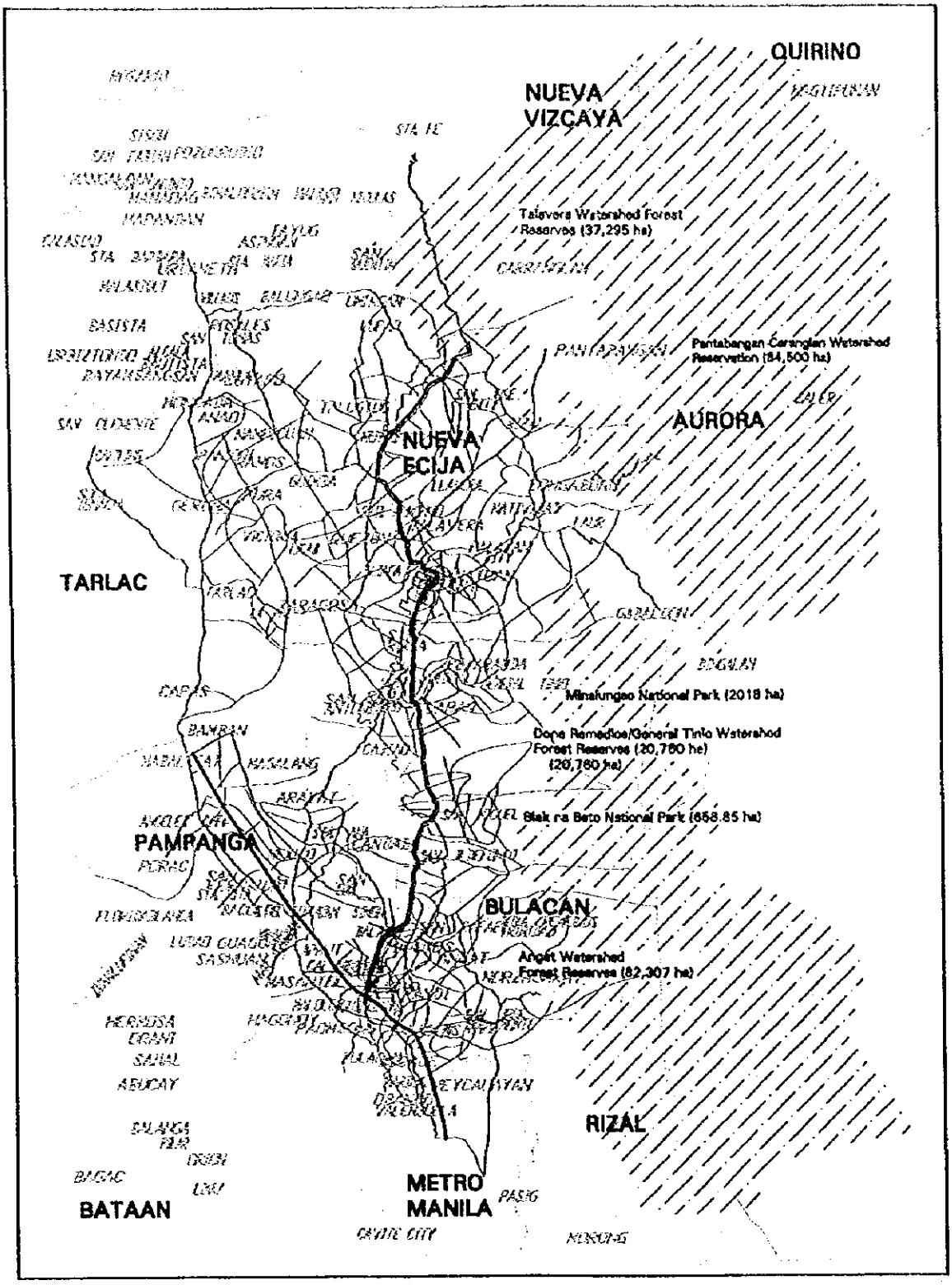


FIGURE 9.2-1

PROTECTED AREAS IN BULACAN AND NUEVA ECIJA

Legend:
Pan-Phil Highway
North Luzon Expressway
Protected Area

9.3 INTERVIEW SURVEY ON ROAD IMPROVEMENT

(1) Key Informants

An interview survey of road users was conducted to obtain a general idea regarding the need and acceptability of a road improvement along the Pan-Philippine Highway. Four (4) groups of key informants were identified. The list of these key informants are shown in Table 9.3-1.

TABLE 9.3-1 LIST OF KEY INFORMANTS BY CATEGORY

Category	Group/Key Informants
Type I	**Drivers** • Public vehicles---tricycles, passenger-type jeeps, All-Purpose Utility Vehicles (AUVs), buses, • Private vehicles--- cargo trucks, delivery vans, cars and owner-type jeeps
Type II	**Rice mill owners** in Bulacan and Nueva Ecija
Type III	Public transportation **commuters**
Type IV	**Owners of commercial establishments** such as gasoline stations and restaurants (particularly those who are dependent on transient customers, and will most probably be affected by the bypass) along the Pan-Philippine Highway

There is another group of key informants, i.e., the communities who will be displaced or adversely affected during the construction of the bypass. They were not included in this survey to avoid any unnecessary, premature, anxiety among these people. Since the improvement measures were not yet final, it shall not cause alarm, apprehension, or even strong objection at this stage.

A total of 330 key informants were interviewed by the socioeconomic survey team. Of these, 210 are drivers of public and private vehicles, 90 are public transportation commuters, 20 are gasoline station owners, and 10 are rice mill owners.

Four (4) sets of questionnaires were designed with the following major categories which are presented in Appendix 9.3-1.

- by vehicle type
- by purposes
- by type of products transported
- by type of occupation / establishment

(2) Result of Interview

The survey result are attached in Appendix 9, and summarized hereunder.

Causes of traffic congestion

Figure 9.3-1 shows the perceived causes of traffic congestion along the Study Road; among which the top three perceive causes of traffic congestion are;

(i) volume of vehicles (35.0%)
(ii) presence of tricycles along the highway (21.6%)
(iii) lack of discipline (14.1%)

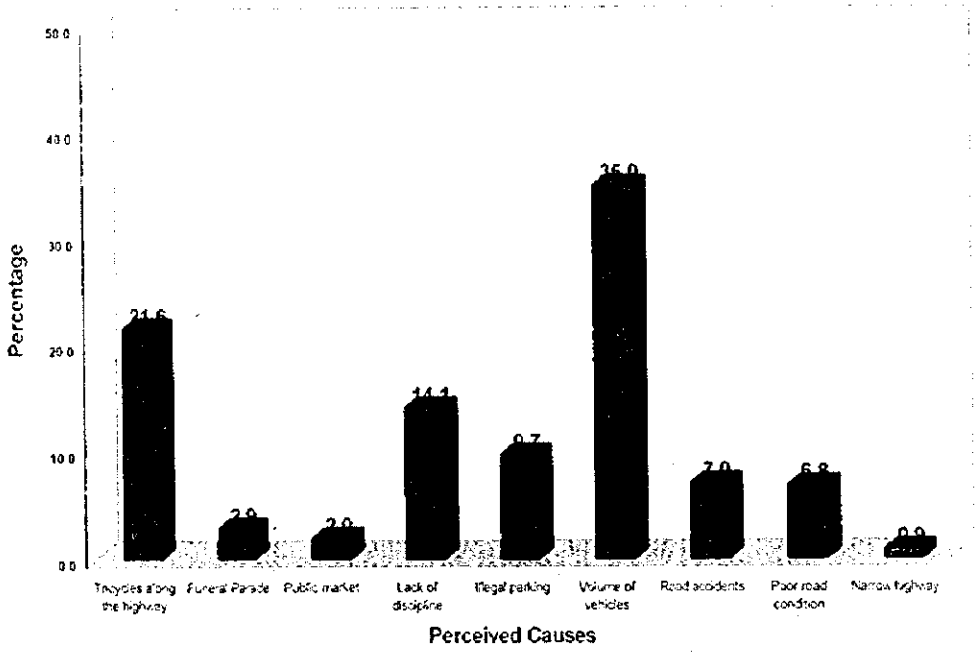


FIGURE 9.3-1 PERCEIVED CAUSES OF TRAFFIC CONGESTION

Solutions to Traffic Congestion

Shown in Figure9.3-2 are the perceived solution to traffic congestion. The top three answers are:

(i) construct a diversion road (43.7%),
(ii) prohibit tricycles along the highway (17.4%),
(iii) discipline drivers (16.5%)

Road widening " only ranked fifth, with only 7.6% share. This may be because the respondents are also aware that prices of land in highly urbanized and commercial areas are very expensive.

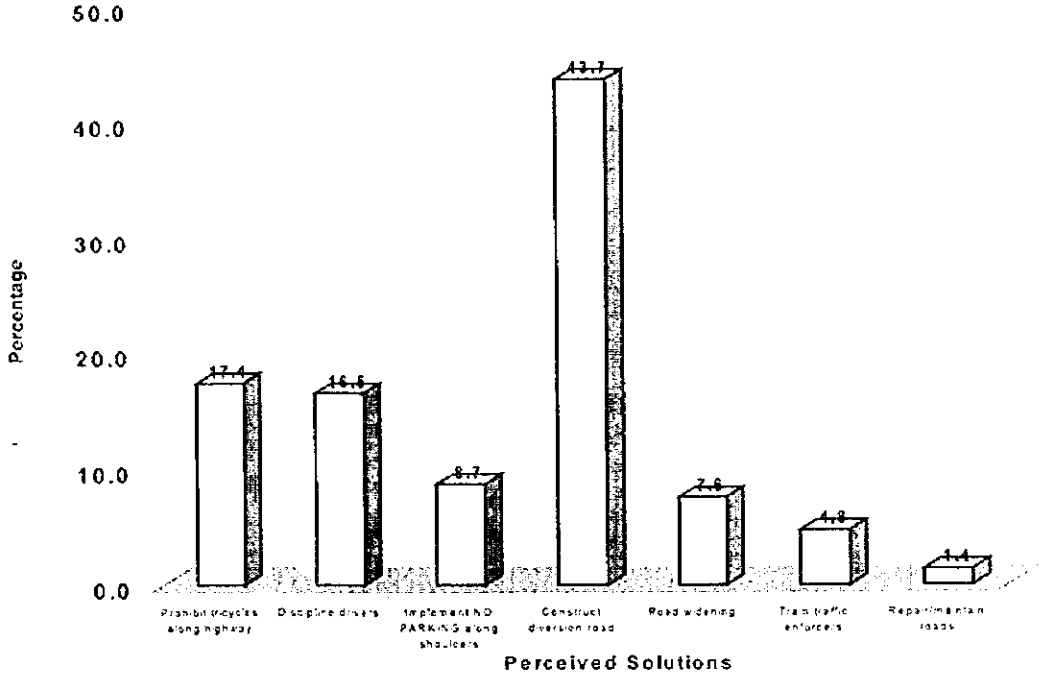


FIGURE 9.3-2 PERCEIVED SOLUTIONS TO TRAFFIC CONGESTION

Favorability of Bypass

As expected, the number two answer among tricycle drivers is to "implement No PARKING ALONG SHOULDER". Again, they are referring to buses and cargo trucks illegally parked along the shoulders of the highway.

When asked "if they are in favor of bypass in Cabanatuan and Plaridel", the majority are in favor of bypass construction as follows (see Figure 9.3-3).

- YES (87.6%)
- NO (6.4%),
- No answer at the moment

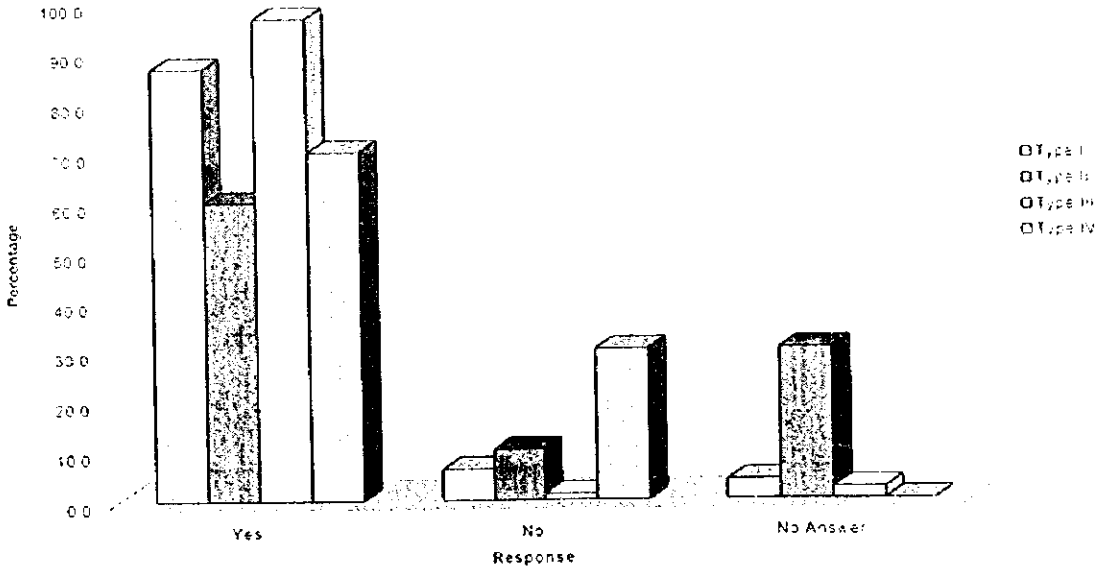


FIGURE 9.3-3 FAVORABILITY OF A BYPASS AS A SOLUTION TO TRAFFIC CONGESTION

For drivers, commuters of rice mills, this trend is understandably normal and expected, since it will either have no effect, or in fact even be beneficial to them. It is noted that 70% of gasoline station operators are in favor of a bypass even if this would literally mean that their establishment will "bypassed".

9.4 ESTABLISHMENT OF ENVIRONMENTAL CONTROL POINTS

The establishment of environmental control points was based on observations and secondary data on the physical, biological, and socioeconomic characteristics of Bulacan and Nueva Ecija.

For each bypass section, the most environmentally viable route shall be chosen based on the following control points:

Natural Environment

- *Physical constraints* – if the receiving environment can still assimilate air and noise pollutants
- *Biological constraints* – with the least abundance of wildlife or wildlife habitats that may be affected

Socio-economic Environment

- *Historical value* – with no shrines or monuments that might be classified as natural patrimony, and thus cannot be removed
- *Density of communities* – with the least number of communities that will be displaced
- *Agricultural productivity* – with the least productive agricultural land

Each of these control points is further explained below.

(1) Natural Environment

Physical Constraints

Areas with the least number of air quality and noise sensitive areas such as residential, school, and hospital and sites which have higher assimilative properties, are better sites for the bypass routes. The following standards were used in assessing the best route:

Impact		Land Use
None	-	Open areas and grasslands
Low	-	Built-up commercial and light industrial areas with existing frontage roads
Medium	-	Built-up residential areas
High	-	School / hospital zones

Biological Constraints

These refers to swamps and marshes which are commonly found in alluvial and flood plains, which are very common in Bulacan and Nueva Ecija. These areas, just like mangroves, are habitats of a wide range of flora and fauna, from shells and crustaceans, amphibians, reptiles, fishes, to mammals, and nesting ground to some birds.

These areas normally have poor substrate characteristics technically referred to as "unsuitable materials" by foundation engineers. It is perhaps better to avoid these swampy areas instead of unearthing and replacing its cover. The following standards were used in assessing the best route:

Impact		Description
None	-	No important habitat found
Low	-	Area is inundated during high precipitation periods only
Medium	-	Area is marshy, but with no distinct swamp areas
High	-	Swampy areas are predominant

(2) Socio-economic Environment

Historical Sites and Protected Areas

Since the provinces of Bulacan and Nueva Ecija have many historical spots such as shrines, monuments, landmarks, and shrines, it must be checked if there are any of these in the proposed bypass routes. Areas found to be classified as of *"national patrimony"* shall be recommended for exclusion.

Based on existing data, the Team found out that there are no historical sites nor protected areas that will be affected by any of the alternative alignments of each bypass section. The following standards were used in assessing the best route:

Impact		Description
None	-	No historical site, no protected area
Low	-	Immediate vicinity of the area is a proclaimed "national patrimony" or protected area
Medium	-	Area is being proposed by the National Historical Institute (NHI) as "national patrimony" or by the DENR as a protected area
High	-	Area has been proclaimed as a "national patrimony" or protected area

Density of Communities

The route with the least density of communities to be displaced would be the best one to choose. By "*community*", this does not only refer to residential units, but includes formal business establishments, as well as facilities accessible to the people such as health clinics, markets, schools, water and power supply, and other important forms of social services. By "*displacement*", this does not only refer to structures along the proposed alignment that will literally be removed from its location. Commercial/business establishments that will be deprived of transient customers as a result of the bypass are also included in this category. The following standards were used in assessing the best route:

Impact		Description
None	-	No displacement of communities
Low	-	Will involve displacement of up to 20 families
Medium	-	Will involve displacement of 20 to 50 families
High	-	Will involve displacement of more than 50 families

Agricultural Productivity

In Bulacan province, one of the major land use issues that are currently considered critical is the conversion of agricultural lands to urban uses. The same is true for Nueva Ecija. If there will be no control, rampant conversion of prime agricultural lands will just continue as a natural consequence of urbanization. As such, the best route would be that which will traverse less productive lands.

The following standards were used in assessing the best route:

Impact		Description
None	-	Non-agricultural areas
Low	-	Multi-crop, non-irrigated agricultural areas
Medium	-	Non-irrigated agricultural (rice) lands
High	-	Prime, irrigated agricultural (rice) lands with multiple cropping pattern

9.5 IMPACT MITIGATION AND ENHANCEMENT

Mitigation here refers to measures or work that must be done to reduce or minimize negative impacts. *Enhancement*, on the other hand, refers to ways in which positive impacts can further be improved or intensified. Table 9.5-1 shows the Impact Mitigation and Enhancement Matrix for the recommended bypass routes during the construction phase and Table 9.5-2 during the operational phase.

TABLE 9.6-1 IMPACT MITIGATION AND ENHANCEMENT MATRIX FOR THE CONSTRUCTION PHASE

IMPACTS	MITIGATION/ENHANCEMENT MEASURES	MANNER OF IMPLEMENTATION	SCHEDULE OF IMPLEMENTATION
PHYSICAL			
Increase in Total Suspended Particulate (TSP) level	Minimize dust re-suspension	Spraying the work area with the use of trucks equipped with water spray jet	Daily, specially during earth moving activities
Increase in vehicular gaseous emissions	Implement exhaust emission reduction measure	Proper maintenance of construction equipment and vehicles	Weekly or monthly depending on the necessity
Increase in noise levels	Minimize disturbance to the public	Schedule high noise level generating activities during the day Vehicles must be provided with efficient mufflers	When necessary particularly when construction site is near schools, hospitals, residential areas, and other noise sensitive areas
BIOLOGICAL			
Loss of vegetation and wildlife habitat	Revegetation of roadside	Planting of fast growing trees such as neem and melina	After demobilization, before opening the road to traffic
SOCIO-ECONOMIC			
Displacement of communities	Implement proper Right-of-Way acquisition procedures	For private property owners, concerned municipal assessor must assess value of property; DPWH-ROW Acquisition Team representative must negotiate with owner and extend necessary assistance; For properties acquired under the Commonwealth Act 141 (Public Land Act), the government is entitled to a sixty (60) meter strip under P. D. 635 of 1975. For public lands with squatters, concerned municipality must provide land for their relocation; DPWH must provide housing and other amenities, at least water and electricity at the relocation site	For private lands, 50% of the total price will be paid in advance, and 50% after the owner vacates the land; DPWH may immediately take possession of this type of land once the need arises and after due notice to the owners DPWH must ready the relocation site and assist the squatters in transferring to the site before any demolition begins
Disruption of commercial activities	Minimize financial losses of the commercial sector	Implement proper traffic management at connection/junction points of the bypass with existing roads specially where there are commercial establishments	Daily
Public inconvenience due to construction activities	Prevent occurrences of accidents	DPWH/Contractor must provide traffic safety measures such as signs, lighting, railings, and traffic aides	Regularly at all construction sites
Generation of employment (at the construction site)	Hire competent and qualified construction workers from the locality	Give priority to applicants who belong to the host barangay or municipality	Before mobilization activities begin

TABLE 9.5-2 IMPACT MITIGATION AND ENHANCEMENT MATRIX FOR THE OPERATIONAL PHASE

IMPACTS	MITIGATION/ENHANCEMENT MEASURES	MANNER OF IMPLEMENTATION	SCHEDULE OF IMPLEMENTATION
PHYSICAL			
Increase in Total Suspended Particulate (TSP) level	Ensure that TSP levels do not exceed DENR standards	Regular monitoring activities by DENR Region III or PENRO Bulacan and Nueva Ecija	Twice a year, once during the dry and wet season
Increase in vehicular gaseous emissions	Ensure that gaseous emissions do not exceed DENR standards	Smoke belches must be apprehended and given appropriate penalties by DENR monitoring teams	Weekly
Increase in noise levels	Ensure that noise levels do not exceed DENR standards particularly at schools, hospitals, and other noise sensitive areas	Provide noise barriers such as line of trees along the road side	Plant saplings instead of seedlings, immediately before operation, for faster noise reduction effect
SOCIO-ECONOMIC			
Decrease in income of commercial establishments along the Pan-Philippine Highway	Minimize financial losses of the commercial sector	Inform commercial establishments specially those who will be "bypassed", early enough so that they can prepare for their financial losses	At least one year before the construction of the bypass routes
Faster, safer travel for through-traffic vehicles	Maintain good road condition	DPWH must implement regular maintenance work and spot check regularly to prevent worsening of defects	Twice a year
LAND USE			
Emergence of ribbon-type commercial development	Discourage ribbon-type of urban development	LGUs must include in their land use plans, buffer zones on both sides of the bypass so that encroachment of the Right-of-Way can be avoided Another option is for the LGU to pass an ordinance which will prohibit any commercial activity within the buffer zones	During planning and design stage of the bypass
Potential loss of productive agricultural land due to conversion to non-agricultural use	Monitor and discourage illegal land conversion of prime agricultural land	LGUs must immediately report to the DENR, HLRB, DAR, DA, and other concerned government agencies if there are violations Most importantly, LGUs must be firm in implementing their land use plans and ordinances. For example, they should always validate the location of application for building permits before issuing them	Immediately after opening of the bypass to traffic

CHAPTER 10

EVALUATION ON BYPASS ALTERNATIVES

CHAPTER 10

EVALUATION ON BYPASS ALTERNATIVES

10.1 PRELIMINARY COST ESTIMATE

The primary purpose of this preliminary evaluation is to identify the prioritization ranking of the proposed bypass route alternatives to be selected for the Feasibility Study. The economic viability of implementing project routes is comprehensively investigated in the next stage.

The economic cost each bypass route was estimated to consist of the following:

- Construction Cost
- ROW Acquisition Cost (include Land Acquisition and Compensation Cost)
- Engineering Cost (Detailed Design and Construction Supervision Cost)

In Appendix 10.1-1, construction, ROW acquisition, compensation and maintenance cost are shown by each bypass route alternative. Engineering cost is assumed as 10 percent of construction cost. ROW acquisition cost was estimated for Industrial, commercial, agricultural, and urban residential and rural residential areas. Compensation cost was estimated by roughly counting of the houses along each bypass route alternative. The prices of construction cost were determined by referring the recent records of relevant data.

TABLE 10.1-1 shows a overall tentative implementation schedule and financial cost of each alternative. This data was used for preliminary economic analysis.

TABLE 10.1-1 OVERALL TENTATIVE IMPLEMENTATION SCHEDULE AND FINANCIAL COST OF EACH ALTENATIVE

Task		1st year	2nd year	3rd year	4th year	Total Cost of each bypass route
Selection of Consultant						
Detailed Design						
Land Acquisition						
Tendering						
Construction						
Pratidel ~ Baliuag Bypass Financial Cost (Pesos)						Million Pesos
R-1	Detailed Design	154,800,000	17,200,000	0	0	172
	R.O.W.	316,500,000	316,500,000	0	0	633
	Construction	0	327,000,000	1,310,000,000	1,310,000,000	2,947
R-2	Detailed Design	138,600,000	15,400,000	0	0	154
	R.O.W.	360,000,000	360,000,000	0	0	720
	Construction	0	294,000,000	1,175,500,000	1,175,500,000	2,645
R-3	Detailed Design	126,000,000	14,000,000	0	0	140
	R.O.W.	404,500,000	404,500,000	0	0	809
	Construction	0	267,000,000	1,067,000,000	1,067,000,000	2,401
R-4	Detailed Design	88,200,000	9,800,000	0	0	98
	R.O.W.	155,500,000	155,500,000	0	0	311
	Construction	0	187,000,000	757,000,000	757,000,000	1,701
Cabanatuan Bypass Financial Cost (Pesos)						Million Pesos
R-1	Detailed Design	200,700,000	22,300,000	0	0	223
	R.O.W.	159,000,000	159,000,000	0	0	318
	Construction	0	426,000,000	1,703,500,000	1,703,500,000	3,833
R-2	Detailed Design	159,300,000	17,700,000	0	0	177
	R.O.W.	176,500,000	176,500,000	0	0	353
	Construction	0	338,000,000	1,353,000,000	1,353,000,000	3,044
R-3	Detailed Design	133,200,000	14,800,000	0	0	148
	R.O.W.	158,000,000	158,000,000	0	0	316
	Construction	0	282,000,000	1,127,000,000	1,127,000,000	2,536
R-4	Detailed Design	102,600,000	11,400,000	0	0	114
	R.O.W.	106,500,000	106,500,000	0	0	213
	Construction	0	217,000,000	866,500,000	866,500,000	1,950
San Jose Bypass Financial Cost (Pesos)						Million Pesos
R-1	Detailed Design	18,900,000	2,100,000	0	0	21
	R.O.W.	19,000,000	19,000,000	0	0	38
	Construction	0	40,600,000	162,200,000	162,200,000	365
R-2	Detailed Design	15,300,000	1,700,000	0	0	17
	R.O.W.	19,500,000	19,500,000	0	0	39
	Construction	0	32,200,000	128,900,000	128,900,000	290
Remarks		・Detailed Design and Construction Foreign Currency 55% Local Currency 30% Tax 15%		・Financial Cost is decided based on the past records of relevant material. ・Escalation of currency is not considered.		

10.2 PRELIMINARY ECONOMIC ANALYSIS

10.2.1 Economic Benefit

The economic benefit is derived from the difference between "With-the-Project" and "Without-the-Project". The economic benefits are composed of three kinds of benefits as the direct benefits as follows;

(i) Saving of running cost of vehicle

Running cost of vehicle is depending on traveled distance of vehicle (vehicle km.) and consists of cost for fuel, lubricant, tire, maintenance and repairs, and distance dependant-depreciation.

(ii) Saving of fixed cost of vehicle

Fixed cost of vehicle is depending on traveled time of vehicle (vehicle hour) and consists of costs for capital, crew, overhead and time-dependent depreciation.

(iii) Saving of time cost

Time cost is time value of passenger. Time value is estimated on the basis of per capita GRDP or average income family and working hours.

The tentative unit traffic cost by vehicle type is estimated as follows;

TABLE 10.2-1 UNIT TRAFFIC COST BY VEHICLE TYPE

(Price at 1998)

Vehicle Type	Running Cost	Fixed Cost	Time Cost (Peso/min.)
Car	3.674	0.154	1.285
Jeepney	2.134	1.055	2.424
Bus	7.799	1.585	8.315
Tricycle	2.204	0.092	0.771
Truck	6.600	0.490	-

Source : DPWH

The result of forecast of vehicle km. and hours for route-2 of all bypass alternatives are shown in Table 10.2-2 and the economic benefit by vehicle type is shown in Table 10.2-3 respectively.

10.2.2 Economic Cost

The project cost is converted from financial price to economic price. The basic conditions for conversions are as follows:

i. The price level is fixed at constant 1998 year.

TABLE 10.2-2 FORECAST OF VEHICLE KM. AND VEHICLE HOURS BY VEHICLE TYPE FOR ROUTE-2 OF ALL BYPASS ALTERNATIVES

Item	Year		Pas. Car	Jeepney	Bus	Truck	Tricycle	Total
Vehicle Km /Day (1,000 km)	1998	Present	5,001.5	2,100.3	804.4	2,914.6	540.9	11,361.7
	2005	Without	10,296.7	3,084.9	1,362.8	5,847.1	630.9	21,222.4
		With	10,212.0	3,056.6	1,353.2	5,794.7	630.7	21,047.4
		With - Without	-84.7	-28.3	-9.6	-52.4	-0.2	-175.0
	2010	Without	14,177.8	3,950.8	1,684.3	7,578.7	863.7	28,255.3
		With	14,122.5	3,927.3	1,678.7	7,546.6	858.8	28,133.9
		With - Without	-55.3	-23.5	-5.6	-32.1	-5.0	-121.4
	2020	Without	29,229.2	6,222.2	2,734.1	14,444.9	1,373.5	54,003.9
		With	29,129.1	6,186.5	2,720.3	14,371.9	1,366.4	53,774.3
		With - Without	-100.1	-35.7	-13.8	-73.0	-7.1	-215.4
Vehicle Hour/Day (1,000 hour)	1998	Present	245.1	107.0	34.0	137.8	27.3	551.2
	2005	Without	711.5	227.6	90.6	384.6	73.9	1,488.2
		With	684.1	219.1	86.5	369.1	67.2	1,426.0
		With - Without	-27.5	-8.5	-4.1	-15.5	-6.7	-62.3
	2010	Without	947.0	276.9	97.3	507.6	55.7	1,884.5
		With	923.1	271.6	95.6	496.4	55.3	1,841.9
		With - Without	-23.9	-5.3	-1.7	-11.2	-0.4	-42.6
	2020	Without	3,608.5	744.7	305.4	1,812.8	227.6	6,699.0
		With	3,523.2	719.5	298.5	1,771.7	211.6	6,524.6
		With - Without	-85.3	-25.2	-6.9	-41.1	-16.0	-174.4

Note : Both of vehicle km and hours will increase until 2009 but decrease at 2010 because of traffic conversion from bypass road and existing study road to express way.

TABLE 10.2-3 ECONOMIC BENEFIT BY VEHICLE TYPE FOR ROUTE-2 OF ALL BYPASS ALTERNATIVES

(Unit : Milli. Pesos/Year)

Year	Vehicle Type	Running Cost	Fixed Cost	Time Cost	Total
2005	Car	114	93	773	979
	Jeepney	22	195	449	667
	Bus	27	143	748	918
	Tricycle	0	14	114	127
	Truck	126	166	-	292
	Total	289	611	2,084	2,983
2010	Car	74	81	674	829
	Jeepney	18	122	280	421
	Bus	16	60	317	393
	Tricycle	4	1	7	12
	Truck	77	120	-	197
	Total	190	384	1,278	1,852
2020	Car	134	288	2,400	2,822
	Jeepney	28	581	1,336	1,946
	Bus	39	238	1,251	1,529
	Tricycle	6	32	270	308
	Truck	176	441	-	617
	Total	383	1,581	5,258	7,221

Note : The benefit will increase until 2009 but decrease at 2010 because of traffic conversion from bypass road and existing study road to express way.

ii. The shadow exchange rate (SER) is applied to the foreign currency portion. The SER is assumed to be 1.00 in this preliminary evaluation.

iii. The local currency portion currency of detailed design and construction cost in financial price includes the transfer items such as custom duties for imported materials, sales tax, value added tax, subsidies, and so on for locally procured materials. These transfer items are eliminated from them. In this study, these transfer items are tentatively assumed to be 20%. Then the conversion factor of 0.8 is applied to them.

Besides, the R.O.W land acquisition cost is tentatively assumed to include a speculative factor of 10%. Then the conversion factor of 0.9 is applied to the R.O.W land acquisition cost.

iv. The operating and maintenance cost after completion of construction is tentatively assumed to be 5% of construction cost.

The disbursement schedule of project cost in financial price and economic price are presented in Appendix 10.2-1.

10.2.3 Economic Evaluation

(1) Basic Conditions

i. The period for evaluation is assumed to be totally 24 years including the four years for construction and twenty years after completion of construction.
ii. The social opportunity cost of capital in the Philippines is considered to be 15%.
iii. The indicators of economic evaluation are "Economic Internal Rate of Return" (EIRR), "Benefit Cost Ratio"(B/C) and "Net Present Value" (NPV). The discount rate of social opportunity cost of capital of 15% is adopted to figure out B/C and NPV.
iv. The economic evaluation for route-2 of all bypass routes is carried out as a base case. Other alternative routes were approximately estimated by taking account of distance of bypass and accessibility.

(2) Preliminary Results of Economic Evaluation

The preliminary results of economic analysis are shown in Table 10.2-4.

Comparing the economic indicators of alternative routes, the highest EIRR is figured out as follows;

i. Plaridel Bypass : Route-2, 26.3% followed by Route-3, 26.0%
ii. Cabanatuan Bypass : Route-3, 34.4% followed by Route-2, 33.8%
iii. San Jose Bypass : Route-2, 33.6% followed by Route-1, 29.7%

TABLE 10.2-4 RESULT OF ESTIMATES OF EIRR, NPV AND B/C

Name of Bypass	Route Alternative	EIRR (%)	NPV (Milli. Pesos)	B/C
Plaridel-Baliuag	Route-1	24.6	1,975	1.7
	Route-2	26.3	2,262	1.9
	Route-3	26.0	2,117	1.8
	Route-4	21.3	688	1.4
Cabanatuan	Route-1	24.9	2,248	1.7
	Route-2	33.8	3,880	2.4
	Route-3	34.4	3,395	2.5
	Route-4	31.5	2,108	2.2
San Jose	Route-1	29.7	343	2.1
	Route-2	33.6	376	2.4

10.3 INITIAL ENVIRONMENTAL ASSESSMENT

This initial environmental impact assessment on the proposed bypasses are presented in Appendix 10.3-1, and summarized as follows.

Plaridel-Baliuag Bypass

Based on Table 10.3-1, Route 2 and 3 show a preferable environmental viability compared with Route 1 and 4, mainly because of low negative impact on an agricultural productivity and better conformity with the land use plan of municipalities.

TABLE 10.3-1 ENVIRONMENTAL IMPACT ASSESSMENT OF ALTERNATIVE ROUTES FOR PLARIDEL – BALIUAG BYPASSES

	Alternative Routes			
Environmental Control Points	**1**	**2**	**3**	**4**
Natural Environment				
Physical constraints	low	low	low	medium
Biological constraints	medium	low	low	medium
Socio-economical Environment				
Historical value	none	none	none	none
Density of communities	medium	medium	medium	low
Agricultural productivity	medium	low	low	medium

Cabanatuan Bypass

It is clearly shown in Table 10.3-2 that the best route in terms of environmental viability is Route 2. This is mainly because it has the lowest number of communities to be displaced, and the agricultural lands are not as productive as those located west of the Pampanga River.

TABLE 10.3-2 ENVIRONMENTAL IMPACT ASSESSMENT OF ALTERNATIVE ROUTES FOR CABANATUAN BYPASS

	Alternative Routes			
Environmental Control Points	**1**	**2**	**3**	**4**
Natural Environment				
Physical constraints	low	low	low	medium
Biological constraints	high	low	low	low
Socio-economical Environment				
Historical value	none	none	none	none
Density of communities	medium	low	medium	high
Agricultural productivity	low	medium	medium	high

San Jose Bypass

As shown in Table 10.3-3, Route 2 is the best route primarily because it has a lower agricultural productivity than Route 1, and it conforms with San Jose City's land use plan.

TABLE 10.3-3 ENVIRONMENTAL IMPACT ASSESSMENT OF ALTERNATIVE ROUTES FOR SAN JOSE BYPASS

	Alternative Routes	
Environmental Control Points	**1**	**2**
Natural Environment		
Physical constraints	low	medium
Biological constraints	low	low
Socio-economical Environment		
Historical value	none	none
Density of communities	medium	medium
Agricultural productivity	medium	low

CHAPTER 11

SELECTION OF THE BEST BYPASS ROUTE

CHAPTER 11

SELECTION OF THE BEST BYPASS ROUTE

11.1 RATING CRITERIA AND EVALUATION ON BYPASS ALTERNATIVES

In order to provide a rating system to select a best bypass route for the Feasibility Study in the next stage, a rating criteria has been established based on the evaluation of four(4) factors, namely Technical, Development, Environment and Economic, and financial related to upgrading the inter-urban road system as described in the following sections.

11.1.1 Technical Evaluation

The comparative evaluation on the proposed bypass routes shall involve the comprehensive factors such as mobility, accessibility, harmony with existing network, etc., including the followings.

(1) Interchange Location (only for Plaridel – Baliuag Bypass)

The appropriateness of connection point with the existing North Luzon Expressway was evaluated in terms of a space of interchange and connection with the existing main arterial roads.

a: Good (reasonable spacing and connection)
b: Fair (connection with the west side)
c: Bad (no connection with main arterials)

(2) Geometry

The mobility of bypasses was evaluated only by differences in vertical and horizontal geometries because a proposed cross section was the same for each route, thus could provide the same level of mobility:

a: Good (preferable standards)
b: Fair (minimum standards)
c: Bad (sub-standards)

(3) Efficiency of Bypass

The efficiency of bypasses was measured by a ratio of traffic volume diverted to bypasses from the Highway in the proposed target year of completion of Year 2010.

a: Good
b: Fair
c: Bad

(4) Accessibility to Urban Center

The accessibility was estimated by spaces between access roads and distances from access points to the urban center.

a: Good (Narrow spaces, Short distances)
b: Fair (Fair spaces, Fair distances)
c: Bad (Wide space, Longer distance)

(5) Harmony with Existing Network

The harmony of proposed bypasses in existing network was assessed in terms of highway hierarchy, density, space and continuity in the influenced area.

a: Good (Highly harmonized)
b: Fair (Fairly harmonized)
c: Bad (Poorly harmonized)

(6) Construction Difficulty

The construction difficulty was evaluated by special structures such as long-span bridges, high embankment on soft ground.

a: Good (No/small bridge, No high embankment)
b: Fair (Fair length bridge, Fair high embankment)
c: Bad (Long span bridge, High embankment)

11.1.2 Developmental Evaluation

The compatibility between the proposed bypass routes and the development plans is vital for selecting route because the bypass road shall support and realize the targets of such development plans. From this, the following items are considered as a development evaluation;

(1) Compatibility with City Development Plan

a: Good
b: Fair
c: Bad

(2) Compatibility with Provincial Development Plan

a: Good
b: Fair
c: Bad

(3) Service to Private Development Plan

a: Good
b: Fair
c: Bad

11.1.3 Environmental Evaluation

The environmental issue is given a importance in the comparative evaluation because major construction activities may cause some negative impact on the natural or social environment.

(1) Natural Environment

The natural environment was examined by physical constraints (air pollution, noise level), and biological constraints (flora, fauna), etc.

a: Good
b: Fair
c: Bad

(2) Socioeconomic Environment

The negative impact socioeconomic environmental aspect was examined by historical sites and protection areas density of communities and agricultural productivity.

a: Low
b: Medium
c: High

(3) Number of Houses Affected

The number of houses affected by construction of bypasses and access roads was counted as a factor of environmental evaluation.

a: Few
b: Fair
c: Many

11.1.4 Economic and Financial Evaluation

As the indicators of economic and financial evaluation, the following three(3) factors were quantified and used for comparative evaluation of the proposed bypass alternatives

(1) Financial aspect (Construction cost)

a: Low
b: Fair

c: High

(2) Social aspect (ROW acquisition and compensation cost)

a: Low
b: Fair
c: High

(3) Economic aspect (EIRR)

a: High
b: Medium
c: Low

11.2 OVERALL EVALUATION ON BYPASS ALTERNATIVES

(1) In the overall evaluation in each bypass at first, from four(4) factors including Technical, Development, Environment and Economic and finalized aspects were evaluated separately giving the following points.

a: 3 points
b: 2 points
c: 1 point

(2) The total point of each factor of each bypass were then classified into three(3) categories to evaluate evenly each factor as follows;

A case of Planned – Baliuag Bypass

- Technical Evaluation

Points 15 - 18	:	Class	**A**
Points 11 – 14	:	Class	**B**
Points 6 – 10	:	Class	**C**

- Development Evaluation

Points 8, 9	;	Class	**A**
Points 6, 7	;	Class	**B**
Points 3, 4, 5	;	Class	**C**

- Environment Evaluation

Points 10 - 12	;	Class	**A**
Points 7 - 9	;	Class	**B**
Points 4 - 6	;	Class	**C**

- Economic and Financial Evaluation

Points 8, 9	;	Class	**A**
Points 6, 7	;	Class	**B**
Points 3, 4, 5	;	Class	**C**

(3) Overall Evaluation

In order to express the results of overall evaluation with numeral, each class was again given the following points.

a: 3 points
b: 2 points
c: 1 point

By the total point of each bypass, the final ranking was assigned.

The rating and overall evaluation are shown in Tables 11.2-1, 11.2-2 and 11.2-3 for the Plaridel-Baliuag Bypasses, Cabanatuan Bypasses and San Jose Bypasses respectively.

TABLE 11.2-1 Evaluation on Plaridel Baliuag Bypass Routes Alternatives

Factors	Alternatives								Remarks
	Route-1		Route-2		Route-3		Route-4		
Length of Routes	22.5 km		22.8 km		20.3 km		18.8 km		
1. Technical Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
1.1 Interchange Location	Bad	c	Good	a	Bad	c	Fair (Connection with west side, Utilization of existing I/C)	b	
1.2 Geometry	Good	a	Fair	b	Good	a	Good	a	
1.3 Efficiency of Bypass	0.16	c	0.48	a	0.45	a	0.41	b	AADT in 2010(2)
1.4 Accessibility to Urban Center	S=10~4.6km O=11.7~8.0km Bad	c	S=17~4.0km O = 9.3 / 6.3km Fair	b	S=17~3.5km O = 9.2 / 6.2km Fair	b	S=2.3~4.3km O = 8.2 / 7.1km Fair	b	S = Spaces O = Distances
1.5 Harmony with Existing Network	Bad	c	Good	a	Bad	c	Bad	c	
1.6 Construction Difficulty	Fair (L=1000m, New Interchange)	b	Fair (L=425m, Improvement of Junction)	b	Fair (L=425m, New Interchange)	b	Good (L=5m, Improvement of Access)	a	
Rating	a + b + 4c (9 points)		3a + 3b (15 points)		2a + 2b + 2c (12 points)		2a + 3b + c (13 points)		a=3, b=2, c=1
2. Developmental Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
2.1 Compatibility with City Development Plan	Bad	c	Good	a	Good	a	Bad	c	
2.2 Compatibility with Provincial Development Plan	Good	a	Fair	b	Bad	c	Bad	c	
2.3 Service to Private Development Plan	Bad	c	Good	a	Good	a	Bad	c	
Rating	a + 2c (7 points)		2a + b (8 points)		2a + c (7 points)		3c (3 points)		a=3, b=2, c=1
3. Environmental Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
3.1 Existing Natural Environment	Medium	b	Low	a	Low	a	Medium	b	
3.2 Socio economic Environment	Medium	b	Low	a	Low	a	Medium	b	
3.3 No. of Houses affected	20 ea	a	25 ea	b	30 ea	c	20 ea	a	
3.4 ROW Acquisition	1073 ha	c	1066 ha	c	980 ha	b	843 ha	b	
Rating	a + 2b + c (8 points)		a + 2b + c (9 points)		2a + b + c (9 points)		2a + 2b (10 points)		a=3, b=2, c=1
4. Economic and Financia Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
4.1 Financial Aspect	P 2,661 M	c	P 2,568 M	b	P 2,331 M	b	P 1,632 M	a	
4.2 Social Aspect	P 63M	b	P 72M	b	P 80M	c	P 31M	a	
4.3 Economic Aspect	24.6	b	26.3	a	26.0	a	21.3	c	
Rating	2b + c (5 points)		a +2b (7 points)		a + b + c (6 points)		2a + c (7 points)		a=3, b=2, c=1
Overall Evaluation									
1. Tequnical Evaluation	9 (C)		15 (A)		12 (B)		13 (B)		A = 15 - 18 B = 11 - 14 C = 6 - 10
2. Developmental Evaluation	7 (B)		8 (A)		7 (B)		3 (C)		A = 8, 9 B = 6, 7 C = 3, 4, 5
3. Environmental Evaluation	8 (B)		9 (B)		9 (B)		10 (A)		A = 10 - 12 B = 7 - 9 C = 4 - 6
4. Economic and Financial Evaluation	5 (C)		7 (B)		6 (B)		7 (B)		A = 8, 9 B = 6, 7 C = 3, 4, 5
Overall Evaluation	2B + 2C (6 points)		2A + 2B (10 points)		4B (8 points)		A + 2B + C (8 points)		A = 3 ; B = 2 ; C = 1
Ranking	4		1		2		2		

TABLE 11.2-2 Evaluation on Cabanatuan Bypass Routes Alternatives

Factors	Alternatives								Remarks
	Route-1		Route-2		Route-3		Route-4		
Length of Routes	35.0 km		29.5 km		24.0 km		19.5 km		
1. Technical Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
1.1 Geometry	Fair	b	Fair	b	Fair	b	Fair	b	
1.2 Efficiency of Bypass	0.29	c	0.60	a	0.60	a	0.50	b	
1.3 Accessibility to Urban Center	S=2.0~6.0km O=11.3km Bad	c	S=2.0~5.5km O=9.4km Fair	b	S=1.6~5.0km O=8.2km Fair	b	S=2.5~4.5km O=11.0km Bad	c	S = Spaces O = Distances
1.4 Harmony with Existing Network	Bad	c	Good	a	Fair	b	Bad	c	
1.5 Construction Difficulty	Fair (L=280m)	b	Fair (L=280m)	b	Fair (L=280m)	b	Good (L=150m)	a	
Rating	2b + 3c (7 points)		2a + 3b (12 points)		a + 4b (11 points)		a + 2b + 2c (9 points)		a=3, b=2, c=1
2. Developmental Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
2.1 Compatibility with City Development Plan	Fair	c	Good	a	Good	a	Bad	c	
2.2 Compatibility with Provincial Development Plan	—		—		—		—		
2.3 Service to Private Development Plan	Fair	b	Good	a	Good	a	Bad	c	
Rating	2b (4 points)		2a (6 points)		2a (6 points)		2c (2 points)		a=3, b=2, c=1
3. Environmental Evaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
3.1 Existing Natural Environment	Medium	b	Low	a	Low	a	Medium	b	
3.2 Socio-economic Environment	Low	a	Low	a	Medium	b	High	c	
3.3 No. of Houses affected	30 ea	a	40 ea	c	35 ea	b	30 ea	a	
3.4 ROW Acquisition	1735 ha	c	1460 ha	b	1185 ha	b	965 ha	a	
Rating	2a + b + c (9 points)		2a + b + c (9 points)		a + 3b (9 points)		2a + b + c (9 points)		a=3, b=2, c=1
4. Economic and Financia lEvaluation	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	Evaluation	Rating	
4.1 Financial Aspect	P 3,721 M	c	P 2,953 M	b	P 2,462 M	b	P 1,893 M	a	
4.2 Social Aspect	P 316 M	b	P 353 M	c	P 316 M	b	P 213 M	a	
4.3 Economic Aspect	24.9	c	33.8	a	34.4	a	31.5	b	
Rating	b + 2c (4 points)		a + b + c (6 points)		a + 2b (7 points)		2a + b (8 points)		a=3, b=2, c=1
Overall Evaluation									
1. Tequnical Evaluation	7 (C)		12 (A)		11 (B)		9 (B)		A = 12 - 15 B = 8 -11 C = 5 - 7
2. Developmental Evaluation	4 (B)		6 (A)		6 (B)		2 (C)		A = 6 B = 4, 5 C = 2, 3
3. Environmental Evaluation	9 (B)		9 (B)		9 (B)		9 (B)		A = 10 - 12 B = 7 - 9 C = 4 - 6
4. Economic and Financial Evaluation	4 (C)		6 (B)		7 (B)		8 (A)		A = 8, 9 B = 6, 7 C = 3, 4, 5
Overall Evaluation	2B + 2C (6 points)		2A + 2B (10 points)		4B (8 points)		A + 2B + C (8 points)		A = 3 ; B = 2 ; C = 1
Ranking	3		1		2		2		

TABLE 11.2-3 Evaluation on San Jose Bypass Routes Alternatives

Factors	Alternatives				Remarks
	Route-1		Route-2		
Length of Routes	9.0 km		6.5 km		
1. Technical Evaluation	Evaluation	Rating	Evaluation	Rating	
1.1 Geometry	Fair	b	Fair	b	
1.2 Efficiency of Bypass	0.94	b	0.96	a	
1.3 Accessibility to Urban Center	S=1.2~2.5km D=2.6km	b	S=2.1~3.5km D=2.0km	b	S = Spaces D = Distances
1.4 Harmony with Existing Network	Fair	b	Fair	b	
1.5 Construction Difficulty	Fair	b	Fair	b	
Rating	5b (10 points)		a + 4b (11 points)		a=3, b=2, c=1
2. Developmental Evaluation	Evaluation	Rating	Evaluation	Rating	
2.1 Compatibility with City Development Plan	Bad	c	Good	a	
2.2 Compatibility with Provincial Development Plan	—		—		
2.3 Service to Private Development Plan	Bad	b	Good	a	
Rating	2c (2 points)		2a (6 points)		a=3, b=2, c=1
3. Environmental Evaluation	Evaluation	Rating	Evaluation	Rating	
3.1 Existing Natural Environment	Low	a	Low	a	
3.2 Socio-economic Environment	Medium	b	Low	a	
3.3 No. of Houses affected	10 ea.	a	15 ea.	b	
3.4 ROW Acquisition	225 ha	b	163 ha	a	
Rating	2a + 2b (10 points)		3a + b (11 points)		a=3, b=2, c=1
4. Economic and Financia lEvaluation	Evaluation	Rating	Evaluation	Rating	
4.1 Financial Aspect	P 316 M	c	P 243 M	b	
4.2 Social Aspect	P 39 M	b	P 40 M	c	
4.3 Economic Aspect	29.7	b	33.6	a	
Rating	2b + c (5 points)		a + 2b (9 points)		a=3, b=2, c=1
Overall Evaluation					
1. Tequnical Evaluation	10 (B)		11 (B)		A = 12 - 15 B = 8 -11 C = 5 - 7
2. Developmental Evaluation	2 (C)		6 (A)		A = 6 B = 4, 5 C = 2, 3
3. Environmental Evaluation	10 (A)		11 (A)		A = 10 - 12 B = 7 - 9 C = 4 - 6
4. Economic and Financial Evaluation	5 (C)		7 (B)		A = 8, 9 B = 6, 7 C = 3, 4, 5
Overall Evaluation	A + B + 2C (7 points)		2A + 2B (10 points)		A = 3 ; B = 2 ; C = 1
Ranking	2		1		

11.3 SELECTION OF THE BEST BYPASS ROUTE

The following bypass routes were recommended as the best bypass route for the Feasibility Study to be conducted in Stage-2.

(1) Plaridel-Baliuag Bypass : Route – 2
(2) Cabanatuan Bypass : Route – 2
(3) San Jose Bypass Bypass : Route – 2

Table 11.3-1 summarizes the ranking, the construction cost and right of way acquisition cost for the proposed bypass alternatives.

TABLE 11.3-1 RANKING AND COST OF BYPASS

Bypass Name	Route Name	Ranking	Cost (Million Pesos)		
			Construction	ROW	Total
Plaridel-Baliuag	R – 1	4	2,861	636	3,497
	R – 2	1	2,568	720	3,288
	R – 3	3	2,311	809	3,120
	R – 4	2	1,632	311	1,943
Cabanatuan	R – 1	3	3,721	318	4,039
	R – 2	1	2,955	353	3,308
	R – 3	2	2,462	316	2,778
	R – 4	3	1,893	213	2,106
San Jose	R – 1	2	316	38	354
	R – 2	1	243	40	283