CHAPTER 12
FEASIBILITY STUDY OF CIRCUMFERENTIAL ROAD NO. 1 (C-1)

12.1 Objectives of the Project

Circumferential Road No. 1 (C-1) is non-existing at present and will become the most fundamental component of the future road network in the Metro Iloilo Area when completed. The objectives of the project are as follows:

Objectives of the Project

- To reduce traffic congestion in the City Proper area by removing unnecessary traffic to pass through the City Proper area;
- To guide and support planned urban development, thus further concentration of socio-economic activities in the City Proper area be avoided;
- To enhance international and domestic investment in the Study Area by providing easy access to Pavia Industrial Area;
- To provide easy access to the Iloilo International Port and new Iloilo Airport.

12.2 Physical Features of the Project Site

The terrain of the project site is flat with the ground elevation ranging from 1m to 14m. Two large rivers, i.e. Iloilo River and Jaro River, cross the project site.

The geological condition is not so favorable for road construction. Soft layer with N-value of 0 to 4 continues to the depth of 10 to 15m from the ground.

Predominant land use is rice fields. Fish ponds have been developed at the adjacent area to Iloilo River. Two large scale subdivisions are being developed along the C-1 corridor. Residential areas exist only along the intersecting roads.

12.3 Engineering Surveys Conducted

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 Coverage = 2km width along the route
Orthophoto mapping	:	Scale = 1/5,000

2) Road Alignment Survey

- Control points survey
- Center line surey (50m interval)
- Profile survey (50m interval)

- Cross-section survey (50m interval, width=60m)
- River profile / cross section survey (large rives only)

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

- Bridge site geo-technical survey (depth = 30~50m)
- Soft ground investigation (depth = 20m)
- Soils / material sources survey (3 locations)

12.4 Selection of Route Alignment

12.4.1 Control Points for Selecting Route Alignment

Control points for selecting route alignment are as follows (see Figure 12.4-1):

- An alignment is selected within 5 to 8 km radius from the City Proper.
- The beginning point shall be the location selected by the City Government where a vacant lot is reserved for C-1.
- The end point shall be at the intersection between Iloilo Coastal Road and Balabago Street where R.O.W. is reserved.
- It passes along the right (or south) bank of the proposed Jaro Floodway.
- Other control points are as follows:
  - Garbage dumping area
  - Memorial parks
  - Schools
  - Minimize dislocation of houses/structures

12.4.2 Alternative Alignments

Four alternative alignments were selected for evaluation as shown in Figure 12.4-1.

Alternative – 1 : This is the alignment selected by the City Government. In accordance with this alignment, the City is guiding subdivision developers to reserve road right-of-way for C-1.

Alternative – 2 : Alternative-1 passes through some residential areas, a memorial park and already developed subdivision, this alternative is shifted about 500 to 800m towards west.

Alternative – 3 : This alignment is planned to avoid all subdivisions (SD-1 is under development, and SD-2 is completed with several houses already built).

Alternative – 4 : This alignment follows more or less the same alignment of Alternative-3 except the section near Iloilo-Sta. Barbara Road where the alignment passes through a vacant lot.

12.4.3 Evaluation of Alternative Alignments and Selection of the Best Alignment

Alternative alignments were evaluated as shown in Table 12.4-1.

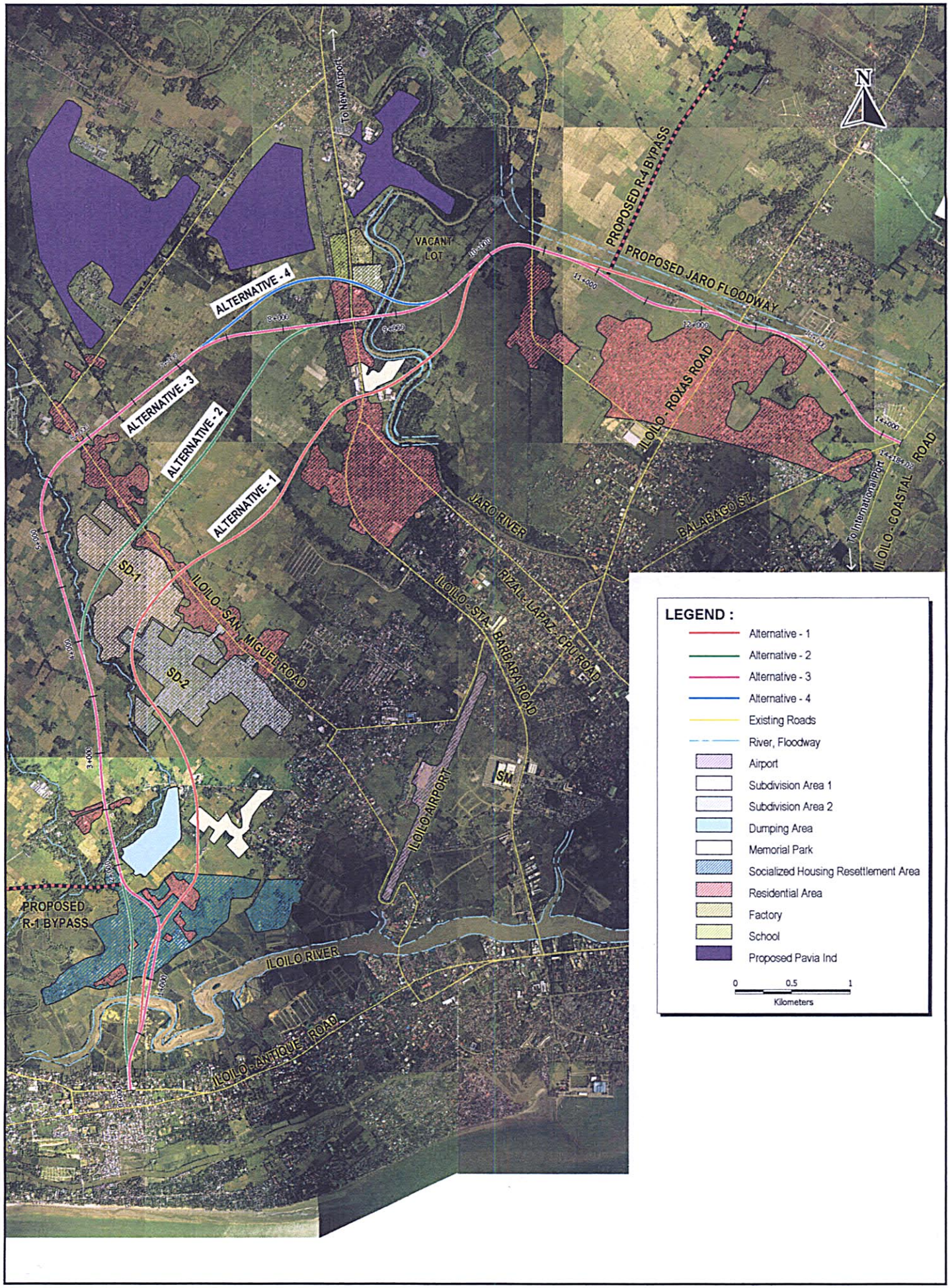


FIGURE 12.4-1 ALTERNATIVE ALIGNMENTS OF ILOILO CIRCUMFERENTIAL ROAD NO. 1 (C-1)

TABLE 12.4-1 EVALUATION OF ALTERNATIVE ALIGNMENTS

Evaluation Item			Alternative-1 Value	Alternative-1 Score	Alternative-2 Value	Alternative-2 Score	Alternative-3 Value	Alternative-3 Score	Alternative-4 Value	Alternative-4 Score
Scope of Civil Work	Total Length	(km)	13.15	-	13.43	-	14.18	-	14.58	-
	Road Length	(km)	12.83	-	13.09	-	13.84	-	14.24	-
	Bridge Length	(km)	0.32	-	0.34	-	0.34	-	0.34	-
Construction Cost (Million Pesos)	Road		442.6	-	451.6	-	477.5	-	491.3	-
	Bridge		144.0	-	153.0	-	153.0	-	153.0	-
	Total	(Weight)	586.6		604.6		630.5		644.3	
(25 points)		25	(0.0)	25	(+18.0)	21	(+43.9)	16	(+57.7)	13
ROW and Compensation Cost (Million Pesos)	ROW Cost		313.0	-	212.5	-	156.9	-	174.5	-
	Compensation Cost		22.5	-	12.6	-	12.6	-	12.0	-
	Total	(Weight)	335.5	0	225.1	14	169.5	25	186.5	22
(25 points)		25	(+166.0)	0	(+55.6)		(0.00)		(+17.0)	
Social Impact	No. of Houses affected	(Weight) 15	149 (1.86)	4	83 (1.04)	13	82 (1.03)	14	80 (1.00)	15
	No. of Warehouses, Cemeteries, Schools affected	(Weight) 7	3 (Cemetery, Warehouse, Jail)	0	1 (Warehouse)	7	1 (Warehouse)	7	1 (School)	3
	Length(m) of Subdivision Traversed	(Weight) 8	1,200	2	700	4	-	8	-	8
(30 points)										
Achievement of Project Objectives	Reduce traffic congestion in City Proper Area		(Same impact for All Alternatives)							
	Guide / Support Planned Urbanization 1/	(Weight) 10	10.6 (-3.3)	3	12.1 (-1.8)	6	13.5 (-0.4)	9	13.9 (0.0)	10
	Enhance Domestic / International Investment 2/	(Weight) 10	Furthest	5	Far	8	Near	9	Nearest	10
	Provide easy access to Port and New Airport		(Same impact for All Alternatives)							
(20 points)										
Evaluation	Total Score	(100)	—	39	—	73	—	88	—	81
	Ranking		4		3		1		2	

Note: *1/ Evaluated by road length (km) along which urbanization is possible.*
2/ Evaluated by proximity to Pavia Industrial Area.

12.5 TRAFFIC FORECAST

Estimated traffic volume by section is shown in Table 12.5-1. Number of lanes required is shown in Figure 12.5-1.

In the Master Plan, it is planned that whole sections will be completed as a 2-lane road by the end of 2012, then it will be widened to a 4-lane divided road by the end of 2022.

In year 2016, Section-4 which is between Iloilo-Sta.Barbara Road attracts the highest traffic of about 31,500 pcu/day, followed by Section-3 which attracts about 23,300 pcu/day.

In year 2022, Section-4 attracts the highest traffic of about 55,100 pcu/day, followed by Section-5 of about 47,900 pcu/day. Section-1 attracts the lowest traffic of about 26,700 pcu/day.

Traffic capacity of a 2-lane road will be exceeded in each section as shown below:

Section	Year when a 2-lane road traffic is exceeded by attracted traffic
1	After 2022
2	2020
3	2018
4	2016
5	2019
6	2022

Traffic growth requires that this road be widened to a 4-lane divided road by the end of year 2022, as planned by the Master Plan.

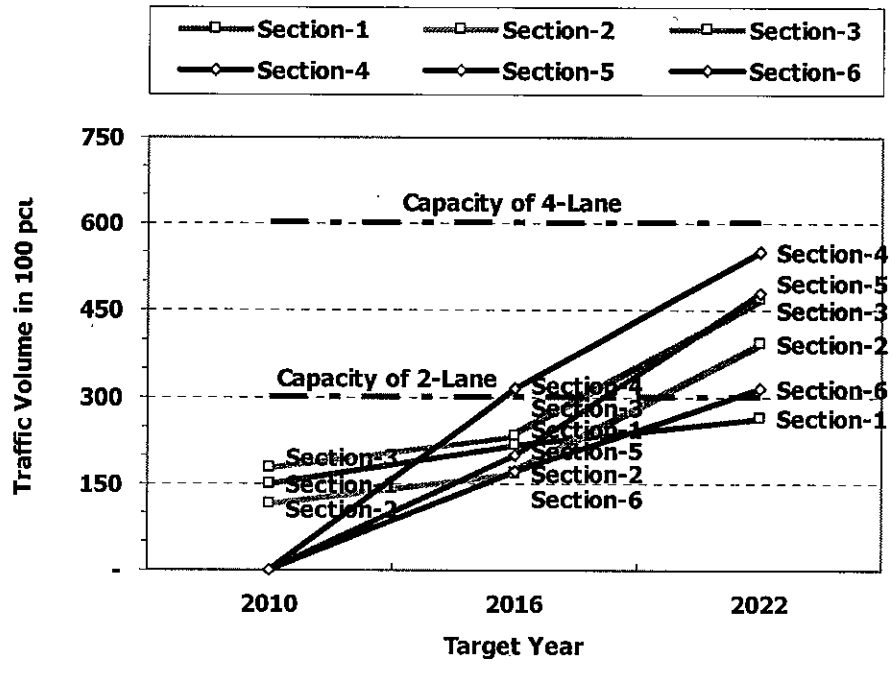


FIGURE 12.5-1 NUMBER OF LANES REQUIRED

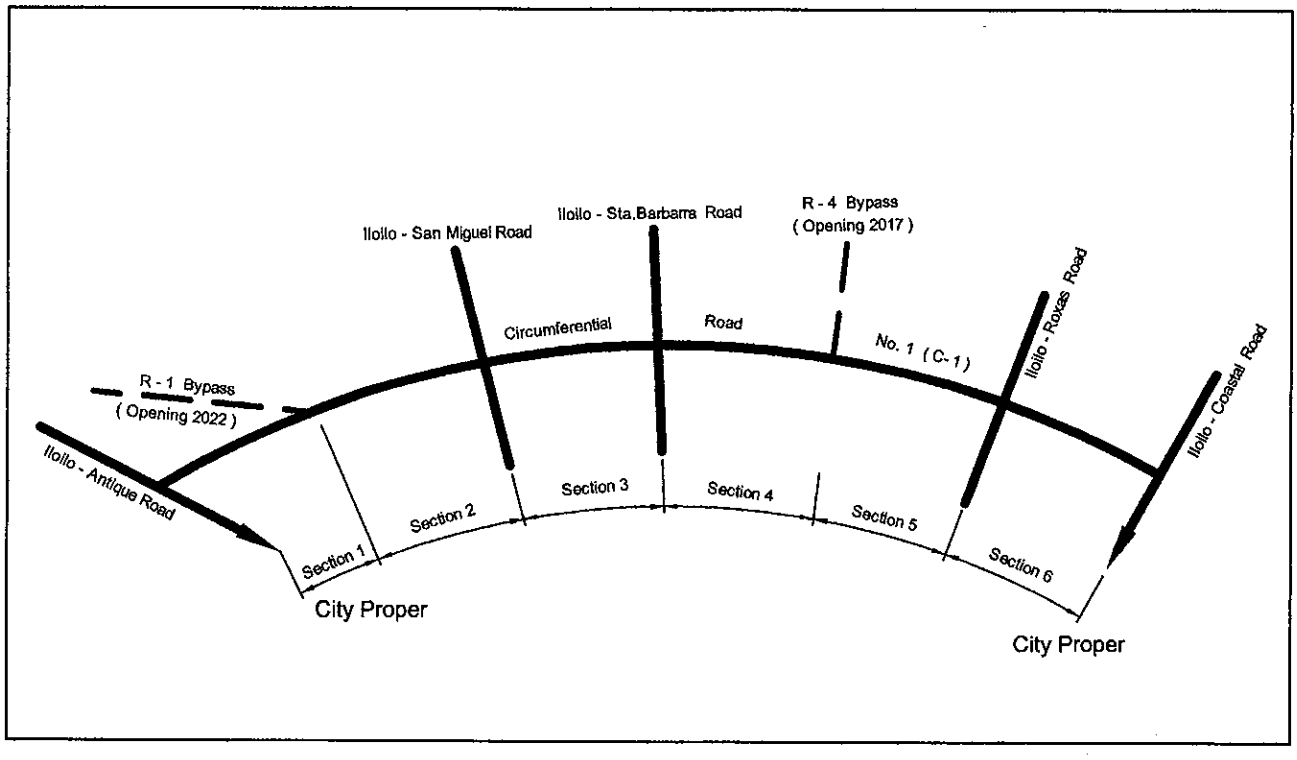


Table 12.5-1 Estimated Traffic Volume and Volume/Capacity Ratio

Conditions & Section			Section-1	Section-2	Section-3	Section-4	Section-5	Section-6
Traffic Volume in 100 pcu	2010		**151**	**116**	**178**	-	-	-
	2016		**219**	**169**	**233**	**315**	**200**	**171**
	2022		**267**	**393**	**470**	**551**	**479**	**315**
Volume / Capacity Ratio (V/C)	2-lane	2010	**0.50**	**0.39**	**0.59**	-	-	-
		2016	**0.73**	**0.56**	**0.78**	**1.05**	**0.67**	**0.57**
		2022	**0.89**	**1.31**	**1.57**	**1.84**	**1.60**	**1.05**
	4-lane	2010	**0.25**	**0.19**	**0.30**	-	-	-
		2016	**0.37**	**0.28**	**0.39**	**0.53**	**0.33**	**0.29**
		2022	**0.45**	**0.66**	**0.78**	**0.92**	**0.80**	**0.53**

12.6 CONSTRUCTION PHASING

As discussed in Section 12.5, development of C-1 is made by phasing as follows:

Construction Phasing

Initial Stage	:	a 2-lane road will be constructed
Ultimate Stage	:	a 2-lane road will be widened to a 4-lane divided road by year 2022

12.7 PRELIMINARY DESIGN

12.7.1 Design Concepts and Criteria

1) Design Concepts

Circumferential Road No. 1 (C-1) functions as a major distributor of traffic to/from intersecting radial roads.

It will traverse the urbanized and the planned urbanized areas. In the urbanized area, major issue is to minimize adverse social impacts. To achieve this objective, the design standards are not necessarily so high.

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

Design Concept

- Design speed of 60 km/hour is selected to minimize adverse social impacts in selecting horizontal alignment.
- For the socially critical area, road width is narrowed as much as possible by applying structures such as retaining wells.
- Intersections with Radial Roads are so designed that left-turn lanes are provided.
- To allow future urbanization along the roadsides, road elevation is designed as low as possible.
- Countermeasures against soft ground is properly selected.
- Bridges are planned reflecting Iloilo and Jaro River Flood Control Project.
- Existing irrigation system is maintained.

2) Road and Intersection Design Criteria

Highway design criteria and intersection design criteria are shown in Table 12.7-1 and Table 12.7-2, respectively.

Typical cross-sections for the initial stage and the ultimate stage are shown in Figure 12.7-1.

Road right-of-way was established as follows:

Standard ROW - 40m (Embankment height of 3m or less can be accommodated. When embankment height becomes more than 3m, retaining wall is provided to limit road width within 40m)

ROW of Socially Critical Area

a) Beginning Section (Km 0+000 – Km 0 +100)

ROW = 18m

b) Near Intersection with Iloilo-Sta. Barbara Road

ROW = 30m

c) Short Section along Jaro Floodway (km 12+600-Km 12+800)

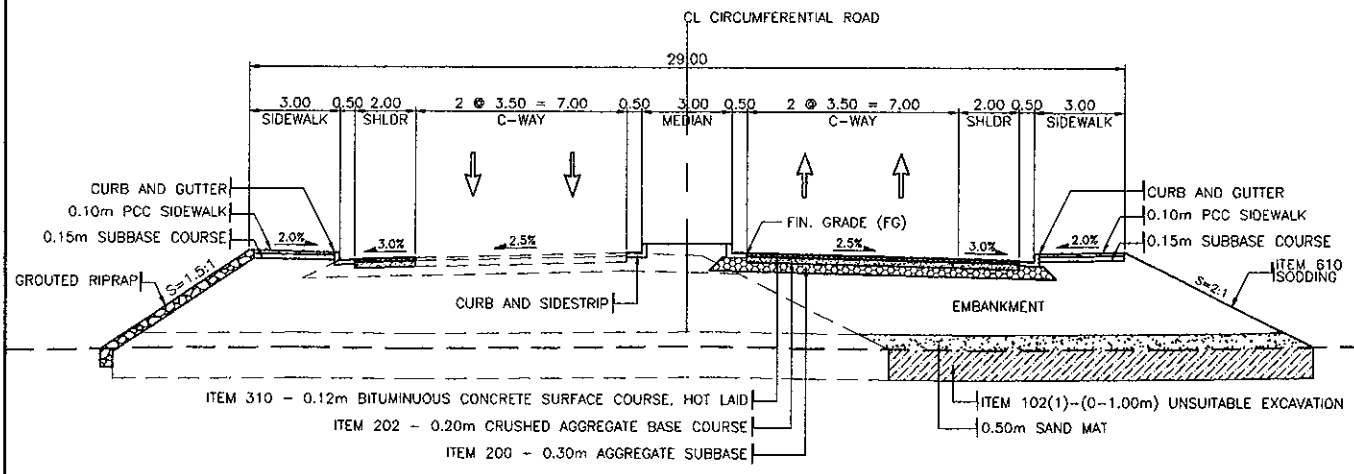
ROW = 22.0m

TABLE 12.7-1 HIGHWAY DESIGN CRITERIA
- Iloilo Circumferential Road No. 1 -

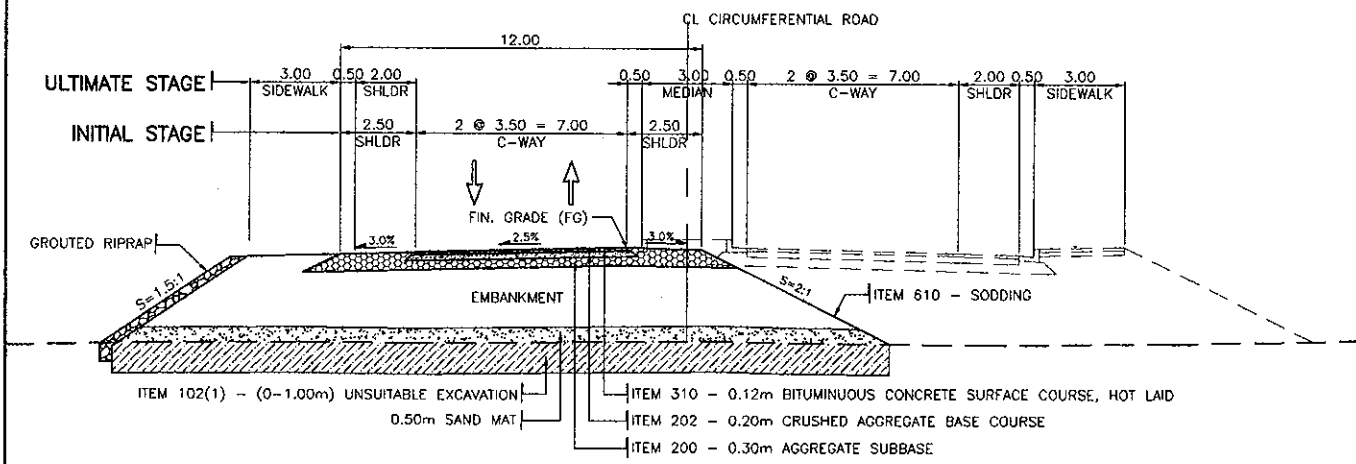
Classification	Unit	Initial Stage	Ultimate Stage
Design Speed	Km/h	60	
Number of Lane		2	4
Type of Pavement		AC	
Lane Width	m	3.5	
Shoulder Width	m	2.5	
Median	m	-	3.0
Side Walk	m	-	3.0
Stopping Sight Distance	m	85	
Passing Sight Distance	m	420	
Minimum Radius	m	120	
Minimum Radius for Normal Cross Slope	m	1,500	
Maximum Grade	%	5	
Minimum Length of Vertical Curve	m	60	
Minimum "K" for Crest		14	
Minimum "K" for Sag		16	
Maximum Superelevation	%	6	
Normal Cross Slope	%	25	

TABLE 12.7-2 INTERSECTION DESIGN CRITERIA

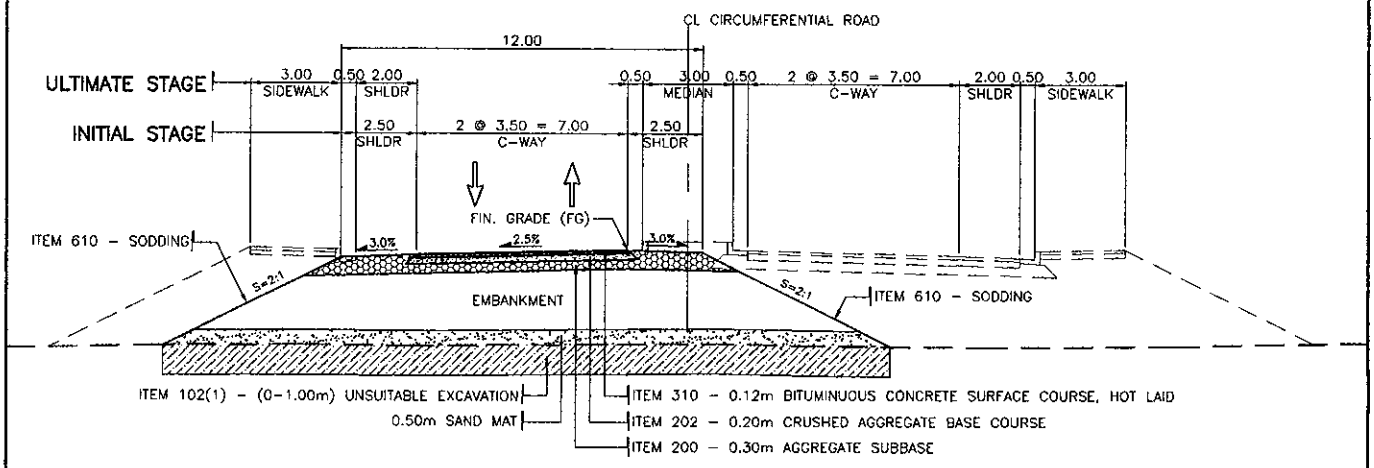
Classification	Unit	Intersection	
		Signal Control	
		Urban	Rural
Design Speed	Km/h	40	60
Sight Distance	m	100	240
Minimum Radius	m	60	150
Maximum Grade	%	2.5	
Width of Left Turn Lane	m	3.0 ~ 3.5	
Length of Teper	m	50 ~ 100	
Length of Storage Lane	m	30 ~ 50	
Minimum Radius Curve	m	12	15
Width of Pedestrian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



ULTIMATE STAGE – NORMAL SECTION



INITIAL STAGE – NORMAL SECTION WITH RIPRAP



INITIAL STAGE – NORMAL SECTION

FIGURE 12.7-1 TYPICAL CROSS-SECTION
ILOILO CIRCUMFERENTIAL ROAD NO.1

3) Bridge and Structures

(a) Design Standards and Specifications

The design of bridges for stream or river crossings will be based on the recommendations of the following standards and specifications:

[1] Design Guidelines, Criteria and Standards for Public Works and Highways, Volumes I & II, Department of Public Works and Highways (DPWH),

[2] Standard Specifications for Highway Bridges, American Association of State Highway and Transportation Officials (AASHTO), 17th Ed., 2002, and

[3] Highway Drainage Guidelines, American Association of State Highway and Transportation Officials (AASHTO), 1999 Metric Ed.

(b) Materials

The basic materials used for bridge and structures shall be:

- Concrete, Reinforced $f'_c = 24Mpa$
- Concrete, Prestressed $f'_c = 41Mpa$
- Steel Reinforcement (Grade 60) $f_y = 415Mpa$
- Prestressing Steel (Grade 270) $f_u = 1862Mpa$

(c) Design Loads

- **Dead Load (*DL*)**

  The dead load shall consist of the weight of the entire structure, including the roadway, sidewalks, car tracks, pipes, conduits, cables, and other public utility services

- **Live Load (*LL*)**

  The carriageway live loading shall be the AASHTO MS 18 (HS20-44) Standard Truck or Lane Loading.

- **Seismic Forces**

  The method of analysis for the bridge structures follows the recommendations of AASHTO 2002 Division I-A Seismic Design using the Single mode or the Multimode Spectral Analysis Method.

Seismic Design Coefficients

Seismic Design Item	Metro Iloilo	Metro Bacolod
Acceleration Coefficient, A	0.40	0.40
Importance Classification, IC	I (Essential)	I (Essential)
Seismic Performance Category, SPC	D	D
Soil Type	III (Soft to Medium Stiff Soil)	I (Stiff Soil)
Site Coefficient	1.5	1.0

(d) Clearances

- **Vertical Clearances**

The following vertical clearances for structures shall be maintained for all bridges crossing major roads, access roads and streams or rivers:

Vertical Clearance

LOCATION	MIN. VERTICAL CLEARANCE (m)	REMARKS
River/Stream Crossing Freeboard Considering Debris Passage Below Bridge	1.50	Max. Flood Water Level to Lowest Structure Member
River/Stream Crossing Freeboard Without Considering Debris Passage Below Bridge	1.00	Max. Flood Water Level to Lowest Structure Member. To be applied also to irrigation canals.

(e) Bridge Planning

Design Flood Frequency	:	50 year return period
Minimum Span Lengt	:	L ≥ 20 + 0.005Q (Q > 500 cum/sec)
Pier Width on River Section	:	Encroachment < 5% of river section
Bridge Length	:	Decided by discharge and Max. Flood Water Level

4) Drainage and Cross Drainage Facilities

a) Design Standards and Guidelines

Drainage design shall be carried out in accordance with the recommendations in "*Part-3 Highway Design, Volume-II of the "DPWH Design Guidelines, Criteria and Standards for Public Works and Highways*". Where there is no relevant provision in the DPWH Guidelines, reference shall be made to the recommendations of "*A Policy on Highway Drainage", June- 1987, Japan Road Association; (JRA) and "Highway Drainage Guidelines", Metric- Edition, American Association of State Highway and Transportation Official; (AASHTO), 1999*".

In the design of drainage facilities, approved "Standard Drawings" by DPWH, prepared by the Bureau of Design (BOD) will also be considered.

Design Frequency (Return Period)

The design frequencies adopted in this project are adhering to the recommendation found in the DPWH Design Guidelines as shown below.

Design Frequencies

Type of Structure	Return Periods
Bridges	1 in 50 years
Box Culverts	1 in 25 years
Road Embankment	1 in 10 years
Drain Pipes and Pipe Culverts	1 in 10 years
Side Ditches	1 in 2 years
Surface Drainage	1 in 2 years

Cross-Drainage

Type and Size of Cross-Drainage Structure

Figure 12.7-2 presents the proposed methodology to choose the most reasonable drainage structure among pipe culverts, box culverts and bridges based on the drainage capacity of these structures and the maximum runoff discharge value of the each defined catchment area. This methodology is based on the DPWH requirements in which the selection starts by using a single pipe culvert having 910 mm diameter, since the minimum size of pipe culvert recommended is 910mmϕ for ease of maintenance. The larger diameters 1070 mmϕ, 1220 mmϕ and up to 1520 mmϕ are used as far as the rate of flow will require. If the rate of flow is greater than the capacity of 1520 mmϕ single pipe, then the capacities of the double 910 mmϕ to 1520 mmϕ pipes are checked. When the rate of flow is greater than the capacity of the double 1520 mmϕ diameter pipes, then the box culvert is chosen to drain the water. Different standard size of box culverts are used to accommodate the drained water as long as the rate of flow is not more than 40 m^3/sec including single, double and up to triple vents. When the rate of flow is greater than 40 m^3/sec, a bridge is recommended.

During the above analysis, the Rational Method of analysis is adopted when the catchment area is not more than 20 km^2. For the areas more than 20 km^2, the Unit Hydrograph Method is used.

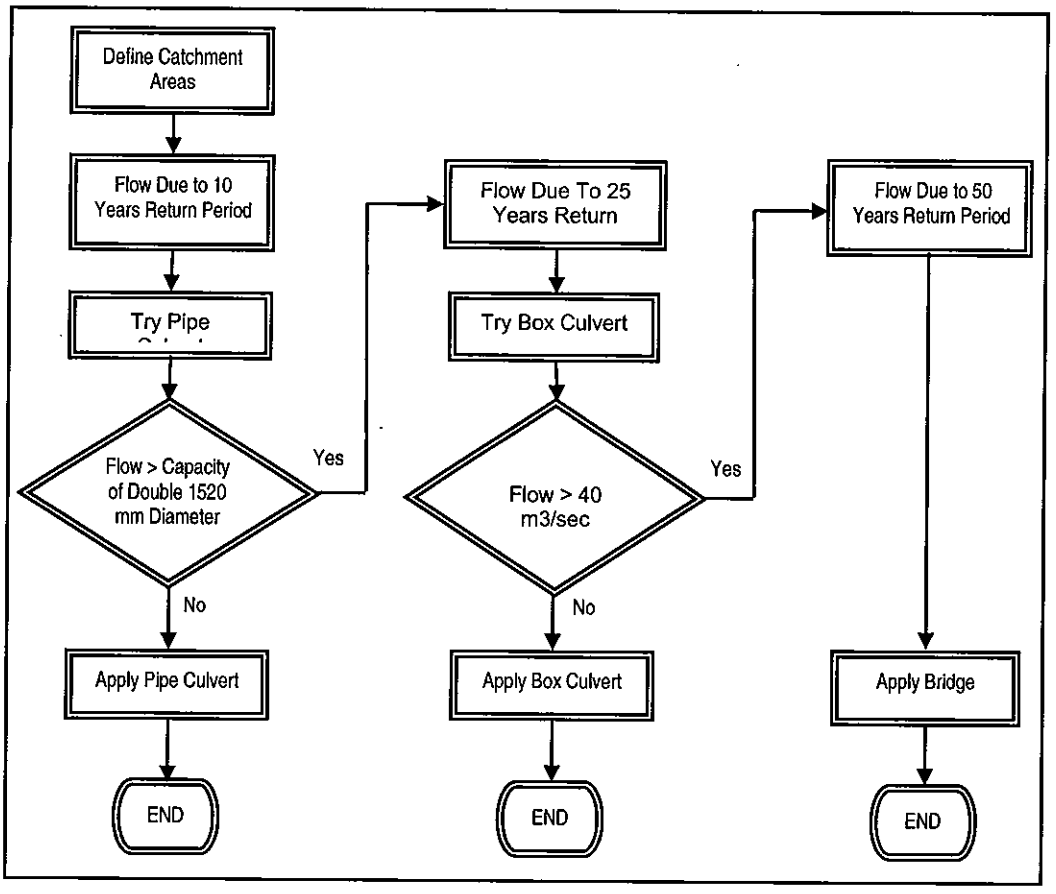


FIGURE 12.7-2 SELECTION OF TYPE OF CROSS DRAINAGE STRUCTURE

Reinforced Concrete Pipe Culverts (RCPC)

Pipe culverts are provided at the following locations:

- Locations defined by the catchment area analysis,
- Locations of existing irrigation channels, and
- Locations in flat terrain where water flow direction cannot be certainly defined. Flat cross-pipe is provided to avoid bypass acting as a dam at this location.

After the required pipes are provided at the abovementioned locations, the spacing between the successive pipes is checked. If the spacing is greater than 250 m, an additional pipe is located in between. This maximum spacing is considered in order to create the facilities to drain the surface water runoff discharge within a reasonable length.

Height of Backfill of RCPC

Based on the DPWH Design Guidelines, (Vol.-II, Item 500.3.6 "Backfilling") the minimum backfilling elevation is 0.3 m. However, based on the requirements of structural design, the minimum height of backfill should be 0.6 m. The finished grade of the project road shall consider the required invert elevation levels of inlets and outlets of the cross drainage structures. The invert elevations shall be modified as far as the standard requirements can be maintained. Otherwise, the finished bypass grade will be modified to coincide with the cross drainage inlets and outlets invert elevations requirements.

Reinforced Concrete Box Culverts (RCBC)

Reinforced concrete box culverts are rigid frame structures with square or rectangular opening. The height and span of the box vary from 1.0m to 3.0m. It is recommended for economy of design to keep the span to the height ratio from 1:1 to 1:1.5.

In areas where the discharge is small and where the road will span a body of water less than or equal to 9m, an RC box culvert is applied. For the proposed three bypasses, the box culverts span mostly irrigation canals and small streams. Considerations are given to the expected maximum flood level at the proposed locations of box culverts.

12.7.2 Road and Intersection Design

1) Horizontal Alignment

Horizontal alignment was designed to satisfy the design speed of 60 km/hour. Horizontal alignment is shown in Figure 12.7-3. Among various horizontal curves, minimum one is 300m in radius with super elevation of 6%.

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.

3) Socially Critical Sections

Beginning Section

C-1 starts from Iloilo-Antique Road. Iloilo-Antique Road. Iloilo-Antique Road is a 2-lane road where roadside development is dense and its widening is no longer practical. Although C-1 is planned as a 4-lane divided road, the beginning section can be narrowed, since Iloilo-Antique Road remains as a 2-lane road.

Intersection design is shown in Figure 12.7-4. ROW width for this beginning Section can be reduced to 18m.

Section near Intersection with Iloilo-Sta. Barbara Road

Iloilo-Sta. Barbara Road is planned to be widened to a 4-lane road. Roadsides along C-1 in this Section is dense. In order to narrow road right-of-way, retaining wall is planned to be utilized. Intersection design of the ultimate stage is shown in Figure 12.7-5.

ROW width : C-1 = 30m
Iloilo-Sta. Barbara Road = 20m

Section near Jaro River Floodway

The alignment is selected to pass besides Jaro Floodway. There is one existing subdivision which will be affected. Two alternatives were studied as follows:

Alternative – 1 : To narrow roadway width (Figure 12.7-6)
Alternative – 2 : To construct a bridge along the floodway (Figure 12.7-7)

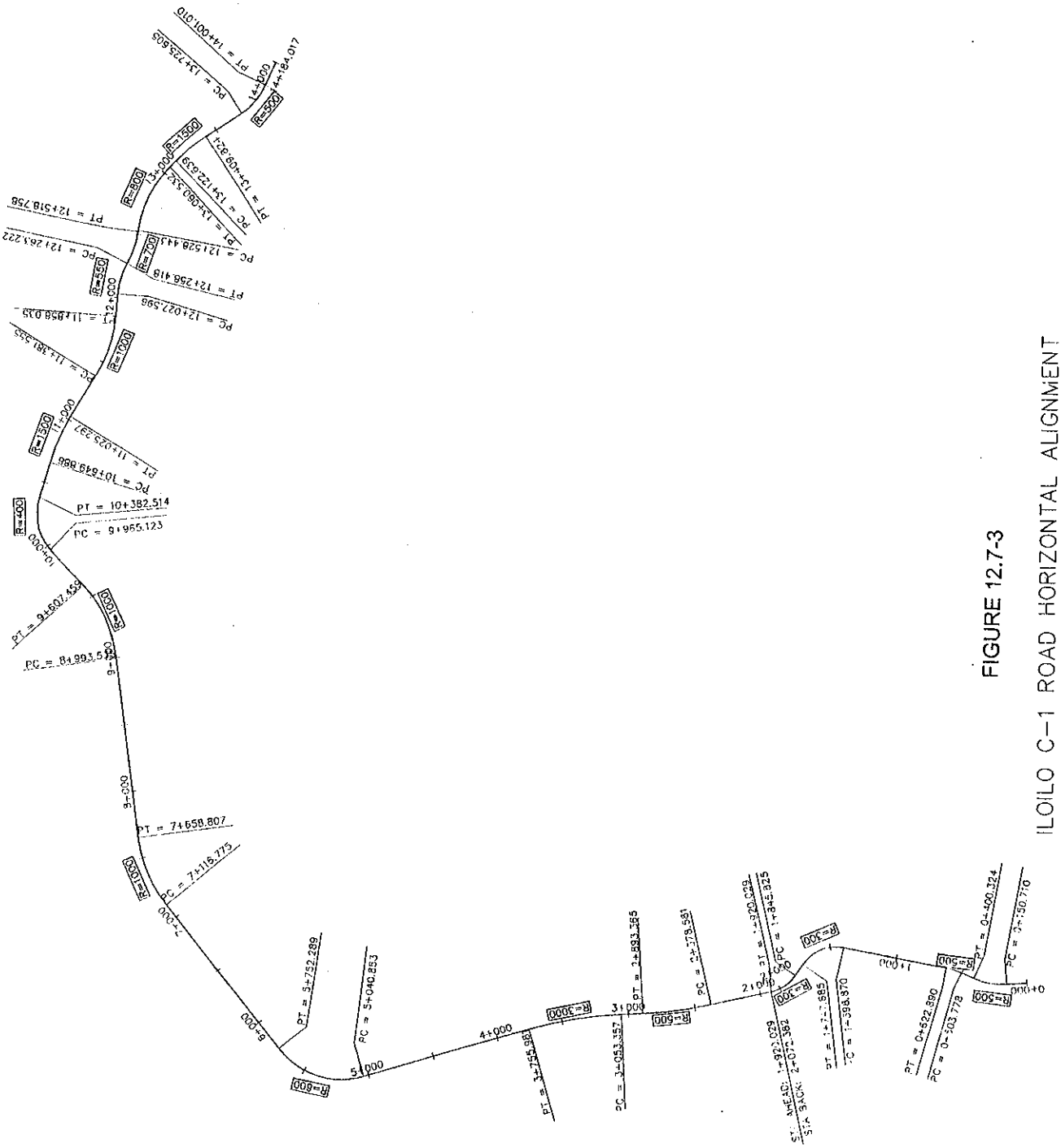


FIGURE 12.7-3

ILOILO C-1 ROAD HORIZONTAL ALIGNMENT

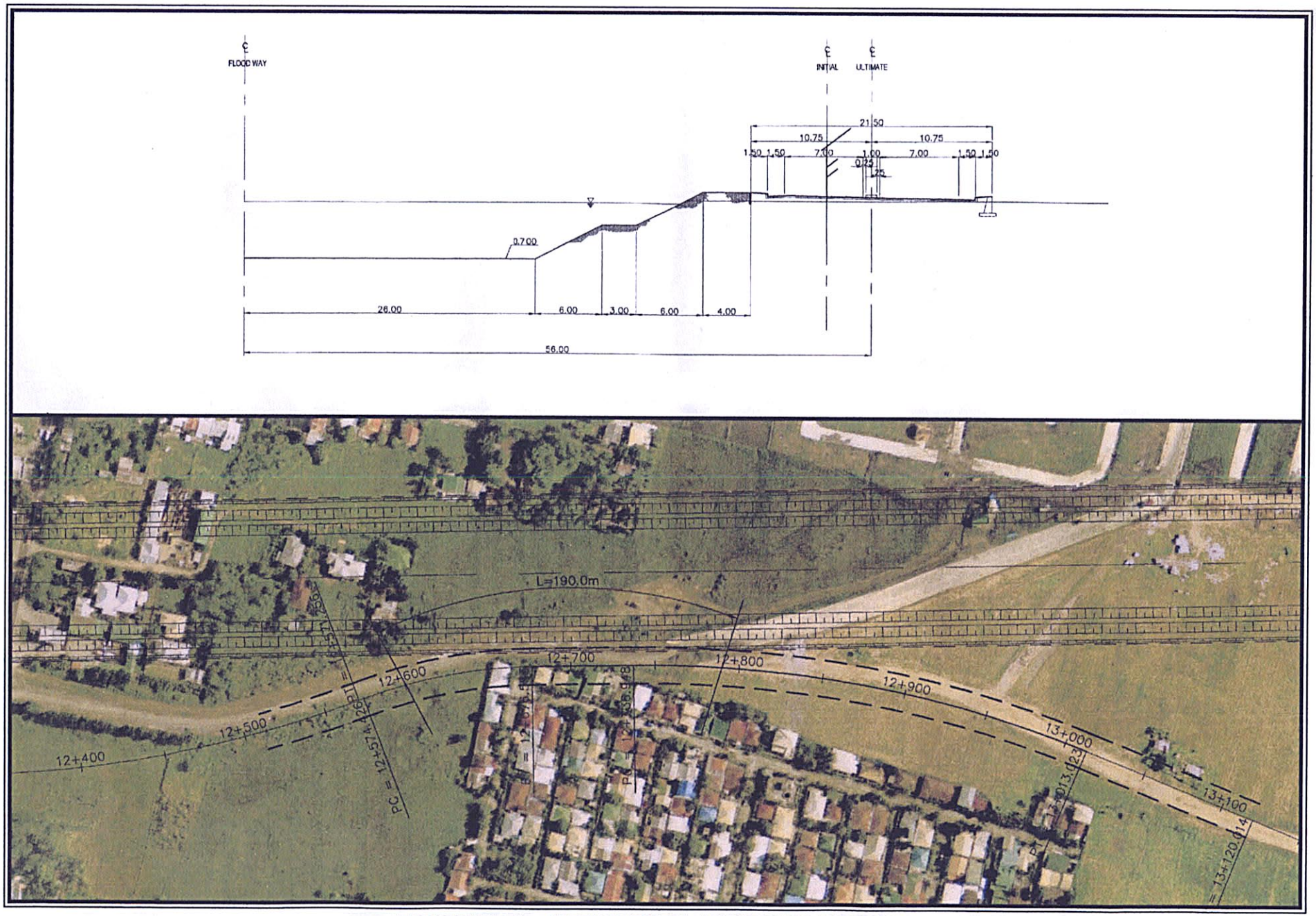


FIGURE 12.7-6 ALTERNATIVE-1 : NARROWED ROADWAY

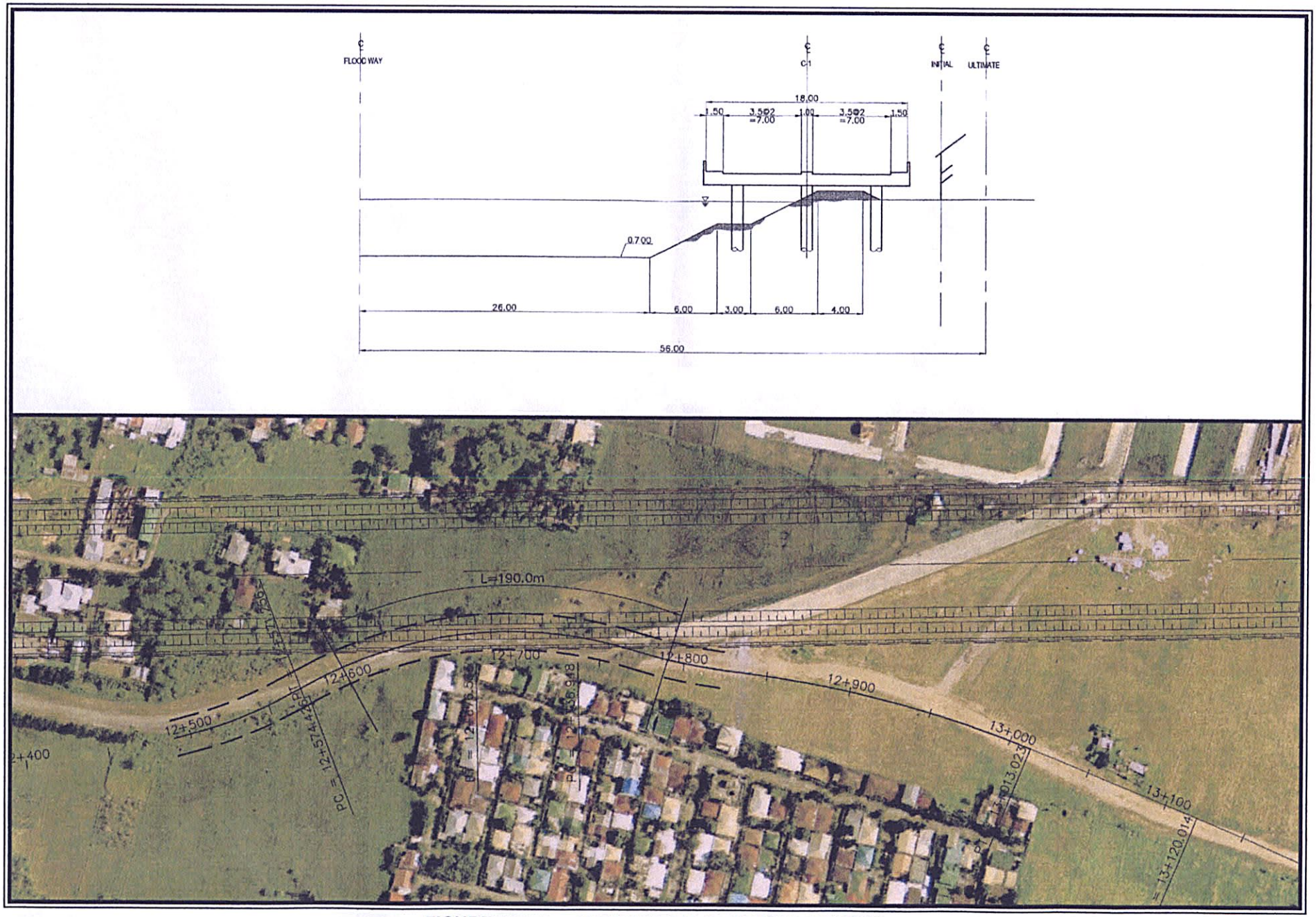


FIGURE 12.7-7 ALTERNATIVE-2 : BRIDGE SCHEME

Comparison of two alternatives for the Section of 0.19km are shown below:

	Alternative - 1	Alternative - 2
• No. of Houses Affected		
• Construction Cost (Million P)	11.1	114.0
• ROW Acquisition Cost (Million P)	1.59	0.12
• Compensation Cost of Affected Structures (Million P) (1,060 sq.m.)	6.89	0
• Total Cost (Million P)	19.58 (1.00)	114.12 (5.83)

Alternative – 2 requires higher cost by about 5.8 times than Alternative-1. It is recommended that Alternative-1 be selected and necessary compensation for affected families be implemented.

4) Intersection Design

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

- Intersection with Iloilo-Antique Road
- Intersection with Iloilo-San Miguel Road
- Intersection with Iloilo-Sta.Barbara Road
- Intersection with proposed R-4 Bypass
- Intersection with Iloilo-Roxas Road
- Intersection with Iloilo-Coastal Road

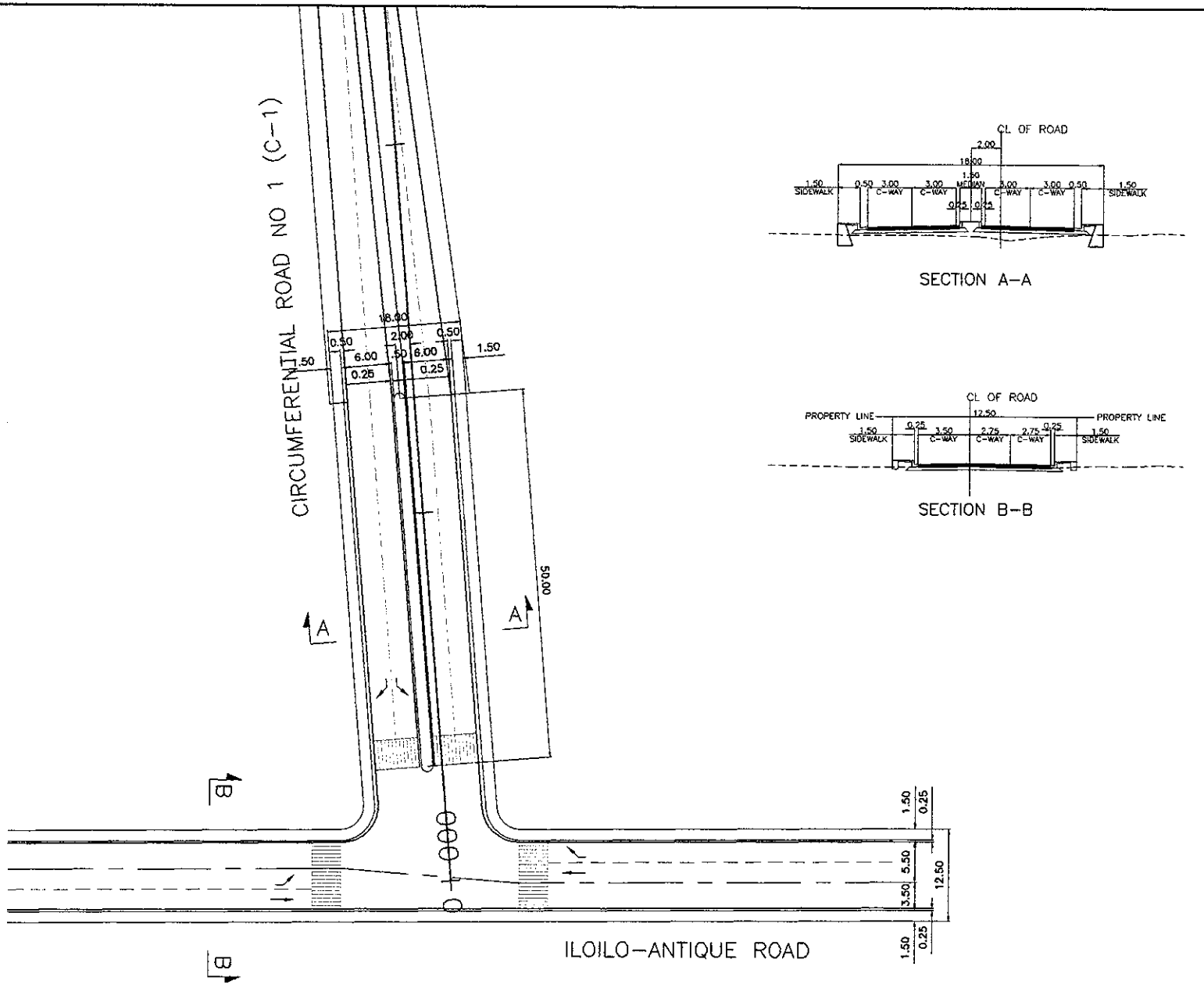


Figure 12.7-4 BEG. OF ILOILO C1 ROAD

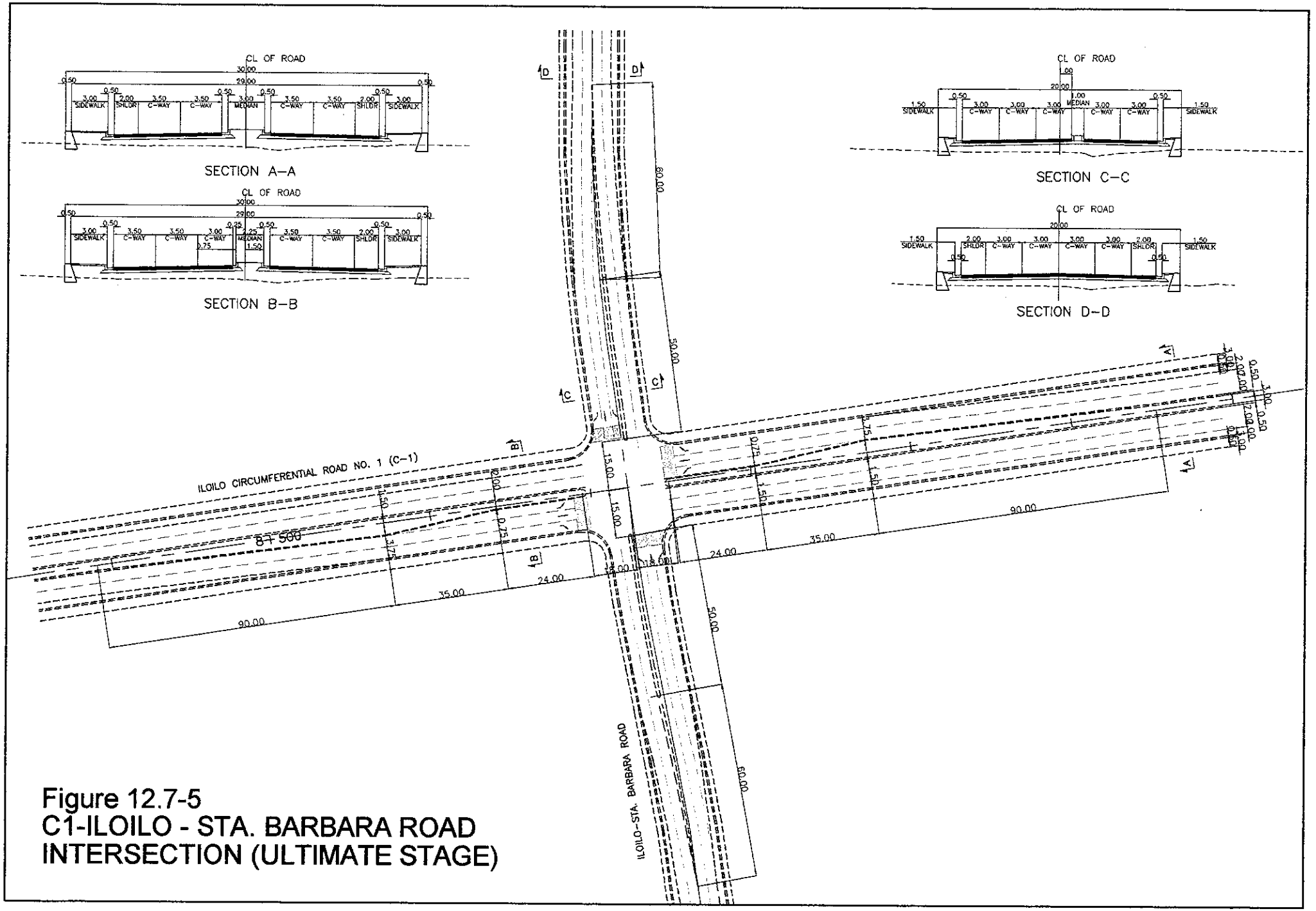


Figure 12.7-5
C1-ILOILO - STA. BARBARA ROAD
INTERSECTION (ULTIMATE STAGE)

12.7.3 Pavement Design

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

Table 12.7.3-1 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) : 1.8

Soft ground is found along the project road, and settlement after construction of pavement is anticipated. For this kind of ground condition, flexible type of pavement is preferred to cope with expected settlement. AC pavement was selected.

Table 12.7.3-2 shows traffic loading. Cummulative ESAL is 5.73 Million for 10 years.

Required pavement thickness is as follows:

AC Pavement : 12cm
Aggregate Base Course : 20cm
Subbase Course : 30cm

TABLE 12.7.3-1 DESIGN REQUIREMENT (C-1)

Category	Description
a. Design Variable	
a.1 Time Constraints - Time Period	AC : 10 years
a.2 Traffic Loading	Directional Distribution Factor : 0.5
a.3 Bus and Truck Factor	Bus : 0.8 Truck : 1.8
a.4 Reliability	Z_R = 1.037 for 85% Reliability So = 0.45 (Flexible)
b. Performance Criteria	
b.1 Serviceability	(Flexible) PSI = Po - Pt = 4.2 - 2.0 = 2.2
c. Material Properties for Structural Design	
c.1 Effective Modulus of Subgrade Reaction	M_R (pci) ; 7,500pci
c.2 Pavement Layer Materials Characterization	E_C = Modulus of Elasticity of PCC (4.20 x 10^6 psi)
c.3 Structural Layer Coefficient (Flexible)	Asphalt Concrete Layer Coefficient ; 0.38
	Crushed Gravel Base ; 0.15
	Subbase ; 0.11
e. Required Pavement Thickness	
d1. AC	t = 12cm
d2. Aggregate Base Course	t = 20cm
d3. Subbase Course	t = 30cm

TABLE 12.7.3-2 TRAFFIC LOADING (Iloilo C-1)

Year	AADT		Cumulative
	Bus	Track	ESAL
2013	60	1,310	439,240
2014	73	1,361	896,887
2015	88	1,413	1,373,961
2016	106	1,468	1,871,675
2017	116	1,575	2,405,916
2018	128	1,689	2,979,375
2019	140	1,812	3,594,940
2020	154	1,943	4,255,716
2021	169	2,084	4,965,036
2022	186	2,235	5,726,390
Total	**1,220**	**16,890**	**5,726,390**

12.7.4 Structure Design

The Circumferential Road No. 1 (C-1), as discussed earlier, stretches to 14.18kms of new road crossing two major rivers (Iloilo River and Jaro River) and three smaller rivers and streams.

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

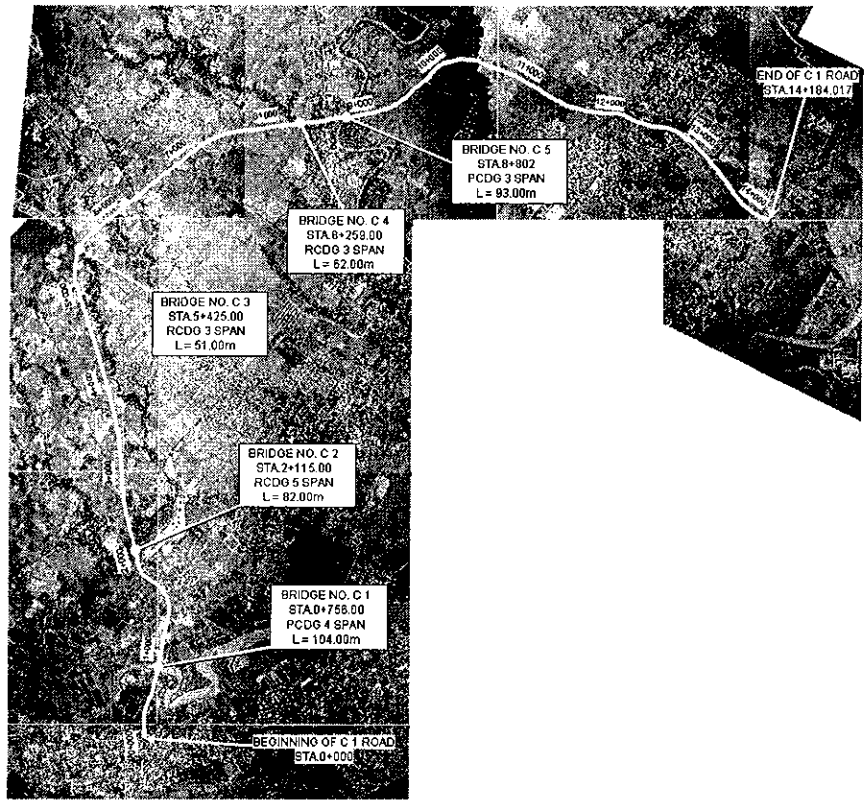


FIGURE 12.7.4-1 BRIDGE LOCATION MAP

12.7.4.1 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 12.7.4-1 shows the locations of bridges along the alignment while Figure 12.7.4-2 presents the conditions of five rivers and streams along the proposed C-1 road alignment.

The following features describe briefly the proposed bridge sites:

Topography

- Since the alignment is located on a relatively flat terrain, the 50-year return flood tends to overflow the river with flood heights averaging to 1.0m above the banks,
- Under this condition, the river sections are found insufficient to the design discharge,

Rivers/Streams

- Iloilo river (C-1) is located on flood plain with soft ground conditions where fishponds abound. The alignment crosses the river on the relatively straight portion of the meandering Iloilo River. The river overflows the earth dike which defines the river width.

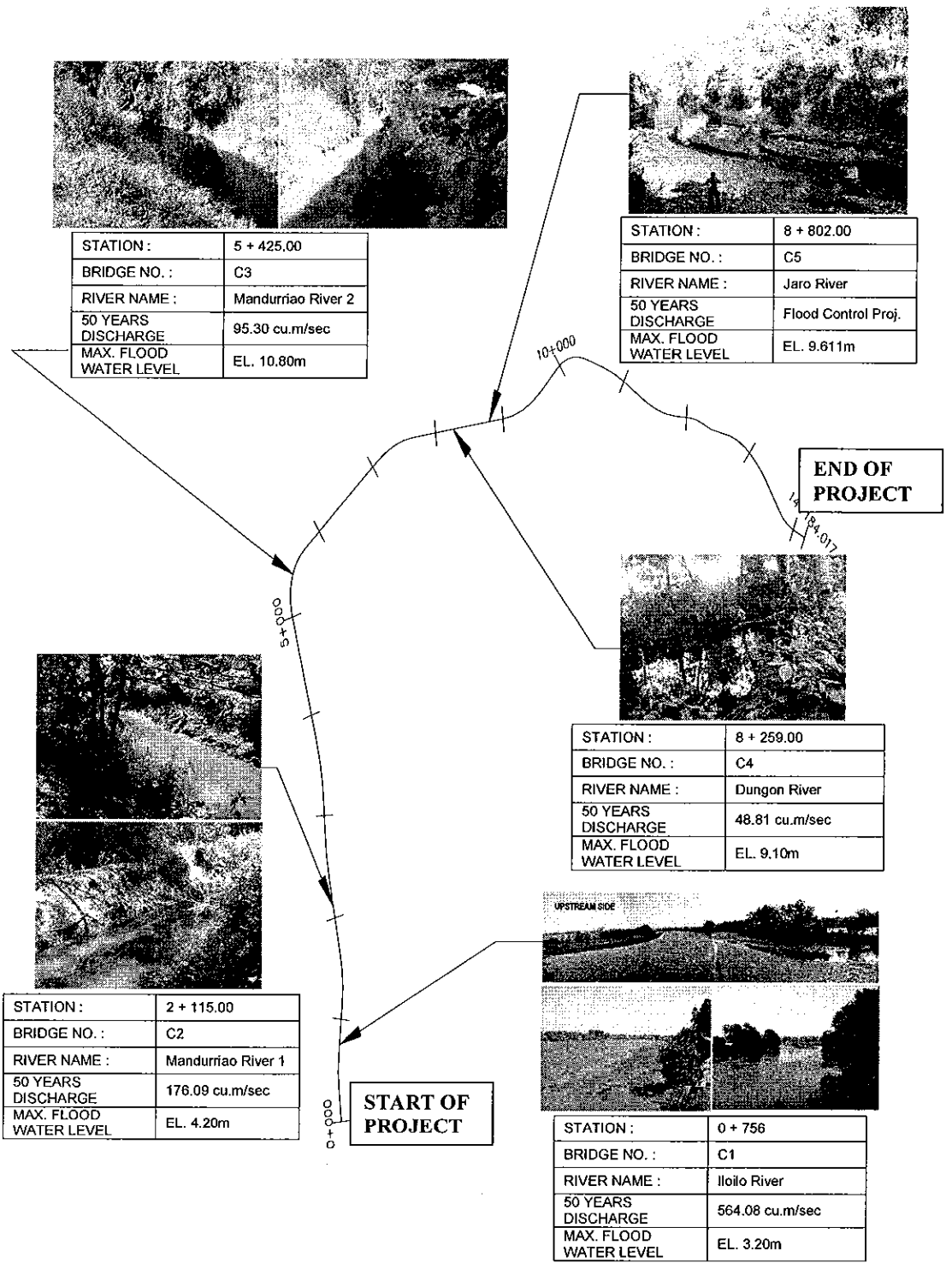


FIGURE 12.7.4-2 RIVER CONDITION AT PROPOSED BRIDGE LOCATION

- The alignment traverses two sections of the Manduriao river (C-2 & C-3) which are 3.3kms apart. The river width on the upstream side is about 10m on banks and becomes wider to about 25m on the downstream side. The river overflows during heavy rain.
- Dungon river (C-4) has a waterway less than 10m wide which tends to become wider during heavy rains. The river overflows to more than 1.0m above the banks.
- The other major river traversed by the alignment is Jaro river (C-5) which is the downstream side of two large rivers - the Aganan river and the Tigum river. The river capacity is observed to be less than the actual discharge and tends to overflow on the banks. The Iloilo Flood Control project proposes a cut-off channel (Floodway) to divert the Tigum river discharge and modify the existing Jaro river section (see Figure 12.7.4-3). The proposed road alignment crosses the Jaro river at 51° skew.

The river discharge for a 50-year return period is calculated for each proposed bridge site and presented in Table 12.7.4-1.

TABLE 12.7.4-1 RIVER DISCHARGE 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
C-1	Iloilo	564.08	3.20	2.80	22.9	26
C-2	Mandurriao	176.09	4.20	1.41	-	22
C-3	Mandurriao	95.30	10.80	1.31	-	21
C-4	Dungon	48.81	9.10	1.79	-	22
C-5	Jaro	FLOOD CONTROL PROJECT	9.61	FLOOD CONTROL PROJECT	-	31

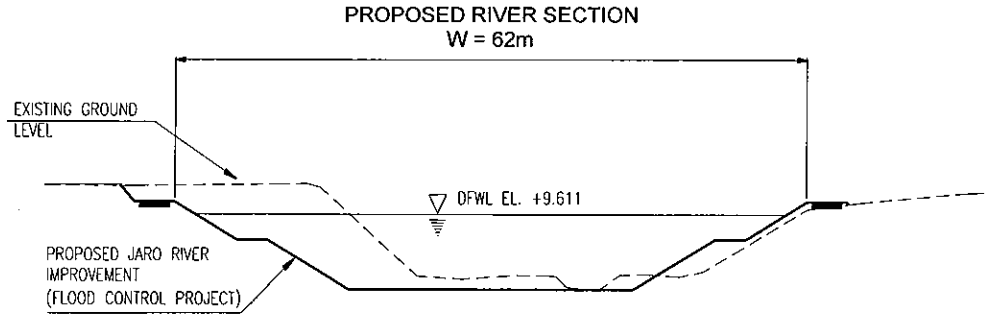


FIGURE 12.7.4-3 JARO RIVER FLOOD CONTROL IMPROVEMENT

Geotechnical

- Geotechnical investigations carried-out for the proposed bridge sites indicate that the subsoil condition along the proposed alignment composed of thick alluvial deposits consisting of alternating layers of sand and clay/clayey silt.

- The thick alluvial deposits can be classified into three (3) layers as follows:
  - Layer A - representing very soft to soft clay and/or plastic silt and very loose sand with N-values ranging from 3 - 6 and depths of 0m - 32m,
  - Layer B - loose to medium dense sand with N-values ranging from 5 - 32 and depths of 12m - 40m,
  - Layer C - medium stiff to very stiff clay and plastic silt with N-values ranging from 6 - 15 and depths of 14m to 50m.

12.7.4.2 Design Concept for Structures

(1) Superstructure

The superstructure preliminary design basically adheres to the following concepts:

Bridge Deck Section

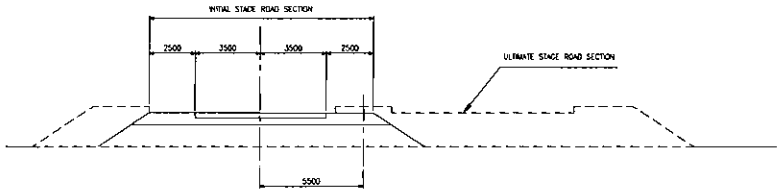
- The bridge deck section should conform with the travelway/carriageway width of the highway for both the initial and ultimate stages of the project. Typical bridge section is illustrated in Figure 12.7.4-4. Since C-1 is to be implemented at two stages with four lanes of travelway at the ultimate stage, the initial two-lane road will have a single cross-slope. The bridge follows the same configuration as the road with provision for the additional two lanes to be carried by a separate or second bridge.
- A 1.5m wide shoulder is provided on one side of the deck to allow space for cars stopping on the bridge.
- Since C-1 will traverse an urbanized area, a 2.0m sidewalk is proposed on one side of the deck and 0.75m wide sidewalk on the other side.

Girder Types

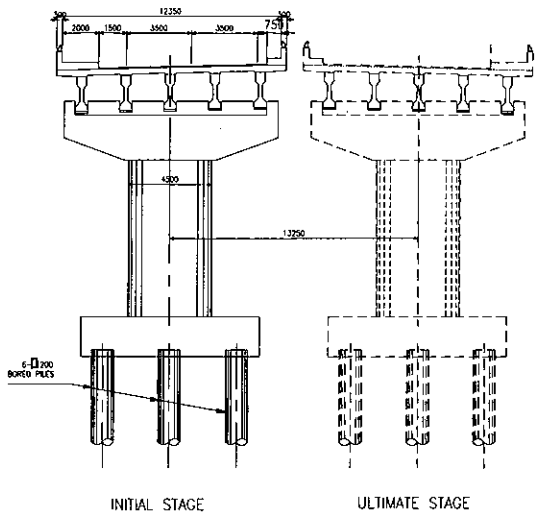
- Two types of superstructures are proposed for the bridges:
  - Prestressed Concrete (PCDG), AASHTO Girder type for spans greater than 22m, and
  - Reinforced Concrete Deck Girder (RCDG) for spans less than or equal to 22m
- To enhance seismic performance, PCDG are made continuous over the intermediate 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 CIRCUMFERENTIAL C-1 ROAD SECTION



TYPICAL CIRCUMFERENTIAL C-1 BRIDGE SECTION

FIGURE 12.7.4-4 TYPICAL C-1 BRIDGE SECTION FOR INITIAL STAGE

(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 Iloilo river (oval shape) and the Jaro river (circular column). A circular column is used for the Jaro river since the bridge alignment is 51° skew with the river.
- On the other hand, a two-column piers are 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

- Driven pile foundation is proposed to support the bridge structures due to the nature of soil at the bridge site. A 450mm x 450mm precast driven pile is

proposed with 60ton - 65ton allowable bearing capacity (compression). Since it is difficult to find a competent bearing layer, the piles are considered friction piles.

- Likewise, foundation for the abutment utilizes precast driven friction piles.

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.

12.7.4.3 Proposed Bridges

Details of the proposed bridges crossing rivers and streams, with a total length of 392m, are presented in Table 12.7.4-2 below.

TABLE 12.7.4-2 PROPOSED BRIDGES FOR CIRCUMFERENTIAL C-1 ROAD

BRIDGE NO.	RIVER NAME	STATION		BRIDGE LENGTH (m)	SUPERSTRUCTURE			SUBSTRUCTURE			
								PIER		ABUTMENT	
		BEG.	END		TYPE	SPAN	SKEW (deg)	COLUMN TYPE	FOUNDATION	TYPE	FOUNDATION
C1	Iloilo River	Sta. 0+756	Sta. 0+860	104.00	PCDG AASHTO Type IV-B	4 @ 26	-	Wall Type 1500x4500	450x450 PC Piles N=32 ; L=37m	Closed Inverted-T Cantilever	450x450 PC Piles N=27 ; L=40m
C2	Mandurriao River 1	Sta. 2+115	Sta. 2+197	82.00	RCDG	15+15+22 +15+15	-	2-Column ϕ 1500	450x450 PC Piles N=21,24 ; L=34m	Closed Inverted-T Cantilever	450x450 PC Piles N=21 ; L=35m
C3	Mandurriao River 2	Sta. 5+435	Sta. 5+486	51.00	RCDG	15+21+15	-	2-Column ϕ 7500	450x450 PC Piles N=24 ; L=33m	Closed Inverted-T Cantilever	450x450 PC Piles N=18 ; L=33m
C4	Dungon River	Sta. 8+259	Sta. 8+321	62.00	RCDG	20+22+20	-	2-Column ϕ 7500	450x450 PC Piles N=27 ; L=30m	Closed Inverted-T Cantilever	450x450 PC Piles N=21,24 ; L=33m,34m
C5	Jaro River	Sta. 8+800	Sta. 8+893	93.00	RCDG	3 @ 31	51	1-Column ϕ2500	450x450 PC Piles N=28 ; L=35m	Closed Inverted-T Cantilever	450x450 PC Piles N=24 ; L=28m

TOTAL BRIDGE LENGTH : 392 m

12.7.5 Drainage Design

12.7.5.1 Principle and Methodology

The standard used in the study is in accordance to the Design Guidelines of Department of Public Works and Highways (DPWH), A Policy on Highway Drainage of the Japan Road Association (JRA) and Highway Drainage Guidelines of the American Association of State Highway and Transportation Official (AASHTO).

12.7.5.2 Hydrological and Hydraulic Analyses

The method used in the hydrological analyses is the Rational Method for catchment's areas less than twenty (20) sq km and the Unit Hydrograph for areas greater than twenty (20) sq km. The hydrological analyses utilized the rainfall intensity - duration frequency data in Table 12.7.5-1 of the Philippines Atmospheric Geophysical and Astronomical Services Administration (PAGASA) station of Iloilo City to determine the rainfall intensity. The topographic maps of National Mapping and Resources Information Agency (NAMRIA) were used to delineate the catchment areas of the road.

In the hydraulic analysis, the procedure applied for establishing the bridge's design flood level is by the Manning's Formula and for the design of the culvert dimensions are the hydraulic monographs of the US Bureau of Public Roads.

12.7.5.3 Results of Hydrologic Analyses

The hydrologic analyses reveal twelve (12) drainage catchment's areas shown in Figure 12.7.5-1 for the Circumferential Road No. 1 (C-1). Two (2) areas are greater than twenty (20) sq.km and all the other less. The analyses also reveal that there are five (5) areas where the discharge are more than forty (40) cu m per sec. The result of the hydrological analyses is shown in Table 12.7.5-2.

12.7.5.4 Results of Hydraulic Analyses

The hydraulic analyses reveal that five (5) bridges and fifty two (52) culverts are needed for the drainage structures in the road. Refer to Section 12.7.3 for the bridges schedule and Table 12.7.5-3 for the list of proposed culverts.

12.7.5.5 Flood Flow Analysis

The flood flow analysis is conducted for the five (5) catchment areas where the discharge is more than forty (40) cu.m. per sec. The results of the analysis are shown in Table 12.7.5-4.

The discharge and design flood level in Table 12.7.5.4 for Jaro and Iloilo River were taken from The Study on the Flood Control for Rivers in the Selected Urban Centers prepared by CTI Engineering Co.,Ltd. in association with Pacific Consultants International.

12.7.5.6 Flooding Condition

Flood control project was designed for Iloilo City by other Consultants as mentioned above. The flooded areas caused by the overflow of Jaro and Iloilo Rives, taken from the flood control detailed design is shown in Figure 12.7.5-2. Result of Inundation Analysis of a 50-Year Return Period, Iloilo City. The map indicates that the road alignment is within and affected by the flooding.

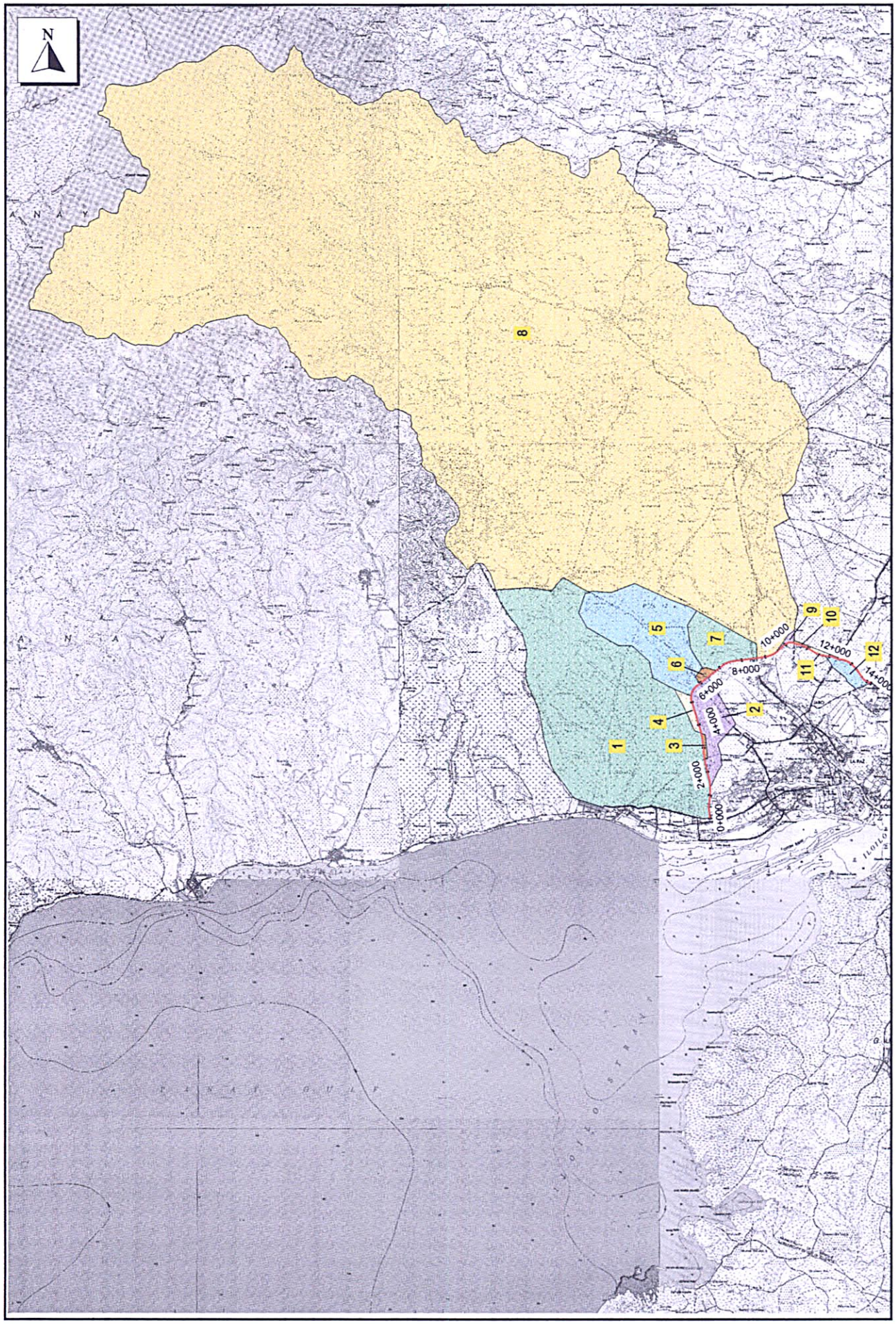


FIG. 12.7.5-1 ILOILO CIRCUMFERENTIAL ROAD NO. 1 (C-1) CATCHMENTS AREA MAP

TABLE 12.7.5-1

RAINFALL INTENSITY-DURATION-FREQUENCY DATA
for
ILOILO CITY, ILOILO

Based on 45 years of record

COMPUTED EXTREME VALUES (in mm) OF PRECIPITATION

Return Period (yrs)	5 mins	10 mins	15 mins	20 mins	30 mins	45 mins	60 mins	80 mins	100 mins	120 mins	150 mins	3 hrs	6 hrs	12 hrs	24 hrs
2	11.2	17.5	22.6	27.0	34.1	40.1	44.1	50.3	55.2	59.6	64.9	69.3	86.5	105.0	119.3
5	14.2	22.4	28.8	34.7	43.7	50.8	56.3	64.9	71.0	76.2	83.1	88.5	111.1	136.1	155.4
10	16.2	25.7	33.0	39.7	50.1	57.9	64.4	74.6	81.5	87.2	95.1	101.2	127.3	156.8	179.3
15	17.3	27.5	35.3	42.6	53.7	61.9	69.0	80.0	87.4	93.4	101.9	108.4	136.5	168.4	192.8
20	18.1	28.8	36.9	44.6	56.3	64.7	72.2	83.9	91.6	97.8	106.6	113.4	142.9	176.5	202.3
25	18.7	29.8	38.2	46.1	58.2	66.9	74.7	86.8	94.8	101.1	110.3	117.3	147.9	182.8	209.6
50	20.6	32.8	42.0	50.8	64.2	73.5	82.3	95.9	104.6	111.5	121.6	129.2	163.1	202.1	232.0
100	22.4	35.8	45.9	55.5	70.2	80.1	89.8	104.9	114.3	121.7	132.7	141.0	178.2	221.3	254.3

EQUIVALENT AVERAGE INTENSITY (in mm/hr) OF COMPUTED EXTREME VALUES

Return Period (yrs)	5 mins	10 mins	15 mins	20 mins	30 mins	45 mins	60 mins	80 mins	100 mins	120 mins	150 mins	3 hrs	6 hrs	12 hrs	24 hrs
2	134.4	105.0	90.4	81.0	68.2	53.5	44.1	37.7	33.1	29.8	26.0	23.1	14.4	8.8	5.0
5	170.4	134.4	115.2	104.1	87.4	67.7	56.3	48.7	42.6	38.1	33.2	29.5	18.5	11.3	6.5
10	194.4	154.2	132.0	119.1	100.2	77.2	64.4	56.0	48.9	43.6	38.0	33.7	21.2	13.1	7.5
15	207.6	165.0	141.2	127.8	107.4	82.5	69.0	60.0	52.4	46.7	40.8	36.1	22.8	14.0	8.0
20	217.2	172.8	147.6	133.8	112.6	86.3	72.2	62.9	55.0	48.9	42.6	37.8	23.8	14.7	8.4
25	224.4	178.8	152.8	138.3	116.4	89.2	74.7	65.1	56.9	50.5	44.1	39.1	24.7	15.2	8.7
50	247.2	196.8	168.0	152.4	128.4	98.0	82.3	71.9	62.8	55.8	48.6	43.1	27.2	16.8	9.7
100	268.8	214.8	183.6	166.5	140.4	106.8	89.8	78.7	68.6	60.9	53.1	47.0	29.7	18.4	10.6

TABLE 12.7.5-2
HYDROLOGICAL ANALYSIS

Road Section: ***ILOILO BYPASS (C-1) ROAD***

Basin Number	STATION		DISCHARGE			
	BEGINNING	END	2 year $m^3/sec.$	10 year $m^3/sec.$	25 year $m^3/sec.$	50 year $m^3/sec.$
1	0 + 000.00	1 + 220.00				564.08
2	1 + 220.00	2 + 540.00	93.93	137.60	159.82	176.09
3	2 + 540.00	3 + 610.00	1.83	2.67	3.10	3.41
4	3 + 610.00	5 + 250.00	3.99	5.83	6.78	7.46
5	5 + 250.00	5 + 920.00	50.65	74.39	86.41	95.30
6	5 + 920.00	6 + 840.00	4.39	6.40	7.41	8.16
7	6 + 840.00	8 + 800.00	26.07	38.16	44.32	48.81
8	8 + 800.00	9 + 600.00				1,400.00
9	9 + 600.00	10 + 300.00	3.00	4.38	5.06	5.58
10	10 + 300.00	11 + 000.00	0.93	1.36	1.57	1.73
11	11 + 000.00	12 + 250.00	2.41	3.52	4.07	4.48
12	12 + 250.00	14 + 000.00	6.79	9.93	11.53	12.70

TABLE 12.7.5-3
HYDRAULIC ANALYSIS

ILOILO BYPASS (C - 1) ROAD

BASIN NUMBER	STATION (km)	SIZE		LENGTH	REMARKS / RECOMMENDATION
		RCPC	RCBC		
		mmØ	SPAN X HEIGHT	(m)	
1	0 + 150.00	1 - 910		19.00	
	0 + 235.00	1 - 910		23.00	
	0 + 450.00	1 - 910		21.00	
	0 + 955.00	1 - 910		21.00	
	1 + 046.00	1 - 910		20.00	
2	1 + 225.00	1 - 910		15.00	
	1 + 410.00	1 - 910		15.00	
	1 + 610.00	1 - 910		19.00	
	1 + 870.00	1 - 910		16.00	
	2 + 360.00	1 - 910		17.00	
3	2 + 700.00	1 - 910		16.00	
	2 + 890.00	1 - 910		15.00	
	3 + 200.00	1 - 910		15.00	
	3 + 630.00	1 - 910		17.00	
4	3 + 700.00	1 - 910		16.00	
	3 + 980.00	1 - 910		18.00	
	4 + 270.00	1 - 910		16.00	
	4 + 600.00	1 - 910		18.00	
	4 + 900.00	2 - 910		16.00	
	5 + 050.00	1 - 910		15.00	
5	5 + 220.00	1 - 910		15.00	
	5 + 710.00	2 - 910		15.00	
6	6 + 000.00	2 - 910		26.00	
	6 + 270.00	2 - 910		18.00	
	6 + 330.00	1 - 910		20.00	
	6 + 480.00	1 - 910		17.00	
	6 + 815.00	2 - 910		21.00	
	6 + 830.00	1 - 910		21.00	
7	7 + 160.00	1 - 910		17.00	
	7 + 550.00	2 - 1070		17.00	
	7 + 800.00		3 - 1.50 X 1.50	15.00	
	8 + 470.00	1 - 910		33.00	
	8 + 550.00	1 - 1220		33.00	
8	9 + 330.00	1 - 910		16.00	
	9 + 415.00	1 - 910		18.00	
9	9 + 550.00	2 - 910		16.00	
	9 + 750.00	2 - 910		15.00	
	10 + 300.00	1 - 910		15.00	
	10 + 375.00	1 - 910		28.00	
10	10 + 600.00	1 - 910		17.00	
	10 + 900.00	1 - 910		16.00	
11	11 + 200.00	1 - 910		16.00	
	11 + 550.00	1 - 910		17.00	
	11 + 650.00	1 - 910		15.00	
	12 + 000.00	1 - 910		15.00	
12	12 + 110.00	1 - 910		20.00	IRRIGATION STRUCTURE
	12 + 300.00	1 - 910		15.00	
	12 + 530.00	1 - 910		16.00	
	13 + 220.00	2 - 910		15.00	
	13 + 550.00	1 - 910		16.00	
	13 + 700.00	2 - 1070		16.00	
	14 + 085.00	2 - 1220		15.00	

TABLE 12.7.5-4 FLOOD FLOW ANALYSIS

CIRCUMFERENTIAL ROAD NO.1 (C-1) , METRO ILOILO

HIGHWAY STATION (km)	BRIDGE NUMBER	BRIDGE NAME	CATCHMENT AREA (km2)	DISCHARGE 50 YEARS (cms)	VELOCITY (mps)	DFL (m)	M.F.L. FROM FIELD SURVEY (m)	WATER WIDTH (m)	REMARKS
0+808	C-1	Iloilo	65.78	564.08	2.80	3.20	3.00	99.58	
2+156	C-2	Mandurriao 1	18.00	176.09	1.41	4.20	4.45	76.55	
5+450	C-3	Mandurriao 2	13.23	95.30	1.31	10.80	11.20	45.71	
8+290	C-4	Dungon	4.48	48.81	1.79	9.10	9.00	50.62	
8+848	C-5	Jaro	448.75	1400.00		9.61	9.45	48.85	

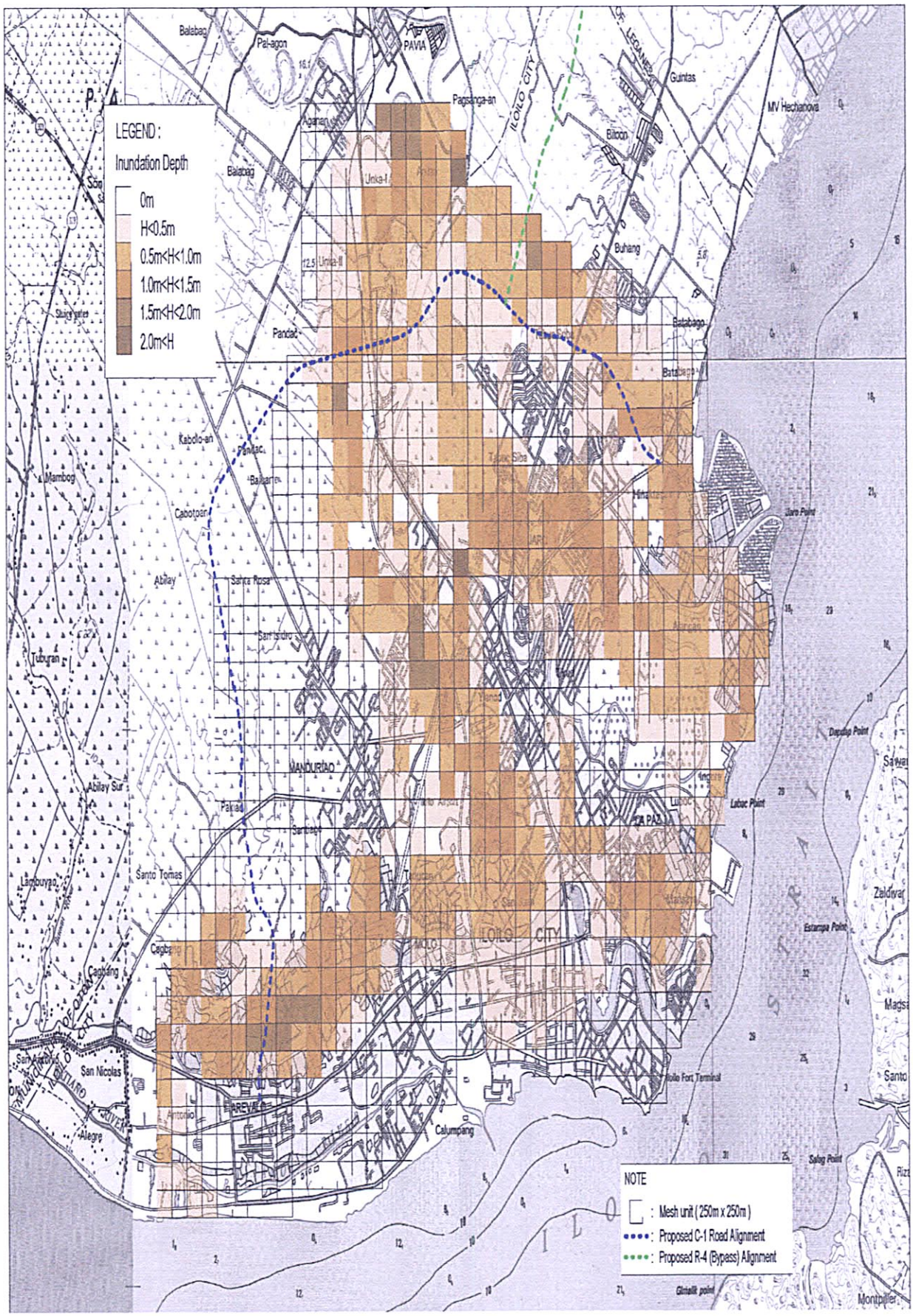


FIGURE 12.7.5–2 RESULT OF INUNDATION ANALYSIS OF A 50-YEAR RETURN PERIOD FLOOD, ILOILO CITY

12.7.6 Soft Ground Analysis

(1) Procedure of Analysis

The Procedure of Analysis is shown in the Figure 12.7.6-1

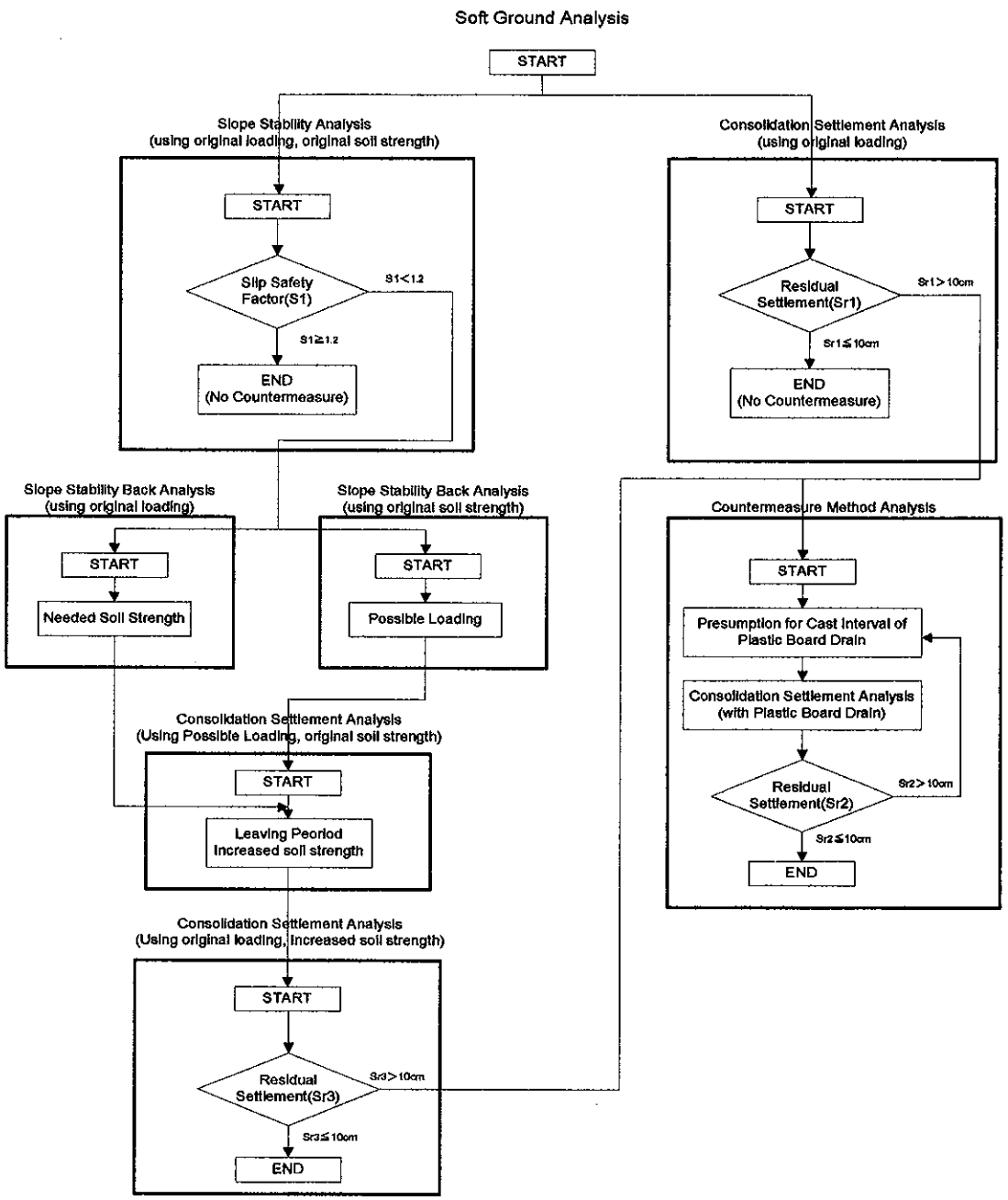


FIGURE 12.7.6-1 PROCEDURE OF ANALYSIS

Soft Ground Analysis was conducted to study the stability of embankment on the soft ground. Main problems of embankment on soft ground are both consolidation settlement and shear deformation. Shear deformation is composed of settlement and deformation of embankment itself and upheaval of side land of embankment mainly caused by slope slip.

Soft Ground Analysis consists of a consolidation settlement analysis and a slope stability analysis. Analysis method of the former and the latter analyses are one-dimension consolidation analysis and slip circle analysis respectively.

The analyses were conducted based on the soil data of the GEOTECHNICAL INVESTIGATION REPORT and the shape of the embankment proposed in 12.7.2 Road and Intersection Design.

(2) Analysis Sections

The Analysis Sections are shown in the Figure 12.7.6-2. And the chainage of each Section and applied Borehole No. for analysis are shown in the Table 12.7.6-1.

The Section is divided into 9 Sections from A to N. The Analysis Sections and locations of boreholes are expressed in this figure.

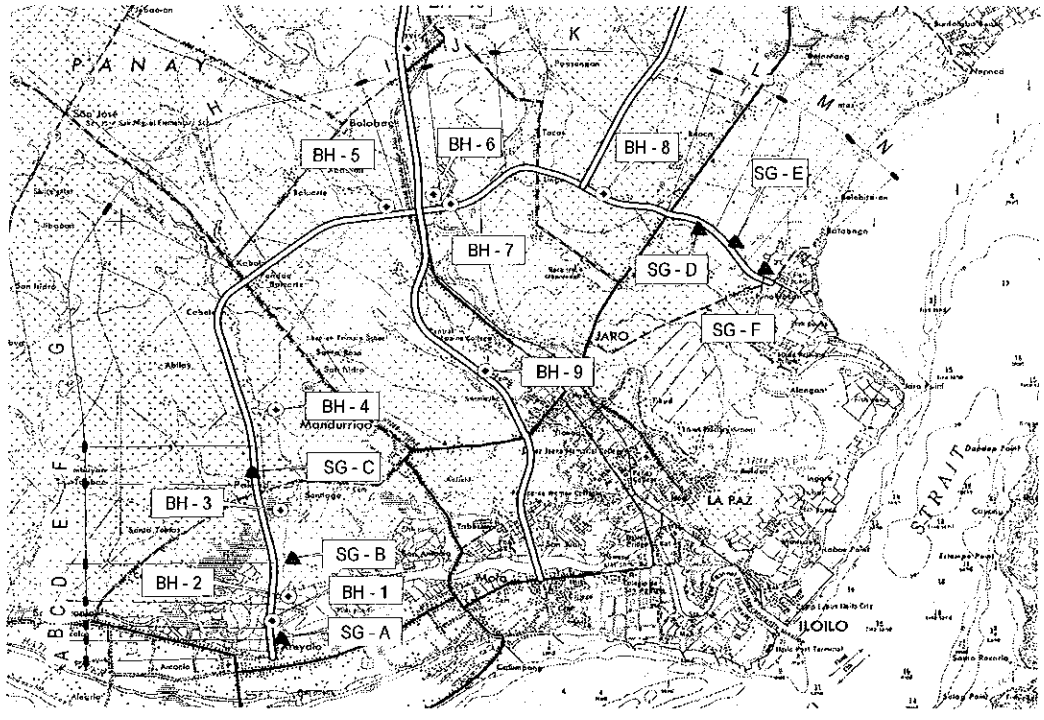


FIGURE 12.7.6-2 ANALYSIS SECTIONS

TABLE 12.7.6-1 ANALYSIS SECTIONS AND BOREHOLE NO.

Section	A	B	C	D	E	F	G
Chainage(STA.)	0+000 ~0+400	0+400 ~0+600	0+600 ~0+800	0+800 ~1+700	1+700 ~2+500	2+500 ~3+200	3+200 ~8+100
Borehole No.	SG-A	SG-B	BH-1	BH-2	BH-3	SG-C	BH-4

Section	H	I	J	K	L	M	N
Chainage(STA.)	8+100 ~8+500	8+500 ~8+800	8+800 ~9+900	9+900 ~12+500	12+500 ~13+200	13+200 ~13+700	13+700 ~14+184
Borehole No.	BH-5	BH-6	BH-7	BH-8	SG-D	SG-E	SG-F

(3) Soil Strata

The Soil Strata of the nearest Borehole Data from a Section is applied to each Section to analyze. And Soil as shown in the Table 12.7.6-2 is defined as Soft Ground.

TABLE 12.7.6-2 DEFINITION OF SOFT GROUND

Soil	Clay		Sand
Layer Thickness (m)	under 10	10 and over	-
N Value	4 and under	6 and under	10 and under
qu (kPa)	60 and under	100 and under	-

(4) Soil Value for Analysis

Shear Strength of Soil

Clay

Cohesion (c_u) of Clay is calculated from the below formula.

$$c_u = q_u/2$$

Where:

q_u = unconfined compressive strength

In case that unconfined compression test is not implemented, cohesion is supposed by the Table 12.7.6-3.

TABLE 12.7.6-3 COHESION OF CLAY

Consistency	c_u (tf/m^2)	N Value
Hard	>20	>15
Very Stiff	10~20	7.5~15
Stiff	5~10	4~7.5
Medium	2.5~5	2~4
Soft	1.25~2.5	1~2
Very Soft	<1.25	<1

Internal friction angle(φ) of Clay is 0 degree.

Sand

Cohesion of Sand is 0.

Internal friction angle (φ) of Sand is calculated from below formula.

$$\varphi(\text{degree}) = 15 + \sqrt{(15N)}$$

Where:

N = N Value

Consolidation Test Data

Consolidation Test Data such as e-log P curve and coefficient of consolidation are

in GEOTECHNICAL INVESTIGATION REPORT.

As a representative Soil Value, soil value of borehole No. BH-8 is shown in the Figure 12.7.6-3. (Other data are shown in the Figure App.-)

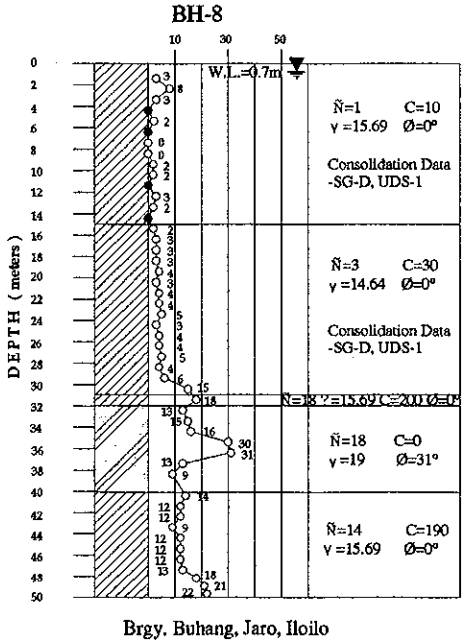


FIGURE 12.7.6-3 SOIL VALUE (BH-8)

(5) Analysis Result

The Summary of Analysis results are shown in the Table 12.7.6-4.

TABLE 12.7.6-4 SUMMARY OF SOFT GROUND ANALYSIS RESULTS

Section	A	B	C	D	E	F	G
Chainage(STA.)	0+000 ~0+400	0+400 ~0+600	0+600 ~0+800	0+800 ~1+700	1+700 ~2+500	2+500 ~3+200	3+200 ~8+100
Borehole No.	SG-A	SG-B	BH-1	BH-2	BH-3	SG-C	BH-4
Max. embankment height(m)	3	4	5	5	5	3	5
Max. final settlement (cm)	55	93	22	80	13	87	148
Max. residual Settlement (cm)	29	55	2	54	1	61	76
Slope Slip Slip Safety Factor [S] > 1.2 is needed	Safe	Safe	Safe	Safe	Safe	Safe	Safe

Section	H	I	J	K	L	M	N
Chainage(STA.)	8+100 ~8+500	8+500 ~8+800	8+800 ~9+900	9+900 ~12+500	12+500 ~13+200	13+200 ~13+700	13+700 ~14+184
Borehole No.	BH-5	BH-6	BH-7	BH-8	SG-D	SG-E	SG-F
Max. embankment height(m)	5	4	4	4	3	3	3
Max. final settlement (cm)	49	47	15	102	56	83	30
Max. residual Settlement (cm)	9	5	2	79	23	40	24
Slope Slip Slip Safety Factor [Fs] > 1.2 is needed	Safe	Safe	Safe	Not Safe (Fs=0.816)	Safe	Safe	Safe

···Countermeasure Method is needed.

(6) Countermeasure method against residual consolidation and slope slip

At all sections where the residual consolidation is over 10 cm on original soil condition analysis, accelerated consolidation method is applied. And at Section K, Applying both accelerated consolidation method and slow construction, Clay strength will increase and slope slip will not occur.

Various countermeasures against soft ground were compared as shown in Table 12.7.6-5. Vertical drain method was recommended for the countermeasure.

Vertical drain method

Appling Vertical drain method as accelerated consolidation method, the drainage distance of consolidation layer will shorten and consolidation settlement will terminate earlier. Plastic Board Drain Method is applied as vertical drain method,.

Layout of Plastic Board Drain is shown in the Figure 12.7.6-4.

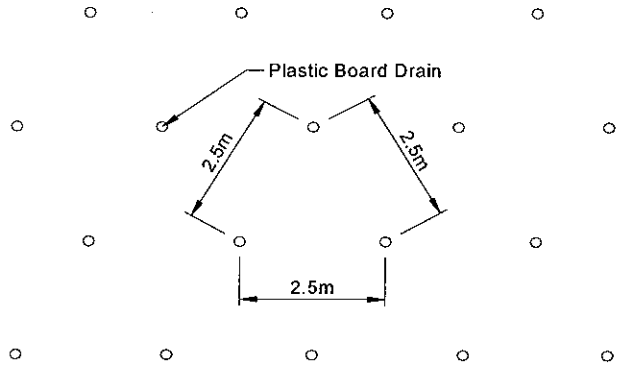


FIGURE 12.7.6-4 LAYOUT OF PLASTIC BOARD DRAIN

Consolidation Settlement Analysis with Plastic Board Drain

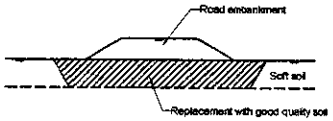
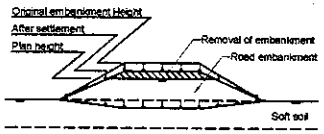
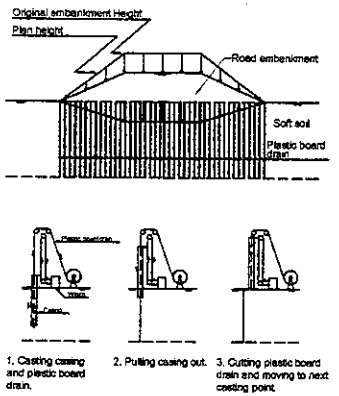
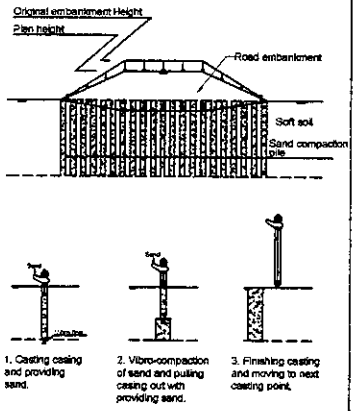
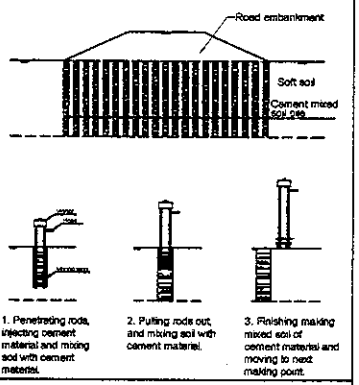
The maximum harmful residual settlement occurs at Section K and also land slip occurs only at Section K (See Table 12.7.6-4). Therefore this analysis was implemented using the condition of Section K.

The condition of this analysis is as follows:

Soil Strata = Borehole No. BH-8
First step embankment construction period = 40 days
First step embankment height = 2.0 m
Period of leaving the first step embankment = 320 days
Second step embankment height = 2.0 m (The first + the second = 4.0 m)
Period of leaving the second step embankment = 513 days

The result of this analysis is shown in the Figure 12.7.6-5.

Table 12.7.6-5 Selection of countermeasure against soft ground

	Replacement method	Pre-loading method	Vertical drain method(Plastic board drain method) + Pre-loading method	Sand compaction pile method	Deep mixing method
Princiole of method	To replace soft soil with good quality soil.	To promote consolidation settlement by loading filling load and increase soil strength.	**Vertical drain method** : To shorten drainage distance and accelerate consolidation by casting vertical drain. **Pre-loading method** : Same as left box.	To increase soil strength by casting sand pile compacting and shorten drainage distance.	To increase soil strength by mixing soil with cement material and hardenning them.
Cross Section					
Executive efficiency	**Merit** : Reliable effect can be expected. **Demerit** : In case that soft soil layer is thick, execution is hard.	**Merit** : Same as normal filling. **Demerit** : In case that soft soil layer is thick, it takes long time to settle and increase soil strength.	**Merit** : Effect of soil improvement will increase by using vertical drain method with pre-loading method. **Demerit** : In case that soft soil layer is thick, reliability of continuity of casted drain will decrease.	**Merit** : To cast strong sand pile, reliable improvement effect can be expected. **Demerit** : A large quantity of procurement of sand is difficult near the site.	**Merit** : To make mixed soil of cement material, reliable improvement effect can be expected. **Demerit** : It is difficult to procure executing machines in the Philippines.
Environmental consideration	To excavate the ground, Corridor of Impact will increase.	Same as normal filling.	There is no chemical environmental impact at all.	Noise and vibration will occur.	There is possibility of soil pollution by resolution of cement constituent.
Economical efficiency	Most inexpensive.	Relatively inexpensive.	Relatively expensive.	Relatively expensive.	Most expensive.
Evaluation	×	×	○	△	×

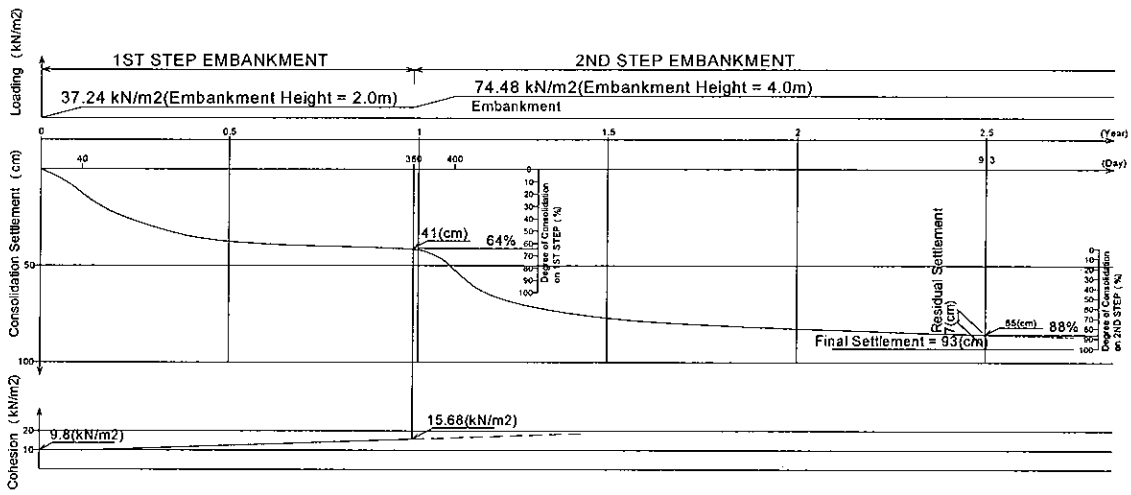


FIGURE 12.7.6-5 RESULT OF CONSOLIDATION SETTLEMENT ANALYSIS WITH PLASTIC BOARD DRAIN

At the time 913days (2.5 year) passed from the starting time of embankment construction, the residual settlement is 7 cm.

The results of Slip Circle Analysis on original condition and on the condition using increased soil strength are shown in the Figure 12.7.6-6 and in the Figure 12.7.6-7 respectively.

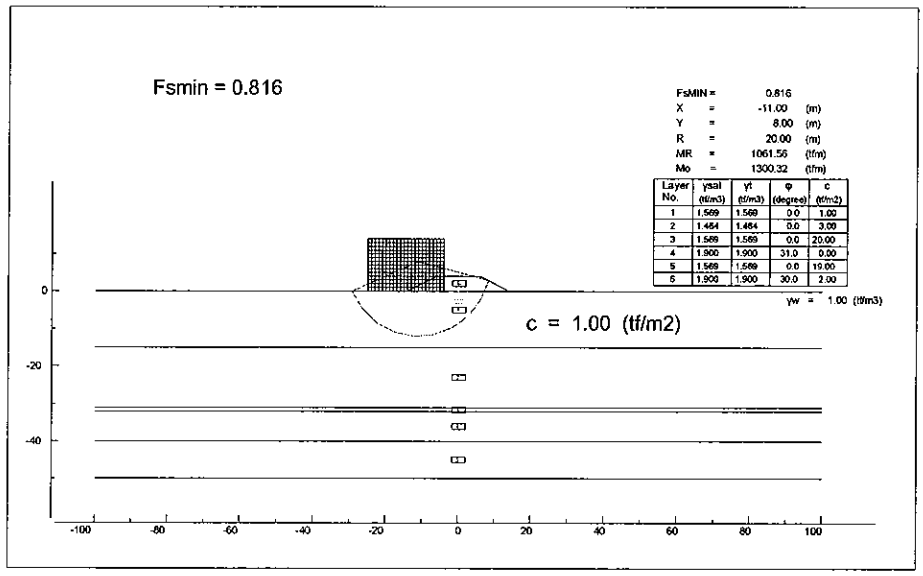


FIGURE 12.7.6-6 RESULTS OF SLIP CIRCLE ANALYSIS AT SECTION K
(Slip Circle Analysis on Original Condition (FS_{min}=0.816))

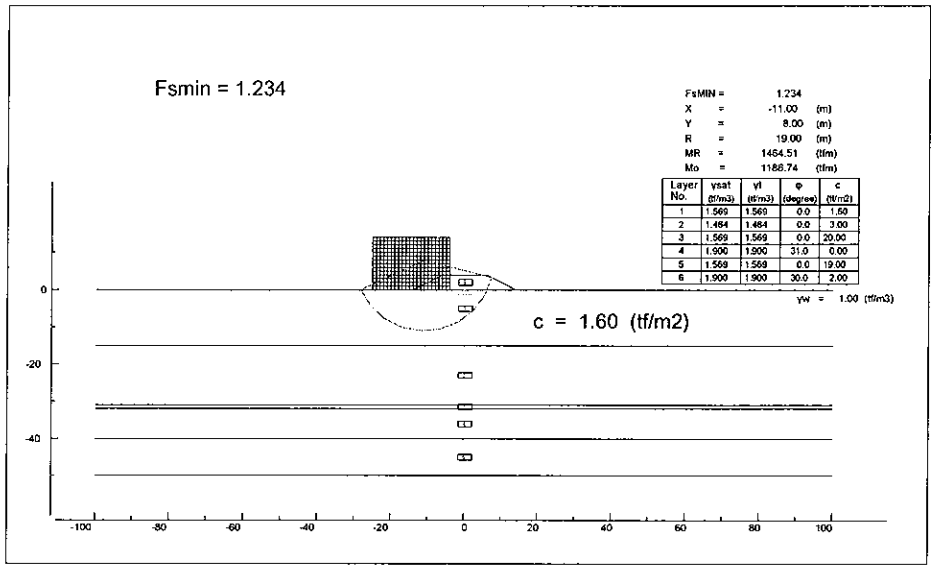


FIGURE 12.7.6-7 RESULTS OF SLIP CIRCLE ANALYSIS AT SECTION K

(Slip Circle Analysis on the condition using increased soil strength (Fs_{min}=1.234))

(7) The construction amount of Plastic Board Drain

The construction amount of Plastic Board Drain depends on both of the width of embankment and the depth of the bottom of the deepest clay layer. The construction amount of Plastic Board Drain is estimated in the Table 12.7.6-6.

TABLE 12.7.6-6 CONSTRUCTION AMOUNT OF PLASTIC BOARD DRAIN

Section	A	B	D	F	G	K	L	M	N	Total
Chainage(STA.)	0+000 ~0+400	0+400 ~0+600	0+800 ~1+700	2+500 ~3+200	3+200 ~8+100	9+900 ~12+500	12+500 ~13+200	13+200 ~13+700	13+700 ~14+184	
Distance(m)	400	200	900	700	4,900	2,600	700	500	484	11,384
Depth of the bottom of the deepest clay layer(m)	13	25	19	16	25	25	19	16	12	
Width of Embankment(m)	40	40	40	40	40	40	40	40	40	
Amount of Target Soil(m3)	208,000	200,000	684,000	448,000	4,900,000	2,600,000	532,000	320,000	232,320	10,124,320
Amount of Soil Casting Drain per meter(m3)	5.4125	5.4125	5.4125	5.4125	5.4125	5.4125	5.4125	5.4125	5.4125	
Casting Length(m)	38,430	36,960	126,380	82,780	905,320	480,370	98,300	59,130	42,930	1,870,600
Borehole No.	SG-A	SG-B	BH-2	SG-C	BH-4	BH-8	SG-D	SG-E	SG-F	

12.8 COST ESTIMATES

12.8.1 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 12.8-1, 2, 3 and 4, respectively.

(2) Construction Cost

Estimated construction cost is presented in Table 12.8-5. Detailed cost estimate is presented in Appendix 12.8-1. The construction cost of Circumferential Road No.1(C-1) was estimated at 661.3 Million pesos, composing of 54.1% a foreign currency component (or 358.3 Million pesos), 30.0% of a local currency component (or 198 Million pesos) and 15.9% of a tax component (or 105.0 Million pesos).

TABLE 12.8-5 CONSTRUCTION COST

(Million Pesos)

	Foreign	Local	Tax	Total
Amount	358.3	198.0	105.0	661.3
%	54.1%	30.0%	15.9%	100%

TABLE 12.8-1 MARKET PRICE OF CONSRUCTION MATERIALS IN ILOILO

(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 12.8-2 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 12.8-3 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 12.8-4 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.	51,000.00	57	27	16
101	Removal of Existing Sidewalk, Railings, Etc. for Bridge Widening	LS		48	28	24
102(1)	Unsuitable Excavation	m3	176.00	59	17	24
102(2)a	Surplus Common Excavation	m3	176.00	60	24	15
103(2)a	Bridge Excavation, Common (AWL)	m3	200.00	53	31	16
103(2)b	Bridge Excavation, Common (BWL)	m3	750.00	51	34	15
104(1)a	Embankment from Excavation	m3	194.00	54	20	26
104(1)b	Embankment from Borrow	m3	390.00	56	30	15
104(1)c	Selected Borrow for Backfilling	m3	547.00	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	148.00	65	20	15
	PART D - SUBBASE AND BASE COURSE					
200	Aggregate Subbase Course	m3	550.00	54	32	14
201	Aggregate Base Course	m3	650.00	53	33	14
202	Crushed Aggregate Base Course (AC)	m3	750.00	54	32	14
	PART E - SURFACE COURSE					
301(1)	Bituminous Prime Coat (MC-70 Cut-Back Asphalt)	t	25,000.00	65	17	18
302(2)	Bituminous Tack Coat (Emulsified Asphalt Grade SS-1)	t	25,000.00	65	18	18
310	Bituminous Concrete Surface Course, Hot Laid	t	3,500.00	64	18	18
311(1)a	PCC Pavement(Plain) (t=0.10m)	m2	450.00	62	23	15
311(1)c	PCC Pavement(Plain) (t=0.23m)	m2	770.00	62	23	15
311(1)d	PCC Pavement(Plain) (t=0.25m)	m2	820.00	62	23	15
311(2)	PCC Pavement(Reinforced) for Approach Slab, t=300mm	m2	4,480.00	62	23	15
	PART F - BRIDGE CONSTRUCTION					
400(4)	Precast Concrete Piles (0.45m×0.45m), Furnished and Driven	m	3,200.00	52	28	20
400(15)	Test Piles (0.45m×0.45m)	m	364.00	52	35	13
400(16)a	Cast-in-Place Concrete Bored Piles, φ1000mm	m	23,900.00	38	45	17
400(16)b	Cast-in-Place Concrete Bored Piles, φ1200mm	m	32,500.00	38	45	17
400(19)	Piles Shoes for 0.45m×0.45m Piles	ea	1,740.00	55	30	15
401	Concrete Railings	m	2,240.00	38	49	13
404(1)	Reinforcing Steel, Grade 40 (Fy=275Mpa)	kg	38.00	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	3,500.00	34	50	16
405(2)	Structural Concrete Class"A2" for Superstructure (f'c=24Mpa)	m3	5,240.00	34	50	16
405(3)	Structural Concrete Class"A3" for Others (f'c=21Mpa)	m3	4,500.00	34	50	16
405(6)	Structural Concrete "Lean Concrete" (f'c=17 Mpa)	m3	2,750.00	43	37	20
406(1)a	Prestressed Concrete Girder, AASHTO Type IV-B, L=22m	ea	331,400.00	22	62	16
406(1)b	Prestressed Concrete Girder, AASHTO Type IV-B, L=25m	ea	391,250.00	25	59	16
406(1)c	Prestressed Concrete Girder, AASHTO Type IV-B, L=26m	ea	405,480.00	22	62	16
406(1)d	Prestressed Concrete Girder, AASHTO Type IV-B, L=27m	ea	419,645.00	22	62	16
406(1)e	Prestressed Concrete Girder, AASHTO Type IV-B, L=28m	ea	441,755.00	20	65	15
406(1) f	Prestressed Concrete Girder, AASHTO Type V, L=30m	ea	505,185.00	20	65	15
406(1)g	Prestressed Concrete Girder, AASHTO Type V, L=31m	ea	520,815.00	20	65	15
406(1)h	Prestressed Concrete Girder, AASHTO Type V, L=34m	ea	622,080.00	17	69	14
406(1)i	Prestressed Concrete Girder, AASHTO Type VI, L=36m	ea	672,500.00	19	67	14
406(1)j	Prestressed Concrete Girder, AASHTO Type VI, L=40m	ea	815,870.00	17	69	14
407(1)a	Elastomeric Bearing Pad, 400×350×60 (Duro 60)	ea	18,000.00	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 (φ150mm G.I. Drain Pipe)	m	985.00	21	64	15
	PART G - DRAINAGE AND SLOPE PROTECTION STRUCTURES					
500(1)a	Reinforced Concrete Pipe Culvert, 610mmφ (Extra. Str.)	m	2,720.00	57	28	16
500(1)b	Reinforced Concrete Pipe Culvert, 910mmφ (Extra. Str.)	m	6,630.00	57	28	16
500(1)c	Reinforced Concrete Pipe Culvert, 1070mmφ (Extra. Str.)	m	10,000.00	57	28	15
500(1)d	Reinforced Concrete Pipe Culvert, 1220mmφ (Extra. Str.)	m	10,600.00	57	28	15
500(1)e	Reinforced Concrete Pipe Culvert, 1520mmφ (Extra. Str.)	m	18,800.00	57	28	15
500(3)a1	Reinforced Concrete Box Culvert 1-1.5m x 1.5m	m	16,400.00	42	43	15
500(3)a2	Reinforced Concrete Box Culvert 2-1.5m x 1.5m	m	26,100.00	42	43	15
500(3)a3	Reinforced Concrete Box Culvert 3-1.5m x 1.5m	m	36,500.00	42	43	15
500(3)b1	Reinforced Concrete Box Culvert 1-2.4m x 2.4m	m	27,700.00	42	43	15
500(3)b2	Reinforced Concrete Box Culvert 2-2.4m x 2.4m	m	47,300.00	42	43	15
500(3)b3	Reinforced Concrete Box Culvert 3-2.4m x 2.4m	m	67,100.00	42	43	15
500(3)c1	Reinforced Concrete Box Culvert 1-3.0m x 3.0m	m	37,900.00	42	43	15
500(3)c2	Reinforced Concrete Box Culvert 2-3.0m x 3.0m	m	66,600.00	42	43	15
500(3)c3	Reinforced Concrete Box Culvert 3-3.0m x 3.0m	m	93,900.00	42	43	15
500(3)d1	Reinforced Concrete Box Culvert 2-4.0m x 2.5m	m	81,400.00	42	43	15
502(2)b1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-910mmφ RCPC	ea.	19,300.00	28	57	15
502(2)b2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-910mmφ RCPC	ea.	25,900.00	28	57	15

TABLE 12.8-4 UNIT COST OF MAJOR CONSTRUCTION ITEM (2/2)

Item No.	Description	Unit	Unit Cost (Peso)	Component(%)		
				Foreign	Local	Tax
500(3)b3	Reinforced Concrete Box Culvert 3-2.4m x 2.4m	m	67,100.00	42	43	15
500(3)c1	Reinforced Concrete Box Culvert 1-3.0m x 3.0m	m	37,900.00	42	43	15
500(3)c2	Reinforced Concrete Box Culvert 2-3.0m x 3.0m	m	66,600.00	42	43	15
500(3)c3	Reinforced Concrete Box Culvert 3-3.0m x 3.0m	m	93,900.00	42	43	15
500(3)d1	Reinforced Concrete Box Culvert 2-4.0m x 2.5m	m	81,400.00	42	43	15
502(2)b1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-910mmφ RCPC	ea.	19,300.00	28	57	15
502(2)b2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-910mmφ RCPC	ea.	25,900.00	28	57	15
502(2)c1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1070mmφ RCPC	ea.	22,000.00	30	55	15
502(2)c2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1070mmφ RCPC	ea.	32,100.00	30	55	15
502(2)d1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1220mmφ RCPC	ea.	27,400.00	31	54	15
502(2)d2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1220mmφ RCPC	ea.	38,600.00	31	54	15
502(2)f1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 1-1520mmφ RCPC	ea.	37,300.00	33	52	15
502(2)f2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, 2-1520mmφ RCPC	ea.	53,200.00	33	52	15
502(10)a1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-1.5m x 1.5m	ea.	51,200.00	44	41	15
502(10)a2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-1.5m x 1.5m	ea.	61,400.00	45	40	15
502(10)a3	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-1.5m x 1.5m	ea.	72,700.00	45	40	15
502(10)b1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-2.4m x 2.4m	ea.	104,000.00	44	41	15
502(10)b2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-2.4m x 2.4m	ea.	126,000.00	45	40	15
502(10)b3	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-2.4m x 2.4m	ea.	145,000.00	45	40	15
502(10)c1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 1-3.0m x 3.0m	ea.	152,000.00	44	41	15
502(10)c2	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-3.0m x 3.0m	ea.	183,000.00	45	40	15
502(10)c3	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 3-3.0m x 3.0m	ea.	207,000.00	45	40	15
502(10)d1	Reinforced Concrete Headwall,Wingwall,Bottom Slab, Box Culvert 2-4.0m x 2.5m	ea.	203,000.00	45	40	15
502(3)a1	Catch Basin for RCPC 1-φ610	ea.	16,800.00	38	47	15
502(3)b1	Catch Basin for RCPC 1-φ910	ea.	24,700.00	38	47	15
502(3)b2	Catch Basin for RCPC 2-φ910		38,700.00	39	46	15
502(3)c1	Catch Basin for RCPC 1-φ1070	ea.	28,900.00	38	47	15
502(3)c2	Catch Basin for RCPC 2-φ1070		46,500.00	39	46	15
502(3)d1	Catch Basin for RCPC 1-φ1220	ea.	37,800.00	38	47	15
502(3)d2	Catch Basin for RCPC 2-φ1220		62,300.00	39	46	15
502(3)e1	Catch Basin for RCPC 1-φ1520	ea.	48,400.00	38	47	15
502(3)e2	Catch Basin for RCPC 2-φ1520		82,200.00	39	46	15
504(5)	Grouted Riprap, Class "A"	m3	2,250.00	48	36	15
505(1)	Stone Masonry	m3	2,360.00	55	30	15
505(2)	Gravity Type Retaining Wall(H=1.0~1.5m)	m3	5,560.00	44	41	15
507	Steel Sheet Pile (85×400×8mm), Furnished and Driven	m	1,430.00	55	30	15
509	Gabions	m3	3,510.00	51	34	15
510	Rubble Concrete Slope Protection, t = 350mm	m3	2,010.00	51	34	15
511(a)	Concrete Side Dicth (0.5 x 0.5)	m	2,270.00	38	47	15
	PART H - MISCELLANEOUS STRUCTURES					
600(1)a	Concrete Curb, Type A (200x450mm)	m	640.00	58	27	15
600(1)c	Concrete Curb for Edge of Sidewalk(200*500)	m	760.00	58	27	15
600(3)a	Combination Concrete Curb & Gutter/Side Strip, Type A (675x364mm)	m	1,095.00	58	27	15
602(2)	Maintenance marker post	ea.	1,070.00	24	64	12
602(3)	Kilometer post	ea.	1,490.00	24	64	12
602(4)	Guide post	ea.	1,250.00	24	64	12
603(3)a	Metal Guardrail	m	2,300.00	58	27	15
610	Sodding	m2	182.00	58	27	15
611(1)	Trees (Furnishing and Transplanting)	ea.	1,220.00	58	27	15
SPL620(1)	Traffic Signal (3-way intersection)	ea.	2,024,400.00	65	20	15
SPL620(2)	Traffic Signal (4-way intersection)	ea.	2,205,700.00	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)					

12.8.2 ROW Acquisition and Compensation Cost (C-1 Iloilo)

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 12.8-6.**

TABLE 12.8-6 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
Rice Field	25 - 32	250
Fish Pond	15 - 32	250
Fruit Orchard	3.5 – 9.0	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 by present land uses are computed based on aerial-photo map and verified by field survey. Number of houses is tentatively obtained from aerial-photo map and will be verified by field investigation during social impact survey. Summary of compensation is shown in **Table 12.8-7.** Detailed estimate is presented in Appendix 12.8-2.

TABLE 12.8-7 ESTIMATED ACQUISITION AND COMPENSATION COST

Item	Quantity	Amount (Million Pesos)
Land Acquisition	**557,350 m^2**	**222.4**
Residential	36,948	105.4
Rice Field	474,203	106.0
Fish Pond	35,600	8.9
Fruit Tree	10,600	2,1
Structures	87 structures	21.9
Other Compensation		**6.1**
Total		**250.4**

12.8.3 Detailed Engineering and Construction Supervision Cost

Engineering services cost for a detailed design ranges from 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 12.8-8 ENGINEERING SERVICE COST

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	32.0 (55%)	20.3 (35%)	5.8 (10%)	58.1 (100%)
Construction Supervision	29.1 (55%)	18.5 (35%)	5.3 (10%)	52.9 (100%)
Total	**61.1 (55%)**	**38.8 (35%)**	**11.1 (10%)**	**111.0 (100%)**

Note: Detailed design cost includes the design of Ultimate Stage.

12.8.4 Summary of Project Cost

Summary of the project cost is shown in Table 12.8-9.

TABLE 12.8-9 SUMMARY OF PROJECT COST : INITIAL STAGE

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	32.0	20.3	5.8	58.1
ROW/Resettlement	-	225.2	25.0	250.2
Construction	358.3	198.0	105.0	661.3
Construction Supervision	29.1	18.5	5.3	52.9
Total	**419.4**	**462.0**	**141.1**	**1,022.5**

12.8.5 Maintenance Cost for C-1

(1) Road and Bridge Conditions and EMK Factors

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

Item	Conditions	EMK Factor
Road Length (km)	13.9	-
Traveled Way Width (m): AC	2-lane < 7.5m	1.0
Bridge Length (total) (l.m)	406	0.01
AADT (2010)	14,500	1.15
Opening Year	2013	-

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 of Routine and Periodic Maintenance

Item	Unit	Financial Cost (Peso)	Economic Cost (Peso)
Routine maintenance (AC Paved: good condition)	km/year	94,850	71,707
Periodic maintenance (AC=5cm overlay at 10 year-interval)	m2	495.00	389.73

(3) Maintenance Cost

Maintenance cost is estimated based on EMK and base costs of routine and periodic maintenance, and shown in Table 12.8-10.

TABLE 12.8-10 MAINTENANCE COST OF C-1

	Calendar	Factors			EMK	Financial Cost (x1000Peso)			Economic Cost (x1000Peso)		
	Year	AADT	Lane	Bridge	(km)	Routine	Periodic	Total	Routine	Periodic	Total
1	2013	1.17	1.00	4.06	20.29	1,925	0	1,925	1,455	0	1,455
2	2014	1.17	1.00	4.06	20.39	1,934	0	1,934	1,462	0	1,462
3	2015	1.18	1.00	4.06	20.48	1,942	0	1,942	1,468	0	1,468
4	2016	1.19	1.00	4.06	20.57	1,951	0	1,951	1,475	0	1,475
5	2017	1.20	1.00	4.06	20.71	1,964	0	1,964	1,485	0	1,485
6	2018	1.21	1.00	4.06	20.85	1,978	0	1,978	1,495	0	1,495
7	2019	1.22	1.00	4.06	20.99	1,991	0	1,991	1,505	0	1,505
8	2020	1.23	1.00	4.06	21.13	2,004	0	2,004	1,515	0	1,515
9	2021	1.24	1.00	4.06	21.27	2,017	0	2,017	1,525	0	1,525
10	2022	1.25	1.00	4.06	21.41	2,031	0	2,031	1,535	0	1,535
11	2023	1.26	1.00	4.06	21.55	2,044	48,264	50,308	1,545	40,714	42,259
12	2024	1.27	1.00	4.06	21.69	2,057	0	2,057	1,555	0	1,555
13	2025	1.28	1.00	4.06	21.83	2,070	0	2,070	1,565	0	1,565
14	2026	1.29	1.00	4.06	21.97	2,083	0	2,083	1,575	0	1,575
15	2027	1.30	1.00	4.06	22.10	2,097	0	2,097	1,585	0	1,585
16	2028	1.31	1.00	4.06	22.24	2,110	0	2,110	1,595	0	1,595
17	2029	1.32	1.00	4.06	22.38	2,123	0	2,123	1,605	0	1,605
18	2030	1.33	1.00	4.06	22.52	2,136	0	2,136	1,615	0	1,615
19	2031	1.34	1.00	4.06	22.66	2,149	0	2,149	1,625	0	1,625
20	2032	1.35	1.00	4.06	22.80	2,163	0	2,163	1,635	0	1,635

12.9 ENVIRONMENTAL IMPACT ASSESSMENT

12.9.1 General Characteristics of the Project Road

The project road traverses perimeter of Iloilo City where most land use is rice field with spotted residential areas at intersections of major arterial roads and strip of coconut orchard along creeks and minor tributaries. Fish ponds currently no operational are found at beginning of the project road in Barangay San Jose. The proposed project is a construction of new two-lane highway named "Circumferential Road No.1". Required right-of-way (ROW) is estimated at mostly 40m that includes land for future widening to four lanes. Five (5) major bridges are proposed to be constructed over Iloilo River (L=104m), Mandurriao River (Br.1 L=82m Br.2 L=51m), Dungon River (L=62m), and Jaro River (L=93m).

The Initial Environmental Examination conducted in July 2003 reported that there were no significant environmentally sensitive spots, such as historical structures, religious institutions and environmentally protected areas, along the proposed road alignment. However, subdivisions, memorial parks, socialized housing and garbage dumping site are planned to be developed, some of them are even under construction. Proposed location of such development sites is considered in selection of final alignment and most of them are avoided.

12.9.2 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 12.9-1** 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. • 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 included in this report as mitigating and enhancement measures to address adverse socio-economic impacts.
4) Mitigating and Enhancement Measures	• Included in **Table 12.9-5**
5) Involve Women and Vulnerable Groups	• Active participation of women and vulnerable groups, such as informal settlers and tenants/renters are considered as mitigating and enhancement measures to address adverse socio-economic impacts.
6) Environmental Monitoring and Evaluation	• Included in **Table 12.9-6**

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

12.9.3 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 the project area were presented to DENR Regional Office. It was agreed that the preparation of EIS was not needed since length project roads are less than 20.0km. However, IEE report that contains the following parameters were agreed to be surveyed.

1. Physical Environment
   a. Climate
   b. Terrain
   c. Air Quality
   d. Hydrology
   e. Noise Level
   f. Land Use
2. Biological Environment
   a. Flora and Fauna
3. Socio-Economic Environment
   a. Demography and Basic Information
   b. Health
   c. Other Social Services/Utilities
4. Social Acceptability

Based on the agreed parameters, the collection of baseline information has been carried out in February 2004. The result of baseline survey is discussed in the next section.

12.9.4 Description of Existing Environmental Condition

1) Physical Environment

Climate

The nearest synoptic meteorological station in the project area is located in Iloilo City. Based on the Modified Corona's Classification, the climate in the project area belongs to Type III and I. A not very pronounced season describes climate Type III. Two (2) pronounced seasons, the wet and dry typifies climate Type I. In both climate types, the dry spell is felt starting December and stretches up to April, while rest of the year is wet season.

The climate characteristics of the project area are summarized in **Table 12.9-2**.

TABLE 12.9.-2 SUMMARY OF CLIMATE CHARACTERISTICS

Data Type	Monthly Normals			Remarks
	Max	Min	Mean	
Rainfall	388.8 mm (Aug.)	30.4 mm (Feb.)	-	Annual Rainfall 2,194 mm
Temperature	33.8°C (Apr.)	22.6°C (Jan.)	27.8°C	
Humidity	84% (July~Nov.)	73% (Apr.)	81%	
Wind	NNE 4 m/s	SW 3 m/s	NNE 3 m/s	

Terrain

Terrain of the project area is generally flat (0-3%) with very limited rolling terrains with 3-8% only. The elevation of the road goes up from coastal sections (3.0m) toward inland sections (16.0m) without any abrupt changes in terrain condition. Iloilo River crosses the proposed alignment at station 0+750 in Barangay San Jose and Jaro River at station 8+600 in Barangay San Isidro. Both rivers frequently inundate project area during tropical cyclones. Elevation of road sections near Iloilo River is designed to raise above projected flood level and slope of embankments is protected by grouted riprap. Inundations around Jaro River are expected to be mitigated significantly with completion of flood control project currently undertaken under JBIC fund. Hence, elevation of the project road around the area is set as ordinary level.

Air Quality

One sampling site for ambient air quality measurement was established in Barangay Polo Maestra Vita, Municipality of Oton for the measurement of the ambient air quality specifically for total suspended particulates (TSP). Results of the sampling indicate that the concentration recorded was only 95.0 micrograms per normal cubic meter. This concentration is way below the standard established by the Department of Environment and Natural Resources at 230.0 micrograms per normal cubic meter.

Noise Level

Noise level measurements were done also at Barangay San Isidro-Hibao-an Norte using a Noise Level Meter. Readings were taken for evening, nighttime, morning, and daytime. The average readings taken at the time of sampling is as follows:

	Time		Reading	DENR Standard
Morning	(5:00 AM – 9:00 AM)	:	63.7 db	50
Daytime	(9:00 AM – 6:00 PM)	:	75.6 db	55
Evening	(6:00 PM – 10:00 PM)	:	63.0 db	50
Nighttime	(10:00 PM – 5:00 AM)	:	63.2 db	45

By comparing with the standards established for the purpose, all readings are above standards, which mean that ambient noise level in the area is already high.

Land Use

Land use along project road is mainly agricultural composed of rice field, coconut orchard and fishpond. Some residential areas are spotted at intersection of exiting arterial roads. There are no major commercial establishments along the project alignment but several large size subdivisions are proposed to be developed or under construction at Barangay Sta. Rosa.

2) Biological Environment

Floral Composition

The Iloilo Circumferential Road (C-1) traverses mainly suburban housing areas, rice fields and idle lands. A few patches of vegetation remain in the southern entrance and the western parts of Iloilo City. Most areas are sporadically planted with mahogany (*Swietenia mahogany*), *talisay* (*terminalia catappa*), *Leucaena leucocephala* (ipil-ipil), *Gmelina*, *Mangifera indica*, *Azidarachta indica* (Neem tree), *Pithecolobium dulce* (Kamonsil), *Eucalyptus*, *Chrysophyllum caimito*, *Tamarindus indicus*, *Acacia auriculiformis*, *Bixa orellana* (*Atchuete*), *Polyalthia longifolia* (Indian willow tree), *Muntigia calabura* (*Datilis*), *Samanea saman* (Rain tree), several fruit trees (mangos, guavas, coconut, atis, papaya, citrus, banana, jackfruit, etc.) and vegetables (squash, melons, horse radish). One area was selected near the southern entrance at Pakiad, Oton with coordinates 447324E and 1183981N with elevation of 23.0 masl. The site sampled is an orchard planted with mangos, jackfruit, coffee, cacao, atis, guyabano, caimito, chico, pomelo, citrus, mabolo, coconut, and guavas.

As seen on the aerial photo, the area has a very thick vegetation due to bamboo thickets (*Bambusa blumeana* and *B. arundinacea*) interspersed with tall buri palms (*Corypha elata*) and *Licuala sp.* Inside the bamboo thickets are shrubs and small trees of *Macaranga aleuritoides*, *Macaranga tanarius*, *Nauclea orientalis*, *Ficus pseudopalma*, *Premna odorata*, *Sysigium samaragense*, *Clerodendron sp.*, *Morinda citrifolia*, *Diospyros discolor*, *Gliricidia sepium*, *Vitex parviflora*, *Eucalyptus globulus* etc. No large trees are evident except shrubs and two to three year old trees such as *Jatropha curcas*, *Abutilon*, *Cordia dichotoma*, *Alocasia macrorhiza*, *Colocasia esculentum*, *Spondias sp. Sandoricum.*

After the harvest season, the early colonizers are vines (Cardiospermum halicacabum) and herbs (*Hyptis suaveolens*). They will later on compete with grasses and other weeds such as *Eleusine indica*, *Chloris barbatra*, *Paspalum conjugatum*, *Amaranthus spinosus*, *Elephantopus mollis*, *Stachytharpeta jamaicensis* and *Mimosa pudica.*

On idle lands and near shady areas, the composite weed, *Wedelia triflora*, dominates while on roadsides, *Ruellia tuberose* (*Acanthaceae*), and in empty places the aromatic sacred basil (*Ocimum sanctum*) and *Chromolaena odorata*, and some legumes such as *Casia alata*, *Clitorea ternatea*, *Tephrosia sp.* Cogon (*Imperata cylindracea*) dominates in wide open idle lands. If there are already shrubs and trees in vacant lots, they will be adorned with another vine, *Antigonon leptopus* or *Aristolochia tagala.*

Local folks are fond of ornamentals such as the ubiquitous *Duranta repens* or Golden Rosary, *Justicia brandegensis*, *Justicia gendarusa*, *Plumeria obtusa* (Calachuchi) *Cymbopogon citratus*, *Bouganivilla spectabilis*, *Gliricidia sepium*, *Sanseviera*, *Euphorbia*, *Lantana camara*, *Portulaca* (Morning Glory), and *Catharanthus roseus.*

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 Calajunan River bordering Barangay Pakiad, Municipality of Oton with Barangay Calajunan, Mandurriao, Iloilo City, but it has to be established preferably before the start of construction because it is unlikely that there could be species of importance considering that it is too shallow when observed at the time of the field work.

3) Socio-Economic Environment

Demography

Settlement and Population Distribution

The settlement and population distribution of the province as well as those of the project-hosting local government units typically follows either along roads or rivers and coasts where transportation is easily accessible and convenient. In the case of the Iloilo Circumferential Road No.1, the settlements are still observed clustered along intersections of existing roads. The road once constructed will exhibit the same characteristics especially so if no regulatory interventions are set in place.

Population and Population Growth Rate

Iloilo City has a total population of 365,820 distributed over its five districts, and lone congressional district while the Municipality of Pavia and the Municipality of Oton has 32,824 and 32,824, respectively. The population growth rates of these local government units vary from a low percentage of 1.93% (Iloilo City) to a very high percentage of 4.17% (Municipality of Pavia). The Municipality of Sta. Barbara on the other hand has a population growth rate of 3.04%. These growth rates are higher than that of the region and the Province of Iloilo (except Iloilo City).

TABLE 12.9-3 POPULATION AND POPULATION GROWTH RATE

Region/ Province/ Iloilo City/LGU	Total Population		HH Population	No. of HH	Average HH Size	Annual Growth Rate*	Population Density (persons/ha)
	2000	1995	2000	2000	2000	1995-2000	2000
Region VI	6,208,733	5,776,938		1,211,647	5.12	1.560	3.07
Iloilo Province	1,559,182	1,415,022		298,593	5.22	2.100	3.34
Iloilo City	365,820	334,539	363,667	72,218	5.04	1.930	52.20
Leganes	23,475	19,235	23,473	4,533	5.18	4.060	7.29
New Lucena	19,490	16,873	19,490	3,744	5.21	2.930	4.40
Oton	65,374	56,821	65,364	12,907	5.06	2.840	7.70
Pavia	32,824	26756	32,756	6,553	5.00	4.170	9.40
Sta. Barbara	46,076	39,667	45,969	8,821	5.21	3.040	5.90
Zarraga	18,252	17,519	18,243	3,507	5.20	0.823	2.30

Sources: Socio-Economic Profiles, Census in Housing and Population 1995 and 2000

Number of Households and Household Size

The comparative number of households and household sizes are shown in **Table 12.9-3** above. Of the three local government units affected by the project, Iloilo City has the most number of households (72,218) followed by the Municipality of Oton (8,821) and the Municipality of Pavia (6,553).

Population Densities

The comparative population densities are shown in **Table 12.9-3**. Of the three local government units traversed by the project, Iloilo City is the most dense (52.2 persons/hectare), while the Municipality of Oton is the least (5.9 persons per hectare).

Literacy and Highest Educational Attainment

The simple literacy rate for Iloilo City was 98.62% for both sexes for ages 10-64 years old. Simple literacy refers to the ability of a person to read and write with understanding of a simple message in any language or dialect. The functional literacy[2] rate was 86.94% for both sexes in 1994.

Main Sources of Income

Most business establishments are found in Iloilo City where there are 4,072 wholesalers and retailers, 1,726 community, social and personal service providers, 1,050 financing, insurance, real estate and business companies, and 10 agriculture, fishery and forestry companies and a water company. Tourism is a major industry in Iloilo Province. Hotels, and motels can be found in Iloilo City, which registered a tourist arrival figure of 570,898 in 2000. Among the attractions in Iloilo City include old churches, museums, and old houses.

Pavia's designation as the Regional Agro-Industrial Center (RAIC) in 1991 has resulted to the influx of industries in the town. Aside from the existing companies like San Miguel Corporation, Coca Cola Bottlers Phils., Inc. and Jaspe Light Steel Industries, a number of corporations have also relocated in Pavia. Among them are the Basic Fruits Corp., Pryce Gas, Pre-Stress International, Kimwa Construction, Mandaue Foam and Vitarich Corporation.

Employment Status

By working population, Iloilo City had a working age group figure that ranged from 244,000 to 248,000 in 2002. Its labor force participation rate for that year was from 58.6 to 65.8 while its employment rate ranged from 85.8 to 88.1 percent. In the same year, the Province of Iloilo had a working age group between 1,017,000 to 1,033,000 with an employment rate of between 81 to 91.9 percent. For the year 2000, its total dependency ratio was computed at 36%.

Health

The required information presented below were culled from the reports of the local government units; the Philippine Health Statistics, and Field Health Service Information System published annually by the Health Intelligence Service of the Department of Health. The latest data used in this report is circa 1997.

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[2] Functional literacy refers to a significantly higher level of literacy which includes not only reading and writing skills but also numerical skills (1994 Functional Literacy, Education and Mass Media Survey NSO-DECS).

Morbidity and Mortality

The ten leading causes of mortality in 2002 for Iloilo City were the following: pneumonia, diarrhea, hypertension, bronchitis, diseases of the heart, TB (all forms), accidents/wounds, dengue H-fever, malignant neoplasm and influenza. The ten leading causes of mortality in the same year were diseases of the heart, pneumonia, cancer, hypertensive disease, accident/wounds, septicemia, kidney disease, TB (all forms) liver disease and diabetes (City Health Office, 2003).

Local Health Resources

Iloilo City has five (5) hospitals that are equipped to perform tertiary services. Two of these hospitals are government-owned. The City Health Office has the following health manpower: physician, nurses, dentists, medical technologists, sanitary inspectors one pharmacist, nursing attendants, laboratory technicians, nutritionists/ dieticians, health educators, statisticians, and administrative staff.

Environmental Health and Sanitation Profile

In 1997, Region VI had a reported total of 1,102,182 households. Of this number, more than 20% have no access to safe water at all. Most of the households (44%) however, had access to Level I water supply[3] and a little more than a fifth (24.3%) had access to Level III services. For the same period, a higher percentage (59.4%) of the total number of households in Iloilo had access to Level I service.

The percentage of households in Region VI with sanitary toilet was reported at 74.3%. But the percentage of households in Iloilo with the same access to toilet facilities is lower at 64.7%. The percentage of households with satisfactory garbage disposal in the province had been reported to be only 42.5%, which is lower to that of the region (56.6%). Only a little more than half (53%) of the total number of households in the region had complete sanitation facilities. But the percentage of total number of households in the province who has the same facilities stood at only 34.7%.

In 1997, the Department of Health reported that Iloilo had a total of 9,796 food establishment. Of this number, only less than 3% operated without sanitary permits. This total number of establishment employed a total of 16,835 food handlers. But of this number, only 95.9% had health certificates.

Other Social Services/Utilities

Water Supply and Demand

The Metro Iloilo Water District serves an estimated population of 225,000. The water capacity per day was 37.707 m^3/day and its water demand was 64.541 m^3/day. Households with total water services connection reached 14,335. Other households also get their water supply from deep wells and by buying distilled or purified water. Water supply for the Municipality of Sta. Barbara comes from its vast underground reserve and the Sta. Barbara Water District.

Existing Transportation Characteristics

Iloilo Province has a river port, a domestic seaport, an international port and an

[3] Level I Water Supply : water is not distributed
Level II Water Supply : water is distributed only to the center of the community
Level III Water Supply : water is distributed to each household

international seaport. Seventy-two (72) foreign vessels and 10,471 domestic vessels docked at the port of Iloilo in 2000.

Iloilo City has an airport located in Mandurriao District, with a 2,100m x 45m runway a modern terminal, with computerized facilities to accommodate flights from key cities in the country. It serves three commercial airlines and had a passenger traffic figure of 702,995 in 2001.

Power

Power in Iloilo City is supplied by Panay Electric Company through its general capacity of 72 megawatts diesel power plant located at Barangay Ingore, Lapaz, Iloilo City. The total energy sold to Panay Electric Company for distribution to its consumers for 2002 was 367,122 megawatts/hr. All barangays in Iloilo City are energized by PECO.

Communication

The communication needs of the areas are met by either the PLDT, cellular phones, and ICOM handheld transceivers.

12.9.5 Perception Survey

The Perception Survey was conducted in the eleven (11) barangays that will be 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 648 respondents were identified during the survey. Most of these respondents (84.9%) were randomly selected within the barangays while the rest (15.1%) were directly selected within the barangay since they are most likely along the project alignment.

TABLE 12.9-4 DISTRIBUTION OF RESPONDENTS BY BARANGAY

City/Barangay	Directly Affected		Indirectly Affected		Total	
	Number	%	Number	%	Number	%
Iloilo City						
Balabago	5	5.1	136	24.7	141	21.8
Buhang	0	0	50	9.1	50	7.7
Tacas	2	2.0	93	16.9	95	14.7
San Isidro-Jibaoan	6	6.1	35	6.4	41	6.3
Sooc	31	31.6	30	5.4	61	9.4
San Jose	8	8.1	33	6.1	41	6.3
Calahunan	6	6.1	29	5.3	35	5.4
Sub-total	**58**	**59.2**	**406**	**73.8**	**464**	**71.6**
Municipality of Pavia						
Ungka II	35	35.7	30	5.4	65	10.0
Pandac	0	0	29	5.3	29	4.5
Sub-total	**35**	**35.7**	**59**	**10.7**	**94**	**14.5**
Municipality of Oton						
Pakiad	5	5.1	49	8.9	54	8.3
Polo Maestra Vita	0	0	36	6.5	36	5.6
Sub-total	**5**	**5.1**	**85**	**15.4**	**90**	**13.9**
Total	**98**	**100**	**550**	**100**	**648**	**100**
% Distribution		15.1		84.9	100	

1) Awareness about the Project

Majority of the respondents (83.8%) of the total number of respondents already heard of the plan for the implementation of the project.

More than half (56.5%) of the respondents heard about the project just recently, but more than a third (34.1%) have already heard about it 1 or 2 years ago, while less than a tenth (6.8%) heard about it more than 2 years ago.

2) Agreement for the Project

More than four-fifths (85.5%) of the respondents are in favor of the implementation of the project. More than a fifth each said that the project will give way to development of the area and the province as a whole (28.9%) and offer safe and efficient transport of people, goods and services (28.7%). More than a tenth (14.5%) did not provide any response.

3) Effect on Source of Income

More than two-thirds (69.8%) of the respondents said that their livelihood will not be affected. More than a fifth (24.8%) said that there will be loss of livelihood, employment and property.

4) Good Things Seen about the Project

About a third (32.7%) of the respondents believed that with the project, there will be easy and fast access to the region while more than a fifth (22.8%) said there will be less traffic in main highway. More than a tenth (15.4%) added that the city or barangay will improve or develop while about a fifth (19.8%) said it will benefit the majority with opportunities for opening of new business.

5) Benefits Expected from the Project

More than half (56.0%) 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 tenth (12.0%) of the respondents, there will be also opening of new industries along the alignment and consequent offer of employment. More than a tenth (15.1%) also said that the project may bring about improvement of barangay. 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 (30.6%) of the total number of respondents said that there will be loss of livelihood/relocation and compensation problem of affected families. On the other hand, more than a fifth (23.9%) said that there will be no bad things that can be seen resulting from the project. About a tenth (10.8%) said that there will be increase in noise and air pollution level. Also less than a tenth (9.7%) said that fast moving vehicles may cause accidents. The rest are spread to other responses such as strangers will be coming into the barangays (0.5%); disruption of regular

activities of barangay residents (3.9%); and increased crime rate (1.5%).

7) Problems Foreseen for the Community as a Whole

More than a third (34.7%) of the respondents believe that the project will not bring any problems to the community as a whole, but more than a tenth (16.2%) said that there will be loss of properties/livelihood problems (lack of jobs). In addition, more than a tenth (11%) said that there will be increased pollution/problem of flooding/heavy erosion and landslide.

12.9.6 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 12.9-5**, Impacts and Mitigation/Enhancement Matrix.

12.9.7 Environmental Management and Monitoring Plan

The Environmental Management and Monitoring Plan is presented in **Table 12.9-6**.

12.9.8 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 12.9-5 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 12.9-5 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: 87	High		Government must ensure that the affected structures are properly compensated based on 'Replacement Cost" method as provided by laws and regulations.
Loss of Land			
Ricefield 474,203 m^2 Residential 36,948 Fruit Tree 10,600 Fishpond 35,600 **Total 557,350 m^2**	High		Region 6 Office shall dissolve such ROW acquisition backlog in close coordination with Central Office as soon as possible.
Loss of Other Improvement			
- Trees and other perennials - Irrigation canals - Other public 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			
Agricultural tenants residing within the proposed ROW will be displaced but no place to settle.	Moderate		Government through the help of the LGUs must provide a sustainable resettlement area with all the basic social services such as water supply, electricity, health facilities, and means of transportation and communications.
Some of the farmers rely on planting rice 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 implement a sound Social Development Program (SDP) that will ensure that affected agricultural tenants get compensated for the disturbance to their normal lives.
			Government must relocate tenant-farmers at a resettlement site or areas they prefer where they can access to their agricultural land.
Loss of/Damage to Means of Livelihood			
Most residents have small scale shops along the road. Relocation of affected houses may disturb their business activities for a certain period of time.	Low		Government must compensate their temporal income loss due to disturbance of their businesses during relocation phase.
Generation of temporary employment opportunities.		Moderate	Contractor must give priority to available local labor.

TABLE 12.9-5 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 12.9-6 ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX (ILOILO, C-1)

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water quality BOD, TSS, and oil and grease of surface water	All major bridge and RCBCsites	Quarterly during construction	Standard EMPASS-EQD water quality analysis	*Class "C"* BOD - <10 mg/L TSS- <30 mg/L increase Oil & Grease - <3mg/L	DENR-Region 6
Air quality TSP, NO_2, and SO_2	Barangay Polo Maestra Vita, Municipality of Oton	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 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 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 road	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

12.10 SOCIAL IMPACT ASSESSMENT AND RESETTLEMENT ACTION PLAN

12.10.1 Measures Taken to Mitigate Negative Impacts

1) Alternatives Studied

Four (4) alternative alignments were examined to determine the most feasible route, that which has the least impact on land and structures and which is the most technically and economically viable, following the process of alternatives selection discussed in **Section 12.4**. Alternative 3, which has the least impact on lands and structures because it avoids major built-up areas and proposed development sites such as subdivision, cemetery, and socialized housing areas, was finally selected.

2) Measures Taken to Mitigate Impacts

To further curtail relocation of residents along the selected alignment, the following additional measures were taken.

TABLE 12.10-1 MEASURES TAKEN TO MITIGATE IMPACTS

Location	Station	Identified Impacts	Mitigation Measures Taken	Mitigated Impacts
Beginning of the project road at Barangay Arevalo	0+000~0+100	7 commercial establishments and 10 residential houses and storage sheds are affected.	The ROW is narrowed from 40m to 25m.	4 commercial establishments and 5 residential houses are avoided.
Barangay Arevalo	1+300	Construction of relocation site is identified during social impact survey.	Shift of alignment to the east by 100m to avoid the relocation site.	1.7 ha of relocation site is avoided.
Intersection with R-3 (Iloilo-Sta. Barbara Road)	8+450~8+800	30 residential houses are affected.	The ROW is narrowed from 40m to 30m.	14 residential houses are avoided.
Subdivision in Barangay Buhang, Municipality of Pavia	12+640~12+800	20 residential houses in the subdivision are affected but alignment cannot be shifted due to construction of proposed floodway.	The ROW is narrowed from 40m to 30m.	8 residential houses are avoided.

12.10.2 Barangays Affected by the Project

The proposed road traverses Iloilo City and the municipalities of Oton and Pavia. After fixing the final alignment, the Study Team visited said city and municipalities to present the extent of ROW required for their comments.

The following barangays were identified to be affected:

Iloilo City

1. Balabago, Jaro District
2. Buhang, Jaro District
3. Tacas, Jaro District
4. Hibao-an, Mandurriao District
5. Sooc, Arevalo District
6. San Jose, Arevalo District

Pavia

1. Ungka II
2. Pandac

Oton

1. Pakiad
2. Polo Maestra Vita

12.10.3 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. Topics discussed in the workshops are summarized in **Table 12.10-2**.

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. These visits were necessary to:

a) Inform them of the purpose of the Team's visit;

b) Validate the list of affected barangays;

c) Coordinate the availability of the Barangay Captains for meetings to discuss the same purpose;

d) Arrange with the Barangay Captains the schedule of the conduct of barangay level consultations and surveys; and

e) Explain to them the necessity for the local government unit's endorsement for the project.

3) Meetings with Barangay Captains

Meetings with the Barangay Captains of each of the affected city and municipality were held after coordination with their respective officials:

a) Present the proposed road alignment, required right-of-way, and the houses and structures that could be possibly affected;

b) Inform them of the schedule of social impact survey;

c) Arrange barangay level consultation meetings; and

d) Secure "**Barangay Endorsement**" for the project.

TABLE 12.10-2 SUMMARY OF WORKSHOPS

	1st Workshop	2nd Workshop	3rd Workshop	4th Workshop
Date	20 April 2003	29 October 2003	28 July 2004	18 August 2004
Venue/Location	Iloilo City	Iloilo City	Iloilo City	Iloilo City
Attendees	**National Gov't.** DPWH Region 6, NEDA, PPTA, LTO **Local Gov't.** Province of Iloilo, Iloilo City, Municipalities of Leganes, Oton, Pavia, San Miguel, Sta. Barbara, Cabatuan, Zarraga	**National Gov't.** DPWH Region 6, DPWH District Office, ATO, NEDA, PPA **Local Gov't.** Province of Iloilo, Iloilo City, Municipalities of Leganes, Oton, Pavia, Zarraga, Cabanatuan, San Miguel **Private Sector** Land Heights	**National Gov't.** DPWH Region 6, DPWH District Office **Local Gov't.** Province of Iloilo, Iloilo City, Municipalities of Leganes, Oton, Sta. Barbara **Private Sector** Monte Rosa Subdivision	**National Gov't.** DPWH Region 6, DPWH District Office **Local Gov't.** Province of Iloilo, Iloilo City, Municipalities of Leganes, Oton, Sta. Barbara **Private Sector** Monte Rosa Subdivision
Objectives of the Meeting	1. Presentation of the scope and schedule of the JICA Study 2. Presentation of development plans prepared by LGUs 3. Discussion of the land development plan for Metro Iloilo 4. Participation of LGUs in the implementation of the project particularly relocation of project affected people	1. Presentation of the result of the master plan 2. Presentation of road sections selected for feasibility study	1. Presentation of the proposed road alignments 2. Presentation of the results of the social impact survey and people's opinions on the project	1. Presentation of Draft Final Report
Topics Discussed	1. The LGUs confirmed that conversion of land use and construction of buildings along the proposed road alignment can be restricted upon approval of the Mayors. 2. All LGUs expressed their support to DPWH in land acquisition, including donation of land, negotiation and consensus building with project affected people.	1. The roads selected for feasibility study have been agreed upon between concerned LGUs and national government agencies. 2. LGUs are advised to control development activities in the proposed right-of-way established during the feasibility study to lessen land acquisition burden on DPWH.	1. The selected road alignments were unanimously accepted by concerned LGUs. 2. LGUs acknowledged that the proposed road alignments will have to be reflected in their respective comprehensive land use plans (CLUP) and land conversion will have to be restricted.	1. Presentation of master plan outline with emphasis on the participation of DPWH and the LGUs on the realization of the plan. 2. Group discussion and group presentation on: - How to realize the master plan - How to minimize social impacts - Other comments on the study

The **"Barangay Endorsement"** is a Barangay Resolution that expresses affirmative support to the proposed project duly signed by concerned Barangay Officials and endorsed to higher local government units.

The dates of meetings with the Barangay Captains and the date of **"Barangay Endorsement"** are summarized in **Table 12.10-3**.

TABLE 12.10-3 SUMMARY OF MEETINGS WITH BARANGAY CAPTAINS AND DATE OF ISSUANCE OF BARANGAY ENDORSEMENT

City / Municipality	Date of Meeting	Venue / Location	Date of Issuance of Barangay Endorsement	
Iloilo City	04 Feb. 2004	Iloilo City Hall	Balabago Bubang Tacas Hibao-an Sooc San Jose	08 Feb. 2004 08 Feb. 2004 08 Feb. 2004 11 Feb. 2004 09 Feb. 2004 11 Feb. 2004
Pavia	29 Feb. 2004	Pavia Municipal Hall	Ungka II Pandac	08 Feb. 2004 07 Feb. 2004
Oton	02 Feb. 2004	Oton Municipal Hall	Paksad Polo Maestra Vita	08 Feb. 2004 08 Feb. 2004

4) Barangay Consultation Meetings

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

TABLE 12.10-4 SUMMARY OF BARANGAY CONSULTATION MEETINGS

Barangay	Venue / Location	Date of Meeting	
Iloilo City			
Balabago	Barangay Hall	06 Feb. 2004	3:00 – 4:00 PM
Buhang	Barangay Hall	08 Feb. 2004	1:00 – 2:00 PM
Tacas	Barangay Hall	08 Feb. 2004	4:00 – 5:00 PM
Hibao-an	Barangay Hall	09 Feb. 2004	10:00 – 11:00 AM
Sooc	Barangay Hall	09 Feb. 2004	9:00 – 10:00 AM
San Jose	Barangay Hall	09 Feb. 2004	3:00 – 4:00 PM
Pavia			
Ungka II	Barangay Hall	08 Feb. 2004	5:00 – 6:00 PM
Pandac	Barangay Hall	07 Feb. 2004	2:00 – 3:00 PM
Oton			
Pakiad	Barangay Hall	07 Feb. 2004	7:00 – 10:00 AM
Pulo Maestra Vita	Barangay Hall	06 Feb. 2004	10:00 – 11:00 AM

The following topics were discussed with residents:

a) Location of proposed road alignment and right-of-way boundaries, land to be acquired and structures that will be affected.

b) Compensation policy of DPWH.

c) Schedule of social impact survey and perception survey.

The barangay level consultations were generally cordial and did not have any incidence of militancy on the part of directly-affected residents. The affected residents were grateful to have been informed and consulted and did not show any indication of resistance against the project, provided that they shall be properly compensated for loss of their properties.

Issues raised by the residents during the barangay consultation meetings and the government's corresponding responses are summarized in **Table 12.10-5**.

TABLE 12.10-5 ISSUES RAISED AND RESPONSE

Issues	Government's Response
1. The road should avoid houses and structures of residents.	The proposed road alignment was selected after thorough review of the engineering and social aspects. The alignment is the best route that has the least number of structures affected.
2. Affected properties should be properly compensated.	Structures are compensated in accordance with the replacement cost method. Lands are compensated with the fair market value.
3. Is there any relocation and other compensation?	A relocation site will be provided to residents financially incapable to relocate by themselves. Other compensation for income loss of shop owners and rehabilitation assistance to agricultural tenants are also given.
	In conclusion, the government's policy is to keep the living standard of affected residents same as or even better after relocation and everybody shall be benefited by the project.

12.10.4 Identified Impacts

The identified impacts and the corresponding compensation amounts are summarized in **Table 12.10-6**.

1) Impact on Land

The project is the construction of a new two-lane highway with provisions for widening to four-lanes in the future. The required width of ROW is 40m, with exception in some urbanized sections that have 25~30m, as discussed in previous sections.

Most of the affected lands are rice fields with scattered residential houses. Some residential/commercial areas are located at intersections of major arterial roads.

Affected lands classified by land use are summarized as follows:

Land Use	Affected Lands (m^2)	Share (%)
Rice field	474,202	85.1
Fishpond	35,600	6.4
Non-productive fruit trees	10,600	1.9
Residential	36,948	6.6
Total	**557,350**	**100.0**

2) Impact on Structures

A total of **88** structures, mostly residential houses, were identified along the proposed alignment, as follows:

Table 12.10-6 Summary of Impact and Compensation Cost

Iloilo Circumferential 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	11,100	38,850,000	Name of land
1) Residential-2	-	m^2	3,000	3,800	11,400,000	owner to be
2) Residential-3	-	m^2	2,500	22,047.5	55,118,750	identified by
3) Agricultural (Rice Field-1)	-	m^2	250	223,802.5	55,950,625	parcelllary
4) Agricultural (Rice Field-2)	-	m^2	200	250,400	50,080,000	survey.
5) Agricultural (Coconut Tree)	-	m^2	200	10,600	2,120,000	
6) Fish Pond	-	m^2	250	35,600	8,900,000	
Subtotal				**557,350**	**222,419,375**	
2.Structures						
1) Shanty (Bamboo, Nipa)	21	m^2	1,000	418.25	418,250	
2) Wood with GI sheet	34	m^2	1,140	1,080.38	1,231,633	
3) Concrete with wood	6	m^2	6,000	321.00	1,926,000	
4) Concrete	26	m^2	8,000	2,291.00	18,328,000	
Subtotal	87			**4,110.63**	**21,903,883**	
3.Other Fixed Structures						
1) Signboard	-	Nos.	1	50,000	50,000	
4.Repair Cost	-	-	-	-	-	None
5.Electric Post Relocation	-	-	-	-	-	None
6.Perennials						
Various types	-	Nos.	various	4,424	1,548,400	
Subtotal					**245,921,658**	
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	61	-	10,000	61	610,000	
2. Subsistence Allowance						
1) Income loss for shop owners	8	-	20,000	8	160,000	
2. Financial Assistance						
1) Land users w/o title	-	-	-	-	-	Not identified
3. Rehabilitation Assistance						
1) Severely affected land owners	-	-	-	-	-	Not identified
2) Agricultural lessees	-	-	-	-	-	Not identified
3) Severely affected structural owners.	-	-	-	-	-	Not identified
4. Transportation Allowance						
1) Relocating PAPs	61	-	3,000	61	183,000	
2) Shanty dwellers go back to province.	-	-	-	-	-	None
5. Transitional allowance						
1) Renters of affected structures	-	-	-	-	-	None
Subtotal					**953,000**	
Total					**246,874,658**	
RAP Implementation					**3,371,150**	
GRAND TOTAL					**250,245,808**	

Structure Use	Number	Floor Area (m^2)
Residential	55	3,224.01
Residential cum Shops	5	124.56
Independent Shop	5	216.00
Farmhouse	10	114.00
Other Buildings	12	432.06
Sub-total	**87**	**4,110.63**
Other Fixed Structures	1	-
Total	**88**	**4,110.63**

3) Impact on Residents

Socio-economic surveys of project affected families were conducted in February and March 2004. The survey form used is shown in **Table 12.10-7**. The impact on affected families is summarized as follows:

Type of PAF	Number
Severely Affected PAFs	61.0
- Renters	- not identified
- Agricultural Tenants	- not identified
Marginally Affected PAFs	8.0
Total	**69.0**
Average Household Size	4.9

The occupation of affected families varies widely from farming, shop operation, laborer, and employee. The average monthly household income of most of these families (78.4%) is below ₱10,000.

Informal settlers or families along the proposed road alignment that need to be relocated were not identified.

4) Impact on Trees and Other Perennials

Grove of fruit trees, mostly non-productive with low commercial values, are observed around residential areas and riverbanks.

4,424 trees of various types are identified along the proposed road.

12.10.5 Valuation of Losses

Municipal/city ordinances that declare market value of real properties were collected from the respective assessor's offices of these LGUs. The BIR zonal values were likewise obtained from BIR regional offices.

The sources of unit prices used to determine values of each type of loss are summarized in **Table 12.10-8**.

The valuations obtained from the assessor's offices for agricultural land and residential/commercial/industrial lands are summarized and presented in **Appendix 12.10-1**.

TABLE 12.10-7 SOCIO-ECONOMIC SURVEY OF HOUSEHOLD

Household No. ☐☐☐ Station: _____ + _____

Address: _____ No. _____ Road / Street _____ Barangay _____ Municipality

1. Household Structure

	Head of Family	Name	Age	Sex	Occupation	Education
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Co-Residents						
1						
2						
3						
4						

2. How many years are you staying at the present address? _____ years

3. Average Family Income per Month

Name of Family Member	Name of Employer	Average Monthly Income (P)

4. If you are doing same business a the present address,

- What kind of business: _____
- Monthly income from the business _____ P/month

5. Average Monthly Family Expenditure

_____ P/month

6. Ownership of a land and a house

Land		House	
☐	Owned	☐	Owned
☐	Rented	☐	Rented
☐	Provided by Government / Company	☐	Provided by Government / Company
☐	Others (specify : _____)	☐	Others (specify : _____)

7. Workplace / Schoolplace and Cost of Transportation

Name	Address of Workplace 1/ or Schoolplace	Mode of Transportation 2/	Transportation Cost per day	How long does it take to reach workplace / schoolplace
		A, B, C, D, E, F	P/day	hr. min.
		A, B, C, D, E, F	P/day	hr. min.
		A, B, C, D, E, F	P/day	hr. min.
		A, B, C, D, E, F	P/day	hr. min.
		A, B, C, D, E, F	P/day	hr. min.
		A, B, C, D, E, F	P/day	hr. min.
			P/day	hr. min.

Note: 1/ In ase of a former, enter barangay names of nearest and farthest farm land
2/ A: Own car B: Walk C; Tricycle D: Jeepney E: Bus
F: Co-riding on company's or friend's car, or school bus

8. House Structure

No. of Story : 1. Flat 2. 2-story 3. 3-story
Floor Area : _____ sq.m.
Type of House : 1. Wooden 2. Concrete 3. Other (specify: _____)
Lighting : 1. Electricity 2. Kerosene lamp 3. Oil lamp 4. Other (specify: _____)
Water System : 1. Piped 2. Well 3. Spring / River 4. Rain
Toilet Facility : 1. Flush 2. Open pit 3. None
Cooking Fuel : 1. Wood / Charcoal 2. LPG 3. Kerosene 4. Electricity

9. If you are affected by a certain Government Project and asked to be relocated, what conditions do you require?

① _____
② _____
③ _____
④ _____
⑤ _____
⑥ _____

TABLE 12.10-8 SOURCES OF UNIT PRICES FOR VALUATION

Type of Loss	Primary Source	Secondary Source
Land	Assessment value from assessor's office; BIR zonal value	Prevailing market prices gathered through interviews with developers/residents
Structures	Unit price of primary structures from DPWH District Offices; schedule of values from assessor's office	-
Trees and Perennials	Schedule of values for agricultural trees from assessor's office	-
Income Loss/Disturbances	Socio-economic survey	-

It should be noted that the proposed road traverses mostly agricultural lands (i.e. rice fields), but such lands are intended to be utilized for residential purposes based on the comprehensive Land Use Plan proposed for Metro Iloilo. Hence, the price of agricultural land currently traded in the area is far higher than the zonal and market values available at the assessor's office.

Additional interviews and surveys were conducted to obtain the prevailing market price for said agricultural lands.

12.10.6 Resettlement Site Survey

Location of resettlement sites is shown in **Figure 12.10-1**. Of the local government units with project affected households, only Iloilo City is known to have a sustaining program of site acquisition for resettlement purposes. It has eleven (11) existing projects and one (1) socialized housing zone located in Barangay Sooc, Arevalo District in addition to five others intended for the Iloilo Flood Control Project.

Seven (7) of Iloilo City's relocation sites have been earmarked for on-site development, meaning that the beneficiaries come from the same place. The seven sites include the following:

TABLE 12.10-9(1) SUMMARY OF RELOCATION SITES

Project Title	Area (Ha)	No. of Home Lots
1. Sto. Nino Sur, Arevalo District	2.6367	296
2. San Juan (Borres Lot), Molo District	3.7342	287
3. San Juan (Villanueva-Sian Lot), Molo District	4.6366	366
4. South Fundidor, Molo District	0.5290	73
5. East Baluarte, Molo District	3.6404	264
6. Tanza Baybay, City Proper	0.5325	99
7. Quintin Salas, Jaro District	3.4982	116

Four (4) of Iloilo City's relocation sites have been earmarked for off-site development, meaning that the beneficiaries come from other places affected by various projects. The four (4) sites include the following:

TABLE 12.10-9(2) SUMMARY OF RELOCATION SITES

Project Title	Area (Ha)	No. of Home Lots
8. San Isidro, La Paz District	2.3567	233
9. Lanit, Jaro District	0.7094	127
10. Bitoon, Jaro District	3.5000	358
11. Buntatala, Jaro District	2.600	217

Five (5) relocation sites earmarked for the JBIC-funded Iloilo City Flood Control Project include the following:

TABLE 12.10-9(3) SUMMARY OF RELOCATION SITES

Project Title	Area (Ha)	No. of Home Lots
11. Buntatala (Tacas), Jaro District	2.0	210
12. Sooc (Sooc) Arevalo District	1.8	179
13. San Isidro (San Isidro), Jaro	3.0	300
14. Kasadyahan, Kasadyahan, Iloilo City	4.5	440
15. San Isidro, Hibao-an Mandurriao	27	3,000

12.10.7 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.

1) Socio-Economic Baseline Survey

The result of the socio-economic baseline survey for project affected persons will be made available to a contracted non-government organization that will need it to design the appropriate income restoration program responsive to the needs of project affected households.

2) Process and Conceptual Framework for Income Restoration Program

The DPWH shall contract out to a non-government organization with specialization in community-based approaches the income restoration programs, community organizing, livelihood and skills enhancement programs, and the like. This is outsourcing of requirements which DPWH is not capable of doing by itself.

In addition, the DPWH shall continue to link with LGUs and tap their income restoration or poverty alleviation programs, as well as those of other agencies. The income restoration program shall be consistent with the needs of the project-affected persons. It should therefore be demand-driven to the extent that resources can be made available from the DPWH or from its own networking effort.

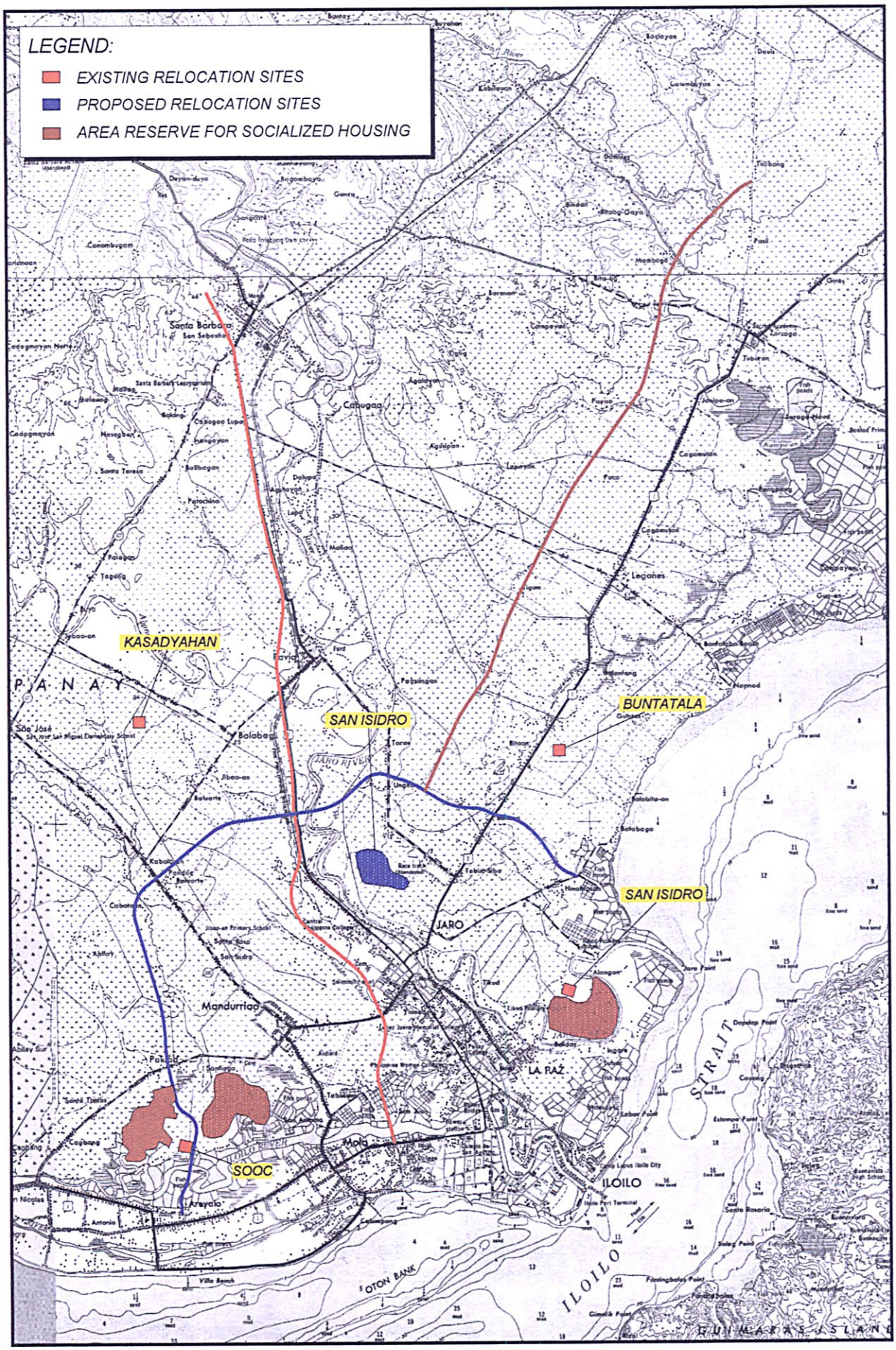

FIGURE 12.10-1 LOCATION OF RELOCATION SITE

12.10.8 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.

1) Department of Public Works and Highways (DPWH)

A PMO shall be designated by the DPWH as its overall responsible unit in the implementation of the Iloilo Circumferential Road Project. It will manage and supervise the Project including its resettlement activities and land acquisition requirement in coordination with concerned agencies. To ensure smooth implementation 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 City District Engineering Office (DEO) of the DPWH based in Iloilo City shall be the lead implementing arm for the Resettlement Action Plan (RAP) for project affected persons within the territorial boundary of Iloilo City. On the other hand, the First DEO of the Department, also based in Iloilo City, shall be responsible for implementation of the RAP for project affected persons within the territorial boundary of the Municipality of Oton, while the Fourth DEO based in the Municipality of Sta. Barbara shall be responsible for implementation of the RAP for project affected persons within the territorial boundary of Pavia.

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 LGUs, namely: Iloilo City, Municipality of Pavia, and Municipality of Oton. 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 Committee (RIC)

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

RAP Implementation Committee (RIC) – A

Chairman and Convenor : City District Engineer (DPWH), Iloilo City
Co-Chairman : City Mayor of Iloilo (or designated representative)
Members :

Barangay Captain – Barangay San Jose, Arevalo
Barangay Captain – Barangay Sooc, Arevalo
Barangay Captain – Barangay San Isidro, Jibao-an Norte, Mandurriao
Barangay Captain – Barangay Tacas, Jaro
Barangay Captain – Barangay Buhang, Jaro
Barangay Captain – Barangay Balabago, Jaro

Representative of PAPs – Barangay San Jose, Arevalo
Representative of PAPs – Barangay Sooc, Arevalo
Representative of PAPs – Barangay San Isidro, Jibao-an Norte, Mandurriao
Representative of PAPs – Barangay Tacas, Jaro
Representative of PAPs – Barangay Buhang, Jaro
Representative of PAPs – Barangay Balabago, Jaro

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), Municipality of Sta. Barbara
Co-Chairman : Municipal Mayor of Pavia (or his designated representative)
Members :

Barangay Captain – Barangay Ungka II, Pavia
Barangay Captain – Barangay Pandak, Pavia

Representative of PAPs – Barangay Ungka II, Pavia
Representative of PAPs – Barangay Pandak , Pavia

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

RAP Implementation Committee (RIC) – C

Chairman and Convenor : District Engineer (DPWH), First DEO, Iloilo City
Co-Chairman : Municipal Mayor of Oton (or his designated representative)
Members :

Barangay Captain – Barangay Polo Maestra Vita, Oton
Barangay Captain – Barangay Pakiad, Oton

Representative of PAPs – Barangay Polo Maestra Vita, Oton
Representative of PAPs – Barangay Pakiad, Oton

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 Resettlement Implementation Committee (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 Iloilo City and the Sangguniang Bayan (SB) of the Municipalities of Pavia and Oton.

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.

12.10.9 Grievance Redress Measures

Grievance redressal is one of the main functions of the RIC. The Resettlement Policy provides that grievances related to any aspect of the project will be handled through negotiations aimed at achieving consensus following the procedures outlined below.

1) Filing and Action

Grievance will be filed by the PAP with the RIC who will act within 15 days on said complaints upon receipt thereof, except complaints and grievances that specifically pertain to the valuation of affected assets, since such will be decided upon by the proper courts.

2) Appeal to the DPWH Regional Director

If no understanding or amicable solution can be reached, or if the PAP does not receive a response from the RIC within 15 days of registry of the complaint, he/she can appeal to the Office of the Regional Director (DPWH), which should act on the complaint/grievance within 15 days from the day of its filing.

3) Court of Law

If the PAP is not satisfied with the decision of the Office of the Regional Director, he/she, as a last resort, can submit the complaint to a court of law.

4) Miscellaneous Provisions

PAPs will be exempted from all administrative and legal fees incurred in pursuance of the grievance redressal procedures. All documents received in writing (or written when received verbally) from the PAPs will be documented.

12.10.10 Monitoring and Evaluation

1) Monitoring and Evaluation Process

The process that will be followed in monitoring and evaluation shall include the following:

a) Data collection, conduct of surveys, interviews and focus group discussions

Data collection could use any or all of the following methods: sample survey using a pre-tested questionnaire prepared by the implementing agency or office; focus group discussions involving specific topics with particular interest groups such as community organizations, cooperatives, women's groups, or project-affected persons; key informant interviews of specific individuals such as local government units officials, community leaders, and implementing agencies; and structured direct observation by monitoring team members.

b) Preparation of preliminary report

The preliminary report shall contain the findings pertaining to the monitoring indicators. It will be written in such a manner that it can be used as a working paper for the feedback sessions (exit conferences, meetings, etc.).

c) Presentation of the preliminary report to the different stakeholders for feedback (including those agencies involved in project implementation and the affected population)

This involves feedback sessions with the different stakeholders: representatives of project affected persons and/or respondents of the surveys and key informants, DPWH-DEOs, DPWH-Region, LGU officials from the host areas, and NGOs and other assisting groups active in the area. The sessions will validate the data and analysis pertaining to the monitoring indicators and solicit observations, feedback, and suggestions from the various stakeholders on the different aspects of the monitoring report.

d) Workshops to identify issues for planning and/or intervention

Workshops may be conducted if it becomes necessary after the feedback sessions to identify problems or issues related to the implementation of the resettlement plan that require resolution, decision, or intervention. But unlike the feedback session which is primarily aimed at completing and validating the data for the monitoring report, the workshops are aimed at identifying practical actions that will have to be undertaken to address specific problems or improve the process of implementation of the resettlement action plan.

e) Preparation of final report incorporating feedback from stakeholders

The final report will contain the validated data, findings, and analysis on the monitoring indicators as well as the recommended courses of action for improving the resettlement action plan.

2) Monitoring and Evaluation Units

The monitoring and evaluation units of this project shall be the Project Management Office for Infrastructure Right-of-Way (PMO-IROW) and the Resettlement Project Management Office consistent with the institutionalization of the implementation of Department Order (DO) No. 5, series of 2003. This DO implements a streamlined infrastructure right-of-way process designed to identify, acquire, and manage right-of-way efficiently and in a timely manner for the implementation of infrastructure projects.

3) Internal Monitoring

Internal monitoring will be done by the ESSO. The ESSO, acting as the Internal Monitor, shall be responsible for the following:

a) Verification that the baseline information of all PAPs has been carried out and that the valuation of lost or damaged assets and the compensation for resettlement and other rehabilitation entitlements are carried out in accordance with the policy framework;

b) Overseeing the implementation of the RAPs as designed and implemented;

c) Verification of timeliness of the availability and sufficiency of funds and that utilization of these funds are consistent with the LARR Policy and the provisions of this RAP; and

d) Recording of all grievances and their resolution and ensure that complaints are dealt with in a timely manner.

4) External Monitoring

External monitoring and evaluation shall cover all the aspects of resettlement activities which include the following:

a) Review of the existing baseline data and gather additional socio-economic baseline data, if necessary, on sample families which are entitled to receive compensation for all their lost assets or for resettlement and rehabilitation;

b) Monitor implementation of the Resettlement Policy and public information campaign;

c) Identify any discrepancy between policy requirements and actual practice, as well as any local level grievances;

d) Gather qualitative indications of the social and economic impact of project implementation on the PAPs; and

e) Provide recommendations for improving implementation of the Department's Resettlement Policy.

12.10.11 RAP Implementation

1) Preparation of Final RAP

The social impacts identified in this study shall be verified and validated during detailed design stage after establishing exact extent of construction limits and corresponding ROW limits required. The following RAP updating surveys shall be carried out to update the preliminary RAP prepared under this study after fixing the final ROW limits.

TABLE 12.10-10 RAP 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 to identify the PAPs eligible for compensation. - **Cut-off-Date** must be set and informed to the residents prior to tagging.
Perennials	- **Validation survey** shall be carried out to identify name of owner of perennials with commercial values.
Tenants/Renters, 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 results of the RAP updating 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 Iloilo City and the Municipalities of Pavia and Oton 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 LGU 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 Iloilo City and the Municipalities of Pavia and Oton. 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 Mayor of Iloilo as well as the Municipal Mayors of Pavia and Sta. Barbara 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 the 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.

12.11 PROJECT EVALUATION

12.11.1 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 circumferential road (C-1) Road. The estimated traffic volume on the Road for the case of "with" the project is summarized in Table 12.11-1.

TABLE 12.11-1 TRAFFIC VOLUME ON C-1 ROAD

Unit: PCU / day

	2010	2016	2022	AAGR (%)	
				'10 - '16	'16 – '22
R-1 - R-1 Bypass	15,500	18,800	20,100	3.2	Δ4.9
R-1 Bypass - R-2	17,200	21,900	31,600	4.1	12.9
R-2 - R-3	13,100	26,500	31,600	12.5	12.2
R-3 - S-2	-	27,200	30,000	-	11.1
S-2 - R-4	-	23,600	26,500	-	12.2
R-4 - R-5	-	19,400	28,700	-	6.7

Notes: 1) In 2010, road section of C-1 road between R-3 and R-5 is only opened to public
2) In 2016 and 2022, all sections of C-1 road is opened to public.

The estimated vehicle kilometers and vehicle hours in Metro Iloilo are shown in Tables 12.11-2 and 12.11-3, respectively. These tables are based on the benefit calculation.

TABLE 12.11-2 TOTAL VEHICLE KILOMETERS IN METRO ILOILO

Unit: PCU Km / day

	W/O Project	W/ Project	W/O – W/
2010	3,158,200	3,167,000	Δ8,800
2016	4,025,300	4,012,000	13,300
2022	5,179,300	5,141,400	39,900

Notes: Same notes in Table 12.10-1

TABLE 12.11-3 TOTAL VEHICLE HOURS IN METRO ILOILO

Unit: PCU Hour / day

	W/O Project	W/ Project	W/O – W/
2010	111,300	109,400	1,900
2016	159,900	149,100	10,800
2022	236,300	217,800	18,500

Notes: Same notes in Table 12.11-1

2) Economic Evaluation

Evaluation Period

The evaluation period is assumed to be 20 years from 2013 to 2032 taking into account the service life of C-1 road.

Implementation Schedule

The implementation schedule is assumed as follows:

- 2007 Detailed design
- 2008 – '09 Land acquisition
- 2010 – '12 Construction of C-1 Road
- 2013 - Open of C-1 road 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 12.11-4)

TABLE 12.11-4 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.

Vehicle operating cost by surface type and travel speed was set up since it varies by these factors.

Estimation of Benefits

The saving in vehicle operating costs and travel time cost were estimated and are shown in **Table 12.11-5.**

TABLE 12.11- 5 ESTIMATION OF BENEFITS

Unit: '000 Pesos/Day

Year	Saving in VRC	Saving in Fixed Cost	Saving in VOC	Saving in TCC	Total Saving
2010	19,763	128,497	148,260	188,068	336,328
2016	20,807	180,723	201,530	264,505	466,035
2020	59,307	311,103	370,410	455,328	825,737

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 12.11- 6.**

TABLE 12.11- 6 ECONOMIC COST ESTIMATE

Unit: '000 Pesos

Description		Economic Cost	Financial Cost
1	Construction Cost	556,300	661,300
2	ROW Acquisition and Resettlement Cost	225,200	250,200
3	Consultancy	99,900	111,000
3-1	Detailed Design	52,300	58,100
3-2	Construction Supervision	47,600	52,900
	Total	870,300	1,022,500

Maintenance Cost

According to the maintenance study in this study, the present maintenance cost for the road has estimated on the basis of the EMK method. In this study, therefore, the maintenance cost of the C-1 is estimated on the basis of the same EMK method.

Benefit Cost Analysis

Based on the above mentioned benefits and cost estimations, the economic analysis of the Project was made. **Table 12.11- 7** shows the benefit – cost analysis of the C-1 Road Construction Project during project life period of 20 years and **Table 12.11- 8** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of ₱ 846 million and BCR of 3.14 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 31.0%.

TABLE 12.11-8 BENEFIT - COST STREAM OF C-1 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	52,300.0	0.0	52,300.0	0.0	-52,300.0
5	2008	112,600.0	0.0	112,600.0	0.0	-112,600.0
6	2009	125,825.0	0.0	125,825.0	0.0	-125,825.0
7	2010	207,930.0	0.0	207,930.0	0.0	-207,930.0
8	2011	207,930.0	0.0	207,930.0	0.0	-207,930.0
9	2012	180,115.0	0.0	180,115.0	0.0	-180,115.0
10	2013	0.0	1,455.0	1,455.0	396,201.2	394,746.2
11	2014	0.0	1,462.0	1,462.0	418,188.5	416,726.5
12	2015	0.0	1,468.0	1,468.0	441,441.9	439,973.9
13	2016	0.0	1,475.0	1,475.0	466,035.1	464,560.1
14	2017	0.0	1,485.0	1,485.0	501,832.3	500,347.3
15	2018	0.0	1,505.0	1,505.0	540,626.4	539,121.4
16	2019	0.0	1,515.0	1,515.0	582,679.1	581,164.1
17	2020	0.0	1,525.0	1,525.0	750,678.2	749,153.2
18	2021	0.0	1,535.0	1,535.0	827,686.1	826,151.1
19	2022	0.0	42,259.0	42,259.0	825,737.1	783,478.1
20	2023	0.0	1,555.0	1,555.0	853,783.2	852,228.2
21	2024	0.0	1,565.0	1,565.0	882,838.4	881,273.4
22	2025	0.0	1,575.0	1,575.0	912,942.0	911,367.0
23	2026	0.0	1,585.0	1,585.0	944,135.7	942,550.7
24	2027	0.0	1,595.0	1,595.0	976,462.7	974,867.7
25	2028	0.0	1,595.0	1,595.0	1,009,967.9	1,008,372.9
26	2029	0.0	1,605.0	1,605.0	1,044,698.7	1,043,093.7
27	2030	0.0	1,615.0	1,615.0	1,080,704.3	1,079,089.3
28	2031	0.0	1,625.0	1,625.0	1,118,036.1	1,116,411.1
29	2032	0.0	1,635.0	1,635.0	1,156,748.1	1,155,113.1

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	34,388.1	0.0	34,388.1	0.0	-34,388.1
5	2008	1.749	64,379.4	0.0	64,379.4	0.0	-64,379.4
6	2009	2.011	62,557.3	0.0	62,557.3	0.0	-62,557.3
7	2010	2.313	89,893.9	0.0	89,893.9	0.0	-89,893.9
8	2011	2.660	78,168.6	0.0	78,168.6	0.0	-78,168.6
9	2012	3.059	58,879.9	0.0	58,879.9	0.0	-58,879.9
10	2013	3.518	0.0	413.6	413.6	112,625.1	112,211.5
11	2014	4.046	0.0	361.4	361.4	103,369.8	103,008.4
12	2015	4.652	0.0	315.5	315.5	94,884.9	94,569.4
13	2016	5.350	0.0	275.7	275.7	87,105.3	86,829.6
14	2017	6.153	0.0	241.4	241.4	81,561.8	81,320.4
15	2018	7.076	0.0	212.7	212.7	76,406.0	76,193.3
16	2019	8.137	0.0	186.2	186.2	71,608.0	71,421.8
17	2020	9.358	0.0	163.0	163.0	80,221.1	80,058.1
18	2021	10.761	0.0	142.6	142.6	76,913.5	76,770.9
19	2022	12.375	0.0	3,414.7	3,414.7	66,723.8	63,309.1
20	2023	14.232	0.0	109.3	109.3	59,991.4	59,882.1
21	2024	16.367	0.0	95.6	95.6	53,941.7	53,846.1
22	2025	18.822	0.0	83.7	83.7	48,505.2	48,421.5
23	2026	21.645	0.0	73.2	73.2	43,619.6	43,546.4
24	2027	24.891	0.0	64.1	64.1	39,228.8	39,164.7
25	2028	28.625	0.0	55.7	55.7	35,282.5	35,226.8
26	2029	32.919	0.0	48.8	48.8	31,735.5	31,686.7
27	2030	37.857	0.0	42.7	42.7	28,547.2	28,504.5
28	2031	43.535	0.0	37.3	37.3	25,681.1	25,643.8
29	2032	50.066	0.0	32.7	32.7	23,104.6	23,071.9
		Total	388,267.2	6,369.9	394,637.1	1,241,056.9	846,419.8

Net Present Value	**846,420**
B/C Ratio	**3.145**
EIRR	**30.96**

TABLE 12.11- 7 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

Net Present Value	P 846 million pesos
BCR	3.14
EIRR	31.0%

Notes: 1) Project life is assumed to be 20 years
2) Discount rate ids 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 12.11-9** shows the results of the sensitivity analysis.

TABLE 12.11- 9 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF C-1 ROAD CONSTRUCTION PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (Pmillion)	677.0	925.0	1,173.0
		B/C Ratio	3.14	3.93	4.72
		EIRR (%)	31.0	34.9	38.4
	Base Case	NPV (Pmillion)	598.0	846.0	1,095.0
		B/C Ratio	2.52	3.14	3.77
		EIRR (%)	27.3	31.0	34.2
	20% up	NPV (Pmillion)	519.0	767.0	1,016.0
		B/C Ratio	2.10	2.62	3.14
		EIRR (%)	24.5	28.0	31.0

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

(3) Summary of Economic Analysis

The implementation of the C-1 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.

12.11.2 Technical Evaluation

The results of the technical analysis of the C-1 road show that the construction of the C-1 road is technically feasible. However, the following technical notes shall be made:

- Ground condition along the C-1 road alignment is generally characterized as soft-ground, especially at the beginning along fish pond area. It is necessary to undertake soft ground treatment such as employment of plastic vertical drain (PVD), sand mat, etc when the C-1 road is constructed.
- Flooding along C-1 corridor is anticipated at most locations. It is therefore necessary to undertake the flood control treatment when the C-1 road is constructed.
- Because the intersecting area of C-1, road with the Iloilo – Sta. Barbara road has a limited area, it is impossible to construct a full scale intersection. It is thus proposed to employ a partial scale of the intersection at this location.

12.11.3 Other Impacts

1) On Traffic

Table 12.11-10 shows the transport efficiency of Metro Iloilo and inside C-1 in cases of with and without the C-1 road.

TABLE 12.11-10 TRANSPORT EFFICIENCY IN METRO ILOILO WITH AND WITHOUT C-1 ROAD

			2010	2016	2022
PCU Kilometers ('000)	Whole Area	W/O Project	3,158 (1.00)	4,025 (1.00)	5,179 (1.00)
		W/ Project	3,138 (0.99)	4,012 (0.99)	5,141 (0.99)
	Inside C-1	W/O Project			
		W/ Project			
PCU Hours ('000)	Whole Area	W/O Project	111.3 (1.00)	159.9 (1.00)	236.3 (1.00)
		W/ Project	109.4 (0.98)	149.1 (0.93)	217.8 (0.92)
	Inside C-1	W/O Project			
		W/ Project			
Average Travel Speed (km / h)	Whole Area	W/O Project	28.4 (1.00)	25.2 (1.00)	21.9 (1.00)
		W/ Project	28.6 (1.01)	26.9 (1.07)	23.6 (1.08)
	Inside C-1	W/O Project			
		W/ Project			
Vehicle Operating Cost (P '000 /day)	Whole Area	W/O Project	21,754 (1.00)	35,885 (1.00)	]49,686 (1.00)
		W/ Project	21,574 (0.99)	34,589 (0.96)	47,391 (0.95)
	Inside C-1	W/O Project			
		W/ Project			

Notes: 1) In 2010, road section of C-1 road between R-1 and R-3 is only opened to public
2) In 2016 and 2022, all sections of C-1 road is opened to public.

2) On Urban Amenity

Through traffic volume inside C-1 road will be greatly reduced due to diverted to the C-1 road. Therefore, noise level, air quality and vibration in the area within the C-1 road will be greatly improved. Thus, urban amenity will be improved.

3) On Urbanization

Urbanization will be guided and supported by the C-1 road. According to the urbanization index calculated in Section 11.2 of the Master Plan, urbanization index (RUa) along C-1 road corridor will be able to calculate to be almost 100 %. With the existing road network with the C-1 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.

12.11.4 Overall Evaluation

As motioned above, the implementation of the C-1 Road construction project can be justified from view of economic, technical, and social impact points.