CHAPTER 15
FEASIBILITY STUDY OF WEST DIVERSION ROAD

15.1 Objectives of the Project

Western Diversion Road is planned to distribute traffic on four major roads, namely; CDO-Talakag Road, CDO-Iligan Road, proposed Western Coastal Road and proposed Opol Diversion Road so as to increase accessibility to CDO CBD as well as Port Area. Objectives of the project are as follows:

Objectives of the Project

- To reduce traffic congestion of CDO-Iligan Road and CDO-Talakag Road by distributing traffic onto another major roads.
- To improve accessibility to CBD and Port Area.
- To formulate flexible road network which will provide alternative routes to road users.
- To guide and support planned urban development.

15.2 Physical Features of the Project Site

The proposed road more or less follows Iponan River, along which relatively flat lands, though narrow, extends. Narrow flat land is followed by relatively steep mountain slopes. Iponan River is meandering. River bank scouring is progressing at the curbed section of the River.

Alluvial deposit accumulated along Iponan River. Silty clay and sand layers with N-value of 5 to 10 are found to the depth of about 30m, then sandy layers with N-value of 30 to 40 continue thereafter.

Predominant land use is coconut plantation with scattered residential areas, except sections near CDO-Iligan Road where commercial and residential land uses are predominant.

15.3 Engineering Surveys Conducted

The following three surveys were undertaken:

- Orthophoto Maping utilizing existing aerial photos
- Road Alignment Survey
- Geo-technical Survey and Soils/Materials Survey

1) Orthophoto Mapping
   - Existing aerial photos : Photo Scale = 1/15,000
   - Orthophoto Mapping : Scale = 1/5,000

2) Road Alignment Survey
   - Control points survey
   - Center line survey (50m interval)
   - Profile survey (50m interval)
   - Cross-section survey (50m interval, width=60m)
   - River profile / cross section survey (Calaanan Creek)
3) Geo-technical Survey and Soils/Material Source Survey
   - Bridge site geo-technical survey (depth=45m)
   - Soils/material sources survey (3 locations)

15.4 Selection of Route Alignment

15.4.1 Control Points for Selecting Route Alignment

Control points for selecting route alignment are as follows (see Figure 15.4-1):

- Canitoan-Pagatpat Road is extended towards the north.
- An alignment passes along Iponan River.
- Small mountains with the height of about 25m extend towards Iponan River where flat area becomes quite narrow.
- Along the corridor, one subdivision is under development.
- Areas near CDO-Iligan Road are residential and commercial areas.

15.4.2 Alternative Alignments

An alignment was divided into five sections. Alternative alignments were developed for Sections-2, 3 and 4 and shown in Figure 15.4-1.

15.4.3 Evaluation of Alternative Alignments and Selection of Best Alignment

Alternative alignments in each section were evaluated and selected as shown in Table 15.4-1.

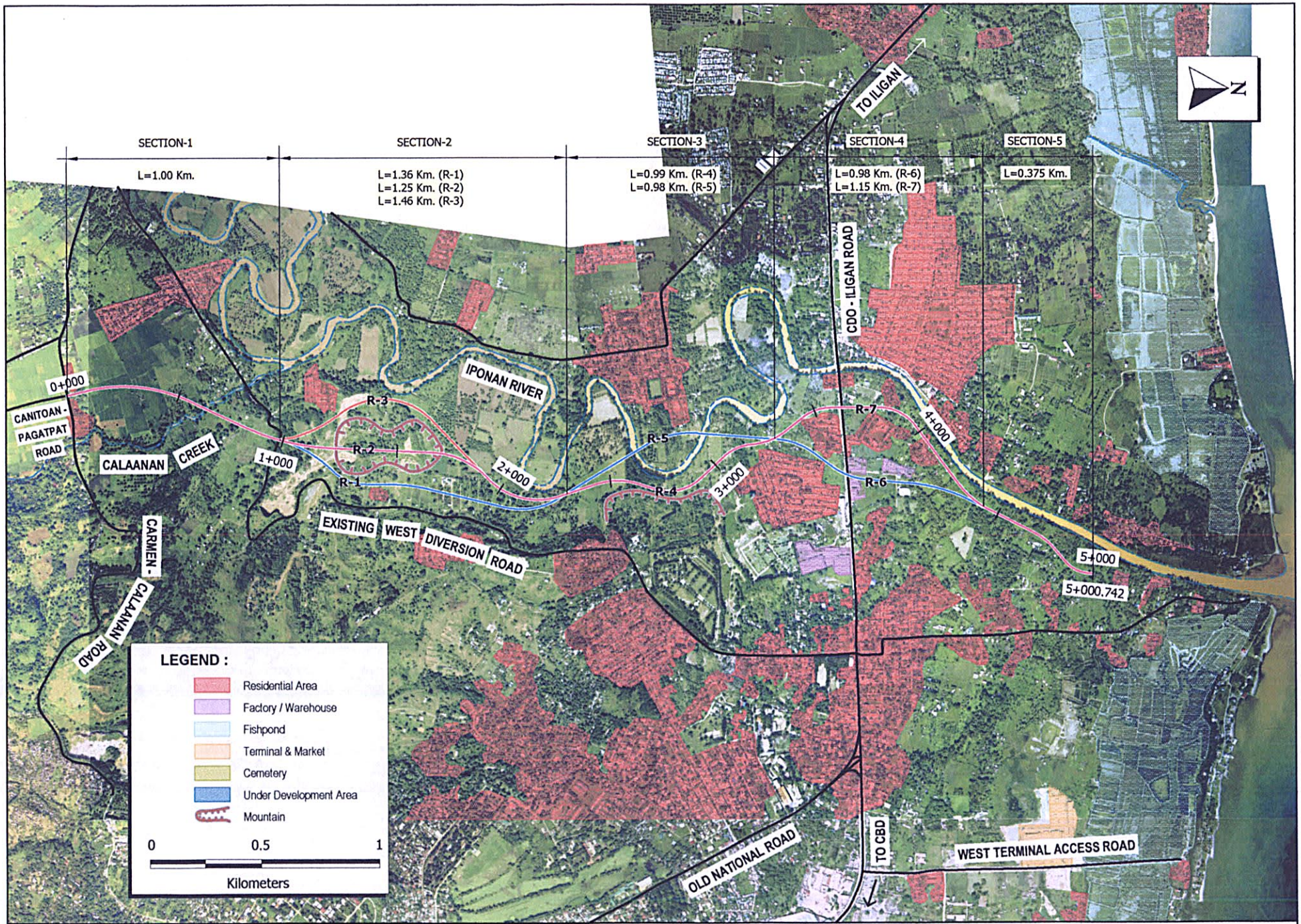


FIGURE 15.4-1 ALTERNATIVE ALIGNMENTS OF WESTERN DIVERSION ROAD

TABLE 15.4-1 EVALUATION OF ALTERNATIVE ALIGNMENTS : NEW WESTERN DIVERSION ROAD

		SECTION - 2			SECTION - 3		SECTION - 4	
		Alternative Alignments			Alternative Alignments		Alternative Alignments	
		R-1	R-2	R-3	R-4	R-5	R-6	R-7
1) Site Conditions and Issues		• Mostly agricultural land. • An alignment be selected between the existing Western Diversion Road and Iponan River. • An alignment has to cross a small mountain of about 30m in height. • Sub-division is under construction along the existing West Diversion Road.			• Mostly agriculture land. • Mountain sloe extends close to Iponan River.		• Mixed land use of agricultural and residential areas. • Needs to select an alignment which minimize social impact, particularly section near CDO-Iligan Road.	
2) Planning Concept		• An alignment which passes through relatively low mountain portion to achieve lower cut height.	• To achieve smooth horizontal alignment, though cut height becomes about 20m.	• To achieve minimum cut height.	• An alignment is to be selected between mountain slope and Iponan River.	• An alignment is to be selected by crossing Iponan River and residents living west of Iponan River can make access to this road.	• An alignment intersects with CDO-Iligan Road at one of less developed area.	• An alignment intersects with CDO-Iligan Road at the other less developed area.
3) Scope of Civil Work	Road Length (km)	1.36	1.25	1.46	0.99	0.88	0.98	1.15
	Bridge Length (km)	-	-	-	-	0.10	-	-
	Total (km)	1.36	1.25	1.46	0.99	0.98	0.98	1.15
4) Construction Cost (Million P)	Road	31.3	46.0	33.7	21.2	18.8	21.0	24.6
	Bridge	-	-	-	-	45.0	-	-
	Total	31.3	46.0	33.7	21.2	63.8	21.0	24.6
5) ROW / Relocation Cost (Million P)	ROW	14.4	5.4	5.8	22.4	23.7	68.5	57.5
	Relocation	0.8	1.2	0.6	1.0	1.8	2.6	2.4
	Total	15.2	6.6	6.4	23.4	25.5	71.1	59.9
6) Evaluation	a) Horizontal Alignment	Rmin.=200m	Rmin.=350m	Rmin.=300m	Rmin.=200m (2 location)	Rmin.=400m	Rm.=300m (2 location)	Rmin.=200m (2 location)
	b) Vertical Alignment	i = 3% Cut height = 10m	i = 4.6~4.8% Cut height = 20m	i = 3.5~4% Cut height = 6m	i = 0.35~0.5%	i = 3%	i = 1.3%	i = 1.3%
	c) Construction Cost	-14.7 (0.68)	- (1.00)	-12.3 (0.73)	- (1.00)	+42.6 (3.01)	-3.6 (0.85)	- (1.00)
	d) ROW / Relocation Cost	+8.6 (2.3)	- (1.00)	-0.2 (0.97)	- (1.00)	+2.1 (1.09)	+11.2 (1.19)	- (1.00)
	e) Social Impact (No.of Affected Structures)	4 and 1 subdivision(260^{m})	6	3	5	9	8 + 1 commercial	12
	f) Advantages / Disadvantages	• Too close to the existing road. • Sub-division under construction affected.	• Best horizontal alignment. • High cut needed. • High development impact.	• Too close to Iponan River, river bank protection required. • S-curve required.	• S-curve is required. • Much cheaper.	• Horizontal alignment is better. • Expensive by 3 times.	• S-curve required. • Surrounding area highly developed. • ROW cost is much higher.	• S-curve required. • Residential area will have good access.
7) Recommendation		X	◎ Recommended	X	◎ Recommended	X	X	◎ Recommended

15.5 Traffic Forecast

Estimated traffic volume by section is shown in Table 15.5-1. Number of lanes required is shown in Figure 15.5-1.

Judging from estimated traffic volume on each Section, it is recommended that the road be constructed as a 2-lane road.

TABLE 15.5-1 ESTIMATED TRAFFIC VOLUME BY SECTION

			Mid South Section	Mid Section	Mid North Section	Northern Section
Traffic Volume (100 PCU)	2010		16.3	18.2	16.8	5.6
	2016		23.9	22.0	20.0	7.3
	2022		36.1	26.7	24.5	9.7
V/C Ratio	2-lane	2010	0.65	0.73	0.67	0.22
		2016	0.96	0.88	0.80	0.29
		2022	1.44	1.07	0.98	0.39
	4-lane	2010	0.41	0.46	0.42	0.14
		2016	0.60	0.55	0.50	0.18
		2022	0.90	0.67	0.61	0.24

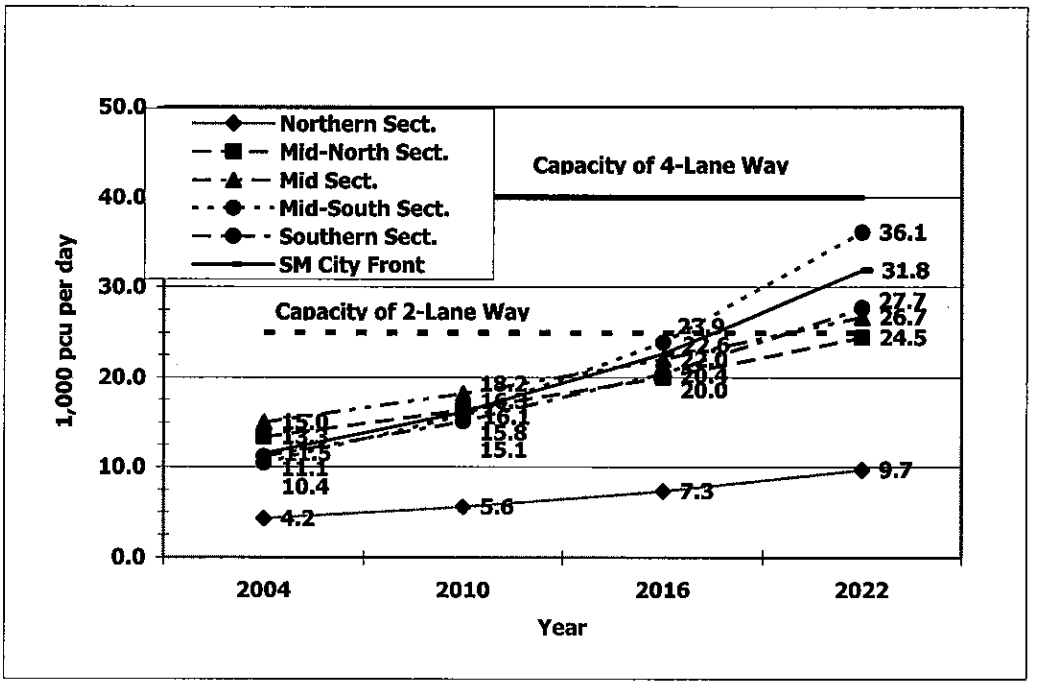


FIGURE 15.5-1 NO. OF LANES REQUIRED

15.6 Construction Phasing

Since the road is proposed to be constructed as a 2-lane road, no stage construction is recommended.

However, road ROW should be acquired to accommodate a 4-lane road to cope with future traffic demand.

15.7 Preliminary Design

15.7.1 Design Concepts and Criteria

1) Design Concepts

Western Diversion Road functions as a traffic distributor in the western areas. Traffic on CDO-Iligan Road, CDO-Talakag Road, proposed Western Coastal Road and proposed Opol Diversion Road.

It traverses mostly agricultural land and partially residential / commercial land where adverse social impacts must be minimized. It also crosses a small mountain.

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 and environmental impacts in determining horizontal and vertical alignments
- Future widening to a 4-lane road is considered in the initial stage design.
- To allow future urbanization in the planned urban area, road elevation is designed as low as possible.
- Intersections are so designed that a left-turn lane is provided.

2) Road and Intersection Design Criteria

Highway design criteria are shown in Table 15.7-1. Intersection design criteria were shown in Table 12.7-2.

Typical cross-sections are shown in Figure 15.7-1.

Road right-of-way was established in consideration of future widening as follows:

Standard ROW : 25m

ROW in cut section : Determined to accommodate future 4-lane road.

TABLE 15.7-1 HIGHWAY DESIGN CRITERIA

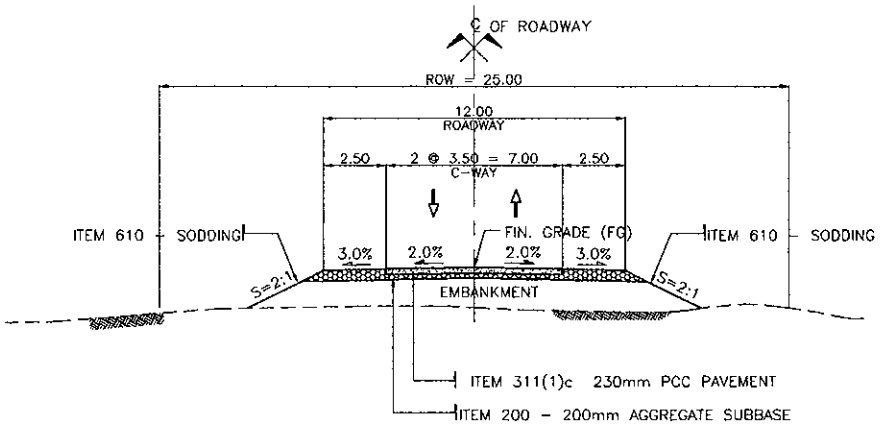
Element	Unit	Flat/Mountainous Terrain
Design Speed	Km/hr.	60
No. of Lanes	-	2
Type of Pavement	-	PCCP
Lane Width	m	3.5
Shoulder Width	m	2.5
Median	m	-
Sidewalk	m	-
Stopping Sight Distance	m	85
Passing Sight Distance	m	420
Minimum Horizontal Radius	m	120
Minimum Horizontal Radius for Normal Cross Slope	m	1,500
Maximum Vertical Grade	%	6
Minimum Length of Vertical Curve	m	60
Maximum Superelevation	%	6
Normal Cross Slope	%	2
Vertical Clearance	m	5

3) Bridge and Structures

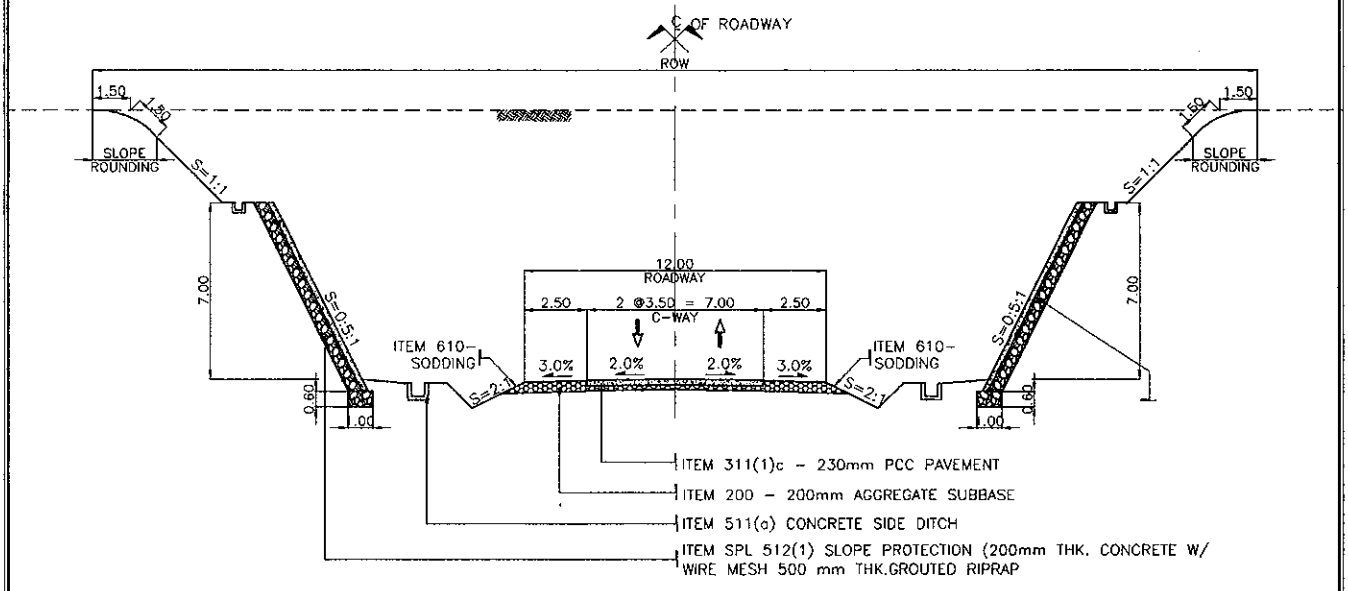
The same design criteria as shown in Section 12.7.1 were adopted.

4) Drainage and Cross Drainage Facilities

The same design criteria as shown in Section 12.7.1 were adopted.



NORMAL SECTION



CUT SECTION

FIGURE 15.7-1 TYPICAL CROSS SECTIONS : WESTERN DIVERSION ROAD

15.7.2 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 15.7-3. Among various horizontal curves, minimum one is150m 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) Typical Cross-sections Applied

Typical cross-sections were applied to the following sections:

Type of Typical Cross-Section		Applied Section	Length
Ordinary Embankment Section	:	Km 0+000-Km 1+260	L = 1.260 km
		Km 1+330-Km 1+500	L = 0.170 km
		Km 1+600-Km 5+000	L = 3.400 km
High Cut Section	:	Km 1+260-Km 1+330	L = 0.070 km
		Km 1+500-Km 1+600	L = 0.100 km

4) Intersection Design

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

- Intersection at the beginning point
- Intersection with CDO-Iligan Road (Figure 15.7-4)
- Intersection with Western Coastal Road

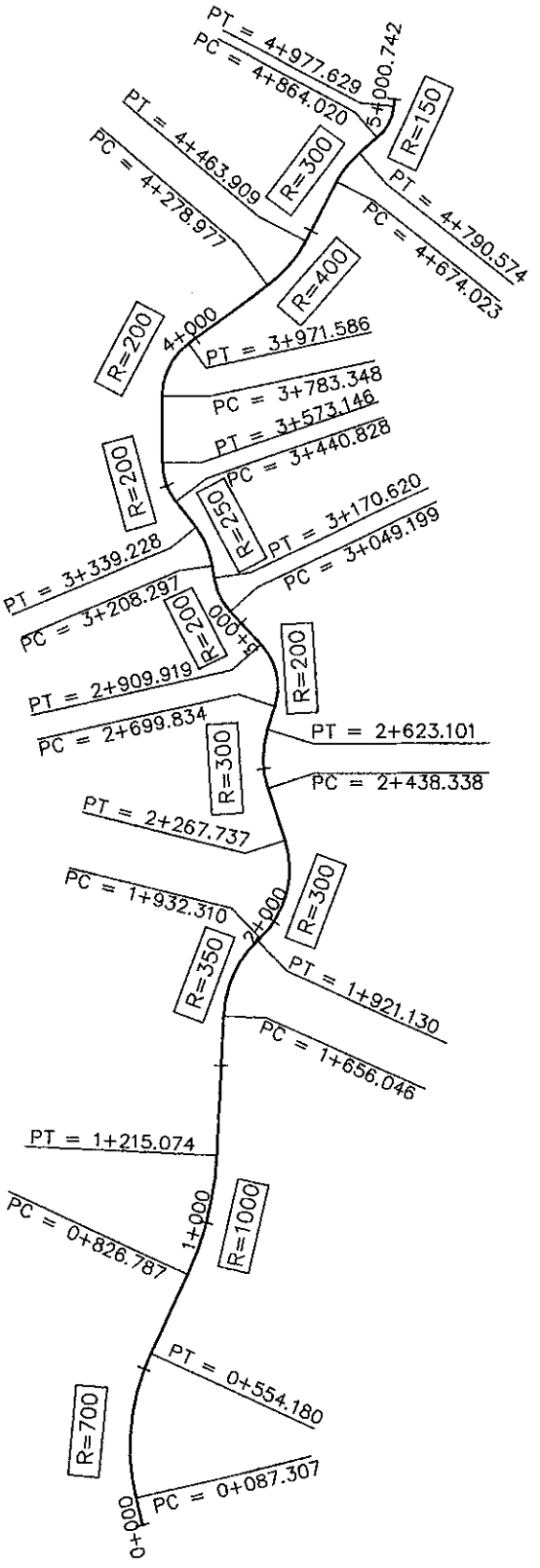


FIGURE 15.7-3 HORIZONTAL ALIGNMENT : WESTERN DIVERSION ROAD

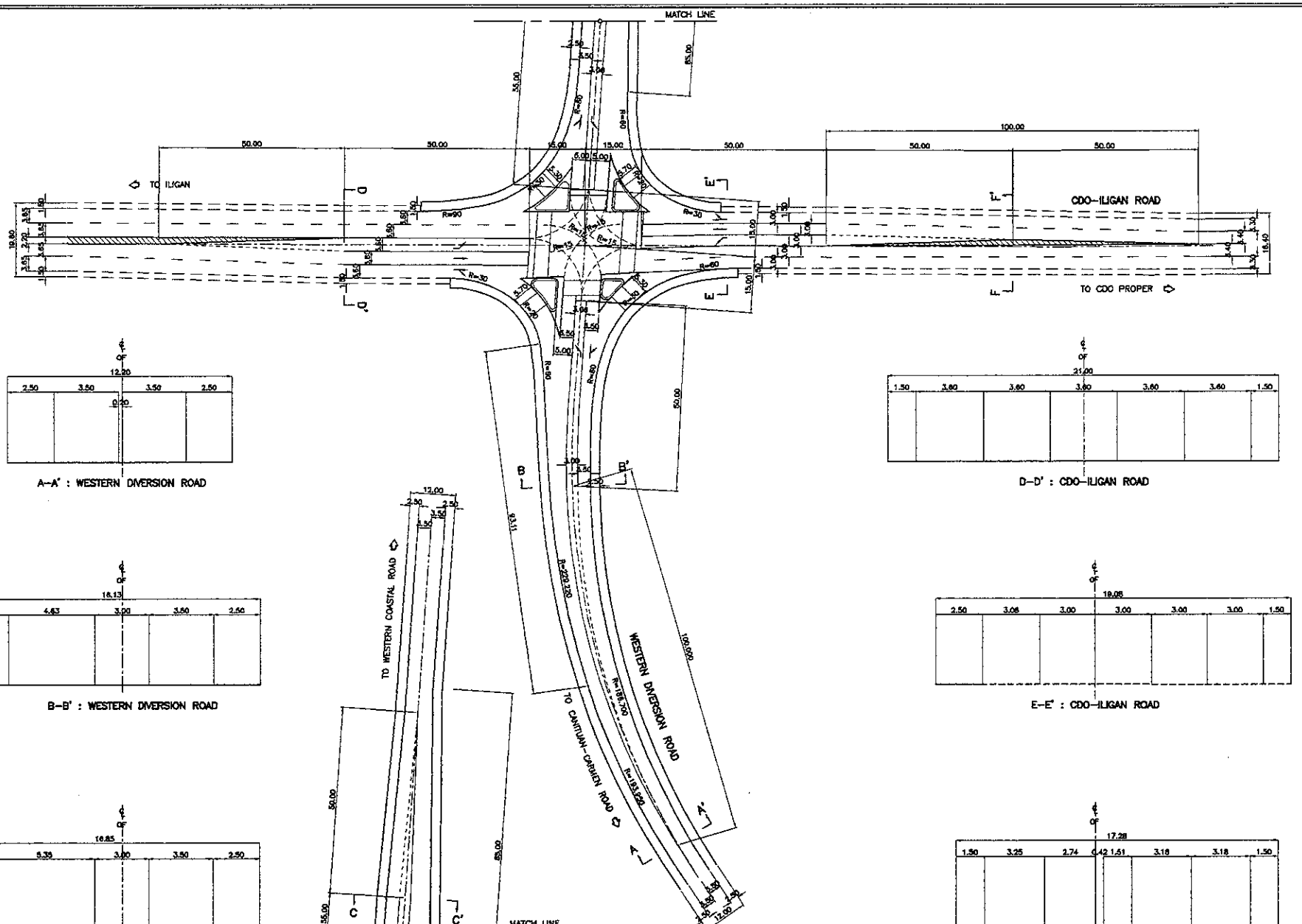


FIGURE 15.7-4 INTERSECTION WITH CDO-ILIGAN ROAD
STA. 3+617.970, MID OF WESTERN DIVERSION ROAD

15.7.3 Pavement Design

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

Table 15.7.3-1 shows the design requirements. Bus and truck factors were determined with reference to the axle load survey results undertaken along Mindanao Section of Pan-Philippine Highway in 1998.

Bus factor (number of ESAL per bus) : 0.9
Truck factor (number of ESAL per truck) : 2.5

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

Table 15.7.3-2 shows traffic loading. Cumulative ESAL is 9.8 Million for 20 years.

Required pavement thickness is as follows:

Subbase course : 20cm
PCC pavement : 23cm

TABLE 15.7.3-1 DESIGN REQUIREMENT (Western Diversion)

Category	Description
a. Design Variable	
a.1 Time Constraints • Initial Performance Period	PCCP : 20 years
a.2 Traffic Loading	Directional Distribution Factor : 0.5
a.3 Bus and Truck Factor	Bus : 0.9 Truck : 2.5
a.4 Reliability	Z_R = 1.037 for 85% Reliability So = 0.35 (Rigid)
b. Performance Criteria	
b.1 Serviceability	(Rigid) PSI = Po - Pt = 4.5 - 2.5 = 2.0
c. Material Properties for Structural Design	
c.1 Effective Modulus of Subgrade Reaction	K-Value (pci) ; 410pci (CBR : 5%, Subbase : 20cm)
c.2 Pavement Layer Materials Characterization	E_C = Modulus of Elasticity of PCC (4.20×10^6 psi)
c.3 PCC Modulus of Rupture (Rigid) (Flexural Strength)	S'c = 797 psi , Sc = 690 psi
d. Pavement Structural Characteristics	
d.1 Drainage	Rigid CD = Drainage Coefficient ; 1.0
d.2 Load Transfer (Rigid)	J = 3.8 (Plane jointed, Untied Shoulder)
e. Required Pavement Thickness	
e1. Subbase Course	t = 20cm
e2. PCC Pavement	t = 23cm

TABLE 15.7.3-2 TRAFFIC LOADING (West Diversion)

	AADT (Both Direction)		Cumulative
Year	Bus	Track	ESAL
2013	123	713	345,748
2014	126	741	704,677
2015	129	770	1,077,292
2016	133	800	1,464,137
2017	136	832	1,865,961
2018	139	865	2,283,347
2019	143	899	2,716,905
2020	146	934	3,167,266
2021	150	971	3,635,087
2022	153	1,010	4,121,030
2023	156	1,040	4,621,299
2024	159	1,072	5,136,321
2025	162	1,104	5,666,531
2026	166	1,137	6,212,382
2027	169	1,171	6,774,336
2028	172	1,206	7,352,871
2029	176	1,242	7,948,479
2030	179	1,279	8,561,666
2031	183	1,318	9,192,955
2032	187	1,357	9,842,882
TOTAL	**3,089**	**20,462**	**9,842,882**

15.7.4 Structure Design

The Proposed West Diversion Road is a new road construction 5.0kms long. One (1) river bridge crossing is identified along the alignment to cross the Calaanan River which is a tributary of the Iponan river. Although the proposed bridge site is at a higher elevation, flood is observed to reach the river banks due to clogging of the 3-barrel RCBC 100m downstream of the alignment.

This section discusses the preliminary design aspects of the proposed Calaanan River bridge crossing along the alignment.

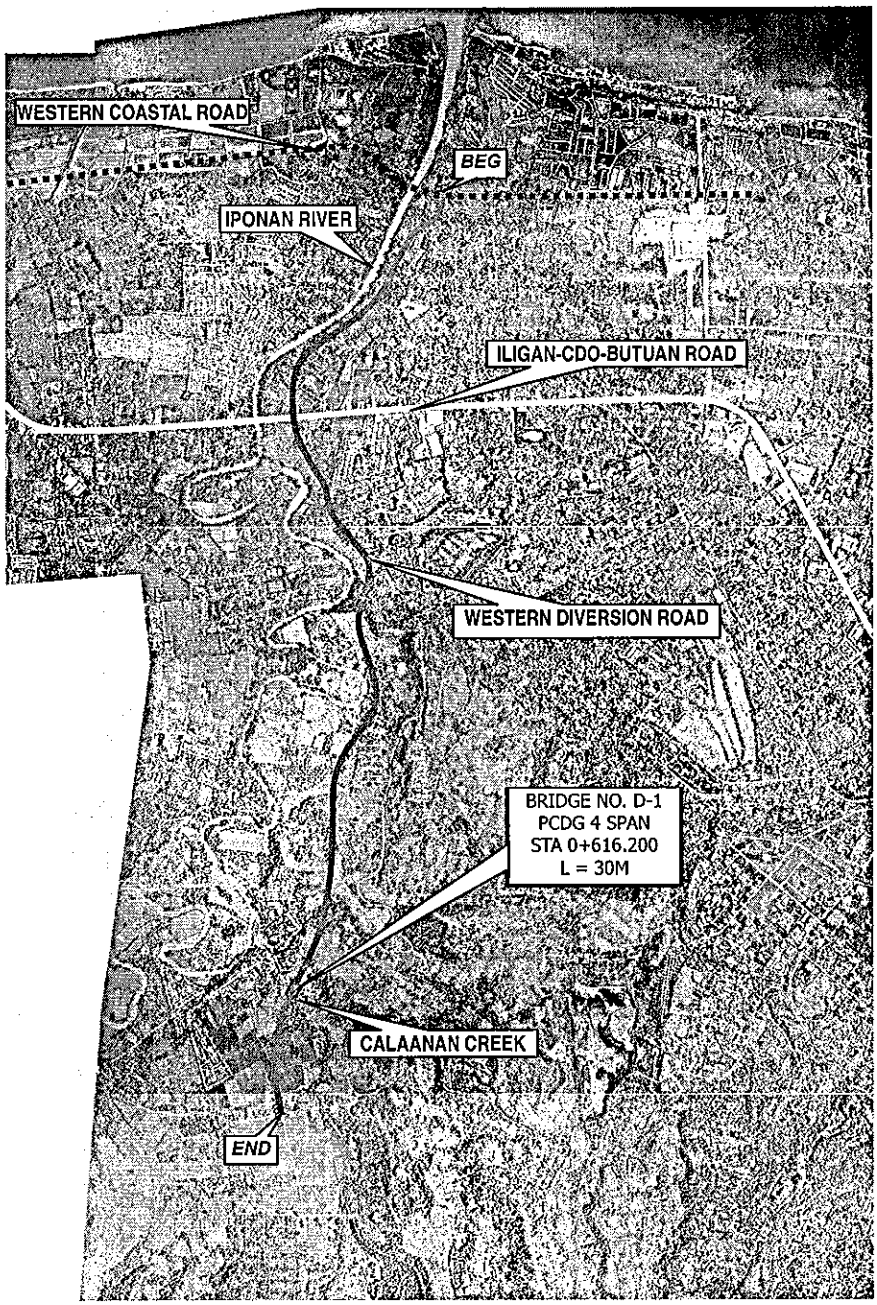


FIGURE 15.7.4-1 BRIDGE LOCATION MAP

15.7.4.1 Present Condition of the Proposed Bridge Site

Site investigation was carried-out to verify the condition of waterway along the alignment and determine the appropriate type and span of bridge suitable for the proposed site. Figure 15.7.4-1 shows the location of the proposed bridge while Figure 15.7.4-2 presents the conditions of the Calaanan Creek along the proposed Western Diversion Road.

The following features describe briefly the proposed bridge sites:

Topography

- The proposed alignment passes over flat to rolling terrain along the Iponan River and towards the proposed Western Coastal road.
- The proposed bridge site is located relatively at a higher elevation than the proposed Western Coastal road and is upstream of the Iponan River.

Rivers/Streams

- The proposed bridge site is located at the foot of the mountain and discharges to Iponan River at 400m downstream.
- The river meanders on the upstream and downstream side of the proposed bridge location,
- Trees and vegetations line up the banks but on areas where there are no vegetation, scouring is observed on the banks with exposed mixture of clayey and sandy soil,
- Since the river originates from the mountain, medium to large debris are expected including small trees and small bamboos,
- A 3-barrel RCBC (3-4.0x4.0) exists at 200m downstream of the proposed bridge site. The box culvert opening is observed to be insufficient for the river discharge as manifested by:
    - Clogging of culvert opening by debris,
    - Overflow of the river on the road during heavy rains,
    - Scouring of the culvert's downstream side with partial collapse of the road and the bank, and
    - Flooding on the proposed bridge site due to river backwater.

The river discharge for a 50-year return period is calculated for the proposed bridge site and presented in Table 15.7.4-1.

TABLE 15.7.4-1 RIVER DISCHARGE FOR PROPOSED BRIDGE SITE

BRIDGE NO.	RIVER NAME	50-YEAR DISCHARGE (cu.m/sec)	DFWL (EL. +m)	VELOCITY (m/s)	BRIDGE SPAN (m)	
					Minimum	Provided
D-1	Calaanan Creek	179.0	11.0	2.10	21	30

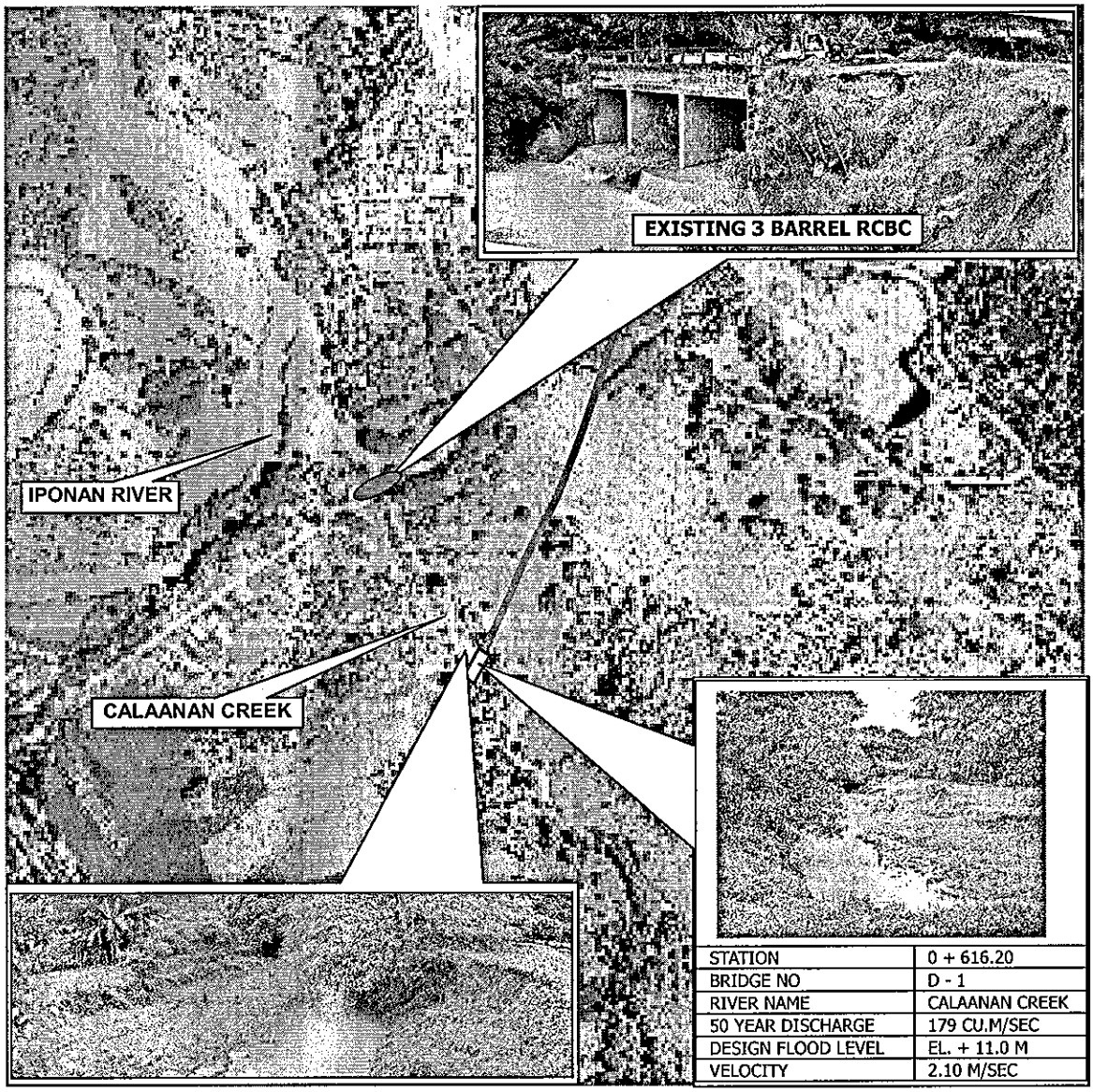


FIGURE 15.7.4-2 RIVER CONDITION AT PROPOSED BRIDGE SITE

Geotechnical

- Geotechnical investigations carried-out for the proposed bridge site (BH6) revealed the presence of thick clay and sand interbeds.
    - The clay layer generally falls under the CL and CL-ML category of the USCS while the sand materials fall under the SM category.
    - Penetration resistance in the upper 31m depth ranged from 5 to 12 with apparent increase in N-values from 13m to 16m depth. Beyond 31m depth, the penetration resistance substantially increased from 28 to a high of 48.
    - Liquefaction may not be a problem in this area due to the presence of cohesive materials.

15.7.4.2 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. Typical bridge section is illustrated in Figure 15.7.4-3. Since the Proposed Western Coastal Road is to be implemented with two lanes of travelway, the bridge deck section will be provided with two lanes of carriageway in the same configuration as the highway.

- The shoulder width of 2.5m from the road is narrowed down to 1.0m on the bridge deck to provide an 8.0m curb-to-curb clear width.

- A 0.75m wide sidewalk is provided at both sides of the deck.

Span and Bridge Length Consideration

- The span length taken in planning the bridge is based on:
    - Design discharge (requiring a minimum of 21m spans)
    - Pier encroachment to be ≤ 5% of river section. Since the site is provided with a 1-span bridge, no pier encroach the river.
    - Existing bridge spans - 200m at the downstream side of the site is an existing 3 barrel 4.0mx4.0m RCBC which has insufficient width as evidenced by the present condition of the banks and partially collapsed road.
    - Since the site is located at the foot of the mountain, a single span bridge is proposed to allow more debris to pass without conflict with the pier.

- The bridge length taken in planning the bridge is based on:
    - Design Flood Water Level at Elevation +11.0m
    - Bank distance to be covered by bridge without river encroachment is 25m.
    - Embankment height at abutment to be no more than 5m.

Girder Types

- The Precast/Prestressed Concrete Deck Girder (PCDG, AASHTO Girders) is proposed for the bridge superstructure. The choice of PCDG is based on the least cost of superstructure for the span considered.

- Construction of the superstructure will b very simple using precast AASHTO girders with cast-in-place slab on suspended formworks.

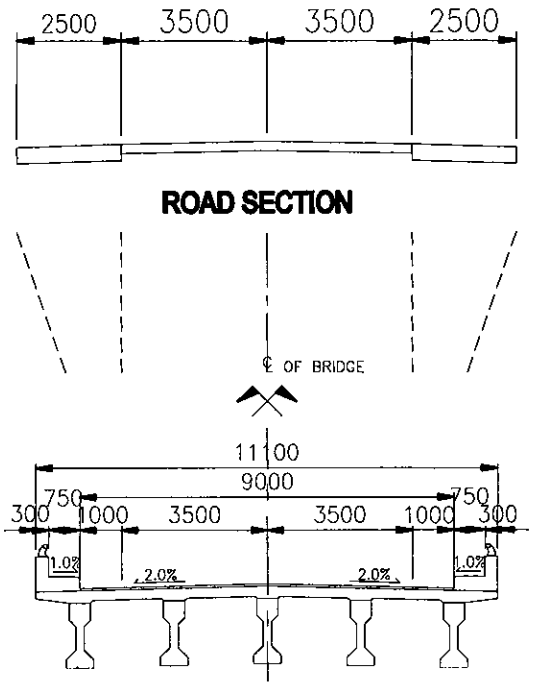


FIGURE 15.7.4-3 TYPICAL BRIDGE SECTION

Vertical Clearance

- A minimum vertical clear height of 1.5m is provided since debris is expected at maximum design flood level.

(2) Substructures

Abutments

- The 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. In this case, a close-type abutment is preferred.

- Abutment preliminary design basically follows the AASHTO Div. I-A recommendations using Mononobe-Okabe formulation to calculate seismic forces due to retained earth.

- Retained earth at the back of the abutment is limited to 5m above the existing ground to minimize settlement and soil improvement of the upper soil layer.

- Expansion joints for the superstructures are provided at abutment locations.

Pile Foundation

- Since the soil condition is relatively soft in this area, deep foundations can be utilized to support the bridge structures. Candidate types of foundations include driven piles (RC and steel) and bored piles.

- The bored pile foundation is preferred over the other types due to:

  - The abutment seismic requirement for driven piles will result in relatively large number of driven piles as compared to bored piles:

Pile Type	No. of Piles
Driven Pile, RC 450mm x 450mm	21
RC Bored Piles, ϕ1000mm	6

  - Pile cap size can be reduced by utilizing lesser number of piles.
  - Bored piles have more moment resisting capacity than driven piles and will perform more efficiently than driven piles under lateral forces and in the event of a very large earthquake.
  - Since the bearing layer tends to be deep at 32m, pile splicing is eliminated if bored piles are utilized.

15.7.4.3 Proposed Bridge

Details of the proposed bridge crossing Calaanan Creek, with a total length of 30m are presented in Table 15.7.4-2 below.

TABLE 15.7.4-2 PROPOSED BRIDGE FOR WESTERN DIVERSION ROAD

BRIDGE NO.	RIVER NAME	STATION		BRIDGE LENGTH (m)	SUPERSTRUCTURE			SUBSTRUCTURE			
								PIER		ABUTMENT	
		BEG.	END		TYPE	SPAN	SKEW (deg)	COLUMN TYPE	FOUNDATION	TYPE	FOUNDATION
D-1	Calaanan Creek	Sta. 0+616.20	Sta. 0+647.00	30.0	PCDG AASHTO Type V	1 @ 30	-	-	-	Closed Inverted-T Cantilever	ϕ1000 Bored Pile N=6; L=30m

TOTAL BRIDGE LENGTH : 30 m

15.7.5 Drainage Design

15.7.5.1 Principle and Methodology

Refer to Sub section 12.7.5.1 for the principle and methodology.

15.7.5.2 Hydrological and Hydraulic Analyses

Refer to Sub section12.7.5.2 for the hydrological and hydraulic analyses.

15.7.5.3 Results of Hydrological Analyses

The hydrological analyses reveal that there are twenty three (23) catchment areas for the proposed road .See Fig. 15.7.5-1 for the catchment areas map of West Diversion Road. The analyses also reveal that there is only one (1) location where the area is greater than twenty (20) sq km. More over there is only one(1) area where the design discharge is more than forty (40) cu m per sec. The result of the hydrological analyses is shown in Table 15.7.5-1.

15.7.5.4 Results of the Hydraulic Analyses

The hydraulic analyses reveal that there are one (1) bridge and twenty five (25) culverts needed for the road. The bridge schedule is shown in Section 15.7.4 and the list of proposed culverts is shown in Table 15.7.5-2.

15.7.5.5 Flood Flow Analysis

The flood flow analysis is conducted for one (1) catchment area where the discharge is more than forty (40) cu m per sec. The result of the analysis is shown in Table 15.7.5-3.

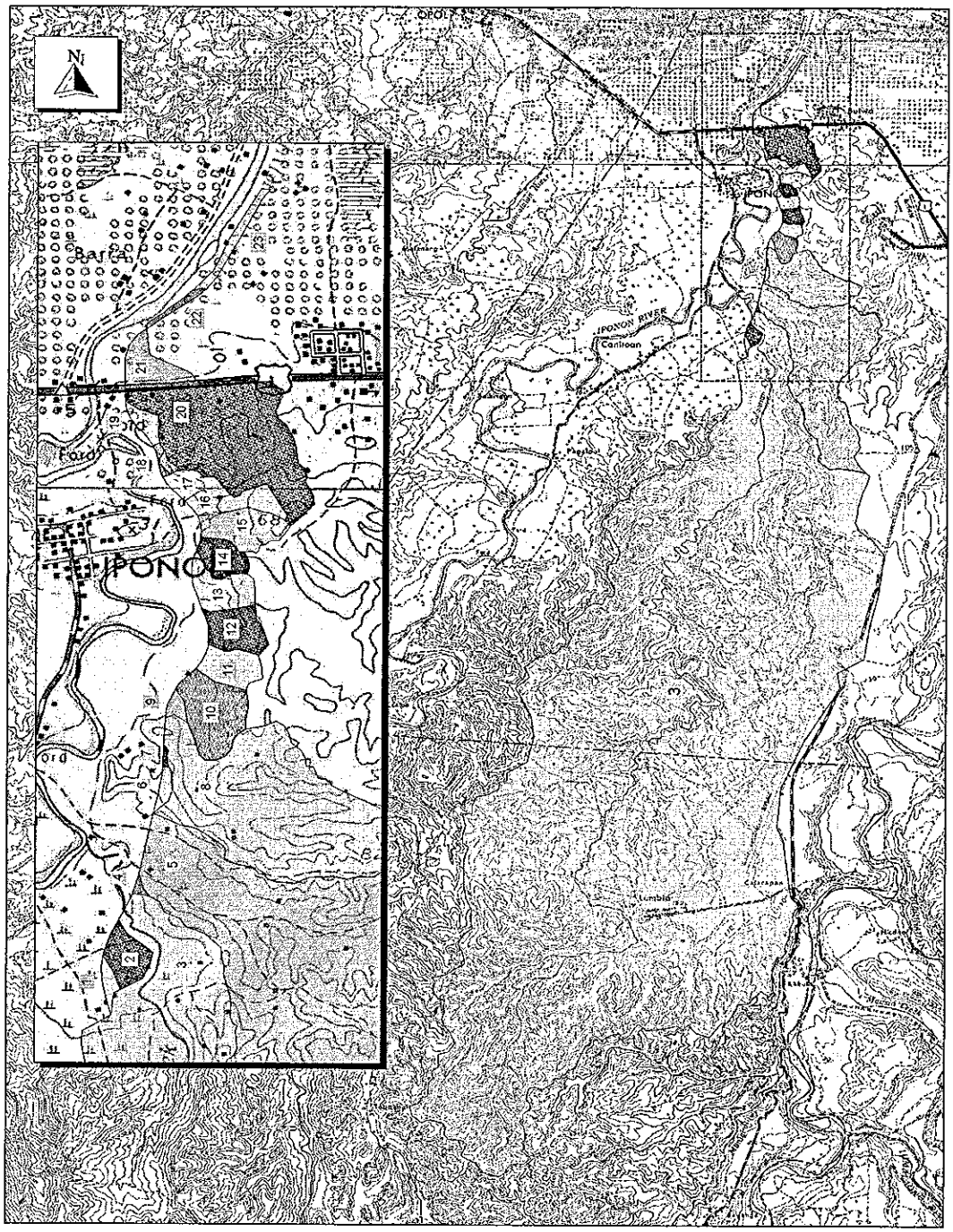


FIGURE 15.7.5-1 WEST DIVERSION ROAD CATCHMENT AREAS MAP

TABLE 15.7.5-1
HYDROLOGICAL ANALYSIS

Road Section: ***WEST DIVERSION ROAD***

Basin Number	STATION		DISCHARGE			
	BEGINNING	END	2 year	10 year	25 year	50 year
			m^3/sec.	m^3/sec.	m^3/sec.	m^3/sec.
1	0 + 000.00	0 + 320.00	0.25	0.40	0.48	0.54
2	0 + 320.00	0 + 540.00	0.95	1.52	1.82	2.04
3	0 + 540.00	0 + 700.00	84.83	134.96	160.18	178.88
4	0 + 700.00	0 + 825.00	0.08	0.12	0.15	0.17
5	0 + 825.00	1 + 160.00	6.84	10.83	12.83	14.31
6	1 + 160.00	1 + 320.00	0.23	0.37	0.45	0.50
7	1 + 320.00	1 + 560.00	0.06	0.09	0.11	0.12
8	1 + 560.00	1 + 700.00	12.42	19.99	23.82	26.72
9	1 + 700.00	1 + 860.00	0.19	0.31	0.37	0.42
10	1 + 860.00	2 + 030.00	2.13	3.42	4.08	4.58
11	2 + 030.00	2 + 150.00	0.99	1.59	1.89	2.12
12	2 + 150.00	2 + 350.00	1.18	1.90	2.26	2.54
13	2 + 350.00	2 + 610.00	2.05	3.30	3.93	4.41
14	2 + 610.00	2 + 720.00	0.24	0.38	0.45	0.51
15	2 + 720.00	2 + 840.00	0.77	1.23	1.47	1.65
16	2 + 840.00	2 + 950.00	1.37	2.21	2.63	2.95
17	2 + 950.00	3 + 120.00	0.58	0.93	1.11	1.25
18	3 + 120.00	3 + 300.00	0.19	0.31	0.37	0.42
19	3 + 300.00	3 + 550.00	0.35	0.56	0.67	0.75
20	3 + 550.00	3 + 620.00	6.23	9.88	11.72	13.10
21	3 + 620.00	4 + 000.00	1.00	1.59	1.89	2.11
22	4 + 000.00	4 + 360.00	0.19	0.31	0.37	0.42
23	4 + 360.00	5 + 003.00	0.46	0.75	0.89	1.00

TABLE 15.7.5-2
HYDRAULIC ANALYSIS

WEST DIVERSION ROAD

BASIN NUMBER	STATION (km)	SIZE		LENGTH	REMARKS / RECOMMENDATION
		RCPC	RCBC		
		mmØ	SPAN X HEIGHT		
1	0 + 200.00	1-910		15	
2	0 + 450.00	2-910		26	
3	0 + 630.00				CALAANAN RIVER
4	0 + 820.00	1-910		16	
5	1 + 060.00		2- 2.40 X 2.40	12.5	
6	1 + 200.00	1-910		15	
7	1 + 460.00	1-910		16	
8	1 + 670.00		2- 3.00 X 3.00	24	
9	1 + 800.00	1-910		16	
10	1 + 920.00	2-1220		16	
11	2 + 100.00	2-910		16	
12	2 + 350.00	2-910		15	
13	2 + 500.00	2-1220		15	
14	2 + 670.00	1-910		15	
15	2 + 800.00	2-910		17	
16	2 + 950.00	2-1070		16	
17	3 + 100.00	2-910		18	
18	3 + 290.00	1-910		15	
19	3 + 440.00	1-910		17	
20	3 + 600.00		1- 2.40 X 2.40	36	
21	3 + 760.00	1-910		17	
	3 + 940.00	1-910		17	
22	4 + 180.00	1-910		15	
23	4 + 400.00	1-1070		18	
	4 + 670.00	1-910		15	
	4 + 900.00	1-910		22	

TABLE 15.7.5-3 FLOOD FLOW ANALYSIS

WEST DIVERSION ROAD , METRO CAGAYAN DE ORO

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+632	D-1	Calaanan	37.41	179.44	2.10	11.00	10.82	30.00	

15.8 COST ESTIMATES

15.8.1 Construction Cost

(1) Unit Cost Analysis

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

The foreign exchange rates used were as follows:

1 US $ = 56.04 P = 109.64 Yen (July, 2004)

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 15.8-1, 2, 3 and 4, respectively.

(2) Construction Cost

Estimated construction cost is presented in Table 15.8-5 and 6. The construction cost of West Diversion Road was estimated at 227.5 Million pesos, composing of 50.8% a foreign currency component (or 115.5 Million pesos), 33.6% of a local currency component (or 76.5 Million pesos) and 15.6 % of a tax component (or 35.5Million pesos). Detailed breakdown of construction cost is presented in Appendix 15.8-1.

TABLE 15.8-5 CONSTRUCTION COST

(Million Pesos)

	Foreign	Local	Tax	Total
Amount	115.5	76.5	35.5	227.5
%	50.8	33.6	15.6	100%

TABLE 15.8-1 MARKET PRICE OF CONSRUCTION MATERIALS IN CAGAYAN DE ORO

(July 2004 Prices)

Price No.	Description	Unit	Unit Price (P)
1	Portland Cement	bag	143.00
2	Reinforcing Steel Bar, Gr. 40	kg.	28.00
3	Reinforcing Steel Bar, Gr. 60	kg.	34.00
4	Gasoline, Premium	lit.	26.68
5	Gasoline, Regular	lit.	26.13
6	Diesel	lit.	20.56
7	Lumber	bd.ft.	29.00
8	Ordinary Plywood 1/2"	pc	380.00
9	Emulsified Asphalt SS-1	drum	4,823.16
10	Asphalt Cement Pen. 85-100	drum	5,023.16
11	Thinner	gal.	130.00
12	Tie Wire #16	kg.	45.00

SOURCE:

- *Study Team Survey*

TABLE 15.8-2 LABOR COST

(July 2004 Prices)

Labor Category	Hourly Rate (Pesos)	Daily Rate (Pesos)
Foreman	34.66	277.30
Operator	26.24	209.90
Driver	26.24	209.90
Carpenter	26.24	209.90
Re-Bar Worker	26.24	209.90
Masonry	26.24	209.90
Blaster	31.25	250.00
Welder	26.24	209.90
Painter	26.24	209.90
Mechanic	26.24	209.90
Electrician	26.24	209.90
Skilled Labor	26.24	209.90
Unskilled Labor	25.00	200.00

SOURCE:

- *DPWH*
- *National Health Insurance Program*
- *Social Security System*

TABLE 15.8-3 HOURLY (OR DAILY) COST OF CONSTRUCTION EQUIPMENT

(July 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 15.8-4 UNIT COST OF MAJOR CONSTRUCTION ITEM (1/2)

Item No.	Description	Unit	Unit Cost	Component(%)		
				Foreign	Local	Tax
	PART C - EARTHWORK					
100(1)	Clearing and Grubbing	ha.	53,000.00	57	27	16
102(1)	Unsuitable Excavation	m3	179.00	59	17	24
102(2)a	Surplus Common Excavation	m3	179.00	60	24	15
102(2)b	Surplus Common Excavation with Big Boulders	m3	210.00	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	195.00	54	20	26
104(1)b	Embankment from Borrow	m3	390.00	56	30	15
104(1)c	Selected Borrow for Backfilling	m3	550.00	54	20	26
105(1)	Subgrade Preparation (Common Material)	m2	17.00	57	27	16
	PART D - SUBBASE AND BASE COURSE					
200	Aggregate Subbase Course	m3	550.00	54	32	14
	Sub Total					
	PART E - SURFACE COURSE					
311(1)a	PCC Pavement(Plain) (t=0.10m)	m2	420.00	62	23	15
311(1)b	PCC Pavement(Plain) (t=0.20m)	m2	620.00	62	23	15
311(1)d	PCC Pavement(Plain) (t=0.25m)	m2	770.00	62	23	15
311(1)e	PCC Pavement(Plain) (t=0.28m)	m2	850.00	62	23	15
311(2)	PCC Pavement(Reinforced) for Approach Slab, t=300mm	m2	4,450.00	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	370.00	52	35	13
400(16)a	Cast-in-Place Concrete Bored Piles, φ1000mm	m	23,800.00	38	45	17
400(16)b	Cast-in-Place Concrete Bored Piles, φ1200mm	m	32,500.00	38	45	17
400(16)c	Cast-in-Place Concrete Bored Piles, φ1500mm	m	47,000.00	38	45	17
400(19)	Piles Shoes for 0.45m×0.45m Piles	ea	1,750.00	55	30	15
401	Concrete Railings	m	2,240.00	38	49	13
404(1)	Reinforcing Steel, Grade 40 (Fy=275Mpa)	kg	39.00	50	37	13
404(2)	Reinforcing Steel, Grade 60 (Fy=415Mpa)	kg	40.00	50	37	13
404(3)	Prestressing Steel, Grade 270 (Fu=1860Mpa)	kg	255.00	50	37	13
405(1)	Structural Concrete Class"A1" for Substructure (f'c=24Mpa)	m3	3,200.00	34	50	16
405(2)	Structural Concrete Class"A2" for Superstructure (f'c=24Mpa)	m3	5,040.00	34	50	16
405(3)	Structural Concrete Class"A3" for Others (f'c=21Mpa)	m3	4,130.00	34	50	16
405(4)	Structural Concrete Class"A4" for Others (f'c=41Mpa)	m3	7,180.00	34	50	16
405(5)	Seal Concrete	m3	420.00	34	50	16
405(6)	Structural Concrete "Lean Concrete" (f'c=17 Mpa)	m3	2,480.00	43	37	20
406(1)a	Prestressed Concrete Girder, AASHTO Type IV-B, L=20m	ea	308,910.00	22	62	16
406(1)b	Prestressed Concrete Girder, AASHTO Type IV-B, L=22m	ea	331,400.00	22	62	16
406(1)c	Prestressed Concrete Girder, AASHTO Type IV-B, L=25m	ea	391,250.00	25	59	16
406(1)d	Prestressed Concrete Girder, AASHTO Type IV-B, L=26m	ea	405,480.00	22	62	16
406(1)e	Prestressed Concrete Girder, AASHTO Type IV-B, L=27m	ea	419,645.00	22	62	16
406(1)f	Prestressed Concrete Girder, AASHTO Type IV-B, L=28m	ea	441,755.00	20	65	15
406(1)g	Prestressed Concrete Girder, AASHTO Type V, L=30m	ea	505,185.00	20	65	15
406(1)h	Prestressed Concrete Girder, AASHTO Type V, L=31m	ea	520,815.00	20	65	15
406(1)i	Prestressed Concrete Girder, AASHTO Type V, L=35m	ea	647,400.00	17	69	14
406(1)j	Prestressed Concrete Girder, AASHTO Type VI, L=36m	ea	672,500.00	19	67	14
406(1)k	Prestressed Concrete Girder, AASHTO Type VI, L=40m	ea	815,870.00	17	69	14
406(1)l	Prestressed Concrete Girder, AASHTO Type IV-A, L=36m	ea	598,500.00	17	69	14
406(1)m	Prestressed Concrete Girder, AASHTO Type IV-B, L=19m	ea	293,500.00	22	62	16
407(1)a	Elastomeric Bearing Pad, 400×350×60 (Duro 60)	ea	18,100.00	55	30	15
407(1)b	Elastomeric Bearing Pad, 500×350×60 (Duro 60)	ea	21,100.00	55	30	15
407(1)c	Elastomeric Bearing Pad, 625×400×60 (Duro 60)	ea	30,100.00	55	30	15
407(2)	Expansion Joint, 50mm Gap	m	46,300.00	55	30	15
407(4)	Metal Drain (φ150mm G.I. Drain Pipe)	m	985.00	55	30	15
408	Chain Link Railing	m	1,570.00	55	30	15
	PART G - DRAINAGE AND SLOPE PROTECTION STRUCTURES					
500(1)a	Reinforced Concrete Pipe Culvert, 610mmφ (Extra. Str.)	m	4,451.00	57	28	15
500(1)b	Reinforced Concrete Pipe Culvert, 910mmφ (Extra. Str.)	m	6,600.00	57	28	15
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	18,700.00	57	28	15
500(3)a1	Reinforced Concrete Box Culvert 1-1.5m x 1.5m	m	16,200.00	42	43	15
500(3)a2	Reinforced Concrete Box Culvert 2-1.5m x 1.5m	m	25,600.00	42	43	15
500(3)a3	Reinforced Concrete Box Culvert 3-1.5m x 1.5m	m	35,800.00	42	43	15
500(3)b1	Reinforced Concrete Box Culvert 1-2.4m x 2.4m	m	27,300.00	42	43	15
500(3)b2	Reinforced Concrete Box Culvert 2-2.4m x 2.4m	m	46,100.00	42	43	15
500(3)b3	Reinforced Concrete Box Culvert 3-2.4m x 2.4m	m	65,400.00	42	43	15
500(3)c1	Reinforced Concrete Box Culvert 1-3.0m x 3.0m	m	37,300.00	42	43	15
500(3)c2	Reinforced Concrete Box Culvert 2-3.0m x 3.0m	m	65,300.00	42	43	15
500(3)c3	Reinforced Concrete Box Culvert 3-3.0m x 3.0m	m	92,000.00	42	43	15
500(3)d1	Reinforced Concrete Box Culvert 2-4.0m x 2.5m	m	2.00	42	43	15
501(4)	Subsurface Drain, Type SSD(G/P)-B	m	490.00	42	43	15
501(5)	Filter Layer	m3	800.00	42	43	15
502(2)b1	Reinforced Concrete Headwall, 1-910mmφ RCPC	ea.	18,800.00	28	57	15
502(2)b2	Reinforced Concrete Headwall, 2-910mmφ RCPC	ea.	25,200.00	28	57	15
502(2)c1	Reinforced Concrete Headwall, 1-1070mmφ RCPC	ea.	21,500.00	30	55	15
502(2)c2	Reinforced Concrete Headwall, 2-1070mmφ RCPC	ea.	31,300.00	30	55	15
502(2)d1	Reinforced Concrete Headwall, 1-1220mmφ RCPC	ea.	26,700.00	31	54	15
502(2)d2	Reinforced Concrete Headwall, 2-1220mmφ RCPC	ea.	37,500.00	31	54	15
502(2)f1	Reinforced Concrete Headwall, 1-1520mmφ RCPC	ea.	36,200.00	33	52	15
502(2)f2	Reinforced Concrete Headwall, 2-1520mmφ RCPC	ea.	51,700.00	33	52	15

TABLE 15.8-4 UNIT COST OF MAJOR CONSTRUCTION ITEM (2/2)

Item No.	Description	Unit	Unit Cost	Component(%)		
				Foreign	Local	Tax
502(10)a1	Reinforced Concrete Headwall, Box Culvert 1-1.5m x 1.5m	ea.	49,900.00	44	41	15
502(10)a2	Reinforced Concrete Headwall, Box Culvert 2-1.5m x 1.5m	ea.	59,800.00	45	40	15
502(10)a3	Reinforced Concrete Headwall, Box Culvert 3-1.5m x 1.5m	ea.	70,700.00	45	40	15
502(10)b1	Reinforced Concrete Headwall, Box Culvert 1-2.4m x 2.4m	ea.	102,000.00	44	41	15
502(10)b2	Reinforced Concrete Headwall, Box Culvert 2-2.4m x 2.4m	ea.	122,000.00	45	40	15
502(10)b3	Reinforced Concrete Headwall, Box Culvert 3-2.4m x 2.4m	ea.	141,000.00	45	40	15
502(10)c1	Reinforced Concrete Headwall, Box Culvert 1-3.0m x 3.0m	ea.	148,000.00	44	41	15
502(10)c2	Reinforced Concrete Headwall, Box Culvert 2-3.0m x 3.0m	ea.	178,000.00	45	40	15
502(10)c3	Reinforced Concrete Headwall, Box Culvert 3-3.0m x 3.0m	ea.	201,000.00	45	40	15
502(3)a1	Catch Basin for RCPC 1-φ610	ea.	16,800.00	45	40	15
502(3)b1	Catch Basin for RCPC 1-φ910	ea.	24,300.00	38	47	15
502(3)b2	Catch Basin for RCPC 2-φ910	ea.	37,900.00	39	46	15
502(3)c1	Catch Basin for RCPC 1-φ1070	ea.	28,400.00	38	47	15
502(3)c2	Catch Basin for RCPC 2-φ1070	ea.	45,500.00	39	46	15
502(3)d1	Catch Basin for RCPC 1-φ1220	ea.	37,100.00	38	47	15
502(3)d2	Catch Basin for RCPC 2-φ1220	ea.	60,900.00	39	46	15
502(3)e1	Catch Basin for RCPC 1-φ1520	ea.	47,500.00	38	47	15
502(3)e2	Catch Basin for RCPC 2-φ1520	ea.	80,300.00	39	46	15
504(5)	Grouted Riprap, Class "A"	m3	2,120.00	49	36	15
505(1)	Stone Masonry	m3	2,200.00	55	30	15
505(2)	Gravity Type Retaining Wall(H=1.0～1.5m)	m3	5,220.00	44	41	15
505(3)	Gravity Type Retaining Wall(H=1.0～3.0m)	m	4,200.00	44	41	15
506	Loose Boulder Apron 300mm ϕ min.,S.G=2.65	m3	2,250.00	44	41	15
507	Steel Sheet Pile (85×400×8mm), Furnished and Driven	m	1,430.00	55	30	15
509	Gabions	m3	3,620.00	51	34	15
510	Rubble Concrete Slope Protection, t = 350mm	m3	1,940.00	51	34	15
511(a)	Concrete Side Dicth (0.5 x 0.5)	m	2,230.00	38	47	15
511(b)	Concrete Side Dicth (1.0 x 0.5)	m	3,100.00	38	47	15
511(c)	Concrete Side Dicth (2.0 x 1.5)	m	8,400.00	38	47	15
SPL512(1)	Slope Protection for Cut	m2	4,500.00	44	41	15
SPL512(2)	RC L-Type Retaining Wall(H=3.0～5.0m)	m	12,500.00	44	41	15
	PART H - MISCELLANEOUS STRUCTURES					
600(1)a	Concrete Curb, Type A (200x450mm)	m	629.00	58	27	15
600(1)c	Concrete Curb for Edge of Sidewalk(200*500)	m	741.00	58	27	15
600(3)a	Combination Concrete Curb & Gutter/Side Strip, Type A (675x364mm)	m	1,050.00	58	27	15
603(3)a	Metal Guardrail	m	2,300.00	58	27	15
610	Sodding	m2	200.00	58	27	15
SPL620(1)	Traffic Signal (3-leg intersection)	ea.	2,082,000.00	20	65	15
SPL620(2)	Traffic Signal (4-leg intersection)	ea.	2,268,500.00	20	65	15
	Other Miscellaneous (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					
	(5% of PART A to H)					

15.8.2 ROW Acquisition and Compensation Cost (west Diversion Road)

1) Unit Price

Unit prices for road right-of-way acquisition and compensation are obtained from the respective Municipal/City Assessor's Offices and regional office of the BIR. Republic Act 8974 provides that compensation cost for land shall be the 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 15.8-6.

TABLE 15.8-6 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	100 – 600	500 – 800
Rice Field	30 – 50	100
Mountain	20 -30	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 presented in Table 14.8-7. Detail is presented in appendix 15.8-2.

TABLE 15.8-7 ESTIMATED LAND ACQUISITION AND COMPENSATION

Item	Quantity	Amount (P1,000)
Land Acquisition	132,289 m^2	36.1
Residential	33,750	26.3
Rice Field	79,841	8.0
Mountain	18,698	1.8
Structures	46 structures	11.5
Other Compensation		2.3
Total		**49.9**

15.8.3 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 15.8-8 ENGINEERING SERVICE COST

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	5.0 (55%)	3.2 (35%)	0.9 (10%)	9.1 (100%)
Construction Supervision	10.0 (55%)	6.4 (35%)	1.8 (10%)	18.2 (100%)
Total	**15.0 (55%)**	**9.6 (35%)**	**2.7 (10%)**	**27.3 (100%)**

15.8.4 Summary of Project Cost

Summary of project cost is shown in Table 15.8-9.

TABLE 15.8-9 SUMMARY OF PROJECT COST

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	5.0	3.2	0.9	9.1
ROW/Resettlement	-	44.9	5.0	49.9
Construction	115.5	76.5	35.5	227.5
Construction Supervision	10.0	6.4	1.8	18.2
Total	**130.5**	**131.0**	**43.2**	**304.7**

15.8.5 Maintenance Cost for West Diversion Road

(1) Road and Bridge Conditions

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

Item	Conditions	EMK Factor
Road Length (km)	7.5	-
Traveled Way Width (m)	4-lane: 15m~175m	1.6
Bridge Length (total) (l.m)	150	0.01
AADT (2016)		1.20
Opening Year	2014	-

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

(2) Base Cost

See Chapter 15.8.5 of Part B.

(3) Maintenance Cost Estimate

Maintenance cost is estimated based on EMK and base costs of routine and periodic maintenance, and shown in Table 15.8-10.

TABLE 15.8-10 MAINTENANCE COST OF WEST DIVERSION

	Calendar Factors		EMK			Financial Cost (x1000Peso)			Economic Cost (x1000Peso)		
	Year	AADT	Lane	Bridge	(km)	Routine	Periodic	Total	Routine	Periodic	Total
1	**2014**	1.12	1.60	1.50	14.93	1,262	0	1,262	954	0	954
2	**2015**	1.13	1.60	1.50	15.05	1,271	0	1,271	961	0	961
3	**2016**	1.14	1.60	1.50	15.17	1,281	0	1,281	969	0	969
4	**2017**	1.15	1.60	1.50	15.28	1,291	0	1,291	976	0	976
5	**2018**	1.16	1.60	1.50	15.40	1,301	0	1,301	984	0	984
6	**2019**	1.17	1.60	1.50	15.52	1,311	0	1,311	991	0	991
7	**2020**	1.18	1.60	1.50	15.63	1,321	0	1,321	998	0	998
8	**2021**	1.19	1.60	1.50	15.75	1,331	0	1,331	1,006	0	1,006
9	**2022**	1.20	1.60	1.50	15.87	1,340	0	1,340	1,013	0	1,013
10	**2023**	1.21	1.60	1.50	15.98	1,350	0	1,350	1,021	0	1,021
11	**2024**	1.22	1.60	1.50	16.10	1,360	0	1,360	1,028	0	1,028
12	**2025**	1.23	1.60	1.50	16.22	1,370	0	1,370	1,036	0	1,036
13	**2026**	1.24	1.60	1.50	16.33	1,380	0	1,380	1,043	0	1,043
14	**2027**	1.25	1.60	1.50	16.45	1,390	0	1,390	1,051	0	1,051
15	**2028**	1.26	1.60	1.50	16.56	1,399	0	1,399	1,058	0	1,058
16	**2029**	1.27	1.60	1.50	16.68	1,409	0	1,409	1,065	0	1,065
17	**2030**	1.27	1.60	1.50	16.80	1,419	0	1,419	1,073	0	1,073
18	**2031**	1.28	1.60	1.50	16.91	1,429	0	1,429	1,080	0	1,080
19	**2032**	1.29	1.60	1.50	17.03	1,439	0	1,439	1,088	0	1,088
20	**2033**	1.30	1.60	1.50	17.15	1,449	0	1,449	1,095	0	1,095

15.9 ENVIRONMENTAL IMPACT ASSESSMENT

15.9.1 General Characteristics of the Project Road

The Urban West Diversion Road is a proposed new road about 5.0km long traversing two (2) barangays of Cagayan de Oro City, namely; Bulua and Canitoan. It will be a two-lane road with a 25m standard right-of-way (ROW) and will be provided with one bridge with a length of 12m at Calaanan Creek. The road starts at junction of existing road in Barangay Canitoan in the inland area then goes toward the coastal area crossing Iligan-Cagayan de Oro-Butuan Road (ICBR) as it joins the proposed new Western Coastal Road in Barangay Bulua. The proposed road runs parallel to Iponan River. River embankment protection works along the river are also included in the project at sections where the river and road come close each other to protect the proposed new road.

The Initial Environmental Examination conducted in June 2004 reported that there were no significant environmentally critical spots, such as historical structures, religious institutions, and other environmentally critical areas along the project road. However, the required ROW along the entire stretch of the road shall be acquired and affected residents to be relocated.

15.9.2 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 15.9-1** shows the action taken to ascertain social acceptability at the feasibility study level.

TABLE 15.9-1 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 sectors 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 15.9-2**
5) Involve Women and Vulnerable Groups	• Active participation of women and vulnerable groups are considered in this report as mitigating and enhancement measures to address adverse socio-economic impacts.
6) Environmental Monitoring and Evaluation	• Included in **Table 15.9-3**

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

15.9.3 Data Gathering for Baseline Information

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

15.9.4 Description of Existing Environmental Condition

1) Physical Environment

Climate

The nearest synoptic meteorological station in the project area is located in Cagayan de Oro City. The climatic characteristics of the project road are identical to the New West Diversion Road discussed in **Section 12.9.4**.

Terrain

Terrain of the project area is generally flat with short stretch of hilly section where the road crosses a small hill currently used as quarry site. The elevation of ground is about 12m at the beginning of the road then gradually goes down toward the coastal area and ends with 2.5m at junction of the New West Diversion Road. The road crosses one creek that requires construction of a 12m bridge.

Air Quality

One (1) hour ambient air quality measurements for total suspended particulates (TSP) was conducted at Barangay Barra, Municipality of Opol. Results of the sampling activity indicate that the concentration recorded for the project alignment ranges from 10.84 micrograms per normal cubic meter (μ/Ncm) to 35.72 (μ/Ncm). This concentration is way below the standard established by the Department of Environment and Natural Resources at 230.0 micrograms per normal cubic meter.

Water Quality

Water quality measurements were made at Iponan River in Barangay Barra, Municipality of Opol, that will be traversed by the proposed project alignment. Result of water quality measurements is shown in **Table 15.9-2**.

TABLE 15.9-2 WATER QUALITY MEASUREMENTS

Location	Temperature	Ph	Dissolved Oxygen (DO), mg/L	Total Dissolved Solids, mg/L	Salinity	Conductivity
Iponan River Upstream	28.6°C	8.30	4.52	107.5	0.1	308
Iponan River Downstream	29.1°C	8.43	3.77	137.5	0.1	306

[2] EMB: Environmental Management Bureau of DENR

Noise Level

Noise level measurements were made at Barangay Barra, Municipality of Opol, adjacent the project roads.

The average readings taken at the time of sampling are shown in **Table 15.9-3**. By comparing with the standards established for the purpose, all readings for the project alignment, except for the morning readings, are higher than the standards, meaning that the ambient noise level in the area is already high.

TABLE 15.9-3 NOISE LEVEL MEASUREMENTS

Trial Readings	Morning	Daytime	Evening	Nighttime
	5 AM - 9 AM	9 AM - 6 PM	6 PM - 10 PM	10 PM - 5 AM
1	47.8	66.1	59.0	47.9
2	51.3	55.8	57.3	55.1
3	50.5	61.7	57.3	56.0
4	47.0	54.4	57.0	51.6
5	48.2	56.2	54.4	50.6
6	50.0	54.9	54.9	54.6
7	49.8	55.8	54.7	48.7
Minimum	47.0	54.4	54.4	47.9
Maximum	51.3	66.1	59.0	56.0
Average	49.2	57.8	56.4	52.1
Standard	50.0	55.0	50.0	45.0

Land Use

Land use along project road is mostly ricefield (74.4%). Residential areas are concentrated at junction with the Iligan-Cagayan de Oro-Butuan Road.

2) Biological Environment

Vegetation and Wildlife

A field survey was conducted to determine species composition of the vegetation that may be affected by the construction of the road and connecting bridges in Cagayan de Oro City. Random sampling method was used. One (1) sampling station was established to represent the project area. Selection of sampling station was based on the route map. The list of plant species and other notable characteristics are presented in the tables provided. The information presents a general overview of the plant composition and assessment of the observed sampling site.

Station 1: Along Iponan River Bulua, Cagayan de Oro City

There were 19 species belonging to 12 families identified in the area. *Vigna sesquipedalis* (*sitao*), *Abelmoschus esculentus* (*okra*), and *Gmelina sp.* were planted. Other plants include a few trees, shrubs and grasses. No rare species were observed in the area.

Aquatic Fresh/Marine Environment

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

3) Socio-Economic Environment

The socio-economic characteristics of the project road are identical to those in the New West Diversion Road as discussed in **Section 12.9.4** since the two project roads are located close to each other.

15.9.5 Perception Survey

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

A total of sixty-nine (69) respondents were identified during the survey. Nearly three-fifths (58%) of these respondents were randomly selected within the barangays while a little more than two-fifths (42%) were directly selected within the barangays since they are most likely along the project alignment.

TABLE 15.9-4 DISTRIBUTION OF RESPONDENTS BY BARANGAY

City/Barangay	Directly Affected		Indirectly Affected		Total	
	Number	%	Number	%	Number	%
Cagayan de Oro City						
Bulua	26	89.7	32	80.0	58	84.1
Canitoan	3	10.3	8	20.0	11	15.9
Total	**29**	**100.0**	**40**	**100.0**	**69**	**100.0**
% Distribution		42.0		58.0	100	

1) Awareness about the Project

More than four-fifths (85.5%) of the respondents have already heard of the plans for the construction of the project. The percentage of directly affected respondents who have already heard of the project is relatively higher (89.7%) and the highest can be found also in Barangay Bulua.

Nearly half (49.3%) of the respondents heard of the project only recently. Less than a third (30.4%) heard about it 1 or 2 years ago while less than a fifth (17.4%) on the other hand heard of it more than two years ago.

Many of those who heard about the project said that it is about the construction of a new road/highway (92.8%) while the remainder believed it is about other projects.

2) Agreement for the Project

Most (95.7%) of the respondents are in favor of the implementation of the project. More than half (53.6%) said that the project will give way to development of the area and the province as a whole. Nearly a third (30.4%) also indicated that the project offers safe and efficient transport of people, goods, and services.

3) Effect on Source of Income

Most (94.2%) of the respondents said that their livelihood will not be affected and that includes more than four-fifths (86.2%) of the directly affected respondents. Only less than a tenth (5.8%) said that there will be loss of livelihood, employment and property. Most did not provide any response.

4) Good Things Seen about the Project

About a third (33.3%) of the respondents believed that with the project there will be less traffic in the main highway and that it there will be easy and fast access to the region (30.4%). More than a fifth (21.7%) said that the city or barangay will improve or develop while a tenth (10.1%) will benefit the majority and opening of new business.

5) Benefits Expected from the Project

About half (50.7%) of the respondents said there will be opening of new industries along the alignment and consequent offer of employment. More than a third (36.2%) of the total number of respondents said that travel time will become shorter (including faster and convenient transport of people and goods). About a tenth (10.1%) said that the project will provide housing/improvement of barangay. A few 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

About a fifth (21.7%) of the total number of respondents believe that no bad things can be attributed to the project. However, more than a third (34.8%) said that there will be increased noise and air pollution level. Also a tenth (10.1%) said that there will be loss of livelihood/relocation of affected families. The rest are spread over to other responses.

7) Problems Foreseen for the Community as a Whole

More than two-fifths (42%) of the respondents believe that the project will bring about accidents/increased crime rates, drug-related incidents, robbery/hold-up cases while close to a third (27.5%) said there will increased pollution/problem of flooding/heavy erosion and landslide. Only less than a fifth (18.8%) indicated that there will be no problem foreseen resulting from the project.

15.9.6 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 15.9-5**, Impacts and Mitigation/Enhancement Matrix.

15.9.7 Environmental Management and Monitoring Plan

The Environmental Management and Monitoring Plan is presented in **Table 15.9-6**.

15.9.8 Resettlement Plan for Affected People

The survey on Resettlement Plan for affected people is currently being undertaken. Status of survey is discussed in **Section 15.10**.

TABLE 15.9-5 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 15.9-5 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: 46	Moderate		Government must ensure that the affected structures are properly compensated based on 'Replacement Cost" method as provided by laws and regulations.
Loss of Land			
Residential 33,750 m^2 Agricultural 79,841 Forest 18,698 **Total 132,289 m^2**	High		The affected land shall be compensated with fair market value.
Loss of Other Improvement			
- Trees and other perennials - Other structures	Moderate		Trees and other perennials with commercial values shall be compensated based on schedule of prices available in municipal/city assessor's office. Other structures shall be compensated based on "Replacement Cost" method.
Agricultural Tenants			
Agricultural tenants residing within the proposed ROW will be displaced.	Moderate		Government must relocate tenant-farmers at a resettlement site or area they prefer where they can access to their agricultural land.
			Government must implement a sound Social Development Program (SDP) that will ensure that affected agricultural tenants get compensated for the disturbance.
Limited Accessibility to Farmlands			
During the construction phase, farmers may experience temporal difficulty in terms of accessibility to the land they are cultivating.	Low		Contractors must provide a safe alternative route to farmers who need to cross the land they are cultivating (during and after construction phase).
Generation of temporary employment opportunities.		Moderate	Contractor must give priority to available local labor.

TABLE 15.9-5 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 15.9-6 ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX (CAGAYAN DE ORO, NS-5)

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water quality BOD, TSS, and oil and grease of surface water	All major bridges and RCBC sites	Quarterly during construction	Standard EMPASS-EQD water quality analysis	Class "C" BOD - <10 mg/L TSS - <30 mg/L increase Oil & Grease - <3mg/L	DENR-Region 10
Air quality TSP, NO_2, and SO_2	Barangay Barra, Municipality of Opol	Quarterly during construction	Standard EMPASS-WQD air quality analysis	TSP: 430, NO_2: 470, SO_2: 375	DENR-Region 10
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 10
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 10 MMT
SOCIAL					
Livelihood restoration	Resettlement site	Monthly	Interview with relocated families	Based on RAP	External Monitoring Agent
Informal settling/squatting/encroaching	Acquired ROW	Weekly	Site inspection	Based on EMP	LGUs, MMT
Illegal conversion of prime agricultural land	Areas adjacent to the bypass	Weekly	Site inspection	Based on EMP	LGUs, MMT
Road condition	Pavement and bridge, including drainage system and embankments	Based on standard DPWH maintenance procedures	Standard DPWH road and bridges maintenance works	Based on DPWH Standard Operating Procedures	DPWH

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

15.10 SOCIAL IMPACT ASSESSMENT AND RESTTLEMENT ACTION PLAN

15.10.1 Measures Taken to Mitigate Negative Impacts

Three (3) alternative alignments were studied 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. The detailed process of alternative selection is discussed in **Section 15.4**. The alternative which avoids built-up areas and other major establishments was finally selected.

15.10.2 Barangays Affected by the Project

The following barangays of Cagayan de Oro City are affected by the project:

1. Bulua
2. Canitian

15.10.3 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.

SUMMARY OF WORKSHOPS

	1st Workshop	2nd Workshop	3rd Workshop	4th Workshop
Date	November 2003	March 2004	July 2004	September 2004
Venue/Location	Cagayan de Oro City	Cagayan de Oro City	Cagayan de Oro City	Cagayan de Oro City
Topics Discussed	1. Outline of the study 2. Projects proposed by LGUs	1. Proposed road network plans	1. Selected road alignments 2. Social Impact Survey results	1. Presentation of Draft Final Report

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

2) Meetings with City Officials

Prior to the Social Impact Survey, the Study Team visited the office of the Mayor of Cagayan de Oro City and the City Planning and Development Office, as discussed in **Section 12.10.3.**

3) Meetings with Barangay Captains

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

The dates of meetings with the Barangay Captains and the date of "**Barangay Endorsement**" in acceptance of the proposed project is summarized in **Table 15.10-1.**

TABLE 15.10-1 SUMMARY OF MEETINGS WITH BARANGAY CAPTAINS AND DATE OF ISSUANCE OF BARANGAY ENDORSEMENT

City	Date of Meeting	Venue / Location	Date of Issuance of Barangay Endorsement	
Cagayan de Oro City	16 June 2004	Brgy. Session Hall	Bulua	16 June 2004
			Canitoan	21 June 2004

4) Barangay Consultation Meetings

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

TABLE 15.10-2 SUMMARY OF BARANGAY CONSULTATION MEETINGS

Barangay	Location/Venue	Date and Time of Meeting
Cagayan de Oro City		
Bulua	Barangay Hall (Gym)	19 June 2004 1:00 PM
Canitoan	Barangay Hall	21 June 2004 1:00 PM

15.10.4 Identified Impacts

Identified impacts and corresponding compensation costs are summarized **Table 15.10-3.**

1) Impact on Land

The project is the construction of a new two-lane highway with required standard right-of -way of 25m.

TABLE 15.10-3 SUMMARY OF IMPACT AND COMPENSATION COST

West Diversion 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	800	31,250	25,000,000	Name of land owners to be identified by parcellary survey.
2) Residential – 2	-	m^2	500	2,500	1,250,000	
3) Agricultural (Rice Field)	-	m^2	100	79,841	7,984,100	
4) Fish Pond	-	m^2	100	18,698	1,869,800	
Subtotal			-	**132,289**	**36,103,900**	
2) **Structures**						
1) Shanty (Bamboo & Nipa)	6	m^2	1,000	137.00	137,000	
2) Wood with GI sheet	16	m^2	1,140	594.00	677,160	
3) Concrete with wood	8	m^2	6,000	186.00	1,116,000	
4) Concrete	16	m^2	7,800	1,361.00	10,615,800	
Subtotal	**46**			**2,278.00**	**11,541,560**	
3) **Other Fixed Structures**						
1) Wooden Fence	2	m	100	33.00	3,300	
2) Concrete/Steel Fence	6	m	200	126.00	25,200	
	8			**159.00**	**28,500**	
4) **Repair Cost**	-	-	-	-	-	None
5) **Electric Post Relocation**	-	-	-	-	-	None
6) **Perennials**						
Various types	-	Nos.	various	523	183,050	
Subtotal					**47,857,010**	
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	29	HH	10,000	29	290,000	
2. Subsistence Allowance						
(1) Income loss for shop owners	3	HH	15,000	3	45,000	
2. Financial Assistance						
1) Land users w/o title	-	-	-	-	-	None
3. Rehabilitation Assistance						
1) Severely affected land owners	-	-	-	-	-	None
2) Agricultural lessees	-	-	-	-	-	None
3) Severely affected structural owners.	-	-	-	-	-	None
4. Transportation Allowance						
1) Relocating PAPs	29	HH	3,000	29	87,000	
2) Shanty dwellers go back to province.	-	-	-	-	-	None
5. Transitional allowance						
1) Renters of affected structures	-	-	-	-	-	
Subtotal					**422,000**	
TOTAL					**48,279,010**	
RAP Implementation					**1,585,150**	
TOTAL					**49,864,160**	

Affected areas by land use are summarized as follows:

Land Use	Land Area (m^2)	Share (%)
Residential	33.750	25.5
Rice fields	79.841	60.4
Mountain	18.698	14.1
Total	**132.289**	**100.0**

2) Impact on Structures

A total of **54** structures, mostly residential houses, are identified along proposed road alignment as follows:

Structure Use	Number of Structures	Floor Area (m^2)
Residential	34	2,071.00
Independent Shops	4	137.00
Farmhouses	7	121.00
Other Buildings	1	3.00
Sub-total	**46**	**2,278.00**
Fence	8	159.00 m
Total	**54**	-

3) Impact on Residents

Impacts on affected families are summarized as follows:

Type of PAF	Number	
Severely Affected PAFs	29.0	
- *Renters*	-	*not identified*
- *Agricultural Tenants*	-	*not identified*
Marginally Affected PAFs	10.0	
Total	**39.0**	
Average Household Size	4.87	
Public Entities and Utility Companies	-	*not identified*

The occupation of affected families varies widely, among which are farmers, shop owners, laborers, and employees. The average monthly household income of most of these families is below ₱12,232.22.

No informal settlers or families along the proposed road alignment that need to be relocated were identified.

4) Impact on Trees and Perennials

Groves of fruit trees, mostly unproductive and with low commercial value, were observed around residential areas. A total of **523** various kinds of trees were identified along the project road.

15.10.5 Valuation of Losses

The sources of data and methods of valuation used to determine compensations for each type of loss are shown in **Section 12.10.5**.

15.10.6 Resettlement Site

There are no informal settlers and urban poor found along the project road, hence, provision of a resettlement site is not necessary. However, Cagayan de Oro City has a number of resettlement sites, as discussed in **Section 12.10.6**, that can accommodate residents who could possibly be displaced.

15.10.7 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. The details of this are discussed in **Section 12.10.6**.

15.10.8 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. This arrangement is discussed in detail below.

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 CDO Urban West Diversion Road Project. It will manage and supervise the project, including its resettlement activities and land acquisition requirements, in coordination with concerned agencies. To ensure smooth implementation 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 Cagayan de Oro City shall be the lead implementing arm for the Resettlement Action Plan (RAP) for project affected persons within the territorial boundary of Cagayan de Oro City.

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

2) Local Government Unit (LGU)

The resettlement requirements of the project shall be coordinated by the DPWH and its regional and district engineering offices with the LGU. 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)

Chairman and Convenor	:	District Engineer (DPWH), Cagayan de Oro City
Co-Chairman	:	City Mayor of Cagayan de Oro (or his designated representative)
Members	:	

Barangay Captain – Barangay Bulua
Barangay Captain – Barangay Canitoan

Representative of PAPs – Barangay Bulua, Cagayan de Oro City
Representative of PAPs – Barangay Canitoan, Cagayan de Oro City

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

The NGO(s) or PO(s) in the 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 Cagayan de Oro.

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 **June 29, 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.

15.10.9 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 discussed in **Section 12.10.8**.

15.10.10 Monitoring and Evaluation

The procedures for monitoring and evaluation of RAP implementation during the project implementation stage are discussed in **Section 12.10.9**.

15.10.11 RAP Implementation

1) Preparation of Final RAP

The social impacts identified in this study shall be verified and validated during the detailed design stage after establishing the exact extent of construction limits and the corresponding ROW limits required. The RAP updating surveys shown in **Table 15.10-4** shall be carried out to update the preliminary RAP prepared under this study after fixing the final ROW limits.

TABLE 15.10-4 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 result 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 Cagayan de Oro City 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 LGU concerned. The MOU will provide the mandate for the formation of the RIC and will likewise spell out the required cooperation and commitment of the LGU 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 Mayor of Cagayan de Oro City 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.

15.11 PROJECT EVALUATION

15.11.1 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 Western Diversion Road. The estimated traffic volume on the Western Diversion Road for the case of "with" the project is summarized in **Table 15.11-1**.

TABLE 15.11-1 TRAFFIC VOLUME ON WESTERN DIVERSION ROAD

Unit: PCU / day

	2010	2016	2022	AAGR (%)	
				'10 – '16	'16 – '22
Northern Section	5,569	7,344	9,685	4.7	4.7
Middle Section	18,164	22,029	26,717	3.3	3.3
South Section	15,080	20,428	27,673	5.2	5.2
SM City Front	16,104	22,643	31,838	5.8	5.8

The estimated vehicle kilometers and vehicle hours in Metro CDO are shown in **Tables 15.11-2** and **15.11-3**, respectively. These tables are based on the benefit calculation.

TABLE 15.11-2 TOTAL VEHICLE KILOMETERS IN METRO CDO WITH AND WITHOUT WESTERN DIVERSION ROAD

Unit: PCU Km / day

	W/O Project	W/ Project	W/O - W/
2010	2,448,270	2,448,750	Δ480
2016	3,277,960	3,278,600	Δ640
2022	4,470,550	4,467,680	Δ2,870

TABLE 15.11-3 TOTAL VEHICLE HOURS IN METRO ILOILO WITH AND WITHOUT WESTERN DIVERSION ROAD

Unit: PCU Hour / day

	W/O Project	W/ Project	W/O - W/
2010	102,010	99,930	2,070
2016	147,330	144,340	2,990
2022	226,190	220,500	5,690

2) Economic Evaluation

Evaluation Period

The evaluation period is assumed to be 20 years from 2015 to 2034 taking into account the service life of the Western Diversion Road.

Implementation Schedule

The implementation schedule is assumed as follows:

- 2009 Detailed design
- 2010 – '11 Land acquisition
- 2012 – '14 Construction of Western Diversion Road
- 2015 – Open to the public

Economic Indicators

The economic evaluation method is principally employed benefit cost analysis. The economic indicators used in this study re 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 15.11-4).

TABLE 15.11-4 BASIC VEHICLE OPERATING COST (EXCLUDING TAX)

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

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

The vehicle operating cost by surface type and travel speed was set up since it varies by these factors as shown in Appendix Table **12.11-1.**

Estimation of Benefits

The saving in vehicle operating costs and travel time cost were estimated and are shown in **Table 15.11-5**.

TABLE 15.11-5 ESTIMATION OF BENEFITS

Unit: '000 Pesos/Year

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TCC	Total Saving
2010	16,625	35,502	52,127	47,992	100,119
2016	21,630	51,276	72,906	69,317	142,223
2022	41,650	97,342	138,992	31,588	270,580

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 15.11-6**.

TABLE 15.11-6 ECONOMIC COST ESTIMATE

Unit: '000 Pesos

	Description	Economic Cost	Financial Cost
1	Construction Cost	192,000	227,000
2	ROW Acquisition / Resettlemet	44,900	49,900
3	Consultancy	24,600	27,300
3-1	Detailed Design	8,200	9,100
3-2	Construction Supervision	16,400	18,200
	Total	261,500	304,200

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 Western Diversion Road 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 15.11-7** show the benefit – cost analysis of the Western Diversion Road Construction Project during project life period of 20 years and **Table 15.11-8** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of ₱ 257 million and BCR of 4.10 over 20 years life of the Bridge using discount date of 15% which is designated by the NEDA. The Economic Internal Rte of Return (EIRR) was compiled at 36.4%.

TABLE 15.11-7 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

Net Present Value	P257 million pesos
BCR	4.10
EIRR	36.40%

Note: 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 15.11-9** show the results of the sensitivity analysis.

TABLE 15.11-8 BENEFIT - COST STREAM OF WESTERN DIVERSION ROAD PROJECT

Sq	Year	Undiscounted Benefit Cost Stream					Discounted Benefit Cost Stream					
		Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit	Discounted	Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit
1	2004	0.0	0.0	0.0	0.0	0.0	1.000	0.0	0.0	0.0	0.0	0.0
2	2005	0.0	0.0	0.0	0.0	0.0	1.150	0.0	0.0	0.0	0.0	0.0
3	2006	0.0	0.0	0.0	0.0	0.0	1.323	0.0	0.0	0.0	0.0	0.0
4	2007	0.0	0.0	0.0	0.0	0.0	1.521	0.0	0.0	0.0	0.0	0.0
5	2008	0.0	0.0	0.0	0.0	0.0	1.749	0.0	0.0	0.0	0.0	0.0
6	2009	8,200.0	0.0	8,200.0	0.0	-8,200.0	2.011	4,076.8	0.0	4,076.8	0.0	-4,076.8
7	2010	22,450.0	0.0	22,450.0	0.0	-22,450.0	2.313	9,705.8	0.0	9,705.8	0.0	-9,705.8
8	2011	22,450.0	0.0	22,450.0	0.0	-22,450.0	2.660	8,439.8	0.0	8,439.8	0.0	-8,439.8
9	2012	72,666.7	0.0	72,666.7	0.0	-72,666.7	3.059	23,754.9	0.0	23,754.9	0.0	-23,754.9
10	2013	72,666.7	0.0	72,666.7	0.0	-72,666.7	3.518	20,656.4	0.0	20,656.4	0.0	-20,656.4
11	2014	63,066.7	0.0	63,066.7	0.0	-63,066.7	4.046	15,589.1	0.0	15,589.1	0.0	-15,589.1
12	2015	0.0	343.0	343.0	134,127.7	133,784.7	4.652	0.0	73.7	73.7	28,829.8	28,756.1
13	2016	0.0	343.0	343.0	142,223.4	141,880.4	5.350	0.0	64.1	64.1	26,582.6	26,518.5
14	2017	0.0	343.0	343.0	150,369.2	150,026.2	6.153	0.0	55.7	55.7	24,439.2	24,383.5
15	2018	0.0	343.0	343.0	158,986.7	158,643.7	7.076	0.0	48.5	48.5	22,469.4	22,420.9
16	2019	0.0	343.0	343.0	168,103.4	167,760.4	8.137	0.0	42.2	42.2	20,659.0	20,616.8
17	2020	0.0	343.0	343.0	225,443.7	225,100.7	9.358	0.0	36.7	36.7	24,092.0	24,055.3
18	2021	0.0	343.0	343.0	246,133.3	245,790.3	10.761	0.0	31.9	31.9	22,872.2	22,840.3
19	2022	0.0	343.0	343.0	270,579.9	270,236.9	12.375	0.0	27.7	27.7	21,864.2	21,836.5
20	2023	0.0	343.0	343.0	282,206.1	281,863.1	14.232	0.0	24.1	24.1	19,829.3	19,805.2
21	2024	0.0	343.0	343.0	294,386.4	294,043.4	16.367	0.0	21.0	21.0	17,987.1	17,966.1
22	2025	0.0	343.0	343.0	307,149.1	306,806.1	18.822	0.0	18.2	18.2	16,319.0	16,300.8
23	2026	0.0	343.0	343.0	320,524.3	320,181.3	21.645	0.0	15.8	15.8	14,808.4	14,792.6
24	2027	0.0	343.0	343.0	334,543.6	334,200.6	24.891	0.0	13.8	13.8	13,440.1	13,426.3
25	2028	0.0	343.0	343.0	349,240.3	348,897.3	28.625	0.0	12.0	12.0	12,200.5	12,188.5
26	2029	0.0	343.0	343.0	364,649.4	364,306.4	32.919	0.0	10.4	10.4	11,077.2	11,066.8
27	2030	0.0	343.0	343.0	380,807.9	380,464.9	37.857	0.0	9.1	9.1	10,059.2	10,050.1
28	2031	0.0	343.0	343.0	397,754.9	397,411.9	43.535	0.0	7.9	7.9	9,136.4	9,128.5
29	2032	0.0	343.0	343.0	415,531.4	415,188.4	50.066	0.0	6.9	6.9	8,299.7	8,292.8
30	2033	0.0	343.0	343.0	434,180.9	433,837.9	57.575	0.0	6.0	6.0	7,541.1	7,535.1
31	2034	0.0	343.0	343.0	453,748.9	453,405.9	66.212	0.0	5.2	5.2	6,853.0	6,847.8
							Total	82,222.8	530.9	82,753.7	339,359.4	256,605.7

Net Present Value	**256,606**
B/C Ratio	**4.101**
EIRR	**36.40**

TABLE 15.11-9 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF WESTERN DIVERSION ROAD CONSTRUCTION PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (P million) B/C Ratio EIRR (%)	205 4.10 36.40	273 5.13 41.0	341 6.15 45.1
	Base Case	NPV (P million) B/C Ratio EIRR (%)	189 3.28 32.2	257 4.10 36.40	324 4.92 40.1
	20% up	NPV (P million) B/C Ratio EIRR (%)	172 2.73 29.0	240 3.42 32.9	308 4.10 36.40

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

(3) Summary of Economic Analysis

The implementation of the Western Diversion 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.

15.11.2 Technical Evaluation

The results of the technical analysis of the Western Coastal Road show that the construction of the Western Coastal Road is technically feasible. In general, there are a few technical problems to construct the Western Diversion Road. However, the following technical notes shall be made:

- Due to minimizing acquisition of ROW along residential areas in the section 1, it is proposed to employ the block masonry as retaining wall.

15.11.3 Other Impacts

1) On Traffic

Table 15.11-10 shows the transport efficiency of Metro Cagayan de Oro in cases of with and without the Western Coastal Road.

TABLE 15.11-10 TRANSPORT EFFICIENCY IN METRO CAGAYAN DE ORO WITH AND WITHOUT WESTERN DIVERSION ROAD

			2010	2016	2022
PCU Kilometers ('000)	Whole Area	W/O Project	2,448,270 1.00	3,277,860 1.00	4,470,550 1.00
		W/ Project	2,448,750 1.00	3,278,600 1.00	4,461,680 0.99
PCU Hour ('000)	Whole Area	W/O Project	102,010 1.00	147,330 1.00	226,190 1.00
		W/ Project	99,930 0.98	144,390 0.98	220,500 0.97
Average Travel Speed (km/h)	Whole Area	W/O Project	24.00 1.00	22.25 1.00	19.76 1.00
		W/ Project	24.50 1.02	22.71 1.02	20.26 1.03
Vehicle Operating Cost (P '000/day)	Whole Area	W/O Project	12,288 1.00	16,695 1.00	23,272 1.00
		W/ Project	12,240 0.99	16,633 0.99	23,153 0.99

Part-D Road Network Development Plan for Metro CDO (Western Diversion Road)

Table 15.11-11 TRAFFIC VOLUME WITH AND WITHOUT WESTERN DIVERSION ROAD CONSTRUCTION PROJECT

Unit: PCU/day

	2016			2022		
	W/O Project	W/ Project		W/O Project	W/ Project	
	Existing Rd	Existing Rd	W Diversion Road	Existing Rd	Existing Rd	W Diversion Road
North Section	8,400	2,200	20,800	13,400	9,400	24,500
Middle Section	10,400	1,700	23,900	17,000	8,300	36,100
South Section	12,500	20,400		18,100	27,700	

2) On Urban Amenity

Traffic volume of the existing secondary road will be greatly reduced due to diverted to the Western Diversion Road. Therefore, noise level air quality and vibration in the area within the Iligan - Cagayan de Oro – Butuan Road will be greatly improved. Thus, urban amenity will be improved.

3) On Urbanization

Urbanization will be guided and supported by the Western Coastal Road. According to the Urban Index calculated in Section 11.2 of the Master Plan, urbanization index (RUa) along Western Diversion Road corridor will be able to calculate to be almost 80%. With the existing road network within the road, sound urbanization will be achieved.

4) On Regional Economy

With the improved and reliable transport facility, economic activities within the influence area of the Western Diversion Road will be stimulated. This project will contribute to economic growth of not only Metro Cagayan de Oro but also Reion X.

15.11.4 Overall Evaluation

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

CHAPTER 16
RECOMMENDATIONS

16.1 IMPLEMENTATION SCHEDULE OF PROJECTS SELECTED FOR F/S

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

Project	Detailed Design	ROW Acquisition	Construction
Western Coastal	2007	2008-2009	2010-2013
7th Bridge	2007	2008	2009-2010
J.R. Borja Extension	2009	2010-2012	2013-2017
West Diversion	2009	2010-2011	2012-2014

FIGURE 16.1-1 IMPLEMENTATION SCHEDULE OF PROJECT SELECTED FOR F/S

Project	Activities	Cost (Million P)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Western Coastal Road	Fund Preparation	-	■■■■												
	Consultant Selection	-		■■■■											
	Detailed Design	24.1			24.1										
	ROW / Resettlement	87.3				43.6	43.7								
	Contractor Selector	-					■■■■								
	Construction	603.6						150.9	150.9	150.9	150.9				
	Const. Supervision	48.3						12.0	12.0	12.0	12.3				
	Total	763.3	-	-	24.1	43.6	43.7	162.9	162.9	162.9	163.2				
7th Bridge	Fund Preparation	-	■■■■												
	Consultant Selection	-		■■■■											
	Detailed Design	7.7			7.7										
	ROW / Resettlement	23.7				23.7									
	Contractor Selector	-				■■■■									
	Construction	193.5					96.7	96.8							
	Const. Supervision	15.5					7.7	7.8							
	Total	240.4	-	-	7.7	23.7	104.4	104.6							
J.R. Borja	Fund Preparation	-			■■■■										
	Consultant Selection	-				■■■■									
	Detailed Design	47.2					47.2								
	ROW / Resettlement	175.9						58.6	58.6	58.7					
	Contractor Selector	-								■■■■					
	Construction	1,179.7									235.9	235.9	235.9	235.9	236.1
	Const. Supervision	94.4									18.8	18.8	18.8	18.8	19.2
	Total	1,497.2	-	-	-	-	47.2	58.6	58.6	58.7	254.7	254.7	254.7	254.7	255.3
West Diversion Road	Fund Preparation	-			■■■■										
	Consultant Selection	-				■■■■									
	Detailed Design	9.1					9.1								
	ROW / Resettlement	49.9						24.9	25.0						
	Contractor Selector	-							■■■■						
	Construction	227.5								75.8	75.8	75.9			
	Const. Supervision	18.2								6.0	6.0	6.2			
	Total	304.7	-	-	-	-	9.1	24.9	25.0	81.8	81.8	82.1			
Total / Annual Investment		2,805.6	-	-	31.8	67.3	204.4	351.0	246.5	303.4	499.7	336.8	254.7	254.7	255.3

16.2 RECOMMENDATIONS

DPWH

- The proposed Road Network Plan should be authorized by agencies concerned as well as LGUs concerned.
- Priority projects should be included in the DPWH Medium-Term Public Investment Program.
- Funding of Western Coastal Road and 7th Bridge needs to be sourced from international agency or bi-lateral aid. Negotiation with one of the agencies or countries should start immediately and concluded within 2005.
- ECC of priority projects should be secured as early as possible.
- DPWH should determine an implementing office of Regional Growth Center Projects as soon as possible.
- Memorandum of Agreement between DPWH and concerned LGUs should be exchanged concerning the securing of the proposed road ROW.
- For smooth implementation of priority projects, DPWH should start coordination with LGUs concerned with regard to ROW acquisition and relocation of project-affected persons.
- Road re-classification should be discussed with LGUs. Some roads should be reclassified from Provincial Road to National Road or vis-à-vis.
- DPWH should review and update proposed Road Network Plan periodically or at least every 6 years. This Plan was prepared under the present tight financial situation. When the financial situation improves, some of projects could be implemented ahead of the proposed schedule.

Concerned LGUs

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

16.3 RECOMMENDATION ON PROJECT PACKAGING

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

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

REGIONAL GROWTH CENTER ROAD NETWORK DEVELOPMENT PROJECT

URGENT PROJECT PACKAGE FOR IMMEDIATE FOREIGN FINANCE

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

PACKAGED PROJECT COST AND COST COMPONENT

Unit: Million Pesos

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

RECOMMENDED PACKAGE OF IMMEDIATE FOREIGN FINANCE

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

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