# CHAPTER 13
# FEASIBILITY STUDY OF SUGAR ROAD: NORTH SECTION

## 13.1 OBJECTIVES OF THE PROJECT

Sugar Road is non-existing at present and will become the most fundamental component of the future road network in the Metro Bacolod area.

Present road network is a comb type with Bacolod Coastal Road as a base, which is planned to be converted to a ladder type with Sugar Road as an another base of road network.

There are five sugar mills in the area. All sugar cane trucks pass on Bacolod Coastal Road causing traffic congestion in urban sections. Sugar Road provides better access to sugar mills, thus sugar cane trucks are planned to be diverted to this road, thus traffic congestion of Bacolod Coastal Road is reduced and at the same time the sugar industry is vitally supported.

Objectives of the Projects are summarized as follows:

**Objectives of the Project**

- To reduce traffic congestion of Bacolod Coastal Road and City proper area
- To formulate a flexible road network
- To support sugar industry development by providing easy access to sugar mills
- To enhance international / domestic investment in the Study Area
- To guide and support planned urban development in Bacolod City area.

## 13.2 PHYSICAL FEATURES OF THE PROJECT SITE

The project site is located at a rolling terrain with undulating topography. The ground elevation varies from 12m to 105m from the mean sea level. Numerous rivers cross the project site, of which the largest is Malogo River. Rivers form a valley with a depth of 10 to 15m.

General geological condition is characterized as volcanic and sedimentary rock. Sand and gravel or sandstone layers with N-value of over 50 can be expected at the depth of 12 to 15 meters from the ground. Cover soils are mostly silty clay or silty sand with N-value from 5 to 20.

The route traverses sugar cane land and no urban development is made yet, except the section near Bacolod-Granda Road.

## 13.3 ENGINEERING SURVEYS UNDERTAKEN

The following three surveys were undertaken:

- Aerial Photography and Orthophoto Mapping
- Road Alignment Survey
- Geo-technical survey and Soils/Material Sources Survey

1) Aerial Photography and Orthophoto Mapping

| | | |
|---|---|---|
| Aerial photography | : | Photo scale = 1/15,000<br>Coverage = 2km width along the route |
| Orthophoto mapping | : | Scale = 1/5,000 |

2) Road Alignment Survey

- Control points survey
- Center line survey (50m interval)
- Profile survey (50m interval)
- Cross-section survey (50m interval, width=60m)
- River profile / cross-section survey (large rivers only)

3) Geo-technical survey and soils/material source survey

- Bridge site geo-technical survey (depth = 30~50m)
- Soils / material sources survey (6 locations)

## 13.4 SELECTION OF ROUTE ALIGNMENT

The route alignment was planned based on the following:

- The road branches off from Bacolod-Murcia Road near the cockpit arena. The beginning point was selected in due consideration of future extension of this road toward the south.
- The Bacolod City Government constructed an earth road near Bacolod-Granada Road. This earth road is utilized as a part of Sugar Road.
- The road ends at Bacolod Coastal Road in Victorias City. End point was selected at the location away from planned urban area where the alignment of Bacolod Coastal Road is almost straight to secure enough sight distance for drivers.
- The existing golf course in Victorias City shall not be affected.
- There are small communities spotted along the corridor which shall not be affected as much as possible.
- An alignment is so selected that it intersects with roads and rivers at almost right angle.

Two alternative alignments were developed for comparison (see Figure 13.4-1):

Alternative – 1 : To achieve minimal social impact
Alternative – 2 : To achieve the best horizontal alignment

Two alternatives were assessed as shown in Table 13.4-1:

**TABLE 13.4-1 ASSESSMENT OF ALTERNATIVE ALIGNMENTS**

| | Alternative-1 | Alternative-2 |
|---|---|---|
| 1) Road Length (km)<br>- Road Section<br>- Bridge Section<br>- Total | <br>32.72<br>1.31<br>34.03 | <br>32.19<br>1.63<br>33.81 |
| 2) No. of Structures Affected | 15 | 64 |
| 3) Construction Cost (Million P)<br>- Road Section<br>- Bridge Section<br>- Total | <br>867.1<br>493.7<br>1,360.8<br>(0.00) | <br>852.9<br>611.0<br>1,463.9<br>(+103.1) |
| 4) ROW Acquisition/Compensation Cost (Million Pesos) | 410.4<br>(0.00) | 417.0<br>(+6.6) |
| Assessment | • Good horizontal alignment<br>• Least negative social impact<br>• Lowest investment than Alternative-2 | • Better horizontal alignment<br>• High negative social impact<br>• Highest investment than Alternative-1 |
| Recommendation | * Recommended | — |

**Alternative – 1** is recommended for the alignment of this road.

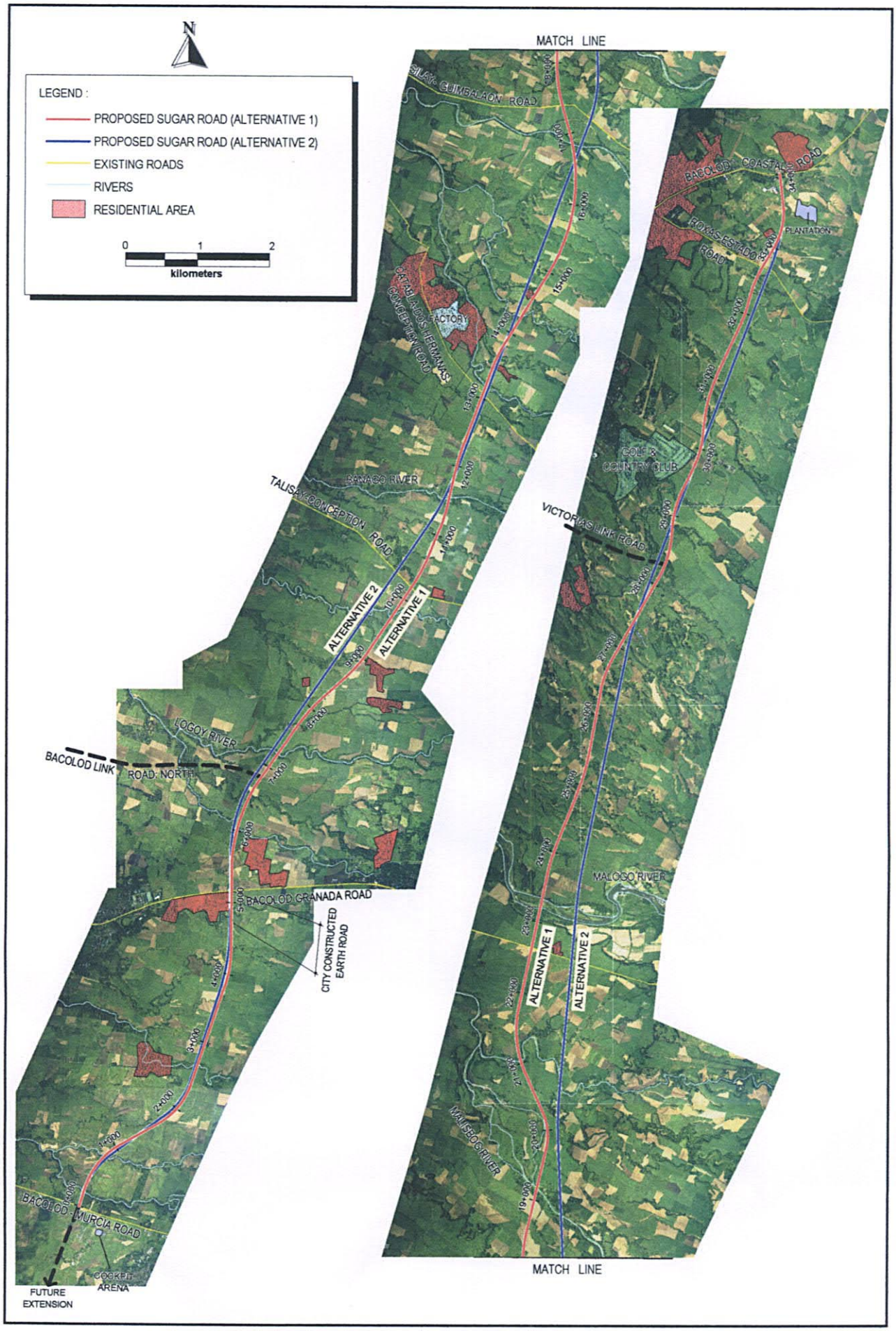



**FIGURE 13.4-1 BACOLOD SUGAR ROAD ALTERNATIVE ALIGNMENTS**

## 13.5 TRAFFIC FORECAST

Result of traffic forecast is shown in Table 13.5-1. Number of lanes required is shown in Figure 13.5-1.

In the Master Plan, Sections 1, 2 and 3 are scheduled to be completed by 2015 and remaining sections by 2020. All sections are planned to be constructed as a 2-lane road, then Sections 1, 2 and 3 are proposed to be widened to a 4-lane divided road by about year 2023.

Sections 1, 2 and 3 will attract traffic ranging from 11,900 to 18,000 pcu/day in year 2016.

In year 2022, Sections 1, 2 and 3 will attract traffic ranging from 25,900 to 30,800 pcu/day which are close to traffic capacity of a 2-lane road. Sections 4 to 7 attract traffic of about 15,900 to 18,500 pcu/day which can be accommodated by a 2-lane road.

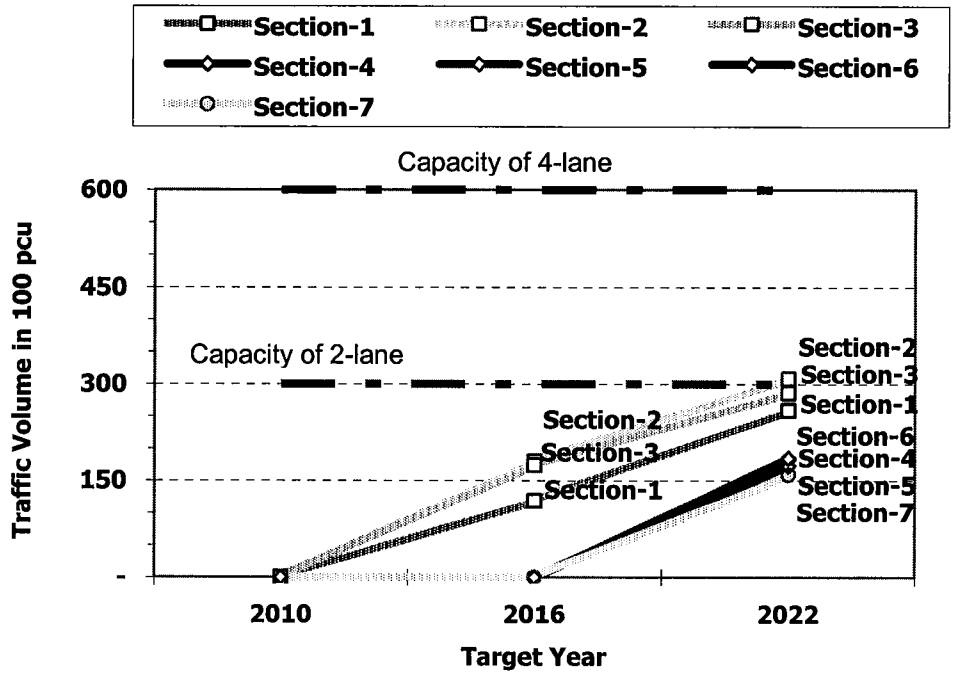



**FIGURE 13.5-1 NUMBER OF LANES REQUIRED**

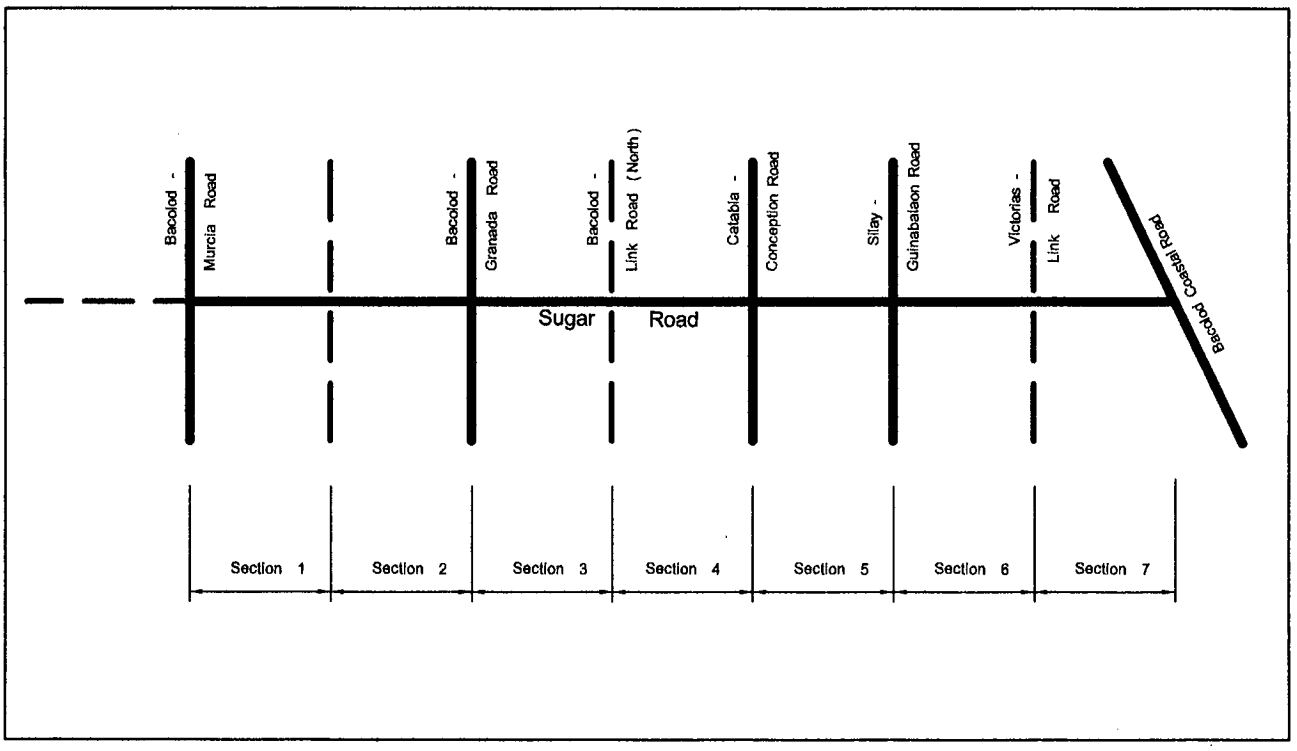



**TABLE 13.5-1 ESTIMATED TRAFFIC VOLUME AND VOLUME/CAPACITY RATIO**

| Conditions & Section | | | Section-1 | Section-2 | Section-3 | Section-4 | Section-5 | Section-6 | Section-7 |
|---|---|---|---|---|---|---|---|---|---|
| Traffic Volume in 100 pcu | 2010 | | - | - | - | - | - | - | - |
| | 2016 | | **119** | **180** | **174** | - | - | - | - |
| | 2022 | | **259** | **308** | **286** | **183** | **173** | **185** | **159** |
| Volume / Capacity Ratio (V/C) | 2-lane | 2010 | - | - | - | - | - | - | - |
| | | 2016 | **0.40** | **0.60** | **0.58** | - | - | - | - |
| | | 2022 | **0.86** | **1.03** | **0.95** | **0.61** | **0.58** | **0.62** | **0.53** |
| | 4-lane | 2010 | - | - | - | - | - | - | - |
| | | 2016 | **0.20** | **0.30** | **0.29** | - | - | - | - |
| | | 2022 | **0.43** | **0.51** | **0.48** | **0.31** | **0.29** | **0.31** | **0.27** |

## 13.6 CONSTRUCTION PHASING

This road is proposed to be constructed as a 2-lane road. As the Section between Bacolod-Murcia Road and Bacolod Link Road (North) is located planned urban area of Bacolod City, the section needs to be widened to a 4-lane divided road by about 2023.

## 13.7 PRELIMINARY DESIGN

### 13.7.1 Design Concepts and Criteria

1) Design Concepts

This road is intended to be mainly utilized sugar cane trucks accessing to Sugar Mills, at the same time, form a parallel road to Bacolod Coastal Road to provide flexible road network for road users.

The section within Bacolod City will guide and support the future urbanization in the area.

In view of above, the design concepts were established as follows:

**Design Concepts**

- To allow smooth driving of heavy-loaded sugar cane trucks, alignment should be as smooth as possible, particularly vertical alignment should avoid steep gradient. To achieve above, the design speed of 80 km/hour is elected.
- Left-turn lanes are provided at major intersections.
- To allow future urbanization along the section in Bacolod City, road elevation is selected as close to the existing ground as possible to avoid high cut section or embankment sections.

2) Road and Intersection Design Criteria

Highway design criteria and intersection design criteria are shown in Table 13.7-1 and Table 13.7-2, respectively.

Typical cross-sections are shown in Figure 13.7-1.

3) Bridge and Structures

The same design criteria discussed in 3) of Section 12.7.1 were adopted.

4) Drainage and Cross Drainage Facilities

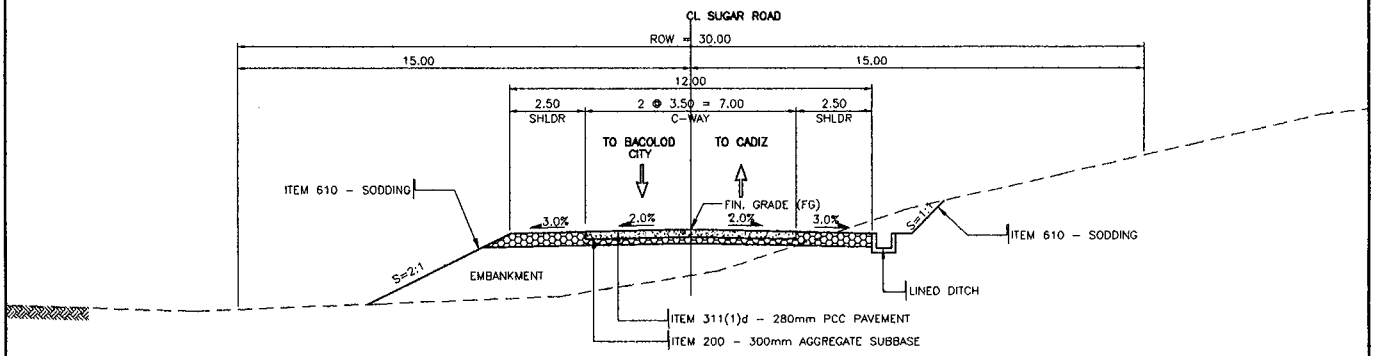
The same design criteria discussed in 4) of Section 12.7.1 were adopted.

**TABLE 13.7-1 HIGHWAY DESIGN CRITERIA**
**- Bacolod Sugar Road (North) -**

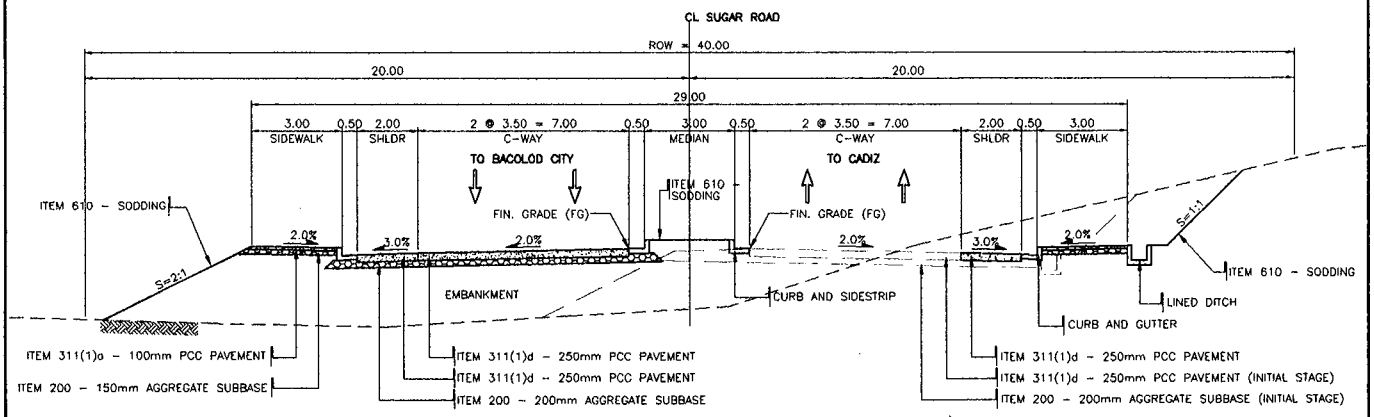
| Classification | | Unit | Initial Stage | Ultimate Stage |
|---|---|---|---|---|
| Design Speed | | Km/h | 80 | |
| Number of Lane | Beginning~Sta.6+300 | | 2 | 4 |
| | Sta.6+300~End | | 2 | |
| Type of Pavement | | | PCCP | |
| Lane Width | | m | 3.5 | |
| Shoulder Width | | m | 2.5 | |
| Median | | m | - | 3.0 |
| Side Walk | | m | - | 3.0 |
| Stopping Sight Distance | | m | 110 | |
| Passing Sight Distance | | m | 560 | |
| Minimum Radius | | m | 230 | |
| Minimum Radius for Normal Cross Slope | | m | 2,500 | |
| Maximum Grade | | % | 4 | |
| Minimum Length of Vertical Curve | | m | 60 | |
| Minimum "K" for Crest | | | 30 | |
| Minimum "K" for Sag | | | 24 | |
| Maximum Superelevation | | % | 8 | |
| Normal Cross Slope | | % | 2 | |
| Vertical Clearance | | m | 4.3 | |

**TABLE 13.7-2 INTERSECTION DESIGN CRITERIA**

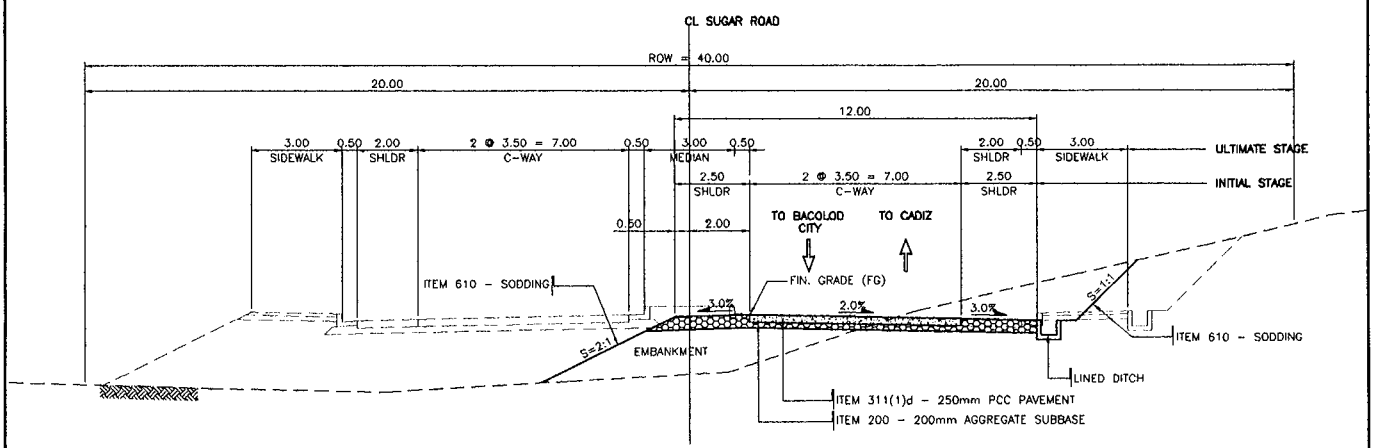
| Classification | Unit | Intersection | |
|---|---|---|---|
| | | Signal Control | |
| | | Urban | Rural |
| Design Speed | Km/h | 40 | 60 |
| Sight Distance | m | 100 | 240 |
| Minimum Radius | m | 60 | 150 |
| Maximum Grade | % | 2.5 | |
| Width of Left Turn Lane | m | 3.0 ~ 3.5 | |
| Length of Teper | m | 50 ~ 100 | |
| Length of Storage Lane | m | 30 ~ 50 | |
| Minimum Radius Curve | m | 12 | 15 |
| Width of Pedestrian Crossing | m | 3 | |




STA. 6+900.000 TO STA. 34+043.640
(Rural Area)




**ULTIMATE STAGE** – STA. 0+000.000 TO STA. 6+900.000
(Planned Urban Area)




**INITIAL STAGE** – STA. 0+000.000 TO STA. 6+900.000
(Planned Urban Area)

**FIGURE 13.7-1**

# TYPICAL CROSS-SECTION
# Bacolod Sugar Road (North)

### 13.7.2 Road and Intersection Design

1) Horizontal Alignment

Horizontal alignment was designed to satisfy the design speed of 80 km/hour. Horizontal alignment is shown in Figure 13.7-3. Among various horizontal curves, minimum one is 800m in radius with super elevation of 4%.

2) Vertical Alignment

Control points for vertical alignment design were as follows:

- Elevation of existing intersecting road
- Proposed bridge elevation
- Minimum depth of 0.6m from road surface to the top of pipe culvert to avoid reinforcement of pipe culvert.

Topography of the project site is undulating, thus embankment section and cut section alternates. Earth work volume of embankment and cut was tried to be even as much as possible to reduce earth work volume.

3) Intersection Design

All major intersections were provided with left turn lane. Major intersections are as follows:

- Intersection with Bacolod-Murcia Road (See Figure 13.7-4)
- Intersection with Bacolod-Granada Road
- Intersection with Talisay-Conception Road
- Intersection with Bacolod Coastal Road

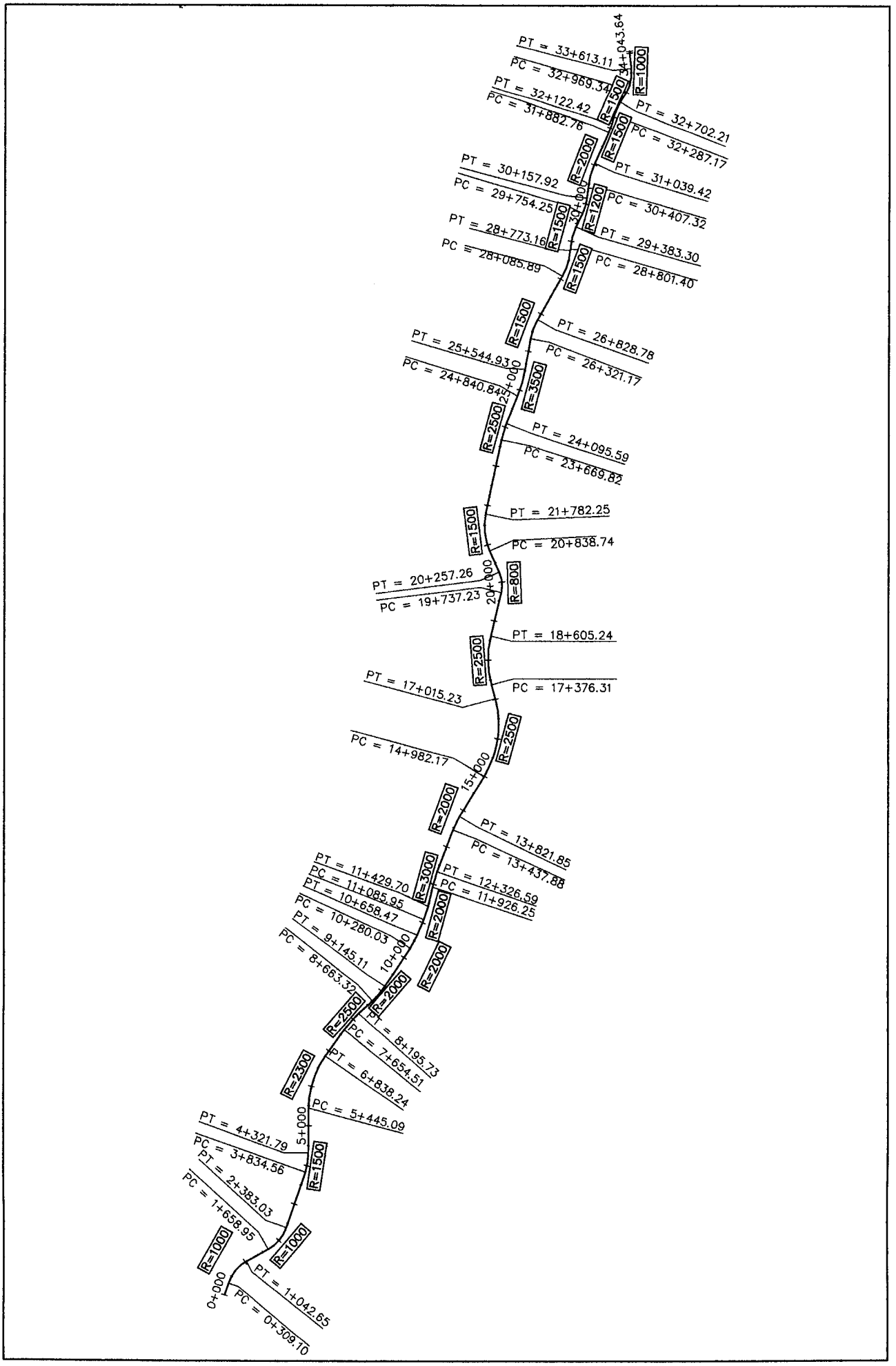
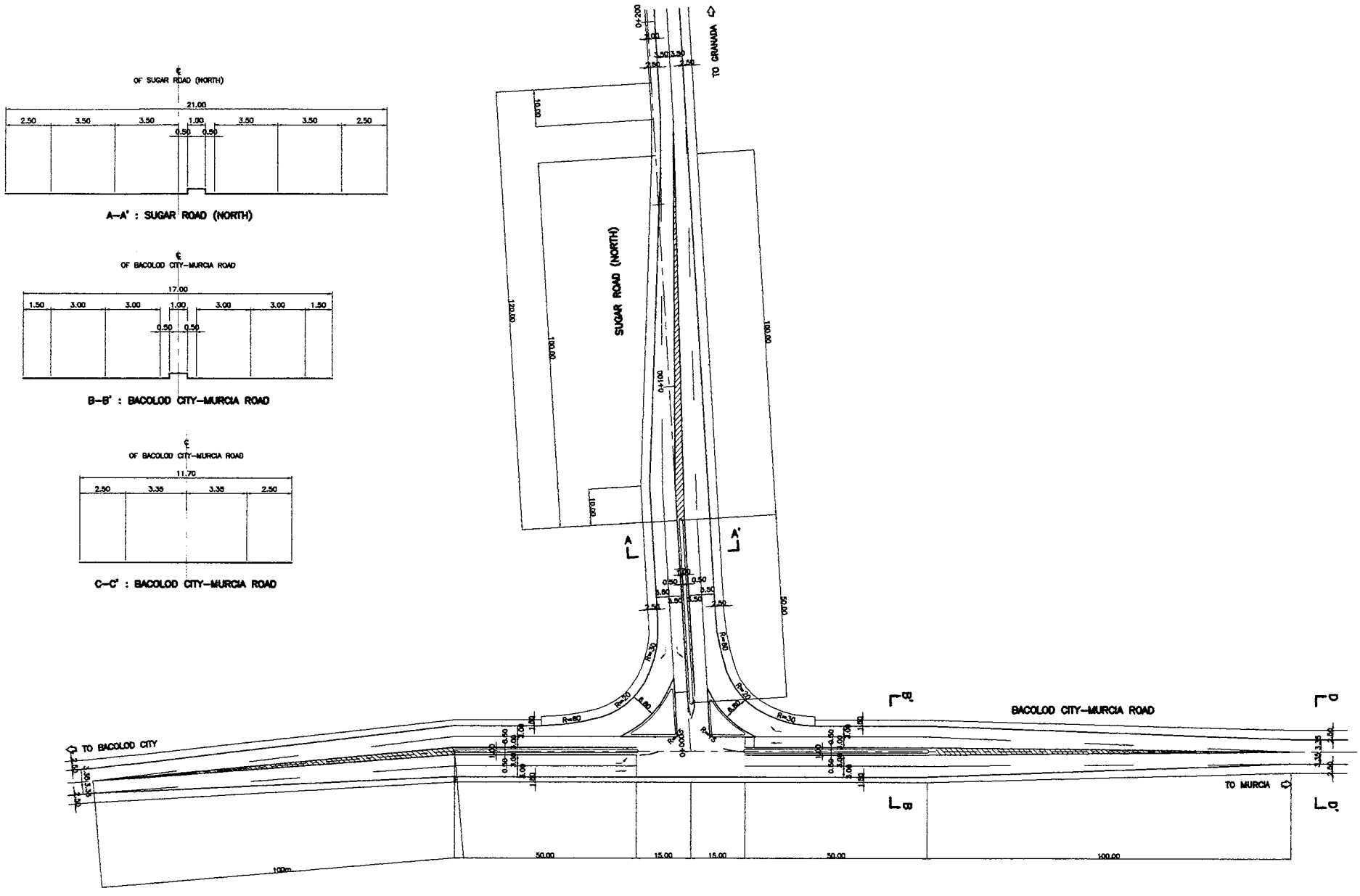



**FIGURE 13.7-2 BACOLOD SUGAR ROAD (NORTH) HORIZONTAL ALIGNMENT**




INTERSECTION WITH BACOLOD CITY-MURCIA ROAD (TYPE K)
STA. 0+000.00, BEG. OF SUGAR ROAD (NORTH)

### 13.7.3 Pavement Design

Pavement design was made in accordance with the AASHTO Guide for Design of Pavement Structures, 1993.

Table 13.7.3-1 shows the design requirements. Bus and truck factors were assumed as follows:

Bus factor (number of ESAL per bus) : 0.8
Truck factor (number of ESAL per truck) : 2.5

PCC pavement was selected for the pavement type, as soft ground is not expected.

Table 13.7.3-2 shows traffic loading. Cummulative ESAI is 16.6 Million for 20 years for urban section and 27.7 Million for 20 years for Rural Section.

Required pavement thickness is as follows:

Urban Section
Subbase Course : 20cm
PCC pavement : 25cm

Rural Section
Subbase Course : 30cm
PCC pavement : 28cm

**TABLE 13.7.3-1 (1/2) DESIGN REQUIREMENT (Bacolod Sugar)**
(Urban Section)

| Category | Description |
|---|---|
| a. Design Variable | |
| a.1 Time Constraints<br>• Initial Performance Period | <br>PCCP : 20 years |
| a.2 Traffic Loading | Directional Distribution Factor : 0.5<br>Lane Distribution Factor: 0.6 |
| a.3 Bus and Truck Factor | Bus : 0.8<br>Truck : 2.5 |
| a.4 Reliability | $Z_R$ = 1.037 for 85% Reliability<br>So = 0.35 (Rigid) |
| b. Performance Criteria | |
| b.1 Serviceability | (Rigid) PSI = Po - Pt = 4.5 - 2.5 = 2.0 |
| c. Material Properties for Structural Design | |
| c.1 Effective Modulus of Subgrade Reaction | K-Value (pci) ; 450pci (CBR : 5%, Subbase : 30cm) |
| c.2 Pavement Layer Materials Characterizati | $E_C$ = Modulus of Elasticity of PCC (4.20 x $10^6$ psi) |
| c.3 PCC Modulus of Rupture (Rigid)<br>(Flexural Strength) | S'c = 797 psi , Sc = 690 psi |
| d. Pavement Structural Characteristics | |
| d.1 Drainage | Rigid CD = Drainage Coefficient ; 1.0 |
| d.2 Load Transfer (Rigid) | J = 3.8 (Plane jointed, Untied Shoulder) |
| e. Required Pavement Thickness | |
| e1. PCC Pavement | t = 25cm |
| e2. Subbase Course | t = 20cm |

**TABLE 13.7.3-2 (1/2) TRAFFIC LOADING (Bacolod Sugar)**

Urban Section

| Year | AADT (Both Direction) Bus (sub) | Truck (sub) | Cumulative ESAL |
|---|---|---|---|
| 2021 | 23 | 2,672 | 1,222,253 |
| 2022 | 26 | 2,912 | 2,554,649 |
| 2023 | 27 | 2,921 | 3,891,221 |
| 2024 | 29 | 2,929 | 5,231,990 |
| 2025 | 30 | 2,938 | 6,576,977 |
| 2026 | 32 | 2,947 | 7,926,206 |
| 2027 | 33 | 2,956 | 9,279,700 |
| 2028 | 35 | 2,965 | 10,637,482 |
| 2029 | 37 | 2,974 | 11,999,576 |
| 2030 | 38 | 2,983 | 13,366,008 |
| 2031 | 40 | 2,992 | 14,736,802 |
| 2032 | 42 | 3,001 | 16,111,986 |
| 2033 | 44 | 3,010 | 17,491,586 |
| 2034 | 47 | 3,019 | 18,875,630 |
| 2035 | 49 | 3,028 | 20,264,146 |
| 2036 | 51 | 3,037 | 21,657,164 |
| 2037 | 54 | 3,046 | 23,054,715 |
| 2038 | 57 | 3,055 | 24,456,829 |
| 2039 | 60 | 3,064 | 25,863,539 |
| 2040 | 63 | 3,073 | 27,274,878 |
| **Total** | **817** | **59,519** | **27,274,878** |

**TABLE 13.7.3-1 (2/2) DESIGN REQUIREMENT (Bacolod Sugar)**
(Rural Section)

| Category | Description |
|---|---|
| a. Design Variable | |
| a.1 Time Constraints<br>・Initial Performance Period | PCCP : 20 years |
| a.2 Traffic Loading | Directional Distribution Factor : 0.5 |
| a.3 Bus and Truck Factor | Bus : 0.8<br>Truck : 2.5 |
| a.4 Reliability | $Z_R$ = 1.037 for 85% Reliability<br>So = 0.35 (Rigid) |
| b. Performance Criteria | |
| b.1 Serviceability | (Rigid) PSI = Po - Pt = 4.5 - 2.5 = 2.0 |
| c. Material Properties for Structural Design | |
| c.1 Effective Modulus of Subgrade Reaction | K-Value (pci) ; 450pci (CBR : 5%, Subbase : 30cm) |
| c.2 Pavement Layer Materials Characterizati | $E_C$ = Modulus of Elasticity of PCC (4.20 x $10^6$ psi) |
| c.3 PCC Modulus of Rupture (Rigid)<br>(Flexural Strength) | S'c = 797 psi , Sc = 690 psi |
| d. Pavement Structural Characteristics | |
| d.1 Drainage | Rigid CD = Drainage Coefficient ; 1.0 |
| d.2 Load Transfer (Rigid) | J = 3.8 (Plane jointed, Untied Shoulder) |
| e. Required Pavement Thickness | |
| e1. PCC Pavement | t = 28cm |
| e2. Subbase Course | t = 30cm |

**TABLE 13.7.3-2 (2/2) TRAFFIC LOADING (Bacolod Sugar)**
Rural Section

| Year | AADT | | Cumulative |
|---|---|---|---|
| | Bus (sub) | Truck (sub) | ESAL |
| 2021 | 23 | 2,672 | 1,222,253 |
| 2022 | 26 | 2,912 | 2,554,649 |
| 2023 | 27 | 2,921 | 3,891,221 |
| 2024 | 29 | 2,929 | 5,231,990 |
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| **Total** | **817** | **59,519** | **27,274,878** |

## 13.7.4 Structure Design

The Sugar Road (North Alignment) is a new road construction 34.04kms long with about 6.9kms passing through urban areas. Nineteen (19) river bridge crossings are identified along the alignment with lengths ranging from 28m to 324m. Considering the site has rolling topography, some bridge lengths tend to be longer than that required by river discharge.

This section discusses the preliminary design aspects of the proposed bridges crossing waterways along the alignment.

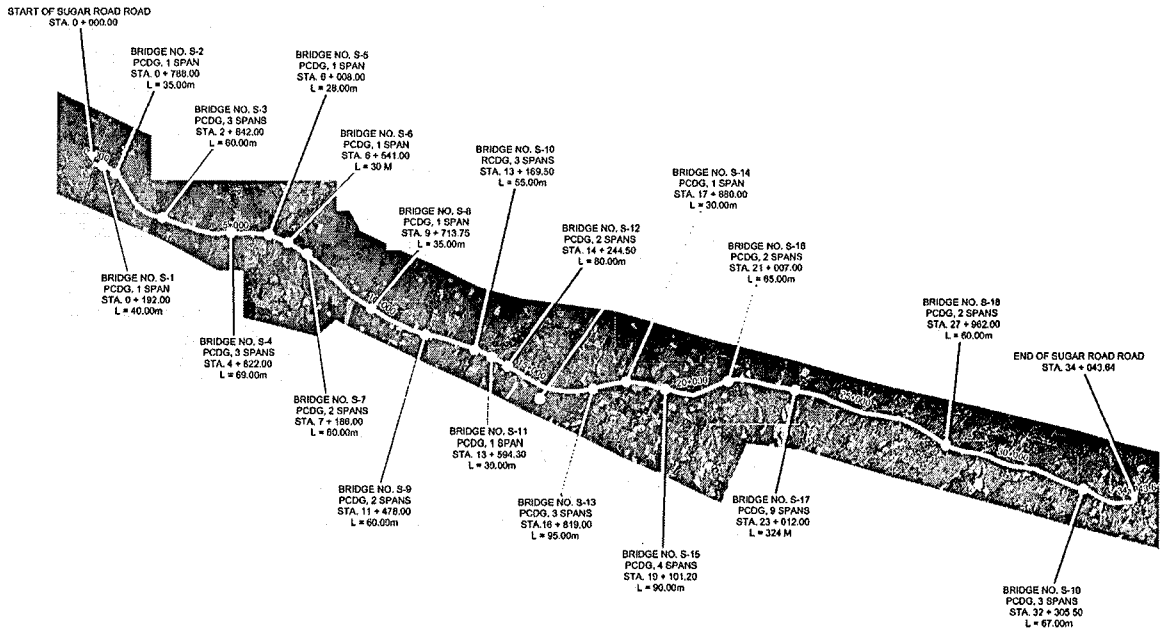



**FIGURE 13.7.4-1 BRIDGE LOCATION MAP**

### 13.7.4.1 Present Condition of the Proposed Bridge Sites

Site investigation was carried-out to verify the conditions of waterways along the alignment and determine the appropriate type and span of bridge suitable for each site. Figure 13.7.4-1 shows the location of bridges along the alignment while Figure 13.7.4-2 presents the conditions of the rivers and streams along the proposed Sugar Road alignment.

The following features describe briefly the proposed bridge sites:

**Topography**

- The proposed alignment passes over mostly sugarcane fields and some rice fields on relatively rolling terrain.
- Since the proposed alignment is in rolling terrain, river bank height varies from 4m to 20m while bank width varies from 10m to 320m.
- Under this condition, most of the flood water is confined within the river section.

**Rivers/Streams**

- Almost all waterways along the alignment have meandering courses for both the upstream and downstream sides of the proposed bridge.
- Bank conditions are found stable for half of the bridge locations while the other half shows evidence of bank scouring.
- Boulders are usually seen on river beds with diameters averaging to 600mm.
- Large debris are not observed on the river courses, only small bamboos and sugar canes.

The river discharge for a 50-year return period is calculated for each proposed bridge site and presented in Table 13.7.3-1.

**TABLE 13.7.4-1 RIVER HYDRAULICS FOR PROPOSED BRIDGE SITES**

| BRIDGE NO. | RIVER NAME | 50-YEAR DISCHARGE (cu.m/sec) | MFWL (EL. +m) | VELOCITY (m/s) | BRIDGE SPAN (m) | |
|---|---|---|---|---|---|---|
| | | | | | Minimum | Provided |
| S-1 | Magsungay Daco | 111.69 | 44.20 | 2.45 | - | 40 |
| S-2 | Magsungay | 49.81 | 43.70 | 2.20 | - | 35 |
| S-3 | Magsungay Pequena | 96.14 | 61.30 | 2.11 | - | 20 |
| S-4 | Ngalan | 106.83 | 74.30 | 2.07 | - | 25 |
| S-5 | Logoy 1 | 57.73 | 79.60 | 1.95 | - | 28 |
| S-6 | Logoy 2 | 40.00 | 71.80 | 2.42 | - | 30 |
| S-7 | Logoy 3 | 102.39 | 61.80 | 2.36 | - | 35 |
| S-8 | Logoy 4 | 42.26 | 87.20 | 2.54 | - | 35 |
| S-9 | Banago | 130.99 | 73.80 | 2.53 | - | 30 |
| S-10 | Imbang 1 | 415.54 | 66.50 | 3.22 | 22.0 | 23 |
| S-11 | Sinuluan | 59.88 | 57.80 | 2.37 | - | 30 |
| S-12 | Imbang 2 | 67.45 | 48.10 | 2.09 | - | 40 |
| S-13 | Hinalinan | 475.54 | 48.60 | 3.18 | 22.4 | 35 |
| S-14 | Muyao | 55.01 | 48.40 | 1.68 | - | 30 |
| S-15 | Malisbog | 554.08 | 41.10 | 2.45 | 22.8 | 25 |
| S-16 | Napilas | 375.32 | 30.10 | 2.49 | 21.9 | 35 |
| S-17 | Malogo | 1451.86 | 36.60 | 2.75 | 27.3 | 36 |
| S-18 | Malijao | 83.19 | 18.90 | 1.67 | - | 30 |
| S-19 | Magnanod | 320.91 | 13.80 | 2.03 | 21.6 | 27 |

**Geotechnical**

- Geotechnical investigations carried-out for the proposed bridge sites revealed that the road alignment and bridge sites are generally characterized by an upper layer consisting of alluvial deposits of sands, silts and clays with thickness varying from site to site. The deposits are generally underlain by sedimentary rocks and boulders at varying depth.
    - Very dense soil layer with N-values greater than 30 are found at depths from ground to 15m.
    - Soft rocks including weathered siltstone, sandstone and boulders are found at very shallow depth, sometimes exposed at river beds.
    - The bearing layer thus varies at different sites but on general can be established from ground to 15m depth.

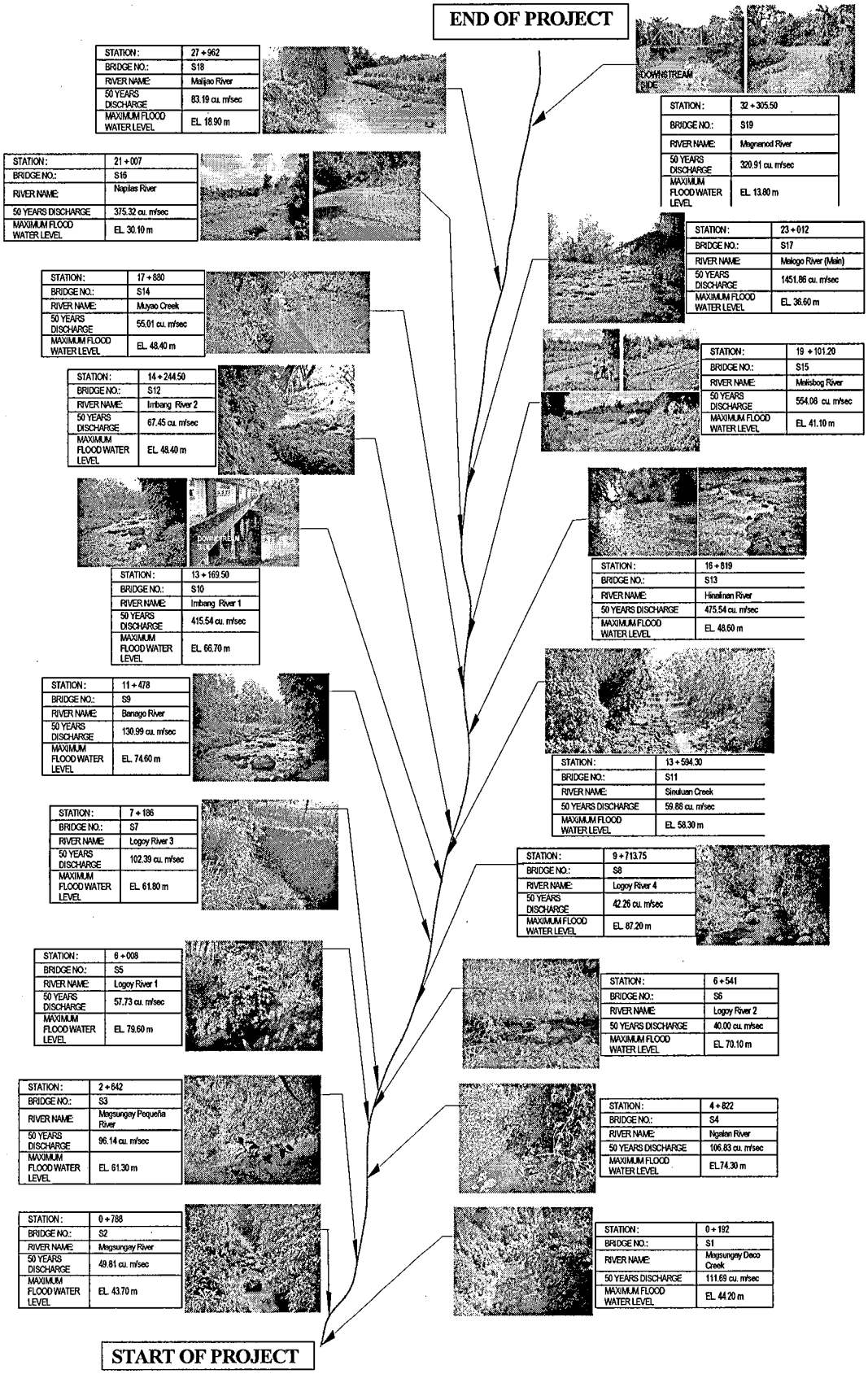



**FIGURE 13.7.4-2 RIVER CONDITIONS AT BRIDGE LOCATIONS**

### 13.7.4.2 Design Concept for Structures

#### (1) Superstructure

The superstructure preliminary design basically adheres to the following concepts:

**Bridge Deck Section**

- The Sugar Road alignment for the north section is divided into two sections - (i) the urban area from beginning to Sta. 6+900, and the (ii) area outside urban area, from Sta. 6+900 to end of alignment.
- The urban road area will have four lanes of carriageway at the ultimate stage while the area after the urban area will only have two lanes of road carriageway. The bridge deck section should then conform with the travelway/carriageway width of the highway for both the urban area section and that outside the urban area section. Typical bridge sections for both cases are illustrated in Figures 13.7.4-3 and 13.7.4-4. .
- The section dimensions for bridges along the alignment are shown in Table 13.7.4-2.

**Table 13.7.4-2 Bridge Section Dimensions**

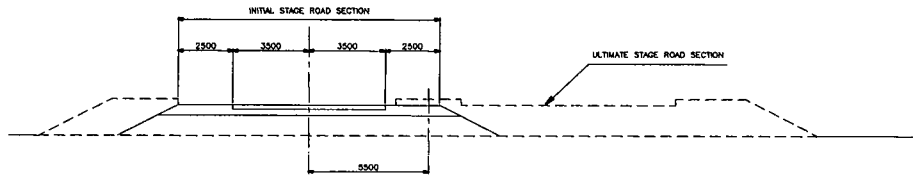
| Station | | Section | Ultimate Stage | Initial Stage (m) | | | |
|---|---|---|---|---|---|---|---|
| From | To | | | Carriage way | Shoulder | Sidewalk | Bridge Width |
| Beginning | 6+900 | Urban | 4 - lanes | 2 @ 3.5 | 1.5 + 0.5 | 2.0 + 0.75 | 12.35 |
| 6+900 | End | Outside Urban | 2 - lanes | 2 @ 3.5 | 1.0 + 1.0 | 0.75 + 0.75 | 11.1 |

**Girder Types**

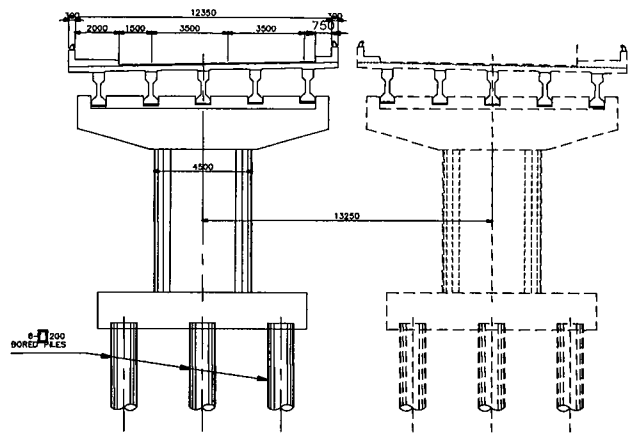
- Two types of superstructures are proposed for the bridges:
  - Prestressed Concrete (PCDG), AASHTO Girder type for spans greater than 20m, and
  - Reinforced Concrete Deck Girder (RCDG) for spans less than or equal to 20m
- To enhance seismic performance, PCDG are made continuous over the intermediate piers allowing transfer of superstructure forces directly to the substructure. On the other hand, RCDG are made rigid with the pier columns to minimize the depth of superstructure.

**Vertical Clearance**

- Since debris are not expected on bridge sites, a minimum flood water vertical clearance of 1.0m is provided.

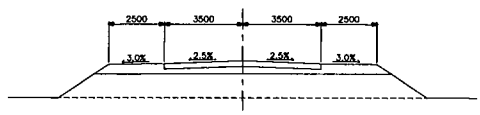



TYPICAL SUGAR ROAD SECTION
(URBAN AREA)

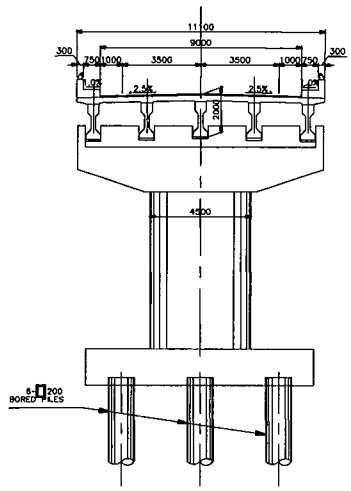



TYPICAL BRIDGE SECTION
(URBAN AREA)

**FIGURE 13.7.4-3 TYPICAL ROAD AND BRIDGE SECTION FOR URBAN AREA**




TYPICAL SUGAR ROAD SECTION
(OUTSIDE URBAN AREA)




TYPICAL BRIDGE SECTION
(OUTSIDE URBAN AREA)

**FIGURE 13.7.4-4 TYPICAL ROAD AND BRIDGE SECTION OUTSIDE URBAN AREA**

**(2) Substructures**

**Piers**

- Preliminary design for substructures considers the seismic design requirements based on the AASHTO Div. I-A Seismic Design recommendations.
- Plastic hinges are expected to form at pier substructures so that design forces of foundations will utilize the said forces.
- Single column piers are proposed for the PCDG structures (oval shape).
- On the other hand, a two-column pier is used for the RCDG superstructure (as recommended by BOD). Since the columns are rigidly connected with the girders, plastic hinging is expected at the top and bottom of the columns. The two-column pier will result in a cheaper substructure cost.

**Pile Foundation**

- Since the soil condition is relatively good in this area, shallow foundations can be utilized to support the bridge structures. Candidate types of foundations include spread footing, short length bored piles and caisson foundation.
- The bored pile foundation is preferred over the other types due to:
  - The seismic requirement (plastic forces) for spread footing will result in relatively very large footing size which will overlap with the foundations of the ultimate stage bridge.
  - Caisson foundation tends to become very expensive.
  - Footing size can be reduced by utilizing the tension (pull-out) capacity of the piles.
  - Bored pile foundation is more stable to river scouring.
- Likewise, foundation for the abutment utilizes bored pile foundation.
- A more detailed study can be done during the detailed design stage to finalize the type of foundation for bridges considering the shallow depth of rocks at some bridge locations.

**Abutments**

- Abutment type is the inverted T cantilever wall seat type abutment. This type, being a closed type abutment is more reliable since it is difficult to guarantee the stability of slope in front of the abutment.
- Abutment preliminary design basically follows the AASHTO Div. I-A recommendations using Mononobe-Okabe formulation to calculate seismic forces due to retained earth.
- Expansion joints for the superstructures are provided at abutment locations.

## 13.7.4.3 Proposed Bridges

Details of the proposed bridges crossing rivers and streams, with a total length of 1313m, are presented in Table 13.7.4-3 below.

**TABLE 13.7.4-3 PROPOSED BRIDGES FOR SUGAR ROAD ALIGNMENT (NORTH SIDE)**

| BRIDGE NO. | RIVER NAME | STATION | | BRIDGE LENGTH (m) | SUPERSTRUCTURE | | | SUBSTRUCTURE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PIER | | ABUTMENT | |
| | | BEG. | END | | TYPE | SPAN | SKEW (deg) | COLUMN TYPE | FOUNDATION | TYPE | FOUNDATION |
| S1 | Magsungay Daco Creek | Sta. 0+192.00 | Sta. 0+232.00 | 40.00 | PCDG AASHTO Type VI | 1 @ 40 | 65.00 | - | - | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=6; L=10m |
| S2 | Magsungay River | Sta. 0+788.00 | Sta. 0+823.00 | 35.00 | PCDG AASHTO Type VI | 1 @ 35 | 107.00 | - | - | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=6; L=12m |
| S3 | Magsungay Pequeña River | Sta. 2+642.00 | Sta. 2+702.00 | 60.00 | PCDG AASHTO Type IV | 3 @ 20 | 105.00 | Wall Type 1500x4500 | ϕ1000 Bored Pile N=6 ; L=10m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S4 | Ngalan River | Sta. 4+822.00 | Sta. 4+891.00 | 69.00 | PCDG AASHTO Type IV-B | 22+25+22 | 120.00 | Wall Type 1500x3500 | ϕ1000 Bored Pile N=6 ; L=10m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S5 | Logoy River 1 | Sta. 6+008.00 | Sta. 6+036.00 | 28.00 | PCDG AASHTO Type IV-B | 1 @ 28 | - | - | - | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=8; L=10m |
| S6 | Logoy River 2 | Sta. 6+541.00 | Sta. 6+571.00 | 30.00 | PCDG AASHTO Type V | 1 @ 30 | - | - | - | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=8; L=12m |
| S7 | Logoy River 3 | Sta. 7+186.00 | Sta. 7+246.00 | 60.00 | PCDG AASHTO Type V,IV-B | 35+25 | 80.00 | Wall Type 2000x5000 | ϕ1200 Bored Pile N=9 ; L=10m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=8; L=12m |
| S8 | Logoy River 4 | Sta. 9+713.75 | Sta. 9+748.75 | 35.00 | PCDG AASHTO Type VI | 1 @ 35 | - | - | - | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=8; L=10m |
| S9 | Banago River | Sta. 11+478.00 | Sta. 11+538.00 | 60.00 | PCDG AASHTO Type V | 2 @ 30 | 105.00 | Wall Type 1500x4500 | ϕ1200 Bored Pile N=6 ; L=12m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S10 | Imbang River 1 | Sta. 13+169.50 | Sta. 13+224.50 | 55.00 | RCDG | 16+23+16 | 70.00 | 2-Column ϕ1500 mm | ϕ1000 Bored Pile N=8 ; L=12m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S11 | Sinuluan Creek | Sta. 13+594.30 | Sta. 13+624.30 | 30.00 | PCDG AASHTO Type V | 1 @ 30 | - | - | - | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=8; L=10m |
| S12 | Imbang River 2 | Sta. 14+244.50 | Sta. 14+324.50 | 80.00 | PCDG AASHTO Type VI | 2 @ 40 | 120.00 | Wall Type 1500x4500 | ϕ1200 Bored Pile N=9 ; L=11m | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=6; L=10m |
| S13 | Hinalinan River | Sta. 16+819.00 | Sta. 16+914.00 | 95.00 | PCDG AASHTO Type VI | 35+30+30 | 65.00 | Wall Type 2000x4500 | ϕ1200 Bored Pile N=9 ; L=10m | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=6; L=10m |
| S14 | Muyao Creek | Sta. 17+880.00 | Sta. 17+910.00 | 30.00 | PCDG AASHTO Type V | 1 @ 30 | - | - | - | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=8; L=10m |
| S15 | Malisbog River | Sta. 19+101.20 | Sta. 19+191.20 | 90.00 | PCDG AASHTO Type IV-B | 20+25+25 +20 | - | Wall Type 1500x3500 | ϕ1000 Bored Pile N=6 ; L=11m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S16 | Napilas River | Sta. 21+007.00 | Sta. 21+072.00 | 65.00 | PCDG AASHTO Type V | 35+30 | - | Wall Type 2000x4500 | ϕ1200 Bored Pile N=9 ; L=10m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=10m |
| S17 | Malogo River (Main) | Sta. 23+012.00 | Sta. 23+336.00 | 324.00 | PCDG AASHTO Type VI | 3 - 3 @ 36 | - | Wall Type 2000x4500 | ϕ1200 Bored Pile N=9 ; L=12m | Closed Inverted-T Cantilever | ϕ1200 Bored Pile N=8; L=12m |
| S18 | Malijao River | Sta. 27+962.00 | Sta. 28+022.00 | 60.00 | PCDG AASHTO Type V | 2 @ 30 | - | Wall Type 1500x4500 | ϕ1200 Bored Pile N=8 ; L=10m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=12m |
| S19 | Magnanod River | Sta. 32+305.50 | Sta. 32+372.50 | 67.00 | PCDG AASHTO Type IV-B | 20+27+20 | - | Wall Type 1500x4500 | ϕ1200 Bored Pile N=6 ; L=14m | Closed Inverted-T Cantilever | ϕ1000 Bored Pile N=6; L=13m |

TOTAL BRIDGE LENGTH : 1313 m

### 13.7.5 Drainage Design

1) *Principle and Methodology*

Refer to Sub section 12.7.4.1 for the principle and methodology

2) *Hydrological and Hydraulic Analyses*

Refer to Sub section12.7.4.2 for the Hydrological Analyses

Table 12.7.4-1 Rainfall Intensity – Duration- Frequency Data for Iloilo was also used for this road.

3) *Results of Hydrologic Analyses*

The hydrological analyses reveals that there are sixty seven (67) catchments areas for this proposed road .See Fig. 13.7.5-1 for the catchments area map of Bacolod Sugar Access Road. The analyses also reveal that there are six (6) locations where the area is greater than twenty (20) sq km. More over there are nineteen (19) areas where the design discharge are more than forty (40) cu m per sec. The result of the hydrological analyses is shown in Table 13.7.5-1.

4) *Results of Hydraulic Analyses*

The hydraulic analyses reveal that there are nineteen (19) bridge sites and one hundred five (105) culverts proposed for the road. The bridge schedule is shown in Section 13.7.3 and the list of proposed culverts is shown in Table 13.7.5-2.

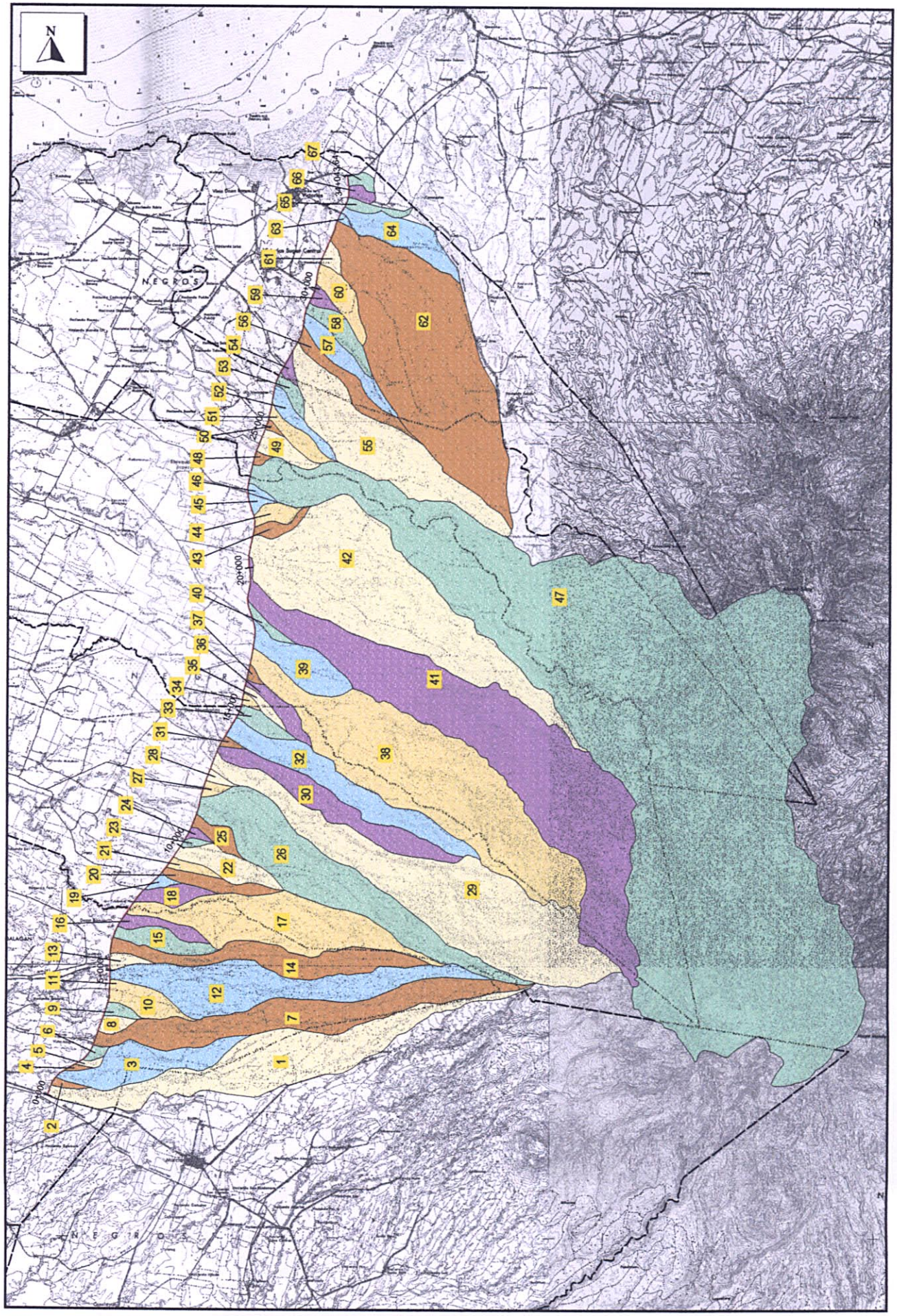



FIG. 13.7.5-1 METRO BACOLOD SUGAR ROAD NORTH (CATCHMENTS AREA MAP)

# TABLE 13.7.5-1 HYDROLOGICAL ANALYSIS

*Road Section : BACOLOD SUGAR ROAD (NORTH)*

| Basin Number | STATION | | DISCHARGE | | | |
|---|---|---|---|---|---|---|
| | BEGINNING | END | 2 year | 10 year | 25 year | 50 year |
| | | | m³/sec. | m³/sec. | m³/sec. | m³/sec. |
| 1 | 0 + 000.00 | 0 + 350.00 | 59.34 | 87.17 | 101.26 | 111.69 |
| 2 | 0 + 350.00 | 0 + 680.00 | 3.45 | 5.04 | 5.82 | 6.42 |
| 3 | 0 + 680.00 | 0 + 950.00 | 26.58 | 38.93 | 45.21 | 49.81 |
| 4 | 0 + 950.00 | 1 + 350.00 | 1.89 | 2.76 | 3.19 | 3.52 |
| 5 | 1 + 350.00 | 1 + 750.00 | 2.90 | 4.24 | 4.90 | 5.40 |
| 6 | 1 + 750.00 | 2 + 430.00 | 4.14 | 6.04 | 6.99 | 7.70 |
| 7 | 2 + 430.00 | 3 + 100.00 | 51.17 | 75.07 | 87.20 | 96.14 |
| 8 | 3 + 100.00 | 3 + 457.00 | 6.83 | 9.97 | 11.55 | 12.72 |
| 9 | 3 + 457.00 | 3 + 950.00 | 4.69 | 6.84 | 7.92 | 8.73 |
| 10 | 3 + 950.00 | 4 + 400.00 | 16.65 | 24.31 | 28.20 | 31.04 |
| 11 | 4 + 400.00 | 4 + 750.00 | 2.73 | 3.99 | 4.62 | 5.09 |
| 12 | 4 + 750.00 | 4 + 950.00 | 56.92 | 83.45 | 96.93 | 106.83 |
| 13 | 4 + 950.00 | 5 + 550.00 | 6.03 | 8.79 | 10.18 | 11.21 |
| 14 | 5 + 550.00 | 5 + 950.00 | 30.78 | 45.10 | 52.39 | 57.73 |
| 15 | 5 + 950.00 | 6 + 100.00 | 21.46 | 31.33 | 36.34 | 40.00 |
| 16 | 6 + 100.00 | 6 + 830.00 | 5.69 | 8.30 | 9.62 | 10.59 |
| 17 | 6 + 830.00 | 7 + 570.00 | 54.57 | 79.99 | 92.91 | 102.39 |
| 18 | 7 + 570.00 | 7 + 950.00 | 10.92 | 15.95 | 18.50 | 20.37 |
| 19 | 7 + 950.00 | 8 + 440.00 | 4.58 | 6.69 | 7.74 | 8.52 |
| 20 | 8 + 440.00 | 9 + 090.00 | 12.68 | 18.52 | 21.49 | 23.66 |
| 21 | 9 + 090.00 | 9 + 630.00 | 6.36 | 9.29 | 10.77 | 11.86 |
| 22 | 9 + 630.00 | 10 + 150.00 | 22.65 | 33.08 | 38.39 | 42.26 |
| 23 | 10 + 150.00 | 10 + 380.00 | 4.48 | 6.53 | 7.57 | 8.33 |
| 24 | 10 + 380.00 | 10 + 790.00 | 2.97 | 4.33 | 5.01 | 5.52 |
| 25 | 10 + 790.00 | 11 + 080.00 | 7.85 | 11.46 | 13.28 | 14.62 |
| 26 | 11 + 080.00 | 11 + 600.00 | 69.79 | 102.32 | 118.85 | 130.99 |
| 27 | 11 + 600.00 | 12 + 540.00 | 4.94 | 7.21 | 8.35 | 9.19 |
| 28 | 12 + 540.00 | 12 + 990.00 | 4.82 | 7.04 | 8.15 | 8.97 |
| 29 | 12 + 990.00 | 13 + 350.00 | | | | 415.54 |
| 30 | 13 + 350.00 | 13 + 750.00 | 31.97 | 46.81 | 54.36 | 59.88 |
| 31 | 13 + 750.00 | 14 + 000.00 | 3.36 | 4.91 | 5.68 | 6.26 |
| 32 | 14 + 000.00 | 14 + 800.00 | 35.98 | 52.70 | 61.21 | 67.45 |
| 33 | 14 + 850.00 | 15 + 300.00 | 12.70 | 18.54 | 21.47 | 23.64 |
| 34 | 15 + 300.00 | 15 + 850.00 | 3.81 | 5.57 | 6.44 | 7.09 |
| 35 | 15 + 850.00 | 16 + 150.00 | 22.17 | 32.34 | 37.48 | 41.26 |
| 36 | 16 + 150.00 | 16 + 350.00 | 12.76 | 18.63 | 21.61 | 23.79 |
| 37 | 16 + 350.00 | 16 + 600.00 | 2.62 | 3.82 | 4.41 | 4.87 |
| 38 | 16 + 600.00 | 17 + 270.00 | | | | 475.54 |
| 39 | 17 + 270.00 | 18 + 220.00 | 29.44 | 43.04 | 49.96 | 55.01 |
| 40 | 18 + 220.00 | 18 + 950.00 | 2.90 | 4.23 | 4.91 | 5.40 |
| 41 | 18 + 950.00 | 19 + 560.00 | | | | 554.08 |
| 42 | 19 + 560.00 | 21 + 290.00 | | | | 375.32 |
| 43 | 21 + 290.00 | 21 + 780.00 | 7.76 | 11.33 | 13.14 | 14.47 |
| 44 | 21 + 780.00 | 22 + 370.00 | 7.31 | 10.67 | 12.38 | 13.63 |
| 45 | 22 + 370.00 | 22 + 634.00 | 4.22 | 6.16 | 7.13 | 7.85 |
| 46 | 22 + 634.00 | 22 + 970.00 | 2.96 | 4.31 | 4.99 | 5.50 |
| 47 | 22 + 970.00 | 23 + 810.00 | | | | 1,451.86 |
| 48 | 23 + 810.00 | 24 + 300.00 | 2.77 | 4.04 | 4.68 | 5.15 |
| 49 | 24 + 300.00 | 25 + 500.00 | 12.09 | 17.65 | 20.47 | 22.53 |
| 50 | 25 + 500.00 | 25 + 850.00 | 3.26 | 4.76 | 5.50 | 6.06 |
| 51 | 25 + 850.00 | 26 + 450.00 | 9.81 | 14.33 | 16.63 | 18.31 |
| 52 | 26 + 450.00 | 26 + 950.00 | 11.17 | 16.32 | 18.94 | 20.85 |
| 53 | 26 + 950.00 | 27 + 200.00 | 4.08 | 5.96 | 6.92 | 7.62 |
| 54 | 27 + 200.00 | 27 + 700.00 | 5.05 | 7.37 | 8.53 | 9.40 |
| 55 | 27 + 700.00 | 28 + 130.00 | 44.18 | 64.92 | 75.41 | 83.19 |
| 56 | 28 + 130.00 | 28 + 540.00 | 13.27 | 19.41 | 22.54 | 24.82 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 57 | 28 + 540.00 | 29 + 080.00 | 15.02 | 21.97 | 25.51 | 28.10 |
| 58 | 29 + 080.00 | 30 + 000.00 | 11.37 | 16.62 | 19.30 | 21.24 |
| 59 | 30 + 000.00 | 30 + 400.00 | 3.95 | 5.77 | 6.68 | 7.36 |
| 60 | 30 + 400.00 | 31 + 370.00 | 12.69 | 18.55 | 21.53 | 23.70 |
| 61 | 31 + 370.00 | 31 + 770.00 | 7.53 | 10.99 | 12.71 | 14.01 |
| 62 | 31 + 770.00 | 32 + 445.00 | | | | 320.91 |
| 63 | 32 + 445.00 | 32 + 700.00 | 3.20 | 4.67 | 5.40 | 5.95 |
| 64 | 32 + 700.00 | 33 + 020.00 | 17.49 | 25.65 | 29.79 | 32.83 |
| 65 | 33 + 020.00 | 33 + 360.00 | 9.06 | 13.21 | 15.31 | 16.85 |
| 66 | 33 + 360.00 | 33 + 680.00 | 6.27 | 9.16 | 10.59 | 11.67 |
| 67 | 33 + 680.00 | 34 + 044.00 | 5.82 | 8.49 | 9.83 | 10.82 |
| | | | | | | |

## TABLE 13.7.5-2 HYDRAULIC ANALYSIS

***The Study on Road Network Improvement on Development of Regional Growth Centers***
***BACOLOD SUGAR ROAD (NORTH)***

| BASIN NUMBER | STATION ( km ) | SIZE | | LENGTH | REMARKS / RECOMMENDATION |
|---|---|---|---|---|---|
| | | RCPC | RCBC | | |
| | | mmØ | SPAN X HEIGHT | ( m ) | |
| 1 | 0 + 068.00 | 1 - 1070 | | 31.00 | |
| 2 | 0 + 430.00 | 1 - 1070 | | 16.00 | |
| | 0 + 606.00 | 2 - 1220 | | 15.00 | |
| 3 | 0 + 895.00 | 1 - 1070 | | 22.00 | |
| 4 | 1 + 040.00 | 1 - 910 | | 16.00 | |
| | 1 + 230.00 | 2 - 1070 | | 19.00 | |
| 5 | 1 + 435.00 | 1 - 910 | | 20.00 | |
| | 1 + 675.00 | 2 - 1220 | | 22.00 | |
| 6 | 1 + 820.00 | 2 - 1220 | | 17.00 | |
| | 2 + 050.00 | 2 - 1070 | | 16.00 | |
| 8 | 3 + 310.00 | | 2 - 2.40 X 2.40 | 17.00 | |
| 9 | 3 + 660.00 | | 1 - 2.40 X 2.40 | 25.00 | |
| 10 | 4 + 300.00 | | 3 - 2.40 X 2.40 | 17.00 | |
| 11 | 4 + 470.00 | 1 - 910 | | 15.00 | |
| | 4 + 700.00 | 2 - 1220 | | 23.00 | |
| 13 | 5 + 130.00 | 1 - 910 | | 29.00 | |
| | 5 + 280.00 | 2 - 1220 | | 30.00 | |
| | 5 + 330.00 | 2 - 1520 | | 22.00 | |
| 14 | 5 + 620.00 | 1 - 1070 | | 19.00 | |
| 16 | 6 + 980.00 | | 3 - 1.50 X 1.50 | 15.00 | |
| 18 | 7 + 710.00 | | 2 - 3.00 X 3.00 | 20.00 | |
| 19 | 8 + 070.00 | 1 - 1070 | | 17.00 | |
| | 8 + 650.00 | | 1 - 2.40 X 2.40 | 28.00 | |
| 20 | 9 + 000.00 | | 2 - 3.00 X 3.00 | 28.00 | |
| 21 | 9 + 350.00 | 1 - 1070 | | 17.00 | |
| | 9 + 530.00 | | 2 - 2.40 X 2.40 | 18.00 | |
| 23 | 10 + 280.00 | | 1 - 2.40 X 2.40 | 25.00 | |
| | 10 + 690.00 | 2 - 1220 | | 17.00 | |
| 25 | 10 + 950.00 | | 2 - 2.40 X 2.40 | 37.00 | |
| 26 | 11 + 670.00 | 1 - 910 | | 16.00 | |
| | 11 + 910.00 | 1 - 910 | | 16.00 | |
| 27 | 12 + 150.00 | 1 - 910 | | 16.00 | |
| | 12 + 320.00 | | 2 - 1.50 X 1.50 | 23.00 | |
| 28 | 12 + 790.00 | | 1 - 2.40 X 2.40 | 16.00 | |
| 30 | 13 + 480.00 | 1 - 910 | | 15.00 | |
| 31 | 13 + 850.00 | 2 - 1520 | | 17.00 | |
| 33 | 15 + 080.00 | | 2 - 3.00 X 3.00 | 15.00 | |
| 34 | 15 + 510.00 | 1 - 1220 | | 26.00 | |
| | 15 + 750.00 | 2 - 1520 | | 31.00 | |
| 35 | 16 + 035.00 | | 2 - 3.00 X 3.00 | 24.00 | |
| 36 | 16 + 245.00 | 2 - 1220 | | 20.00 | |
| 37 | 16 + 470.00 | 2 - 1520 | | 22.00 | |
| 38 | 17 + 180.00 | | 3 - 3.00 X 3.00 | 20.00 | |
| 39 | 17 + 585.00 | 1 - 1070 | | 17.00 | |
| 40 | 18 + 650.00 | 1 - 910 | | 16.00 | |
| | 18 + 900.00 | | 3 - 1.50 X 1.50 | 16.00 | |
| 41 | 19 + 410.00 | 1 - 910 | | 15.00 | |
| 42 | 19 + 780.00 | 1 - 910 | | 18.00 | |
| | 20 + 020.00 | 1 - 910 | | 16.00 | |
| | 20 + 420.00 | 1 - 910 | | 15.00 | |
| | 20 + 660.00 | 1 - 910 | | 16.00 | |

***BACOLOD SUGAR ROAD (NORTH)***

| BASIN NUMBER | STATION ( km ) | SIZE | | LENGTH | REMARKS / RECOMMENDATION |
|---|---|---|---|---|---|
| | | RCPC | RCBC | | |
| | | mmØ | SPAN X HEIGHT | ( m ) | |
| 43 | 21 + 350.00 | 1 - 910 | | 15.00 | |
| | 21 + 630.00 | | 2 - 2.40 X 2.40 | 24.00 | |
| 44 | 22 + 020.00 | | 2 - 2.40 X 2.40 | 15.00 | |
| | 22 + 160.00 | 1 - 910 | | 21.00 | |
| 45 | 22 + 280.00 | 1 - 910 | | 18.00 | |
| | 22 + 480.00 | 2 - 1520 | | 18.00 | |
| 46 | 22 + 650.00 | 1 - 1070 | | 22.00 | |
| | 22 + 800.00 | 2 - 1220 | | 15.00 | |
| 47 | 23 + 580.00 | 1 - 910 | | 15.00 | |
| 48 | 23 + 770.00 | 1 - 910 | | 15.00 | |
| | 23 + 960.00 | 2 - 1220 | | 23.00 | |
| | 24 + 210.00 | 1 - 910 | | 16.00 | |
| 49 | 24 + 440.00 | 1 - 1220 | | 17.00 | |
| | 24 + 540.00 | 1 - 910 | | 18.00 | |
| | 24 + 640.00 | | 2 - 1.50 X 1.50 | 17.00 | |
| | 24 + 960.00 | | 2 - 1.50 X 1.50 | 17.00 | |
| | 25 + 320.00 | | 2 - 2.40 X 2.40 | 23.00 | |
| | 25 + 450.00 | 1 - 1070 | | 28.00 | |
| 50 | 25 + 620.00 | 2 - 1220 | | 17.00 | |
| | 25 + 720.00 | 1 - 910 | | 16.00 | |
| | 25 + 820.00 | 1 - 910 | | 15.00 | |
| 51 | 26 + 040.00 | 2 - 1220 | | 18.00 | |
| | 26 + 220.00 | | 2 - 2.40 X 2.40 | 16.00 | |
| | 26 + 380.00 | 1 - 1070 | | 23.00 | |
| 52 | 26 + 570.00 | 1 - 1220 | | 20.00 | |
| | 26 + 670.00 | | 2 - 2.40 X 2.40 | 20.00 | |
| | 26 + 835.00 | 1 - 910 | | 18.00 | |
| 53 | 27 + 080.00 | 2 - 1220 | | 32.00 | |
| | 27 + 150.00 | 2 - 1220 | | 24.00 | |
| 54 | 27 + 295.00 | 1 - 910 | | 22.00 | |
| | 27 + 400.00 | 2 - 1220 | | 20.00 | |
| | 27 + 510.00 | 2 - 1220 | | 24.00 | |
| | 27 + 640.00 | 1 - 1070 | | 25.00 | |
| 55 | 27 + 790.00 | 1 - 1070 | | 19.00 | |
| 56 | 28 + 370.00 | | 2 - 3.00 X 3.00 | 32.00 | |
| 57 | 28 + 870.00 | | 2 - 3.00 X 3.00 | 20.00 | |
| 58 | 29 + 220.00 | | 2 - 2.40 X 2.40 | 30.00 | |
| | 29 + 490.00 | 1 - 910 | | 15.00 | |
| | 29 + 700.00 | 2 - 910 | | 16.00 | |
| 59 | 30 + 200.00 | 2 - 1070 | | 16.00 | |
| | 30 + 350.00 | 2 - 1220 | | 15.00 | |
| 60 | 30 + 760.00 | | 2 - 2.40 X 2.40 | 19.00 | |
| | 31 + 040.00 | 2 - 1220 | | 17.00 | |
| | 31 + 175.00 | 1 - 910 | | 21.00 | |
| 61 | 31 + 600.00 | | 2 - 2.40 X 2.40 | 16.00 | |
| 62 | 32 + 150.00 | | 3 - 2.40 x 2.40 | 20.00 | |
| 63 | 32 + 520.00 | | 1 - 2.40 X 2.40 | 25.00 | |
| 64 | 32 + 890.00 | | 3 - 2.40 X 2.40 | 30.00 | |
| 65 | 33 + 090.00 | | 1 - 3.00 X 3.00 | 20.00 | |
| | 33 + 260.00 | 1 - 1070 | | 15.00 | |
| 66 | 33 + 430.00 | 1 - 1070 | | 16.00 | |
| | 33 + 620.00 | | 3 - 1.50 X 1.50 | 17.00 | |
| 67 | 33 + 810.00 | 2 - 1220 | | 16.00 | |
| | 33 + 855.00 | | 1 - 2.40 X 2.40 | 26.00 | |

## 13.8 COST ESTIMATES

### 13.8.1 Construction Cost

(1) Unit Cost Analysis

The project cost was estimated based on the January 2004 prices with breakdown of foreign and local currency components and a tax component.

The foreign exchange rates used were as follows:

1 US $ = 55.36 P = 106.85 Yen

A market price survey was conducted to obtain information on market or prevailing prices of construction materials, labor cost and equipment cost. Based on these prices, a unit cost analysis was conducted to develop unit costs for construction items. Unit prices of major construction items are presented in Tables 13.8-1, 2, 3 and 4, respectively.

(2) Construction Cost

Estimated construction cost is presented in Table 13.8-5. Detailed cost estimate is presented in Appendix 3.8-1. The construction cost of Sugar Road was estimated at 1,417.5 Million pesos, composing of 48.6% a foreign currency component (or 681.1 Million pesos), 36.3% of a local currency component (or 515.2 Million pesos) and 15.7 % of a tax component (or 221.2 Million pesos).

**TABLE 13.8-5 CONSTRUCTION COST**

Unit: Million Pesos

| | Component | | | TOTAL |
|---|---|---|---|---|
| | Foreign | Local | Tax | |
| Urban Section | 217.9<br>(47.6%) | 167.4<br>(36.6%) | 72.5<br>(15.8%) | 457.8<br>(100%) |
| Rural Section | 463.2<br>(48.3%) | 347.8<br>(36.%) | 148.7<br>(15.5%) | 959.7<br>(100%) |
| **Total** | **681.1<br>(48.0%)** | **515.2<br>(36.3%)** | **221.2<br>(15.7%)** | **1,417.5<br>(100%)** |

**TABLE 13.8-1 MARKET PRICE OF CONSRUCTION MATERIALS IN BACOLOD**

(January 2004 Prices)

| Price No. | Description | Unit | Unit Price (P) |
|---|---|---|---|
| 1 | Portland Cement | bag | 182.00 |
| 2 | Reinforcing Steel Bar, Gr. 40 | kg. | 25.00 |
| 3 | Reinforcing Steel Bar, Gr. 60 | kg. | 27.00 |
| 4 | Gasoline, Premium | lit. | 23.94 |
| 5 | Gasoline, Regular | lit. | 22.40 |
| 6 | Diesel | lit. | 18.11 |
| 7 | Lumber | bd.ft. | 36.00 |
| 8 | Ordinary Plywood 1/2" | pc | 580.00 |
| 9 | Emulsified Asphalt SS-1 | tonne | 23,500.00 |
| 10 | Asphalt Cement Pen. 85-100 | tonne | 21,500.00 |
| 11 | Thinner | gal. | 137.00 |
| 12 | Tie Wire #16 | kg. | 60.00 |

*SOURCE:*

- *Study Team Survey*

**TABLE 13.8-2 LABOR COST**

(January 2004 Prices)

| Labor Category | Hourly Rate (Pesos) | Daily Rate (Pesos) |
|---|---|---|
| Foreman | 46.00 | 368.00 |
| Operator | 41.00 | 328.00 |
| Driver | 38.00 | 307.00 |
| Carpenter | 41.00 | 328.00 |
| Re-Bar Worker | 43.00 | 340.00 |
| Masonry | 45.00 | 358.00 |
| Blaster | 40.00 | 320.00 |
| Welder | 47.00 | 376.00 |
| Painter | 40.00 | 320.00 |
| Mechanic | 40.00 | 323.00 |
| Electrician | 41.00 | 325.00 |
| Skilled Labor | 40.00 | 320.00 |
| Unskilled Labor | 32.00 | 252.00 |

*SOURCE:*

- *DPWH - Iloilo City District Engineering Offices*
- *National Health Insurance Program*
- *Social Security System*

**TABLE 13.8-3 HOURLY (OR DAILY) COST OF CONSTRUTION EQUIPMENT**

(January 2004 Prices)

| | Construction Equipment | Unit | Cost (P) |
|---|---|---|---|
| 1 | Tractor, crawler w/dozer (Bulldozer, 15t) | hr | 2,243.00 |
| 2 | Tractor, crawler w/dozer (Bulldozer, 21t) | hr | 3,623.00 |
| 3 | Backhoe, hydraulic, crawler, 0.61m3 | hr | 1,295.00 |
| 4 | Backhoe, hydraulic, crawler, 0.80m3 | hr | 1,766.00 |
| 5 | Dump Truck, 6.0-9.0 cu-yds (4.6-6.9m3) | hr | 807.00 |
| 6 | Motor Grader, 3.71m | hr | 1,748.00 |
| 7 | Vibratory Tandem Smooth Drum 10.6t | hr | 1,622.00 |
| 8 | Four Tamping Foot Wheels (Tire Roller) 16t | hr | 1,583.00 |
| 9 | Water Wagon/Pump Truck 500-1000 gal | hr | 968.00 |
| 10 | Asphalt Paver/Finisher, 4.7m | hr | 1,974.00 |
| 11 | Truck Mixer 5.0-6.0 cu-yds | hr | 1,066.00 |
| 12 | Concrete Batch Plant 40m3/hr with silo | hr | 1,990.00 |
| 13 | Crawler Drill | hr | 428.00 |
| 14 | Concrete Vibrator *(operator not included)* | day | 456.00 |
| 15 | Concrete Cutter *(operator not included)* | day | 1,080.00 |
| 16 | Concrete Paver/Finisher | hr | 870.00 |
| 17 | Truck Crane, Hydraulic 21-25t | hr | 1,297.00 |
| 18 | Concrete Pump Vehicle 100cu-yds/hr (76.5m3/hr) | hr | 1,668.00 |
| 19 | Air Compressor 456-500 cfm | hr | 876.00 |
| 20 | Aggregate Crusher 100t/hr *(operator not included)* | hr | 2,730.00 |
| 21 | Trailer 20t | hr | 1,588.00 |
| 22 | Welding Machine 250A | hr | 300.00 |
| 23 | Generator 51-100 kW *(operator not included)* | day | 3,310.00 |
| 24 | Bar Bender *(operator not included)* | day | 1,310.00 |
| 25 | Electric Bar Cutter | day | 1,310.00 |

*SOURCE: Associated Construction Equipment Lessors (ACEL)*

# TABLE 13.8-4 UNIT COST OF MAJOR CONSTRUCTION ITEM (1/2)

| Item No. | Description | Unit | Unit Cost (Peso) | Component(%) | | |
|---|---|---|---|---|---|---|
| | | | | Foreign | Local | Tax |
| | **PART C - EARTHWORK** | | | | | |
| 100(1) | Clearing and Grubbing | ha. | 55,100.00 | 57 | 27 | 16 |
| 101 | Removal of Existing Sidewalk, Railings, Etc. for Bridge Widening | LS | | 48 | 28 | 24 |
| 102(1) | Unsuitable Excavation | m3 | 179.00 | 59 | 17 | 24 |
| 102(2)a | Surplus Common Excavation | m3 | 179.00 | 60 | 24 | 15 |
| 103(2)a | Bridge Excavation, Common (AWL) | m3 | 202.00 | 53 | 31 | 16 |
| 103(2)b | Bridge Excavation, Common (BWL) | m3 | 763.00 | 51 | 34 | 15 |
| 104(1)a | Embankment from Excavation | m3 | 196.00 | 54 | 20 | 26 |
| 104(1)b | Embankment from Borrow | m3 | 397.00 | 56 | 30 | 15 |
| 104(1)c | Selected Borrow for Backfilling | m3 | 573.00 | 54 | 20 | 26 |
| 105(1) | Subgrade Preparation (Common Material) | m2 | 17.00 | 57 | 27 | 16 |
| | Plastic-board drain (@2.5m * 2.5m triangle, Depth 20.0m) | m2 | 151.00 | 65 | 20 | 15 |
| | **PART D - SUBBASE AND BASE COURSE** | | | | | |
| 200 | Aggregate Subbase Course | m3 | 561.00 | 54 | 32 | 14 |
| 201 | Aggregate Base Course | m3 | 662.00 | 53 | 33 | 14 |
| 202 | Crushed Aggregate Base Course (AC) | m3 | 763.00 | 54 | 32 | 14 |
| | **PART E - SURFACE COURSE** | | | | | |
| 301(1) | Bituminous Prime Coat (MC-70 Cut-Back Asphalt) | t | 24,500.00 | 65 | 17 | 18 |
| 302(2) | Bituminous Tack Coat (Emulsified Asphalt Grade SS-1) | t | 24,500.00 | 65 | 18 | 18 |
| 310 | Bituminous Concrete Surface Course, Hot Laid | t | 3,430.00 | 64 | 18 | 18 |
| 311(1)a | PCC Pavement(Plain) (t=0.10m) | m2 | 420.00 | 62 | 23 | 15 |
| 311(1)c | PCC Pavement(Plain) (t=0.23m) | m2 | 720.00 | 62 | 23 | 15 |
| 311(1)d | PCC Pavement(Plain) (t=0.25m) | m2 | 763.00 | 62 | 23 | 15 |
| 311(2) | PCC Pavement(Reinforced) for Approach Slab, t=300mm | m2 | 4,440.00 | 62 | 23 | 15 |
| | **PART F - BRIDGE CONSTRUCTION** | | | | | |
| 400(4) | Precast Concrete Piles (0.45m×0.45m), Furnished and Driven | m | 3,190.00 | 52 | 28 | 20 |
| 400(15) | Test Piles (0.45m×0.45m) | m | 371.00 | 52 | 35 | 13 |
| 400(16)a | Cast-in-Place Concrete Bored Piles, f 1000mm | m | 23,800.00 | 38 | 45 | 17 |
| 400(16)b | Cast-in-Place Concrete Bored Piles, f 1200mm | m | 32,500.00 | 38 | 45 | 17 |
| 400(19) | Piles Shoes for 0.45m×0.45m Piles | ea | 1,750.00 | 55 | 30 | 15 |
| 401 | Concrete Railings | m | 2,240.00 | 38 | 49 | 13 |
| 404(1) | Reinforcing Steel, Grade 40 (Fy=275Mpa) | kg | 39.00 | 50 | 37 | 13 |
| 404(2) | Reinforcing Steel, Grade 60 (Fy=415Mpa) | kg | 40.00 | 50 | 37 | 13 |
| 405(1) | Structural Concrete Class"A1" for Substructure (f'c=24Mpa) | m3 | 3,200.00 | 34 | 50 | 16 |
| 405(2) | Structural Concrete Class"A2" for Superstructure (f'c=24Mpa) | m3 | 5,040.00 | 34 | 50 | 16 |
| 405(3) | Structural Concrete Class"A3" for Others (f'c=21Mpa) | m3 | 4,130.00 | 34 | 50 | 16 |
| 405(6) | Structural Concrete "Lean Concrete" (f'c=17 Mpa) | m3 | 2,480.00 | 43 | 37 | 20 |
| 406(1)a | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=20m | ea | 309,840.00 | 22 | 62 | 16 |
| 406(1)b | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=22m | ea | 332,398.00 | 22 | 62 | 16 |
| 406(1)c | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=25m | ea | 392,428.00 | 25 | 59 | 16 |
| 406(1)d | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=26m | ea | 406,293.00 | 22 | 62 | 16 |
| 406(1)e | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=27m | ea | 419,645.00 | 22 | 62 | 16 |
| 406(1) f | Prestressed Concrete Girder, AASHTO Type Ⅳ-B, L=28m | ea | 442,641.00 | 20 | 65 | 15 |
| 406(1)g | Prestressed Concrete Girder, AASHTO Type Ⅴ, L=30m | ea | 504,177.00 | 20 | 65 | 15 |
| 406(1)h | Prestressed Concrete Girder, AASHTO Type Ⅴ, L=31m | ea | 519,776.00 | 20 | 65 | 15 |
| 406(1)i | Prestressed Concrete Girder, AASHTO Type Ⅴ, L=34m | ea | 622,080.00 | 17 | 69 | 14 |
| 406(1)j | Prestressed Concrete Girder, AASHTO Type Ⅵ, L=35m | ea | 647,400.00 | 19 | 67 | 14 |
| 406(1)k | Prestressed Concrete Girder, AASHTO Type Ⅵ, L=40m | ea | 816,687.00 | 17 | 69 | 14 |
| 407(1)a | Elastomeric Bearing Pad, 400×350×60 (Duro 60) | ea | 18,100.00 | 21 | 64 | 15 |
| 407(1)b | Elastomeric Bearing Pad, 500×350×60 (Duro 60) | ea | 21,100.00 | 21 | 64 | 15 |
| 407(2) | Expansion Joint, 50mm Gap | m | 46,300.00 | 21 | 64 | 15 |
| 407(4) | Metal Drain (f 150mm G.I. Drain Pipe) | m | 985.00 | 21 | 64 | 15 |
| | **PART G - DRAINAGE AND SLOPE PROTECTION STRUCTURES** | | | | | |
| 500(1)a | Reinforced Concrete Pipe Culvert, 610mmf (Extra. Str.) | m | 4,434.00 | 57 | 28 | 16 |
| 500(1)b | Reinforced Concrete Pipe Culvert, 910mmf (Extra. Str.) | m | 6,600.00 | 57 | 28 | 16 |
| 500(1)c | Reinforced Concrete Pipe Culvert, 1070mmf (Extra. Str.) | m | 10,000.00 | 57 | 28 | 15 |
| 500(1)d | Reinforced Concrete Pipe Culvert, 1220mmf (Extra. Str.) | m | 10,600.00 | 57 | 28 | 15 |
| 500(1)e | Reinforced Concrete Pipe Culvert, 1520mmf (Extra. Str.) | m | 18,700.00 | 57 | 28 | 15 |
| 500(3)a1 | Reinforced Concrete Box Culvert 1-1.5m x 1.5m | m | 16,200.00 | 42 | 43 | 15 |
| 500(3)a2 | Reinforced Concrete Box Culvert 2-1.5m x 1.5m | m | 25,600.00 | 42 | 43 | 15 |
| 500(3)a3 | Reinforced Concrete Box Culvert 3-1.5m x 1.5m | m | 35,800.00 | 42 | 43 | 15 |
| 500(3)b1 | Reinforced Concrete Box Culvert 1-2.4m x 2.4m | m | 27,300.00 | 42 | 43 | 15 |
| 500(3)b2 | Reinforced Concrete Box Culvert 2-2.4m x 2.4m | m | 46,100.00 | 42 | 43 | 15 |
| 500(3)b3 | Reinforced Concrete Box Culvert 3-2.4m x 2.4m | m | 65,400.00 | 42 | 43 | 15 |
| 500(3)c1 | Reinforced Concrete Box Culvert 1-3.0m x 3.0m | m | 37,300.00 | 42 | 43 | 15 |
| 500(3)c2 | Reinforced Concrete Box Culvert 2-3.0m x 3.0m | m | 65,300.00 | 42 | 43 | 15 |
| 500(3)c3 | Reinforced Concrete Box Culvert 3-3.0m x 3.0m | m | 92,000.00 | 42 | 43 | 15 |
| 500(3)d1 | Reinforced Concrete Box Culvert 2-4.0m x 2.5m | m | 79,300.00 | 42 | 43 | 15 |
| 502(2)b1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-910mmf RCPC | ea. | 18,800.00 | 28 | 57 | 15 |
| 502(2)b2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-910mmf RCPC | ea. | 25,200.00 | 28 | 57 | 15 |

## TABLE 13.8-4 UNIT COST OF MAJOR CONSTRUCTION ITEM (2/2)

| Item No. | Description | Unit | Unit Cost (Peso) | Component(%) | | |
|---|---|---|---|---|---|---|
| | | | | Foreign | Local | Tax |
| 502(2)c1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1070mmf RCPC | ea. | 21,500.00 | 30 | 55 | 15 |
| 502(2)c2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1070mmf RCPC | ea. | 31,300.00 | 30 | 55 | 15 |
| 502(2)d1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1220mmf RCPC | ea. | 26,700.00 | 31 | 54 | 15 |
| 502(2)d2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1220mmf RCPC | ea. | 37,500.00 | 31 | 54 | 15 |
| 502(2)f1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1520mmf RCPC | ea. | 36,200.00 | 33 | 52 | 15 |
| 502(2)f2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1520mmf RCPC | ea. | 51,700.00 | 33 | 52 | 15 |
| 502(10)a1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-1.5m x | ea. | 49,900.00 | 44 | 41 | 15 |
| 502(10)a2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-1.5m x | ea. | 59,800.00 | 45 | 40 | 15 |
| 502(10)a3 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-1.5m x | ea. | 70,700.00 | 45 | 40 | 15 |
| 502(10)b1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-2.4m x | ea. | 102,000.00 | 44 | 41 | 15 |
| 502(10)b2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-2.4m x | ea. | 122,000.00 | 45 | 40 | 15 |
| 502(10)b3 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-2.4m x | ea. | 141,000.00 | 45 | 40 | 15 |
| 502(10)c1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-3.0m x | ea. | 148,000.00 | 44 | 41 | 15 |
| 502(10)c2 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-3.0m x | ea. | 178,000.00 | 45 | 40 | 15 |
| 502(10)c3 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-3.0m x | ea. | 201,000.00 | 45 | 40 | 15 |
| 502(10)d1 | Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-4.0m x | ea. | 197,000.00 | 45 | 40 | 15 |
| 502(3)a1 | Catch Basin for RCPC 1-f 610 | ea. | 16,700.00 | 38 | 47 | 15 |
| 502(3)b1 | Catch Basin for RCPC 1-f 910 | ea. | 24,300.00 | 38 | 47 | 15 |
| 502(3)b2 | Catch Basin for RCPC 2-f 910 | | 37,900.00 | 39 | 46 | 15 |
| 502(3)c1 | Catch Basin for RCPC 1-f 1070 | ea. | 28,400.00 | 38 | 47 | 15 |
| 502(3)c2 | Catch Basin for RCPC 2-f 1070 | | 45,500.00 | 39 | 46 | 15 |
| 502(3)d1 | Catch Basin for RCPC 1-f 1220 | ea. | 37,100.00 | 38 | 47 | 15 |
| 502(3)d2 | Catch Basin for RCPC 2-f 1220 | | 60,900.00 | 39 | 46 | 15 |
| 502(3)e1 | Catch Basin for RCPC 1-f 1520 | ea. | 47,500.00 | 38 | 47 | 15 |
| 502(3)e2 | Catch Basin for RCPC 2-f 1520 | | 80,300.00 | 39 | 46 | 15 |
| 504(5) | Grouted Riprap, Class "A" | m3 | 2,120.00 | 48 | 36 | 15 |
| 505(1) | Stone Masonry | m3 | 2,200.00 | 55 | 30 | 15 |
| 505(2) | Gravity Type Retaining Wall(H=1.0~1.5m) | m3 | 5,220.00 | 44 | 41 | 15 |
| 507 | Steel Sheet Pile (85x400x8mm), Furnished and Driven | m | 1,430.00 | 55 | 30 | 15 |
| 509 | Gabions | m3 | 3,620.00 | 51 | 34 | 15 |
| 510 | Rubble Concrete Slope Protection, t = 350mm | m3 | 1,940.00 | 51 | 34 | 15 |
| 511(a) | Concrete Side Dicth (0.5 x 0.5) | m | 2,230.00 | 38 | 47 | 15 |
| | | | | | | |
| | **PART H - MISCELLANEOUS STRUCTURES** | | | | | |
| | | | | | | |
| 600(1)a | Concrete Curb, Type A (200x450mm) | m | 629.00 | 58 | 27 | 15 |
| 600(1)c | Concrete Curb for Edge of Sidewalk(200*500) | m | 741.00 | 58 | 27 | 15 |
| 600(3)a | Combination Concrete Curb & Gutter/Side Strip, Type A (675x364mm) | m | 1,050.00 | 58 | 27 | 15 |
| 602(2) | Maintenance marker post | ea. | 1,140.00 | 24 | 64 | 12 |
| 602(3) | Kilometer post | ea. | 1,520.00 | 24 | 64 | 12 |
| 602(4) | Guide post | ea. | 1,250.00 | 24 | 64 | 12 |
| 603(3)a | Metal Guardrail | m | 2,360.00 | 58 | 27 | 15 |
| 610 | Sodding | m2 | 200.00 | 58 | 27 | 15 |
| 611(1) | Trees (Furnishing and Transplanting) | ea. | 1,260.00 | 58 | 27 | 15 |
| SPL620(1) | Traffic Signal (3-way intersection) | ea. | 2,082,000.00 | 65 | 20 | 15 |
| SPL620(2) | Traffic Signal (4-way intersection) | ea. | 2,268,500.00 | 65 | 20 | 15 |
| | Other Miscellaneous Fascilities (Road Signs, Pavement Stud, etc.) | km | 1,500,000.00 | 70 | 20 | 10 |
| | | | | | | |
| | **PART A,B - ENGINEER'S FACILITY AND MOBILIZATION / DEMOBILIZATION** | | | | | |
| | (5% of PART C to H) | | | | | |
| | | | | | | |
| | **CONTINGENCY** | | | | | |
| | (10% of PART A to H) | | | | | |

### 13.8.2 ROW Acquisition and Compensation Cost (Bacolod NB-3)

#### 1) Unit Price

Unit prices for road right-of-way acquisition and compensation are obtained from respective municipality/city Assessor's Offices and regional office of BIR. The Republic Act 8974 provides that compensation cost for land shall be BIR zonal value that is normally far lower than prevailing market prices. Since the agricultural land around the study area has strong potential demand for residential use, price of the land currently transacted around area is fairly higher than zonal value. For the purpose of obtaining practical cost estimate for the project, prevailing market prices are adopted in this study.

Prices of structures are determined based on schedule of prices available in the Assessor's Office. The unit prices of structures are determined without any depreciation to obtain replacement cost of structures. Unit prices are summarized in **Table 13.8-6.**

**TABLE 13.8-6 UNIT PRICES OF LAND ACQUISITION AND COMPENSATION**

| Item | Zonal Value Assessed Value ($P/m^2$) | Prevailing Market Price ($P/m^2$) |
|---|---|---|
| **Land Acquisition** | **Zonal Value** | |
| Residential | 1,200 - 2,000 | 2,000 - 3,500 |
| Sugar Land | 23 - 30 | 250 |
| Fruit Orchard | 18.5 – 29.0 | 100 |
| **Structures (floor area in $m^2$)** | **Assessed Value** | |
| Concrete House | 6,000 – 6,300 | |
| Semi Concrete House | 4,800 – 5,000 | |
| Light Material House | 3,000 – 3,500 | |

#### 2) Compensation Cost

Land area to be acquired is computed by present land use based on aerial- photo map and verified by field survey. Number of structures is tentatively obtained from aerial-photo map and will verified field investigation during social impact survey.

Summary of compensation is presented in Table 13.8-7. Detailed estimate is shown in Appendix 13.8-2.

**TABLE 13.8-7 ESTIMATED OF LAND ACQUISITION AND COMPENSATION COST**

| Item | Quantity | Amount (P1,000) |
|---|---|---|
| Land Acquisition | 1,073,790 $m^2$ | 411.9 |
| Residential | 75,940 | 212.3 |
| Sugar Land | 997,850 | 199.6 |
| Structures | 14 structures | 1.1 |
| Other Compensation | | 6.0 |
| Total | | 419.0 |

### 13.8.3 Detailed Engineering and Construction Supervision Cost

Engineering services cost for a detailed design ranges form 3 to 5% of construction cost, and a construction supervision from 5 to 9%. An average of 4% of construction cost was adopted for the detailed design and 8 % for the construction supervision for this project.

**TABLE 13.8-8 ENGINEERING SERVICE COST (Million Peso)**

Unit: Million Pesos

| | Component | | | TOTAL |
|---|---|---|---|---|
| | Foreign | Local | Tax | |
| Urban Section | 18.0 (55%) | 11.5 (35%) | 3.3 (10%) | 32.8 (100%) |
| Rural Section | 21.1 (55%) | 13.5 (35%) | 3.8 (10%) | 38.4 (100%) |
| **Total** | **39.1 (55%)** | **25.0 (35%)** | **7.1 (10%)** | **71.2 (100%)** |

### 13. 8.4 Summary of Project Cost

Summary of project cost is shown in Table 13.8-9.

**TABLE 13.8-9 SUMMARY OF PROJECT COST**

Unit: Million Pesos

| | Component | | | TOTAL |
|---|---|---|---|---|
| | Foreign | Local | Tax | |
| Urban Section | | | | |
| Detailed Design | 18.0 | 11.5 | 3.3 | 32.8 |
| ROW / Relocation | - | 134.2 | 14.9 | 149.1 |
| Construction | 217.9 | 167.4 | 72.5 | 457.8 |
| Construction Supervision | 20.1 | 12.8 | 3.7 | 36.6 |
| **Total** | **256.0** | **325.9** | **94.4** | **676.3** |
| Rural Section | | | | |
| Detailed Design | 21.1 | 13.5 | 3.8 | 38.4 |
| ROW / Relocation | - | 242.9 | 27.0 | 269.9 |
| Construction | 463.2 | 347.8 | 148.7 | 959.7 |
| Construction Supervision | 42.2 | 26.9 | 7.7 | 76.8 |
| **Total** | **526.5** | **631.1** | **187.2** | **1,344.8** |
| TOTAL | | | | |
| Detailed Design | 39.1 | 25.0 | 7.1 | 71.2 |
| ROW / Relocation | - | 377.1 | 41.9 | 419.0 |
| Construction | 681.1 | 515.2 | 221.2 | 1,417.5 |
| Construction Supervision | 62.3 | 39.7 | 11.4 | 113.4 |
| **Total** | **782.5** | **957.0** | **281.6** | **2,021.1** |

### 13.8.5 Maintenance Cost for Sugar Road

(1) Road and Bridge Conditions

Road and bridge conditions and EMK factors are determined as follows.

| Item | Conditions | EMK Factor |
|---|---|---|
| Road Length (km) | 32.7 | - |
| Traveled Way Width (m) | 2-lane < 7.5m | 1.0 |
| Bridge Length (total) (l.m) | 1,313 | 0.01 |
| AADT (2016) | 18,000 | 1.20 |
| Opening Year | 2016 (L=6.6km)<br>2021 (L=26.1km) | - |

*Note: AADT is estimated by PCU divided by 1.3. EMK factor is limited at 1.38 for 2-lane and 1.48 for 4-lane road. Total EMK=Road Length (km) x (Width F. x Surface Type F.) + Bridge Length x (Bridge F.)*

(2) Base Cost

See Chapter 12.8.5

(3) Maintenance Cost Estimate

Maintenance cost is estimated based on EMK and base costs of routine and periodic maintenance, and shown in Table 13.8-10.

**TABLE 13.8-10 MAINTENANCE COST OF SUGAR ROAD**

| | Calendar Factors | | | | EMK | Financial Cost (x1000Peso) | | | Economic Cost (x1000Peso) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Year | AADT | Lane | Bridge | (km) | Routine | Periodic | Total | Routine | Periodic | Total |
| 1 | 2016 | 1.20 | 1.00 | 2.62 | 10.56 | 892 | 0 | 892 | 674 | 0 | 674 |
| 2 | 2017 | 1.21 | 1.00 | 2.62 | 10.68 | 903 | 0 | 903 | 682 | 0 | 682 |
| 3 | 2018 | 1.23 | 1.00 | 2.62 | 10.81 | 913 | 0 | 913 | 690 | 0 | 690 |
| 4 | 2019 | 1.25 | 1.00 | 2.62 | 10.94 | 924 | 0 | 924 | 699 | 0 | 699 |
| 5 | 2020 | 1.27 | 1.00 | 2.62 | 11.06 | 935 | 0 | 935 | 707 | 0 | 707 |
| 6 | 2021 | 1.29 | 1.00 | 13.13 | 55.39 | 4,679 | 0 | 4,679 | 3,537 | 0 | 3,537 |
| 7 | 2022 | 1.31 | 1.00 | 13.13 | 56.01 | 4,732 | 0 | 4,732 | 3,577 | 0 | 3,577 |
| 8 | 2023 | 1.33 | 1.00 | 13.13 | 56.63 | 4,784 | 0 | 4,784 | 3,617 | 0 | 3,617 |
| 9 | 2024 | 1.35 | 1.00 | 13.13 | 57.26 | 4,837 | 0 | 4,837 | 3,657 | 0 | 3,657 |
| 10 | 2025 | 1.37 | 1.00 | 13.13 | 57.88 | 4,890 | 0 | 4,890 | 3,697 | 0 | 3,697 |
| 11 | 2026 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 12 | 2027 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 13 | 2028 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 14 | 2029 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 15 | 2030 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 16 | 2031 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 17 | 2032 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 18 | 2033 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 19 | 2034 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |
| 20 | 2035 | 1.38 | 1.00 | 13.13 | 58.30 | 4,925 | 0 | 4,925 | 3,723 | 0 | 3,723 |

## 13.9 ENVIRONMENTAL IMPACT ASSESSMENT

### 13.9.1 General Characteristics of the Project Road

The project road that runs Metro Bacolod South to North traversing cities of Bacolod, Silay and Silay and municipalities of E.M. Magolana and Victoria approximately 10.0km away from coastal line. Terrain is flat to rolling (0-4%) with occasional hilly (5% above) sections with limited length. Flow of creeks and rivers crossing the proposed alignment is generally stable and no traces of flooding are observed. Land use along the road is mostly sugar cane plantation with scattered residential areas for employees and laborers of the plantation. Grove of coconut, mango, bamboo, and other fruit trees are observed along creeks and rivers. No other major establishments are found.

The proposed project is construction of two-lane highway with required ROW of 30m. Total length of the road is estimated at 34.0km. A total of 19 bridges with an aggregate length of 1,756m are planned to be constructed.

The Initial Environmental Examination conducted in July 2003 reported that there are no significant environmentally critical spots, such as historical structures, religious institutions, and environmentally protected areas along the project road. However, the required ROW along the entire stretch of the road shall be acquired from owners of sugar cane plantation.

### 13.9.2 Social Acceptability

The criterion provided by the DENR DAO 96-37[1] for evaluating the social acceptability of a project has been considered during the course of the study to a certain extent. **Table 13.9-1** shows the action taken to ascertain social acceptability at the feasibility study level.

**TABLE 12.9-1 ACTION TAKEN BY THE STUDY TEAM TO ASCERTAIN SOCIAL ACCEPTABILITY**

| Criteria | Action Taken |
|---|---|
| 1) Consistency with land use plan | . Provincial and municipal land use plans and infrastructure development plan are obtained and examined. The proposed widening project is confirmed with the local infrastructure development plan. |
| 2) Public Participation | . Officials from regional offices of national government (NEDA, DENR, DOTC), local government units and private sector were consulted during selection the project road and its improvement level.<br>• Public consultation meeting involving the communities along the project road were held by barangay level. |
| 3) Promotion of Social Equity | . Preferential hiring of local labor and provision of alternative means of livelihood are considered as mitigating and enhancement measures to address adverse socio-economic impacts. |
| 4) Mitigating and Enhancement Measures | • Included in **Table 13.9-8** |
| 5) Involve Women and Vulnerable Groups | • Active participation of women and vulnerable groups, such as informal settlers and tenants/renters are included in this report as mitigating and enhancement measures to address adverse socio-economic impacts. |
| 6) Environmental Monitoring and Evaluation | • Included in **Table 13.9-9** |

[1] Department of Environment and Natural Resources, Administrative Order No. 37, Series 1996. This Administrative Order provides detailed procedures of the EIA System.

### 13.9.3 Data Gathering for Baseline Information

The parameters of baseline data needed to establish historical trends and present condition of the physical, biological and socio-economic environment of project area were agreed during Level I Scoping Meeting (Technical Scoping) with EMB[2] held in 28 February 2004 at the EMB conference room. Based on the agreed parameters, the collection of baseline information has been carried out in March 2004. The result of baseline survey is discussed in the next section.

### 13.9.4 Description of Existing Environmental Condition

#### 1) Physical Environment

**Climate**

The nearest synoptic meteorological station in the project area is located in Dumaguete City. The climatic characteristics of the project road are identical to the Airport Access Road as discussed in **Section 12.9.4.**

**Terrain**

Terrain of the project area is flat and rolling with occasional hilly sections with short stretches. The elevation of the ground along proposed alignment varies from 60m at beginning of the project in Bacolod City and goes up to 100m at boundary of Talisay City then gradually descends and end with 20m at the municipality of Victoria. Nineteen (19) creeks originate from Mt. Mandalagan that require construction of bridges along the proposed alignment are observed.

**Air Quality**

Two sites were selected as the sampling stations for the ambient air quality measurements specifically for total suspended particulates (TSP). These sites include the following: Barangay Dos Hermanas, Talisay City (Sampling Station 2) and Barangay Eustaquio Lopez, Silay (Sampling Station 3). Results of the sampling activity indicate that the concentration recorded was only 59.0 micrograms per normal cubic meter in Barangay Dos Hermanas, Talisay City; and 110.0 micrograms per normal cubic meter in Barangay Eustaquio Lopez, Silay City. This concentration is way below the standard established by the Department of Environment and Natural Resources at 230.0 micrograms per normal cubic meter.

**TABLE 13.9.-2 RESULTS OF AMBIENT AIR QUALITY MEASUREMENTS**

| Sampling Station | Sampling Time | Parameter | Concentration (μ/Ncm) | Standard (μ/Ncm) |
|---|---|---|---|---|
| 1 | 24 | TSP | 120 | 230 |
| **2** | **24** | **TSP** | **59** | **230** |
| **3** | **24** | **TSP** | **110** | **230** |

[2] EMB: Environmental Management Bureau of DENR

## Water Quality

Two stations were established for the measurement of water quality in selected waterways that will be traversed by the alignment. The parameters include the following parameters as shown in **Table 13.9-3**.

**TABLE 13.9-3 RESULTS OF PHYSICAL AND CHEMICAL ANALYSIS OF WATER**

| Parameters | Sampling Station Number | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| **Color, units** | **20.0** | **5.0** | 20.0 |
| **Temperature, $^0$C** | **28.5** | **28.5** | 27.0 |
| PH | **8.5** | **8.5** | 8.6 |
| Dissolved Oxygen (DO), mg/L | **8.0** | **8.0** | 7.3 |
| BOD (5 day), 20 $^0$C mg/L | **2.0** | **2.0** | 2.0 |
| Total Suspended Solids, mg/L | **100.0** | **80.0** | 40.0 |
| Total Dissolved Solids, mg/L | - | - | - |
| Oil and Grease, mg/L | - | - | - |
| Settleable Solids, mg/L | < 1 | < 1 | < 1 |
| Total Coliforms, MPN/100 ml | - | - | - |
| Fecal Coliforms, MPN/100 ml | - | - | - |

Notes: **Station 1 – Km 13+00 Imbang River at Barangay Dos Hermanas, Talisay City**
**Station 2 – Km 23+250 Malogo River at Barangay E. Lopez, Silay City**
**Station 3** – Km 3+900 Barangay Matab-ang, Talisay City

## Noise Level

One sampling site each were established in Barangay Dos Hermanas, Talisay City (Sampling Station 1); Barangay XXI, Victorias City (Sampling Station 2); and Barangay Mansilingan, Bacolod City (Station 4) for noise level measurements using a Noise Level Meter. Readings were taken for the evening, nighttime, morning, and daytime periods. The average readings taken at the time of sampling is as shown in **Table 13.9-4**. By comparing with the standards established for the purpose, all readings (except during the daytime readings for Station 1) are above standards, meaning that the ambient noise level in the area is already high.

**TABLE 13.9-4 NOISE LEVEL MEASUREMENTS**

| Trial Readings | Morning | | | | Daytime | | | | Evening | | | | Nighttime | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 AM - 9 AM | | | | 9 AM - 6 PM | | | | 6 PM - 10 PM | | | | 10 PM - 5 AM | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 1 | **43.9** | **69.8** | 46.4 | **83.6** | **57.0** | **88.8** | 70.7 | **60.1** | **44.3** | **47.0** | 55.2 | **57.8** | **59.6** | **84.4** | 45.1 | **57.6** |
| 2 | **46.2** | **78.3** | 45.6 | **86.0** | **44.2** | **83.0** | 62.3 | **53.1** | **55.4** | **48.3** | 48.0 | **80.4** | **48.2** | **50.4** | 50.9 | **63.1** |
| 3 | **42.2** | **82.6** | 48.5 | **62.5** | **63.4** | **81.3** | 56.7 | **62.5** | **43.9** | **48.9** | 50.2 | **71.1** | **48.1** | **49.7** | 45.5 | **48.8** |
| 4 | **57.3** | **82.9** | 44.7 | **85.9** | **49.9** | **56.1** | 81.4 | **56.9** | **43.5** | **58.6** | 44.3 | **59.1** | **60.9** | **44.1** | 50.1 | **83.9** |
| 5 | **62.5** | **65.4** | 54.4 | **83.5** | **60.5** | **86.5** | 76.1 | **57.8** | **59.7** | **66.2** | 41.9 | **67.4** | **46.4** | **84.8** | 52.0 | **51.8** |
| 6 | **47.6** | **79.1** | 55.2 | **64.0** | **50.6** | **77.6** | 59.2 | **54.2** | **64.4** | **60.2** | 50.2 | **82.4** | **51.7** | **57.4** | 52.0 | **51.5** |
| 7 | **60.0** | **83.1** | 46.7 | **71.3** | **50.6** | **77.6** | 83.4 | **59.2** | **62.1** | **52.8** | 42.8 | **50.2** | **46.9** | **50.2** | 45.8 | **69.3** |
| | | | | | | | | | | | | | | | | |
| Minimum | **42.2** | **82.9** | 44.7 | **64.0** | **44.2** | **56.1** | 56.7 | **53.1** | **43.5** | **47.0** | 41.9 | **57.8** | **46.4** | **44.1** | 45.1 | **45.1** |
| Maximum | **62.5** | **65.4** | 55.2 | **86.0** | **63.4** | **88.8** | 83.4 | **60.1** | **64.4** | **66.2** | 55.2 | **82.4** | **60.9** | **84.8** | 50.9 | **50.9** |
| Average | **51.4** | **77.3** | 48.8 | **76.7** | **53.7** | **78.7** | 70.0 | **57.7** | **53.3** | **54.6** | 47.5 | **66.9** | **51.7** | **60.1** | 48.8 | **60.9** |
| Standard | **50.0** | **50.0** | 50.0 | **50.0** | **55.0** | **55.0** | 55.0 | **55.0** | **50.0** | **50.0** | 50.0 | **50.0** | **45.0** | **45.0** | 45.0 | **45.0** |
| Variance | **2.8** | **54.6** | -2.4 | **53.4** | **-2.3** | **43.1** | 27.2 | **4.9** | **6.7** | **9.1** | -5.0 | **33.8** | **14.9** | **33.7** | 8.4 | **35.2** |

Note: **Station 1 – Barangay Dos Hemanas, Talisay City**
**Station 2 – Barangay XXI, Victorias City**
**Station 3** – Barangay Matab-ang, Talisay City
**Station 4 – Barangay Mansilingan, Bacolod City**

**Land Use**

Land use along project road is mostly sugar cane plantation. Limited area of fruit tree groves such as coconut, mango, and star apples are observed around residential houses found along exiting feeder roads and riverbanks. Occupants the residential houses are mainly employees and laborers of sugar cane plantation. No other major establishments are observed.

## 2) Biological Environment

**Vegetation and Wildlife**

Two (2) sampling sites were established for the road alignment. These are located in Hacienda San Juan, Barangay Dos Hermanas, Talisay City - Site 1; and Hacienda Alegria, Barangay Eustaquio Lopez, Silay City - Site 2. Each site involved two transects. Site 1 has the following coordinates: 505120 E and 1185999 N/505122 E and 1185996 N, and 505118 E and 1185993 N/505113 E and 1185990 N. Site 2 on the other hand has the following coordinates: 506420 E and 1195433 N/506423 E and 1195430 N, and 506430 E and 1195440 N/506433 E and 1195442 N.

Site 1 is generally consist of partially closed vegetation along the river with a number of tall trees such as *Gmelina arborea* (10-15 year olds) and bamboos (*Bambusa blumeana* and *B. arundinacea*), and shrubs [e.g. *madre de cacao* (*Gliricidia sipium*)] creating a partially dark understorey condition. However some portions of the area contain low patches under full exposure to the sun. Species include a combination of cultivated and wild species (fruit trees such as jackfruit, mango, banana, and coconut; timber trees such as mahogany and narra), bamboos, and others. The sugar cane field (*Saccharum officinale*) has stretched to the edge of the creek with barely a few meters left for vegetation. The area near the river is cool even during summer as ecologically indicated by species of ferns and mosses. The slopes are dominated by green succulent broad-leaved *Colocasia* and *Alocacia* species and shrubs of *Macaranga tanarius* and *Typha angustifolia* (Cat-tail). Butterflies, dragonflies, fruitflies, bees, moths, beetles, ants, and spiders were abundant in the area. Birds such as the sparrows and egrets were common. Snails, lizards, toads, tree frogs, were also present.

Site 2 also consist of open vegetation near the creek but with isolated patches of tall bamboos (*Bambusa blumeana*) and many newly grown wild trees of different species such as *Nauclea orientalis, Casia alata, Ficus septica*, *Ficus pseudopalma*, and *Premna odorata* (adgao), dominated by wild species of small woody shrubs such as *Sida rhombifolia, Stachytharpeta jamaicensis*, *Chromolaena odorata*, and *Mimosa pudica*. The area has a natural vegetation but is heavily disturbed. And although it is partially open, there were indicators of vegetative regeneration as indicated by some ferns and bryophytes. One would not think that such an open vegetation would still support new and varied living vegetation. Butterflies, dragonflies, beetles, bees, grasshoppers, mosquitoes, moths, ants, and spiders were abundant. Birds and few domesticated animals were observed. Snails, frogs, toads, lizards and snakes were also present.

**Floral Composition**

A total of 19 species of plants, distributed in approximately 90 families, were recorded. This includes 41 species of trees, 31 species of shrubs, 90 species of low plants, i.e. semi-woody, herbaceous weeds and vines, 4 species of lower plants (ferns and bryophytes) and 25 species of common grasses typical of open waste lands in the Philippines.

The whole length of the sampled area was covered by secondary growth vegetation, composed of a combination of cultivated crop and ornamental plants (mostly exotics) and some wild species (native and naturalized ones). The same typical grassland and shrub growth combinations recur at various points along the transects and study sites.

**Faunal Composition**

Major animal groups identified in the area include invertebrates as well as vertebrate taxa. A total of 85 species were recorded; only 14 of which are vertebrates. Animals belonging to Phylum Arthropoda and Phylum Nematoda were the most common inhabitants in the four sampling sites studied. Insects of common species (Class Insecta) were most numerous and widely spread over the eight stations. A total of 63 species of insects were identified and recorded to occur in the four sampling sites. In the order of abundance, dragonflies and fruitflies were the most abundant, followed by black and red ants, bowflies, plant hoppers, bees and wasps, beetles, bugs, grasshoppers, crickets, katydids, butterflies and moths, praying mantis, mosquitoes, dragonflies, damselflies, and termites, respectively. Five species of spiders (Class Arachnida) and one species representative of Phylum Mollusca and Phylum Annelida were recorded and identified. Eight species of birds were identified from the four sampling sites. Cows, goats, dogs, cats (Class Mammalia), toads and tree frogs (Class Amphibia), and green and monitor lizard (Class Reptilia) were also noted.

**Aquatic Fresh/Marine Environment**

There are no local account of freshwater fish present in the rivers sampled during the water quality measurements, but it has to be established preferably before the start of construction. It is likely that there could be endemic species in these rivers but that had not been noticed during the field survey.

### 3) Socio-Economic Environment

The socio-economic characteristics of the project area are identical to the project area of the New Airport Access Road (NS-2) as discussed in **Section 12.9.4**, since the two project roads run across Metro Bacolod area north to south only a few kilometers apart.

## 13.9.5 Perception Survey

The Perception Survey was conducted in the 18 barangays traversed by the proposed road. The respondents were disaggregated into two major identification (unless specified otherwise in the rest of the tables): (1) respondents within the barangays traversed by the alignment that are directly affected, and (2) respondents within the barangays that are not directly affected by the alignment.

A total of 571 respondents were identified during the survey. Most of these respondents (97.7%) were randomly selected within the barangays while the rest (2.3%) were directly selected within the barangay since they are most likely along the project alignment.

**TABLE 13.9-5 DISTRIBUTION OF RESPONDENTS BY BARANGAY**

| City/Barangay | Directly Affected | | Indirectly affected | | Total | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| **Bacolod City** | | | | | | |
| Mansilingan | 0 | 0 | 8.00 | 1.4 | 8 | 1.4 |
| Vista Alegre | 1 | 7.7 | 1.02 | 2.1 | 13 | 2.3 |
| Granada | 7 | 53.8 | 140.00 | 25.1 | 147 | 25.7 |
| Estefania | 0 | 0 | 75.0. | 13.4 | 75 | 13.1 |
| Mandalagan | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sub-total** | **8** | **61.5** | **235.00** | **42.1** | **243** | **42.6** |
| **Talisay City** | | | | | | |
| Concepcion | 1 | 7.7 | 57.00 | 10.2 | 58 | 10.1 |
| Matab-ang | 0 | 0 | 16.00 | 2.9 | 16 | 2.8 |
| Dos Hermanas | 0 | 0 | 60.00 | 10.7 | 60 | 10.5 |
| **Sub-total** | **1** | **7.7** | **133.00** | **23.8** | **134** | **23.5** |
| **Silay City** | | | | | | |
| Guimbala-on | 0 | 0 | 17.00 | 3.0 | 17 | 3.0 |
| E. Lopez | 0 | 0 | 35.00 | 6.3 | 35 | 6.1 |
| **Sub-total** | **0** | **0** | **52.00** | **9.3** | **52** | **9.1** |
| **E.B. Magalona** | | | | | | |
| Alacaygan | 3 | 23.1 | 29.00 | 5.2 | 32 | 5.6 |
| Concing | 0 | 0 | 0 | 0 | 0 | 0 |
| **Sub-total** | **3** | **23.1** | **29.00** | **5.2** | **32** | **5.6** |
| **Victorias City** | | | | | | |
| Barangay XX | 0 | 0 | 40.00 | 7.2 | 40 | 7.0 |
| Barangay VIII | 1 | 7.7 | 6.00 | 1.1 | 7 | 1.2 |
| Barangay XVIII-A | 0 | 0 | 20.00 | 3.6 | 20 | 3.5 |
| Barangay XII | 0 | 0 | 21.00 | 3.8 | 21 | 3.7 |
| Barangay XIV | 0 | 0 | 12.00 | 2.1 | 12 | 2.1 |
| Barangay XXI | 0 | 0 | 10.00 | 1.8 | 10 | 1.7 |
| **Sub-total** | **1** | **7.7** | **109.00** | **19.5** | **110** | **19.3** |
| **Total** | **13** | **100.0** | | **100.0** | **571** | **100.0** |
| % Distribution | | 2.3 | | 97.7 | 100 | |

### 1) Awareness about the Project

More than half of the respondents (56%) of the total number of respondents already heard of the plan for construction of the project. The percentage of directly affected respondents who have already heard of the project is relatively higher (53.8%) and the highest can be found also in Barangay Granada.

More than half (51%) of the respondents heard of the project only recently. About a fourth heard it 1 or 2 years ago. Only a very small percentage (4%) heard of it more than two years ago.

Those who heard about the project said that it is about the construction of a new road/highway (44.3%) while others (27.4%) believed it is about other projects.

### 2) Agreement for the Project

Most (93.3%) of the respondents are in favor of the implementation of the project. More than a third (37.8%) said that the project offers safe and efficient transport of people, goods, and services. The respondents also believe that the project will give way to development of the area and the province as a whole (26.6%); project will invite small and big investors in the province (5.1%). More than a fifth (22.9%) did not provide any response.

### 3) Effect on Source of Income

More than a fifth (88.6%) of the respondents said that their livelihood will not be affected. Less than a tenth (8.2%) said that there will be loss of livelihood, employment and property.

### 4) Good Things Seen about the Project

About half (49.6%) of the respondents believed that with the project, there will be easy and fast access to the region. More than a fifth (21%) on the other hand said that it will benefit the majority and opening of new business. More than a tenth (12.4%) added that the city or barangay will improve or develop while about the same percentage (12.1%) said that there will be less traffic in the main highway.

### 5) Benefits Expected from the Project

Three-fifths (60.1%) of the total number of respondents said that travel time will become shorter (including faster and convenient transport of people and goods). According to more than a fourth (25.7%) of the respondents, there will also be opening of new industries along the alignment and consequent offer of employment. The rest did not provide any response or comment or do not know at all what to expect from the project.

### 6) Bad Things about the Project

Nearly a third (29.6%) of the total number of respondents believe that no bad things can be attributed to the project. On the other hand, more than a tenth (15.9%) said that there will be increase in noise and air pollution level. Also more than a tenth (14%) said that fast moving vehicles may cause accidents; more than a tenth (13.7%) said that there will be loss of livelihood/relocation of affected families. The rest are spread to other responses such as strangers will be coming into the barangays (1.2%); disruption of regular activities of barangay residents (2.5%); and increased crime rate (1.9%).

### 7) Problems Foreseen for the Community as a Whole

Close to a third (32.4%) of the respondents believe that the project will not bring any problems to the community as a whole, but nearly a fifth (18.6%) said that there will be increased pollution/problem of flooding/heavy erosion and landslide. About a tenth (10.9%) also said that there will be loss of properties, and livelihood problems (lack of jobs).

## 13.9.6 Identified Impacts and Mitigation Measures

The predicted environmental impacts, along with the mitigation (for negative impacts) and enhancement (for positive impacts) measures are presented in **Table 13.9-6**, Impacts and Mitigation/Enhancement Matrix.

## 13.9.7 Environmental Management and Monitoring Plan

The Environmental Management and Monitoring Plan is presented in **Table 13.9-7**.

## 13.9.8 Resettlement Plan for Affected People

The survey on Resettlement Plan for affected people is currently being undertaken. Status of survey is discussed in **Section 12.10**.

## TABLE 13.9-6 SUMMARY MATRIX OF IMPACTS AND MITIGATION AND ENHANCEMENT MEASURES (1/3)

| Impacts | Type | | Mitigation/Enhancement Measures |
|---|---|---|---|
| | Negative | Positive | |
| **CONSTRUCTION PHASE** | | | |
| **Physical Environment** | | | |
| **Air Quality and Noise Levels** | | | |
| Increase in levels of Total Suspended Particulates (TSP) such as dust, dirt, and oil soot. | Low | | Use of water trucks equipped with horizontal spray jets located on the aft end and perpendicular to the direction of travel. |
| Increase in exhaust gas emission levels due to the operation of various heavy equipment and vehicles. | Low | | Regular maintenance of heavy equipment and other smoke emitting machinery must be strictly complied with. |
| Increase in noise levels and vibration due to the operation of heavy equipment and vehicles. | Low | | Use of mufflers and appropriate noise suppressors for heavy equipment and machinery. |
| | | | Scheduling of high noise generating activities during the daytime. |
| Temporary stockpiles of excavated and surplus materials as well as fill and embankment materials may also add to the present TSP levels. | Low | | Excavate unsuitable materials and contraction spoils will be regularly hauled and disposed to DENR approved disposal site. |
| | | | Temporary stockpiles of fill and embankment materials will be covered with tarpaulin canvass or sack materials to prevent re-suspension of particulate matters. |
| **Water Quality** | | | |
| Increase in the amount of suspended solids of receiving natural water ways due to the deposition of high volumes of exposed, loose sediments transported by surface run-off. | Low | | Since wetlands have the natural ability to filter and purify water, some areas, particularly those which have low agricultural productivity can be used as natural treatment facilities. |
| Possible contamination of surface and ground water due to borrow pits and quarries and other excavation activities. | Low | | Contamination of surface and ground water due to borrow pits and quarries and other excavation activities may be minimized by carefully studying the substances profiles before any disturbance is started. |
| Increase in the bacteriological content of local surface water bodies due to domestic wastewater generated by construction personnel. This may eventually transmit diseases. | Low | | Sanitation facilities should be provided by the Contractor to ensure that local water bodies are not polluted. |
| Washing of construction vehicles and other mobile equipment such as cement mixers, chutes, and related equipment will pollute the surface waters. | Low | | Washing of construction vehicles and other mobile equipment along the waterways should be prohibited. |
| Improper storage and handling of chemicals such as lubricants, fuel, paint, and other solutions for routine vehicular operation may contaminate local surface and ground water. | Low | | Chemicals such as lubricants, fuel, paint, and other solutions for routine vehicular operation must be handled with care and properly stored. |
| **Biological** | | | |
| As a result of an increase in noise levels and vibration, natural wildlife activates such as mating, nesting, and migratory patterns, particularly of birds will be disrupted/disturbed. | Low | | Disruption/disturbance to natural wildlife activities such as mating, nesting, and migratory patterns is inevitable but reversible. |
| As a result of an increased turbidity of surface waters, the sediments will block light penetration into the rivers and creeks and inhibit both natural and algal photosynthesis and visibility of aquatic fauna required for location of food. | Low | | Increased turbidity of surface waters is a short term and reversible type of adverse impact. |

**TABLE 13.9-6 SUMMARY MATRIX OF IMPACTS AND MITIGATION AND ENHANCEMENT MEASURES (2/3)**

| Impacts | Type | | Mitigation/Enhancement Measures |
|---|---|---|---|
| | Negative | Positive | |
| **Socio-Economic Environment** | | | |
| **Loss of Structure** | | | |
| Number structures affected: 14 | Moderate | | Government must ensure that the affected structures are properly compensated based on 'Replacement Cost" method as provided by laws and regulations. |
| **Loss of Land** | | | |
| Sugarcane 997,850 $m^2$<br>Residential 75,940<br>**Total 1,073,790 $m^2$** | High | | The affected land shall be compensated with fair market value. |
| **Loss of Other Improvement** | | | |
| - Trees and other perennials<br>- Other structures | Moderate | | Trees and other perennials with commercial values shall be compensated based on schedule of prices available in municipal/city assessor's office. Other structures shall be compensated based on "Replacement Cost" method. |
| **Agricultural Tenants and Informal Settlers** | | | |
| Agricultural tenants residing within the proposed ROW will be displaced but no place to settle. | Moderate | | Government must relocate tenant-farmers at a resettlement site where they can access to their agricultural land. |
| Some of the farmers rely on sugarcane planting as their means of livelihood. Damage to or loss of these agricultural lands would surely hamper their capacity to support their family. | Moderate | | Government must negotiate with the employers of sugarcane plantation workers for their relocation. |
| **Limited Accessibility to Farmlands** | | | |
| During the construction phase, farmers may experience temporal difficulty in terms of accessibility to the land they are cultivating. | Low | | Contractors must provide a safe alternative route to farmers who need to cross the land they are cultivating (during and after construction phase). |
| Generation of temporary employment opportunities. | | Moderate | Contractor must give priority to available local labor. |

**TABLE 13.9-6 SUMMARY MATRIX OF IMPACTS AND MITIGATION AND ENHANCEMENT MEASURES (3/3)**

| Impacts | Type | | Mitigation/Enhancement Measures |
|---|---|---|---|
| | Negative | Positive | |
| **OPERATIONAL PHASE** | | | |
| **Physical Environment** | | | |
| Increase in vehicular gaseous emissions and noise level along the highway as a result of increase in vehicles due to increase in number of lanes. | Moderate | | To improve air quality and noise level along the highway, LTO shall regulate operation of vehicles that emit smokes and make noise beyond limit provided by law. LGUs shall enforce strict traffic regulations to regulate speeding vehicles. |
| **Socio-Economic Environment** | | | |
| Means of livelihood of the dislocated people may not be restored properly as planned in Resettlement Plan. | Low | | External and internal monitoring shall be regularly conducted to verify status of income restoration of dislocated people. |
| Improved accessibility to basic social services such as schools, hospitals, markets, churches, and communication facilities. | | Moderate | DPWH must regularly maintain the bypass sections. |
| | | | DPWH must improve/construct access roads to the road so that more people can have better access to basic social services. |
| Reduction of transport costs due to improved traffic flow. | | Moderate | DPWH must regularly maintain the road. |
| Better flow of industrial, commercial, and agricultural commodities. | | Moderate | DPWH must regularly maintain the road to ensure continuous, undisrupted flow of agricultural products. |
| Urbanization and commercial development of non-agricultural and non-prime agricultural areas. | | Moderate | Concerned LGUs must work hard towards achieving the development plans. |
| Increase in land values of areas traversed by and in the vicinity of the bypass sections. | | Moderate | Landowners will benefit from increase of land values in areas traversed by or near the bypass sections. |
| Increase in employment opportunities as a result of commercial development. | | Moderate | Government must ensure that qualified measures of the host community are given priority in the hiring of local labor force. |

## TABLE 13.9-7 ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX (BACOLOD, NS-3)

| Parameters to be Monitored | Stations to be Monitored | Frequency of Monitoring | Methods of Analysis/Execution | DENR Standard | Implementor |
|---|---|---|---|---|---|
| ***CONSTRUCTION PHASE*** | | | | | |
| **PHYSICAL** | | | | | |
| Water quality BOD, TSS, and oil and grease of surface water | All major bridges and RCBC sites | Quarterly during construction | Standard EMPASS-EQD water quality analysis | Class "C"<br>BOD - <10 mg/L<br>TSS - <30 mg/L increase<br>Oil & Grease - <3mg/L | DENR-Region 6 |
| Air quality TSP, $NO_2$, and $SO_2$ | Barangay Dos Hermanas, Talisay City and Barangay E. Lopez, Silay City | Quarterly during construction | Standard EMPASS-WQD air quality analysis | TSP: 430, $NO_2$: 470, $SO_2$: 375 | DENR-Region 6 |
| **BIOLOGICAL** | | | | | |
| Tree cutting | Entire alignment where there are trees to be cut | Daily | Monitoring team must ensure that tree cutting is limited within the required ROW only | N. A. | MMT |
| Waste management and disposal | All portions with excavation and fill activities | Weekly during construction | Site inspection | Based on EMP | DENR-Region 6 |
| **SOCIAL** | | | | | |
| Relocation of project affected families | All stretch of the project road and relocation site | Monthly | Monitoring team must ensure that affected families are properly compensated and their means of livelihood is maintained or restored | Based on RAP | MRIC<br>External Monitoring Agent |
| Compliance of Contractor to occupational health and safety rules and regulation | All construction areas | Weekly | Site inspection of work areas including sanitation facilities | Based on EMP | MMT |
| Road safety | Signalized intersections, merging lanes | Quarterly | Site inspection | Based on DPWH Standard Operating Procedures | DPWH |
| ***OPERATIONAL PHASE*** | | | | | |
| **BIOLOGICAL** | | | | | |
| Tree planting and its maintenance on both sides of the highway | Designated environmental belts/zones | Monthly | Site inspection | Based on EMP | DENR-Region 6<br>MMT |
| **SOCIAL** | | | | | |
| Livelihood restoration | Resettlement site | Monthly | Interview with relocated families | Based on RAP | External Monitoring Agent |
| Informal settling/squatting/encroaching | Acquired ROW | Weekly | Site inspection | Based on EMP | LGUs, MMT |
| Illegal conversion of prime agricultural land | Areas adjacent to the bypass | Weekly | Site inspection | Based on EMP | LGUs, MMT |
| Road condition | Pavement and bridge, including drainage system and embankments | Based on standard DPWH maintenance procedures | Standard DPWH road and bridges maintenance works | Based on DPWH Standard Operating Procedures | DPWH |

MMT : Multi-Partite Monitoring Team
MRIC : Municipal RAP Implementation Committee

## 13.10 SOCIAL IMPACT ASSESSMENT AND RESETTLEMENT ACTION PLAN

### 13.10.1 Alternatives Studied

Two (2) alternative alignments were examined to determine the most feasible route, that which has the least impact on land, structures, and residents and which is the most technically and economically viable. The detailed process of alternativse selection is discussed in **Section 13.4**. Alternative 1, which avoids built-up areas and major establishments, was finally selected.

### 13.10.2 Barangays Affected by the Project

The following barangays are identified to be affected:

| Bacolod City | Talisay City | Silay City |
|---|---|---|
| 1. Mansilingan | 1. Concepcion | 1. Guimbala-an |
| 2. Vista Alegre | 2. Matab-ang | 2. E. Lopes |
| 3. Granada | 3. Dos Hemanas | |
| 4. Estefania | | |
| 5. Mandalangan | | |

### 13.10.3 Community Consultation and Participation

Series of community consultation meetings have been held since the beginning of the study. The topics discussed in these meetings are presented below.

#### 1) Workshops

The JICA Study Team has conducted workshops, whenever major study outputs are made, to present the process of the master plan and feasibility study to all concerned agencies and residents. The location of the final alignment and the extent of land acquisition and social impacts are also presented to the public and their comments and suggestions are incorporated in the study.

**First Workshop**
Date : April 24, 2003
Venue/Location : Bacolod City
Topics : Outline of the Study, Projects proposed by LGUs

**Second Workshop**
Date : October 30, 2003
Venue/Location : Bacolod City
Topics : Proposed Road Network Plan

**Third Workshop**
Date : July 30, 2004
Venue/Location : Bacolod City
Topics : Selected Alignments, Social Impact Survey Results

**Fourth Workshop**
Date : August 30, 2003
Venue/Location : Bacolod City
Topics : Presentation of Draft Final Report

Details of the workshops are presented in **Section 12.10.3**.

### 2) Meeting with City / Municipal Officials

Prior to the Social Impact Survey, the Study Team visited the offices of the mayors and the planning and development offices of the affected city and municipalities, as discussed in **Section 12.10.3**.

### 3) Meetings with Barangay Captains

Meetings with the Barangay Captains of each of the barangays of the affected cities were held after coordination with their respective officials.

The dates of meetings with the Barangay Captains and the date of "Barangay Endorsement" in acceptance of the proposed project is summarized in **Table 13.10-1**.

**TABLE 12310-2 SUMMARY OF MEETINGS WITH BARANGAY CAPTAINS AND DATE OF ISSUANCE OF BARANGAY ENDORSEMENT**

| City | Date of Meeting | Venue / Location | Date of Issuance of Barangay Endorsement |
|---|---|---|---|
| Bacolod City | Feb. 26, 2004 | Barangay Offices | Mansilingan : March 2, 2004<br>Vista Alegre : March 6, 2004<br>Granada : March 3, 2004<br>Estefania : to be issued<br>Mandalangan : to be issued |
| Talisay City | Feb. 27, 2004 | Barangay Offices | Concepcion : to be issued<br>Matab-ang : to be issued<br>Dos Hemanas: to be issued |
| Silay City | Feb. 26, 2004 | Barangay Office | Guimbala-on : March 6, 2004<br>E. Lopez : March 6, 2004 |

### 4) Barangay Consultation Meeting

Consultation meetings with residents that could be possibly affected were held in each barangay as summarized below.

**TABLE 12.10-3 SUMMARY OF BARANGAY CONSULTATION MEETINGS**

| Barangay | Location/Venue | Date and Time of Meeting |
|---|---|---|
| Bacolod City | | |
| Mansilingan | Barangay Hall | March 2, 2004 3:00 p.m. |
| Vista Alegre | Barangay Hall | Mach 6, 2004 2:00 p.m. |
| Granada | Barangay Hall | March 1, 2004 10:00 a.m. |
| Estefania | Barangay Hall | March 1, 2004 10:00 a.m. |
| Mandalangan | Barangay Hall | March 1, 2004 2:00 p.m. |
| Talisay City | | |
| Concepcion | Barangay Hall | March 2, 2004 8:00 a.m. |
| Matab-ang | Barangay Hall | March 2, 204 4:00 p.m. |
| Dos Hemanas | Barangay Hall | Mach 2, 2004 10:00 a.m. |
| Silay City | | |
| Guimbala-on | Barangay Hall | March 3, 2004 10:00 a.m. |
| E. Lopez | Barangay Hall | March 3, 2004 3:00 p.m. |

### 13.10.4 Identified Impacts

The identified impacts and the corresponding compensation costs are summarized in **Table 13.10-3**

#### 1) Impact on Land

The required rights-of-way widths for the road are:

Sta. 0 + 000 ~ 6 + 900 : ROW = 40m (4 lanes); and
Sta. 6 + 900 ~ 34 +043 : ROW = 30m (2 lanes)

The affected areas by land use are summarized as follows:

| Land Use | Affected Area ($m^2$) | Share (%) |
|---|---|---|
| Sugar cane | 997,850 | 92.9 |
| Residential | 75,940 | 7.1 |
| **Total** | **1,073,790** | **100.0** |

More than 90% of the affected lands are sugarcane plantations. Some areas classified as residential are still utilized as sugarcane plantations but the value of which may be the same as residential since these areas have high potential for residential use due to the presence of access road and built-up areas adjacent to the road

## TABLE 13.10-3 SUMMARY OF IMPACTS AND COMPENSATION COST

North Section Sugar Road

| Description | No. of HHs | Unit | Rate/ Unit | Quantity | Amount (Php) | Remarks |
|---|---|---|---|---|---|---|
| **Compensation for Land and Other Assets** | | | | | | |
| **1. Land** | | | | | | |
| 1) Residential-1 | - | $m^2$ | 3,500 | 34,980 | 122,290,000 | Name of land owners to be identified by parcellary survey |
| 2) Residential-2 | - | $m^2$ | 3,000 | 8,000 | 24,000,000 | |
| 3) Residential-3 | - | $m^2$ | 2,000 | 33,000 | 66,000,000 | |
| 4) Agricultural | - | $m^2$ | 200 | 997,850 | 199,570,000 | |
| **Subtotal** | | | | **1,073,830** | **411,860,000** | |
| **2. Structures** | | | | | | |
| 1) Residential (Concrete) | 1 | $m^2$ | 8,000 | 48.64 | 389,120 | |
| 2) Residential (Shanty) | 9 | $m^2$ | 1,140 | 455.46 | 519,224 | |
| 3) Worker's Quarter (Shanty) | 3 | $m^2$ | 1,140 | 87.96 | 100,274 | |
| 4) Pig Pen (Concrete Mix) | 1 | $m^2$ | 6,000 | 18.40 | 110,400 | |
| **Subtotal** | **14** | | | **610.46** | **1,119,018** | |
| **3. Other Fixed Structures** | | | | | | |
| 1) Concrete Fence | - | m | 200 | 48.75 | 9,750 | |
| **4. Repair Cost** | - | | - | - | - | None |
| **5. Electric Post Relocation** | - | | - | - | - | None |
| **6. Perennials** | | | | | | |
| Various types | 9 | Nos. | various | 182 | 62,390 | |
| **Subtotal** | | | | | **413,051,158** | |
| **Other Compensations** | | | | | | |
| **1. Disturbance Allowance** | | | | | | |
| 1) Severely affected land owners | - | - | - | - | - | None |
| 2) Agricultural lessees | - | - | - | - | - | None |
| 3) Temporary land users | - | - | - | - | - | None |
| 4) Severely affected structural owners | 14 | - | 10,000 | 14 | 140,000 | |
| **2. Subsistence Allowance** | | | | | | |
| 1) Income loss for shop owners | - | | - | - | - | None |
| **2. Financial Assistance** | | | | | | |
| 1) Land users w/o title | 14 | | 15,000 | 14 | 210,000 | |
| **3. Rehabilitation Assistance** | | | | | | |
| 1) Severely affected land owners | - | - | - | - | - | None |
| 2) Agricultural lessees | - | - | - | - | - | None |
| 3) Severely affected structural owners. | - | - | - | - | - | None |
| **4. Transportation Allowance** | | | | | | |
| 1) Relocating PAPs | 14 | | 3,000 | 14 | 42,000 | |
| 2) Shanty dwellers go back to province. | - | | - | - | - | None |
| **5. Transitional allowance** | | | | | | |
| 1) Renters of affected structures | - | - | - | - | - | None |
| **Subtotal** | | | | | **392,000** | |
| **TOTAL** | | | | | **413,443,158** | |
| **RAP Implementation** | | | | | **5,362,900** | |
| **GRAND TOTAL** | | | | | **413,806,058** | |

### 2) Impact on Structures

A total of **14** structures, mostly residential houses for sugarcane plantation employees are identified along the proposed alignment, as described below.

| Structure Use | Number | Floor Area ($m^2$) |
|---|---|---|
| Residential | 10 | 504.1 |
| Workers quarters | 3 | 87.96 |
| Pig pen | 1 | 18.40 |
| **Total** | **14** | **610.46** |

### 3) Impact on Residents

Impacts on affected families are summarized as follows :

| Type of PAF | Number of PAF |
|---|---|
| Severely affected PAFs | 14 |
| *Renters* | - |
| *Agricultural land users* | *(14)* |
| Marginally affected PAFs | 4 |
| **Total** | **18** |
| Average household size | 5.12 |

Most of the severely affected structure owners are agricultural tenants and workers in sugarcane plantations who are allowed to occupy the land as plantation workers. They may be allowed by landowners to transfer their residence outside the proposed ROW and rebuild their houses there.

### 4) Impacts on Trees and Perennials

**182** fruit trees with commercial values are observed along the project road's alignment.

## 13.10.5 Valuation of Losses

The sources of unit prices used to determine values of each type of loss are summarized in **Table 12.10-5**.

## 13.10.6 Resettlement Site

There are no informal settlers and urban poor found along the project road, hence provision of a resettlement site is not necessary. It should be noted, however, that the cities and municipalities in the area have a number of resettlement sites, as discussed in **Section 12.10.6**, that can accommodate residents who could possibly be displaced, if necessary.

### 13.10.7 Income Restoration Program

An income restoration training will be given to PAPs who will be obliged to shift from their present occupation or income generating activity due to relocation. Details of this program are discussed in **Section 12.10.6**.

### 13.10.8 Institutional Arrangements

The DPWH, through an appropriate Project Management Office (PMO) shall be the lead agency responsible for the implementation of the Project and the compliance requirement of this RAP. The institutional arrangement is discussed in more detail below.

#### 1) Department of Public Works and Highways (DPWH)

A PMO shall be designated by the DPWH as the overall responsible unit of the DPWH in the implementation of the North Section of Sugar Road Project. It will manage and supervise the project including its resettlement activities and land acquisition requirements in coordination with concerned agencies. To ensure smooth implementation of the project the PMO shall facilitate the availability of funds, including those required for RAP implementation, in a timely manner.

**Regional and District Engineering Offices of the DPWH**

The District Engineering Office (DEO) of the DPWH based in Talisay City shall be the lead implementing arm for the Resettlement Action Plan (RAP) for project affected persons within the territorial boundary of the cities of Talisay, Silay, and Victorias and the Municipality of E.B. Magalona. On the other hand, the Bacolod City District Engineering Office of the Department based in Bacolod City shall be responsible for implementation of the RAP for project affected persons within the territorial boundary of Bacolod City.

The District Engineers (DEs), upon receipt of the appropriate Department Order (DO) for the RAP's implementation, shall appoint an adequate number of staff to perform the necessary activities under the plan. Should the number fall short of that required, the DE shall seek assistance from the DPWH Regional Office.

#### 2) Local Government Units (LGUs)

The resettlement requirements of the project shall be coordinated by the DPWH and its regional and district engineering offices with the local government units, namely: Bacolod City, Talisay City, Silay City, Victorias City, and the Municipality of E.B. Magalona. This is especially critical insofar as implementation of the provisions of Republic Act 7279 (the Urban Development and Housing Act of 1992) and its implementing rules and regulations are concerned to ensure the observance of proper and humane relocation and resettlement.

### 3) RAP Implementation Committees (RICs)

The DEO RAP Staff shall be assisted in the implementation by a City or Municipal Resettlement Implementation Committee (C/MRIC) which, consistent with the Resettlement Policy, shall be composed of the following:

**RAP Implementation Committee (RIC) – A**

Chairman and Convenor - District Engineer (DPWH), Talisay City
Co-Chairman - City Mayor of Talisay (or his designated representative)
- City Mayor of Silay (or his designated representative)
- City Mayor of Victorias (or his designated representative)
- Municipal Mayor of E.B. Magalona (or his designated representative)

Members:

Barangay Captain - Barangay Matab-ang, Talisay City
Barangay Captain - Barangay Dos Hermanas, Talisay City
Barangay Captain - Barangay Concepcion, Talisay City
Barangay Captain - Barangay Eustaquio. Lopez, Silay City
Barangay Captain - Barangay Guimbala-on, Silay City
Barangay Captain - Barangay Alacaygan, E.B. Magalona
Barangay Captain - Barangay Consing, E.B. Magalona
Barangay Captain - Barangay XX, Victorias City
Barangay Captain - Barangay VII, Victorias City
Barangay Captain - Barangay XVIII-A, Victorias City
Barangay Captain - Barangay XII, Victorias City
Barangay Captain - Barangay XIV, Victorias City
Barangay Captain - Barangay XXI, Victorias City

Representative of PAPs - Barangay Matab-ang, Talisay City
Representative of PAPs - Barangay Dos Hermanas, Talisay City
Representative of PAPs - Barangay Concepcion, Talisay City
Representative of PAPs - Barangay Eustaquio Lopez, Silay City
Representative of PAPs - Barangay Guimbala-on, Silay City
Representative of PAPs - Barangay Alacaygan, E.B. Magalona
Representative of PAPs - Barangay Consing, E.B. Magalona
Representative of PAPs - Barangay XX, Victorias City
Representative of PAPs - Barangay VII, Victorias City
Representative of PAPs - Barangay XVIII-A, Victorias City
Representative of PAPs - Barangay XII, Victorias City
Representative of PAPs - Barangay XIV, Victorias City
Representative of PAPs - Barangay XXI, Victorias City

Representative(s) from a Non-Government Organization (NGO) or People's Organization (PO) active in all the traversed barangays

**RAP Implementation Committee (RIC) – B**

Chairman and Convenor - District Engineer (DPWH), Bacolod City
Co-Chairman - City Mayor of Bacolod (or his designated representative)

Members:

Barangay Captain - Barangay Mansilingan, Bacolod City
Barangay Captain - Barangay Mandalagan, Bacolod City
Barangay Captain - Barangay Estefania, Bacolod City
Barangay Captain - Barangay Granada, Bacolod City
Barangay Captain - Barangay Vista Alegre, Bacolod City

Representative of PAPs - Barangay Mansilingan, Bacolod City
Representative of PAPs - Barangay Mandalagan, Bacolod City
Representative of PAPs - Barangay Estefania, Bacolod City
Representative of PAPs - Barangay Granada, Bacolod City
Representative of PAPs - Barangay Vista Alegre, Bacolod City

Representative(s) from a Non-Government Organization (NGO) or People's Organization (PO) active in all the traversed barangays

The NGO(s) or PO(s) in the RIC should be active in the communities traversed by the alignment and registered organization(s) with the Securities and Exchange Commission (SEC). In addition, it should be duly recognized by the LGU through a process of accreditation and recognition by the Sangguniang Panlungsod (SP) of the cities of Bacolod, Talisay, Silay, and Victorias and the Sangguniang Bayan (SB) of E.B. Magalona.

The functions of the RIC shall be as follows:

a) Assist the DPWH DEO in validating the list of PAPs, the assets of PAPs that will be affected by the project (using a prepared compensation form), and in implementing the RAP;
b) Assist the DPWH DEO in public information campaign, public participation and consultation;
c) Assist the DEO in the payment of compensation to PAPs;
d) Receive complaints and grievances from PAPs and other stakeholders and act on them accordingly;
e) Maintain record of all public meetings, complaints, and actions taken to address complaints and grievances;
f) In coordination with concerned government authorities, assist in the enforcement of laws/ordinances regarding encroachment into the project road corridor.

### 4) Internal Monitoring and Evaluation Requirement

The Environmental Social Service Office (ESSO) of the DPWH shall be responsible for the internal monitoring and evaluation requirement of the RAP. Prior to the RAP implementation, however, the ESSO shall provide the DEO

RAP Implementation Staff with the proper orientation in the implementation of the RAP and the DPWH Resettlement Policy.

**5) External Monitoring and Evaluation Requirement**

An external monitoring agency (EMA) or institution shall be engaged by the DPWH upon the donor agency's concurrence of this RAP. The EMA shall perform independent third party monitoring of DPWH's compliance to its own Resettlement Policy and the implementation of the provisions of this Resettlement Action Plan. Selection of this institution shall be in accordance with DPWH's selection process, which shall be concurred by the donor agency before its eventual engagement.

The scope of services of the EMA shall be governed by a Terms of Reference which shall spell out in detail the indicators to be measured among other important aspects of the external monitoring work. The main objectives of conducting an independent external monitoring and evaluation for each of the RAPs implemented are the following:

a) To determine whether or not the implementation of the RAP is carried out according to the Department's Resettlement Policy, and
b) To determine whether or not the main objectives of the RAP (i.e. to improve or at least restore the living standards, income-earning capacity and production levels of affected people) have been achieved.

**6) Control of Land Speculation and Illegal Encroachment**

To deter the proliferation of project affected persons (PAPs) that have not been censused or inventoried during the socio-economic survey as well as the inventory of affected assets, the RAP implementation team shall be guided during the validation work of the "**Cut-off Date**" as **March 10, 2004** (conclusion of the socio-economic survey for affected persons). Any PAPs identified during the validation work, except those which have not been interviewed but who had already been earlier identified, may not be entitled for compensation. The same restriction shall apply for additional assets built and/or improvements made on existing assets of identified PAPs after the cut-off date. Photographs earlier taken of these assets shall be used to validate any variances made after the cut-off date.

### 13.10.9 Grievance Redress Measures

Grievance redressal is one of the main functions of the RAP Implementation Committee (RIC). The Resettlement Policy provides that grievance related to any aspect of the project will be handles through negotiations aimed at achieving consensus following the procedures discussed in **Section 12.10-8**.

### 13.10.10 Monitoring and Evaluating

The procedures for monitoring and evaluation of RAP implementation during the project implementation stage are discussed in **Section 12.10-9**.

### 13.10.11 RAP Implementation

#### 1) Preparation of Final RAP

The social impacts identified in this study shall be verified and validated during the detailed design stage after the exact extent of construction limits and the corresponding ROW limits required have been established. The following RAP updating surveys (**Table 13.10-4**) shall be carried out to update the preliminary RAP prepared under this study after fixing the final ROW limits.

**TABLE 13.10-4 UPDATING SURVEYS TO BE UNDERTAKEN**

| Impact Item | Surveys to be Undertaken |
|---|---|
| Land | - **Parcellary survey** shall be carried out to identify the names of lot owners and the area to be acquired from each lot owner. |
| Structure | - **Tagging and picture taking** must be carried out to identify the PAPs eligible for compensation.<br>- **Cut-off Date** must be set and informed to residents prior to tagging. |
| Perennials | - **Validation survey** shall be carried out to identify the names of owners of perennials with commercial values. |
| Tenants/Renters and Informal Settlers | - **Socio-economic survey** shall be carried out to identify the presence of agricultural tenants, renters of structures, and informal settlers who need special consideration by providing relocation site, financial assistance, and other assistance. |

A final RAP shall be prepared based on the preliminary RAP and the result of RAP update surveys.

#### 2) RAP Approval

The final RAP will have to be presented to the DPWH for approval and for concurrence by the donor agency by the scheduled period in 2007. The salient points of the final RAP will have to be reiterated with concerned officials of the cities of Bacolod, Talisay, Silay, and Victorias and the Municipality of E.B. Magalona upon its approval prior to implementation. The RIC that will be organized for the purpose shall provide the necessary assistance to the DPWH DEOs during the implementation process. Any technical assistance, when required by the RIC, will be extended by the DPWH Regional Office upon request.

### 3) MOU with LGUs and the Establishment of the RIC

Within a reasonable period of time from the approval of this RAP, a Memorandum of Understanding (MOU) will be executed between the DPWH and the LGUs of Bacolod City, Talisay City, Silay City, and Victorias City and the Municipality of E.B. Magalona. The MOU will provide the mandate for the formation of the RIC and will likewise spell out the required cooperation and commitment of the LGUs in ensuring that the right-of-way is sustainably free from encroachments and illegal squatting even after project completion.

### 4) Orientation and Training of the RIC

The members of the RIC will be given orientation on the scope and coverage of their work under the final RAP. In addition, the same RIC members will be trained on the implementation requirements of the RAP, including the scope and coverage of the DPWH policy framework that will be embodied in that RAP.

### 5) Stake-out

During the validation period, the RIC shall conduct a stakeout of the project corridor to determine the extent of the area required by the road project. The results of the alignment survey used during the detailed engineering design, and the latest parcellary survey conducted in the area will be used as basis for this activity.

### 6) PAP Validation and Establishment of Detailed Compensation Rates

The RIC members will validate the census of PAPs and inventory of affected assets; and review and update where necessary, the compensation entitlements payable to these PAPs. This will be done at a pre-agreed period prior to the conclusion of the orientation training.

### 7) Conduct of Public Information Campaign

While the PAPs have already been informed about the project during the series of barangay consultations, perception survey, and socio-economic survey conducted during the preparation of the preliminary RAP, the RIC will again call for public meetings to explain further the details of the RAP upon its implementation. The RIC can, upon public information, improve materials prepared during the formulation of the RAP. The PAPs will be informed of the schedule of the RIC's validation work and will be requested to keep documents that would attest ownership of their affected assets as these may be requested by the RIC.

### 8) Finalization of Compensation and Other Entitlements of PAPs

The RIC shall finalize the entitlements and the total amount of compensation payable to each PAP following the updating of the unit prices that will be used, and after confirmation visit to each PAP to validate the inventory of affected

assets. This shall be consistent with the entitlement matrix of the RAP. The possibility of additional PAPs who have not bee identified during the preparation of the RAP due to potential minor re-alignment remains high and the validated list is expected to reflect these changes. Those that are within the ROW but who came in after the cut-off period established for the RAP are excluded.

An "Inventory of Affected Fixed Assets Form" will have to be accomplished and signed by each PAP or his duly authorized representative to indicate concurrence with the estimates of the affected assets, entitlements, and total compensation amounts. A copy of the acknowledged form will be given to each of the PAPs for their reference.

**9) Public Meetings**

Public meetings will be held during the disclosure of compensation to the PAPs in the barangays traversed by the road project. These meetings will be conducted in a public place following conclusion of the finalization of the compensation entitlements to inform them of the results of the validation of impacts and computation of compensation and other entitlements, other resettlement activities, and the schedule of payment to PAPs.

During this activity the PAPs are expected to register any disagreement on the validated results through the grievance redressal mechanism established in the policy framework that will be reiterated in the final RAP. The PAPs will be advised on the options that may be taken following the grievance redressal procedures of the same policy and the Policy Framework on Public Participation and Consultation of the DPWH. The result of the disclosure meetings shall be the basis for the preparation of payment vouchers and subsequent payments to the PAPs.

**10) Payment of Compensation and Other Entitlements**

The place, date, and time of the payment activity will be communicated to the City Mayors of Bacolod, Talisay, Silay, and Victorias and the Municipal Mayor of E.B. Magalona with a request that this be announced in advance to the barangay officials/RIC members. The announcement will likewise be posted by the barangay officials in a place accessible to the public to ensure that all PAPs within their administrative jurisdiction are informed. All payments of compensation will be also done in public.

The activity will be highlighted with the signing of a Pledge of Undertaking (POU) by the PAP, which states among others the demolition, removal or relocation of structures from the ROW within a specified period of time, the failure of which provides corresponding recourse of the DPWH to either carry out the stipulation at the PAPs expense or filing of criminal case in a court of law. In addition, the POU prohibits the rebuilding of such structures by the PAPs or their heirs within the DPWH's road right-of-way (RROW).

### 11) Reorganization and Relocation

The DPWH will not cause any demolition, reorganization or relocation along the ROW until all the PAPs are duly paid their compensation and other entitlements as disclosed during the public meetings.

### 12) Hand Over of Site for Construction

The site may be handed over for the civil works construction at least a month following the conclusion of the RAP implementation and after the issuance of a "No Objection Letter" from the donor agency.

### 13) Monitoring and Supervision of RAP Implementation

The implementation of the RAP will be supervised by the Project Implementing Office in coordination with the ESSO. The ESSO will also carryout internal monitoring of the RAP implementation and will provide periodic progress reports to the donor agency. Supervision and monitoring of the RAP implementation will be done through the ESSO counterpart staff at the regional level.

An independent agency will be contracted to carry out external monitoring and post-evaluation study.

## 13.11 PROJECT EVALUATION

### 13.11.1 Economic Evaluation

#### 1) Traffic Demand Forecast

Future traffic demand forecasted in a form of OD matrix (years 2010, 2016 and 2022) was assigned on the road network to estimate traffic volume on the Sugar Road in Bacolod. The estimated traffic volume on the Road for the case of "with" the project is summarized in Table 13.11-1.

**TABLE 13.11-1 TRAFFIC VOLUME ON SUGAR ROAD**

Unit: PCU / day

| | 2010 | 2016 | 2022 |
|---|---|---|---|
| Section 1 & 2 (Bacolod Murcie Road – Bacolod Guranada Road) | - | 18,000 | 30,800 |
| Section 3 (Bacolod Guranada Road – Bacolod Link Road) | - | 17,400 | 28,600 |
| Section 4 (Bacolod Link Road – Talisay Concepcion Road) | - | - | 18,300 |
| Section 5 (Talisay Concepcion Road – Salay Guimbalaon Road) | - | - | 17,300 |
| Section 6 (Salay Guimbalaon Road – Victorias Link Road) | - | - | 18,500 |
| Section 6 (Victorias Link Road – Bacolod Coastal Road ) | - | - | 15,900 |

*Notes: 1) In 2016, sugar road of sections 1 & 2 is on operation*
*2) In 2021, all sections of sugar road is on operation*

The estimated vehicle kilometers and vehicle hours in Metro Bacolod are shown in Tables 13.11-2 and 13.11-3, respectively. These tables are based on the benefit calculation.

**TABLE 13.11-2 TOTAL VEHICLE KILOMETERS IN METRO BACOLOD WITH AND WITHOUT SUGAR ROAD IMPROVEMENT PROJECT**

Unit: PCU Km / day

| | W/O Project | W/ Project | W/O – W/ |
|---|---|---|---|
| 2010 | — | — | — |
| 2016 | 5,198,530 | 5,138,200 | 60,330 |
| 2022 | 7,042,400 | 6,702,800 | 339,600 |

*Note: Same notes as in Table 13.11-1*

**TABLE 13.11-3 TOTAL VEHICLE HOURS IN METRO BACOLOD WITH AND WITHOUT SUGAR ROAD IMPROVEMENT PROJECT**

Unit: PCU Hour / day

| | W/O Project | W/ Project | W/O – W/ |
|---|---|---|---|
| 2010 | — | — | — |
| 2016 | 166,990 | 159,450 | 7,540 |
| 2022 | 266,230 | 224,280 | 41,950 |

*Note: Same notes as in Table 13.11-1*

## 2) Economic Evaluation

### Evaluation Period

The evaluation period is assumed to be 20 years from 2020 to 2039 taking into account the service life of Sugar Road.

### Implementation Schedule

The implementation schedule is assumed as follows:

North section – urban area
- 2011 Detailed design
- 2012 Land acquisition
- 2013 – ' 15 Construction
- 2016 Open to public

North section – urban area
- 2014 Detailed design
- 2015 – ' 16 Land acquisition
- 2017 – ' 20 Construction
- 2021 - Open to public

### Economic Indicators

The economic evaluation method is principally employed benefit cost analysis. The economic indicators used in this study are as follows:

- Net Present Value (NPV)
- Benefit Cost Ratio, (BCR), and
- Economic Internal Rate of Return (EIRR)

### Estimation of Benefit

#### Basic Vehicle Operating Cost

The basic vehicle operating cost (BVOC) is estimated annually by PMO-FS Office in DPWH. The latest BVOC was estimated in April 2002. In this study, this VBOC with some modification by inflation between April 2002 and April 2003 is utilized in this study (See Table 13.11-4)

**TABLE 13.11-4 BASIC VEHICLE OPERATING COST (EXCLUDING TAX)**

| Vehicle Type | Running (P/1000km) | Fixed [P/Min] | Time [P/Min] |
|---|---|---|---|
| Car /Taxi / Jeep | 4,441 | 0.245 | 0.991 |
| Jeepney | 2,991 | 1.181 | 1.468 |
| Bus | 7,453 | 1.794 | 5.561 |
| Truck | 9,622 | 2.107 | 0 |

*Source: PMO-FIS, DPWH*
*Note: BVOC prepared by PMO-FIS is modified with inflation rate.*
*All costs are expressed as 2003 prices*

The vehicle operating cost by surface type and travel speed was set up since it varies by surface type and travel speed as shown in Appendix Table 12.11-5.

**Estimation of Benefits**

The saving in vehicle operating costs and travel time cost were estimated and are shown in **Table 13.11-5**.

**TABLE 13.11- 5 ESTIMATION OF BENEFITS**

Unit: '000 Pesos/Year

| Year | Saving in VRC | Saving in VFC | Saving in VOC | Saving in TCC | Total Saving |
|---|---|---|---|---|---|
| 2010 | - | - | - | - | - |
| 2016 | 60,638 | 81,312 | 141,950 | 61,908 | 203,858 |
| 2022 | 340,853 | 451,476 | 792,329 | 343,673 | 1,136,003 |

*Note: Same notes as in Table 13.11-1*

## Economic Cost

The project cost, which was already calculated in the previous section, is expressed as the financial cost. It is therefore to convert from financial cost to economic cost. In this study the economic cost was estimated to deduct from financial cost to government taxes and shadow prices of unskilled labor is shown in **Table 13.11- 6**.

**TABLE 13.11- 6 ECONOMIC COST ESTIMATE**

('000 Pesos)

| Description | | | Economic Cost | Financial Cost |
|---|---|---|---|---|
| Phase 1 | 1 | Construction Cost | 385,300 | 457,800 |
| | 2 | Row Acquisition/ Resettlement | 134,200 | 149,100 |
| | 3 | Consultancy | 69,400 | 62,400 |
| | 3-1 | Detailed Design | 29,500 | 32,800 |
| | 3-2 | Construction Supervision | 32,900 | 36,600 |
| | | Total | 581,900 | 676,300 |
| Phase 2 | 1 | Construction Cost | 811,000 | 959,700 |
| | 2 | Row Acquisition/ Resettlement | 242,900 | 269,900 |
| | 3 | Consultancy | 103,700 | 115,200 |
| | 3-1 | Detailed Design | 34,600 | 38,400 |
| | 3-2 | Construction Supervision | 69,100 | 76,800 |
| | | Total | 1,157,600 | 1,344,800 |
| GRAND TOTAL | | | 1,739,500 | 2,021,100 |

## Maintenance Cost

The maintenance cost was estimated in 12.8.5 on the basis of EMK method which is employed in DPWH. In this study, therefore, the maintenance cost for the Iloilo - Sta. Barbara is used as the economic maintenance cost estimated in 12.8.5.

## TABLE 13.11-8 BENEFIT - COST STREAM OF SUGAR ROAD CONSTRUCTION PROJECT

**Undiccounted BenefiT Cost Stream**

000 Pesos

| Sq | Year | Construction Cost | O & M Cost | Cost Total | Benefit | Cost-Benefit |
|---|---|---|---|---|---|---|
| 1 | 2004 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2005 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2006 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 2007 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2008 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | 2009 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 2010 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 2011 | 29,500.0 | 0.0 | 29,500.0 | 0.0 | -29,500.0 |
| 9 | 2012 | 134,200.0 | 0.0 | 134,200.0 | 0.0 | -134,200.0 |
| 10 | 2013 | 139,399.7 | 0.0 | 139,399.7 | 0.0 | -139,399.7 |
| 11 | 2014 | 173,999.7 | 0.0 | 173,999.7 | 0.0 | -173,999.7 |
| 12 | 2015 | 260,849.7 | 0.0 | 260,849.7 | 0.0 | -260,849.7 |
| 13 | 2016 | 121,450.0 | 674.0 | 122,124.0 | 203,857.5 | 81,733.5 |
| 14 | 2017 | 220,025.0 | 582.0 | 220,607.0 | 218,611.5 | -1,995.5 |
| 15 | 2018 | 220,025.0 | 690.0 | 220,715.0 | 234,469.1 | 13,754.1 |
| 16 | 2019 | 220,025.0 | 699.0 | 220,724.0 | 251,514.9 | 30,790.9 |
| 17 | 2020 | 220,025.0 | 707.0 | 220,732.0 | 269,840.3 | 49,108.3 |
| 18 | 2021 | 0.0 | 3,537.0 | 3,537.0 | 1,006,652.2 | 1,003,115.2 |
| 19 | 2022 | 0.0 | 3,577.0 | 3,577.0 | 1,136,002.6 | 1,132,425.6 |
| 20 | 2023 | 0.0 | 3,617.0 | 3,617.0 | 1,172,695.5 | 1,169,078.5 |
| 21 | 2024 | 0.0 | 3,657.0 | 3,657.0 | 1,210,573.8 | 1,206,916.8 |
| 22 | 2025 | 0.0 | 3,697.0 | 3,697.0 | 1,249,675.9 | 1,245,978.9 |
| 23 | 2026 | 0.0 | 3,723.0 | 3,723.0 | 1,290,041.3 | 1,286,318.3 |
| 24 | 2027 | 0.0 | 3,723.0 | 3,723.0 | 1,331,710.7 | 1,327,987.7 |
| 25 | 2028 | 0.0 | 3,723.0 | 3,723.0 | 1,374,726.4 | 1,371,003.4 |
| 26 | 2029 | 0.0 | 3,723.0 | 3,723.0 | 1,419,131.8 | 1,415,408.8 |
| 27 | 2030 | 0.0 | 3,723.0 | 3,723.0 | 1,464,971.8 | 1,461,248.8 |
| 28 | 2031 | 0.0 | 3,723.0 | 3,723.0 | 1,512,292.9 | 1,508,569.9 |
| 29 | 2032 | 0.0 | 3,723.0 | 3,723.0 | 1,561,142.8 | 1,557,419.8 |
| 30 | 2033 | 0.0 | 3,723.0 | 3,723.0 | 1,611,571.0 | 1,607,848.0 |
| 31 | 2034 | 0.0 | 3,723.0 | 3,723.0 | 1,663,628.4 | 1,659,905.4 |
| 32 | 2035 | 0.0 | 3,723.0 | 3,723.0 | 1,717,367.7 | 1,713,644.7 |
| 33 | 2036 | 0.0 | 3,723.0 | 3,723.0 | 1,772,843.3 | 1,769,120.3 |
| 34 | 2037 | 0.0 | 3,723.0 | 3,723.0 | 1,830,111.3 | 1,826,388.3 |
| 35 | 2038 | 0.0 | 3,723.0 | 3,723.0 | 1,889,229.6 | 1,885,506.6 |
| 36 | 2039 | 0.0 | 3,723.0 | 3,723.0 | 1,950,258.0 | 1,946,535.0 |
| 37 | 2040 | 0.0 | 3,723.0 | 3,723.0 | 2,013,258.2 | 2,009,535.2 |

**Diccounted BenefiT Cost Stream**

000 Pesos

| Sq | Year | Discounted | Construction Cost | O & M Cost | Cost Total | Benefit | Cost-Benefit |
|---|---|---|---|---|---|---|---|
| 1 | 2004 | 1.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 2005 | 1.150 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | 2006 | 1.323 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | 2007 | 1.521 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 2008 | 1.749 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6 | 2009 | 2.011 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7 | 2010 | 2.313 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8 | 2011 | 2.660 | 11,090.1 | 0.0 | 11,090.1 | 0.0 | -11,090.1 |
| 9 | 2012 | 3.059 | 43,870.2 | 0.0 | 43,870.2 | 0.0 | -43,870.2 |
| 10 | 2013 | 3.518 | 39,626.1 | 0.0 | 39,626.1 | 0.0 | -39,626.1 |
| 11 | 2014 | 4.046 | 43,010.1 | 0.0 | 43,010.1 | 0.0 | -43,010.1 |
| 12 | 2015 | 4.652 | 56,067.9 | 0.0 | 56,067.9 | 0.0 | -56,067.9 |
| 13 | 2016 | 5.350 | 22,699.9 | 126.0 | 22,825.9 | 38,102.4 | 15,276.5 |
| 14 | 2017 | 6.153 | 35,760.2 | 94.6 | 35,854.8 | 35,530.5 | -324.3 |
| 15 | 2018 | 7.076 | 31,095.8 | 97.5 | 31,193.3 | 33,137.2 | 1,943.9 |
| 16 | 2019 | 8.137 | 27,039.9 | 85.9 | 27,125.8 | 30,909.8 | 3,784.0 |
| 17 | 2020 | 9.358 | 23,512.9 | 75.6 | 23,588.5 | 28,836.4 | 5,247.9 |
| 18 | 2021 | 10.761 | 0.0 | 328.7 | 328.7 | 93,544.0 | 93,215.3 |
| 19 | 2022 | 12.375 | 0.0 | 289.0 | 289.0 | 91,794.8 | 91,505.8 |
| 20 | 2023 | 14.232 | 0.0 | 254.1 | 254.1 | 82,399.8 | 82,145.7 |
| 21 | 2024 | 16.367 | 0.0 | 223.4 | 223.4 | 73,966.4 | 73,743.0 |
| 22 | 2025 | 18.822 | 0.0 | 196.4 | 196.4 | 66,396.1 | 66,199.7 |
| 23 | 2026 | 21.645 | 0.0 | 172.0 | 172.0 | 59,600.7 | 59,428.7 |
| 24 | 2027 | 24.891 | 0.0 | 149.6 | 149.6 | 53,500.7 | 53,351.1 |
| 25 | 2028 | 28.625 | 0.0 | 130.1 | 130.1 | 48,025.1 | 47,895.0 |
| 26 | 2029 | 32.919 | 0.0 | 113.1 | 113.1 | 43,109.9 | 42,996.8 |
| 27 | 2030 | 37.857 | 0.0 | 98.3 | 98.3 | 38,697.7 | 38,599.4 |
| 28 | 2031 | 43.535 | 0.0 | 85.5 | 85.5 | 34,737.2 | 34,651.7 |
| 29 | 2032 | 50.066 | 0.0 | 74.4 | 74.4 | 31,181.9 | 31,107.5 |
| 30 | 2033 | 57.575 | 0.0 | 64.7 | 64.7 | 27,990.6 | 27,925.9 |
| 31 | 2034 | 66.212 | 0.0 | 56.2 | 56.2 | 25,125.9 | 25,069.7 |
| 32 | 2035 | 76.144 | 0.0 | 48.9 | 48.9 | 22,554.3 | 22,505.4 |
| 33 | 2036 | 87.565 | 0.0 | 42.5 | 42.5 | 20,246.0 | 20,203.5 |
| 34 | 2037 | 100.700 | 0.0 | 37.0 | 37.0 | 18,173.9 | 18,136.9 |
| 35 | 2038 | 115.805 | 0.0 | 32.1 | 32.1 | 16,313.9 | 16,281.8 |
| 36 | 2039 | 133.176 | 0.0 | 28.0 | 28.0 | 14,644.3 | 14,616.3 |
| 37 | 2040 | 153.152 | 0.0 | 24.3 | 24.3 | 13,145.5 | 13,121.2 |
| | | Total | 333,773.1 | 2,927.9 | 336,701.0 | 1,041,665.0 | 704,964.0 |

| | |
|---|---|
| **Net Present Value** | **704,964** |
| **B/C Ratio** | **3.094** |
| **EIRR** | **30.7** |

## Benefit Cost Analysis

Based on the above mentioned benefits and cost estimates, the economic analysis of the Project was made. **Table 13.11- 7** shows the benefit – cost analysis of Sugar Road Construction Project during project life period of 20 years and **Table 13.11- 8** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of ₱ 720 million and BCR of 3.34 over 20 years life of the Bridge using a discount date of 15% which is designated by the NEDA. The Economic Internal Rate of Return (EIRR) was compiled at 33.0%.

**TABLE 13.11- 7 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS**

| | |
|---|---|
| Net Present Value | P 705 million |
| BCR | 3.09 |
| EIRR | 30.7 % |

*Notes: 1) Project life is assumed to be 20 years*
*2) Discount rate is 15%*

### (2) Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. **Table 13.11-9** shows the results of the sensitivity analysis.

**TABLE 13.11- 9 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF SUGAR ROAD (BACOLOD CONSTRUCTION PROJECT**

Unit: %

| | | Indicator | Benefits | | |
|---|---|---|---|---|---|
| | | | 20% down | Base Case | 20% up |
| Costs | 20% down | NPV (P million) | 564 | 772 | 981 |
| | | B/C Ratio | 3.09 | 3.87 | 4.64 |
| | | EIRR (%) | 30.7 | 34.7 | 38.2 |
| | Base Case | NPV (P million) | 497 | 705 | 913 |
| | | B/C Ratio | 2.48 | 3.09 | 3.79 |
| | | EIRR (%) | 27.0 | 30.7 | 33.9 |
| | 20% up | NPV (P million) | 429 | 637 | 846 |
| | | B/C Ratio | 2.06 | 2.58 | 3.09 |
| | | EIRR (%) | 24.3 | 27.7 | 30.7 |

*Note: Project life of the project is assumed to be 20 years*

*Note: Project life of the project is assumed to be 20 years*

### (3) Summary of Economic Analysis

The implementation of the Sugar Road construction project can be justified from view of national economic point since the economic indicators of all cases more than the over cut-off level which can be considered as 15% of EIRR in the Philippines.

### 13.11.2 Technical Evaluation

The results of the technical analysis of the Sugar Road show that there are not much problems for implementation of the construction project. It is concluded that the road construction project is technically feasible.

### 13.11.3 Other Impacts

1) On Traffic

Table 13.11-10 shows the transport efficiency in the Metro Bacolod in cases of with and without the Sugar Road.

**TABLE 13.11-10(1) TRAFFIC VOLUME WITH AND WITHOUT SUGAR ROAD CONSTRUCTION PROJECT**

Unit: PCU/day

| | 2016 | | | 2022 | | |
|---|---|---|---|---|---|---|
| | W/O Project | W/ Project | | W/O Project | W/ Project | |
| | Existing Coastal Road | Sugar Road | Existing Coastal Road | Existing Parallel Road | Sugar Road | Existing Parallel Road |
| Section 1 & 2 (Bacolod Murcie Road – Bacolod Guranada Road) | 19,800 | 27,600 | 12,700 | 21,600 | 48,300 | 15,200 |
| Section 3 (Bacolod Guranada Road – Bacolod Link Road) | 27,400 | 31,400 | 10,000 | 35,200 | 43,500 | 14,600 |
| Section 4 (Bacolod Link Road – Talisay Concepcion Road) | 63,000 | 26,500 | 40,800 | 80,400 | 40,000 | 53,400 |
| Section 5 (Talisay Concepcion Road – Salay Guimbalaon Road) | 50,200 | 20,900 | 27,100 | 64,700 | 33,900 | 33,300 |
| Section 6 (Salay Guimbalaon Road – Victorias Link Road) | 33,000 | 18,800 | 14,200 | 41,600 | 26,900 | 18.500 |
| Section 6 (Victorias Link Road – Bacolod Coastal Road ) | 26,800 | 16,000 | 8,300 | 33,500 | 18,500 | 10,600 |

*Note: For a comparison purpose, an assumption was made that all sections of the Sugar Road are in operation in 2016*

**TABLE 13.11-10(2) TRAVEL SPEED WITH AND WITHOUT SUGAR ROAD CONSTRUCTION PROJECT**

Unit: Km/Hr

| | 2010 | | | 2022 | | |
|---|---|---|---|---|---|---|
| | W/O Project | W/ Project | | W/ Project | W/ Project | |
| | Existing Coastal Road | Sugar Road | Existing Coastal Road | Existing Coastal Road | Sugar Road | Existing Coastal Road |
| Section 1 & 2 (Bacolod Murcie Road – Bacolod Guranada Road) | 27.5 | 56.9 | 35.4 | 25.7 | 45.3 | 32.8 |
| Section 3 (Bacolod Guranada Road – Bacolod Link Road) | 12.6 | 55.0 | 26.1 | 10.5 | 48.2 | 21.0 |
| Section 4 (Bacolod Link Road – Talisay Concepcion Road) | 28.2 | 57.3 | 39.5 | 23.2 | 50.3 | 32.4 |
| Section 5 (Talisay Concepcion Road – Salay Guimbalaon Road) | 34.1 | 67.8 | 46.5 | 27.6 | 56.5 | 43.5 |
| Section 6 (Salay Guimbalaon Road – Victorias Link Road) | 43.7 | 70.5 | 50.0 | 39.0 | 62.7 | 49.6 |
| Section 6 (Victorias Link Road – Bacolod Coastal Road ) | 46.7 | 75.2 | 50.0 | 43.4 | 73.5 | 50.0 |

*Note: Same note as Table 13.11-10 (1)*

**TABLE 13.11-10 (3) TRANSPORT EFFICIENCY IN METRO ILOILO WITH AND WITHOUT SUGAR ROAD CONSTRUCTION PROJECT**

| | | 2016 | 2022 |
|---|---|---|---|
| PCU Kilometers ('000) | W/O Project | 5,198 (1.00) | 7,043 (1.00) |
| | W/ Project | 4,876 (0.938) | 6,363 (0.903) |
| PCU Hours ('000) | W/O Project | 167,0 (1.00) | 266.2 (1.00) |
| | W/ Project | 126.1 (0.755) | 182.5 (0.686) |
| Average Travel Speed (km / h) | W/O Project | 31.1 (1.00) | 26.5 (1.00) |
| | W/ Project | 38.7 (1.24) | 34.9 (1.32) |
| Vehicle Operating Cost (P '000 /day) | W/O Project | 22,585 (1.00) | 30,596 (1.00) |
| | W/ Project | 21,182 (0.938) | 27,645 (0.904) |

**2) On Urban Amenity**

Traffic volume on the existing Bacolod Coastal Road will be greatly reduced because airport traffic and traffic along this Sugar Road are mostly diverted to the Sugar Road. Therefore, noise level, air quality and vibration in the area of the existing Bacolod Coastal Road will be greatly improved. Thus, urban amenity will be improved.

**3) On Urbanization**

Urbanization will be guided and supported by the Sugar Road. According to the urbanization index calculated in Section 11.2 of the Master Plan, urbanization index (RUa) along Sugar Road corridor will be able to calculate to be almost 50 %. With the existing road network with the Sugar Road, sound urbanization will be achieved.

**4) On Regional Economy**

With the improved and reliable transport facility, economic activities within the influence area will be stimulated. The project will contribute to economic growth of not only Metro Iloilo but also region VI.

### 13.11.4 Overall Evaluation

As motioned above, the implementation of the Sugar Road construction project can be justified from view of economic, technical, and social impact points.

# CHAPTER 14
# RECOMMENDATIONS

## 14.1 IMPLEMENTATION SCHEDULE OF PROJECTS SELECTED FOR F/S

Implementation schedule of projects selected for F/S was planned within the financial framework as follows (see Figure 14.1-1):

| Project | Detailed Design | ROW Acquisition | Construction |
|---|---|---|---|
| Airport Access Rd. | 2007 | 2008-2009 | 2010-2011 |
| Sugar Road (Urban) | 2011 | 2012 | 2013-2015 |
| Sugar Road (Rural) | 2014 | 2015-2016 | 2017-2020 |

**FIGURE 14.1-1 IMPLEMENTATION SCHEDULE OF PROJECT SELECTED FOR F/S**

| Project | Activities | Cost (Million P) | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Airport Access Road | Fund Preparation | - | ▪▪▪▪ | | | | | | | | | | | | | | | |
| | Consultant Selection | - | | ▪▪▪▪ | | | | | | | | | | | | | | |
| | Detailed Design | 34.3 | | | 34.3 | | | | | | | | | | | | | |
| | ROW / Resettlement | 200.7 | | | | 100.3 | 100.4 | | | | | | | | | | | |
| | Contractor Selector | - | | | | | ▪▪▪▪ | | | | | | | | | | | |
| | Construction | 378.0 | | | | | | 189.0 | 189.0 | | | | | | | | | |
| | Const. Supervision | 30.2 | | | | | | 15.1 | 15.1 | | | | | | | | | |
| | **Total** | **643.2** | **-** | **-** | **34.3** | **100.3** | **100.4** | **204.1** | **204.1** | | | | | | | | | |
| Sugar Road (Urban) | Fund Preparation | - | | | | | ▪▪▪▪ | | | | | | | | | | | |
| | Consultant Selection | - | | | | | | ▪▪▪▪ | | | | | | | | | | |
| | Detailed Design | 32.8 | | | | | | | 32.8 | | | | | | | | | |
| | ROW / Resettlement | 149.1 | | | | | | | | 149.1 | | | | | | | | |
| | Contractor Selector | - | | | | | | | | | | | | | | | | |
| | Construction | 457.9 | | | | | | | | | 152.6 | 152.6 | 152.7 | | | | | |
| | Const. Supervision | 36.6 | | | | | | | | | 12.2 | 12.2 | 12.2 | | | | | |
| | **Total** | **676.4** | **-** | **-** | **-** | **-** | **-** | **-** | **32.8** | **149.1** | **164.8** | **164.8** | **164.9** | | | | | |
| Sugar Road (Rural) | Fund Preparation | - | | | | | | | | ▪▪▪▪ | | | | | | | | |
| | Consultant Selection | - | | | | | | | | | ▪▪▪▪ | | | | | | | |
| | Detailed Design | 38.4 | | | | | | | | | | 38.4 | | | | | | |
| | ROW / Resettlement | 269.9 | | | | | | | | | | | 134.9 | 135.0 | | | | |
| | Contractor Selector | - | | | | | | | | | | | | ▪▪▪▪ | | | | |
| | Construction | 959.7 | | | | | | | | | | | | | 239.9 | 239.9 | 239.9 | 240 |
| | Const. Supervision | 76.8 | | | | | | | | | | | | | 19.2 | 19.2 | 19.2 | 19.2 |
| | **Total** | **1,344.8** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **38.4** | **134.9** | **135.0** | **259.1** | **259.1** | **259.1** | **259.2** |
| **Total / Annual Investment** | | **2,664.4** | **-** | **-** | **34.3** | **100.3** | **100.4** | **204.1** | **236.9** | **149.1** | **164.8** | **164.8** | **164.9** | **135.0** | **259.1** | **259.1** | **259.1** | **259.2** |

## 14.2 RECOMMENDATIONS

**DPWH**

- The proposed Road Network Plan should be authorized by agencies concerned as well as LGUs concerned.
- Priority projects should be included in the DPWH Medium-Term Public Investment Program.
- Funding of Airport Access Road needs to be sourced from international agency or bi-lateral aid. Negotiation with one of the agencies or countries should start immediately and concluded within 2005.
- Silay-Guimbalaon Road (up to New Airport) should be upgraded to a national road and be improved prior to the opening of New Airport.
- ECC of priority projects should be secured as early as possible.
- DPWH should determine an implementing office of Regional Growth Center Projects as soon as possible.
- Memorandum of Agreement between DPWH and concerned LGUs should be exchanged concerning the securing of the proposed road ROW.
- For smooth implementation of priority projects, DPWH should start coordination with LGUs concerned with regard to ROW acquisition and relocation of project-affected persons.
- Road re-classification should be discussed with LGUs. Some roads should be reclassified from Provincial Road to National Road or vis-à-vis.
- DPWH should review and update proposed Road Network Plan periodically or at least every 6 years. This Plan was prepared under the present tight financial situation. When the financial situation improves, some of projects could be implemented ahead of the proposed schedule.

**Concerned LGUs**

- The proposed road network should be reflected in the land use plan as soon as possible. If necessary, land use along the proposed roads should be amended.
- Development within the proposed road ROW should be strictly controlled. City / municipal ordinance to control such development should be enacted as soon as possible.
- Maintenance of local roads should be intensified. Regular amount should be allocated yearly to road maintenance.
- Bacolod City Government should implement the proposed traffic management plan in the city proper area and its adjoining areas.
- Resettlement site for the project-affected persons should be secured as early as possible.

## 14.3 RECOMMENDATION ON PROJECT PACKAGING

Various projects were proposed in each Regional Growth Center. It is expected that most projects will be implemented with foreign financial assistance, and therefore, projects of the three Regional Growth Centers should be packaged under the name of "Regional Growth Center Road Network Development Project".

The following urgent projects of the three Metro Areas are recommended to be packaged for immediate foreign financing.

**REGIONAL GROWTH CENTER ROAD NETWORK DEVELOPMENT PROJECT**

**URGENT PROJECT PACKAGE FOR IMMEDIATE FOREIGN FINANCE**

| Metro Iloilo | Metro Bacolod | Metro Cagayan de Oro |
|---|---|---|
| - C-1 | - New Airport Access Road | - Western Coastal Road |
| - Iloilo-Sta.Barbara Road | - Bacolod Circumferential Road | - 7th Bridge |

**PACKAGED PROJECT COST AND COST COMPONENT**

Unit: Million Pesos

| | | Foreign | Local | ROW / Tax | Total |
|---|---|---|---|---|---|
| Metro Iloilo | C-1 | 419.4 | 236.8 | 366.3 | 1,022.5 |
| | Iloilo-Sta.Barbara | 283.0 | 134.4 | 150.8 | 568.2 |
| Metro Bacolod | New Airport Access | 229.9 | 150.5 | 262.8 | 643.2 |
| | Bacolod Circum. | 339.9 | 188.6 | 159.1 | 687.6 |
| Metro CDO | Western Coastal | 360.3 | 219.1 | 183.9 | 763.3 |
| | 7th Bridge | 94.2 | 90.6 | 55.6 | 240.4 |
| | **Total** | **1,726.7** (44%) | **1,020.0** (26%) | **1,178.5** (30%) | **3,925.2** (100%) |

**RECOMMENDED PACKAGE OF IMMEDIATE FOREIGN FINANCE**

| Area | Project | Project Cost (Million Pesos) | Implementation 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Metro Iloilo | C-1 | 1,022.5 | - - - - - | //////// | 58.1 | 125.1 | 125.1 | 238.0 | 238.0 | 238.2 | |
| | Iloilo-Sta. Barbara | 568.2 | - - - - - | //////// | 17.7 | 36.6 | 36.6 | 238.6 | 238.7 | | |
| Metro Bacolod | New Airport Access | 643.2 | - - - - - | //////// | 34.3 | 100.3 | 100.4 | 204.1 | 204.1 | | |
| | Bacolod Circumferential | 687.6 | - - - - - | //////// | 22.1 | 34.9 | 34.9 | 148.9 | 148.9 | 148.9 | 149.0 |
| Metro CDO | Western Coastal Road | 763.3 | - - - - - | //////// | 24.1 | 43.6 | 43.7 | 163.0 | 163.0 | 163.0 | 162.9 |
| | 7th Bridge | 240.4 | - - - - - | //////// | 7.7 | 23.7 | 104.5 | 104.5 | | | |
| Total/Annual Investment (Million Pesos) | | 3,925.2 | - | - | 164.0 | 364.2 | 445.2 | 1097.1 | 992.7 | 550.1 | 311.9 |

*Legend:* - - - - - Fund Preparation; //////// Selection of Consultant; Detailed Design; ROW / Resettlement and Contractor Selection; Construction and Construction Supervision