CHAPTER 11
ROAD NETWORK DEVELOPMENT MASTER PLAN

11.1 FINANCIAL FRAMEWORK

Proposed future road network consists of various road projects which are required to be systematically implemented in accordance with priority and within the financial framework. At present, the Philippine Government is suffering the severe financial constraints. In this section, possible amount for road investment to the Study Area is discussed for the following terms:

Short Term	:	2005 - 2010	(6 years)
Medium Term	:	2011 – 2016	(6 years)
Long Term	:	2017 – 2022	(6 years)

11.1.1 National Road

1) Procedure to Estimate Possible Investment Amount for Road Development

The procedure to estimate possible investment amount for road development is shown in Figure 11.1-1.

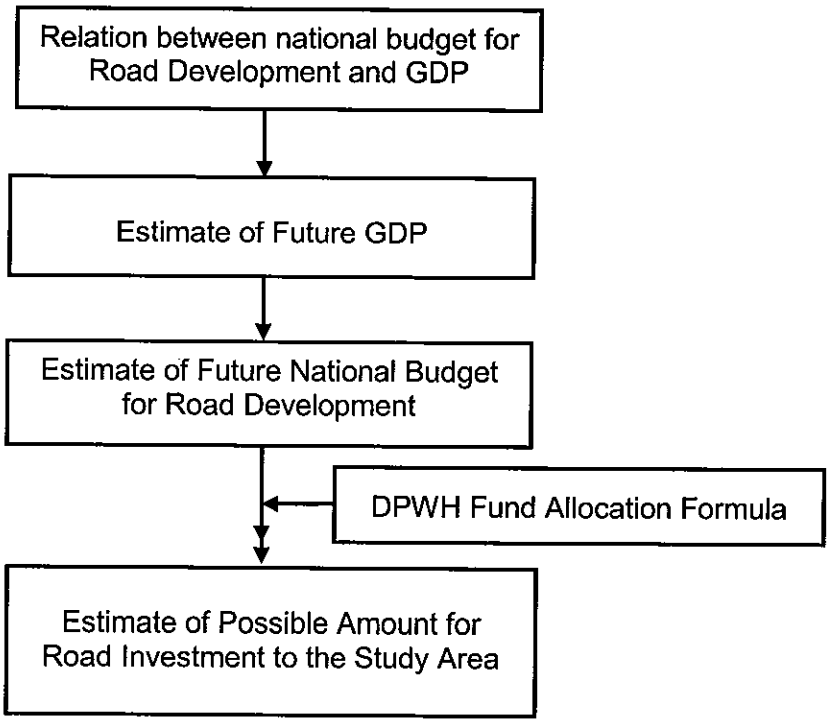


FIGURE 11.1-1 PROCEDURE TO ESTIMATE POSSIBLE INVESTMENT AMOUNT

2) Estimate of Possible Investment Amount for Road Development

a) Relation between National Budget and GDP

Table 11.1-1 shows past capital outlay for road development in relation with GDP. Past trend was as follows:

% share of road investment to GDP

Max.	1.12%	(year 1998)
Min.	0.40%	(year 2002)

b) Future GDP

GDP growth rate was estimated as follows:

Years 2003 and 2004	:	Philippine Medium - Term Development Plan 2001-2004
2005 – 2010	:	5% per annum by the Study Team and accepted by NEDA.
2011 - 2022	:	4.5% per annum by the Study Team and accepted by NEDA.

c) Future % share of Capital Outlay to GDP

Amount of capital outlay for year 2004 was given by DPWH. It is also informed that year 2004 budget level will continue at least for the next 5 years.

From year 2009 to 2022, it was assumed that % share of capital outlay to GDP will increase from 0.45% in 2009 to 0.65% in 2022.

d) DPWH Fund Allocation to the Study Area

DPWH has developed the Fund Allocation Formula to each congressional district. According to the formula, budget allocation to the Study Area will be as follows:

Metro Bacolod	:	0.70 ~ 0.80% of national capital outlay for road development

e) Estimated Possible Amount for Road Development

Possible amount for road development to Metro Cagayan de Oro was estimated as shown in Table 11.1-2, and summarized as follows:

Term		Possible Investment Amount (Million ₱)
Short Term	(2005 ~ 2010)	970 ~ 1,110
Medium Term	(2011-2016)	1,740 ~ 1,990
Long Term	(2019-2022)	2,550 ~ 2,910
Total	**(2005 ~ 2022)**	**5,260 ~ 6,010**

TABLE 11.1-1 GDP AND CAPITAL OUTLAY FOR ROAD DEVELOPMENT

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
GDP (Current Price, Million P)	1,474,457	1,692,932	1,905,951	2,171,922	2,426,743	2,665,060	2,976,905	3,308,318	3,639,980	3,977,380	–
GDP Nominal Growth Rate (% per annum)	9.09	14.82	12.58	13.95	11.73	9.82	11.70	11.13	10.03	9.27	–
GDP Growth Rate in real term (% per annum)	2.12	4.39	4.68	5.85	5.19	-0.58	3.40	4.38	3.22	4.56	(5.20)
Capital Outlay for Highway Development (Current Price, Million P)	10,436	10,925	11,789	15,428	22,723	29,733	24,220	21,469	21,469	15,980	21,014
% share of Capital Outlay to GDP	0.71	0.65	0.62	0.71	0.94	1.12	0.81	0.65	0.59	0.40	–

TABLE 11.1-2 ESTIMATED POSSIBLE INVESTMENT AMOUNT

Year	GDP Growth Rate (%)	Estimated GDP at 2003 Constant Prices (Million Pesos)	% share of Capital Outlay for Highway Development (%)	Estimated Capital Outlay to Highway Development (Million Pesos)	6 Year Total (Million Pesos)	Possible Investment Amount to Metro Cagayan de Oro (0.70%~0.80%) (Million Pesos)
2002	-	3,977,380	0.40	15,980		
2003	(5.20)	4,335,300	0.48	21,014		
2004	5.50	4,573,742	0.45	20,400		
2005	5.00	4,802,429	0.42	20,400		
2006	5.00	5,042,550	0.40	20,400		
2007	5.00	5,294,678	0.39	20,400		
2008	5.00	5,559,412	0.37	20,400		
2009	5.00	5,837,383	0.45	26,268		
2010	5.00	6,129,252	0.50	30,646	138,514	970~1,110
2011	4.50	6,405,068	0.50	32,025		
2012	4.50	6,693,296	0.55	36,813		
2013	4.50	6,994,494	0.55	38,470		
2014	4.50	7,309,246	0.60	43,855		
2015	4.50	7,638,162	0.60	45,829		
2016	4.50	7,981,879	0.65	51,882	248,874	1,740~1,990
2017	4.50	8,341,064	0.65	54,217		
2018	4.50	8,716,412	0.65	56,657		
2019	4.50	9,108,651	0.65	59,206		
2020	4.50	9,518,540	0.65	61,871		
2021	4.50	9,946,874	0.65	64,655		
2022	4.50	10,394,483	0.65	67,564	364,170	2,550~2,910
				Total	**751,558**	**5,260~6,010**

11.1.2 Investment Capacity of LGUs

Investment capacity of LGUs for local road development was estimated for the following two (2) cases:

Case - 1 : Development Fund = 20% of Internal Revenue Allotment (IRA)
Investment for local road development = 30% of Development Fund

Case - 2 : Investment for local road development = 25% of Borrowing Capacity
Loan term = 12 years
After initial borrowing, one half of above is borrowed at every 6 years.

Table 11.1-3 shows IRA and borrowing capacity of the Province of Misamis Oriental and Cagayan de Oro City.

TABLE 11.1-3 IRA AND BORROWING CAPACITY

(Million Pesos)

Financial Position		Province of Misamis Oriental	Cagayan de Oro City
Revenues	Local Income	111.0	354.9
	IRA (2003)	367.1	458.7
	Total Revenue	478.1	813.6
Debt Service Ceiling		95.6	162.7
Net Debt Service Capacity		95.6	162.7
Borrowing Capacity		592.3	1,007.9

Investment capacity of LGUs for local road development was estimated as shown in Table 11.1-4.

TABLE 11.1-4 INVESTMENT CAPACITY OF LGUs

(Million Pesos)

		IRA or Borrowing Capacity	2005-2010 (6 years)	2011-2016 (6 years)	2017-2022 (6 years)	Total (2005-2022)
Province of Misamis Oriental	Case-1 (50% to Study Area)	(367.1) 183.6	66.1	66.1	66.1	198.3
	Case-2 (50% to Study Area)	(592.3 296.2	74.1	37.1	37.1	148.3
Cagayan de Oro City	Case-1	458.7	165.1	165.1	165.1	495.3
	Case-2	1,007.9	252.0	126.0	126.0	504.0

Investment capacity of LGUs was estimated as follows:

(Million Pesos)

	Short Term (2005-2010)	Medium Term (2011-2016)	Long Term (2017-2022)
Province of Misamis Oriental	66.1~74.1	37.1~66.1	37.1~66.1
Cagayan de Oro City	165.1~252.0	126.0~165.1	126.0~165.1

11.2 PRIORITY OF ROAD PROJECTS

Future road network plan was formulated in Section 10.4. Based on the future road network, road projects were identified. Implementation of priority order of the road projects is determined in this section.

11.2.1 Basic Policy and Prioritization Procedure

The following prioritization factors for the road projects were set up in line with the objectives of the road network development;

a) Reduce traffic congestion of:
   - Iligan – CDO – Bhutuan Road
   - Roads accessing to CBD / Port Area

b) Guide and support planned urban development

c) Form flexible road network

d) Contribute to economic development of the Study Area and its hinterland.

e) Enhance international / domestic investment in the Study Area as well as its hinterland

f) Improve accessibility to related projects

g) Less environmental and social impacts

h) Urgency of the project

11.2.2 Prioritization Criteria

1) Selection of Prioritization Factors

In order to prioritize the road projects, the following factors and indicators were selected as shown in Table 11.2-1, together with its weight and score as shown in Table 11.2-2.

TABLE 11.2-1 PRIORITIZATION FACTORS AND INDICATORS

	Factors	Indicators	How to Measure
a)	Reduce traffic congestion of Iligan-CDO-Butuan Road	Contribution degree of traffic congestion reduction of Iligan-CDO-Butuan Road	• Judgement based on traffic assignment result.
	Reduce traffic congestion of Roads accessing to CBD	Contribution degree of traffic congestion reduction of Marcos Bridge and Carmen Bridge.	• Judgement base on traffic assignment result.
b)	Guide and support planned urban development	Planned urban road section Ratio (2022)	Section Length along the planned urban area per Total Length RUA = RLu / RLw Where : RUA = Section ratio of planned urban area RLu = Section length in planned urban area RLw = Whole road length
c)	Form flexible road network	Function as an alternative route	• Does the road function as an alternative route or not.
d)	Contribute to economic development	Net Present Value	• Economic analysis of each road project.
		EIRR	• Economic analysis of each road project.
e)	Enhance domestic / international investment	Accessibility to Industrial, Commercial and Housing Development.	• Whatever direct or indirect access road to industrial, commercial and/or housing development site.
f)	Improve accessibility of related projects	Function as an access road to related projects.	• Does the road function as an access road to New Airport and/or Container Terminal Port directly or indirectly.
g)	Less environmental and social impacts	No. of Project Affected Houses	• No. of houses affected by the project.
		Necessity of EIS Study	• Needs of EIS Study or IEE.
h)	Urgency for Road Construction, Widening and Improvement	For widening project, year when VCR of existing road becomes 0.9.	• Identify year when VCR of existing road becomes 0.9.
		For improvement project, year when traffic volume exceeds 1,000 pcu/day	• Identify year when traffic volume exceeds 1,000 pcu/dayu
		For new construction road, year when it will attract more than 10,000 pcu/day	• Identify year when a new road attract more than 10,000 pcu/day.

2) Weight of Factor and Score

TABLE 11.2-2 WEIGHT OF FACTOR AND SCORE

	Factors	Range of Indicator	Weight of Factor	Score
a)	Reduction traffic congestion of Iligan-CDO-Butuan Road	Very High High Medium Low	30	30 20 10 5
	Reduce traffic congestion of roads accessing to CBD	Very High High Medium Low		30 20 10 5
b)	Guide and support planned urban development	Planned urban section ratio Over 80% 60 – 80% 40 – 60% Less than 40%	10	 10 8 6 4
c)	Form flexible road network	Function as an alternative road Yes Yes, but indirectly No	5	 5 3 1
d)	Contribution to economic development	NPV (in Million P) Over 1,000 500 – 1,000 100 – 500 Less than 100	5	 5 4 3 1
		EIRR (%) Over 40 20 – 40 15 – 20 Less than 15	5	 5 4 3 1
e)	Enhance domestic / international investment	• Direct access to industrial area • Indirect access to industrial area • No access to industrial area	10	10 6 3
f)	Improve accessibility to related projects	• Direct access • Indirect access • No access	10	10 6 3
g)	Less environmental / social impacts	No. of project affected houses 0 – 100 100 – 300 300 – 500 Over 500	5	 5 3 2 0
		Needs of EIS No need IEE EIS	5	 5 4 3
h)	Urgency for Road Construction, Widening and Improvement	For widening project, year of VCR becomes 0.9 · Year < 2006 · 2006 < Year < 2010 · 2010 < Year < 2016 · 2016 < Year < 2022 · 2022 < Year	15	 15 12 9 6 3
		For improvement project, year of traffic volume exceeds, 1,000 pcu/day · Year < 2006 · 2006 < Year < 2010 · 2010 < Year < 2016 · 2016 < Year < 2022 · 2022 < Year		 15 12 9 6 3
		For new construction, year a road attract more than 10,000 pcu/day · Year < 2006 · 2006 < Year < 2010 · 2010 < Year < 2016 · 2016 < Year < 2022 · 2022 < Year		 15 12 9 6 3
		Total	**100**	

Part-D (Metro Cagayan de Oro)

11.2.3 Priority Ranking of Road Projects

In accordance with the prioritization criteria, all road projects were evaluated their implementation priority as shown in Table 11.2-3.

Road projects for strengthening of E-W transport axis and improvement of accessibility to CBD were evaluated high priority.

Road projects for improvement of sub-urban road were evaluated low priority.

Top ten priority projects are as follows:

Priority	Name of Project
1	New Western Coastal Road
2	J.R. Borja Extension
3	Iligan-CDO-Butuan Road
4	7th Bridge and Access Road
5	6th Bridge (committed under Spanish Bridge Grant)
6	West Diversion Road
7	Opol Diversion Road
8	8th Bridge
9	5th Bridge
10	New Western Coastal Road Extension

TABLE 11.2-3 SCORE AND RANKING OF EACH ROAD PROJECT

Factors			Strengthening of E-W Transport Axis						Improvement of Accessibility to CBD					Strengthening of N-S Transport Axis					Phividec		Improvement of Sub-Urban Road										
			EW-1 (1)	EW-1 (3)	EW-2	EW-3 (1)	EW-3 (2)	EW-4	CU-1	CU-2	CU-3	CU-4	CU-5	NS-3	NS-3	NS-4	NS-5	NS-6	1	2	J-1	V-1	T-1	C-1	C-2	C-3	C-4	O-1	E-1	A-1	G-1	GE-1
a)	Reduction traffic congestion of Iligan-CDO-Butuan Road		30	30	30	30	10	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reduce traffic congestion of roads accessing to CBD		—	—	—	—	—	—	20	30	30	20	10	—	—	—	20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
b)	Guide and support planned urban development		6	6	10	10	6	6	4	4	8	6	10	4	4	4	10	8	10	10	4	4	4	4	4	4	4	4	4	4	4
c)	Form flexible road network		1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
d)	Contribution to economic development	NPV	4	4	5	5	3	3	3	3	3	3	1	3	1	1	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1
		EIRR	5	5	4	4	3	4	4	4	4	4	5	4	4	1	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3
e)	Enhance domestic / international investment		10	10	10	10	6	6	1	1	1	1	1	6	6	10	6	1	10	10	1	1	1	1	1	1	1	6	6	1	1	1
f)	Improve accessibility to related projects		10	10	6	10	6	6	1	1	1	1	1	6	6	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
g)	Less environmental / social impacts	House	2	2	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
		EIA	4	4	3	3	3	3	3	3	3	3	3	3	3	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
h)	Urgency	Widening	15	15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Improvement	—	—	—	—	—	—	—	—	—	—	15	9	9	—	—	12	12	12	3	6	6	6	6	6	6	3	3	3	6	3
		New	—	—	15	15	9	9	15	15	15	15	—	—	—	3	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Score			**87**	**87**	**91**	**95**	**56**	**67**	**61**	**71**	**75**	**63**	**56**	**45**	**43**	**44**	**69**	**40**	**50**	**50**	**24**	**27**	**27**	**27**	**27**	**27**	**27**	**29**	**29**	**24**	**27**	**24**
Ranking	All Projects		**3**	**3**	**2**	**1**	**11**	**8**	**10**	**6**	**5**	**9**	**11**	**15**	**17**	**16**	**7**	**18**	**13**	**13**	**28**	**21**	**21**	**21**	**21**	**21**	**21**	**19**	**19**	**28**	**21**	**28**
	National Road		**3**	**3**	**2**	**1**	**8**	**6**	**7**	—	**5**	—	—	**9**	**11**	**10**	—	—	—	—	—	**12**	—	—	—	—	—	—	—	—	—	—
	Provincial Road		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	**1**	**1**	**7**	—	**5**	—	—	—	—	**3**	**3**	**7**	**5**	**7**
	City Road		—	—	—	—	—	—	—	**1**	—	**3**	**4**	—	—	—	**2**	**5**	—	—	—	—	—	**6**	**6**	**6**	**6**	—	—	—	—	—

11.3 ROAD NETWORK MASTER PLAN

The Master Plan was formulated for the following three terms:

Short-Term	:	2005 to 2010
Medium-Term	:	2011 to 2016
Long-Term	:	2017 to 2022

Financial framework (or possible investment amount) for each term is summarized as follows:

Financial Framework (Million P)

Term	National Road	Provincial Road	City Road
Short-Term	970 ~ 1,110	66 ~ 74	165 ~ 252
Medium-Term	1,740 ~ 1,990	37 ~ 66	126 ~ 165
Long-Term	2,550 ~ 2,910	37 ~ 66	126 ~ 165
Total	5,260 ~ 6,010	140 ~ 206	417 ~ 582

In due consideration of above financial framework and priority of road projects, the implementation schedule was established as shown in Table 11.3-1 and shown in Figure 11.3-1 and shown in Figure 11.3-1. Due to financial constraint of the period of Short-Term, the scale of the project is limited.

Planned investment requirement and financial framework are compared as follows:

Planned Investment Requirement vs. Financial Framework

		Planned Investment Requirement (Million P) (a)	Financial Framework (Million P) (b)	a/b
National Road	Short	917	1,110	0.83
	Medium	2,421	1,990	1.22
	Long	2,159	2,910	0.74
	Total	5,497	6,010	0.91
Provincial Road	Short	69	74	0.93
	Medium	282	66	4.27
	Long	195	66	2.95
	Total	546	206	2.65
City Road	Short	34	252	0.13
	Medium	274	165	1.66
	Long	466	165	2.82
	Total	774	582	1.33

Both the Provincial Government and the City Government need to increase funding capacity by about 3 times and 2 times, respectively. In order to achieve above, the following measures are needed:

Provincial Government	:	All amount of borrowing capacity is to be spent for road investment	296 Million P
		50% of Development Fund is to be spent for road investment	330 Million P
		Total (2005~2022)	**626 Million P**
City Government	:	50% of borrowing capacity is to be spent for road investment	504 Million P
		40% of Development Fund is to be spent for road investment	660 Million P
		Total (2005~2022)	**1,164 Million P**

TABLE 11.3-1 IMPLEMENTATION PROGRAM FOR METRO CAGAYAN DE ORO FUTURE ROAD NETWORK PLAN

Detailed Design | Bidding | ROW Acquisition/Resettlement | Construction/Const. Supervision

Objectives	Code	Project Name	Road Class	Length (km)	Type of Work	Project Cost (Million Peso) DID	CIB	Civil Cost	ROW Resettle	Total Cost	2003	2004	Short-Term 2005	2006	2007	2008	2009	2010	Medium-Term 2011	2012	2013	2014	2015	2016	Long-Term 2017	2018	2019	2020	2021	2022	2023~
Strengthening of E-W Transport Axis	EW-1 (1)	Iligan - CDO - Butuan Road (East) Jasaan - Tagoloan	NR	19.4	Shoulder pavement (W=3.0m)	17.1	34.1	426.4	-	498.6																					
									21.0				3.4	2.1	2.1	30.7	30.7	30.7	6.8	4.2	4.2	61.4	61.4	61.4	6.8	4.2	4.2	61.4	61.4	61.4	
	EW-1 (3)	Iligan - CDO - Butuan Road (West) Opol- El Salvador- Alubijid - Gitagum	NR	30.0	Shoulder pavement (W=3.0m)	21.5	42.9	536.4	-	653.8																					
									53.0				4.3	5.3	5.3	38.6	38.6	38.6	9.6	10.6	10.6	77.2	77.2	77.2	9.6	10.6	10.6	77.2	77.2	77.2	
	EW-2	New J.R. Borja Extension	NR	7.7	New construction (4-lane	47.2	94.4	1,179.7	113.0	1,497.2							47.2	58.6	58.6	58.7	254.6	254.8	254.8	254.8	254.9						
									62.9																					
	EW-3 (2)	New Western Coastal Road Phase I	NR	7.6	New construction (4-lane) (Upto ICB Road)	24.1	48.3	603.6	86.9	763.3					24.1	43.6	43.7	163.0	163.0	163.0	162.9										
									20.4																					
		New Western Coastal Road Phase II	NR	1.7	New construction (4-lane) (Upto Opol Bypass)	6.5	13.0	162.3	77.0	264.8															6.5	41.5	41.5	52.6	70.1	52.6	
									6.0																					
	EW-4	Opol Diversion Road	NR	9.1	New construction (2-lane	14.1	28.2	352.8	93.0	493.1															14.1	49.0	49.0	114.3	114.3	152.4	
									5.0																					
Improvement of Accessibility to CBD	CU-0	The Third Bridge	NR	B=0.35 km	New construction (4-lane	-	-	-	-	-																					
									-																					
	CU-1	New 5th Bridge	NR	B=0.30 km	New construction (2-lane	7.5	14.9	186.5	17.0	244.9																7.5	18.0	18.0	100.7	100.7	
				0.20					19.0																					
	CU-2	New 6th Bridge	City	B=0.28 km	New construction (2-lane	7.0	14.0	174.5	15.0	222.4																					
				0.20					12.0							7.0	13.5	13.5	94.2	94.2										
	CU-3	New 7th Bridge and Access Road	NR	B=0.29 km	New construction (2-lane	7.7	15.5	193.5	8.6	240.4																					
				0.7					15.7						7.7	23.7	104.5	104.5												
	CU-4	New 8th Bridge and Access Road	City	B=0.30 km	New construction (2-lane	11.1	22.2	278.1	45.0	360.5																					
				3.5					4.0																11.1	24.5	24.5	150.2	150.2		
	CU-5	Canitoan - Carmen Link Road	City	1.5	Improvement from earth to PCC/AC pave.(2-lane)	0.9	1.8	23.0	-	25.6																					
									-										0.9		12.4	12.4								
Strengthening of N-S Transport Axis	NS-3 (1)	Syre Highway Parallel Road (Agusan - Balubal - Syre)	NR	8.2	Improvement from earth to PCC/AC	13.0	26.0	324.4	9.0	372.3																					
									-																13.0	9.0	105.1	140.1	105.1		
	NS-3(2)	Syre Highway Parallel Road (Balbalu - Alae)	NR	5.0	Improvement from earth to PCC/AC pave.(2-lane)	3.2	6.4	79.5	-	89.0																					
									-																				3.2		85.9
	NS-4	Mindanao Container Terminal - Buldinon Link Road (Tagoloan - Alae)	NR	13.5	New construction (2-lane	39.0	78.0	975.3	20.0	1,112.3																					
									-																						
	NS-5	CDO Urban West Diversion Road (Coast - Airport Road)	NR	5.0	New Construction	9.1	18.2	227.5	36.1	304.7																					
									13.6								9.1	24.9	25.0	81.9	81.9	81.9								
	NS-6	Balulang West River Bank Road	City	5.8	Improvement from earth to PCC/AC pave.(2-lane)	2.1	4.3	53.4	-	59.8																					
									-													2.1		57.7							
Improvement of PhiVides Roads	PHIVIDEC-1	Sta. Ana Road	Prov.	3.7	Improvement from earth to PCC/AC pave.(2-lane)	4.8	9.5	119.5	-	133.8																					
									-																						
	PHIVIDEC-2	San. Martin - Sta. Ana Junction Road	Prov.	5.3	Improvement from earth to PCC/AC pave.(2-lane)	7.8	15.6	194.5	-	217.8																					
									-																						
Improvement of Sub-urban Roads	J-1	Jasaan Mountain Access Road	Prov.	8.9	Improvement from earth to PCC/AC pave.(2-lane)	4.4	8.8	110.4	-	123.6																					
									-																						
	V-1	Villanueva Mountain Access Road	NR	12.0	Rehabilitation for PCC/AC pave.(2-lane)	6.2	12.3	153.9	-	172.4																					
									-																				6.2		166.2
	T-1	Tagoloan Mountain Road	Prov.	6.5	Improvement from earth to PCC/AC pave.(2-lane)	3.0	6.0	75.6	-	84.7																					
									-																						84.7
	C-1	Guza - Camaksewan - Indahag Road	City	4.8	Improvement from earth to PCC/AC pave.(2-lane)	1.7	3.4	43.1	-	48.3																					
									-																1.7		23.3	23.3			
	C-2	Camaman-an - Indahag Road	City	7.5	Improvement from earth to PCC/AC pave.(2-lane)	2.9	5.8	72.9	-	81.6																					
									-																				2.9		78.7
	C-3	Jct. Macasandig - Jct. Indahag Road	City	3.2	Improvement from earth to PCC/AC pave.(2-lane)	1.7	3.5	43.2	-	48.4																					
									-																		1.7				
	C-4	Canitoan - Balulang Bridge Access Road	City	10.1	Improvement from earth to PCC/AC pave.(2-lane)	5.5	11.0	137.3	-	153.8																					
									-																				5.5		148.3
	O-1	Opol Mountain Road	Prov.	23.3	Improvement from earth to PCC/AC pave.(2-lane)	12.8	25.6	319.9	-	358.3																					
									-																			12.8		86.4	259.1
	E-1	El Salvador Mountain Access Road	Prov.	9.8	Improvement from earth to PCC/AC pave.(2-lane)	3.4	6.9	85.7	-	96.0																					
									-																3.4		46.3	46.3			
	A-1	Alubijid Mountain Access Road	Prov.	6.2	Improvement from earth to PCC/AC pave.(2-lane)	3.0	6.1	75.8	-	84.9																					
									-																						84.9
	G-1	Gitagum Mountain Access Road	Prov.	6.4	Improvement from earth to PCC/AC pave.(2-lane)	3.2	6.5	81.0	-	90.7																					
									-																						90.7
	GE-1	Gitagum-El Salvador Mountain Link Road	Prov.	14.8	Improvement from earth to PCC/AC pave.(2-lane)	8.8	17.6	219.4	-	245.7																					
									-																						245.7
Total				242.9		300.3	600.8	7509.1	732.8	9143.0	0.0	0.0	7.7	7.4	39.2	148.4	287.3	498.4	421.7	412.6	334.6	489.5	498.5	556.1	320.2	146.3	324.2	595.0	730.1	564.0	2421.2
Funding Demarcation					DPWH						0.0	0.0	7.7	7.4	39.2	136.5	273.8	420.3	262.0	318.4	514.4	475.3	393.4	393.4	303.9	121.8	228.4	502.7	548.2	454.3	1,305.4
					DPWH Total					5706.8		0.0						885.1						2257.0						2759.3	1305.4
					Provincial Goverment						0.0	0.0	0.0	0.0	0.0	4.8	0.0	84.5	84.5	0.0	7.8	0.0	105.0	105.0	3.4	0.0	46.3	59.1	0.0	86.4	888.8
					PG Total					1435.6		0.0						69.3						282.4						195.2	888.8
					Cagayan de Oro City						0.0	0.0	0.0	0.0	0.0	7.0	13.5	13.5	95.2	94.2	12.4	14.6	0.0	57.7	12.8	24.5	49.5	173.4	181.9	23.3	227.0
					CDO Total					1000.6		0.0						34.0						274.0						465.5	227.0
									Total forTerm			0.0						988.4						2,913.4						2,820.0	2,421.2

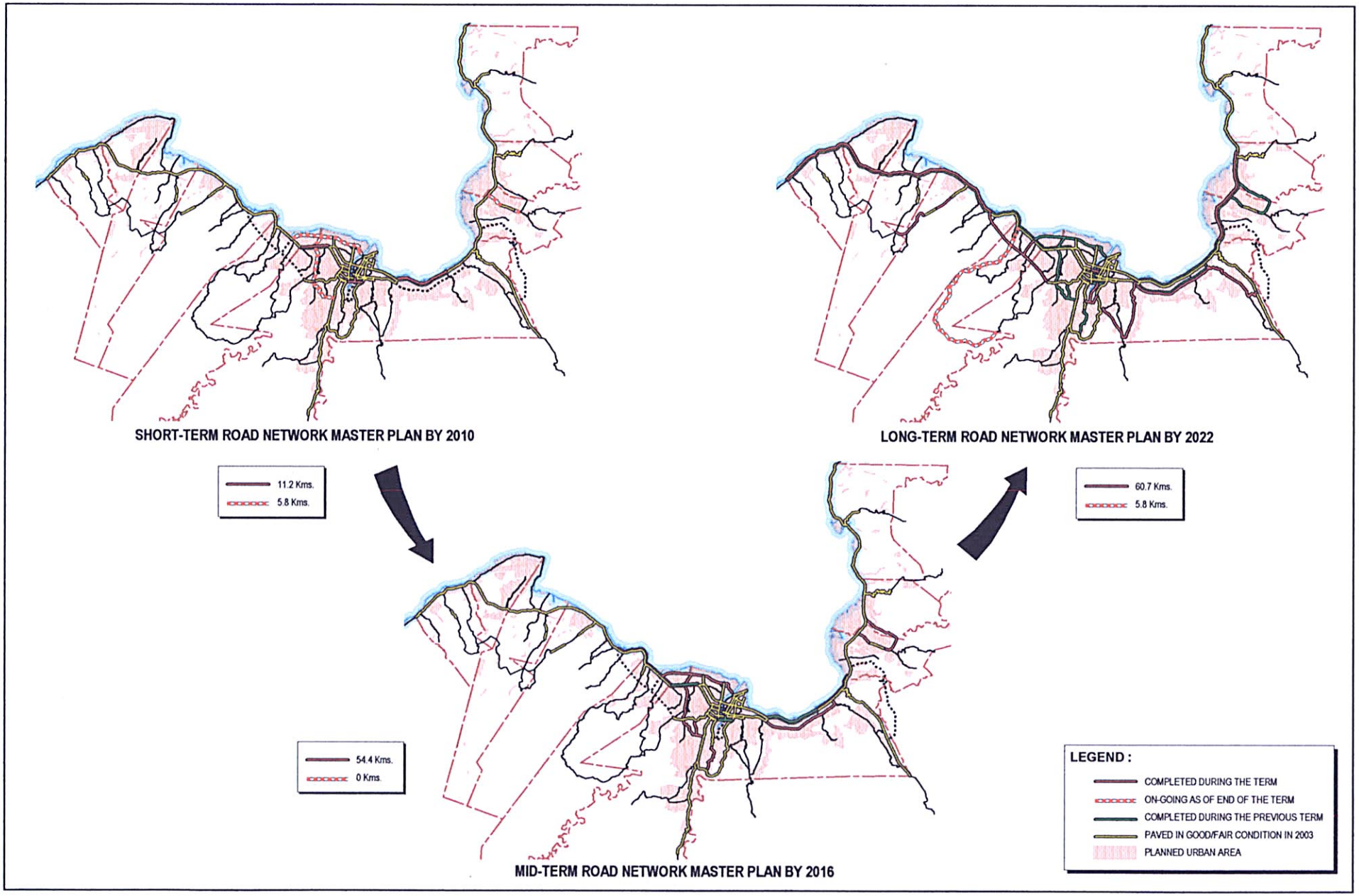


FIGURE 11.3-1 MASTER PLAN ROAD NETWORK : CAGAYAN DE ORO

11.4 EVALUATION OF ROAD NETWORK DEVELOPMENT MASTER PLAN

The Master Plan was evaluated from the following factors:

- Improvement of transport efficiency
- Economic viability
- Achievement of road network development objectives by the Master Plan

11.4.1 Improvement of Transport Efficiency by Master Plan

Transport efficiency was evaluated on the following indicators by comparing "Do Nothing" Case with the Master Plan;

- PCU-km (vehicle travel distance)
- PCU – hour (vehicle travel time)
- Average travel speed
- Congestion road section length
- Vehicle operating cost

Traffic assignment was carried out for the final year of each term and shown in Figure 11.4-1, 11.4-2 and 11.4-3.

Transport efficiency improvement by each term is summarized in Table 11.4-1 and graphically shown in Figure 11.4-4.

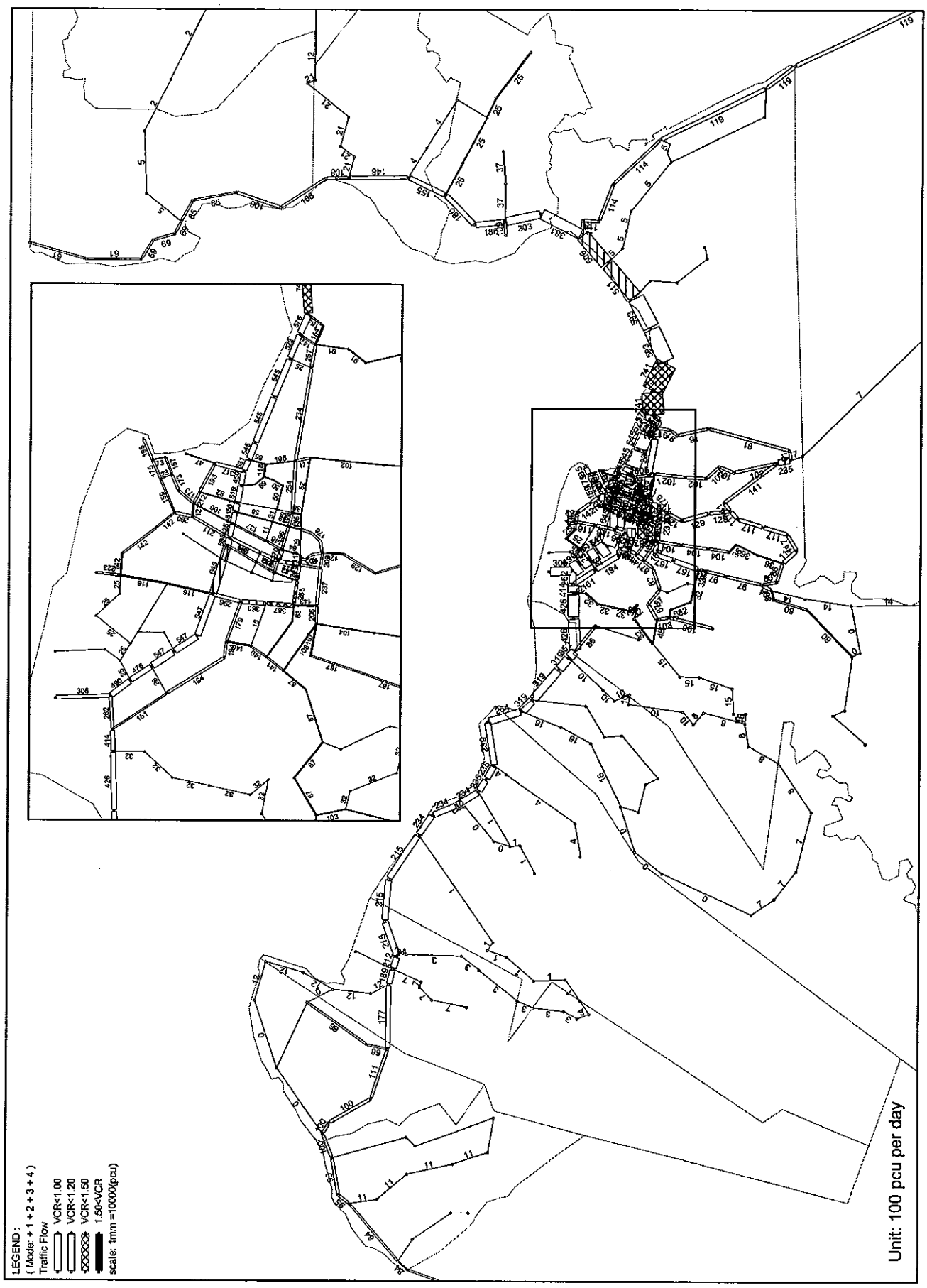


FIGURE 11.4-1 TRAFFIC ASSIGNMENT IN METRO CAGAYAN DE ORO, SHORT-TERM MASTER PLAN, IN 2010

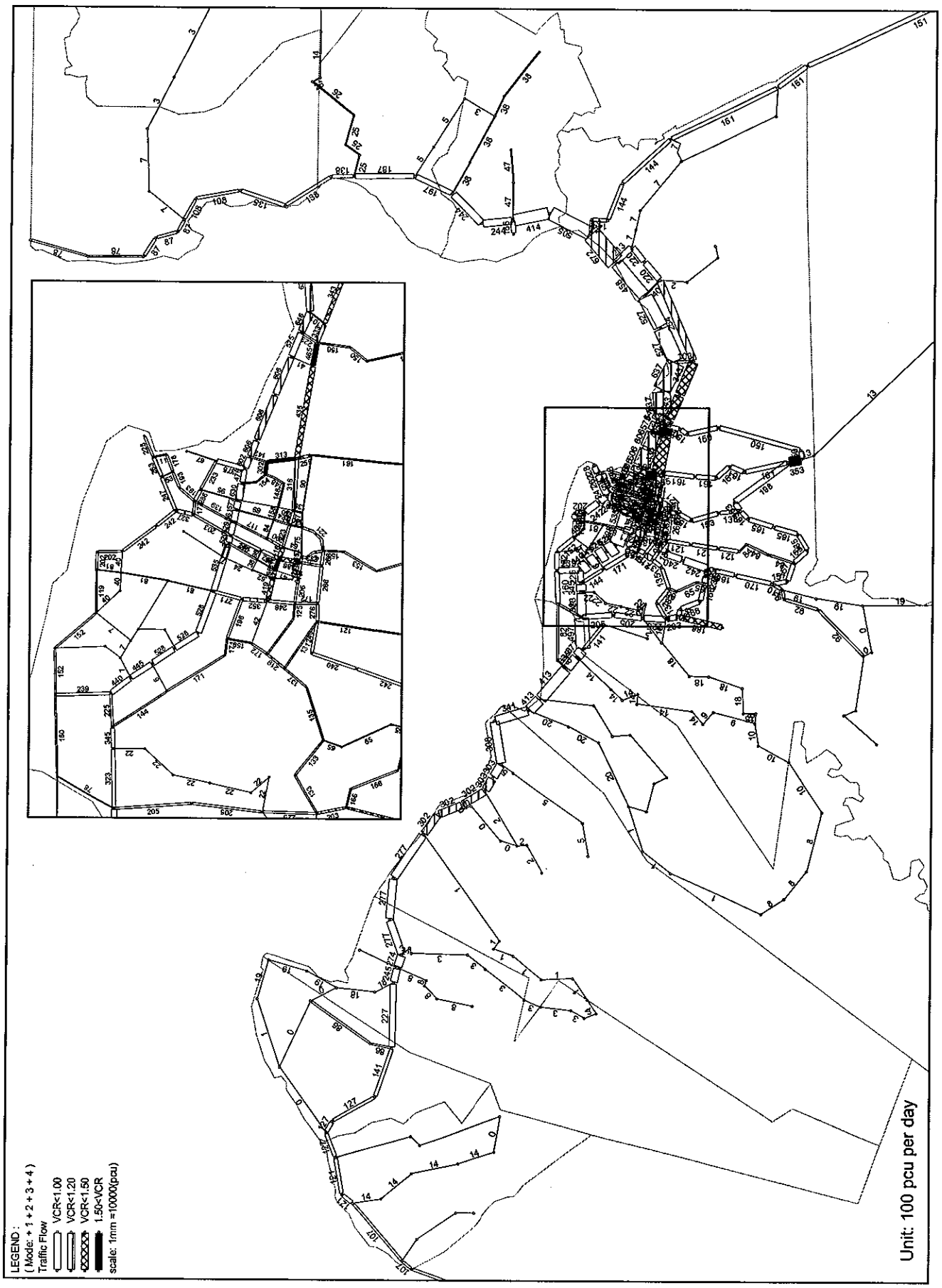


FIGURE 11.4-2 TRAFFIC ASSIGNMENT IN METRO CAGAYAN DE ORO, MEDIUM TERM MASTER PLAN IN 2016

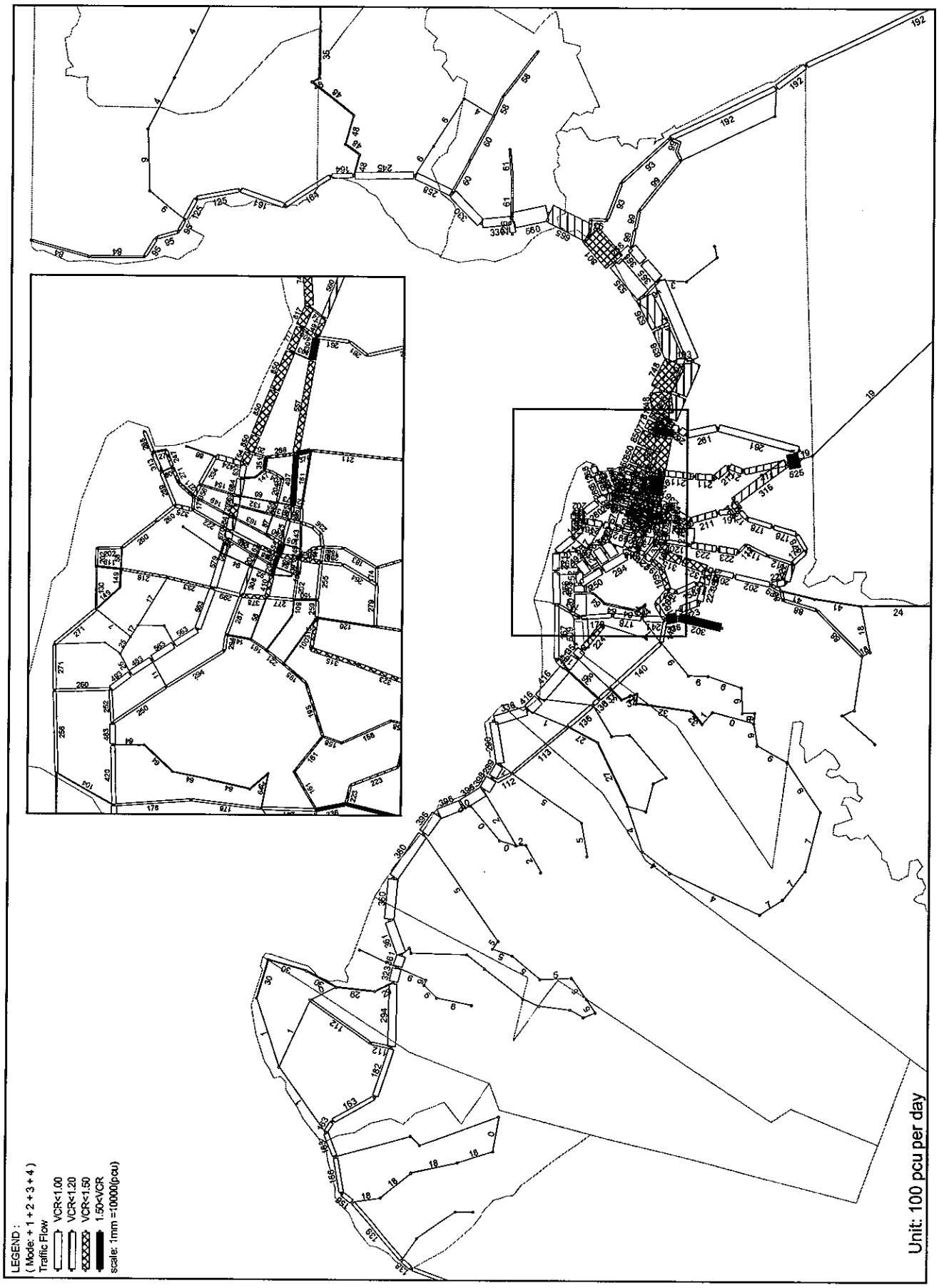


FIGURE 11.4-3 TRAFFIC ASSIGNMENT IN METRO CAGAYAN DE ORO, LONG-TERM MASTER PLAN IN 2022

TABLE 11.4-1 TRANSPORT EFFICIENCY IMPROVEMENT BY MASTER PLAN

		Short Term (in 2010)	Medium Term (in 2016)	Long Term (in 2022)
PCU-KILOMETER ('000)	DO-NOTHING	3,588 (1.00)	4,648 (1.00)	6,246 (1.00)
	MASTER PLAN	3,466 (0.99)	4,640 (0.99)	6,239 (0.99)
PCU-HOUR	DO-NOTHING	150,917 (1.00)	223,554 (1.00)	346,537 (1.00)
	MASTER PLAN	145,316 (0.96)	196,246 (0.88)	276,115 (0.80)
AVERAGE TRAVEL SPEED (KM/H)	DO-NOTHING	23.1 (1.00)	20.8 (1.00)	18.0 (1.00)
	MASTER PLAN	23.9 (1.03)	23.6 (1.13)	22.6 (1.26)
AVERAGE TRAVEL TIME (MIN/TRIP)	DO-NOTHING	30.7 (1.00)	34.7 (1.00)	40.9 (1.00)
	MASTER PLAN	29.6 (0.96)	30.5 (0.88)	32.6 (0.80)
VEHICLE OPERATING COST (MILLION PESOS)	DO-NOTHING	21,435 (1.00)	29,329 (1.00)	41,282 (1.00)
	MASTER PLAN	21,102 (0.98)	27,973 (0.95)	38,225 (0.93)
AVERAGE TRAVEL TIME (Min / Trip)	DO-NOTHING	30.7	34.7	40.9
	MASTER PLAN	29.6	30.5	32.6

11.4.2 Economic Viability

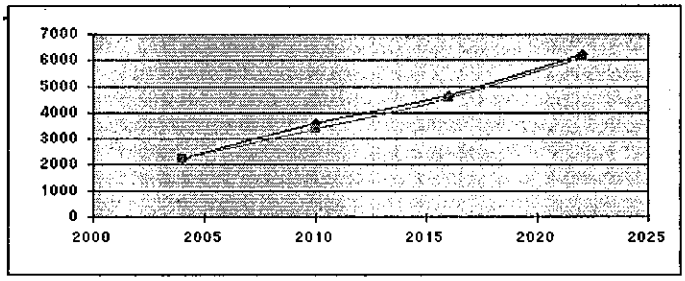
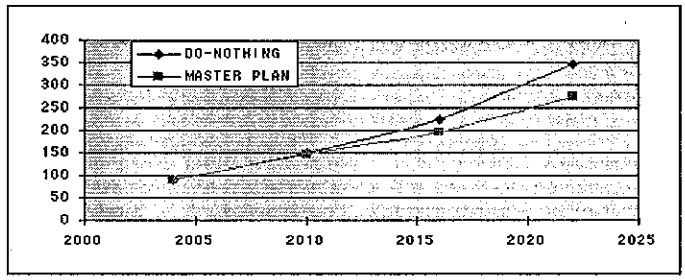
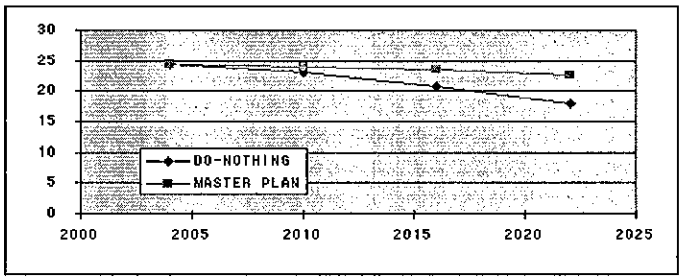
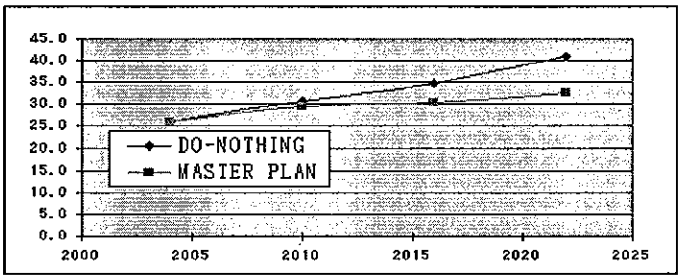
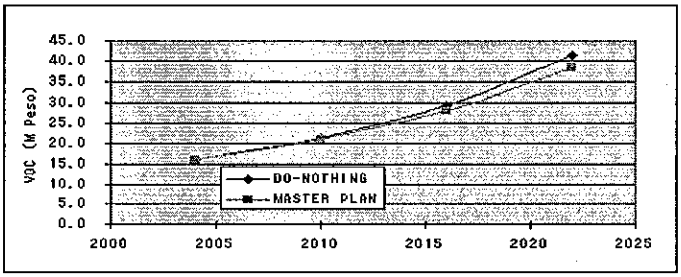
Economic viability of the Master Plan was evaluated in accordance with the assumptions and procedures presented in Appendix 11.4-1. Results of economic evaluation were as follows;

	Net Present Value (Million Pesos)	B/C ratio	EIRR (%)
Short Term Plan	1,835	3.51	43.0
Medium Term Plan	670	1.81	23.3
Long Term Plan	57	1.12	17.0
Whole Master Plan	2,562	2.25	34.1

Notes; 1) Project life was assumed to be 20 years
2) Discount rate at 15 %

As shown above, the Master Plan was evaluated highly economically feasible.

FIGURE 11.4-4 TRANSPORT EFFICIENCY IMPROVEMENT BY MASTER PLAN

PCU Kilometer ('000)	
PCU Hour ('000)	
Average Travel Speed	
Average Travel Time	
Vehicle Operating Cost	

11.4.3 Achievement of Road Network Development by the Master Plan

Prior to formulation of future road network development plan, road network development objectives were established. Whether the established objectives can be achieved by the Master Plan in each term was evaluated and summarized in Table 11.4-2.

It can be concluded that the Master Plan will successfully achieve the objectives of road network development.

TABLE 11.4-2 ACHIEVEMENT OF ROAD NETWORK DEVELOPMENT OBJECTIVES BY MASTER PLAN

Road Network Development Objectives	SHORT-TERM (2005-2010)	MEDIUM-TERM (2011-2016)	LONG-TERM (2017-2022)
• Physical Target	• Iligan-CDO-Butuan Road (East and West) • Construction at New 6th Bridge • Construction of New 7th Bridge and Access Road • CDO Urban West Diversion Road (Coast-Airport Road)	• Iligan-CDO-Butuan Road (East and West) • New J.B. Borja Extension • New Western Coastal Road (Phase 1) • Construction of New 8th Bridge	• Iligan-CDO-Butuan Road (East and West) • New J.B. Borja Extension • New Western Coastal Road (Phase 2) • Opol Diversion Road • New 8th Bridge and Access Road • Syre Highway Parallel Road (Agusan-Balubal-Syre) • Syre Highway Parallel Road (Balbalu-Alae)
• Reduction of Traffic Congestion of Iligan-CDO- Butuan Road and Roads accessing to CBD/Port Area	• Capacity expansion of Iligan-CDO-Buluan (Widening and Flyover) and construction of 6th and 7th bridges will contribute to mitigation of traffic congestion.	• Construction of new western coastal road and JR Borja Extension will contribute to mitigation of traffic congestion in Cagayan de Oro.	• Construction of Opol diversion road. New western coastal road will contribute to mitigation of traffic congestion in Cagayan de Oro.
• Road network which will guide and support planned urban development	• Planned urban development along Iligan-CDO-Butuan will be guided and accelerated by its improvement.	• Planned urban development along new Western Coastal Road will be guided and accelerated by the New Western Coastal Road.	• Planned urban development along JR Borja Extension will be guided and accelerated by the JB Borja Extension.
• Formulation of flexible road network which provide alternative routes to road user	• Improvement of Iligan-CDO- Butuan Road and construction of new bridges will provide alternative routes for road users, thus road network in CBD and East West Axle becomes highly flexible.	• With construction of new western coastal road and JR Borja Extension are provided alternative routes for Iligan-CDO-Butuan Road. • CDO New West Diversion Road will have alternative roads.	• Opol diversion road will provide alternative route and east west axle.
• Road network which will enhance international and domestic investment in the Study Area.	• Due to improvement of accessibility to PHIVIDEC industrial estates, more local/international investors will be attracted.	• New western coastal road will provide access to west coastal area.	• Effective transport linkage between industrial estates and transport facilities (airport and seaport) will attract more local / foreign investors.
• Road network which will realize expected investment effects of related projects.	• Accessibility to New Airport, MCTP, PHIVIDEC, etc. will be improved thus economic return of investment these project will be realized.	• Accessibility to PHIVIDEC and MCTR will be improved, thus economic return of investment to these projects will be realized.	• Accessibility to New Airport will be improved thus economic return of investment to the project will be realized.
• Road network development with environmental and socio consideration.	• Relocation of affected families and ROW acquisition must be undertaken that adverse social impact will be minimized.	• Same as Short-Term	• Same as Short-Term

11.5 PROPOSED ADMINISTRATIVE ROAD CLASSIFICATION AND IMPLEMENTATION AGENCY

As discussed in "Section 11.1 Financial Framework", funding capacity for road development of LGUs is quite limited, thus LGUs cannot make investment for large scale projects. It is recommended that new road construction be implemented basically by DPWH. Widening, improvement and rehabilitation of existing roads should be implemented basically by presently responsible agency.

Present Classification	Proposed Administrative Classification	Proposed Implementing Agency
None (new road)	National Road	DPWH
National Road	National Road	DPWH
Provincial Road	Provincial Road	Provincial Government
City Road	City Road	City Government

J.B. Borja Extension : Although the existing J.B. Borja Street is a city road, this extension provides a vital alternative route for Iligan-CDO-Butuan Road and involves large investment. It is recommended to be implemented by DPWH.

Western Coastal Road : This road is connected within the 3rd Bridge which is being implemented by DPWH. This road functions as an alternative route of Iligan-CDO-Butuan Road as well as an access road to the national port (CDO Port), thus recommended to be implemented by DPWH.

5th Bridge : This is considered as an extension of the Old National Road, thus recommended to be implemented by DPWH.

6th Bridge : This bridge connects city roads each other, thus recommended to be implemented by the City Government.

7th Bridge : This bridge is considered as an extension of CDO-Talakag Road (national road), thus recommended to be implemented by DPWH.

8th Bridge : This bridge connects city roads each other, thus recommended to be implemented by the City Government.

West Diversion Road : The existing section of this road is a city road, thus recommended to be implemented by the City Government.

Syre Highway Parallel Road : It is currently classified as a city road, however, it will function as alternative route of Syre Highway which will have traffic capacity problem due to steep gradient and sharp curves. Improvement of alignment of this road is much easier than Syre Highway. It is recommended that this project be implemented by DPWH.

Mindanao Container Terminal - Bukidnon Link Road : This road provides direct access to Mindanao Container Terminal from Bukidnon Province, thus recommended to be implemented by DPWH.

11.6 ROAD MAINTENANCE PLAN

11.6.1 Unit Rate of Maintenance

Unit rate of maintenance is shown in Table 11.6-1.

TABLE 11.6-1 UNIT RATE OF MAINTENANCE ACTIVITY

Maintenance Definition	Activity	Unit	Unit Rate (Economic)	Unit Rate (Financial)
I. Routine Maintenance				
	1.Vegetable control	P/km	21,351.91	26,040.05
	2.Clearing and repair of culverts	P/km	7,278.65	11,909.96
	3.Replace, clean and repair traffic signs	P/km	6,136.94	7,856.64
	4.Clearing side ditches	P/km	11,520.99	15,750.12
	Total per annum	**P/km**	**46,288.49**	**61,556.77**
II. Periodic Maintenance				
	1.Gravel (Surface)	P/m3	1,611.01	2,181.07
	1.1 Regrade and reshape gravel			
	a. Traveled way (carriage way)	P/m2	12.55	17.15
	b. Shoulder	P/m2	21.05	28.78
	2. Resurfacing			
	a. DBST (SST)	P/m2	86.37	113.54
	b. AC (3cm)	P/m2	248.88	328.36
	3. Overlays			
	a. AC (5cm)	P/m2	389.26	512.99
	b. AC (8cm)	P/m2	527.97	754.08
	c. AC (10cm)	P/m2	708.05	930.96
	4. Replacement of failed bays	P/m2		
	a. t=250mm	P/m2	4,269.00	5,675.29
	b. t=230mm	P/m2	3,927.33	5,221.06
	c. t=200mm	P/m2	3,415.20	4,540.23
	d. t=190mm	P/m2	3,255.11	4,312.53
	e. t=180mm	P/m2	3,073.44	4,085.88
	5. Repair cracks/joints	P/m	33.00	44.54
	6. Patching and potholes repair			
	a. Pothole repair (Gravel)	P/m3	1,505.64	2,037.74
	C.pothole repair			
	c.1 Repair (AC)	P/m2	894.41	1,193.07
	c.2 Sealing (AC)	P/m2	112.77	148.30
	c.3Patching (AC)	P/m2	615.49	817.49

Source: DPWH, February, 2004

11.6.2 Routine Maintenance and Minor Repair Cost

Maintenance cost by pavement type is estimated by adopting the above cost estimate. Table 11.6-2 presents the annual maintenance costs including routine maintenance and minor repair cost.

TABLE 11.6-2 ANNUAL ROUTINE AND MINOR REPAIR COST

Unit: Peso/km/year

Pavement (PCC)		Pavement (AC)		Un-Paved (Gravel)	
Good	Bad	Good	Bad	Good	Bad
88,869	161,987	99,793	232,286	95,218	166,240

The cost estimate is mostly same as base cost of Equivalent Maintenance Kilometer (EMK) estimated by DPWH (EMK = 82,000 Pesos in 2003). Since new maintenance cost estimate has not been established, the Study will apply the above cost.

11.6.3 Rehabilitation Cost

Overlay on the new road is considered as rehabilitation after 10 year service. The folowing cost will be applied.

TABLE 11.6-3 OVERLAY COST

Overlays	Unit	Economic Cost (Peso)	Financial Cost (Peso)
a. AC (5cm)	P/m2	389.26	512.99
b. AC (8cm)	P/m2	527.97	754.08
c. AC (10cm)	P/m2	708.05	930.96

11.6.4 Increase of Maintenance Expenditure

In progress of implementing the master plan, maintenance cost will be increased by additional length of new roads. Table 11.6-4 summarizes the annual increase of maintenance cost by administration.

TABLE 11.6-4 MAINTENANCE EXPENDITURE

Unit: '000 Pesos

Term	Year	DPWH	Term Total	City	Term Total
Short-Term (2005~2010)	2006	0		0	
	2007	0		0	
	2008	0		0	
	2009	292		0	
	2010	292		0	
Medium-Term (2011~2016)	2011	292	877	0	0
	2012	355		0	
	2013	355		0	
	2014	355		667	
	2015	4,274		1,066	
	2016	4,274		1,066	
Long –Term (2017~2022)	2017	4,274	13,888	1,066	3,866
	2018	4,274		1,066	
	2019	4,274		1,066	
	2020	4,274		1,066	
	2021	4,859		1,066	
	2022	4,859		1,066	
After 2023 (Annual cost)	2023	4,859	27,399	1,644	6,976

Note: No new provincial road construction

11.6.5 Requirement of Total Maintenance Expenditure

1) Requirement of Total Maintenance Expenditure

Requirement for total maintenance expenditure for the road network in Metro Cagayan de Oro is estimated as shown in Table 11.6-5.

TABLE 11.6-5 REQUIREMENT OF TOTAL MAINTENANCE EXPENDITURE

Unit: '000 Pesos

Administration	Annual Cost		Maintenance Expenditure			Annual Cost (2023~)
	Road	Bridge	Short Term (2005~2010)	Medium Term (2011~2016)	Long Term (2017~2022)	
National	22,652	680	140,869	153,880	167,391	30,351
Province	17,937	538	110,853	110,736	110,388	17,954
City	19,564	587	120,903	124,655	127,399	21,582
Municipal	1,793	54	11,081	11,081	11,081	1,847
Barangay	10,690	321	66,067	66,067	66,067	11,011
Total	**72,637**	**2,179**	**449,773**	**466,419**	**482,327**	**82,746**

2) Maintenance Capacity Building for LGU

In addition to budgetary arrangement, capacity building for road and bridge maintenance to LGU is required. The DPWH staff organize periodic seminar and training for technical staff in the province, city and municipality engineer's offices. Major training issues are:

- Maintenance operation management;
- Contract management; and
- Engineering technology update.

11.7 TRAFFIC MANAGEMENT PLAN

11.7.1 Recommended Traffic Management Measures

Traffic management issues and recommendation were presented in Section 4.3.10.. Some of the improvement measures require time to implement and to observe tangible effects.. Among the recommended measures, those that can be implemented immediately are presented here with the tentative list of target intersections and road sections. They cover the following works:

- Geometric improvement at intersection and road section
- Traffic signal
- Pavement marking and traffic sign

These measures aim to enhance the efficiency and safety of traffic in the study area by regulating the flow. More specific objectives are to prevent the traffic accidents along National Highway and improve traffic condition in CBD. In addition to solve parking problem, consultation with the city government, building owners and potential users must be undertaken.

1) *Geometric Improvement at intersection*

Intersection geometric improvement work modifies intersection geometry. Basic objectives of the work are to:

- Regulate and guide traffic movement at intersection by such facilities as median and island
- Provide left turn lane to the intersection where left turn volume is high and intersection geometry permits it.
- Provide or improve sidewalk for better pedestrian environment

Geometric improvement is possible at the limited number of intersections due to the limited right of way. A total of eight (8) intersections are tentatively selected for the work as listed below and shown in Figure 11.7-1. Intersection inventory survey and turning volume count survey must be conducted and needs and effectiveness of the improvement must be verified. Then geometric improvement work can be designed based on the analysis of the collected data.

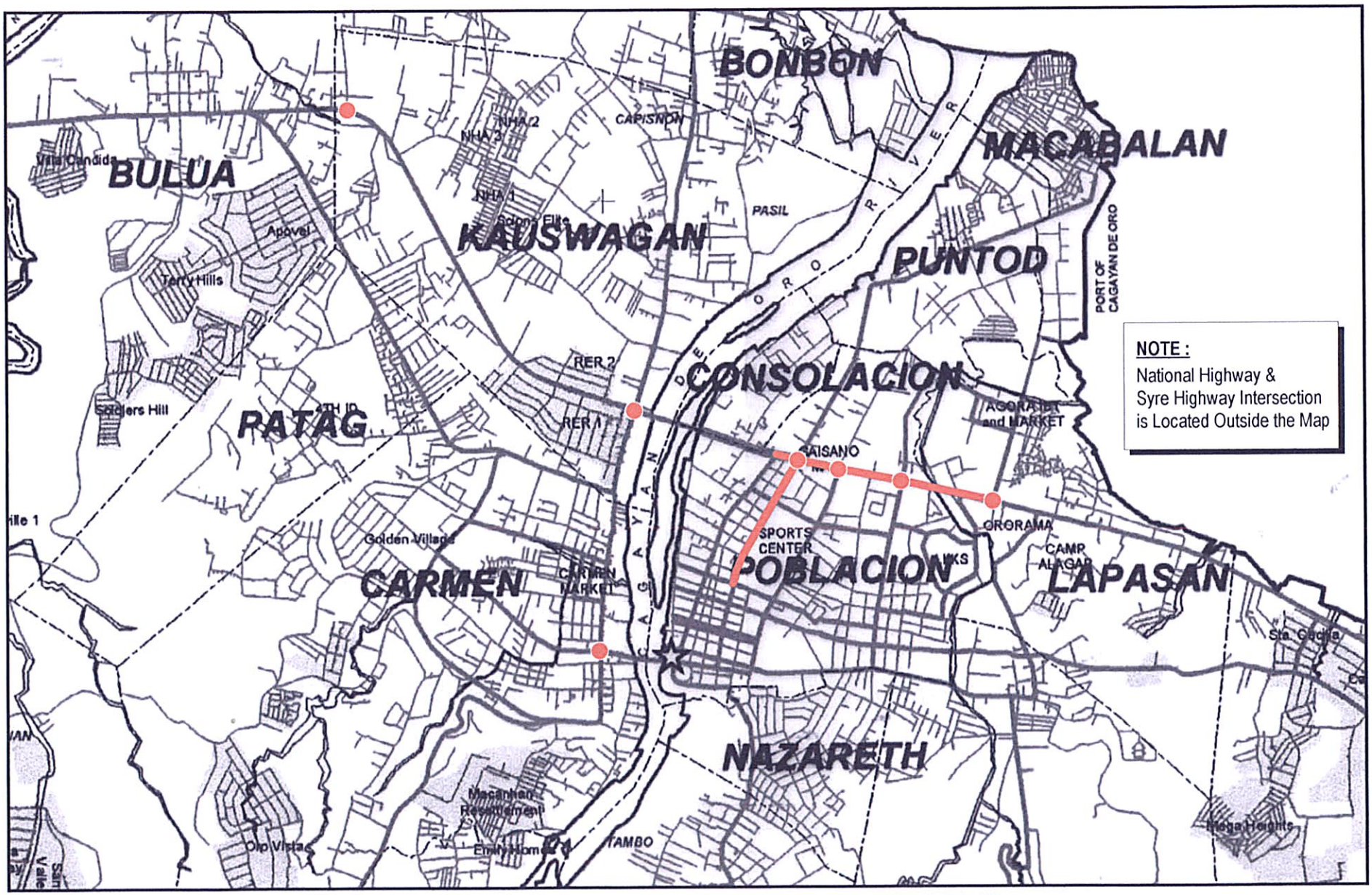


FIGURE 11.7-1 LOCATION OF GEOMETRIC IMPROVEMENT WORKS

TABLE 11.7-1 GEOMETRIC IMPROVEMENT AT INTERSECTIONS

	Intersection		Median	Island	Side-walk	Pave-ment	Others
1	National Highway	Agora	O				
2	National Highway	Osmena	O				
3	National Highway	Corrales	O				
4	National Highway	Velez	O				
5	National Highway	Vamenta	O				
6	National Highway	Calamansi	O				
7	National Highway	Syre Highway	O	O	O	O	
8	Vamenta	Carmen		O			

In addition to the geometric improvement work at intersections, median will be provided along National highway and Velez Street. Construction of median is intended to reduce the accident along the national highway, which is the most accident prone street in Cagayan de Oro City.

TABLE 11.7-2 GEOMETRIC IMPROVEMENT AT MID-BLOCK SECTIONS

	Road	From	To	Length (m)	Type
1	National Highway	Maharlika Bridge	Agora	1400	With pedestrian barrier
2	Velez	National Highway	Yacapin	460	With pedestrian barrier

2) Traffic signal

Traffic signal is a basic tool to control right-of-way at intersection, where conflicting movements cross each other. There are at the moment 14 traffic signals in Cagayan de Oro City but nine (9) of them are not operating. The proposed work will replace the old signals which were installed more than 10 years ago. Signals in the central area will be coordinated using wireless linking. In addition, 7 signals will be newly installed. It is noted, however, that these new signal intersections are selected without signal warrant analysis. Turning movement count survey must be conducted and signal warrant must be checked before the final selection of intersections for signalization.

TABLE 11.7-3 TRAFFIC SIGNAL IMPROVEMENT

	Intersection of		Signal		Remarks
			New	Replace-ment	
1	National Highway	Agora Road		O	
2	National Highway	Osmena Street		O	
3	National Highway	Corrales Ave.		O	
4	National Highway	Velez Street		O	
5	National Highway	Vamenta Blvd.		O	
6	Corrales Ave.	Yacapin Street		O	
7	Corrales Ave.	J. R. Borja Street		O	
8	Velez Street	A. Luna Street		O	
9	Velez Street	Yacapin Street		O	
10	Velez Street	J. R. Borja Street		O	
11	Velez Street	Neri/Abejuela		O	
12	Vamenta Blvd.	Serina Street		O	
13	National Highway	East Bus Terminal			No change
14	National Highway	West Bus Terminal			No change
15	Corrales	Caabucayan	O		
16	Vamenta	Calamansi	O		
17	Vamenta	Max Suniel	O		
18	Hayes	Chavex	O		
19	Hayes	Osmena	O		
20	Osmena	Ramonal	O		
21	National Highway	Syre Highway	O		Outside CDO

3) Pavement Markings

Pavement markings are almost non existent in the study area. The situation seems to be a factor of many accidents and contribute to the disorder of the traffic in the area. Arterial streets within the outer central area and the national highway within the study area are selected for pavement marking. The total road length is 124 km covering 36 sections of road and 149 intersections as shown in the table below and in Figure 3. Center line, lane line, stop line, directional arrow and pedestrian crossing will be drawn. Reflective thermoplastic pavement marking materials shall be applied with the standard thickness of 2.0 mm.

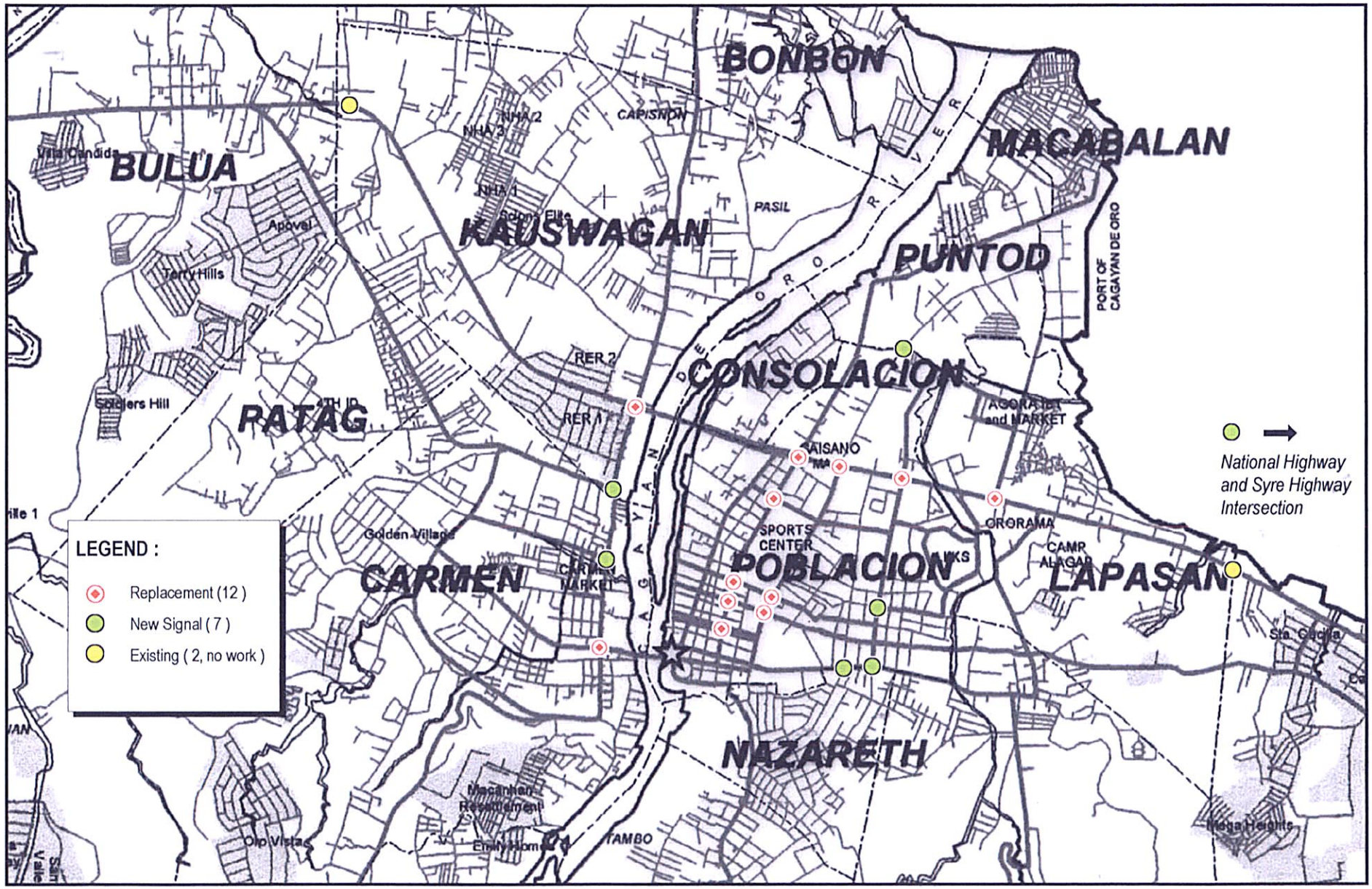


FIGURE 11.7-2 TRAFFIC SIGNAL LOCATIONS

TABLE 11.7-4 ROAD SECTIONS FOR PAVEMENT MARKING WORK

	Street Name	From	To	Length	Lane
				(m)	
1	National Highway	Gitagum	Opol	29,000	2
2	National Highway	Opol	Iponan	1,700	4
3	National Highway	Iponan	Bulua	2500	2
4	National Highway	Bulua	Kauswagan	2,300	4
5	National Highway	Kauswagan		700	6
6	National Highway	Maharlika Bridge		630	4
7	National Highway	Maharlika Bridge	Gusa	5,100	6
8	National Highway	Gusa		670	4
9	National Highway	Gusa	Tagoloan	15,200	4
10	National Highway	Tagoloan	Jasaan	20,000	2
11	Syre Highway			12,200	2
12	Calamansi	Bulua	Vamenta	3,100	2
13	Vamenta	Hational Highway	Masterson	2,000	4
14	Masterson			4,700	2
15	Velez	National Highway	Gaerlan	1,220	2
16	Capistrano	National Highway	Gaerlan	1,220	4
17	Corrales	National Highway	Clemente	1,260	2
18	Chaves	National Highway	Hayes	1,000	2
19	Osmena	National Highway	Hayes	970	4
20	Villarin	Calamansi	Zayas	1,000	2
21	Max Suniel	Vamenta	Viilarin	820	2
22	Serina	Vamenta	Viilarin	1,100	2
23	Zayas	Vamenta	Viilarin	1,000	2
24	Luna	Capistrano	Osmena	880	2
25	Ramonal	Corrales	Osmena	580	2
26	Yacapin	Capistrano	Osmena	1,070	2
27	Borja	Capistrano	Quirino	1,230	2
28	Neri	Burgos	Corrales	490	2
29	Abejuela	Burgos	Corrales	490	2
30	Hayes	Capistrano	Osmena	1,170	2
31	Gaerlan	Vamenta	Velez	520	4
32	LKKS Drive			1,920	2
33	Pacana	National Highway	Agora	2,060	2
34	Corrales Ext.	National Highway	Agora	1,600	2
35	Agora	National Highway	Pacana	1,540	2
36	Caabucayan	Pacana	Agora	1,040	2
	Total Length			123,980	

4) Traffic Sign

Another shortcoming in terms of traffic management facility in Cagayan de Oro area is that non-standards traffic signs are used. These signs are not reflectorized and less effective particularly in the night. Traffic signs for parking regulation, speed limit, one-way, no entry, turn restriction, loading/unloading zone, etc. must be extensively installed. The target road sections and intersections will be same as those for pavement markings.

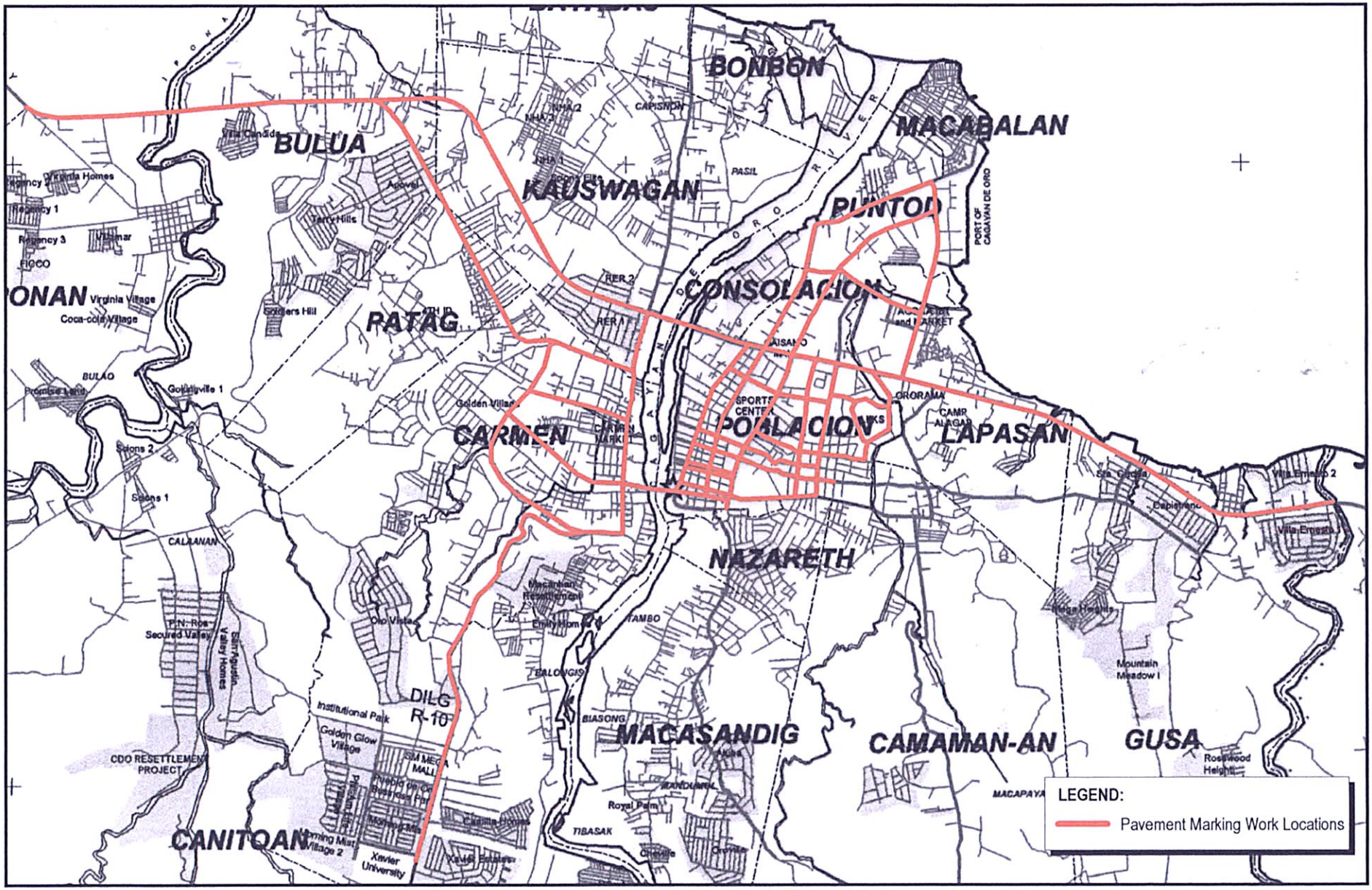


FIGURE 11.7-3 PAVEMENT MARKING WORK LOCATIONS

11.7.2 Cost Estimates

Cost for implementing these improvement works is estimated. The table below presents the estimated costs. It is pointed out that the cost at this stage is very rough as the target intersections and road sections are tentative and scope of work is not defined.

TABLE 11.7-5 ESTIMATED COST FOR TRAFFIC MANAGEMENT IMPROVEMENT WORKS

	Improvement Measure	Cost ('000 Pesos)	Remarks
1.	Geometric improvement	7,091	8 intersections and 2 mid-block sections
2.	Traffic signal	52,155	12 existing signals and 7 new signals
3.	Pavement marking	57,582	36 road sections and 149 intersections with total length of 124 km
4.	Traffic sign	3,028	1183 traffic signs. Project sites are same as pavement marking
	Total	**119,857**	

11.8 SELECTION OF ROAD PROJECTS FOR F/S

Road projects subjected to a feasibility study under this Study are selected in this section.

1) Selection Criteria

Selection criteria were established as follows:

- Implementation priority is high and the project is planned to be implemented in the Short Term or early part of Medium Term.
- Proposed road right-of-way needs to be determined as early as possible, so that any development within the proposed road right-of-way can be controlled, then future ROW acquisition can be done without affecting structures and houses.
- The road project is vitally needed to support on-going related projects.

2) Selection of Road Projects for F/S

Candidate road projects selected based on above criteria were as follows:

Candidate Projects for F/S

- Iligan-CDO-Butuan Road (widening of existing road)
- J.B. Borja Extension (New road)
- Western Coastal Road : Phase I (New road)
- West Diversion Road (improvement of existing road and new road)
- 6th Bridge (New bridge)
- 7th Bridge and access road (New bridge / road)

a) Iligan-CDO-Butuan Road
   - Scope of civil work is mainly paving of existing gravel shoulder with minor widening. Due to encroachment of structures, DPWH has been implementing slowly but continuously. Thus, this project is considered as continuation of the previous project.
   - Not recommended for F/S.

b) J.B. Borja Extension
   - New road construction.
   - The corridor of this route is rapidly urbanizing.
   - ROW must be determined as early as possible, then any development within the proposed ROW must be strictly controlled.
   - Recommended for F/S.

c) Western Coastal Road : Phase I
   - 3rd Bridge to which this road is accessed is under construction, thus urgent.
   - New road construction.
   - ROW must be determined as early as possible.
   - Recommended for F/S.

d) West Diversion Road
- Project sites are rapidly urbanizing. ROW must be determined as early as possible.
- This road will function as a traffic distributor and improve accessibility to various areas of CDO.
- Recommended for F/S (new alignment section only)

e) 6th Bridge
- New bridge.
- Decrease traffic congestion of Marcos Bridge and Carmen Bridge.
- Recommended for F/S.

f) 7th Bridge and Access Road
- New bridge.
- Vitally reduce traffic congestion of Carmen Bridge.
- Recommended for F/S.

It is recommended that four projects (b, c, d and f) be subjected for a feasibility study under the Study (see Figure 11.8-1):

Recommended Road Projects for F/S

• J.B. Borja Extension	L =	8.0 km
• Western Coastal Road : Phase I	L =	7.5 km
• West Diversion Road	L =	4.7 km
• 7th Bridge and Access Road	L =	0.9 km
Total	**L =**	**21.1 km**

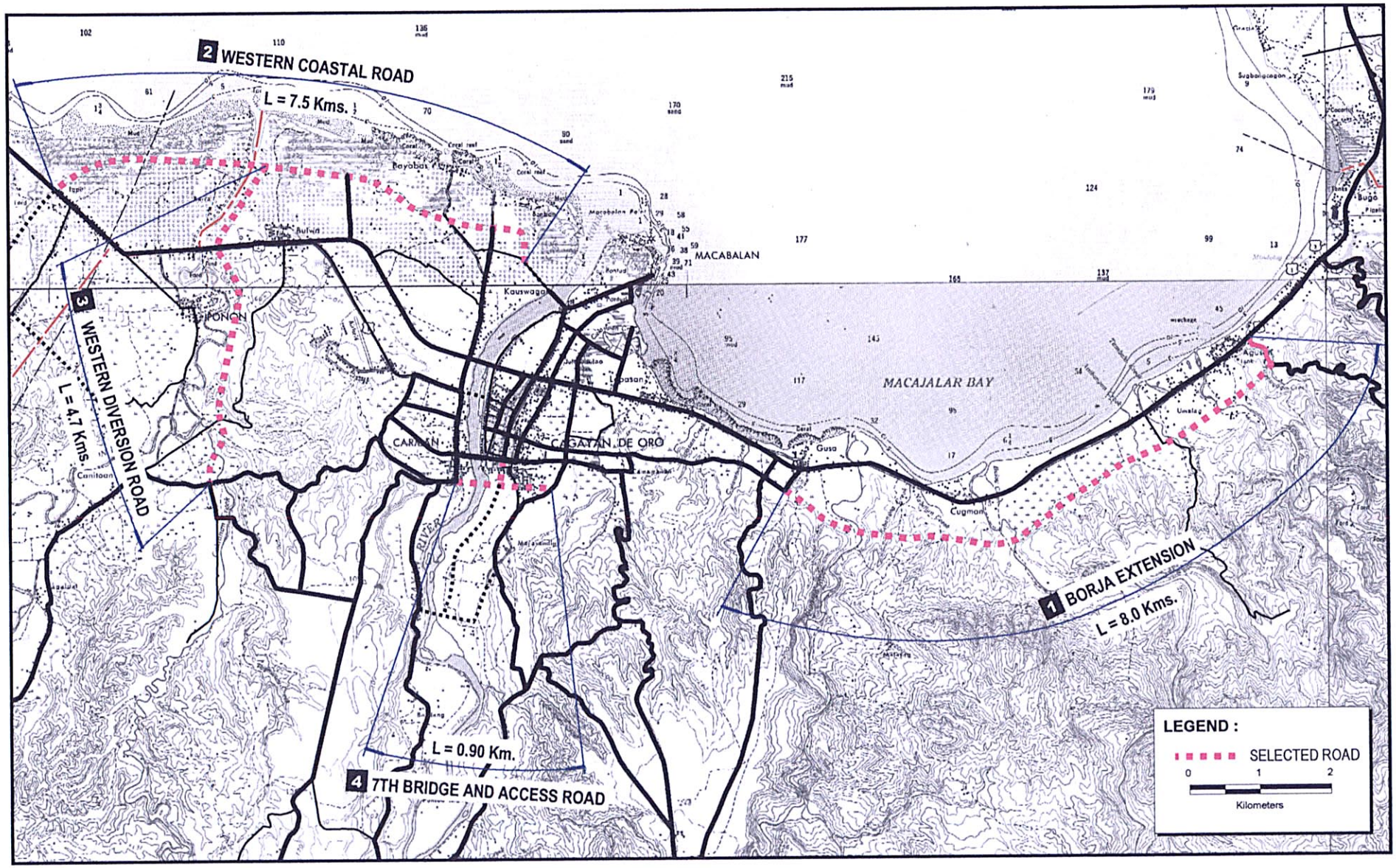


FIGURE 11.8-1 SELECTED ROAD PROJECTS FOR F/S

CHAPTER 12
FEASIBILITY STUDY OF WESTERN COASTAL ROAD: PHASE-1

12.1 Objectives of the Project

The 3rd Bridge is under construction at the mouth of Cagayan de Oro River. Western Coastal Road will be connected with the 3rd Bridge and form a major trunk road network in the western coastal area of Cagayan de Oro City where new industrial / commercial and residential areas are planned. The objectives of the project are as follows:

Objectives of the Project

- To reduce traffic congestion of Iligan-CDO Road.
- To guide and accelerate sound urbanization in the Western Coastal Area of CDO City.
- To provide the direct access from the Western area to the Port Area.
- To enhance international / domestic investment by providing easy access to industrial areas and CDO Port as well as new Airport in Laguindingan.

12.2 Physical Features of the Project Site

The terrain of the project site is flat with ground elevation ranging from 0m to 3m. One large river, i.e. Iponan River crosses the project site.

Silty fine sand with N-value of less than 5 is deposited for the depth of 5m, followed by silty sand with N-value less than 30 up to the depth of 35m from the ground. Bearing strata for bridge foundation is found deeper than 35m from the ground.

Fish ponds are developed along the shore line, which are planned to be converted to industrial areas. Land use between fish ponds and Iligan-CDO Road are mixture of agriculture and residential lands. West Bus/Jeepney Terminal with public markets exists within the project site.

12.3 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 (Iponan river)

3) Geo-technical Survey and Soils/Material Source Survey

- Bridge site geo-technical survey (depth=45m)
- Soft ground investigation (depth=20m)
- Soils/material sources survey (3 locations)

12.4 Selection of Route Alignment

12.4.1 Control Points for Selecting Route Alignment

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

- An alignment starts from CDO-Iligan Road at about 200 to 500m east (or CDB side) of Igpit Bridge. It will be extended towards inland side in future and connected with Proposed Opol Diversion Road.
- An alignment ends at the road going to 3rd Bridge.
- An alignment runs almost parallel to CDO-Iligan Road with the distance of 1 to 1.5 km.
- Scattered residential areas have been developed. An alignment should be so selected that social impact can be minimized.
- To utilize an existing road within the West Terminal should be carefully studied.
- Existing fishponds along the coast are planned to be converted to Industrial / Commercial areas, therefore, accessibility to these areas be considered.

12.4.2 Alternative Alignments

An alignment was divided into seven Sections. In each section except Section-2, alternative alignments were developed as shown in Figure 12.4-1.

12.4.3 Evaluation of Alternative Alignments and Selection of the Best Alignment

Alternative alignments in each section were evaluated and selected as shown in Table 12.4-1.

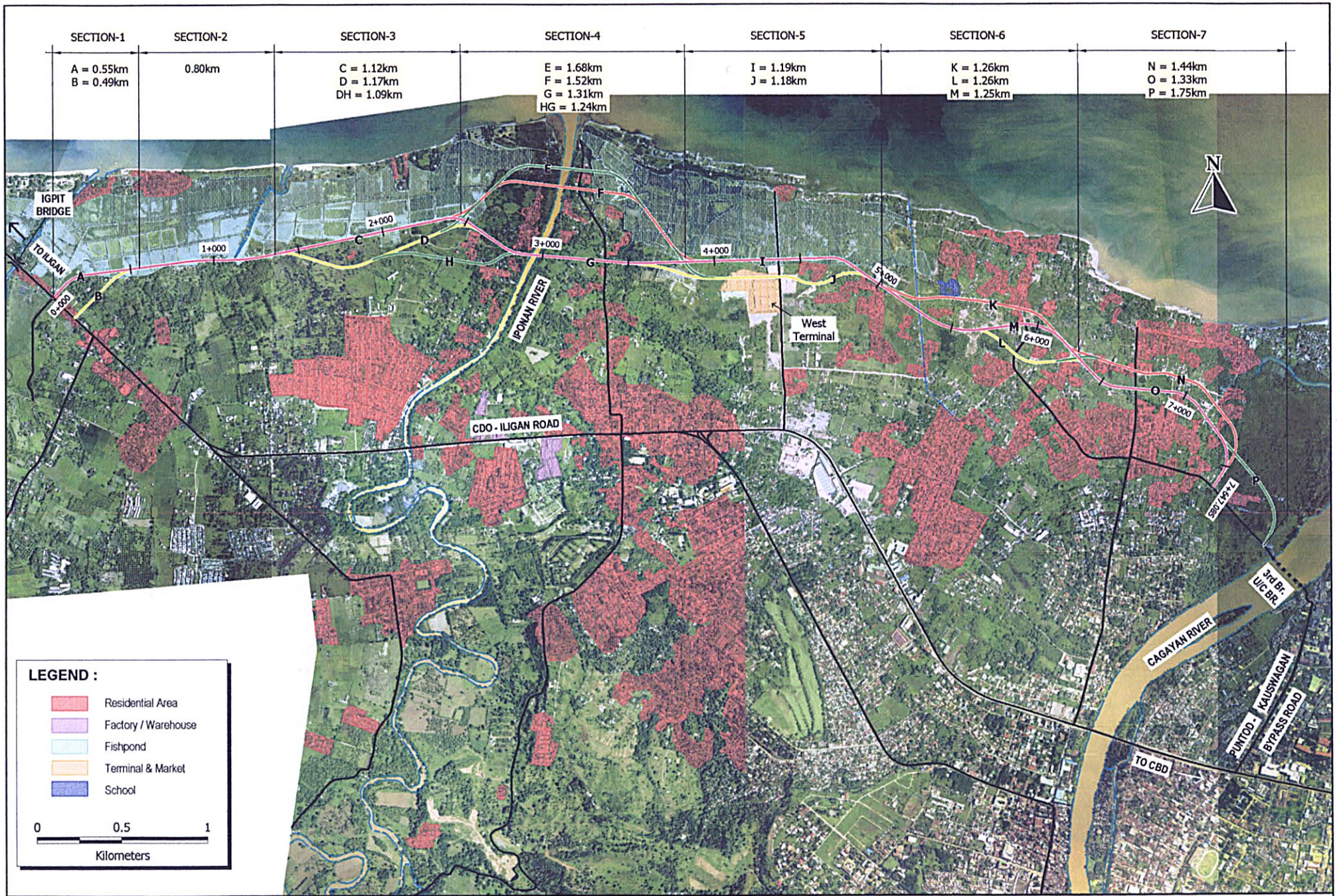


FIGURE 12.4-1 ALTERNATIVE ALIGNMENTS OF CAGAYAN WESTERN COASTAL ROAD

TABLE 12.4-1 (1/2) EVALUATION OF ALTERNATIVE ALIGNMENTS : WESTERN COASTAL ROAD

		SECTION - 1		SECTION - 3			SECTION - 4			
		Alternative Alignments		Alternative Alignments			Alternative Alignments			
		A	B	C	D	DH	E	F	G	H-G
1) Site Conditions and Issues		• An alignment starts from CDO-Iligan Road. It will be extended towards inland side in future and connected with proposed Opol Diversion Road. • Roadside of CDO-Iligan Road is slightly built-up. • Mostly agricultural land with scattered residential areas.		• Mostly agriculture land. • Fish ponds have been developed along the coast. • An alignment depends on that of Section 4.			• An alignment crosses Iponan River. • Residential areas are developed along the River. • Where to cross Iponan River.			
2) Planning Concept		• To minimize social impacts. • Future extension towards inland can utilize existing road. • Intersection layout does not affect Igpit Bridge.	• To minimize social impact. • Future extension will utilize open spaces except alongside of CDO-Iligan Road.	• An alignment passes along the boundary between agricultural land and fish ponds.	• An alignment passes through agricultural land.	• An alignment passes through agricultural land.	• An alignmen is to be selected to minimize social impact. • To achieve above, an alignment is to be selected at the mouth of Iponan River.	• Almost same concept as Route E, however, an alignment is to be selected at about 100m upstream of Route E.	• An alignment is to be selected at almost parallel to CDO-Iligan Road in order to accelerate development of both sides of an alignment. • An alignment is to be selected to minimize social impact.	
3) Scope of Civil Work	Road Length (km)	0.55	0.49	1.12	1.17	1.09	1.55	1.39	1.2	1.19
	Bridge Length (km)	-	-	-	-	-	0.13	0.13	0.11	0.11
	Total (km)	0.55	0.49	1.12	1.17	1.09	1.68	1.52	1.31	1.30
4) Construction Cost (Million P)	Road	40.0	35.7	81.5	85.2	79.4	112.8	101.2	87.4	86.6
	Bridge	-	-	-	-	-	117.7	117.7	99.0	99.0
	Total	40.0	35.7	81.5	85.2	79.4	230.5	218.9	186.4	185.60
5) ROW / Relocation Cost (Million P)	ROW	11.9	11.5	7.8	16.4	15.3	27.9	26.7	33	47.6
	Relocation	0.6+0.80 = 1.4	1.0+1.6 = 2.6	0	1.2	1.8	1.2	1.6	1.0	2.0
	Total	13.3	14.1	7.8	17.6	17.1	29.1	28.3	34.0	49.6
6) Evaluation	a) Horizontal Alignment	Rmin.=200m	Rmin.=300m	Tangent	Rmin.=250m	Rmin.=250m	Rmin.=200m (2 locations)	Rmin.=200m (2 locations)	Rmin.=200m & 250m	Rmin.=150m (2 locations)
	b) Vertical Alignment	0.35~0.36% (Almost flat)	0.35~0.36% (Almost flat)	0.35% (Almost flat)	0.35% (Almost flat)	0.35% (Almost flat)	5.25% at bridge approach	5.25% at bridge approach.	5.25% at bridge approach.	5.25% at bridge approach.
	c) Construction Cost	- (1.0)	-4.3MP (0.89)	- (1.0)	+3.7MP (1.04)	- 2.1MP (0.93)	+44.1MP (1.24)	+32.5MP (1.17)	- (1.0)	-0.8MP (1.0)
	d) ROW / Relocation Cost	- (1.0)	+1.2MP (1.06)	- (1.0)	+8.6MP (2.25)	+9.3MP (2.19)	-4.9MP (0.88)	-6.3MP (0.81)	- (1.0)	+15.6MP(1.50)
	e) Social Impact (No.of Affected Structures)	3 + 4 = 7	5 + 8 = 13	0	6	9	6	8	5	10
	f) Advantages / Disadvantages	• Future extension will be easier. • Less social impact. • No difference in horizontal/vertical alignments.	• Construction cost is slightly less but ROW / relocation cost is slightly higher.	• No house is affected. • No big difference in construction cost. • Horizontal alignment is better than others.	• Higher social impact. • S-curve is required for a horizontal alignment.	• Higher social impact. • S-curve is required for a horizontal alignment.	• An alignment is too close to the shoreline, development impact is less. • Most expensive alternative.	• Almost same as Route-E.	• Most economical alternative. • Social impact is not so high. • Most smooth horizontal alignment.	• Highest social impact. • Slightly expensive than Route-G. • Worst horizontal alignment.
7) Recommendation		◎ Recommended	X	◎ Recommended	X	X	X	X	◎ Recommended	X

TABLE 12.4-1 (2/2) EVALUATION OF ALTERNATIVE ALIGNMENTS : WESTERN COASTAL ROAD

		SECTION - 5		SECTION - 6			SECTION - 7		
		Alternative Alignments		Alternative Alignments			Alternative Alignments		
		I	J	K	L	M	N	O	P
1) Site Conditions and Issues		• West Terminal and public market developed. • Mostly agricultural land with fishponds. • Scattered residential areas. • To utilize existing road in West Terminal or not.		• Mixed land use with agricultural land and residential areas. • Narrow road exists.			• Residential area are expands along this corridor. • Two options; to pass through vacant lots or to utilize the existing road. • Where to select the end point of this road. • Near the 3rd Bridge, swampy area exists.		
2) Planning Concept		• Not utilize the existing road in the West Terminal.	• To utilize existing road in the West Terminal.	• Existing road is to be utilized with necessary widening.	• To minimize social impact, an alignment is to be so selected that vacant lots be fully utilized.	• Almost same concept as Route-L. • To select better horizontal alignment.	• To utilize the existing road with necessary widening.	• To pass through vacant lots.	• End point is to be selected nearer to the 3rd Bridge.
3) Scope of Civil Work	Road Length (km)	1.19	0.88 (New Road)	1.26	1.26	1.25	0.54 (New)	1.33	1.75
	Bridge Length (km)	-	-	-	-	-	-	-	-
	Total (km)	1.19	0.88+0.3=1.18	1.26	1.26	1.25	0.54+0.9=1.44	1.33	1.75
4) Construction Cost (Million P)	Road	86.6	64.1	65.3	72.6	72.0	74.7	76.6	100.8
	Bridge	-	-	-	-	-	-	-	-
	Total	86.6	64.1	65.3	72.6	72.0	74.7	76.6	100.8
5) ROW / Relocation Cost (Million P)	ROW	8.3	12.3	46.0	78.0	76.9	66.3	81.8	73.4
	Relocation	0.8	1.0	9.4	1.6	1.6	7.0	4.4	4.4
	Total	9.1	13.3	55.4	79.6	78.5	73.3	86.2	77.8
6) Evaluation	a) Horizontal Alignment	Rmin.=200m	Rmin.=300m (2 locations)	Rmin.=200m (2 locations)	Rmin.=150m,200m	Rmin.=300m	Rmin.=200m (4 locations)	Rmin.=200m (3 locations)	Rmin.=200m (3 locations)
	b) Vertical Alignment	0.35~0.36% (Almost flat)	0.35~0.36% (Almost flat)	0.35~0.46% (Almost flat)	0.35~0.46% (Almost flat)	0.35~0.46% (Almost flat)	0.35~0.5% (Almost flat)	0.35~0.5% (Almost flat)	0.35~0.5% (Almost flat)
	c) Construction Cost	- (1.00)	-22.5MP (0.74)	- 6.7MP (0.91)	+ 0.6MP (1.01)	- (1.00)	-1.9MP (0.97)	- (1.00)	+24.2MP (1.32)
	d) ROW / Relocation Cost	- (1.00)	+4.0MP (1.46)	- 23.1 (0.71)	+ 1.1MP (1.01)	- (1.00)	-12.9MP (0.85)	- (1.00)	-8.4MP (0.90)
	e) Social Impact (No.of Affected Structures)	4	5	47	8	8	35	22	22
	f) Advantages / Disadvantages	• Through traffic on the road will not be disturbed by local traffic in West Terminal and public market.	• The road in Public Market is narrow. • Traffic congestion is expected due to local traffic. • Sharp S-curve required to minimize social impact.	• High number of houses along existing road. Affected. Quite high social impact.	• Almost same as Route-M, but horizontal alignment is not so good.	• Minimum social impact. • Better horizontal alignment than others.	• High number of houses along existing road affected. Quite high social impact. • Worst horizontal alignment.	• Social impact is smaller than Route-N. • Horizontal alignment is better than Route-N.	• Almost same as Route-O. • End point is too close to 3rd Bridge. Widening of bridge approach required.
7) Recommendation		◎ Recommended	X	X	X	◎ Recommended	X	◎ Recommended	X

12.5 Traffic Forecast

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

As the 3rd Bridge is being constructed with 4-lanes, this road is also proposed to be constructed with 4-lanes.

TABLE 12.5-1 ESTIMATED TRAFFIC VOLUME BY SECTION

			3rd Bridge	1st Sect. (East Sect.)	2nd Sect. (Middle Sect.)	3rd Sect. (West Sect.)
Traffic Volume (100 PCU)	2010		26.7	15.3	18.6	11.7
	2016		37.5	22.1	27.3	18.1
	2022		52.7	31.9	40.0	28.0
V/C Ratio	2-lane	2010	1.01	0.61	0.74	0.47
		2016	1.50	0.89	1.09	0.72
		2022	2.10	1.28	1.60	1.12
	4-lane	2010	0.53	0.30	0.37	0.23
		2016	0.75	0.44	0.55	0.36
		2022	1.05	0.64	0.80	0.56

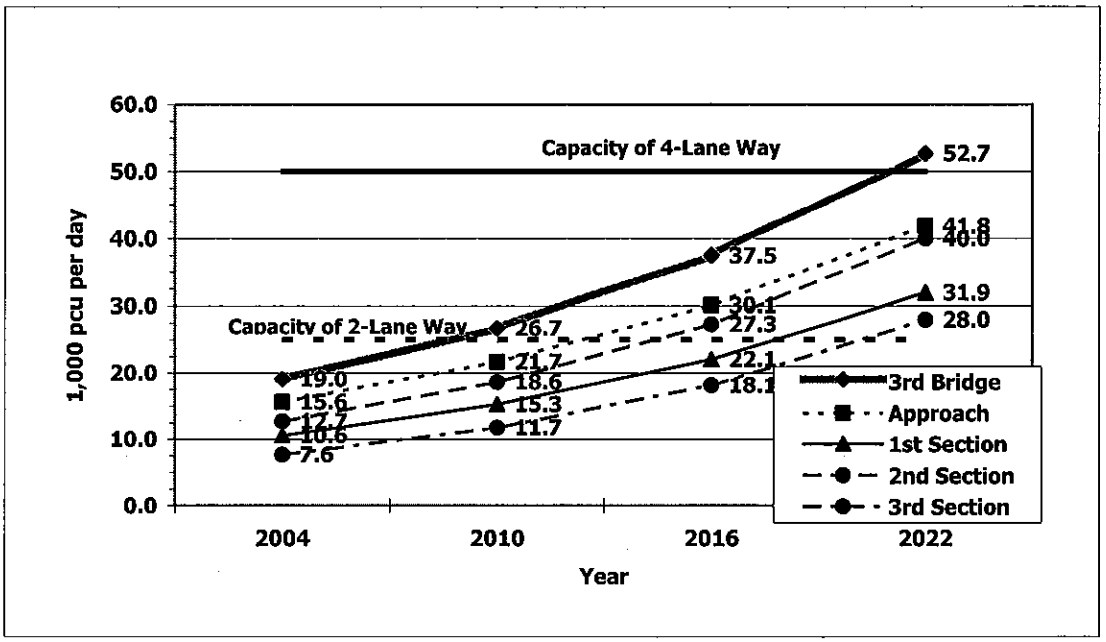


FIGURE 12.5-1 NO. OF LANES REQUIRED

12.6 Construction Phasing

As shown in Table 12.5-1, if this road is constructed as a 2-lane road, V/C ratio in 2016 will be close to 1.0 (approaching traffic capacity) and will become 1.1 to 1.6 in 2022. The 3rd Bridge with which this road is connected is being constructed as a 4-lane bridge, it is recommended that this bridge be constructed as a 4-lane divided road. Stage construction from a 2-lane road to a 4-lane divided road is not recommended.

12.7 Preliminary Design

12.7.1 Design Concepts and Criteria

1) Design Concepts

Western Coastal Road functions an alternative route of CDO-Iligan Road and strengthens the east-west transport axis.

It traverses the urbanized and the planned urbanized areas. In the urbanized areas, major issue is to minimize adverse social impact by avoiding to affect existing houses and structures. To achieve this objective, the design standards are not necessarily be so high.

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

Design Concept

- Design speed of 60 km/hour is selected to minimize adverse social impact in determining horizontal alignment.
- For socially critical areas, ROW width is narrowed as much as possible by applying structures such as retaining walls.
- To allow future urbanization along the roadsides, 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 and intersection design criteria are shown in Table 12.7-1 and 12.7-2, respectively.

Typical cross-sections are shown in Figure 12.7-1.

Road right-of-way was established as follows:

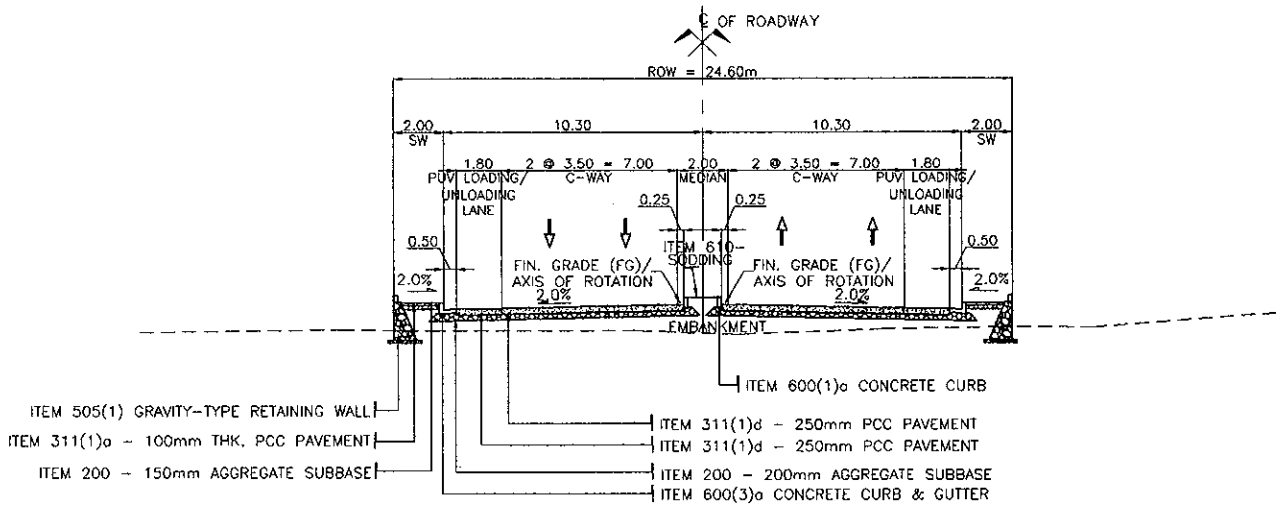
Standard ROW	:	35m (Embankment height of 2.5m or less can be accommodated. When embankment height becomes more than 2.5m, retaining wall is provided to limit road width within 35m.)
ROW of Socially Critical Area	:	24.6m (In socially critical area such as built-up areas, retaining walls are provided to minimize ROW width.)

TABLE 12.7-1 HIGHWAY DESIGN CRITERIA

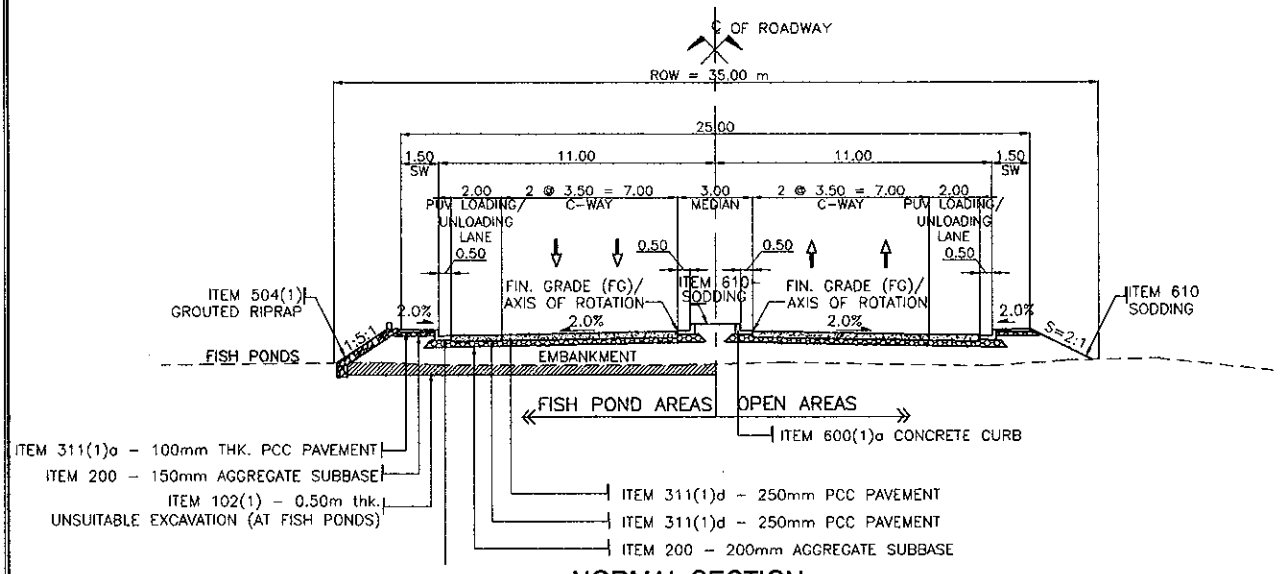
Element	Unit	Flat Terrain
Design Speed	Km/hr.	60
No. of Lanes	-	4
Type of Pavement	-	PCCP
Lane Width	m	3.5
PUV Loading / Unloading Lane	m	2.3~2.5
Median	m	2.0~3.0
Sidewalk	m	1.5~2.0
Stopping Sight Distance	m	85
Passing Sight Distance	m	420
Minimum Horizontal Radius	m	120
Minimum Horizontal Radius for 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

TABLE 12.7-2 INTERSECTION DESIGN CRITERIA

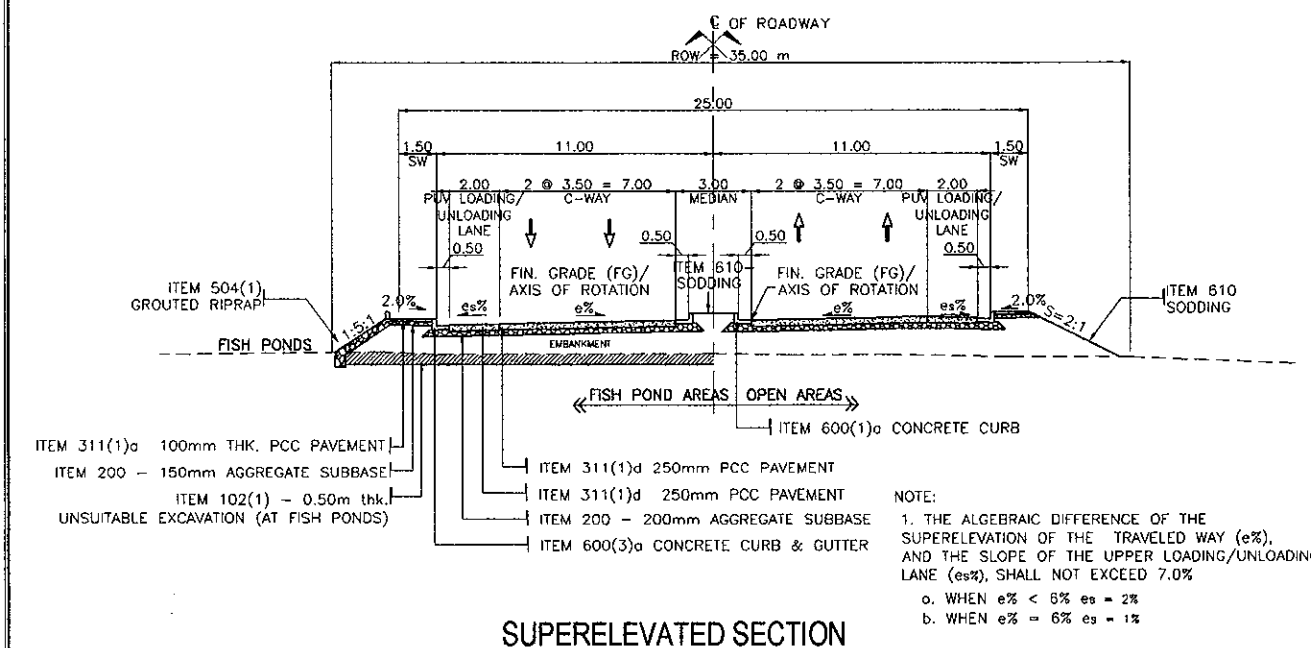
Element	Unit	Urban Signal Control Intersection
Design Speed	Km/hr.	40
Sight Distance	-	100
Minimum Horizontal Radius	-	60
Maximum Vertical Grade	m	2.5
Width of Lane	m	3.0~3.5
Length of Taper	m	50~100
Length of Storage Lane	m	30~50
Minimum Turning Way Radius	m	12
Width of Pedestrial Crossing	m	4



BUILT-UP AREAS



NORMAL SECTION



NOTE:

1. THE ALGEBRAIC DIFFERENCE OF THE SUPERELEVATION OF THE TRAVELED WAY (e%), AND THE SLOPE OF THE UPPER LOADING/UNLOADING LANE (es%), SHALL NOT EXCEED 7.0%
   a. WHEN e% < 6% es = 2%
   b. WHEN e% = 6% es = 1%

SUPERELEVATED SECTION

FIGURE 12.7-1 TYPICAL CROSS SECTION : WESTERN COASTAL ROAD

3) Bridge and Structures

(a) Design Standards and Specifications

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

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

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

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

(b) Materials

The basic materials used for bridge and structures shall be:

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

(c) Design Loads

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

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

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

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

- **Seismic Forces**

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

Seismic Design Coefficients

Seismic Design Item	Metro Cagayan de Oro
Acceleration Coefficient, A	0.40
Importance Classification, IC	I (Essential)
Seismic Performance Category, SPC	D
Soil Type	III
Site Coefficient	1.5

(d) Vertical Clearances

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

Vertical Clearance

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

(e) Bridge Planning

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

4) Drainage and Cross Drainage Facilities

a) Design Standards and Guidelines

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

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

Design Frequency (Return Period)

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

Design Frequencies

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

Cross-Drainage

Type and Size of Cross-Drainage Structure

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

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

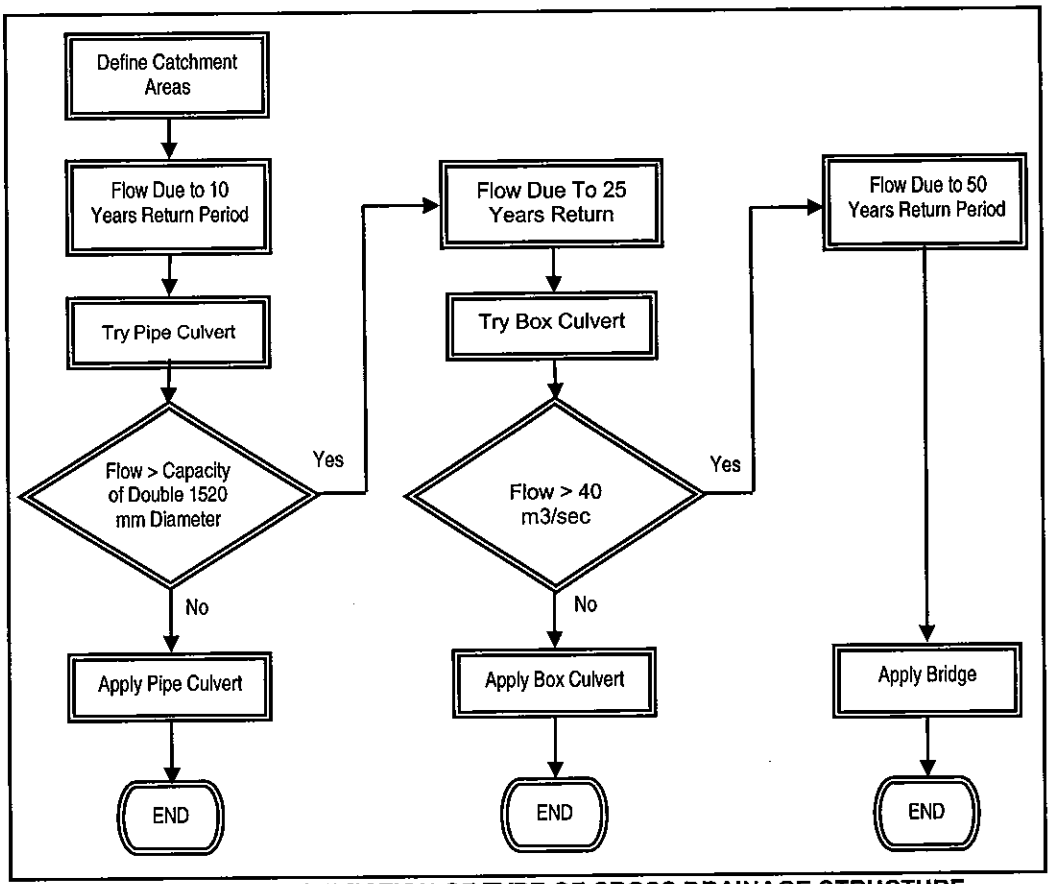


FIGURE 12.7-2 SELECTION OF TYPE OF CROSS DRAINAGE STRUCTURE

Reinforced Concrete Pipe Culverts (RCPC)

Pipe culverts are provided at the following locations:

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

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

Height of Backfill of RCPC

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

Reinforced Concrete Box Culverts (RCBC)

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

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

12.7.2 Road and Intersection Design

1) Horizontal Alignment

Horizontal alignment was designed to satisfy the design speed of 60 km/hour. Horizontal alignment is shown in Figure 12.7-3. Among various horizontal curves, minimum one is 200m 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
Built-up Area	:	Km 4+900-Km7+651	L = 2.75 km
Ordinary Section	Embankment :	Km 0+000-Km 0+250	L = 0.250 km
		Km 1+450-Km 1+700	L = 0.250 km
		Km 2+450-Km 3++400	L = 0.950 km
		Km 3+750-Km 4+100	L = 0.350 km
Fishpond Area	:	Km 0+300-Km 1+400	L = 1.100 km
		Km 1+750-Km 2+400	L = 0.650 km
		Km 3+450-Km 3+700	L = 0.250 km
		Km 4+150-Km 4+850	L = 0.700 km

4) Intersection Design

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

- Intersection with CDO-Iligan Road (Figure 12.7-4)
- Intersection with Access Road to West Terminal
- Intersection with the road going to 3rd Bridge

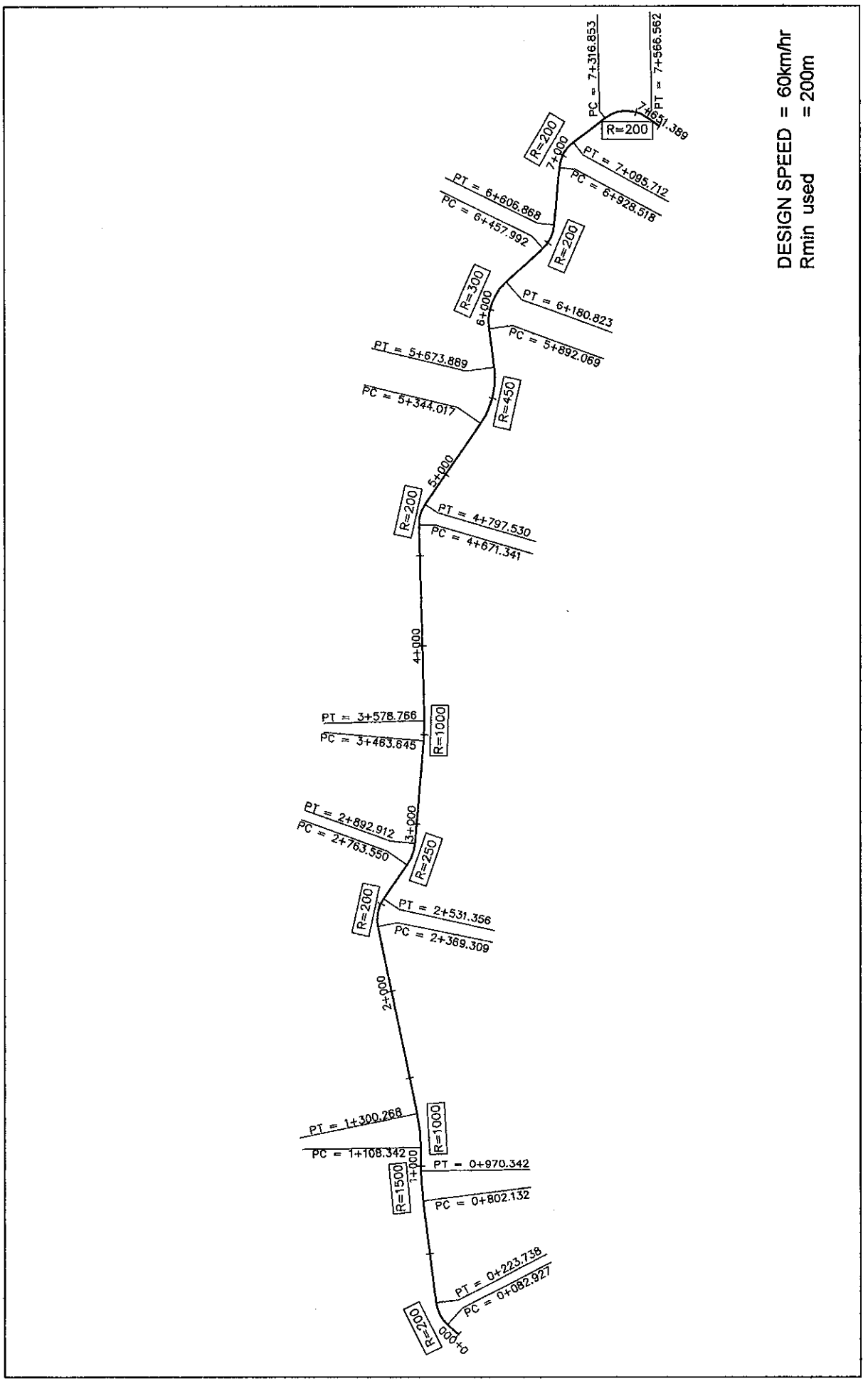


FIGURE 12.7-3 HORIZONTAL ALIGNMENT : WESTERN COASTAL ROAD

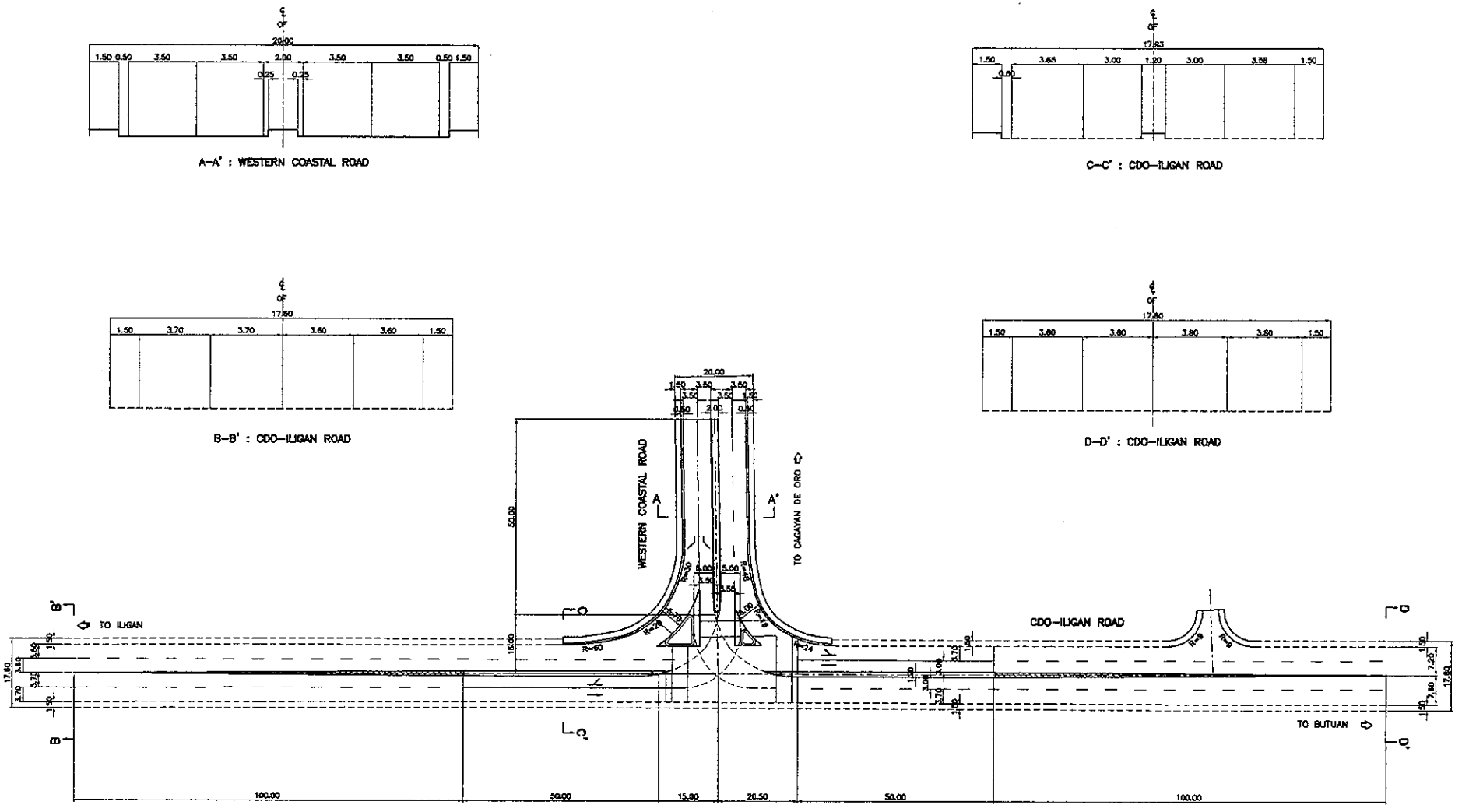


FIGURE 12.7-4 INTERSECTION WITH CDO-ILIGAN ROAD (ICBR)
STA. 0+000.00, BEG. OF WESTERN COASTAL ROAD

12.7.3 Pavement Design

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

Table 12.7.3-1 shows the design requirements. Bus and truck factors were 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 12.7.3-2 shows traffic loading. Cummulative ESAL is 13.9 Million for 20 years.

Required pavement thickness is as follows:

Subbase course : 20cm
PCC pavement : 25cm

TABLE 12.7.3-1 DESIGN REQUIREMENT (Western Coastal)

Category	Description
a. Design Variable	
a.1 Time Constraints · Initial Performance Period	 PCCP : 20 years
a.2 Traffic Loading	Directional Distribution Factor : 0.5 Lane Distribution Factor : 0.6
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 = 25cm

TABLE 12.7.3-2 TRAFFIC LOADING (Western Coastal)

Year	AADT (Both Direction) Bus	Track	Cumulative ESAL
2014	366	1,378	413,215
2015	385	1,470	853,593
2016	405	1,569	1,323,019
2017	426	1,674	1,823,319
2018	449	1,786	2,356,529
2019	472	1,906	2,924,823
2020	497	2,034	3,530,518
2021	523	2,170	4,176,085
2022	551	2,316	4,864,391
2023	568	2,385	5,573,346
2024	585	2,457	6,303,570
2025	602	2,531	7,055,701
2026	620	2,607	7,830,395
2027	639	2,685	8,628,331
2028	658	2,765	9,450,204
2029	678	2,848	10,296,734
2030	698	2,934	11,168,659
2031	719	3,022	12,066,742
2032	740	3,113	12,991,768
2033	763	3,206	13,944,545
TOTAL	**11,343**	**46,856**	**13,944,545**

12.7.4 Structure Design

The Proposed Western Coastal Road : Phase I is a new road construction 7.65kms long. One (1) river bridge crossing is identified along the alignment to cross the Iponan River which is approximately 600m upstream of the river mouth. Considering the nearness of the proposed site to the sea, the flood level is still within the influence of tidal variation.

This section discusses the preliminary design aspects of the proposed Iponan river bridge crossing along the alignment.

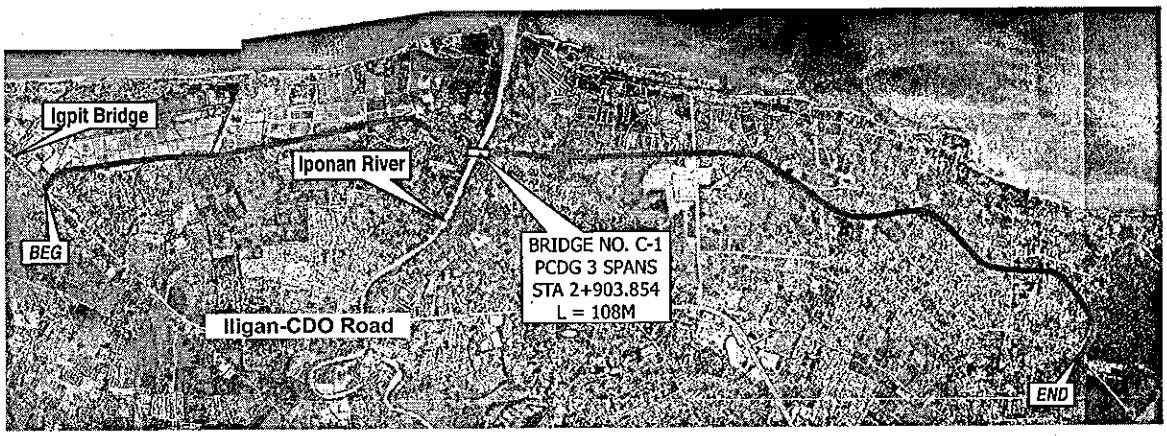


FIGURE 12.7.4-1 BRIDGE LOCATION MAP

12.7.4.1 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 12.7.4-1 shows the location of the proposed bridge while Figure 12.7.4-2 presents the conditions of the Iponan River along the proposed Western Coastal Road.

The following features describe briefly the proposed bridge sites:

Topography

- The proposed alignment starts at Iligan-Cagayan de Oro Road to approximately 300m southeast of the existing Igpit Bridge. The alignment is planned to be extended inland to connect with the Opol Diversion Road which becomes the basis of the proposed starting point.
- The proposed alignment passes over mostly flat terrain along the coastal areas of Cagayan de Oro and passes through some fishponds and agricultural land in the area.
- Due to its proximity to the sea and the relatively flat terrain at the proposed bridge site, it is expected that flood will cover a wider area near the river.

Rivers/Streams

- The proposed bridge site is about 600m upstream of the river mouth towards the sea,
- The river meanders on the upstream side of the proposed bridge location and is relatively straight towards the sea,
- Trees and vegetations line up the banks but on areas where there are no vegetation, scouring is observed on the banks with exposed sandy soil,
- Since the river originates from the mountain, medium to large debris are expected including small trees and small bamboos,
- The Iligan-Cagayan-Butuan Road crosses the Iponan River 800m upstream of the proposed site. Two separate bridges exist at this river crossing with the old bridge on the upstream side having spans at 15m and total length of 90m. The downstream side bridge is a two-span (35m span) PCDG with a total length of 70m.

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

TABLE 12.7.4-1 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
C-1	Iponan River	918.0	2.00	2.97	25.0	36

Geotechnical

- Geotechnical investigations carried-out for the proposed bridge site (BH4 and BH5) revealed the presence of thick sand layer with varying densities.
    - The upper 22m depth of the two boreholes has N-values generally ranging from about 5-12 with occasional high values ranging from 17 to 30. Subsequent depths down to the end of the boreholes have N-values ranging from 23 to 46.
    - The thick sand formation is interbedded by the slightly plastic clayey Silt/Clay (CL-ML) layer.
    - The site can be considered susceptible to liquefaction phenomena due to
        - Non-plastic loose sand/silty sand of medium to fine grain size distribution,
        - Generally high ground water table, and
        - Loose relative density.

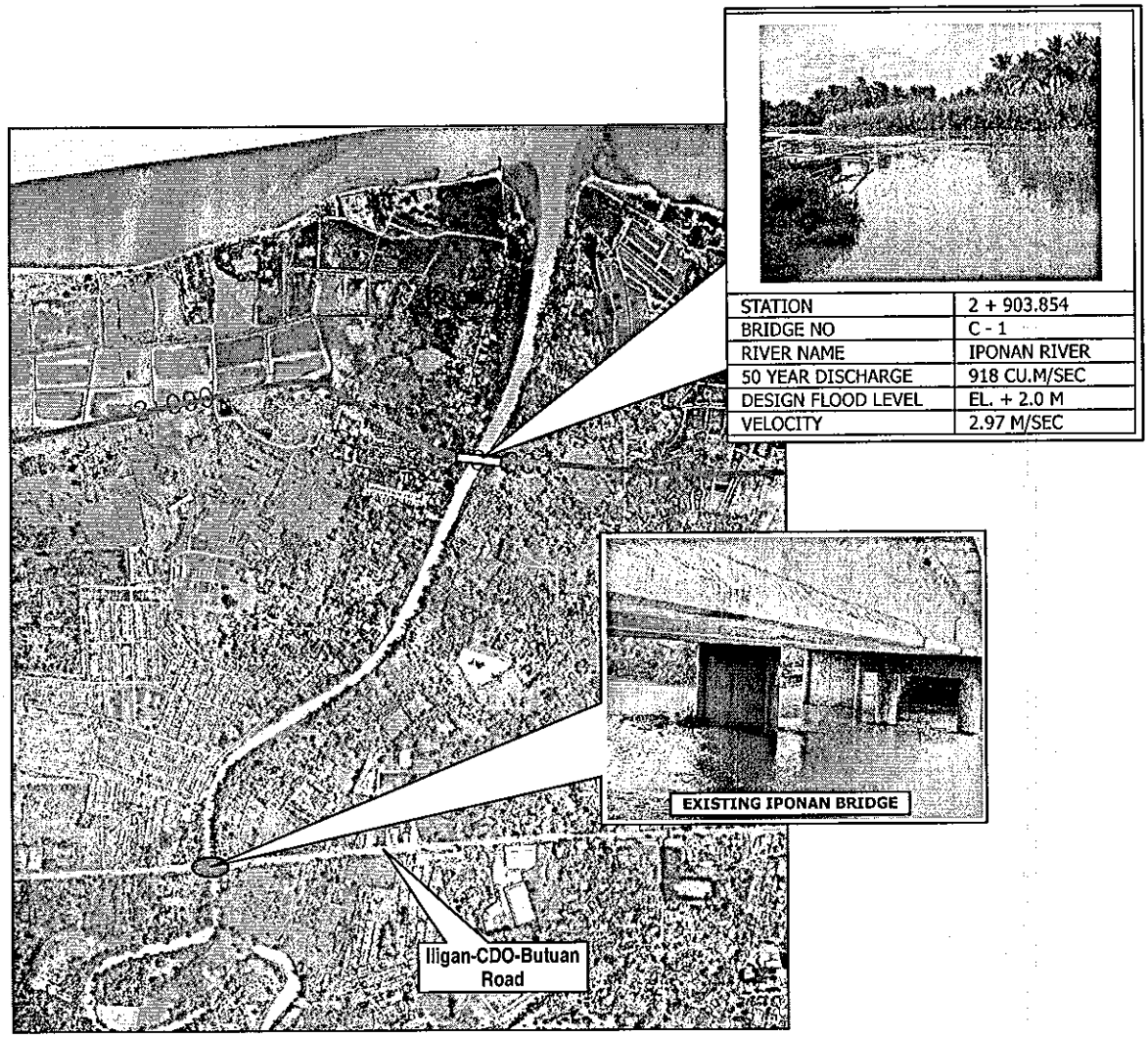


FIGURE 12.7.4-2 RIVER CONDITION AT PROPOSED BRIDGE SITE

12.7.4.2 Design Concept for Structures

(1) Superstructure

The superstructure preliminary design basically adheres to the following concepts:

Bridge Deck Section

- The bridge deck section should conform with the travelway/carriageway width of the highway. Typical bridge section is illustrated in Figure 12.7.4-3. Since the Proposed Western Coastal Road is to be implemented with four lanes of travelway, the bridge deck section will be provided with four lanes of carriageway and median in the same configuration as the highway.

- A 1.5m wide sidewalk is provided at both sides of the deck since the proposed road is located in an urbanized area.

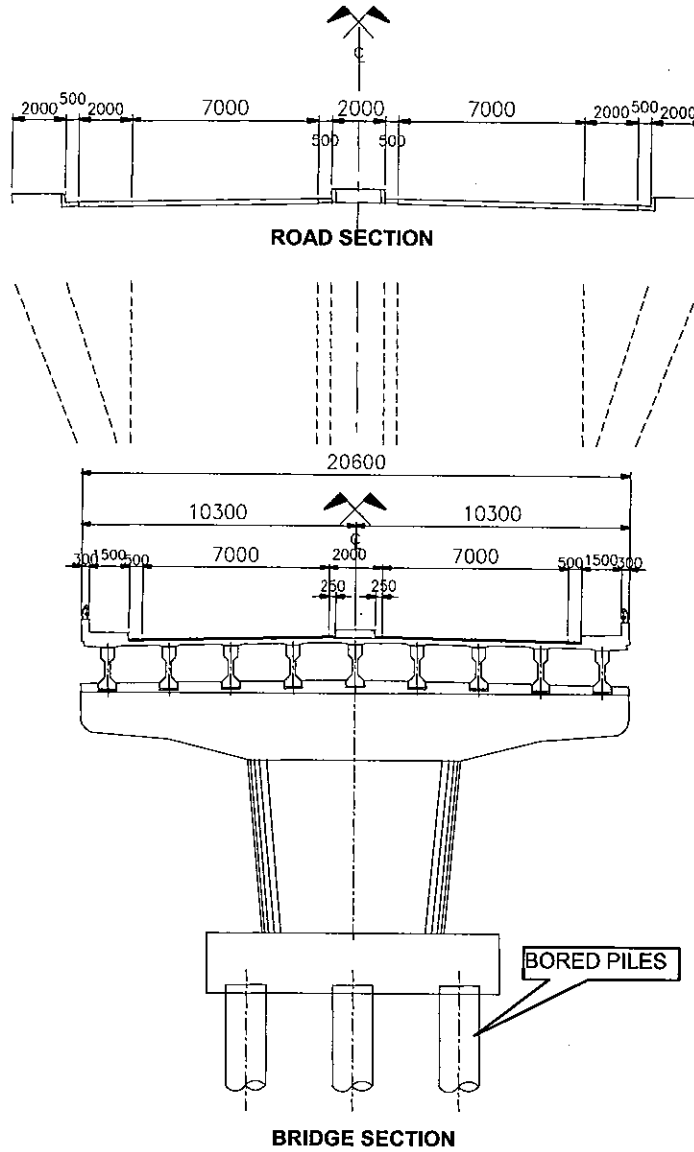


FIGURE 12.7.4-3 TYPICAL BRIDGE SECTION

Span and Bridge Length Consideration

- The span length taken in planning the bridge is based on:
  - Design discharge (requiring a minimum of 25m spans)
  - Pier encroachment to be ≤ 5% of river section
  - Existing bridge spans (upstream has spans of 15m and 35m)
- The bridge length taken in planning the bridge is based on:
  - Design Flood Water Level at Elevation +2.0m
  - Bank distance to be covered by the bridge without river encroachment is 50m.
  - 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.
- The bridge vertical profile is controlled by the at-grade connection to the existing Barangay road on the west bank and the proposed Western Diversion road on the east bank. Under this circumstance, the girder depth is minimized to provide sufficient clearance from design flood and minimize grade of slope of bridge approach.
- To enhance seismic performance, PCDG are made continuous over the intermediate piers allowing transfer of superstructure horizontal forces directly to the substructure.

Vertical Clearance

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

(2) Substructures

Piers

- Single column piers on multiple bored piles are proposed for the PCDG substructures (oval shape) on the following grounds:
    - The bridge is skew at 20° with the river,
    - Single column on multiple piles with pile cap are more stable under general scour and uneven scour condition when river beds tend to become deeper due to scouring,
    - Uneven scouring (upstream vs downstream side) tends to result in unsymmetrical length of columns/piles for multiple column/pile bents thus producing unbalanced forces in the substructure,
    - Uneven scouring for columns on multiple piles does not present much structural problem since forces are transmitted as vertical pile reactions, unlike pile bents which requires moment resistance of piles on unbalanced loading,
    - Plastic hinging of the proposed substructure form is defined at the column base which can be easily verified in the event of a major earthquake. Plastic hinging for pile bents occur at the top and somewhere at the buried section of the pile which is very difficult to inspect and repair.
- Preliminary design for substructures considers the seismic design requirements based on the AASHTO Div. I-A Seismic Design recommendations.
- Plastic hinges are expected to form at pier substructures so that design forces

of foundations will utilize the said forces.

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 seismic requirement (plastic forces of pier columns) 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	60
RC Bored Piles, ϕ1500mm	6

  - Pile cap size can be reduced by utilizing lesser number of piles.

  - Since the site has potential for liquefaction, bored piles have more moment resisting capacity than driven piles and will perform more efficiently than driven piles in the event of a very large earthquake.

  - Since the bearing layer tends to be deep at 35m, pile splicing is eliminated if bored piles are utilized.

- Likewise, foundation for the abutment utilizes bored pile foundation.

Abutments

- Abutment type is the inverted T cantilever wall seat type abutment. This type, being a closed type abutment is more reliable since it is difficult to guarantee the stability of slope in front of the abutment. Existing soil condition tends to be soft in the upper 6m with potential for liquefaction. 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.

12.7.4.3 Proposed Bridge

Details of the proposed bridge crossing Iponan River, with a total length of 108m are presented in Table 12.7.4-2 below.

TABLE 12.7.4-2 PROPOSED BRIDGE FOR WESTERN COASTAL ROAD : PHASE 1

BRIDGE NO.	RIVER NAME	STATION		BRIDGE LENGTH (m)	SUPERSTRUCTURE			SUBSTRUCTURE			
								PIER		ABUTMENT	
		BEG.	END		TYPE	SPAN	SKEW (deg)	COLUMN TYPE	FOUNDATION	TYPE	FOUNDATION
C-1	Iponan River	Sta. 2+903.854	Sta. 3+012.754	108.00	PCDG AASHTO Type IV-A	36+36+36	20°	Wall Type 2.0mx7.0m	ϕ1500 Bored Pile N=6 ; L=29m	Closed Inverted-T Cantilever	ϕ1000 Bored Pile N=10; L=34m

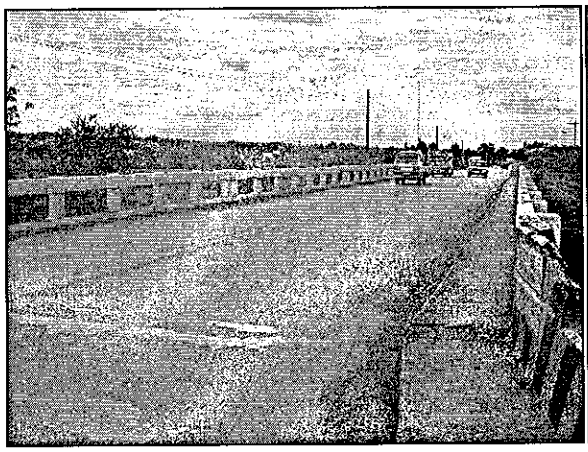
TOTAL BRIDGE LENGTH 108 m

12.7.4.4 Existing Igpit Bridge

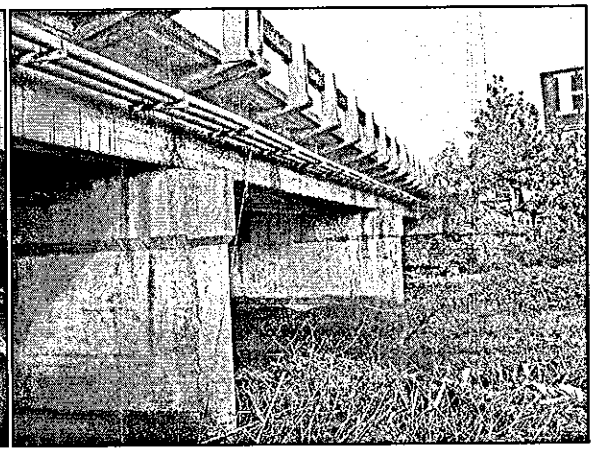
Approximately 300m northwest of the proposed alignment beginning point is the existing Igpit Bridge crossing Buncalalan River. Igpit Bridge, constructed in 1977, is a two-lane, two-way 45m long RCDG bridge with three spans at 15m. The bridge is part of the four-lane Iligan-Cagayan de Oro-Butuan road.

Since Igpit Bridge is located after the proposed Western Coastal Road (Iligan bound), the bridge is not part of the project. However, some observations on the existing condition of the bridge, as presented in Photo 12.7.4-1 are noted as follows:

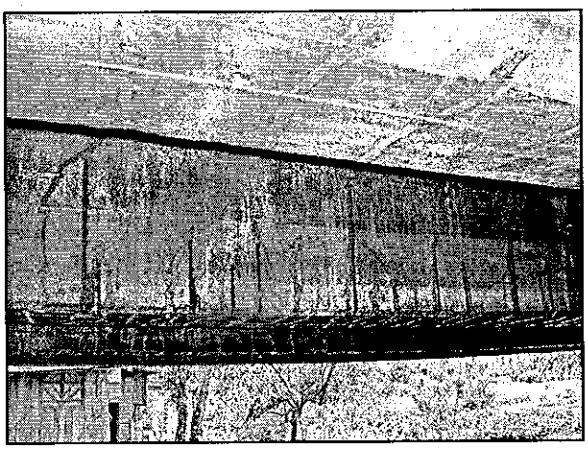
- The bridge has two-lanes of carriageway serving the four-lane Iligan-CDO-Butuan Road,
- Existing condition of the abutment support seems to restrain movement of the superstructure,
- Vertical cracks (bending moment nature) extending to the depths of all girders and penetrating to the webs are observed to have been repaired by concrete epoxy. It should be noted that such cracks extend to the length of the members.
- Diagonal shear cracks are also observed on the abutment support side of the girders,
- Two-way random cracks are observed on the soffit of the slab which could indicate lack of slab thickness,
- Secondary members like transverse diaphragms also exhibits vertical cracks of bending origin,
- Discolorization and free lime of pier walls at points of girder supports indicates water leaks from cracks on the deck slab,
- Debris accumulating on the upstream side of the pier indicates longer pier spans necessary,



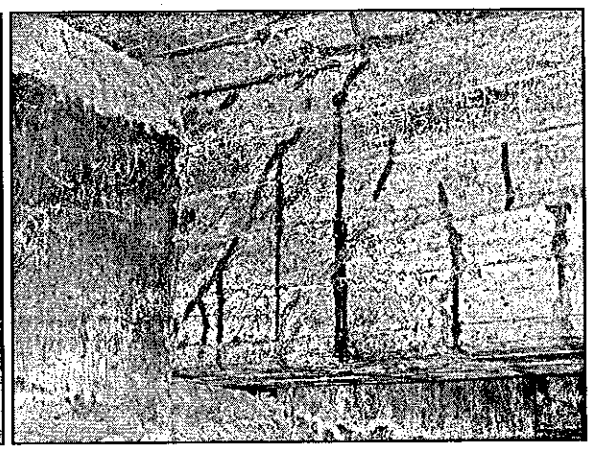
Igpit Bridge Two- Lane Carriageway



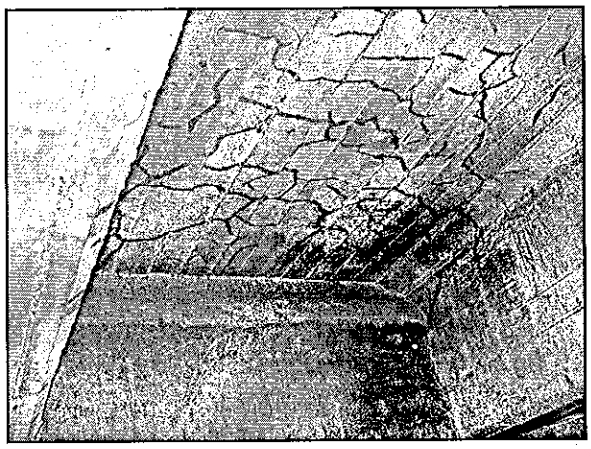
RCDG on Wall Piers



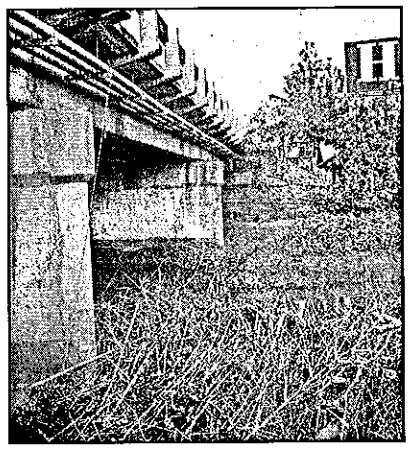
Vertical Cracks on Girders



Diagonal Cracks on Supports



Two-way Cracks on Slab



Debris at Upstream Side of Pier

PHOTO 12.7.4-1 PRESENT CONDITION OF IGPIT BRIDGE

Since the Iligan-CDO-Butuan Road is an important major east-west link in northern Mindanao, assuring the bridge structural integrity becomes a principal issue. Although observations stated earlier are based on visual inspection from under the bridge, a more in-depth survey need to be conducted to assure serviceability and load capacity of the bridge. The following recommendations are thus stated:

- ***Very Urgent***:
  - Visual Inspection from under the bridge indicates serious distress in the condition of structural members (girders and slab) which warrants In-Depth Survey or Detailed Inspection. The following will have to be verified/checked:
    - ☑ Temporary measures to assure structural stability,
    - ☑ In-Depth Survey to check extent of cracks on the members using non-destructive tests,
    - ☑ Bridge Load Rating Investigation or the live load carrying capacity of the bridge (existing condition) by analytical means or actual load tests,

- ***Urgent***:
  - Study on the appropriateness of the bridge function in relation to the Iligan-CDO-Butuan Road.
    - ☑ Since the existing road is a four-lane road, investigation on bridge traffic capacity is necessary that may require bridge widening or replacement with a four-lane bridge.
    - ☑ Heavy traffic is expected once Cagayan de Oro and neighboring towns are in full development which could require bridge replacement to serve future traffic load demand.
    - ☑ Pier spans may need to be widened necessitating longer superstructure.

12.7.5 Drainage Design

12.7.5.1 Principle and Methodology

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

12.7.5.2 Hydrological and Hydraulic Analyses

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

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

12.7.5.3 Results of Hydrologic Analyses

The hydrologic analyses reveal twenty one (21) drainage catchment areas for the proposed Western Coastal Road. See Fig 12.7.5-1 for the delineated catchment areas of the road. One (1) area is greater than twenty (20) sq km and all the other less .The analyses also reveal that there is one (1) area where the discharge is more than forty (40) cu m per sec. The result of the hydrological analyses is shown in Table 12.7.5-2.

12.7.5.4 Results of Hydraulic Analyses

The hydraulic analyses reveal one (1) bridge and twenty nine (29) culverts are needed for the drainage structures in the road. Refer to Section 12.7.4 for the bridges schedule and Table 12.7.5-3 Hydraulic Analysis for the list of proposed culverts.

12.7.5.5 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 12.7.5-4.

TABLE 12.7.5-1

RAINFALL INTENSITY-DURATION-FREQUENCY DATA
for
CAGAYAN DE ORO CITY, MISAMIS OR.

Based on 42 years of record

COMPUTED EXTREME VALUES (in mm) OF PRECIPITATION

Return Period (yrs)	5 mins	10 mins	15 mins	20 mins	30 mins	45 mins	60 mins	80 mins	100 mins	120 mins	150 mins	3 hrs	6 hrs	12 hrs	24 hrs
2	12.3	18.8	24.6	29.6	37.4	44.2	48.0	54.0	58.9	62.5	66.9	70.6	84.0	96.8	104.5
5	17.0	25.2	32.6	39.3	49.3	59.1	64.1	71.9	79.7	85.0	90.0	94.6	114.7	135.8	150.1
10	20.2	29.4	37.9	45.6	57.2	68.9	74.7	83.7	93.5	100.0	105.4	110.4	135.1	161.7	180.3
15	21.9	31.8	40.9	49.2	61.7	74.5	80.7	90.3	101.3	108.4	114.0	119.4	146.6	176.3	197.4
20	23.2	33.5	43.0	51.8	64.8	78.4	84.9	95.0	106.7	114.3	120.1	125.6	154.6	186.5	209.3
25	24.1	34.8	44.6	53.7	67.2	81.4	88.2	98.6	110.9	118.9	124.7	130.5	160.8	194.3	218.5
50	27.1	38.8	49.6	59.7	74.6	90.6	98.1	109.7	123.9	132.9	139.1	145.3	179.9	218.5	246.9
100	30.0	42.7	54.5	65.6	82.0	99.8	108.0	120.7	136.7	146.8	153.4	160.1	198.8	242.6	275.0

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

Return Period (yrs)	5 mins	10 mins	15 mins	20 mins	30 mins	45 mins	60 mins	80 mins	100 mins	120 mins	150 mins	3 hrs	6 hrs	12 hrs	24 hrs
2	147.6	112.8	98.4	88.8	74.8	58.9	48.0	40.5	35.3	31.2	26.8	23.5	14.0	8.1	4.4
5	204.0	151.2	130.4	117.9	98.6	78.8	64.1	53.9	47.8	42.5	36.0	31.5	19.1	11.3	6.3
10	242.4	176.4	151.6	136.8	114.4	91.9	74.7	62.8	56.1	50.0	42.2	36.8	22.5	13.5	7.5
15	262.8	190.8	163.6	147.6	123.4	99.3	80.7	67.7	60.8	54.2	45.6	39.8	24.4	14.7	8.2
20	278.4	201.0	172.0	155.4	129.6	104.5	84.9	71.3	64.0	57.2	48.0	41.9	25.8	15.5	8.7
25	289.2	208.8	178.4	161.1	134.4	108.5	88.2	73.9	66.5	59.5	49.9	43.5	26.8	16.2	9.1
50	325.2	232.8	198.4	179.1	149.2	120.8	98.1	82.3	74.3	66.5	55.6	48.4	30.0	18.2	10.3
100	360.0	256.2	218.0	196.8	164.0	133.1	108.0	90.5	82.0	73.4	61.4	53.4	33.1	20.2	11.5

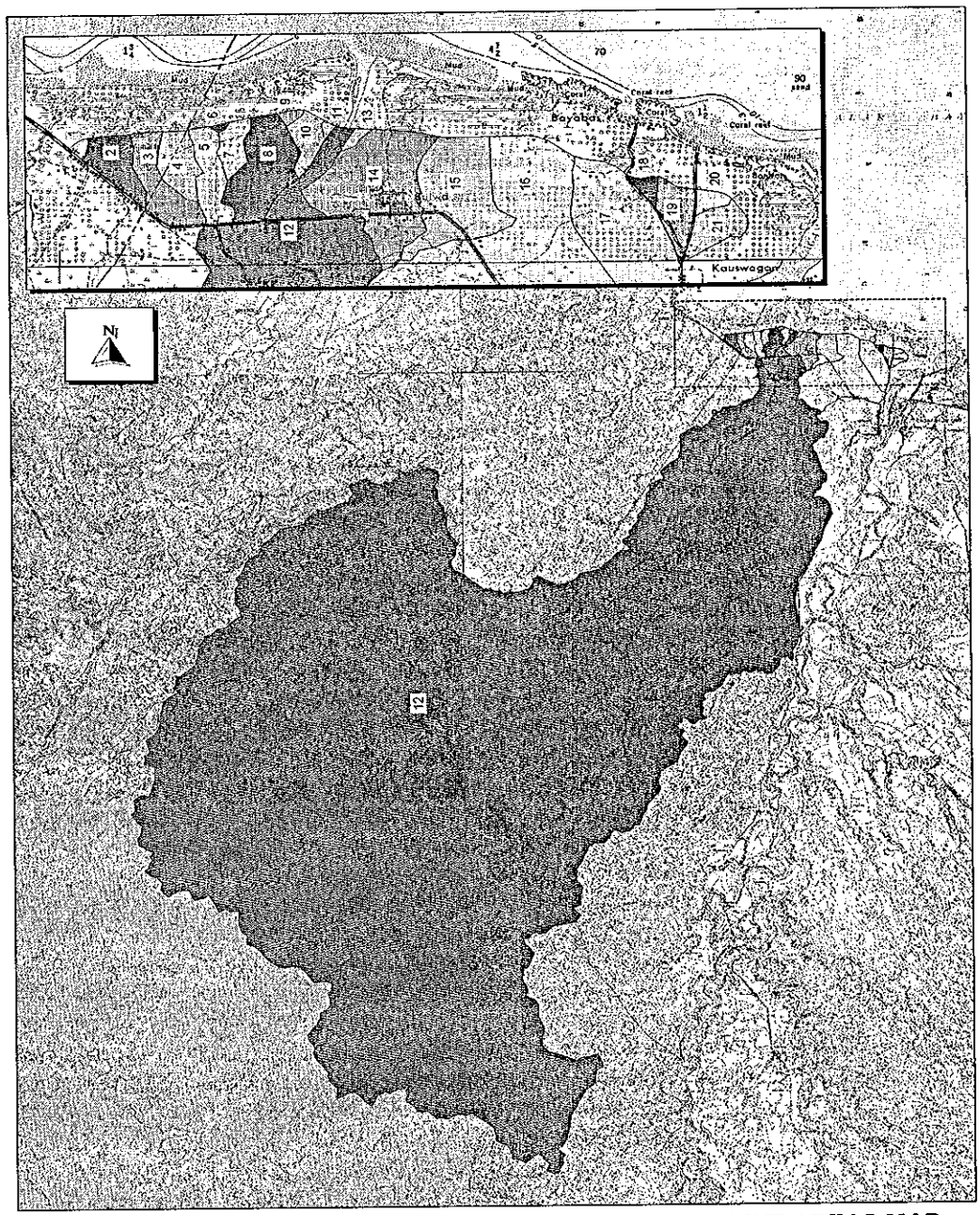


FIGURE 12.7.5-1 WESTERN COASTAL ROAD CATCHMENT AREAS MAP

TABLE 12.7.5-2
HYDROLOGICAL ANALYSIS

Road Section: WESTERN COASTAL 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 + 380.00	1.64	2.66	3.18	3.58
2	0 + 380.00	0 + 680.00	3.69	5.81	6.87	7.67
3	0 + 680.00	1 + 010.00	4.16	6.46	7.61	8.46
4	1 + 010.00	1 + 290.00	3.70	5.80	6.85	7.64
5	1 + 290.00	1 + 480.00	3.59	5.57	6.56	7.30
6	1 + 480.00	1 + 690.00	0.30	0.50	0.60	0.68
7	1 + 690.00	1 + 900.00	2.48	3.90	4.62	5.15
8	1 + 900.00	2 + 170.00	6.48	10.04	11.83	13.15
9	2 + 170.00	2 + 470.00	0.66	1.07	1.29	1.45
10	2 + 470.00	2 + 710.00	2.49	3.90	4.61	5.14
11	2 + 710.00	2 + 830.00	0.37	0.60	0.72	0.82
12	2 + 830.00	3 + 030.00	395.39	680.23	823.74	918.24
13	3 + 030.00	3 + 200.00	0.67	1.09	1.30	1.46
14	3 + 200.00	3 + 880.00	12.47	19.32	22.74	25.28
15	3 + 880.00	4 + 400.00	10.25	15.89	18.71	20.81
16	4 + 400.00	5 + 330.00	42.71	66.07	77.75	86.41
17	5 + 330.00	5 + 910.00	10.02	15.52	18.27	20.30
18	5 + 910.00	6 + 220.00	1.26	2.03	2.42	2.72
19	6 + 220.00	6 + 650.00	0.34	0.53	0.63	0.70
20	6 + 650.00	6 + 700.00	1.23	1.98	2.36	2.64
21	6 + 700.00	7 + 620.00	2.35	3.73	4.42	4.94

TABLE 12.7.5 - 3
HYDRAULIC ANALYSIS

The Study on Road Network Improvement on Development of Regional Growth Centers

WESTERN COASTAL ROAD

BASIN NUMBER	STATION (km)	SIZE		LENGTH	REMARKS / RECOMMENDATION
		RCPC	RCBC		
		mmØ	SPAN X HEIGHT	(m)	
1	0 + 070.00	1 - 910		28.00	
2	0 + 310.00		1 - 2.40 X 2.40	26.00	
	0 + 504.00	1 - 910		28.00	
3					NO OUTFALL. DIVERT TO STA. 1 + 120
4	1 + 120.00		2 - 2.40 X 2.40	28.00	
5					NO OUTFALL. DIVERT TO STA. 1 + 990
6					NO OUTFALL. DIVERT TO STA. 1 + 990
7					NO OUTFALL. DIVERT TO STA. 1 + 990
8	1 + 996.00		2 - 2.40 X 2.40	28.00	
9	2 + 464.00	1 - 910		29.00	
10	2 + 535.00	2 - 1070		28.00	
	2 + 614.00	1 - 910		28.00	
11	2 + 814.00	1 - 910		29.00	
12	2 + 950.00				IPONAN RIVER / CONSTRUCT BRIDGE
13	3 + 144.00	1 - 910		28.00	
14	3 + 304.00	2 - 910		28.00	
	3 + 527.00		2 - 2.40 X 2.40	27.00	
15	3 + 824.00		2 - 2.40 X 2.40	26.00	
16	4 + 810.00		3 - 2.40 X 2.40	27.00	
	5 + 294.00		2 - 3.00 X 3.00	24.00	
	5 + 154.00	2 - 910		24.00	EQUALIZER
17	5 + 424.00		2 - 1.50 X 1.50	25.00	
	5 + 584.00		2 - 1.50 X 1.50	25.00	
	5 + 804.00		2 - 1.50 X 1.50	25.00	
18	6 + 024.00	1 - 910		25.00	
	6 + 154.00	1 - 910		25.00	
19	6 + 394.00	2 - 1070		25.00	
	6 + 654.00	2 - 1070		25.00	
20	6 + 719.00	1 - 910		25.00	
	6 + 914.00	1 - 910		25.00	
20	6 + 929.00	1 - 910		25.00	
	7 + 164.00	1 - 910		25.00	
21	7 + 390.00		2 - 1.50 X 1.50	25.00	
	7 + 534.00	1 - 910		25.00	

TABLE 12.7.5-4 FLOOD FLOW ANALYSIS

WESTERN COASTAL 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
2+954	C-1	Iponan	418.40	918.00	2.97	2.00	1.94	150.00	

12.8 COST ESTIMATES

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

(2) Construction Cost

Estimated construction cost is presented in Table 12.8-5. The construction cost of Western Coastal Road was estimated at 603.6 Million pesos, composing of 53.1% a foreign currency component (or 320.4 Million pesos), 32.1% of a local currency component (or 193.8 Million pesos) and 14.8 % of a tax component (or 89.4 Million pesos). Detailed breakdown of construction cost is presented in Appendix 12.8-1.

TABLE 12.8-5 CONSTRUCTION COST

(Million Pesos)

	Foreign	Local	Tax	Total
Amount	320.4	193.8	89.4	603.6
%	53.1%	32.1%	14.8%	100%

TABLE 12.8-1 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 12.8-2 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 12.8-3 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 12.8-4 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 12.8-4 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)					

12.8.2 ROW Acquisition and Compensation Cost (Western Coastal Road)

1) Unit Price

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

Prices of structures are determined based on schedule of prices available in the Assessor's Office. The unit prices of structures are determined without any depreciation to obtain replacement cost of structures.

Unit prices are summarized in **Table 12.8-6.**

TABLE 12.8-6 UNIT PRICES OF LAND ACQUISITION AND COMPENSATION

Item	Zonal Value Assessed Value (P/m^2)	Prevailing Market Price (P/m^2)
Land Acquisition	Zonal Value	
Residential	170 – 500	500-800
Rice Field	10 – 30	100
Fish Pond	10 – 30	50
Fruit Orchard	10 – 30	50
Residential / Fishpond	30 – 200	300
Rice Field / Fishpond	10 – 30	80
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 12.8-7.** Details are presented in Appendix 12.8-2.

TABLE 12.8-7 ESTIMATED LAND ACQUISITION AND COMPENSATION COST

Item	Quantity	Amount (Million ₱)
Land Acquisition	**241,304**	**66.9**
Residential	73,362	54.5
Rice Field	68,627	6.9
Fish Pond	16,850	1.3
Coconut	82,465	4.1
Structures	63 structures	17.2
Other Compensation	-	3.2
Total		**87.3**

12.8.3 Detailed Engineering and Construction Supervision Cost

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

TABLE 12.8-8 ENGINEERING SERVICE COST

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	13.2 (55%)	8.4 (35%)	2.4 (10%)	24.1 (100%)
Construction Supervision	26.6 (55%)	16.9 (35%)	4.8 (10%)	48.3 (100%)
Total	**39.8** **(55%)**	**25.3** **(35%)**	**7.2** **(10%)**	**72.4** **(100%)**

12.8.4 Summary of Project Cost

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

TABLE 12.8-9 SUMMARY OF PROJECT COST

Unit: Million Pesos

	Component			TOTAL
	Foreign	Local	Tax	
Detailed Design	13.3	8.4	2.4	24.1
ROW/Resettlement	-	78.6	8.7	87.3
Construction	320.4	193.8	89.4	603.6
Construction Supervision	26.6	16.9	4.8	48.3
Total	**360.3**	**297.7**	**105.3**	**763.3**

12.8.5 Maintenance Cost for New Western Coastal Road: Phase I

(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 12.8.5 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 12.8-10.

TABLE 12.8-10 MAINTENANCE COST OF NEW WESTERN COASTAL ROAD: PHASE I

	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

12.9 ENVIRONMENTAL IMPACT ASSESSMENT

12.9.1 General Characteristics of the Project Road

The project road is proposed to be constructed to lessen traffic congestion of Iligan-Cagayan de Oro-Butuan Road. The proposed road runs along the coastal area of Cagayan de Oro City where land use is a combination of residential, ricefields, and fishponds. Ricefields and fishponds along the proposed road are being converted into residential and commercial use in recent years. Total road length is estimated at 7.65km. The proposed project is the construction of a new four-lane highway named "New Western Coastal Road". Required standard right-of-way (ROW) width is estimated at 35m and narrowed to 24.6m at populated sections to lessen negative social impact. One bridge with a length of 108m is proposed to be constructed over Iponan River.

The Initial Environmental Examination conducted in June 2004 reported that there are no significant environmentally critical spots, such as historical structures, religious institutions, and other environmentally critical areas along the proposed road alignment. However, the required ROW along the entire stretch of the road shall be acquired since the proposed road is a newly constructed highway.

12.9.2 Social Acceptability

The criterion provided by the DENR DAO 96-37[1] for evaluating the social acceptability of a project has been considered during the course of the study to a certain extent. **Table 12.9-1** shows the action taken to ascertain social acceptability at the feasibility study level.

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

Criteria	Action Taken
1) Consistency with land use plan	• Provincial and municipal land use plans and infrastructure development plan are obtained and examined. The proposed widening project is confirmed with the local infrastructure development plan.
2) Public Participation	. Officials from regional offices of national government (NEDA, DENR, DOTC), local government units and private 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 12.9-2**
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 12.9-3**

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

12.9.3 Data Gathering for Baseline Information

The parameters of baseline data needed to establish historical trends and present condition of the physical, biological and socio-economic environment of the project area were presented to DENR Regional Office and the following parameters were agreed upon:

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

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

12.9.4 Description of Existing Environmental Condition

1) Physical Environment

Climate

Climate in the Philippines has been described in terms of rainfall distribution that occur during the year, classified as Type I, II, III, and IV. Cagayan de Oro belongs to Type III that has no pronounced rainy season, relatively dry November to April and wet during the rest of the year.

The climatic characteristics of the project road are summarized in **Table 12.9-2.**

TABLE 12.9.-2 SUMMARY OF CLIMATE CHARACTERISTICS

Data Type	Monthly Normals			Remarks
	Max	Min	Mean	
Rainfall	212.1 mm (July)	45.8 mm (Apr.)	-	Annual Rainfall 1,568.0 mm
Temperature	33.9°C (May)	22.2°C (Feb.)	27.9°C	
Humidity	81% (Jan.)	73% (May)	79%	
Wind	-	-	N 1 m/s	

Sources: CDS / CAR / PAGASA

In terms of natural calamities there are no major events reported.

Terrain

The topography of Cagayan de Oro City can be described as a narrow coastal plain along the Macalajar Bay and by highland areas separated by steeply inclined escarpments. It is bound on the south by the plateaus and mountains of Bukidnon and Lanao del Norte. The City is relatively flat with an elevation of not more than 10m above the mean sea level. The highlands that bound the City in the south from east to west consist of plateaus, terraces, hills, mountains, canyons, and gorges.

The proposed road passes along the coastal area of the western part of Metro Cagayan de Oro where terrain is generally flat. The Iponan River crosses the project road at sta 3+000 that requires construction of a 108m bridge. No other major rivers and creeks are observed.

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 12.9-3**.

TABLE 12.9-3 WATER QUALITY MEASUREMENTS

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

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 12.9-4**. 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 12.9-4 NOISE LEVEL MEASUREMENTS

Trial Readings	Morning	Daytime	Evening	Nighttime
	5 AM - 9 AM	9 AM - 6 PM	6 PM - 10 PM	10 PM - 5 AM
1	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 the project road is a combination of residential (29.7%), ricefield (31.4%), and fishpond (36.7%). Groups of mangroves and coconut trees are spotted at an isolated area that account for only 2.2%. The alignment of the proposed road in the residential area passes mainly through vacant lots to minimize relocation of residents.

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. A total of four (4) sampling stations were identified and 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 sites.

SUBSTATION 1 : DALUS, KAUSWAGAN, CAGAYAN DE ORO CITY: A total of 26 species of plants were identified under 16 families. Plants identified were common herbs, shrub, grasses with a few trees. There is no rare species identified.

SUBSTATION 2 : BAYABAS, CAGAYAN DE ORO CITY: Nine (9) species belonging to eight (8) families were identified. The plants identified were common vegetation. As observed *Avicennia sp* (piapi), a mangrove species is the abundant species in the area.

SUBSTATION 3 : BARRA, OPOL, MISAMIS ORIENTAL: The vegetation is comprised of 46 species belonging to 26 families. The area is dominated with common herbs and grasses except for a few trees such as coconut and mango.

SUBSTATION 4 : IGPIT, OPOL, MISAMIS ORIENTAL: The plant species identified in the sampling area comprised of 24 species in 17 families. Common fruit bearing trees were found which were planted near the houses and other common vegetations were common grasses, weeds and herbs.

Aquatic Fresh/Marine Environment

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

3) Socio-Economic Environment

Demography

Population and Population Growth Rate

The annual average growth rates (AAGRs) of Region X was the same as the national average of 2.32 during the first half of the 1990s and slowed down to 2.19% during the second half. The AAGR of the Province of Misamis Oriental was higher than the national average from 1990 to 1995, but also changed to a lower level of 2.23% from 1995 to 2000. The Metro Cagayan de Oro registered a high AAGR of 4.36% during th e period 1995-2000. However, its AAGR fell drastically to 1.81% during the next period of 1995-2000.

Number of Households and Household Size

The City had a total of 93,525 households in 2000. Its population then was placed at 461,877. This roughly gives an estimate of the household size 4.93.

Population Densities

Cagayan de Oro is the most crowded city in Region X. If the population distribution were uniform all throughout the city, there would be 945 persons for every square kilometer of land. In contrast to Misamis Oriental which has an average density of only 258 persons, and R X - 177 but the 1995 census reveals that the City's population is almost as large as Misamis Oriental's population – roughly 72,000 difference. The most densely populated urban barangay is Macabalan with a population of 18,875 in an area of 0.398560 square kilometer as of 2000 NSO count. Seventeen (17) barangays of the City are sparsely populated and are classified rural. The average density of the rural barangays was estimated to be 120 persons per square kilometer in 1997 and 131 in 2000.

Employment Status

In 2001 the City had an employment rate of over 90% (91.32%). A bigger percentage of this are dominated by males. Unemployment at that time stood at a little over 5% (5.68%). But there were more male unemployed than females. The distribution of this employment status can be seen in **Table 12.9-5**.

TABLE 12.9-5 POPULATION 15 YEARS OLD AND OVER BY SEX AND EMPLOYMENT STATUS, 2001

Trial Readings	Rate	Both Sexes	Male	Female
Total Population		**469,406**	**232,249**	**237,157**
Total 15 years old and over	71.00	331,000	154,000	177,000
In the Labor Force	69.18	229,000	120,000	109,000
Employed	91.32	216,000	112,000	104,000
Unemployed	5.68	13,000	8,000	5,000
Not in the Labor Force	30.82	102,000	34,000	68,000

Source: National Statistics Office (NSO)-Project Evaluation Division, CPDO

Health

The required information presented below were culled from the reports of the local government unit (LGU) to the extent these are immediately available or accessible.

Morbidity and Mortality

The leading cause of morbidity and mortality in the city is pneumonia.

Notifiable Diseases

Information is available for 33 notifiable diseases as of 1997.

Local Health Resources

The City has the following health resources:

	2002	2003
Physician	631	691
Nurse	532	591
Midwives	207	219
Sanitary Inspectors	23	23
Dentists	17	20
Medical/Dental Clinics (Private)	160	161
Family Planning Centers	20	20
Barangay Health Centers	49	49
Hospitals	12	12
Hospital Beds	1,045	1,090

Environmental Health and Sanitation Profile

All of the households in Cagayan de Oro City has access to safe water supply even if only 76 of the City's 80 barangays have access to Levels I, II, and III water supply services. However, only a tenth (10.8%) of its total number of households have sanitary toilets.

Other Social Services/Utilities

Water Supply and Demand

The water services requirements of the city is served by the Cagayan de Oro Water District (COWD). In 2001 its service area covered 68 of the 80 barangays of Cagayan de Oro City, which include Barangays 1-40 of the Poblacion and 28 non-poblacion barangays, namely: Agusan, Balulang, Bayabas, Bonbon, Bugo, Bulua, Camaman-an, Canitoan, Carmen, Consolacion, Cugman, Gusa, Iponan, Kauswagan, Lapasan, Macabalan, Macasandig, Nazareth, Pagatpat, Patag, Puerto, Puntod, and Tablon.

In 2001, water production reached 28,715,292 m^3. The average production per day is 79,764.70 m^3 and the water consumption per capita per day is 0.1275 lpcpd. The COWD has six (6) reservoirs, with the following location and respective capacity: Camaman-an (5,304 m^3); Carmen (5,304 m^3); Bulua (2,900 m^3); Bugo (443 m^3); Gaston Park (170 m^3 utilized for firefighting); Aluba (Macasandig - 76 m^3). Service connections reached 55,390 in 2001, majority of which were residential and government.

Water consumption in the city reached up to 20,470,217 m^3 was consumed by residential/government and commercial users. People living in areas not presently covered by COWD rely on point sources such as shallow well, dug well and spring or a combination of these sources for their water needs. Some areas are served by communal faucet system. Other areas rely on ground water sources or rainwater and surface water.

Existing Transportation Characteristics

Cagayan de Oro City is connected to five other regions in Mindanao with a good network of highways and is the strategic gateway to the rest of Mindanao. It has a total road network of 406.87941km consisting as follows: gravel - 259.3291km (63.74%); asphalt-paved - 29.47925km (7.25%), and concrete - 106.74155km (26.23%), earth - 11.32951km (2.78%).

The City, being a primary regional center is a major public transport center. Land transportation services are provided by several bus companies with plying routes to and from Bukidnon, Davao, Butuan, Iligan, Zamboanga, and Manila.

The Cagayan de Oro trunkline airport is serving Regions 10, 12, and 13. It is located in Lumbia, some 10 km from the city proper. The largest aircraft that the runway can currently accommodate is B-737. Cagayan de Oro seaports have the shortest distance to the major ports in the Visayas and Luzon, thus making such ports the favorite exit of people and cargo coming from various points in Mindanao. The City has one government port and five private ports.

Power

Electric power in Cagayan de Oro City has been supplied by the Maria Cristina Hydroelectric Plant through its main 69 KV transmission lines and finally, through its substations: 10 MVA in Barangay Carmen and 50 MVA in Natumulan of the Municipality of Tagoloan. Power distribution is facilitated by the Cagayan Electric Power and Light Company (CEPALCO) and by the Misamis Oriental Rural Electrification Cooperative (MORESCO). Seventy-eight (78) of the 80 barangays are energized by both CEPALCO and MORESCO.

Communication

The communications services in the city are of many types, one of which include telecommunications services such as telegraph/telex stations of the DOTC-TELOF; telephone service providers (landline/conventional system, cellular mobile telephone, and telephone long distance); trunked radio stations; fixed and land mobile radio; safety and special services stations; and postal courier services. In addition, the City hosts six (6) TV stations and several broadcast stations such as nine (9) AM stations and 14 FM stations, and eight (8) internet service providers.

12.9.5 Perception Survey

The Perception Survey was conducted in the six (6) 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 309 respondents were identified during the survey. Most of the respondents (88.7%) were randomly selected within the barangays while a little more than a tenth (11.3%) were directly selected within the barangays since they are most likely along the project alignment.

TABLE 12.9-6 DISTRIBUTION OF RESPONDENTS BY BARANGAY

City/Barangay	Directly Affected		Indirectly Affected		Total	
	Number	%	Number	%	Number	%
Cagayan de Oro City						
Kauswagan	2	5.7	89	32.5	91	29.4
Bayabas	13	37.1	40	14.6	53	17.1
Bonbon	16	45.7	42	15.3	58	18.8
Bulua	0	0	38	13.9	38	12.3
Sub-total	**31**	**88.6**	**209**	**76.3**	**240**	**77.7**
Municipality of Opol						
Igpit	2	5.7	10	3.6	12	3.9
Barra	2	5.7	55	20.1	57	18.4
Sub-total	**4**	**11.4**	**65**	**23.7**	**69**	**22.3**
Total	35	100	274	100.0	309	100.0
% Distribution		11.3		88.7	100	

1) Awareness about the Project

More than four-fifths (88.7%) of the respondents have already heard of the plans for the construction of the project. The most number of respondents who heard about it can be found in Barangay Kauwagan while the least can be found in Barangay Igpit. The percentage of directly affected respondents who have already heard of the project is relatively higher (80.0%) and the highest can be found in Barangay Bonbon.

More than a third (36.6%) of the respondents heard of the project more than two years ago. Less than a third (31.1) heard about it only recently. Less than a third (30.4%) also heard of the plans 1-2 years ago.

Most of those who heard about the project said that it is about the construction of a new road/highway (72.2%) while the remainder believed it is about other projects.

2) Agreement for the Project

Most (94.8%) of the respondents are in favor of the implementation of the project. More than two-fifths (48.5%) said that the project will give way to development of the area and the province as a whole. More than a fifth (23.3%) also indicated that the project offers safe and efficient transport of people, goods and services.

3) Effect on Source of Income

Majority (92.2%) of the respondents said that their livelihood will not be affected and that includes also a majority (91.4%) of the directly affected respondents. Only less than a tenth (6.1%) said that there will be loss of livelihood, employment and property. Majority (92.9%) did not provide any response.

4) Good Things Seen about the Project

More than a third (36.6%) of the respondents believe that there will be easy and fast access to the region. More than a fourth (28.8%) on the other hand said that the project will benefit the majority/cause the opening of new business. Less than a fifth (18.1%) however said that there will be less traffic in the main highway. More than a tenth (12.6%) added that the city or barangay will improve or develop.

5) Benefits Expected from the Project

More than two-fifths (45%) of the total number of respondents said that travel time will become shorter (including faster and convenient transport of people and goods) while according to just a little over two-fifths (41.1%) of the respondents, there will be also opening of new industries along the alignment and consequent offer of employment. The rest said that the project will provide housing/improvement of barangay (8.7%). Only a few did not provide any response or comment (2.3%) or do not know at all what to expect from the project (2.9%).

6) Bad Things about the Project

Nearly a third (30.4%) of the total number of respondents believe that no bad things can be attributed to the project, but about a third (33.7%) said that there will be increase in noise and air pollution level. About a tenth (10.4%) said that fast moving vehicles may cause accidents. The rest are spread over to other responses such as disruption of regular activities of barangay residents (6.8%); loss of livelihood/relocation and compensation of affected families (6.8%); strangers will be coming into the barangays (1.0%); and increased crime rate (1.3%) among others.

7) Problems Foreseen for the Community as a Whole

About a fifth (19.1%) of the respondents believe that the project will not bring any problems to the community as a whole, but a third (33%) indicated that there will be pollution/problem of flooding, heavy erosion and landslide. More than a fifth (23.9%) said that there will be accidents/increased crime rates, drug-related incidents, robbery/hold-up cases while about a tenth (10.7%) said there will be loss of properties/ livelihood problems.

12.9.6 Identified Impacts and Mitigation Measures

The predicted environmental impacts, along with the mitigation (for negative impacts) and enhancement (for positive impacts) measures are presented in **Table 12.9-7**, Impacts and Mitigation/Enhancement Matrix.

12.9.7 Environmental Management and Monitoring Plan

The Environmental Management and Monitoring Plan is presented in **Table 12.9-8**.

12.9.8 Resettlement Plan for Affected People

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

TABLE 12.9-7 SUMMARY MATRIX OF IMPACTS AND MITIGATION AND ENHANCEMENT MEASURES (1/3)

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

TABLE 12.9-7 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 70,070 m^2 Ricefield 75,802 Fishpond 88,469 Coconut Tree 4,025 Mangrove 1,250 **Total 241,304 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 12.9-7 SUMMARY MATRIX OF IMPACTS AND MITIGATION AND ENHANCEMENT MEASURES (3/3)

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

TABLE 12.9-8 ENVIRONMENTAL MANAGEMENT AND MONITORING MATRIX (CAGAYAN DE ORO, EW-3)

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standard	Implementor
CONSTRUCTION PHASE					
PHYSICAL					
Water quality BOD, TSS, and oil and grease of surface water	All m 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 in 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

12.10 SOCIAL IMPACT ASSESSMENT AND RESTTLEMENT ACTION PLAN

12.10.1 Measures Taken to Mitigate Negative Impacts

Four (4) alternative alignments were examined to determine the most feasible route, that which has the least impact on land, structures, and residents and which is the most technically and economically viable. The detailed process of alternative selection applied is discussed in **Section 12.4**. The alternative which avoids built-up areas and major establishments was finally selected.

12.10.2 Barangays Affected by the Project

The following barangays were identified to be affected by the project:

Cagayan de Oro City	Municipality of Opol
1. Kauswagan	1. Igpit
2. Bayabas	2. Barra
3. Bonbon	
4. Bulua	

12.10.3 Community Consultation and Participation

Series of community consultation meetings have been held since the beginning of the study. Details of these meetings are discussed.

1) Workshops

The JICA Study Team has conducted workshops, whenever major study outputs are made, to present the process of the master plan and feasibility study to all concerned agencies and residents. The location of the final alignment and the extent of land acquisition and social impacts are also presented to the public and their comments and suggestions are incorporated in the study. Topics discussed in the workshops are summarized in **Table 12.10-2**.

2) Meetings with City / Municipal Officials

Prior to the Social Impact Survey, the Study Team visited the offices of the mayors and the planning and development offices of the affected city and municipalities. These visits were necessary to:

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

b) Validate the list of affected barangays;

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

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

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

TABLE 12.10-1 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
Participants/ Attendees	• Regional Offices of DPWH, NEDA, DOTC, PPA, LTO • LGUs (1 City, 8 Municipalities and 1 Province)	• Regional Offices of DPWH, NEDA, DOTC, PPA, LTO • LGUs (1 City, 8 Municipalities and 1 Province) • Private subdivision developers	• Regional Offices of DPWH, NEDA, DOTC, PPA, LTO • LGUs (1 City, 8 Municipalities and 1 Province) • Private subdivision developers • Representatives from the different Barangays	• Regional Offices of DPWH, NEDA, DOTC, PPA, LTO • LGUs (1 City, 8 Municipalities and 1 Province) • Private subdivision developers • Representatives from the different Barangays
Topics Discussed	• Outline of the Study • Presentation by the City Government of Cagayan de Oro of the urban problems, priority development areas, road network, etc. • Road projects planned by concerned LGUs • LGU participation in the implementation of the project	• Proposed road network plan • Priority road projects and projects selected for F/S • Comments of LGUs • Announcement of social/ environmental surveys requesting participation and coordination of stakeholders	• Selected alignment • Results of socio-environmental survey • Government's and DPWH's policies on compensation	• Presentation of Draft Final Report • Results of socio-environmental survey • Government's and DPWH policies on compensation

3) Meetings with Barangay Captains

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

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

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

c) Arrange barangay level consultation meetings; and

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

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

The dates of meetings with the Barangay Captains and the date of "**Barangay Endorsement**" are summarized in **Table 12.10-2**.

TABLE 12.10-2 SUMMARY OF MEETINGS WITH BARANGAY CAPTAINS AND DATES OF ISSUANCE OF BARANGAY ENDORSEMENT

City / Municipality	Date of Meeting	Venue / Location	Date of Issuance of Barangay Endorsement	
Cagayan de Oro City	07 June 2004	Brgy. Session Hall	Kauswagan	21 June 2004
			Bayabas	14 June 2004
			Bonbon	23 June 2004
			Bulua	16 June 2004
Opol	11 June 2004	Brgy. Session Hall	Igpit	11 June 2004
			Barra	18 June 2004

4) Barangay Consultation Meetings

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

TABLE 12.10-4 SUMMARY OF BARANGAY CONSULTATION MEETINGS

Barangay	Venue / Location	Date of Meeting
Cagayan de Oro City		
Kauswagan	Kahoa Chapel	19 June 2004 9:00 AM
Bayabas	Barangay Hall	20 June 2004 9:00 AM
Bonbon	Barangay Chapel (Villa Cristo Rey)	19 June 2004 10:00 AM
Bulua	Barangay Hall (Gym)	19 June 2004 1:00 PM
Opol		
Igpit	Mini Market	18 June 2004 10:00 AM
Barra	Jessie Madeoñgal Residence	18 June 2004 10:00 AM

12.10.4 Identified Impacts

The identified impacts and the corresponding compensation amounts are summarized in **Table 12.10-4**.

1) Impact on Land

The project is the construction of a new four-lane highway with a required standard ROW of 35m, except at the built-up section at the port area where the ROW is narrowed to 25m to reduce the number of affected residents.

Affected land by land use is summarized as follows:

Land Use	Land Area (m^2)	Share (%)
Residential	73,362	30.4
Rice field	85,477	35.4
Fish pond	78,480	32.5
Others (coconut)	4,025	1.7
Total	**241,304**	**100.0**

TABLE 12.10-4 SUMMARY OF IMPACT AND COMPENSATION COST

New Western Coastal 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	61,920	49,536,000	Name of land owners to be identified by parcellary survey.
2) Residential – 2	-	m^2	500	8,150	4,075,000	
3) Residential – 3	-	m^2	300	3,292	987,600	
4) Rice Field-1	-	m^2	100	68,627	6,862,700	
5) Rice Field-2		m^2	80	16,850	1,348,000	
6) Fish Pond		m^2	50	78,440	3,922,000	
7) Others		m^2	50	4,025	201,250	
Subtotal				**241,304**	**66,932,550**	
2. Structures						
1) Shanty (Bamboo & Nipa)	8	m^2	1,000	113.00	113,000	
2) Wood with GI sheet	25	m^2	1,140	1,379.50	1,572,630	
3) Concrete with wood	9	m^2	6000	442.00	2,652,000	
4) Concrete	31	m^2	7,800	1,647.00	12,846,600	
Subtotal	**73**			**3,581.50**	**17,184,230**	
3. Other Fixed Structures						
1) Wooden Fence	8	m	100	187.50	18,750	
2) Concrete/Steel Fence	4	m	200	188.00	37,600	
3) Concrete Pavement	1	m^2	300	810.00	243,000	
	13				**299,350**	
4. Repair Cost	-	-	-	-	-	None
5. Electric Post Relocation	-	-	-	-	-	None
6. Perennials						
Various types	-	Nos.	various	463	162,050	
Subtotal					**84,578,180**	
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	48	HH	10,000	48	480,000	
2. Subsistence Allowance						
1) Income loss for shop owners	7	HH	15,000	7	105,000	
3. Financial Assistance						
1) Land users w/o title	-	-	-	-	-	
4. Rehabilitation Assistance						
1) Severely affected land owners	-	-	-	-	-	None
2) Agricultural lessees	-	-	-	-	-	None
3) Severely affected structural owners.	-	-	-	-	-	None
5. Transportation Allowance						
1) Relocating PAPs	51	HH	3,000	51	153,000	
2) Shanty dwellers go back to province.	-	-	-	-	-	None
6. Transitional allowance						
1) Renters of affected structures	3	HH	3,000	3	9,000	
Subtotal					**747,000**	
TOTAL					**85,325,180**	
RAP Implementation					**1,992,600**	
GRAND TOTAL					**87,317,780**	

2) Impact on Structures

A total of **86** structures, mostly residential houses, were identified along the proposed alignment. The most marginally affected structures are fences.

Structure Use	Number of Structures	Floor Area (m^2)
Residential	48	2,012.50
Independent Shop	10	864.00
Farm House	3	63.00
School/Public Market	5	458.00
Other Buildings	7	184.00
Sub-Total	**73**	**3,581.50**
Fence	12	375.50 m
Concrete Pavement	1	810.00 m^2
Total	**86**	

3) Impact on Residents

Socio-economic surveys of project affected families were conducted in February and March 2004. The survey form used is shown in **Table 12.10-5**. The impact on affected families is summarized as follows:

Type of PAF	Number
Severely Affected PAFs	48.0
- *Renters*	(*1.0*)
- *Agricultural Tenants*	- *not identified*
Marginally Affected PAFs	11.0
Renters	2.0
Total	**59.0**
Average Household Size	5.15
Public Entities and Utility Companies	5.0

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 ₱8.483.

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 **463** various kinds of trees were identified along the project road.

TABLE 12.10-5 SOCIO-ECONOMIC SURVEY FORM

Household No. ☐☐☐ Station: _____ + _____

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

1. Household Structure

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

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

3. Average Family Income per Month

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

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

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

5. Average Monthly Family Expenditure

_____ P/month

6. Ownership of a land and a house

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

7. Workplace / Schoolplace and Cost of Transportation

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

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

8. House Structure

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

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

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

12.10.5 Valuation of Losses

The latest ordinances on market valuation of real properties in the affected areas were collected from the assessor's offices of these LGUs. The BIR zonal values were likewise obtained from the BIR regional offices.

The sources of values used to determine compensations for each type of loss are shown in **Table 12.10-6**.

TABLE 12.10-6 SOURCES OF UNIT PRICES FOR VALUATION

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

The values of agricultural and residential/commercial/industrial lands collected from the assessor's offices are summarized in **Appendix 12.10-1**.

12.10.6 Resettlement Site

The City has 21 existing relocation housing projects and three (3) new ones proposed. These are shown in **Table 12.10-7** and **Figure 12.10-1**.

12.10.7 Income Restoration Program

An income restoration training will be given to PAPs who will be obliged to shift from their present occupation or income generating activity due to relocation.

1) Socio-Economic Baseline Survey

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

2) Process and Conceptual Framework for Income Restoration Program

The DPWH shall contract out to a non-government organization with specialization in community-based approaches the income restoration programs, community organizing, livelihood and skills enhancement programs, and the like.

TABLE 12.10-7 EXISTING AND PROPOSED RELOCATION SITES

Project Areas	Location	Area (ha)	Total No. of Lots
Existing			
Calaanan – CDOSHP 1	Calaanan, Canitoan	63/11* ha	919
M. Vega – CDORSHP 2	Consolacion	0.86	111
IUPA –CDORSHP 3	Iponan	2.30	263
Balubal – CDORSHP 4	Balubal	6.97	554
P.P. Socialized Housing Project	Puntod	1.30	118
Zonacar	Carmen	2.73	298
MCUPA	Balulang	2.35	243
KAHOA	Kauswagan	1.01	116
ISLACUPA	Consolacion	1.36	186
BZ4 Homeowners	Bugo	1.64	122
BOHAI – Buena Oro	Macansandig	3.00	198
Cawilihan Village	Cugman	1.25	101
Macanhan	Carmen	29.56	796
Paglaum Socialized Housing	Camaman-an	1.12	103
Centennial Village Upgrading	Mambuaya	1.50	111
AMOR	Macabalan	3.04	375
Lapasan Urban Poor Upgrading	Lapasan	-	380
UKLAI	Lapasan	0.52	75
St. John	Puntod	0.52	77
BICUPHAI	Puntod, Lapasan, B22	1.54	348
Malinawon	Puntod	0.44	78
Proposed			
City Gov't. Employees Village	Macasandig	3.45	240
Indahag	Indahag	11.85	640
Calaanan, Canitoan	Calaanan, Canitoan	3.10	217

** Developed*

This is outsourcing of requirements which DPWH is not capable of doing by itself.

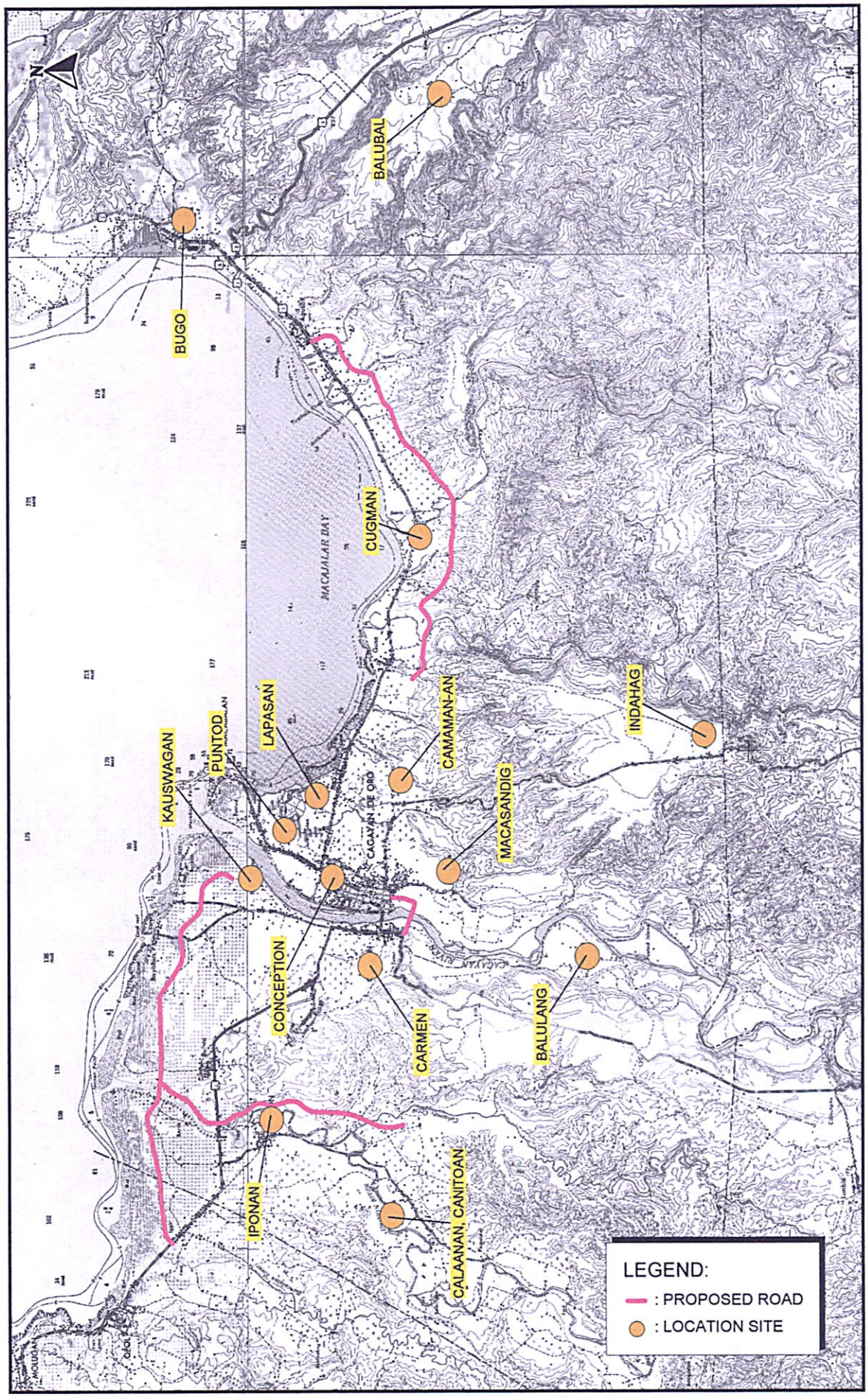
In addition, the DPWH shall continue to link with LGUs and tap their income restoration or poverty alleviation programs, as well as those of other agencies. The income restoration program shall be consistent with the needs of the project-affected persons. It should therefore be demand-driven to the extent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

12.10.8 Institutional Arrangements

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

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 New Western Coastal Road Project. It will manage and



FIGURRE 12.10-1 LOCATION OF RESTTLEMENT SITE

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. On the other hand, the First Misamis Oriental DEO of the Department, also based in Cagayan de Oro City, shall be responsible for implementation of the RAP for project affected persons within the territorial boundary of the Municipality of Opol.

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

2) Local Government Units (LGUs)

The resettlement requirements of the project shall be coordinated by the DPWH and its regional and district engineering offices with the LGUs, namely: Cagayan de Oro City and the Municipality of Opol. This is especially critical insofar as implementation of the provisions of Republic Act 7279 (the Urban Development and Housing Act of 1992) and its implementing rules and regulations are concerned to ensure the observance of proper and humane relocation and resettlement.

3) RAP Implementation Committees (RICs)

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

RAP Implementation Committee (RIC) – A

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

- Barangay Captain – Barangay Kauswagan, Cagayan de Oro City
- Barangay Captain – Barangay Bonbon, Cagayan de Oro City
- Barangay Captain – Barangay Bayabas, Cagayan de Oro City
- Barangay Captain – Barangay Bulua, Cagayan de Oro City

- Representative of PAPs – Barangay Kauswagan, Cagayan de Oro City
- Representative of PAPs – Barangay Bonbon, Cagayan de Oro City
- Representative of PAPs – Barangay Bayabas, Cagayan de Oro City
- Representative of PAPs – Barangay Bulua, Cagayan de Oro City
- Representative(s) from a Non-Government Organization (NGO) or People's Organization (PO) active in all the traversed barangays

RAP Implementation Committee (RIC) – B

Chairman and Convenor: District Engineer (DPWH), First Misamis Oriental DEO, Cagayan de Oro City

Co-Chairman : Mayor of the Municipality of Opol (or his designated representative)

Members:

Barangay Captain – Barangay Barra, Municipality of Opol
Barangay Captain – Barangay Igpit, Municipality of Opol

Representative of PAPs – Barangay Barra, Municipality of Opol
Representative of PAPs – Barangay Igpit, Municipality of Opol
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 and the Sangguniang Bayan (SB) of Opol.

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 26, 2004** (conclusion of the socio-economic survey for affected persons). Any PAPs identified during the validation work, except those which have not been interviewed but who had already been earlier identified, may not be entitled for compensation. The same restriction shall apply for additional assets built and/or improvements made on existing assets of identified PAPs after the cut-off date. Photographs earlier taken of these assets shall be used to validate any variances made after the cut-off date.

12.10.9 Grievance Redress Measures

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

1) Filing and Action

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

2) Appeal to the DPWH Regional Director

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

3) Court of Law

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

4) Miscellaneous Provisions

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

12.10.10 Monitoring and Evaluation

1) Monitoring Process

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

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

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

b) Preparation of preliminary report

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

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

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

monitoring indicators and solicit observations, feedback, and suggestions from the various stakeholders on the different aspects of the monitoring report.

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

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

e) Preparation of final report incorporating feedback from stakeholders

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

2) Monitoring and Evaluation Units

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

3) Internal Monitoring

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

a) Verification that the baseline information of all PAPs has been carried out and that the valuation of lost or damaged assets and the compensation for resettlement and other rehabilitation entitlements are carried out in accordance with the policy framework;
b) Overseeing the implementation of the RAPs as designed and implemented;
c) Verification of timeliness of the availability and sufficiency of funds and that utilization of these funds are consistent with the LARR Policy and the provisions of this RAP; and
d) Recording of all grievances and their resolution and ensure that complaints are dealt with in a timely manner.

4) External Monitoring

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

a) Review of the existing baseline data and gather additional socio-economic baseline data, if necessary, on sample families which are entitled to receive compensation for all their lost assets or for resettlement and rehabilitation;
b) Monitor implementation of the Resettlement Policy and public information campaign;
c) Identify any discrepancy between policy requirements and actual practice, as well as any local level grievances;
d) Gather qualitative indications of the social and economic impact of project implementation on the PAPs; and
e) Provide recommendations for improving implementation of the Department's Resettlement Policy.

12.10.11 RAP Implementation

1) Internal Monitoring and Evaluation Requirement

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 following RAP updating surveys shall be carried out to update the preliminary RAP prepared under this study after fixing the final ROW limits:

TABLE 12.10-8 RAP UPDATING SURVEYS TO BE UNDERTAKEN

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

A final RAP shall be prepared based on the preliminary RAP and the results of the RAP updating surveys.

2) RAP Approval

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

3) MOU with LGUs and Establishment of the RICs

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 City Government of Cagayan de Oro and the Municipal Government of Opol. The MOU will provide the mandate for the formation of the RIC and will likewise spell out the required cooperation and commitment of the LGUs in ensuring that the right-of-way is sustainably free from encroachments and illegal squatting even after project completion.

4) Orientation and Training of the RICs

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 Mayors of Cagayan de Oro City as well as the Municipality of Opol with a request that this be announced in advance to the barangay officials/RIC members. The announcement will likewise be posted by the barangay officials in a place accessible to the public to ensure that all PAPs within their administrative jurisdiction are informed. All payments of compensation will be also done in public.

The activity will be highlighted with the signing of a Pledge of Undertaking (POU) by the PAP, which states among others the demolition, removal or

relocation of structures from the ROW within a specified period of time, the failure of which provides corresponding recourse of the DPWH to either carry out the stipulation at the PAPs expense or filing of criminal case in a court of law. In addition, the POU prohibits the rebuilding of such structures by the PAPs or their heirs within the DPWH's road right-of-way (RROW).

11) Reorganization and Relocation

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

12) Hand-over of the Site for Construction

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

13) Monitoring and Supervision of RAP Implementation

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

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

12.11 PROJECT EVALUATION

12.11.1 Economic Evaluation

1) Traffic Demand Forecast

Future traffic demand forecasted in a form of OD matrix (years 2010, 2016 and 2022) was assigned on the road network to estimate traffic volume on the Western Coastal Road. The estimated traffic volume on the Western Coastal Road for the case of "with" the project is summarized in **Table 12.11-1**.

TABLE 12.11-1 TRAFFIC VOLUME ON WESTERN COASTAL ROAD

Unit: PCU / day

	2010	2016	2022	AAGR (%)	
				'10 – '16	'16 – '22
3rd Bridge Section	26,724	37,511	52,653	5.8	5.8
Section 1	18,621	27,294	40,006	6.5	6.5
Section 2	11,747	18,131	27,985	7.5	7.5

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

TABLE 12.11-2 TOTAL VEHICLE KILOMETERS IN METRO CDO WITH AND WITHOUT WESTERN COASTAL ROAD

Unit: PCU Km / day

	W/O Project	W/ Project	W/O - W/
2010	2,448,270	2,412,220	36,051
2016	3,277,960	3,229,690	48,268
2022	4,470,550	4,405,120	65,429

TABLE 12.11-3 TOTAL VEHICLE HOURS IN METRO CDO WITH AND WITHOUT WESTERN COASTAL ROAD

Unit: PCU Hour / day

	W/O Project	W/ Project	W/O - W/
2010	102,010	98,540	1,532
2016	147,330	142,330	5,002
2022	226,190	217,561	8,627

2) Economic Evaluation

Evaluation Period

The evaluation period is assumed to be 20 years from 2014 to 2033 taking into account the service life of the Western Coastal Road.

Implementation Schedule

The implementation schedule is assumed as follows:

- 2007 Detailed design
- 2008 – '09 Land acquisition
- 2010 – '13 Construction of Western Coastal Road
- 2014 Open to 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 12.11-4).

TABLE 12.11-4 BASIC VEHICLE OPERATING COST (EXCLUDING TAX)

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

Source: PMO-FIS, DPWH
Note: BVOC prepared by PMO-FIS is modified with inflation rate.
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.

Estimation of Benefits

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

TABLE 12.11-5 ESTIMATION OF BENEFITS

Unit: '000 Pesos/Year

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TCC	Total Saving
2010	79,835	59,298	139,133	80,160	219,293
2016	107,520	85,646	193,170	115,778	308,944
2022	154,385	147,724	302,109	199,694	501,803

Economic Cost

The project cost, which was already calculated in the previous section, is expressed as the financial cost. It is therefore to convert from financial cost to economic cost. In this study the economic cost was estimated to deduct from financial cost to government taxes and shadow prices of unskilled labor is shown in **Table 12.11-6**.

TABLE 12.11-6 ECONOMIC COST ESTIMATE

Unit: '000 Pesos

Description		Economic Cost	Financial Cost
1	Construction Cost	514,200	603,600
2	ROW Acquisition / Resettlement	78,600	87,300
3	Consultancy	65,200	72,400
3-1	Detailed Design	21,700	24,100
3-2	Construction Supervision	43,500	48,300
	Total	658,000	763,300

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 Coastal 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 12.11-7** show the benefit – cost analysis of the Western Coastal Road Construction Project during project life period of 20 years and **Table 12.11-8** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of ₱ 462 million and BCR of 2.81 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 29.0%.

TABLE 12.11-7 ECONOMIC INDICATIONS OF BENEFIT COST ANALYSIS

Net Present Value	P462 million
BCR	2.81
EIRR	28.99%

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

(2) Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. **Table 12.11-9** shows the results of the sensitivity analysis.

TABLE 12.11-8 BENEFIT - COST STREAM OF WESTERN COASTAL 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	21,700.0	0.0	21,700.0	0.0	-21,700.0	1.521	14,268.1	0.0	14,268.1	0.0	-14,268.1
5	2008	39,300.0	0.0	39,300.0	0.0	-39,300.0	1.749	22,469.9	0.0	22,469.9	0.0	-22,469.9
6	2009	39,300.0	0.0	39,300.0	0.0	-39,300.0	2.011	19,539.0	0.0	19,539.0	0.0	-19,539.0
7	2010	139,425.0	0.0	139,425.0	0.0	-139,425.0	2.313	60,277.3	0.0	60,277.3	0.0	-60,277.3
8	2011	139,425.0	0.0	139,425.0	0.0	-139,425.0	2.660	52,415.0	0.0	52,415.0	0.0	-52,415.0
9	2012	139,425.0	0.0	139,425.0	0.0	-139,425.0	3.059	45,578.3	0.0	45,578.3	0.0	-45,578.3
10	2013	139,425.0	0.0	139,425.0	0.0	-139,425.0	3.518	39,633.3	0.0	39,633.3	0.0	-39,633.3
11	2014	0.0	854.0	854.0	275,554.6	274,700.6	4.046	0.0	211.1	211.1	68,112.9	67,901.8
12	2015	0.0	961.0	961.0	291,767.6	290,806.6	4.652	0.0	206.6	206.6	62,713.5	62,506.9
13	2016	0.0	969.0	969.0	308,944.1	307,975.1	5.350	0.0	181.1	181.1	57,743.9	57,562.8
14	2017	0.0	976.0	976.0	326,399.5	325,423.5	6.153	0.0	158.6	158.6	53,049.1	52,890.5
15	2018	0.0	984.0	984.0	344,848.4	343,864.4	7.076	0.0	139.1	139.1	48,737.0	48,597.9
16	2019	0.0	991.0	991.0	364,347.8	363,356.8	8.137	0.0	121.8	121.8	44,776.3	44,654.5
17	2020	0.0	998.0	998.0	446,506.8	445,508.8	9.358	0.0	106.7	106.7	47,715.8	47,609.1
18	2021	0.0	1,006.0	1,006.0	478,350.3	477,344.3	10.761	0.0	93.5	93.5	44,451.1	44,357.6
19	2022	0.0	1,013.0	1,013.0	501,803.1	500,790.1	12.375	0.0	81.9	81.9	40,548.3	40,466.4
20	2023	0.0	1,021.0	1,021.0	519,294.7	518,273.7	14.232	0.0	71.7	71.7	36,488.4	36,416.7
21	2024	0.0	1,028.0	1,028.0	537,430.4	536,402.4	16.367	0.0	62.8	62.8	32,837.1	32,774.3
22	2025	0.0	1,036.0	1,036.0	556,235.2	555,199.2	18.822	0.0	55.0	55.0	29,553.2	29,498.2
23	2026	0.0	1,043.0	1,043.0	575,735.3	574,692.3	21.645	0.0	48.2	48.2	26,599.3	26,551.1
24	2027	0.0	1,051.0	1,051.0	595,957.9	594,906.9	24.891	0.0	42.2	42.2	23,942.3	23,900.1
25	2028	0.0	1,058.0	1,058.0	616,931.3	615,873.3	28.625	0.0	37.0	37.0	21,552.1	21,515.1
26	2029	0.0	1,065.0	1,065.0	638,685.0	637,620.0	32.919	0.0	32.4	32.4	19,401.7	19,369.3
27	2030	0.0	1,073.0	1,073.0	661,249.6	660,176.6	37.857	0.0	28.3	28.3	17,467.1	17,438.8
28	2031	0.0	1,080.0	1,080.0	684,657.2	683,577.2	43.535	0.0	24.8	24.8	15,726.5	15,701.7
29	2032	0.0	1,088.0	1,088.0	708,941.0	707,853.0	50.066	0.0	21.7	21.7	14,160.2	14,138.5
30	2033	0.0	1,095.0	1,095.0	734,135.6	733,040.6	57.575	0.0	19.0	19.0	12,750.8	12,731.8
							Total	254,180.9	1,743.5	255,924.4	718,326.6	462,402.2

Net Present Value	462,402
B/C Ratio	2.807
EIRR	28.99%

TABLE 12.11-9 SENSITIVITY ANALYSIS REGARDING COSTS AND BENEFITS OF WESTERN COASTAL ROAD CONSTRUCTION PROJECT

		Indicator	Benefits		
			20% down	Base Case	20% up
Costs	20% down	NPV (P million)	370	514	657
		B/C Ratio	2.81	3.51	4.21
		EIRR (%)	29.0	32.7	36.0
	Base Case	NPV (P million)	319	462	606
		B/C Ratio	2.25	2.81	3.37
		EIRR (%)	25.5	29.0	32.0
	20% up	NPV (P million)	268	411	555
		B/C Ratio	1.87	2.34	2.81
		EIRR (%)	22.9	26.1	29.0

Note: Project life is assumed to be 20 years

(3) Summary of Economic Analysis

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

12.11.2 Technical Evaluation

The results of the technical analysis of the 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 Coastal Road. However, the following technical notes shall be made:

- It is proposed to utilize riprap stone as water protection work along fish pond area.
- In order to minimize the ROW acquisition alongside the residential area, it is proposed to employ the retaining wall in the embankment section.

12.11.3 Other Impacts

1) On Traffic

Table 12.11-10 shows the transport efficiency of Metro Cagayan de Oro in cases of with and without the Western Coastal Road.

TABLE 12.11-10 TRANSPORT EFFICIENCY IN METRO CAGAYAN DE ORO WITH AND WITHOUT WESTERN COASTAL ROAD

			2010	2016	2022
PCU Kilometers ('000)	Whole Area	W/O Project	2,448,270 (1.00)	3,277,960 (1.00)	4,470.550 (1.00)
		W/ Project	2,412,220 (0.98)	3,229,690 (0.98)	4,405,120 (0.98)
PCU Hour ('000)	Whole Area	W/O Project	102,010 (1.00)	147,330 (1.00)	226,190 (1.00)
		W/ Project	98,540 (0.97)	142,330 (0.97)	217,561 (0.96)
Average Travel Speed (km/h)	Whole Area	W/O Project	24.00 (1.00)	22.25 (1.00)	19.76 (1.00)
		W/ Project	24.48 (1.02)	22.69 (1.02)	20.25 (1.02)
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	12,060 (0.98)	16,387 (0.98)	22,831 (0.98)

TABLE 12.11-11 TRAFFIC VOLUME WITH AND WITHOUT WESTERN COASTAL ROAD CONSTRUCTION PROJECT

Unit: PCU/day

	2016			2022		
	W/O Project	W/ Project		W/O Project	W/ Project	
	Existing Rd	Existing Rd	W Coastal Road	Existing Rd	Existing Rd	W Coastal Road
West Section	82,800	66,200	37,500	97,700	76,500	52,700
Middle Section	60,600	46,900	22,100	72,000	57,800	40,000
East Section	57,500	56,500	18,100	77,900	50,900	28,000

2) On Urban Amenity

Traffic volume of the existing Iligan - Cagayan de Oro – Butuan Road will be greatly reduced due to diverted to the Western Coastal Road. Therefore, traffic congestion, 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 Coastal Road corridor will be able to calculate to be almost 80%. With the existing road network within this 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 Coastal Road will be stimulated. This project will contribute to economic growth of not only Metro Cagayan de Oro but also Reion X.

12.11.4 Overall Evaluation

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