4 CASE STUDY OF R10/C3/R9 (+ R10/C5 Link) EXPRESSWAY

4.1 Planning Environment

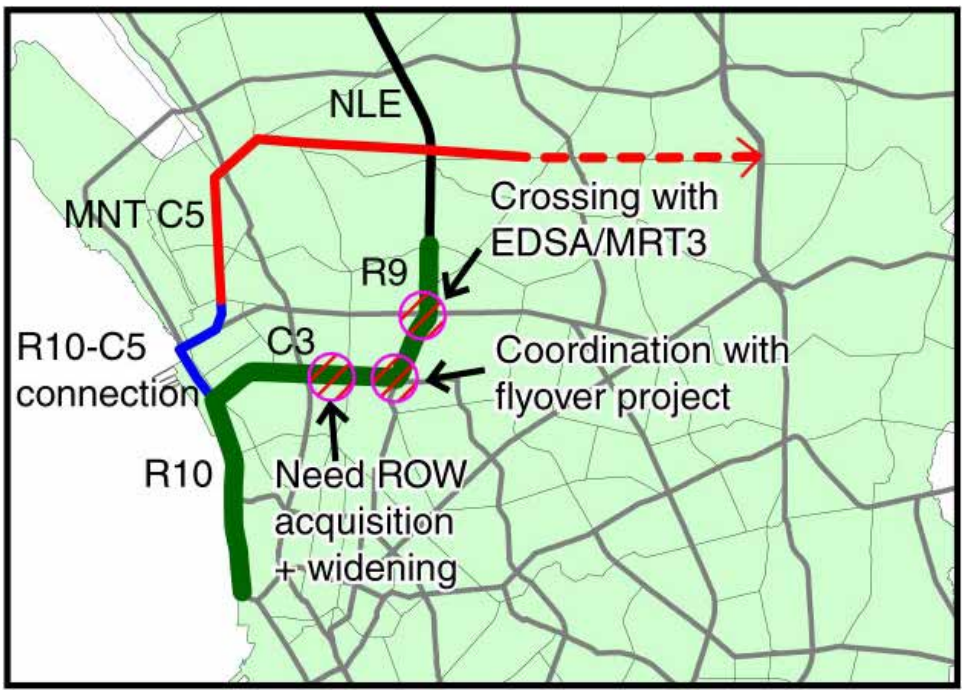
4.1.1 Background of the Case Study Expressway

In the preparatory stage of this PPP Study, an expressway over R10 (from 100 meters north of Zaragoza intersection to the C3 intersection) and C3 (from the R10 intersection to Bonifacio Avenue) was the object of the case study. These sections were selected mainly because the project has not yet been concessioned.

In the meeting on the Scope of Works for the Study held in October 2001, the DPWH proposed to include the R9 section (from the C3 intersection to the toll plaza of the NLE) in the case study. JICA agreed with the DPWH proposal on condition that CMMTC, whose existing concession includes the R9 section shall waive its right on this section before the start of this Study. As a result of discussions, CMMTC partially waived its concession for the said section.

At the end of Phase 1 of this PPP Study in March 2002, the Study Team proposed to extend the R10 section to the north beyond the R10/C3 intersection, turning right on C4 and linking the Case Study Expressway with the MNT C5 (Phase 2) at the northern end of Dagat-dagatan Avenue. This was approved by the DPWH and the JICA. Thus, the alignment of the Case Study Expressway was finalized as shown in Figure 4.1.

Figure 4.1 Location of Case Study Expressway



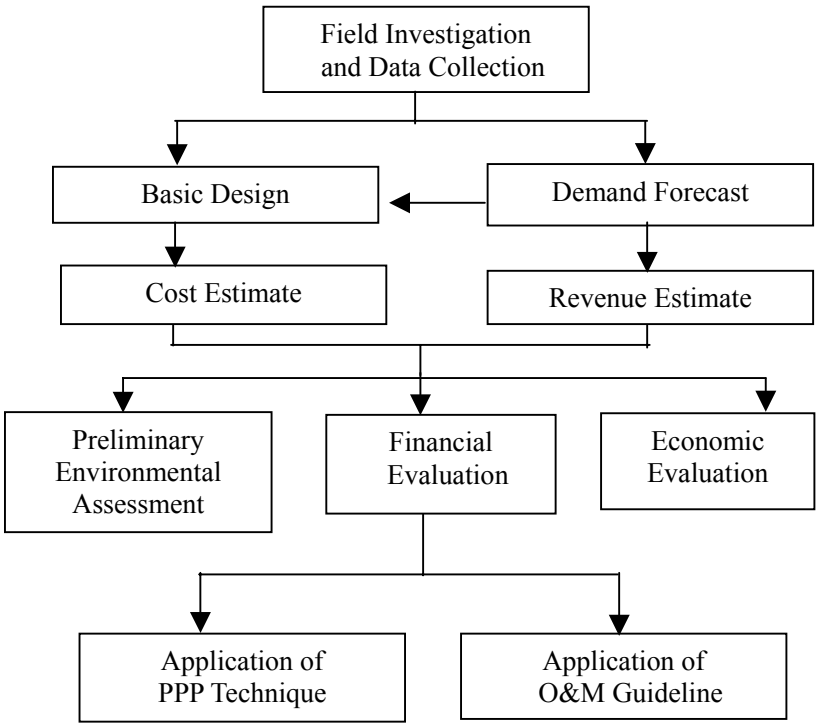
4.1.2 Approach for the Case Study

The main purpose of the case study was to examine the applicability of the PPP technique stated in Chapter 2 and the O&M system (focusing on TIS, ETC and maintenance of expressways) stated in Chapter 3 to a selected expressway. This chapter explains the PPP technique and the O&M system more concretely from the standpoint of the Government and the private sector.

Prior to applying the PPP technique and the O&M guidelines, a feasibility study was conducted on the Case Study Expressway, following the procedure shown in Figure 4.2. Of the three evaluation methods, the results of the financial evaluation became the key information in designing the PPP structure for the project.

The project cost was estimated based on the basic design and a study of ROW acquisition, resulting in higher accuracy than other projects stated in Chapter 1.2. Estimate of revenue was also done based on demand forecast under various toll rates and conditions of other projects affecting the Case Study Expressway.

Figure 4.2 Work Flow of Case Study



4.1.3 Consideration of Other Projects

Since the demand for an expressway will be affected by the development of another expressway as stated in Chapter 1.3, the case study needed clear assumptions on the existence of other expressways. The following cases of expressway network development, therefore, were analyzed to forecast demand and evaluate the financial condition of the case study expressway:

1) Existing expressways and Case Study Expressway only (Base Case)
2) Existing expressways, Case Study Expressway and Skyway Stage 3
3) Existing expressways, Case Study Expressway and MNT C5 Expressway
4) Existing expressways and Group A expressways (which includes the MCTE extension, the MNT rehabilitation/widening, the NAIA Expressway, the Skyway Stages 2 & 3, and the Case Study Expressway)

The following rail lines were assumed to open; however, it was determined that the rail network would have little effect on the demand of expressways:

Existing as of 2002	LRT-1, MRT, PNR
By 2005	Line 2, MRT extension, LRT-1 extension
By 2010	Line 4
By 2015	MCX, North Rail

In doing the basic design, integration with the following projects was considered:

1) Junction with Skyway Stage 3 at C3/R9 intersection
2) Junction with MNT C5 Expressway at the northern end of Dagat-dagatan Avenue
3) Crossing over MRT extension in Balintawak

4.1.4 ROW Acquisition on C3

A precondition of this Study was that the current Case Study Expressway arteries be widened prior to constructing in accordance with the geometric design standard of each artery. Some sections of these arteries are not wide enough to accommodate the elevated structures of an expressway. In particular, a narrow section on C3 between Rizal Avenue and PNR North, or 5th Avenue, has a long and difficult history.

The initial road widening project for 5th Avenue had three options, i.e. widening on the north side only, the south side only, or both sides. The Consultant for that project recommended the second option. However, after a public hearing in July 1980 among residents of the area, the Consultant was requested to evaluate other options

to avoid the economic dislocation of workers of factories that will be affected by the project. The reevaluation resulted in the recommendation of a route combining the first two options. In September 1980, the then Ministry of Public Works and Highways approved the final alignment and drawings.

In January 1985 the alignment's ROW width was reduced from 40 to 32 meters to reduce acquisition costs. The detailed design of the new alignment was approved in 1987.

In May 1988, the Notice of Implementation was issued to residents. The Notice to Proceed was issued to the contractor, Makati Development Corporation, whose contract took effect on 16 January 1989. According to the DPWH, at that time 70% of the affected residents already agreed to sell their property to the Government. However, a Mr. Roque Edgardo Que of the Workers Party in his letters dated 22 February, 9 May and 28 June 1989, requested the DPWH to suspend the C3 road project until a just and equitable solution for everyone is met. A Mr. Leroy S. Tan also requested the DPWH in a letter dated 27 September 1990 to immediately stop the implementation of the C3 road project under the "Alternative Plan" (1986 approved plan) and for the DPWH to follow the "Original Plan" (1980 public hearing alignment).

In October 1990, the DPWH filed expropriation cases against the residents for their continued refusal to accept the Government's offer to buy their properties (RP vs. Asuncion Galang, et al and RP vs. Go Ban, et al). In January 1991, the Kalookan City court allowed the Government to expropriate the affected properties of Go Ban, et al. A week later, however, on 28 January 1991, the contract of Makati Development Corporation for the construction of C3 was terminated due to the non-acquisition of the ROW.

On 11 February 1991, Go Ban et al filed a Motion to Dismiss the case against them. On 10 June 1991, the court ruled in their favor. After a month, on 17 July, the Office of the Solicitor General filed a motion to consolidate the two expropriation cases at RTC Branch 128 and this was granted.

In February 1992, administration works from the section near A. Mabini St. to Baltazar Street started. However, on 18 February, the court issued a temporary restraining order to stop the DPWH from continuing with the project in view of the reevaluation of the validity and necessity of the project.

Four years after the expropriation cases were consolidated, the RTC dismissed the case on 27 October 1995. It was elevated to the Court of Appeals but was withdrawn by then DPWH Secretary Gregorio Vigilar on 9 January 1997.

In early 1996, URPO re-surveyed the area and together with Pacific Consultants International prepared a realignment plan connecting the existing C3 from A. Mabini Street to the intersection of 5th Avenue-Rizal Avenue Extension. The approved plan, however, only covered the southern portion of 5th Avenue from Rizal Avenue Extension to Baltazar Street, failing to reach A. Mabini Street and connect to the existing C3 in the west.

4.2 Demand/ Revenue Forecast

4.2.1 Base Case (Case Study Expressway only)

As a base case of demand forecast, future traffic was assigned on the network composed of existing expressways (SLE, NLE, MCTE and Skyway Stage 1) and the Case Study Expressway (R10/C3/R9+R10/C5 Link) Here, no other expressways were assumed for 2010-2040.

Under the basic toll rate of ₱ 4/km, daily patronage of the Case Study Expressway was estimated at 97,400 PCUs in 2010, which will increase to 143,300 PCUs in 2020 (see Table 4.1). The average running distance on the expressway will be 6.3 – 6.9 kilometers. Annual revenues will be ₱ 781 million in 2010 and ₱ 1,312 million in 2020. (One year is equivalent to 330 days, assuming half of a weekday demand for holidays.

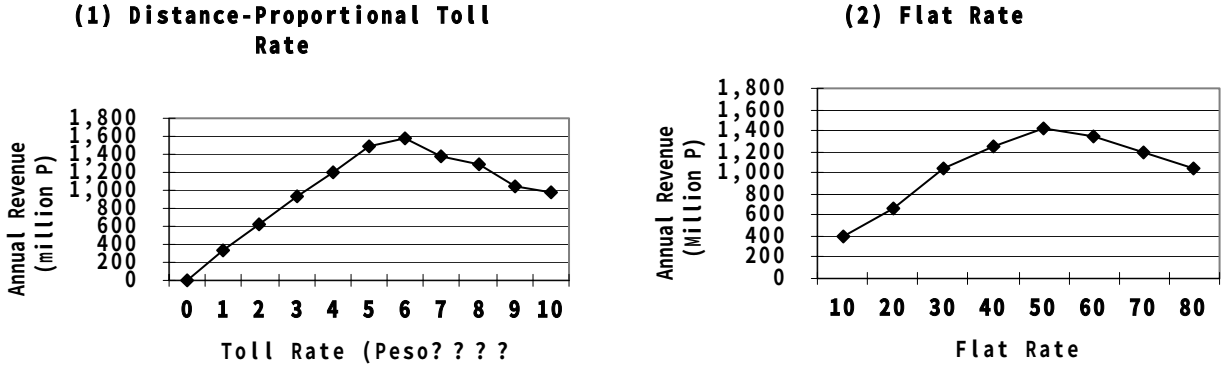
Table 4.1 Demand and Revenue of Case Study Expressway under various Toll Rates

Case	Year	Demand of Case Study Section			Toll Revenue (Million Peso/year)		
		Patronage (1000pcu/day)	PCU-Km (1000/day)	Av. Length used per PCU (Km)	Basic Toll	Toll by distance	Total
(1) Distance Proportional Toll Rate							
Base Case (4Peso/km)	2010	94.7	592	6.3	0	781	781
	2015	132.8	915	6.9	0	1,207	1,207
	2020	143.3	994	6.9	0	1,312	1,312
(2) Flat Rate							
10	2015	120.4	989	8.2	397	0	397
20	2015	99.2	907	9.1	654	0	654
30	2015	105.7	965	9.1	1,046	0	1,046
40	2015	94.1	885	9.4	1,242	0	1,242
50	2015	86.7	847	9.8	1,430	0	1,430
60	2015	67.9	670	9.9	1,344	0	1,344
70	2015	52.0	523	10.0	1,202	0	1,202
80	2015	39.7	396	10.0	1,048	0	1,048
(3) Compromised Rate							
10Peso+4 Peso/km	2010	55.9	428	7.7	184	565	749
	2015	116.5	897	7.7	384	1,184	1,568
	2020	123.8	924	7.5	409	1,220	1,629
20Peso+4 Peso/km	2010	35.9	309	8.6	237	408	645
	2015	86.5	725	8.4	571	957	1,529
	2020	122.1	991	8.1	806	1,308	2,114

Demand of an expressway is directly affected by toll rates. Generally, as the rate goes up, the demand decreases, and the revenue rises to a certain point and thereafter goes down. In the case of the distance-proportional toll rate, the annual revenue of the Case Study Expressway is shown in Figure 4.3 (1). Annual revenue will be maximized at ₱ 1,800 million in 2015, when the toll rate will be ₱ 6/km.

As the Case Study Expressway is rather short (about 12 km), a flat rate system may be practical than the distance-proportional rate, if it can be determined independently from other expressways. Figure 4.3 (2) shows revenues under various flat rates. Maximum revenue in 2015 will be ₱ 1,400 million when the toll is ₱=50/use. The same amount of revenue can be expected at ₱ 4.5/km of the distance-proportional toll rate.

Figure 4.3 Revenue Comparison of Distance-proportional Toll Rate and Flat Toll Rate (Year 2015)



Distance-proportional toll rate and flat toll rate are combined into the "hybrid rate" in Table 4.1 (3) where the toll rate is a sum of the distance-proportional toll and an entry charge (A * Distance + B). Assuming two cases of ₱ 10 and ₱ 20 for the entry charge, and ₱ 4/km for the distance-proportional toll, maximum revenue can be expected when B=0 in 2010 (Base Case), B=10 in 2015 and B=20 in 2020, respectively.

As the average running distance will be about 8 km, a ₱10 + ₱ 4/km toll will be equivalent to a ₱ 5.25/km toll in 2015 and a ₱ 20 + ₱ 4/km toll rate will be equivalent to a ₱ 6.5/km toll rate in 2020. In the toll rate analysis in Chapter 1.2, ₱ 4/km is suggested as a reasonable rate for year 2002. If this rate rises at the same rate as the growth of GDP per capita (2.1% per annum), the rate will be ₱ 5.24 in 2015 and ₱ 5.81 in 2020. The recommended toll rate for 2010 can be considered within affordable range. The recommended toll rate for 2020, however, exceeds the projected affordable rate in 2020, but worsening traffic conditions on alternative routes by that time would justify a slightly higher equivalent toll rate of ₱ 6.5/km. Then, the recommended rates will still be affordable.

Based on the foregoing analysis, the following toll rates are recommendable for the Case Study Expressway:

Year 2010	₱ 4/km
Year 2015	₱ 10 + ₱ 4/km
Year 2020	₱ 20 + ₱ 4/km

Figure 4.4 shows the traffic flows on the Case Study Expressway assuming the recommended toll rates. The widest flow band between EDSA and Balintawak tollgates encompasses the total volume of the NLE and the elevated portion of the Case Study Expressway.

Figure 4.4 Demand Forecast for the Case Study Expressway

2010 **2020**

In 2010, there will be daily traffic of 74,000 PCUs on the eastern links of C3 and R9 and 41,000-44,000 PCUs on R10. The other links of the Case Study Expressway will have 20,000-33,000 PCUs. In 2020, traffic on R9, R10 and eastern links of C-3 will reach 80,000 PCUs which is the capacity of a four-lane expressway. On the other links, traffic will increase to 40,000-60,000 PCUs, almost double after 10 years.

Table 4.2 shows the traffic assignment results of the case without the R10/C5 link of the Case Study Expressway. Without the R10/C5 Link, the Expressway will lose about 25% of its demand (in terms of PCU-km) in 2010. However, this loss will gradually lessen to 11% in 2015 and 7% in 2020.

C3 has to be widened to six lanes for about 600 m prior to constructing the elevated expressway. Unless the land acquisition problem is solved, the Case Study Expressway cannot be realized. In such a case, however, the R10 section and the R10/C5 Link can be built. Table 4.3 shows the traffic assignment result under such a case. Demands in 2010 and 2015 are approximately half and two thirds, respectively, of the entire Case Study Expressway's demand in 2020, while the project cost of the R10 section and the R10-C5 Link is about half of the total. Therefore, this case can be expected to have a higher financial return than the whole Case Study Expressway.

Table 4.2 Demand and Revenue of R10/C3/R9 of the Case Study Expressway (Without R10/C5 Link)

Case	Year	Demand of Case Study Section			Toll Revenue (Million Peso/year)		
		Patronage (1000pcu/day)	PCU-Km (1000/day)	Av. Length used per PCU (Km)	Basic Toll	Toll by distance	Total
4 P/km (Base Case)	2010	127.3	442	3.5	0	584	584
	2015	254.8	862	3.4	0	1,138	1,138
	2020	285.2	933	3.3	0	1,231	1,231
10Peso+4 Peso/km	2010	60.1	413	6.9	198	545	744
	2015	120.2	805	6.7	397	1,063	1,459
	2020	134.6	871	6.5	444	1,149	1,593
20Peso+4 Peso/km	2010	37.4	298	8.0	247	393	640
	2015	91.4	681	7.5	603	899	1,502
	2020	124.1	925	7.5	819	1,221	2,040

Table 4.3 Demand and Revenue of R10+R10/C5 Link of Case Study Expressway (Without C3/R9 Section)

Case	Year	Demand of Case Study Section			Toll Revenue (Million Peso/year)		
		Patronage (1000pcu/day)	PCU-Km (1000/day)	Av. Length used per PCU (Km)	Basic Toll	Toll by distance	Total
(Base Case) 4 Peso/km	2010	26.8	323	12.0	0	426	426
	2015	73.8	623	8.4	0	785	785
	2020	106.3	812	7.6	0	1,072	1,072
10Peso+4 Peso/km	2010	21.6	175	8.1	71	230	302
	2015	59.6	480	8.1	197	633	830
	2020	85.9	744	8.7	283	914	1,198
20Peso+4 Peso/km	2010	14.2	115	8.1	94	152	247
	2015	46.4	374	8.1	306	493	800
	2020	82.1	653	8.0	542	875	1,416

4.2.2 Case Study Expressway and Skyway 3

The most influential expressway projects to the Case Study Expressway are the Skyway Stage 3 and the MNT C5, exclusive of the MBE, which is very costly and difficult to realize in the near future. The influence of these projects is examined here and in the next section.

Figure 4.5 and Table 4.4 show the demand and revenue of the Case Study Expressway together with the Skyway Stage 3. In the figure, the widest flow expresses the sum of traffics on the SLE and the Skyway Stage 1.

By connecting the Case Study Expressway with the Skyway System, the expressway will significantly lose its demand. The demand will become almost half of the case without Skyway connection. This is mainly because a sizeable part of the north-south traffic along the coast will be diverted to the inland north-south corridor enhanced by the Skyway. Fortunately, this negative influence will weaken in the long run due to the overall increase in demand and the worsening congestion on ordinary roads. The Case Study Expressway should therefore be planned in close coordination with the Skyway Stage 3.

Figure 4.5 Demand Forecast for Case Study Expressway and Skyway Stage 3

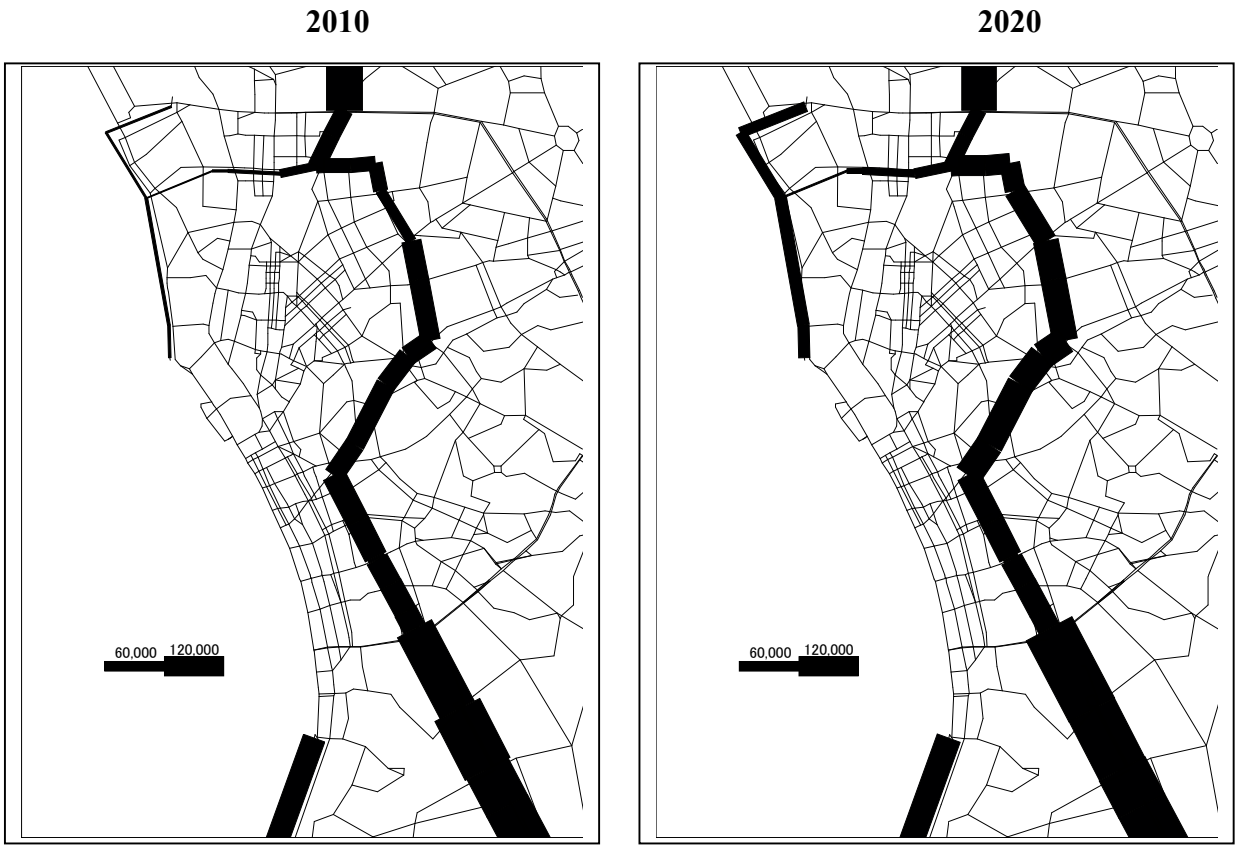


Table 4.4 Demand and Revenue of Case Study Expressway and Skyway Stage 3

Case	Year	Demand for Case Study Sec. & Skyway 3			Toll Revenue (Million Peso/year)		
		Patronage (1000pcu/day)	PCU-Km (1000/day)	Av. Length used per PCU (Km)	Case Study Section	Skyway 3	Total
(1) Distance Proportional Toll Rate							
Base Case (4Peso/km)	2010	288	1,697	5.9	536	1,704	2,240
	2015	355	2,478	7.0	1,059	2,212	3,270
	2020	423	2,776	6.6	1,328	2,336	3,665
Toll Rate per km							
1	2015	434	2,659	6.1	345	532	877
2	2015	404	2,580	6.4	638	1,066	1,703
3	2015	355	2,568	7.2	900	1,643	2,542
4	2015	355	2,478	7.0	1,059	2,212	3,270
5	2015	359	2,247	6.3	1,069	2,638	3,707
6	2015	317	2,063	6.5	1,102	2,983	4,084
7	2015	318	1,863	5.9	1,070	3,234	4,304
8	2015	271	1,600	5.9	1,086	3,137	4,223
9	2015	239	1,437	6.0	1,001	3,268	4,269
10	2015	218	1,313	6.0	908	3,426	4,334
11	2015	202	1,090	5.4	809	3,148	3,957
12	2015	183	983	5.4	640	3,252	3,892
(2) Flat Rate							
10	2015	234.4	2663	11.4	292	482	774
20	2015	243.1	2720	11.2	585	1020	1,605
30	2015	235.3	2771	11.8	716	1613	2,329
40	2015	204.1	2644	13.0	797	1898	2,694
50	2015	171.8	2313	13.5	814	2021	2,834
60	2015	160.5	2196	13.7	841	2337	3,178
70	2015	156.4	2233	14.3	877	2736	3,613
80	2015	139.7	2057	14.7	885	2803	3,688
90	2015	138.6	2116	15.3	954	3162	4,116
100	2015	134.4	2077	15.5	955	3481	4,435
110	2016	122.5	1924	15.7	998	3450	4,448
120	2017	108.9	1731	15.9	974	3338	4,312
130	2018	98.4	1586	16.1	951	3271	4,223
140	2019	86.4	1408	16.3	904	3088	3,992
150	2020	79.4	1301	16.4	892	3040	3,932
(3) Compromised Toll Rate							
10Peso+4 Peso/km	2010	186.2	1,598	8.6	618	2,106	2,724
	2015	254.1	2,162	8.5	1,034	2,658	3,692
	2020	326.2	2,793	8.6	1,671	3,093	4,764
20Peso+4 Peso/km	2010	143.0	1,417	9.9	585	2,229	2,814
	2015	224.7	2,083	9.3	1,026	3,207	4,233
	2020	278.1	2,541	9.1	1,691	3,499	5,190
40Peso+4 Peso/km	2010	79.9	1,012	12.7	334	1,976	2,310
	2015	161.5	1,914	11.8	632	3,760	4,391
	2020	199.9	2,213	11.1	730	4,014	4,744

4.2.3 Case Study Expressway and MNT C5

As shown in Figure 4.6 and Table 4.5, the MNT C5 will have a positive influence on the demand and revenue of the Case Study Expressway. Dividing the total revenue of both expressways by their respective PCU-km will result in revenue for the Case Study Expressway at 20% higher than that of the case without the MNT C5 in 2010, 40% higher in 2015 and 50% higher in 2020.

Therefore, the financial feasibility of the Case Study Expressway will be much improved by the construction of the MNT C5, particularly the western arc. In Chapter 1, the MNT C5 is shown to have a very large potential demand, thus, high profitability, while its cost is comparatively low because most of its segments will be at-grade. It is, therefore, strongly recommended that the MNT C5 be developed soon by solving land acquisition problems along the route, not only for its sake but also for the sake of the Case Study Expressway.

Figure 4.6 Demand Forecast for Case Study Expressway and MNT C5

Table 4.5 Demand and Revenue of Case Study Expressway and MNT C5

Case	Year	Demand for Skyway 3 & R9			Toll Revenue (Million Peso/year)		
		Patronage (1000pcu/day)	PCU-Km (1000/day)	Av. Length used per PCU (Km)	Case Study	MNT C5	Total
(1) Distance Proportional Toll Rate							
Base Case (4Peso/km)	2010	403.9	2113	5.2	1,373	7,175	8,549
	2015	419.4	2511	6.0	2,318	7,724	10,042
	2020	518.6	2967	5.7	2,850	9,205	12,055
(2) Compromised Toll Rate							
10Peso+4 Peso/km	2010	299.2	1,624	5.4	1,000	8,488	9,488
	2015	403.8	2,509	6.2	2,194	11,878	14,072
	2020	499.3	2,965	5.9	2,698	14,155	16,853
20Peso+4 Peso/km	2010	287.2	1,554	5.4	752	11,209	11,961
	2015	387.9	2,400	6.2	2,318	15,041	17,359
	2020	499.8	3,032	6.1	3,214	18,883	22,097

4.3 Preliminary Engineering Studies

4.3.1 Design Criteria

(1) Geometric Design Standard

Two classifications of expressway design were proposed in the MMUES:

Expressway Class-A: Expressways proposed outside of EDSA, with a design speed of 80 kph.
Expressway Class-B: Expressways proposed inside of EDSA, with a design speed of 60 kph.

The Case Study Expressway falls under Class-B. The applied design standards for expressways, interchanges, ramps, and design of speed change lanes in the Case Study Expressway are tabulated below.

Table 4.6 Geometric Design Standards for an Expressway

Description		Unit	Class-B (Inside EDSA)
Design Speed		kph	60
Lane Width		m	3.25
Outer Shoulder Width		m	2.00
Median Width		m	2.00
Median Island Width		m	1.00
Inner Shoulder Width		m	0.50
Horizontal Alignment	Minimum Radius	m	150 (130)
	Minimum Curve Length	m	100
	Maximum Superelevation	%	10.0
	Minimum Transition Length	m	50
Vertical Alignment	Maximum Gradient	%	5.0
	Minimum Radius of Vertical Curve		
	Crest	m	2,000 (1,400)
	Sag	m	1.500 (1,000)
	Minimum Vertical Curve Length	m	50
Minimum Stopping Sight Distance		m	85 (75)
Pavement Crossfall		%	2.0
Composite Gradient		%	10.5
Vertical Clearance		m	5.0

Note: Figures in ( ) show absolute minimum value to be used only when conditions necessitate it.

Table 4.7 Geometric Design Standards for an Interchange

Description		Unit	Case 1	Case 2	Case 3
Design Speed		km/h	80	60	50
Lane Width		m	3.50	3.25	3.25
Inner Shoulder Width		m	0.75	0.75	0.75
Outer Shoulder Width 1-lane		m	2.00	2.00	2.00
Outer Shoulder Width 2-lane		m	1.25	1.25	1.25
Horizontal Alignment	Minimum Radius	m	280 (230)	150 (120)	100 (80)
	Minimum Curve Length	m	140	100	80
	Maximum Superelevation	%	10.0	10.0	10.0
	Minimum Transition Length	m	70	50	40
Vertical Alignment	Maximum Gradient	%	4	5	6
	Minimum Radius of Vertical Curve				
	Crest	m	5,000 (3,000)	2,000 (1,400)	1,200 (800)
	Sag	m	3,000 (2,000)	1.500 (1,000)	1,100 (700)
	Minimum Vertical Curve Length	m	70	50	40
Minimum Stopping Sight Distance		m	140 (110)	85 (75)	65 (55)
Pavement Crossfall		%	2.0	2.0	2.0
Composite Gradient		%	10.5	10.5	11.0
Vertical Clearance		m	5.0	5.0	5.0

Notes: 1. Use Case 1 when intersecting expressways are both Class A.
2. Use Case 2 when intersecting expressways are Class A and Class B or both Class B.
3. Could be downgraded from Case 1 to Case 2 or Case 2 to Case 3, only when the conditions necessitate it.
4. Figures in ( ) show absolute minimum value to be used only when conditions necessitate it.

Table 4.8 On/Off-ramp Geometric Design Standards

Description		Unit	Expressway Class-B
Design Speed of Street to be Connected		kph	80, 60, 50
Design Speed of On/Off-ramp		kph	40
Lane Width		m	3.25
Inner Shoulder Width		m	0.75
Outer Shoulder Width		m	1.50
Horizontal Alignment	Minimum Radius	m	50 (40)
	Minimum Curve Length	m	-
	Maximum Superelevation	%	10.0
	Minimum Transition Length	m	35
Vertical Alignment	Maximum Gradient	%	7.0
	Minimum Radius of Vertical Curve		
	Crest	m	450
	Sag	m	450
	Minimum Vertical Curve Length	m	35
Minimum Stopping Sight Distance		m	50 (40)
Pavement Crossfall		%	2.0
Composite Gradient		%	11.0
Vertical Clearance		m	5.0

Note: 1. Use design speed of 40 kph for street or ramp with toll facility.
2. Figures in ( ) show absolute minimum value to be used only when conditions necessitate it.

Table 4.9 Standard Speed Change Lane

		Expressway Design Speed	
		80 kph	60 kph
Single Acceleration Lane	Acceleration Length (m)	160	120
	Taper Length (m) for Parallel Design	80	60
Single Deceleration Lane	Deceleration Length (m)	110	90
	Taper Length (m) for Parallel Design	80	60

(2) Typical Cross-section

Figure 4.7 Typical Cross-section of the Case Study Expressway

(4 Lanes)

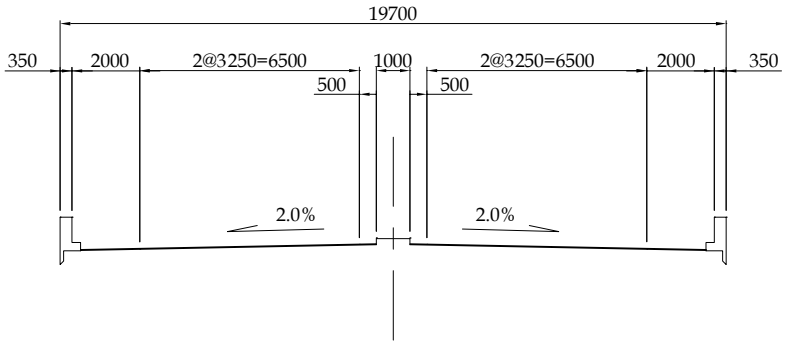


Figure 4.8 Typical Cross-section of the Case Study Expressway

(2 Lanes Separated)

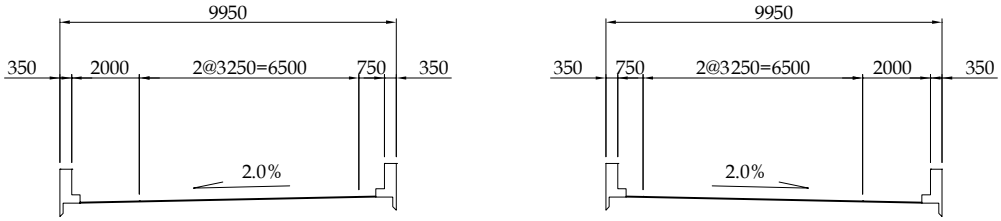


Figure 4.9 Typical Cross-section of the Case Study Expressway

(1 Lane Separated for Interchanges)

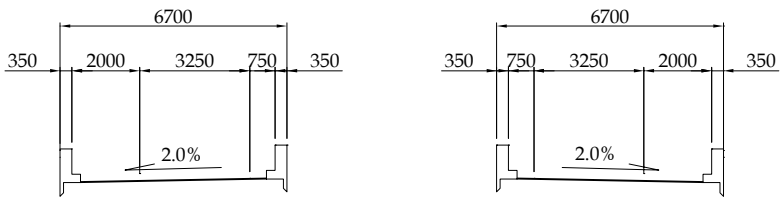
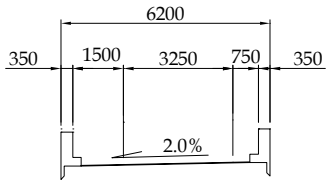


Figure 4.10 Typical Cross-section of the Case Study Rampway

(1 Lane)



4.3.2 Alignment Design

In this Study, the following two routes were studied:

1) Original Route (R10/C3/R9)

This starts about 100 m north of the R10-Zaragoza intersection and runs northward along the existing R10 up to C3. The alignment then turns eastward along C3 up to C3-A. Bonifacio intersection. From this intersection, it turns north along R9 (A. Bonifacio), crosses EDSA and links up with the NLE.

2) Link Route to C5 Expressway (R10 + R10/C5 Link)

This starts about 100 m north of the R10-Zaragoza intersection, runs northward along the existing R10, turns eastward on C-4 up to the end point of the MNT C5 Expressway on Letre Road. The alignment layout of these two routes is illustrated in Figure 4.11.

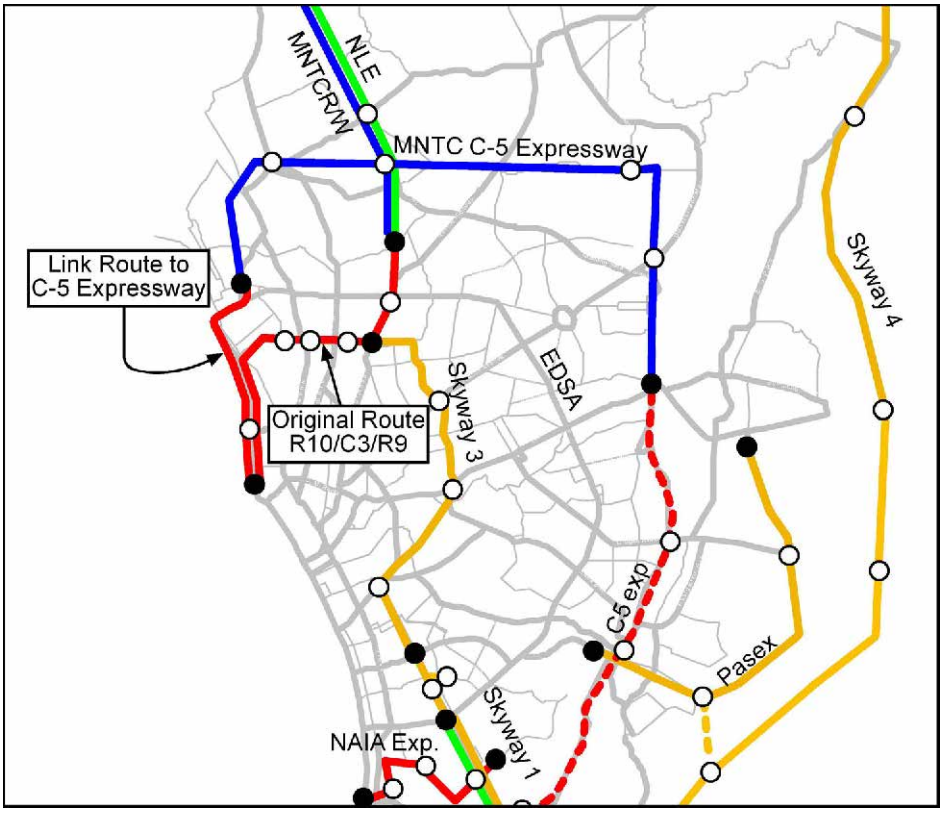
The coordinates of the horizontal alignment of the original route and link route are in Annex D.

(1) Issues of the Original Route

In order to understand the issues concerning the original route, the following should be noted:

- Along the existing R10, the proposed widening area (landside) is occupied by informal dwellers. According to information by URPO, the relocation program is already set and its implementation has already been in effect section by section. In order to finish the proposed expressway, it may be needed to accelerate the informal dwellers' relocation.
- Regarding the unacquired section of C3 between PNR North and Rizal Avenue, the Kalookan LGU was entrusted to conduct land acquisition, which may be done in the near future. The horizontal alignment in this section requires adjustment based on the actual acquired land area.

Figure 4.11 Alignment Layout of Case Study Expressway

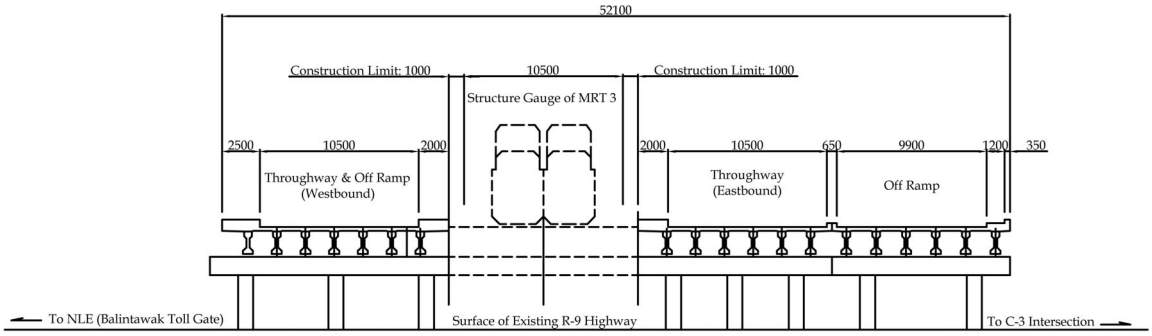


- The C3-A. Bonifacio Intersection Improvement Project (detailed design, JBIC-financed) commenced in August 2002. According to the awarded consultant of the project, the proposed plan for intersection improvement will be the introduction of a flyover along C3. To ensure that the designs of the expressway and the flyover complement each other, one of the tentative solutions based on a discussion with the awarded consultant calls for the modification of the expressway alignment.
- MRT 3 intends to extend (future MRT 3 Phase 2) from North Avenue to Monumento along EDSA. Although the design work for the MRT 3 extension has not commenced yet, SYSTRA, the design consultant, has suggested that the MRT 3 extension be located at the center of the EDSA Flyover over R9. The proposed expressway shall secure the vertical clearance for the MRT 3, in addition to the clearance for vehicles on the flyover. The design in this Study was carried out based on the assumed EDSA flyover with the MRT 3 extension, as shown in Figure 4.12. The vertical alignment of the expressway shall be finalized during the detailed design incorporating the MRT 3 extension design.
- The alignment of the expressway (original alignment) ends at approximately 160 m north of the existing Balintawak toll plaza of the NLE which will be replaced with a new toll plaza by the MNTC, planned to be located 800 m north from the existing one. The end point of the Case

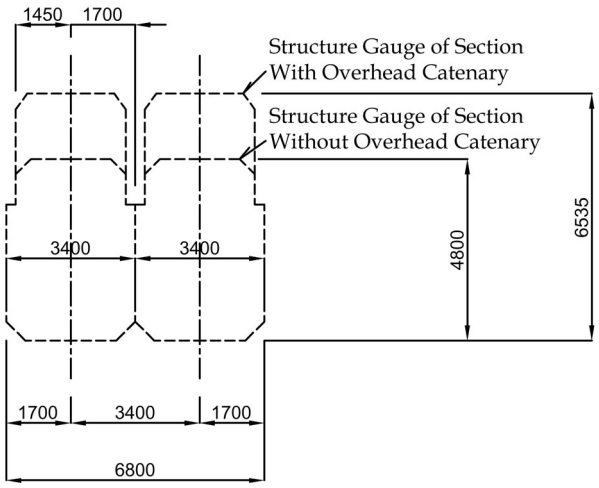
Study Expressway was adopted to minimize construction costs and to avoid the complexity of administrative jurisdiction between the private proponent for the Case Study Expressway and the MNTC.

Figure 4.12

(1) Assumed Cross-section of EDSA Flyover and MRT 3 Extension



(2) Structure Gauge of MRT 3



(3) Link Route to C5 Expressway

The MNTC has a concession to cover the following:

Phase I: Upgrading and expansion of:

- 84 km of the NLE from Balintawak to Santa Ines
- 8-km segment of the Subic Expressway linking Barrio Tipo to SBMA

Phase II: Northern arc of C5 extension:

- 16.5 km from C. P. Garcia to McArthur Highway

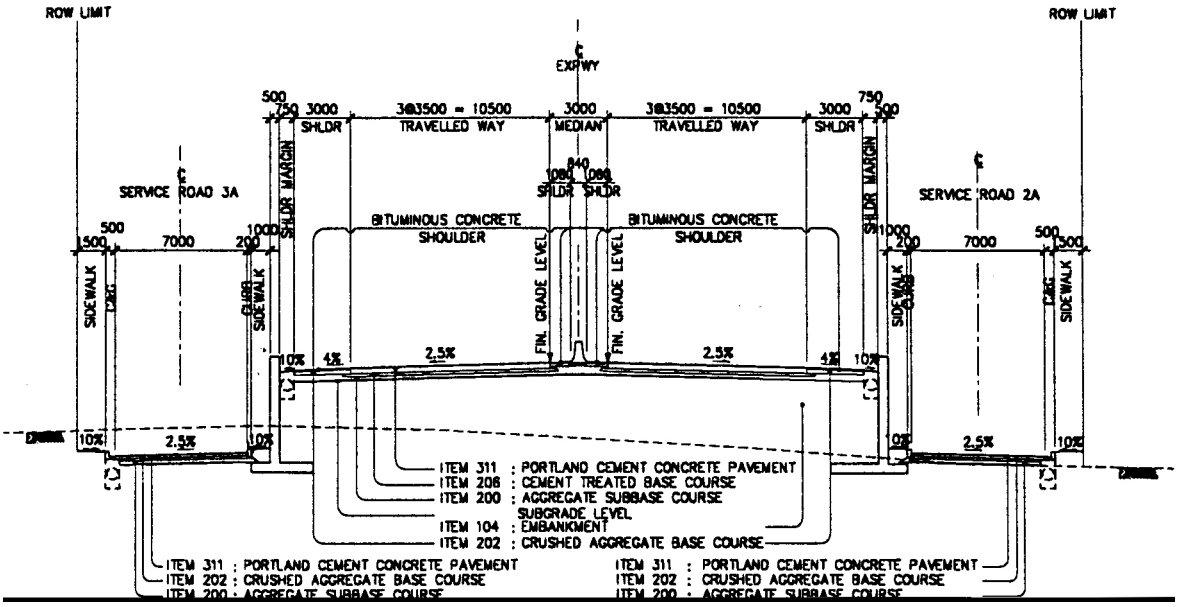
Phase III: Consists of:

- 58.5 km of the Subic Expressway linking San Simon to Barrio Tipo
- 5.9 km of the northern arc of C5 from McArthur to Letre, Malabon

Figure 4.13 shows the location plan of the proposed C5 Expressway based on the basic design study. The proposed C5 Expressway is designed as a dual three-lane artery (3.5-m lane) with service roads at both sides.

Figure 4.13 Typical Cross-section of C5 Expressway

(STA. 2+100~STA. 2+300, STA. 2+500~STA. 2+780)



As shown in Figures 4.14 and 4.15, the MNT C5 Expressway is scheduled to end at Letre Road with an at-grade intersection and has no link with the future MMUEN.

Due to the section's proximity to the sea and its topographic conditions, the section from McArthur Highway to Letre Road is frequently flooded by sea tide backwater, Hence, the MNTC suggested the application of a viaduct in this section.

In this Study, a link route to C5 Expressway is established to provide a direct connection to the MMUEN. Figure 4.16 shows the proposed layout where the elevated C5 Expressway directly connects to the elevated link route proposed in this Study, with a trumpet-type interchange connecting ramps to Letre Road.

As a large-scale building is now under construction at the northwest corner of C4-Dagat-dagatan Avenue, it is considered technically inappropriate to extend the original C5 Expressway alignment and connect it to the link route. The proposed alignment of the modified C5 Expressway alignment crosses over Letre Road and merges with C4 at the east of C4-Dagat-dagatan Avenue. Because there is not enough length to secure the required vertical clearance above Letre Road, the on-ramp to the project expressway (southbound) is designed on C4, around 100 m west of the C4-Dagat-dagatan Avenue Intersection.

Figure 4.14 Location Plan of the MNT C5 Expressway

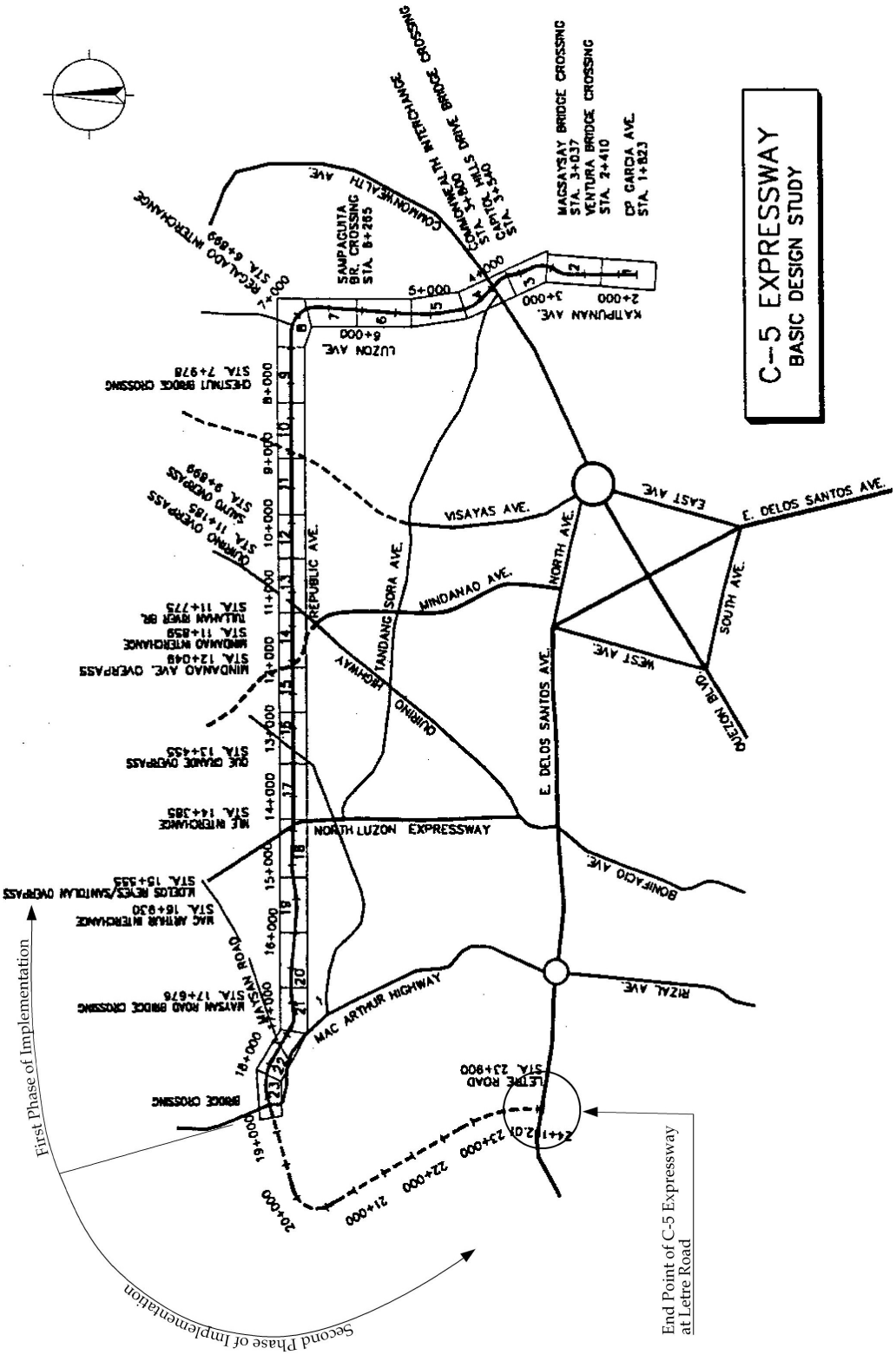


Figure 4.15 Road Alignment Key Plan for the C5 Expressway

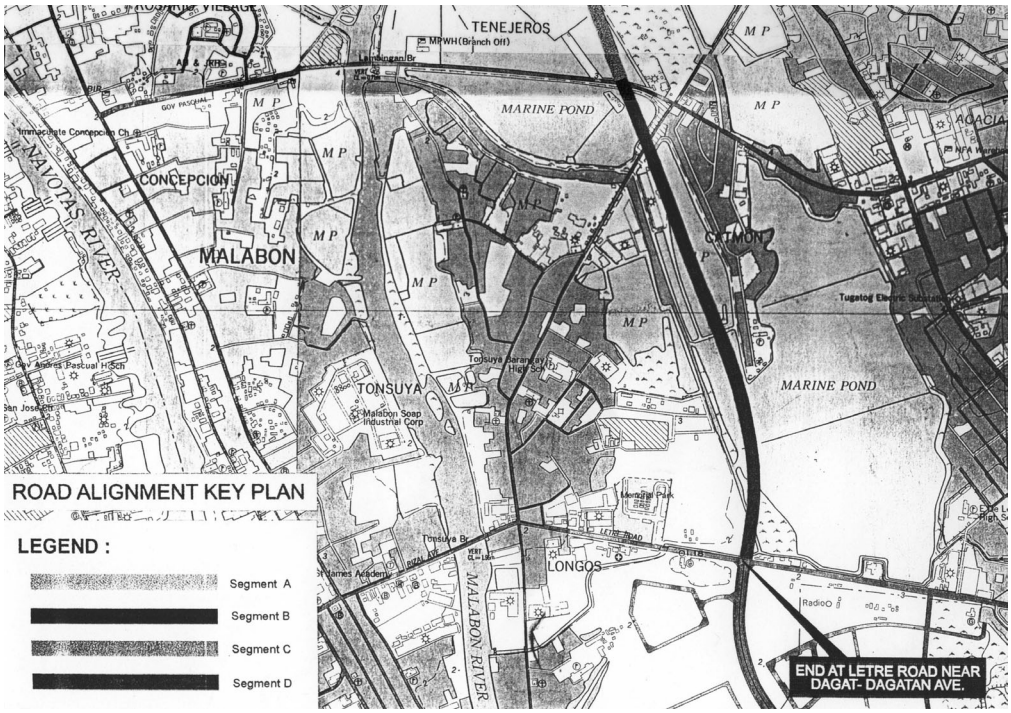
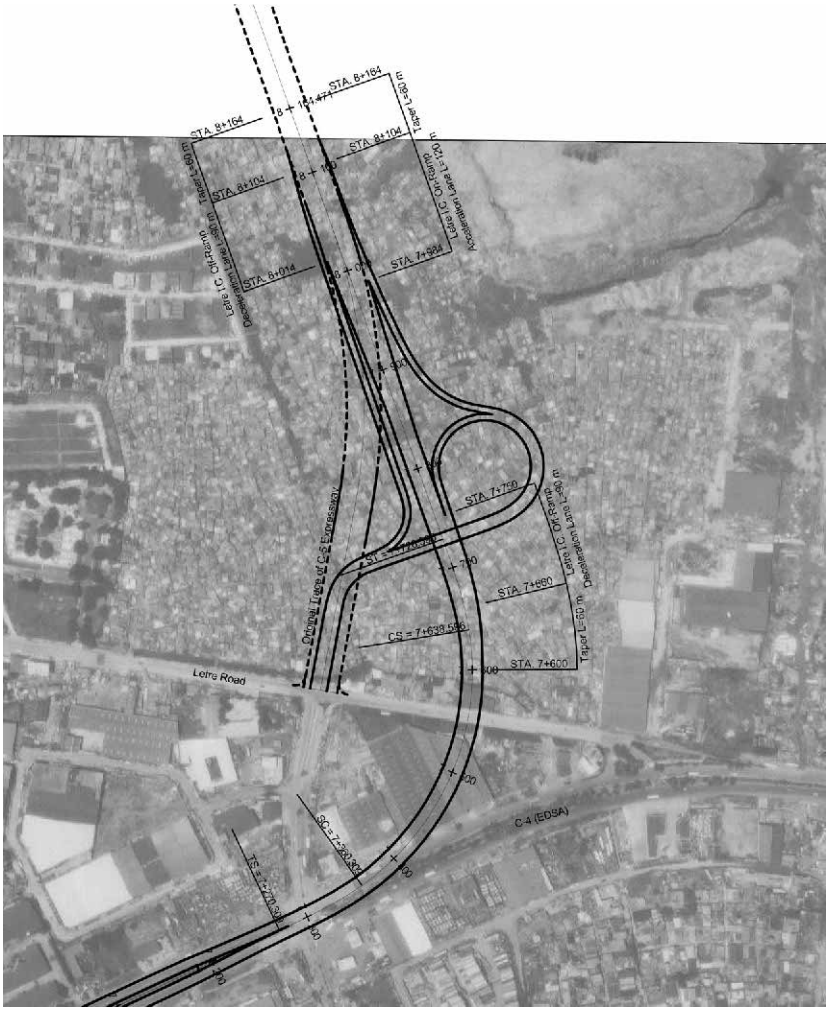


Figure 4.16 Proposed Link of the Case Study Expressway and the MNT C5 Expressway

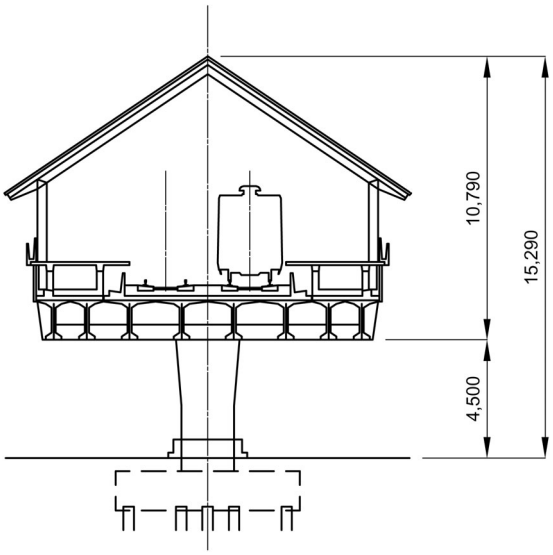


(4) Major Crossing Facilities

The following are the major crossing facilities considered for study:

- 5th Avenue Station of LRT 1 (see Figure 4.17)
- EDSA Flyover with MRT 3 Extension (see Figure 4.12)

Figure 4.17 Cross-section of 5th Avenue Station of LRT 1



A vertical clearance of 4.5m was applied based on the field investigation as shown in the photo below.

Figure 4.18 Caution Board at 5th Avenue Station of LRT 1

(5) Consideration of C3-A. Bonifacio Intersection Improvement Project

The detailed design of the C3-A. Bonifacio Intersection Improvement Project commenced in August 2002. The details of the improvement scheme, however, have not been decided yet as of July 2002. But, the awarded consultant provided the following details.

- Proposed Structure: Flyover along C3 over A. Bonifacio Ave.
- Number of Lanes: 2@ 2 lanes

  Assumed Length of Flyover: 500 m approximately, 100 m with a 5-m vertical clearance from existing at-grade C3, and 200 m on both ends to connect with C3

The expressway alignment and the location of the planned intersection are shown in Figure 4.19. The expressway alignment overlaps above the intersection flyover with a length of approximately 150 m. Furthrmoere, the two rampways connected to the Skyway Phase 3 will be located at almost the same horizontal alignment with the intersection flyover.

Figure 4.19 Expressway Alignment and Location of Planned Intersection

Figure 4.20 shows the cross-section of the rampways around STA: 8+200. The center line of the rampways will almost be the same as that of the intersection flyover. Five meters of vertical clearance on the intersection flyover will be secured for the eastbound rampway, but it would not be possible for the westbound rampway. To solve this problem, the following alternative is proposed:

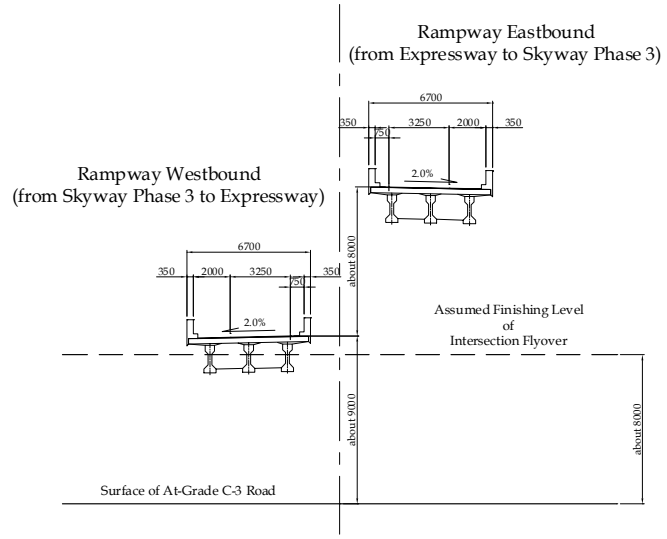
<Alignment>

- The horizontal alignment of the westbound rampway will be shifted northward to avoid overlapping with the intersection flyover.
- The vertical alignment of both westbound and eastbound rampways will be reviewed to secure a 5-m clearance from the finishing level of the intersection flyover.

<Structural Planning>

- In the longitudinal direction, the substructures (piers) for rampways will be arranged at the same location with those of the intersection. In the transverse direction, the pier columns of the rampways will be planned near the flyover to secure the traffic flow of at-grade C3.

Figure 4.20 Cross-section of the Rampways (around STA: 8+200)



The profile and cross-section of the proposed alternative are shown in Figures 4.21 and 4.22, respectively.

Figure 4.21 Profile of the Alternative Rampways

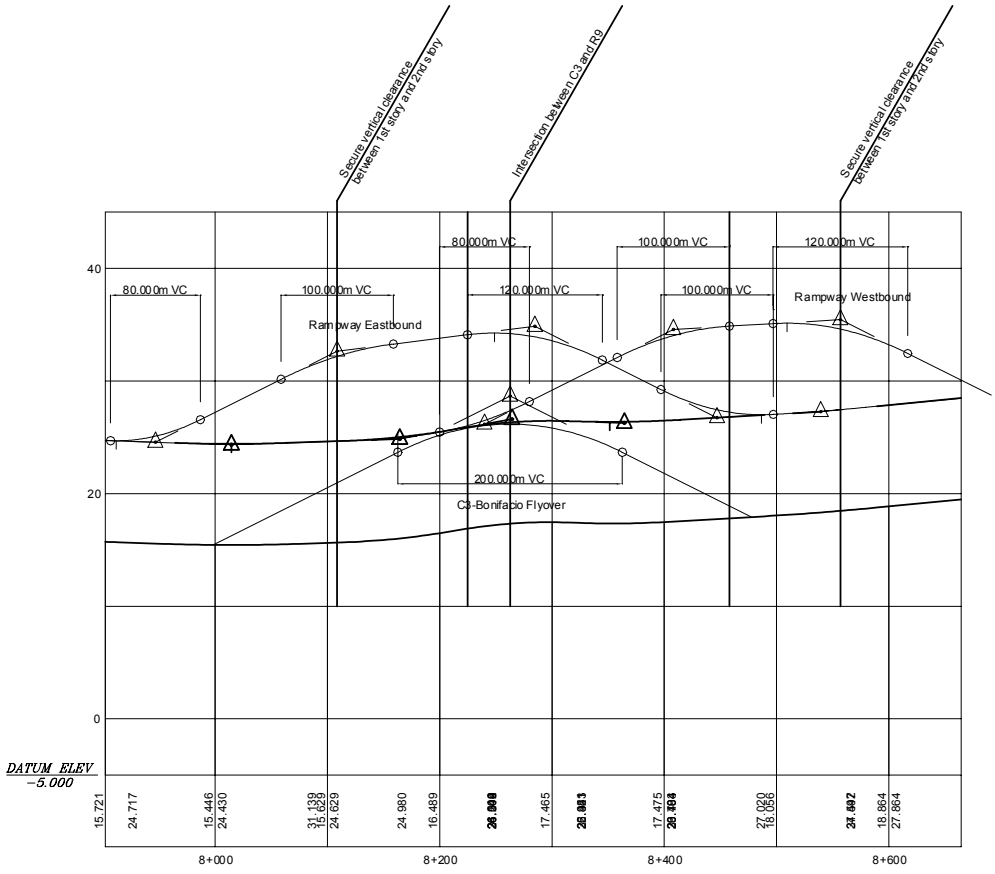
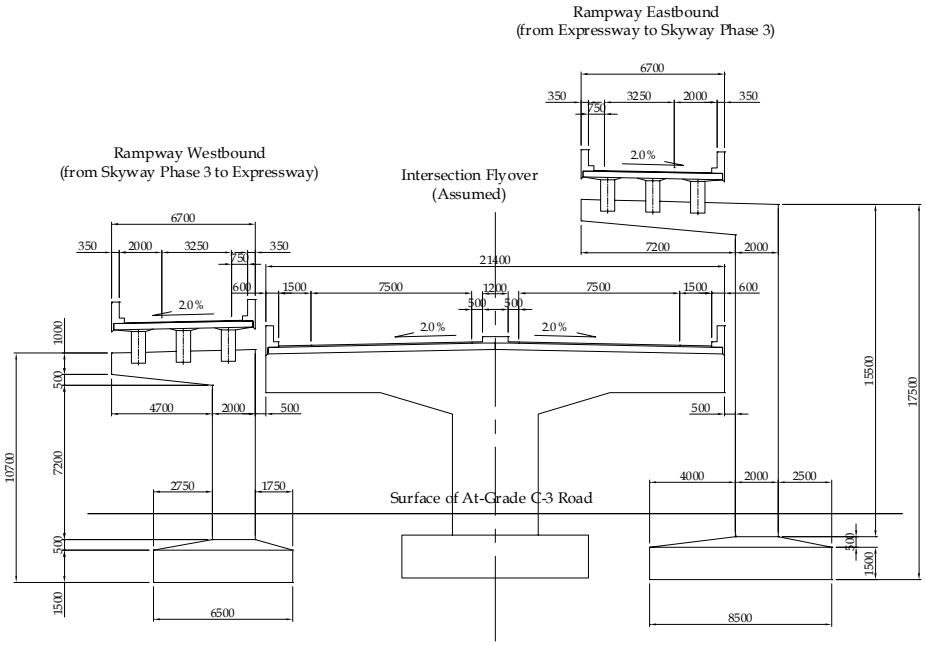


Figure 4.22 Cross-section of the Alternative Rampways and the Intersection Flyover



4.3.3 On/Off-ramp Schedule

The following shows the on/off-ramp schedule in the case study section.

		On-ramp	Off-ramp
R10	1	STA. 0+000 Northbound Beginning Point	STA. 0+000 Southbound Beginning Point
	2	STA. 1+435 Northbound from PPA Area	STA. 1+300 Southbound to PPA area
C3	3	STA. 5+889 Eastbound from Dagat-dagatan Avenue	STA. 5+570 Westbound, between Navotas Bridge and Dagat-dagatan Avenue
	4		STA. 7+661 Westbound to Rizal Avenue
R9	5	STA. 9+721 Southbound from EDSA	STA. 9+810 Northbound to EDSA
	6	STA. 11+290 Southbound from NLE	STA. 11+290 Northbound into NLE
R10/ C5 Link	7	STA. 6+905 Westbound from Dagat-dagatan Avenue	STA. 7+750 Northbound at Letre I.C.
	8	STA. 7+894 Northbound into MNTC C-5 Expressway at Letre I.C.	STA. 8+014 Southbound from MNTC C-5 Expressway at Letre I.C.

Note: On/Off-ramp data in rows 7 and 8 were provided for the Link Route to C-5 Expressway.

The number of on/off-ramps and their locations provided for in the original route are the same as that proposed in the MMUES except for the on/off-ramps listed in the second row of the above table, which directly links to the PPA (North Harbor) area.

The PPA appreciates the direct installation of the on/off-ramps in the port area, as this will complement the scheduled upgrading of the North Harbor based on the Manila North Harbor Master Plan (2001~2004) as illustrated in Figure 4.23. The Master Plan consists of three phases and will be implemented on a BOT basis. Figure 4.24 shows the project location of Phase I, and Figures 4.25 and 4.26 show the proposed location of the on/off-ramps.

The PPA states that the Master Plan defines the reclamation policy and guides the pier/berth arrangement. The private proponent, who will be entitled to implement the project, will finalize the layout plan. Therefore, it is important to review/adjust the on/off-ramps alignment design to fit with the final layout of the North Harbor Phase I project to ensure a smooth access to the port area.

Figure 4.23 Manila North Harbor Master Plan (2001~2004)

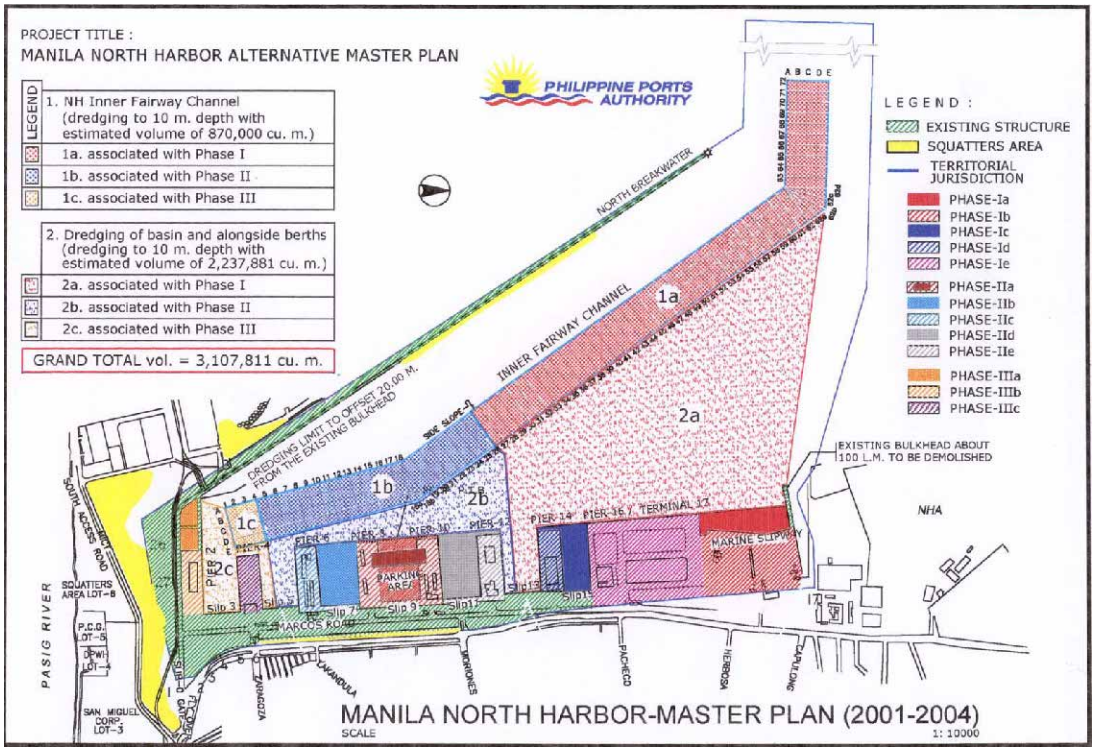


Figure 4.24 Manila North Harbor Master Plan Phase I

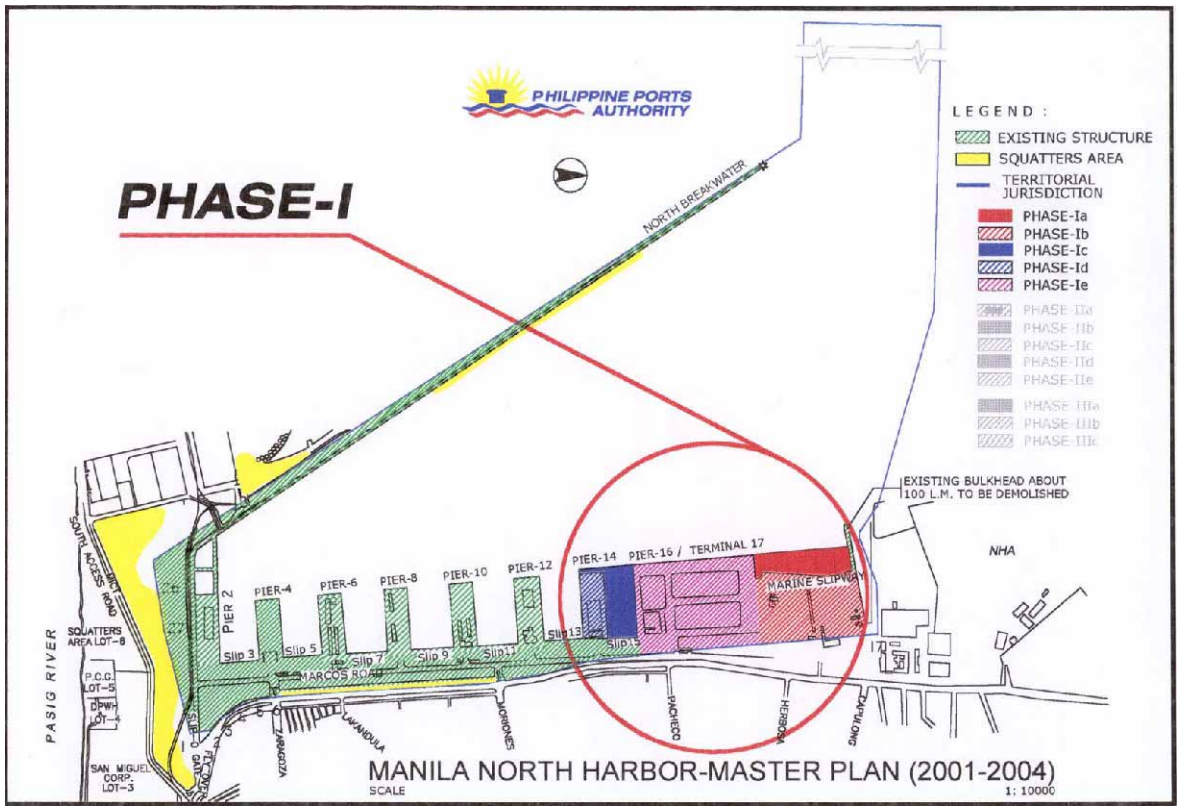
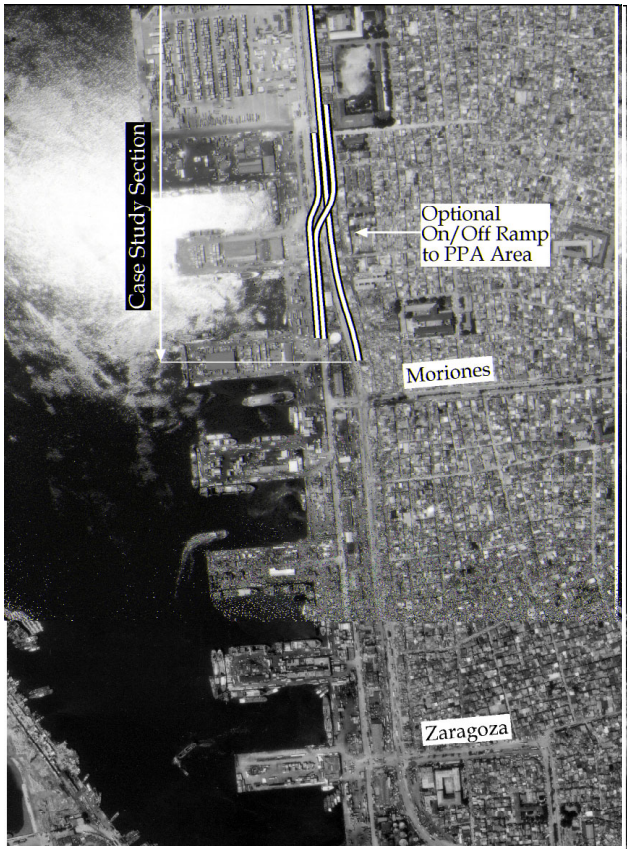
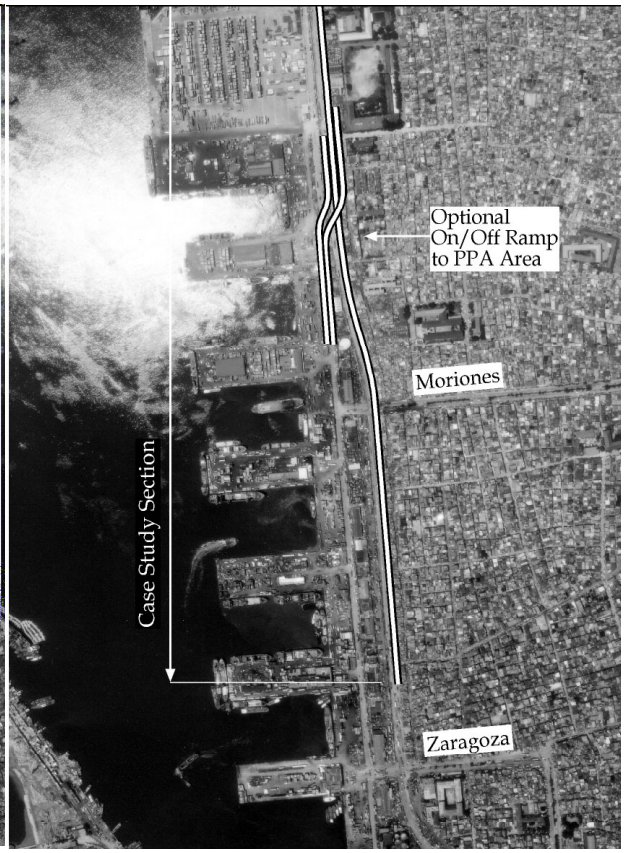


Figure 4.25 Original Alignment of the On/Off-ramps



Start from around 100 m north of Moriones Intersection as proposed by the MMUES

Figure 4.26 Proposed Alignment of the On/Off-ramps



Extend to around 750 m down south from the MMUES location

4.3.4 Consideration of Expressway Extension Southward (South Port Area)

As shown in Figure 4.26, it was agreed that the southern terminal of the expressway will be extended around 750 m southward, or 100 m north from Moriones Intersection. The alternative to be chosen will depend on a detailed analysis of queuing at the southern terminal. There is a private sector proposal to construct the MBE, the coastal expressway linking the port area to the MCTE in the south, which is part of the MMUEN. It is therefore necessary to consider its interconnection to the Case Study Expressway. The following two alignments are thus considered as alternatives (see Figure 4.27):

- Alternative-1: Basically, the proposed expressway is designed to have its substructures in the at-grade road median space. Accordingly, the extended expressway southward will be constructed above two bridges, namely the flyover for at-grade R-10, and the Roxas Bridge crossing Pasig River.
- Alternative-2: There is a feasibility study of the Manila Bay Expressway which incorporates the R10 Expressway and links to NLE via C5.

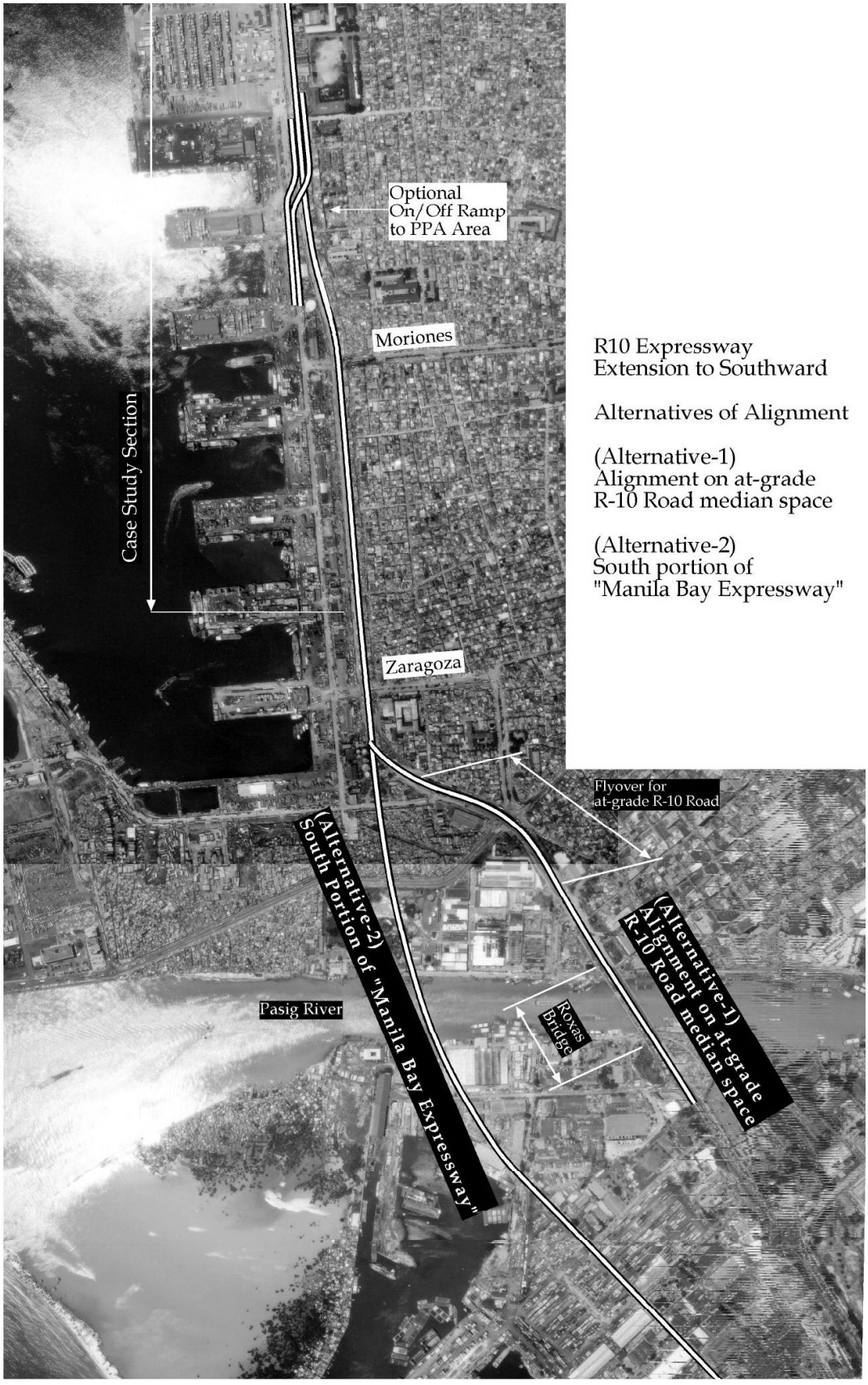
Although the possibility of realization of the Manila Bay Expressway is considered not high, extending the proposed R10 Expressway to the south is in line with the overall objective of providing Metro Manila with an effective expressway network.

The consideration of the above two alternatives is summarized in Table 4.10, and Alternative-2 is recommended.

Table 4.10 Consideration of Expressway Extension Southward

	Alternative-1	Alternative-2
Land Acquisition	- Minimal	- Relatively more substantial, with relocation of informal dwellers
Construction of Structures	- Construction of substructures in the median space of two large bridges is considerably difficult. - Securing of traffic safety on at-grade R10 Road is required during construction.	- Relatively easier than Alternative-1.
South Port Accessibility	- Relatively worse than Alternative-2.	- Smooth and direct access is anticipated.
Traffic Disruption on Local Roads	- Large piers would decrease capacity of local roads causing traffic disruption.	- Marginal, if not positive, effect on traffic
Cost	- Relatively lower cost required	- Higher cost due to required long-span bridge
Evaluation	- Not Recommendable	- Recommendable

Figure 4.27 Consideration of Expressway Extension Southward



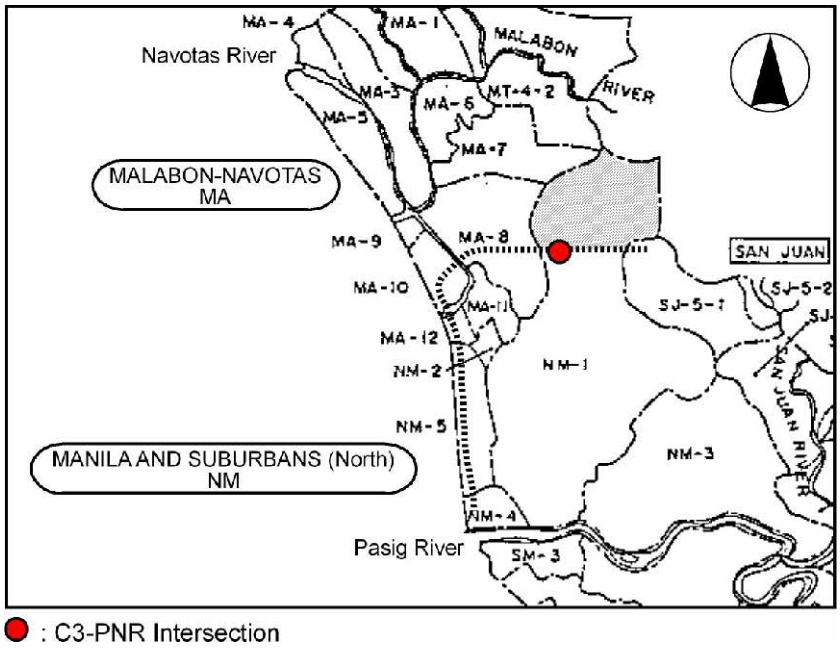
4.3.5 Mitigation Measures Against Flooding at C3-PNR Intersection

In accordance with the "Study on Flood Control and Drainage Project in Metro Manila" (JICA, March 1990), Metro Manila is divided into the following 10 subdrainage areas:

1.	Valenzuela	6.	Manila and Suburbs (North)
2.	Malabon-Navotas	7.	Manila and Suburbs (South)
3.	San Juan	8.	East of Manggahan
4.	Mandaluyong-Pasig	9.	West of Manggahan
5.	Marikina	10.	Parañaque-Las Piñas

The flood-prove area around PNR North on C-3 is located in the NM-1 subdrainage area of Manila and Suburbs (North), as illustrated in Figure 4.28.

Figure 4.28 Subdrainage Areas in the Study Area



Source: Extracted from Fig. 3.4-3 of "Study on Flood Control and Drainage Project in Metro Manila", JICA, March 1990

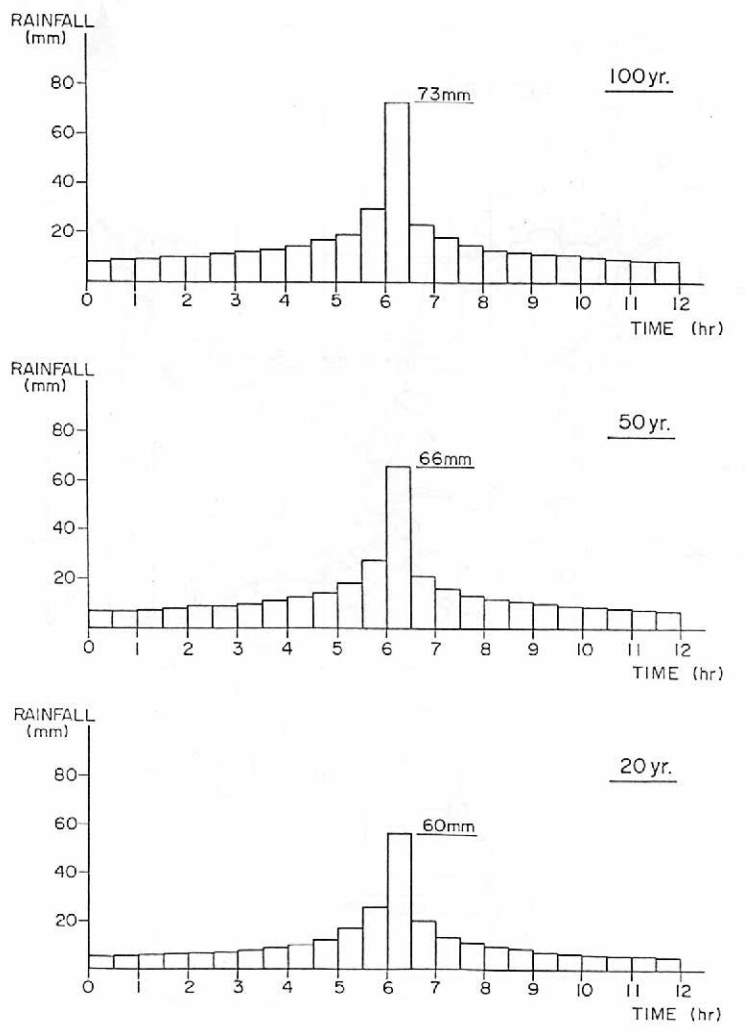
The JICA report estimated the probable discharge from each subdrainage area by referring to the design hyetograph at Port Area Gauge, which is illustrated in Figure 4.29. The catchment area of and probable discharge from NM-1 subdrainage area are as follows (see Table 4.11 for more information on the Manila and Suburbs (North) subdrainage area):

- Catchment Area: 1,679 ha
- Probable Discharge: 249.1 m^3/s in 10 years return period
- Runoff Coefficient: 0.70

It is noted that the above probable discharge represents the peak (maximum) discharge during flooding. Furthermore, since the assessment was conducted from the viewpoint of a road drainage system subjected to drainage from neighboring areas, ten years is adopted as the design return period. Based on the above information, the catchment area and the amount of probable discharge at the flooding area around PNR North on C3 are interpolated as follows:

- Catchment Area: 352.5 ha
- Probable discharge: 52.4 m^3/s (peak) in 10 years return period

Figure 4.29 Example of Design Hyetograph at Port Area Gauge



Source: Extracted from Fig. 3.4-2 of the "Study on Flood Control and Drainage Project in Metro Manila", JICA, March 1990

Table 4.11 Estimated Discharge from Subdrainage Areas

Name	Catchment Area	Runoff Coefficient	Probable Discharge (m3/s) in Flood Return Period						
			100 Years	50 Years	30 Years	10 Years	5 Years	3 Years	2 Years
Manila & Suburbs (North)									
NM-1	1,679	0.70	324.7	299.9	285.9	249.1	223.1	200.3	179.7
NM-2	36	0.67	16.6	15.1	14.3	12.3	11.1	9.9	9.1
NM-3	906	0.74	221.6	204.0	194.2	168.9	151.1	135.9	122.4
NM-4	69	0.73	27.1	24.7	23.4	20.3	18.3	16.3	14.9
NM-5	168	0.66	52.8	48.2	45.8	39.6	35.6	31.9	29.1

Note: Extracted from Fig. 3.4-4(1/2) of the "Study on Flood Control and Drainage Project in Metro Manila", JICA, March 1990

As seen in Figure 4.28, the flood in the subject area belongs to the NM-1 subdrainage area and flows into the Pasig River and its tributaries. It is understood that the flood drainage system in Metro Manila is being improved based on various studies, including the referred JICA report, thereby eliminating flooding in the area.

However, as the area of PNR North is concave between A. Mabini Street and the unacquired section on C3 around 500 m long, the area frequently suffers from flooding. It will be worthwhile to provide a flood drainage system along C3 to guide the flood water into the Navotas River.

Figure 4.30 illustrates a tentative flood drainage system along C3. This plan includes a raised C3 road formation height (maximum 2.3 m) and the installation of a one-meter diameter flood drainage pipe with a minimum of 0.5 m depth along C3 down to Navotas Bridge. The installation length will be around 1,700 m. Due to the terrain, the approach section of the drainage pipe will have a 0.3% grade.

Due to the gentle slope and influence of the Navotas River backwater, it is anticipated that the drainage capacity would not be sufficient to cope with the peak flood discharge. However, the duration to receive the peak flood discharge is quite short. Judging from the profile shown in Figure 4.30, the system was judged to be technically feasible. It is recommended that the C3 formation height be raised and the flood drainage facility along C3 down to Navotas River be installed during the implementation of the proposed expressway construction.

To realize this flood drainage system on C3, the following shall be noted in further studies:

- In case the PNR North, which is currently abandoned, is to be revived, the elevation of the railway tracks shall be raised to a certain length for it to cross the raised C3. The implementation of the proposed mitigation measures against flooding at the C3-PNR intersection may need the concurrence of both the PNR and the DOTC.
- The area along PNR North is a built-up area. Furthermore, the area within the PNR North ROW is occupied by informal dwellers. When the C3 formation height is raised to ease flooding, the upstream area may also need reclamation work to avoid a pond-like terrain. This reclamation work will affect private properties along the area and will also need relocation of informal dwellers. These issues will need cooperation from several governmental agencies including the Kalookan LGU.

The preliminary construction cost of the flood drainage system is in Table 4.12.

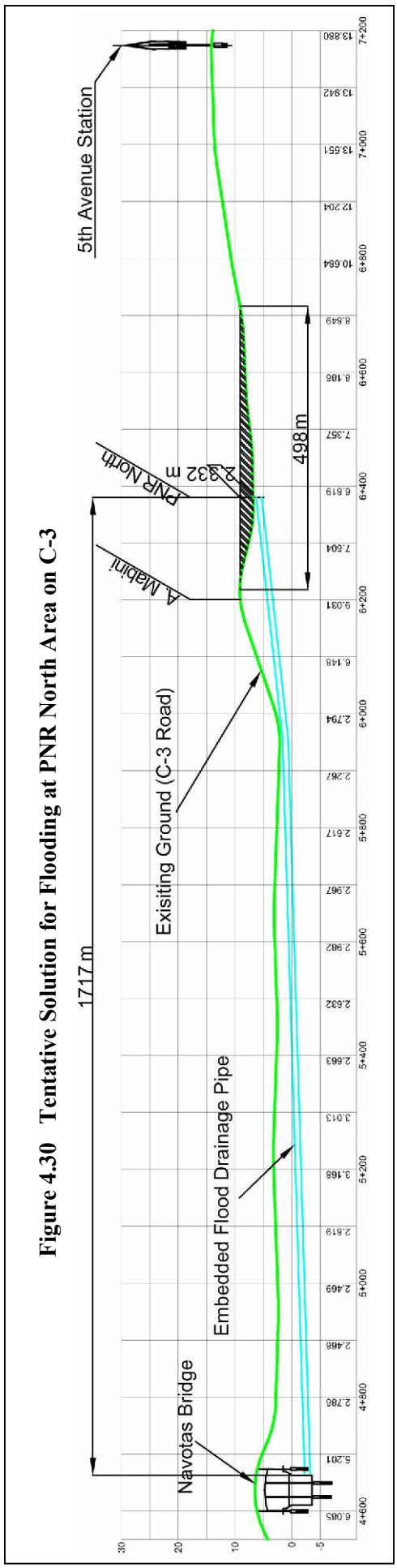


Figure 4.30 Tentative Solution for Flooding at PNR North Area on C-3

Table 4.12 Preliminary Construction Cost of the Flood Drainage System

Unit cost: mil ₱

Item	Quantity	Construction Cost
<1> Elevation of C3 Road Formation		
- Removal of Existing PCC Pavement	9,462 m^2	1.82
- Removal of Existing Sidewalk	4,980 m^2	0.75
- Earthwork for Road Embankment	17,960 m^3	3.59
- Base Course (t=20cm)	1,892.4 m^3	0.90
- PCC Pavement (t=23cm)	9,462 m^2	8.16
- Sidewalk	4,980 m^2	2.59
- Curb	1,992 m	1.16
- Retaining Concrete Wall	597.6 m^3	2.98
Subtotal 1		**21.95**
<2> Installation of Drainage Pipes		
- Excavation	8,785 m^3	1.72
- Sheet Pile Retaining Wall (l = 10m)	3,514 m	35.14
- Foundation Concrete	421.7 m^3	1.31
- Backfilling	6,983 m^3	1.60
- Concrete Pipe (f = 1.0m)	1,757 m	5.62
- Curb Inlet Manhole (every 50m)	35 units	0.65
Subtotal 2		**46.04**
Total		**67.99**

4.3.6 Study of Structures

The structures were studied based on the structure planning of the MMUES. In principle, the structure plans in the MMUES were not modified in terms of site and design conditions.

(1) Summary of the MMUES for the Case Study Section

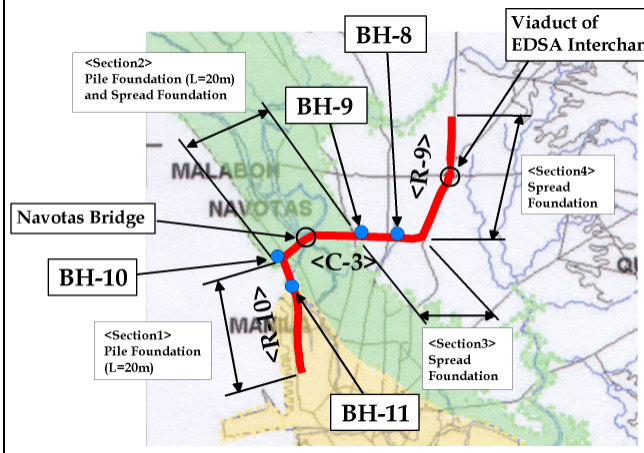
Design Standards in the MMUES

- Design Standard - Design Guideline Criteria and Standards (Philippines)
- National Structural Code of the Philippines, Volume II Bridges
- Standard Specification for Highway Bridges, AASHTO 1991 (as supplement)

Structures Adopted in the MMUES

- Superstructure: AASHTO standard types of PC I girders (span length: 30 m, 35 m and 40 m)
- Substructures: Several types of RC piers and abutment
- Foundation: Driven square RC piles (450 x 450 mm, 20 m depth) in seashore area (R10 and C3); Spread foundation in inland area (C3 and R9)

Figure 4.31 Arrangement of Foundations



<Section 1>
B.P. to Interchange R-10/C-3

Foundation: Driven Pile, 20m

<Section 2>
Interchange R-10/C-3 to
Interchange C-3/R-10(A)

Foundation: Driven Pile, 20m

<Section 3>
Interchange C-3/R-10(A) to
Interchange C-3/R-9

Foundation: Spread Foundation

<Section 4>
Interchange C-3/R-9 to E.P.

Foundation: Spread Foundation

(2) Typical Structures Adopted in this Study

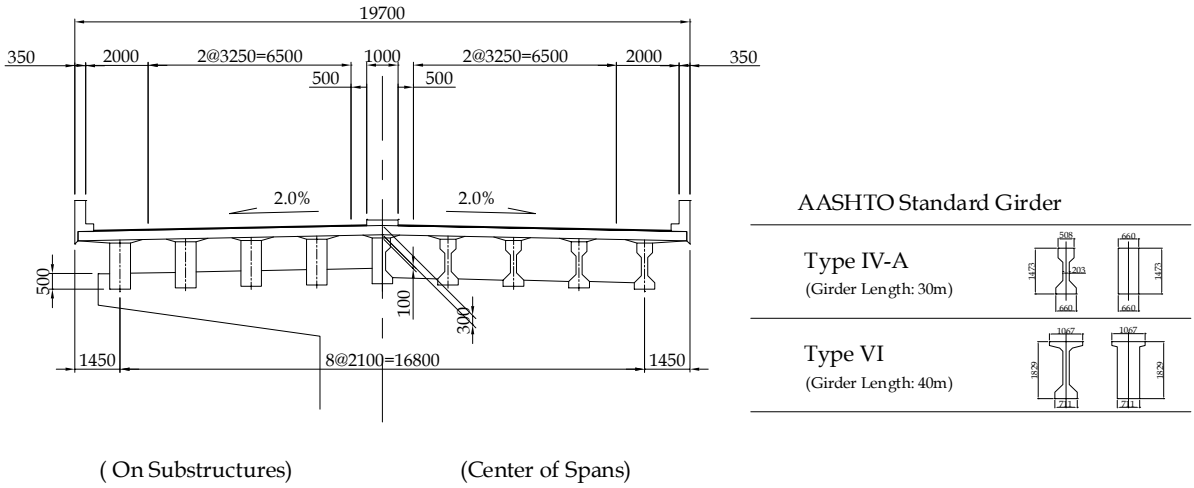
Superstructures

The AASHTO standard types of PC I girders were adopted with the following advantages:

- Familiar type of superstructure in the Philippines
- Easy fabrication at site
- Possibility of girder erection during daytime and nighttime
- Comparatively cheaper

Considering the alignment of expressways and the widening schemes of at-grade national highways, the span length with 30 m and 40 m was adopted. Cross-sections of several types of superstructures are illustrated in Annex E.

Figure 4.32 Typical Cross-section of an Expressway with AASHTO Girders



Substructures and Foundations

Substructures were planned as reinforced concrete structures, and their shapes were arranged and categorized according to the alignment of expressways and the widening schemes of at-grade national highways.

For planning the foundations, several data on soil properties were collected and reviewed. The collected data are summarized in Figure 4.33 and Table 4.13. Based on the data review, the depths of foundations in the MMUES were judged as adequate. The depths of the foundation for the Link Route to the MNT C5 Expressway were assumed as the same as those of R10 in its seashore area, i.e 20 m.

For the type of pile foundations, bored hole piles (ϕ1.0 m, 20 m depth) were adopted instead of driven piles (450 x 450 mm, 20 m depth), for the following reasons:

- Driven piles have less resistance against lateral forces caused by seismic forces because of the weak connecting structure of pile.
- The possibility of liquefaction in seashore areas including the expressway alignment was pointed out by the Philippine Institute of Volcanology and Seismology (PHIVOLCS). In this area, bored hole piles with higher resistance against lateral forces are preferable to driven piles.
- During the construction of driven piles, the driving hammer creates noise and vibration. Because of this, the DPWH EIAPO generally recommends the use of bored hole piles in Metro Manila.

The comparison of pile foundations was conducted with reference to "The National Structural Code of the Philippines, Volume II - Bridges", and the result is summarized in Figure 4.34. The categorized substructures and foundations are summarized in Annex E.

Figure 4.33 Soil Properties Data

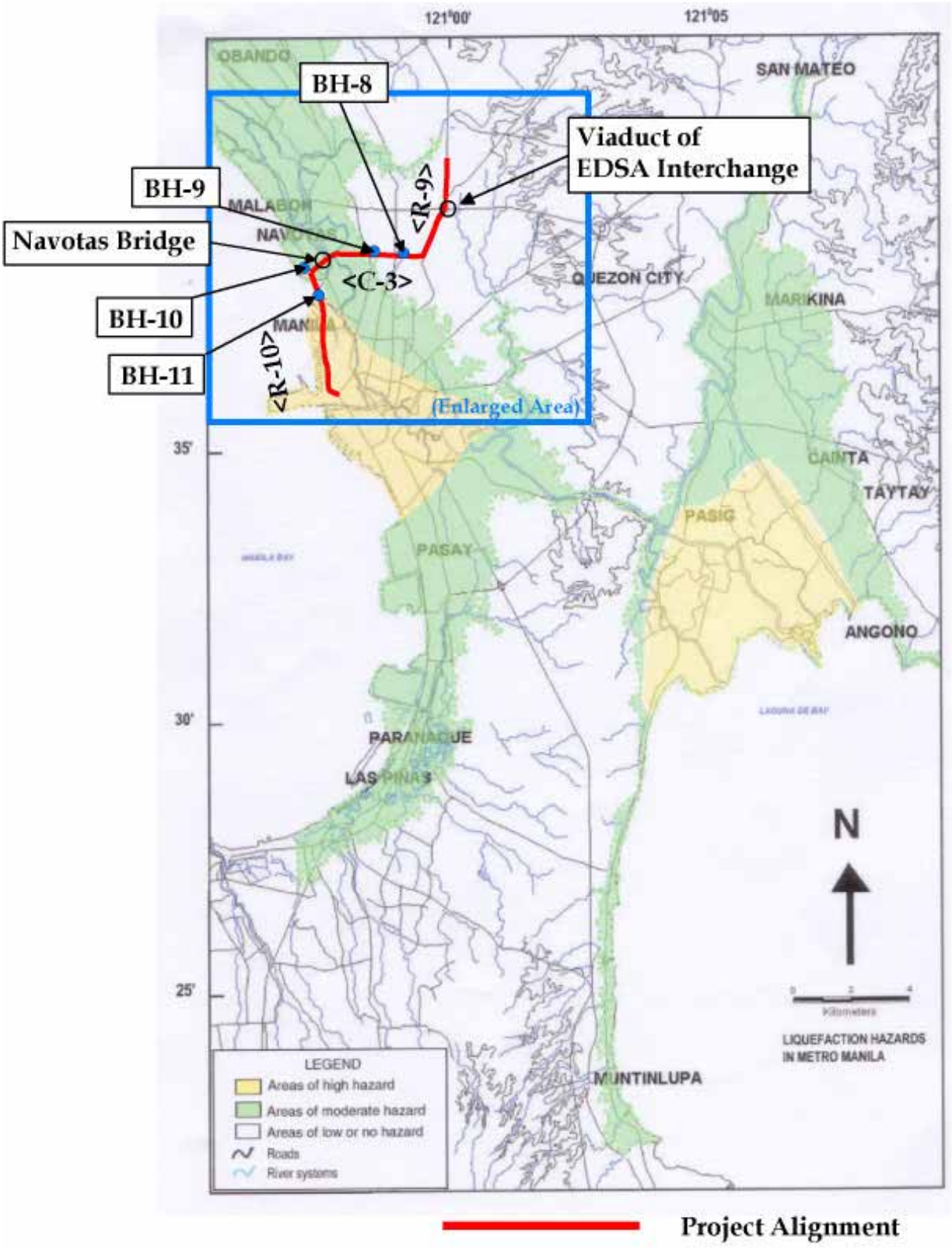


Table 4.13 Soil Properties Data

1) Boring Point (BH-8, 9, 10 & 11)

Resource: MMUES (1993)

The boring logs indicating soil properties and the depth of foundations were assumed in the MMUES.

2) Navotas Bridge (on C-3 Highway)

Resource: "Radial Road 10 and Related Roads Project, Phase II, Contract Package I, II, III, IV"

(Type of Foundation)

- 0.40x0.40, Prestressed Concrete Pile with 20m length
- Lowest level of pile caps: E.L. – 4.965
- Level of Pile Tip: E.L. - 24.965

3) Viaduct of EDSA Interchange (on R-9 Highway)

Resource: "Widening of Balintawak Bridge Project"

(Type of Foundation)

- Spread Foundation
- Level of the Bottom of Footing:

  About 4.5m below the surface of A. Bonifacio Ave., that is the crossing at-grade road under viaduct.
- Soil Properties and N-Values

  Not clearly described, but more than 50 of N values are indicated in the shallow level (about 1.5m ~ 5.0m) from the surface of A. Bonifacio Ave.

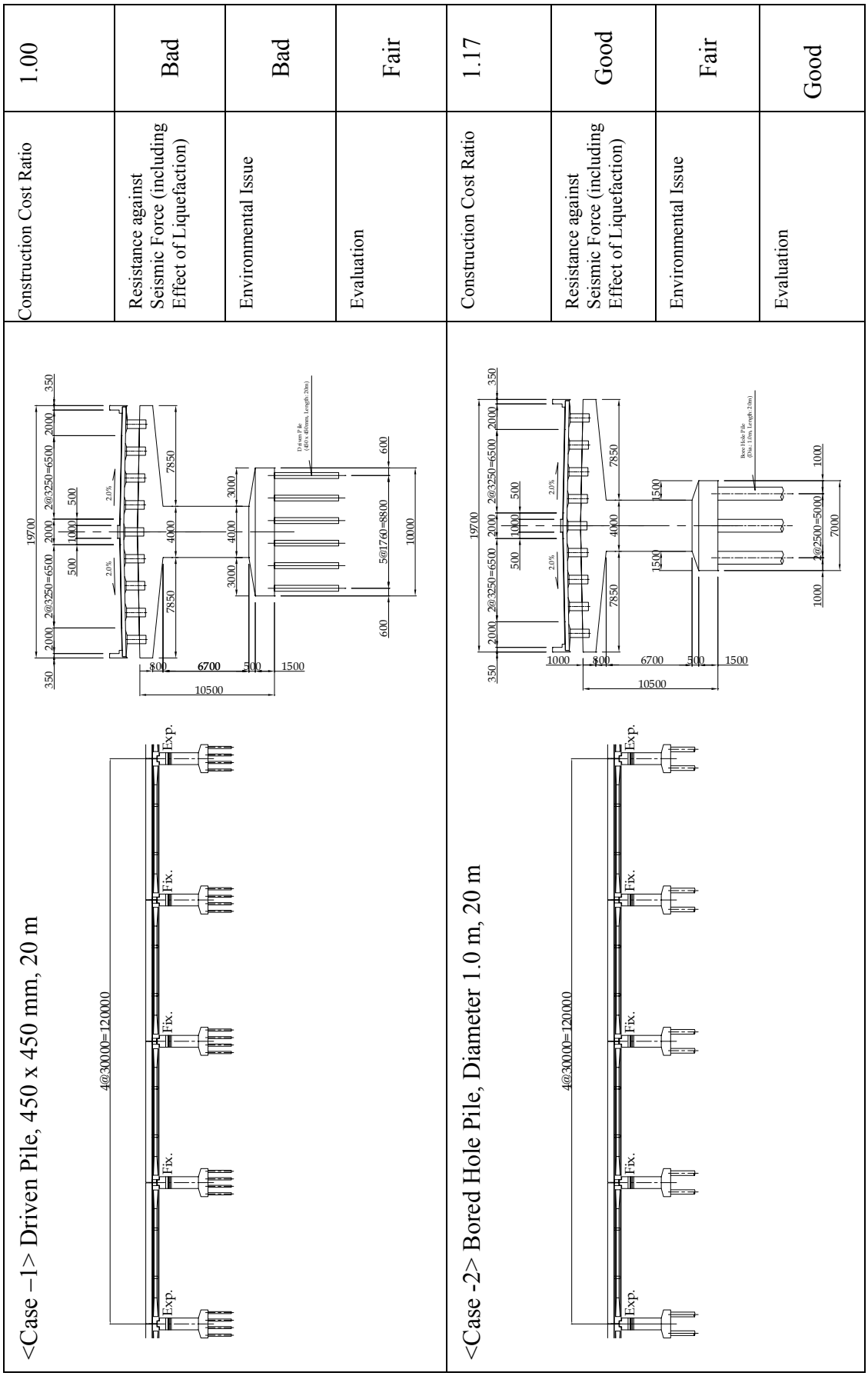
4) Liquefaction hazards Map in Metro Manila

Resource: Draft Report of "Evaluation of Liquefaction Hazards in Metro Manila" prepared in the PHIVOLCS

The base map of Figure 4.33 was quoted from that report, indicating the liquefaction susceptibility at 3 levels.

The susceptibility of liquefaction shown on this map is to be considered carefully for the review of foundations, especially in the seashore area (R10 and part of C3).

Figure 4.34 Comparison of Pile Foundations



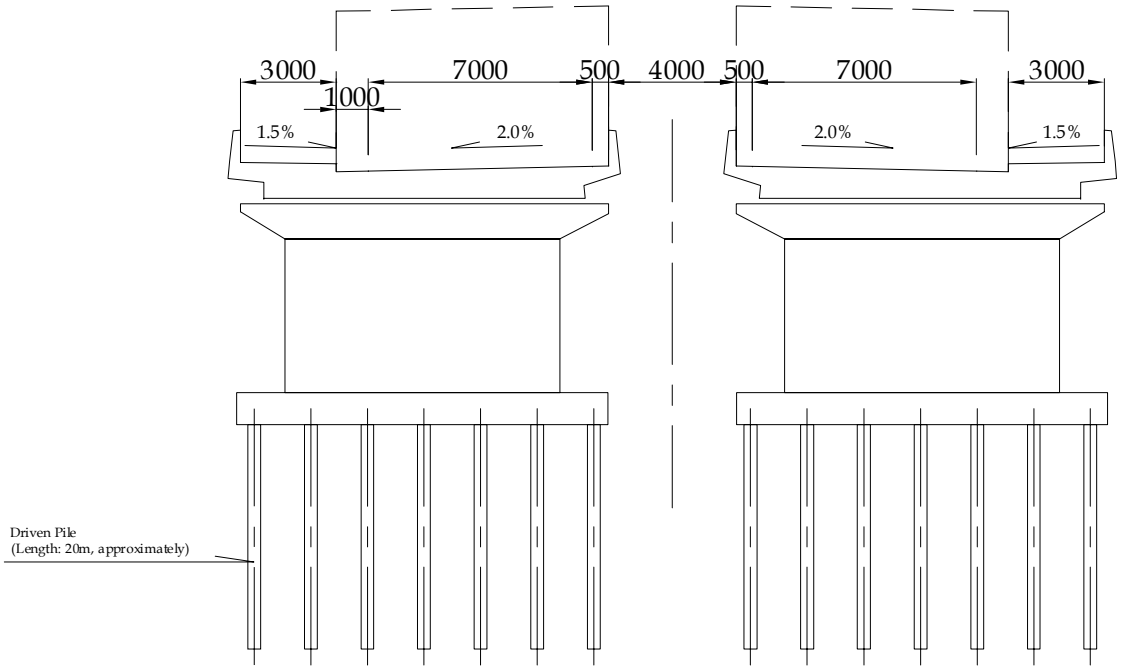
(3) Structures for Particular Crossing Facilities

The crossing facilities to be considered in structure planning are the Navotas River Bridge on C3 and the EDSA interchange and MRT 3 extension.

Navotas River Bridge on C3

As shown in Figure 4.35, the width of the central median of the Navotas River Bridge on C3 is 4.0 m.

Figure 4.35 Cross-section of the Existing Navotas River Bridge

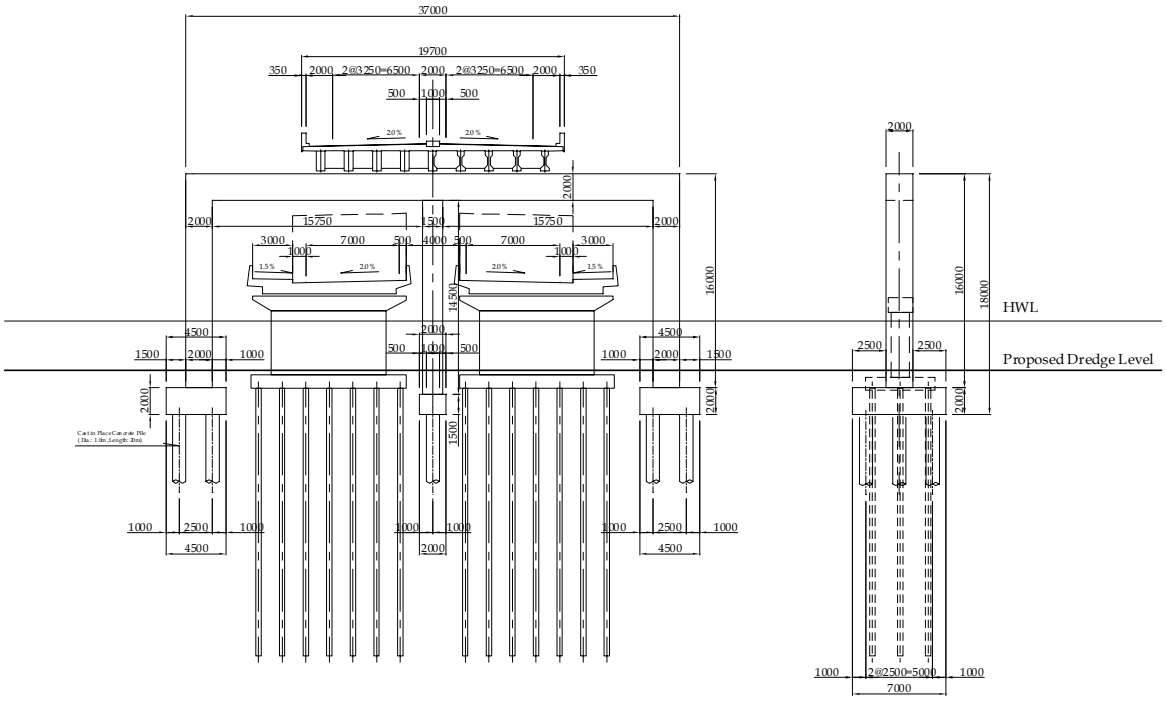


The horizontal alignment of the expressway is basically planned to follow the alignment of the existing at-grade highways, and consequently, the substructures are planned to be located at the central median.

Considering the narrow width of the central median of the Navotas River Bridge, the shape and allocation of piers need to be carefully planned.

The span arrangement and total bridge length of the Navotas River Bridge is 3 @ 24.0 m and 74.20 m, respectively. In case one long-span superstructure is used as an expressway bridge, the required span length will be more than 85 m, and the total construction cost will considerably increase. On the other hand, PC I girder is applicable as a superstructure in case the piers are allocated in the same location with the existing bridge, and it will result in savings of construction cost. Figure 4.36 illustrates the proposed type of substructure and foundation.

Figure 4.36 Proposed Substructure and Foundation for the Navotas River Bridge

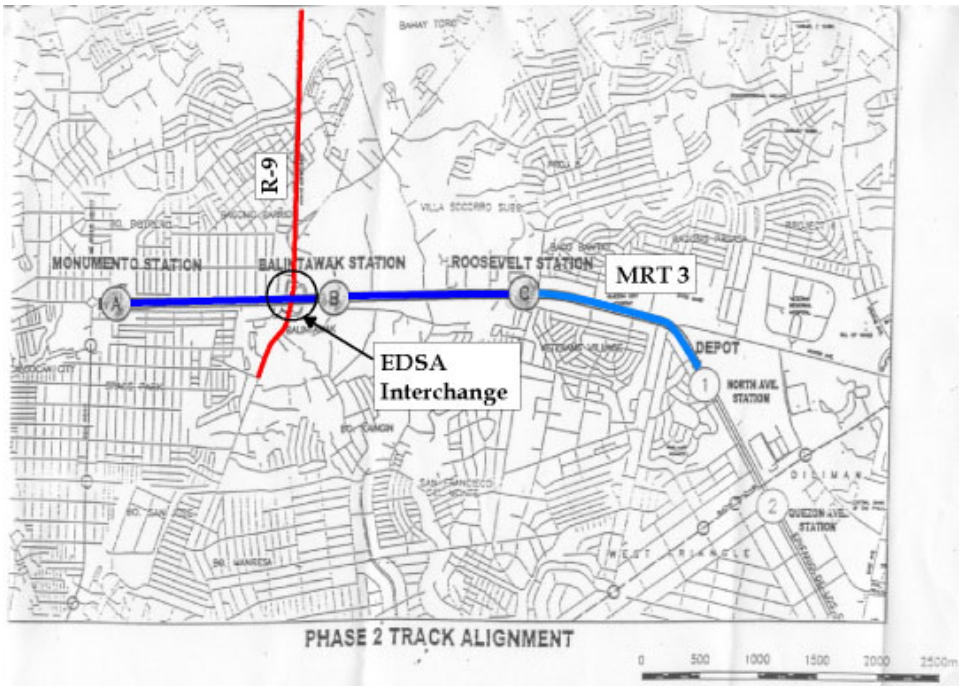


The bored hole piles and pier should be constructed carefully to prevent adverse impact on the piers of the existing bridge. Meanwhile, the cross beams of the substructure will be constructed in two stages with a temporary support bent installed between the superstructures of the existing bridge.

EDSA Interchange and MRT 3 Extension Scheme

As mentioned earlier, the DOTC has a plan to extend the MRT 3 to Monumento, and the proposed alignment will be located along EDSA (see Figure 4.37).

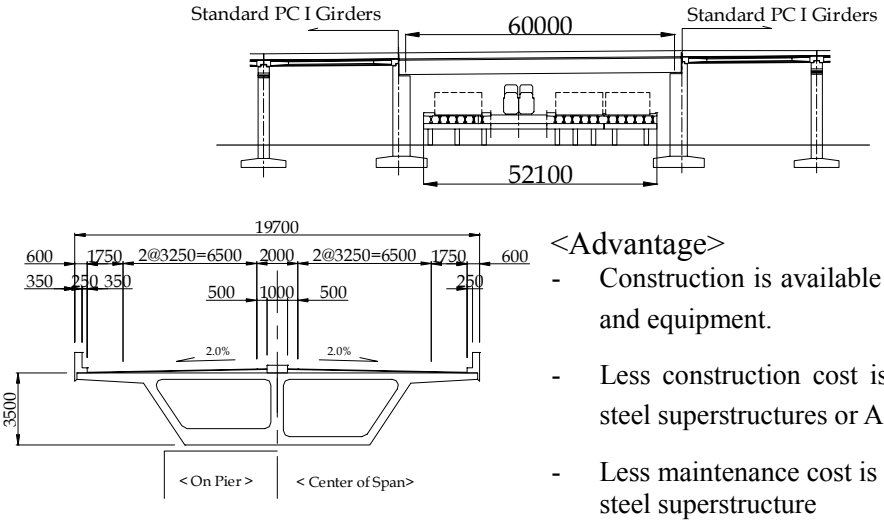
Figure 4.37 Extension Plan of MRT 3



According to the DOTC, the widening direction of the viaduct is planned in the north (direction of the NLE), and the installation of substructures for R9 expressway between two tracks of the MRT 3 is not acceptable. Consequently, the minimum required horizontal clearance will be 52.1 m, and the vertical clearance from the existing R9 highway will be approximately 14 m. Two alternatives are shown in Figure 4.38.

Figure 4.38 Alternatives of Expressway Viaduct over EDSA Interchange

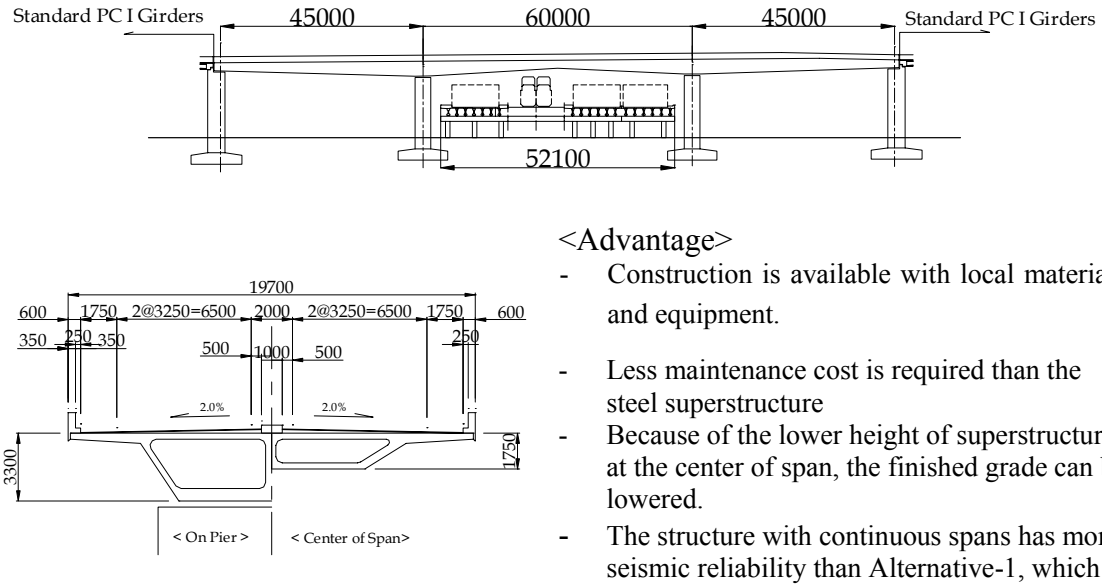
<Alternative 1, Single Span, 60 m of PC Box Girder>



<Advantage>

- Construction is available with local materials and equipment.
- Less construction cost is necessary than the steel superstructures or Alternative 2.
- Less maintenance cost is required than the steel superstructure

<Alternative 2, 3 Continuous Span PC Box Girder (45m + 60m + 45m)>



<Advantage>

- Construction is available with local materials and equipment.
- Less maintenance cost is required than the steel superstructure
- Because of the lower height of superstructure at the center of span, the finished grade can be lowered.
- The structure with continuous spans has more seismic reliability than Alternative-1, which is more important, considering that the viaduct is over the roads and railways.

Alternative 2 is recommended because of its reliability during seismic activity.

(4) Aesthetic Design

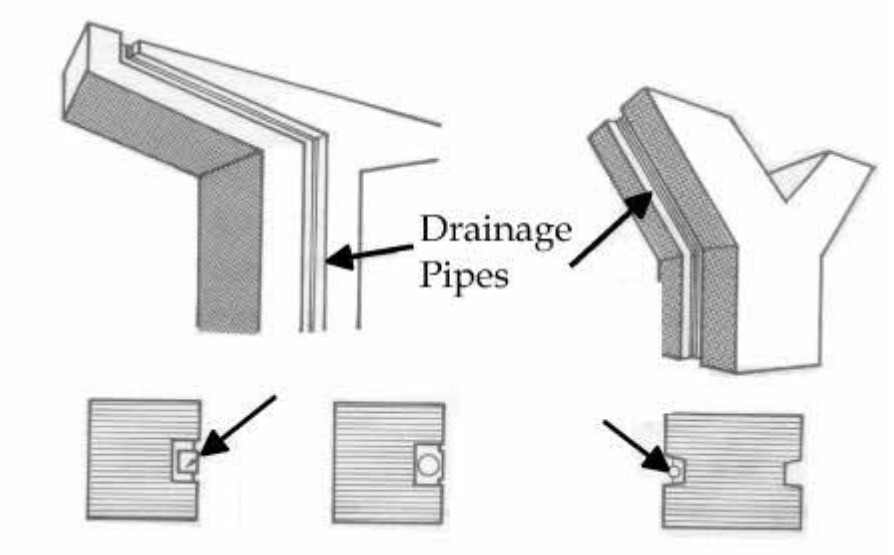
The following are ideas on aesthetic design suggested in the MMUES:

- Treatment of Side View of PC I Girder
- Integration of Coping and Girder

These ideas will mainly contribute in maintaining the continuity of the superstructures and reducing the feeling of suffocation among drivers on the at-grade highways under the expressway.

In addition to the above ideas, hiding the drainage pipes in the ground is suggested as shown in Figure 4.39. Exposure of drainage pipes on the surface of pier columns gives an unaesthetic look. Providing a slit along the pier columns and installation of the drainage pipes in it will solve the problem.

Figure 4.39 Location of Drainage Pipes



(5) Suggestion to Detailed Design

<u>Optimization of Span Length for Typical Structures</u>

The girder with a span length of 30 m was adopted as the standard in the MMUES wherever applicable. The span length of girders to be adopted without any requirement of horizontal clearance should be defined based on a comparison of the following items:

- Total Construction Cost: Including not only superstructures but also substructures and foundations
- Total Construction Period

In the MMUES, driven piles and spread foundations were applied. However, the driven piles are replaced with bored hole piles in this Study, because of their resistance to seismic activities and environmental friendliness during construction.

In case the types of foundation are modified, the optimum span length must be reconsidered. Because the bearing capacity of one bored hole pile is larger than that of one driven pile, differences in foundation quantities between 4@30-m spans and 3@40-m spans might be small. Accordingly, a 40-m span might be more cost-efficient because of the lesser number of needed substructures and foundations. This matter is to be considered in the detailed design stage, based on the detailed geological surveys.

Relocation of Power Lines and Other Miscellaneous Items

During the site survey, power lines along the edge of non-widened highways (R-10) or crossing of the highway alignment were observed. Road lighting poles on the central median of highways were also found. Their relocation according to the construction of the expressway should be discussed and agreed upon with the concerned organizations and/or departments during the detailed design stage.

4.4 Cost Estimates

4.4.1 Basic Conditions of Cost Estimates

(1) Project Execution Method

All the construction works of the project will be executed on a contract basis. The contractor will be selected through international tendering and will mobilize the construction equipment, materials and labor to be required for the works according to respective construction plans.

(2) Price Level

The price levels of the cost estimate were of July 2002. However, the cost of equipment was based on the *Equipment Guide Book of the Association of Construction Equipment Lessors Inc. (ACEL) 1998*, which is the latest publication.

(3) Currency of Cost Estimate

This cost estimate is in Philippine Peso for both foreign and local currency portions.

(4) Exchange Rate

The exchange rate applied to the cost estimate was **1.00 Philippine Peso = 2.36 Japanese Yen = 0.0198 US Dollar,** based on the selling rate of the Bangko Sentral ng Pilipinas as of July 2002.

(5) Existing Road Condition

The existing R10, C3, R9, andR10/C5 Link are planned to be widened and improved as per their respective ROWs. The widening and improvement will be completed up to the construction of the Case Study Expressway.

4.4.2 Unit Price Analysis

The unit price analysis of the direct construction cost of the Case Study Expressway was based on the following conditions for labor, equipment and material cost:

(1) Labor Cost

Labor cost includes wages and all fringe benefits, such as vacation/sick leave, bonuses, SSS contributions, Philhealth, and workmen's compensation. The wages adopted which are considered fair and equitable comply with the wage increase per Minimum Wage Law - R.A. 6727 as reflected in the latest Wage Order No. RB05-08, as summarized and detailed (see Table 4.14).

Table 4.14 Computation of Labor Rates

Unit: ₱

Description	Labor Cost Index	Basic Wage		Leave	Bonus	SSS	Medicare	Pag-IBIG	Employee Comp. Contrib.	Total per Month	Rate per Day	Rate per Hour
		Daily	Monthly									
Foreman	1.49	253.3	6,332.5	527.7	527.7	216.7	62.5	100.0	10.0	7,777.1	311.1	38.9
Asst. Foreman	1.42	241.4	6,035.0	502.9	502.9	200.0	62.5	100.0	10.0	7,413.3	296.5	37.1
Equipment Checker	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Skilled Labor	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Blaster	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Carpenter	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Mason	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Steelman	1.29	219.3	5,482.5	456.9	456.9	183.3	62.5	100.0	10.0	6,752.1	270.1	33.8
Unskilled Labor	1.00	170.0	4,250.0	354.2	354.2	150.0	50.0	100.0	10.0	5,268.3	210.7	26.3
OP Helper	1.00	170.0	4,250.0	354.2	354.2	150.0	50.0	100.0	10.0	5,268.3	210.7	26.3

Sources: National Wage Council; Department of Labor and Employment (DOLE); Social Security System (SSS); Phil. Contractors Association (PCA); Private Contractors, Civil Engineering Consultants and other related sources.

Note: Monthly wages based on 25 days per month, 8 hours per day
a. Leave, Vacation and Sick = Basic Monthly pay / 12
b. Bonus, 13th month pay = Basic Monthly pay / 12
c. SSS, Philhealth, Employees Compensation = Amount Representing Employers Contribution, Graduated Scale

(2) Equipment Cost

The rental rates for mechanical equipment were based on the *Equipment Guide Book of the Association of Construction Equipment Lessors Inc. (ACEL) 1998*. All rental rates included depreciation, cost of maintenance, fuel, lubricants, and the wages for each equipment operator. Rental costs for hourly equipment rate of the related major construction equipment are in Annex F.

(3) Material Cost

Materials will be procured from the current commercial market around Metro Manila, and the processed material will be supplied from existing plants near the construction site. The cost was estimated at July 2002 price levels.

(4) Unit Cost of Major Construction Items

The unit costs of major construction items were established by analyzing prevailing materials, labor and equipment prices as well as by referring to the approved agency estimates of recently bid projects. Table 4.15 shows the unit costs of major construction items (see Annex F).

Table 4.15 Unit Cost of Major Construction Items

Item No.	Description	Unit	Unit Price (₱)
Earth Work			
E 1	Excavation for Structures	m^3	196.1
E 2	Back Filling for Structures	m^3	228.9
E 3	Road Embankment	m^3	200.2
E 4	Temporary Sheet Pile for Retaining Wall (Type-4; L = 10 m) Unit : Retaining Wall Length	m	20,703.2
E 5	Removal of Existing Cement Concrete Pavement	m^2	191.6
Road Pavement Work			
R 1	Sub-base Course (t = 40 cm)	m^3	347.9
R 2	Base Course (t = 20 cm)	m^3	474.9
R 3	Asphalt Course (t = 10 cm)	m^2	627.4
R 4	Cement Concrete Pavement (t = 23 cm)	m^2	861.6
Concrete Structure Work			
S 1	In-situ Borehole Concrete Pile (diameter 1.0 m, with 3.0m steel casing)	m	28,624.1
S 2	Lean Concrete	m^3	2,795.2
S 3	Reinforcing Steel Bars, Grade 60	kg	30.3
S 4	Structure Concrete (Footing)	m^3	4,993.3
S 5	Structure Concrete (Columns, Coping)	m^3	5,841.0
S 6	Prestressed Concrete Girder (I-Shape Girder) (AASHTO type-4, Span-30m)	each	700,925.0
S 7	Structure Concrete (Diaphragm : Pre-stress)	m^3	6,022.5
S 8	Structure Concrete (Deck Slab, Curb & Parapet, Center Median)	m^3	5,606.4
S 9	Temporary Timbering for Coping Concrete Work Unit : Cubic Capacity of Temporary Timbering	m^3	463.0

4.4.3 Base Costs of Expressway Structures and Miscellaneous Items

(1) Direct Cost of Elevated Expressway Structure

The base costs of the elevated expressway were estimated to be divided into superstructure and substructure. The base costs of each structure, given from the Preliminary Design, are shown in Table 4.17 (see Annex F).

(2) Direct Cost of Miscellaneous Items

The miscellaneous base costs of expressway, which include pavement marking, road signs, lighting system, emergency and communications system, etc., were estimated for each traffic lane as shown in Table 4.16 (see Annex F).

Table 4.16 Base Costs of Miscellaneous Items Per Kilometer

Number of Lane	Unit	Unit Price (Mil. ₱)
1-traffic lane	km	7.99
2-traffic lane (without median)	km	12.80
2-traffic lane (with median)	km	18.15
4-traffic lane	km	22.59
5-traffic lane	km	23.50
6-traffic lane	km	24.06

(3) Direct Cost of Reconstruction for At-grade Road

Most of the substructures of the elevated expressway are located at the median of the at-grade road under the expressway. Following the construction of the substructure, remedial works, such as reconstruction of pavement and curbstone, will be necessary. The base cost of reconstruction for at-grade road was estimated at ₱8.60 million/km (see Annex F).

Table 4.17 Base Costs of Elevated Expressway Structure

Description	Unit	Unit Price (Mil. ₱)
Superstructure		
PC I-Girder : 1-lane (W= 6.20 m) 30m-span	span	3.85
PC I-Girder : 1-lane (W= 6.20 m) 40m-span	span	5.45
PC I-Girder : 1-lane (W= 6.70 m) 30m-span	span	3.92
PC I-Girder : 1-lane (W= 6.70 m) 40m-span	span	5.76
PC I-Girder : 2-lane (W= 9.95 m) 30m-span	span	5.24
PC I-Girder : 2-lane (W=12.20 m) 30m-span	span	6.46
PC I-Girder : 4-lane (W=19.70 m) 30m-span	span	10.77
PC I-Girder : 4-lane (W=19.70 m) 40m-span	span	15.26
PC I-Girder : 5-lane (W=22.95 m) 30m-span	span	12.13
PC I-Girder : 6-lane (W=32.20 m) 30m-span	span	16.65
PC Box-Girder : 4-lane (W=19.70 m) 45m-span	span	31.00
PC Box-Girder : 4-lane (W=19.70 m) 60m-span	span	42.06
Superstructure for Throughway		
Abut - 1 (30m-span)	each	6.30
Abut - 2 (30m-span)	each	2.85
Pier - 1 (30m-span)	each	3.56
Pier - 2 (30m-span)	each	10.83
Pier - 3 (30m-span)	each	6.54
Pier - 4 (30m-span)	each	13.91
Pier - 5 (30m-span)	each	10.68
Pier - 6 (30m-span)	each	9.30
Pier - 7 (30m-span)	each	11.26
Pier - 8 (30m-span) for Crossing Navotas River	each	19.40
Pier - 9 (30m-span)	each	8.83
Pier -10 (30m-span)	each	4.66
Pier -11 (30m-span)	each	5.57
Pier -12 (30m-span)	each	5.91
Pier -13 (30m-span)	each	5.20
Pier -14 (30m-span)	each	3.38
Pier -15 (30m-span)	each	6.30
Pier -16 (30m-span)	each	4.12
Pier -17 (30m-span)	each	7.40
Pier -18 (30m-span)	each	5.02
Pier -19 (30m-span)	each	5.53
Pier -20 (30m-span)	each	6.48
Pier -21 (30m-span)	each	7.13
Pier -22 for PC Box Girder of EDSA Flyover	each	7.62
Pier -23 for PC Box Girder of EDSA Flyover	each	6.72
Pier -24 (30m-span)	each	12.17
Pier -25 (30m-span)	each	15.86
Pier -26 (30m-span)	each	11.16
Superstructure for Ramp		
Abut - 1 (30m-span)	each	6.35
Abut - 2 (30m-span)	each	2.20
Abut - 3 (30m-span)	each	1.05
Pier - 1 (30m-span)	each	3.53
Pier - 2 (30m-span)	each	5.21
Pier - 3 (30m-span)	each	10.76
Pier - 4 (30m-span)	each	12.10
Pier - 5 (30m-span)	each	3.04
Pier - 6 (30m-span)	each	8.27
Pier - 7 (30m-span)	each	3.85

4.4.4 Construction Cost of the Case Study Expressway

(1) Direct Construction Cost

The direct construction cost of the Case Study Expressway, based on the preliminary engineering design of the case study, was estimated at ₱10,717.8 million using July 2002 prices as shown in Table 4.18. The case study route is divided into five segments, and the direct construction of each segment includes the main throughway and on/off-ramp. The details of each segment are in Annex F.

(2) Project Cost

The project cost of the Case Study Expressway is composed of the following items:

- Direct Construction Cost
- Indirect Construction Cost
- (Mobilization, Office administration, Overhead, Profit, Miscellaneous, etc.)
- Engineering Cost (Detailed design and construction supervision)
- Physical Contingency

Table 4.19 shows the project cost of the Case Study Expressway.

Table 4.18 Direct Construction Cost of the Case Study Expressway

Segment	Length (km)	Unit Cost (Mil. ₱)	Total Cost (Mil. ₱)
1. R-10 (from 0+000 to 3+406)	3.41	668.2	2,278.5
2. Junction : R10/C3 (from 3+406 to 4+773)	1.37	1,037.7	1,421.6
3. C3 (from 4+773 to 7+948)	3.18	642.1	2,041.7
4. Junction : C3/R9 (from 7+948 to 8+638)	0.69	574.0	396.1
5. R9 (from 8+638 to 11+300)	2.66	583.8	1,553.0
6. R10 Extension (from 3+908 to 8+164)	4.26	710.5	3,026.9
TOTAL	**15.56**	**688.8**	**10,717.8**

Table 4.19 Project Cost of the R10/C3/R9 Expressway

Description	Cost (Mil. ₱)
a) Direct Construction Cost of R10/C3/R9 Expressway	10,717.8
b) Indirect Construction Cost (8.0 % of Direct Construction Cost)	857.4
c) Engineering Cost (7.0 % of Direct Construction Cost)	750.3
d) Physical Contingency (10.0 % of Direct Construction Cost)	1,071.8
TOTAL CONSTRUCTION COST :	**13,397.3**
VAT (Value Added Tax) (10.0% of Total Construction Cost)	**1,339.8**

4.4.5 Resettlement Costs of the Case Study Area

An understanding of the social issues and community concerns was derived from focus group discussions (FGDs), key informant interviews and a review of past studies. Details of the FGDs are provided as Annex G. It must be noted that due to limited time for this study, no structured social survey was conducted in the case study area. Therefore, the Study Team recommends that a socioeconomic survey be undertaken further before the implementation stage.

(1) ROW Acquisition and Scale of Affected Families

The Case Study Expressway will require about 15.5 kilometers of ROW at a 20-meter width, necessary for road widening and the Skyway. Within the proposed ROW, an identified number of informal and formal dwellers are settled. The Census and Tagging conducted by the URPO in 1996-1997 showed the magnitude of the project-affected families (PAFs) households in the vicinity of R10 as presented in Table 4.20.

Table 4.20 Scale of PAFs in R10/C3/C5 Link

Section		Estimated No. of Affected Households	Status
Kalookan (C3 5th Ave.)		62	For expropriation
R-10		9,100	For resettlement - ongoing
R10/C5 Link		3,500	For resettlement
	Bgy Longos, Malabon	319[1]	For resettlement
	Bgy 8, Kalookan	None[2]	For priority development
Total		**12, 981**	

Sources: URPO, Bgy Tonsuya, and Kalookan City LGU
Note: Estimated by the Study Team based on a 1996 photo of the area
Only one warehouse will be affected

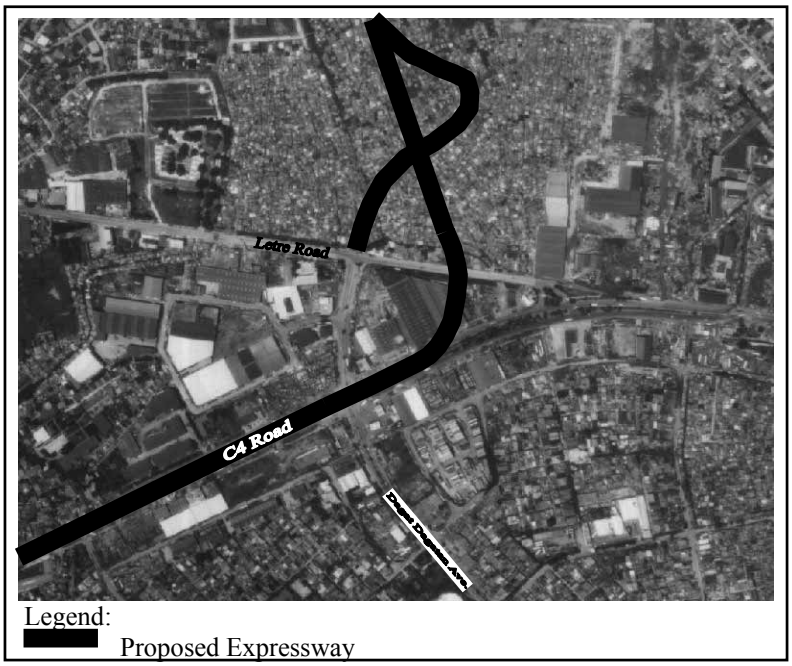
The table indicates that about 12,981 households or PAFs will be affected within the case study area. Assuming an average size of six per family, the total project-affected persons (PAPs) would be about 77,886. Of these, 62 households (about 0.51%) are formal dwellers and 12,919 (about 99.5%) are informal dwellers.

Informal Dwellers

The URPO estimated that while the 1996-1997 census showed that 9,100 PAFs are settled within the R10, 40-50% of these are renters. Thus, in terms of relocation planning, only 4,550 (50%) families are considered for relocation. They are covered by the moratorium specified in UDHA, Section 2 of RA 727. The other half of the PAFs is composed of families not covered by the moratorium and who have constructed their houses after the effectivity of the UDHA on 28 March 1992.

There is no data on the number of renters on the C5 Link. However, based on current trends, the barangay office estimated it to be about 20% of the population, or 700 PAFs. Thus, on the C5 Link an estimated number of about 2,800 are assumed to be covered by the UDHA's moratorium. Besides this group, about 319 more PAFs are in Barangay Longos in Malabon (see Figure 4.40).

Figure 4.40 Proposed Expressway Alignment in C-5 Link (R-10 Extension)



(2) Resettlement Site

The National Housing Authority (NHA) is the government agency mandated to address the provision of socialized housing programs. The DPWH assists in acquiring land for resettlement. While efforts of the Government to provide in-city resettlement are being considered, there is no available land within the city to resettle the large influx of squatters in Metro Manila. Thus, most government resettlement sites are off-city. The proposed resettlement site for the PAFs within R10 is in Bitungol, Norzagaray, Bulacan, about 65 kilometers from Metro Manila, which is rather far from the people's economic activities and will require additional budget for transportation cost. Presently, some families are being resettled to this area. The resettlement site is about 32 hectares and has the following features:

- Concrete paved road
- Available basic infrastructure facilities such as water system, electricity, barangay halls, public toilets, health centers, school, etc.
- Available core house and plots

There are about 5,000 available plots in this area, but a number of these have already been utilized by the NHA for the KAMANAVA flood control project. According to the URPO, this site can still accommodate the 4,550 PAFs from R10.

The affected families on the C5 Link have not been considered in the resettlement provision yet. In consultation with the barangay officials of Bgy. Tonsuya and the LGU, the development of Tanza as a potential resettlement site for the PAFs is being

proposed to avoid economic dislocation. The NHA has also recommended that a feasibility study of Tanza as a resettlement site be explored, as this is the place nearest to Metro Manila and its area of about 900 hectares could potentially solve the resettlement problem of the Project. However, a major constraint is the lack of fund to develop the land. Another constraint is that Tanza is a sunken land, a former fishpond, which would require in-filling of land to make it usable. According to the NHA, another sunken land which was developed as a resettlement site is Dagat-dagatan Island. Although this area gets flooded especially during the rainy season, the site is generally acceptable and early resettled people still remain in this area. Tanza's advantage is that it is the people's choice and the owner is willing to sell the land for a reasonable cost. According to the URPO, a consulting firm, PROS, is currently conducting a study on the feasibility of Tanza as a resettlement site.

(3) Resettlement and Compensation Requirement

According to the URPO, the land needed to resettle a family is about 40 square meters. This implies that about 12 hectares of land is needed to resettle the 2,800 PAFs on the C5 Link. The development of a resettlement site requires an additional 20% of land for road and infrastructure facilities, thus the total land required would be about 14.4 hectares. The estimated cost per family by category of resettlement packages is presented in Table 4.21.

Table 4.21 Estimated Cost of Resettlement by Category

Category	Cost of Land	Cost of Unit and Land	Example of Site
Lot only	₱52,000 (40 sq m)		Bitungol, Norzagaray
Lot and Core House		₱73,122.59	Bitungol, Norzagarya
House and Lot		₱124,000-278,000	Pabahay 2000
Row House		₱165,000	Kasiglahan Village, Montalban

Source: URPO

RA 8974 and UDHA govern the policy on ROW acquisitions, land evaluation and compensation. In the case of expropriation, the DPWH shall negotiate with the owners for a fair and just compensation, which is usually based on the current market value at replacement costs. Along C3 the zonal value determined by the Bureau of Internal Revenue (BIR) is much higher than the assessed value by the City Assessor. Examples of some selected areas are shown in Table 4.22.

Table 4.22 Variations in the Cost of Land by Area

Unit: ₱/sq.m

Area	BIR Zonal Value (March 24 1997 /sq m)	City Assessor Market Value (Kalookan City)
Kalookan City (5th Ave.)	P13,000	P2,750
D. Aquino St.	P9,100	P2,350
P. Sevilla	P12,000	P2,750
C. Cordero	P14,430	P2,750
Area	**Residential**	**Commercial**
R10	3,500	20,000
C5 Link	3,500	20,000
R9/C3	8,000	20,000

An inventory and estimates on compensation cost of properties (land and improvement) for expropriation ion 5th Avenue are provided as Annex H.

In Barangay Longos, Malabon, the zonal values based on the BIR's third revision ranges from ₱1,300 to ₱4,035/sq m for residential land, about ₱3,600 to ₱7,200/sq m for commercial land and ₱5,700 to ₱7,200/sq m for industrial land (see Table 4.23).

Table 4.23 Zonal Values of Real Properties in Bgy Longos, Malabon
Department Order No. 42-98 (1998)

Street / Subdivision	Vicinity	Classification *	3rd Revision ZV/sq m	2nd Revision ZV/sq m	1st Revision ZV/sq m
Adalla	Gen Borromeo-End	RR	4,320.00	3,600.00	3,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Alupihang Dagat	Solomon-Maya Maya	RR	1,440.00	1,200.00	1,000.00
	Interior	RR	1,300.00	1,080.00	900.00
Azucena	Gen Borromeo-End	RR	4,320.00	3,600.00	3,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
C-4 Road	Mal-Cal Bdry	CR	7,200.00	6,000.00	5,000.00
	Interior	CR	5,760.00	4,800.00	4,000.00
	Gen Borromeo	I	7,200.00	6,000.00	5,000.00
	Interior	I	5,760.00	4,800.00	4,000.00
Camia	Gen Borromeo-Rosal	RR	4,320.00	3,600.00	3,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Champaca	Gen Borromeo-Campupot	RR	4,320.00	3,600.00	3,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Cruz	Gen Borromeo-End	RR	4,320.00	3,600.00	3,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Dagat-Dagatan Ave	Letre-Lapu Lapu Ave	CR	4,320.00	3,600.00	3,000.00
	Interior	CR	4,032.00	3,360.00	2,800.00
Dalagang Bukid	Lapu Lapu-Tanigue	RR	2,880.00	2,400.00	2,000.00
	Interior	RR	2,160.00	1,800.00	1,500.00

Cont'd… Table 4.23 Zonal Values of Real Properties in Bgy Longos, Malabon
Department Order No. 42-98 (1998)

Street / Subdivision	Vicinity	Classification *	3rd Revision ZV/sq m	2nd Revision ZV/sq m	1st Revision ZV/sq m
Gen Borromeo	Rizal Ave-End	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Halaan	Pla Pla-Hasa Hasa	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Hasa Hasa	Lapu Lapu-Langaray	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Hiwas	Hasa Hasa-Pla Pla	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Jasmin	Gen Borromeo-End	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Kabya	Maya Maya-Solomon	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Kaligay	Solomon-Pampano	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Kampupot	Azucena-Champaca	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Kitang	Labahita-Dalagang Bukid	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Labahita	Lapu Lapu-Langaray	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Langaray	Pla Pla-Dalagang Bukid	RR	3,600.00	3,000.00	2,500.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Lapu Lapu	D Dagatan-Dalagang Bukid	RR	4,035.00	3,360.00	2,800.00
	Interior	RR	3,600.00	3,000.00	2,500.00
Martinico	Lapu Lapu Ave-End	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Maya Maya	D Dagatan-Martinico	RR	3,600.00	3,000.00	2,500.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Pampano	Solomon-Langaray	RR	3,600.00	3,000.00	2,500.00
	Interior	RR	2,880.00	2,400.00	2,000.00
	Interior	RR	2,880.00	2,400.00	2,000.00
Rizal Ave Ext	Tonsuya-Letre	RR	4,035.00	3,360.00	2,800.00
	Interior	RR	3,600.00	3,000.00	2,500.00
	Tonsuya-Letre	CR	4,320.00	3,600.00	3,000.00
	Interior	CR	3,600.00	3,000.00	2,500.00
Rosal	Rizal Ave-Camia	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Salmon	Maya Maya-Pampano	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Sampaguita	Borromeo-Campupot	RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00
Tanigue	Dalagang Bukid-Labahita	RR	3,600.00	3,000.00	2,500.00
	Interior	RR	2,880.00	2,400.00	2,000.00
All Other Streets		RR	2,160.00	1,800.00	1,500.00
	Interior	RR	1,440.00	1,200.00	1,000.00

Source: BIR
* Classification: RR-Residential Regular, RC-Residential Condominium, CR-Commercial Regular, I-Industrial

In Barangay 8, Kalookan City, most of the lands are classified as Area for Priority Development (APD) (see Table 4.24).

Table 4.24 Zonal Values of Real Properties in Barangay 8, Kalookan City
Department Order No. 42-98 (1998)

Street / Subdivision	Vicinity	Classification
Gen. San Miguel		APD
Felipe West	S Miguel Brgy. 8 & 12	APD
Fili West	Buklod Nayon Felipe	APD
Noli West	Buklod Nayon Felipe	APD
Buklod Ng Nayon	Sn Miguel deadend	APD
All Other Streets	-	APD

Source: BIR

(4) Estimate of ROW Cost

The estimates of ROW costs are indicated in Table 4.25. They vary depending on barangay classification and land category. It must be noted that the ROW length on C3/R9 was reduced by 1.8 km, the ROW cost of which has been incorporated in the compensation cost for land and structures of the 62 affected landowners. The estimates of ROW costs used for this Study were based on the assessed value categorized as residential. Since the land area that will be affected by the alignment in Barangay Longos in Malabon, about 3,168 sq m, was flood-prone being a former fishpond, land cost was placed at ₱ 1,300/sq m, the lowest zonal valuation in Table 4.23.

Table 4.25 Estimate of ROW Cost

Area		Length (km)	Size[1] (sq m)	Unit Cost[2] (₱/sq m)	Total Cost (₱)	Classification
R10		3.30	66,000	3,500	231,000,000	Residential (government land)
C3/R9		7.19[3]	143,800	none	none	Gov't land (existing road)
R10/C5 Link		4.30	86,000	3,500	301,800,000	Residential
	Bgy Longos, Malabon		3,168[4]	1,300	4,118,400	Residential
	Bgy 8, Kalookan				none	APD
Total					**536,918,400**	

Note: [1] Expressway length is multiplied by 20-m ROW width.
[2] Land cost is based on BIR's zonal valuation (see Table 4.23).
[3] Total length is 8.99 km less 1.8 km (C-3). On R-9, the expressway will not need ROW as it will be constructed in the middle of the existing road.
[4] Estimated by the Study Team

(5) Replacement Cost

Based on RA 8974 Section 10 (Valuation of Improvements and/or Structures: pursuant to Section 7 of the Act), the Implementing Agency shall determine the valuation of the improvements and/or structures on the land to be acquired using replacement cost methods. The replacement cost of the improvements/structures is defined as the amount necessary to replace the improvements/structures based on the current market prices for materials, equipment, labor, contractor's profit and overhead, and all other attendant costs associated with the acquisition and installation in place of the affected improvements/structures. In the valuation of the affected improvements/structures, the Implementing Agency shall consider, among other things, the kinds and qualities of materials/equipment used, the location, configuration, and other physical features of the properties, and prevailing construction prices (see Annex I for an example of an actual replacement costing).

Before RA 8974 took effect in 2001, the system used to obtain replacement costs was through the schedule of values for improvement as shown in Table 4.26. For purposes of estimating the replacement cost, this was the method used in Table 4.27.

Table 4.26 Schedule of Base Unit Construction for Building & Other Improvements

Unit: ₱/sq m

Type*	Residential Condo	Commercial Condo	Hotel	Theater, Conventional Hall and Auditorium	Hospital
IA	15500-16000	14200-14700	13700-14200	13200-13700	12700-13100
IB	14500-15000	13200-13700	12700-13200	12200-12700	11900-12300
IC	13500-14000	12200-12700	11700-12200	11200-11700	11100-11500
IIA	11500-12000	10200-10700	9700-10200	9200-9700	9100-9500
IIB	10500-11000	9200-9700	8700-9200	8200-8700	8300-8700
IIC	9500-10000	8200-8700	7700-8200	7200-7700	7500-7900

Type*	Apartelle / Apartment Bldg.	Office Bldg. / Bank	Cathedral / Church / Chapel	Restaurant	Funeral Parlor
IA	12200-12600	11800-12200	11400-11800	10700-11000	10500-10800
IB	11400-11800	11000-11400	10600-11000	10100-10500	9800-10100
IC	10600-11000	10200-10600	9800-10200	9400-9700	9100-9400
IIA	9000-6400	8700-9100	7900-6300	7800-8100	7300-7600
IIB	8200-8600	7900-8300	7100-7500	7400-7700	6600-6900
IIC	7400-7800	7100-7500	6300-6700	6600-7000	5900-6200
IIIA	-	-	-	5400-6000	4600-520

Type*	Schools	One Family Dwelling	Gasoline Station	Duplex / Townhouse	Car Park Bldg.
IA	10100-10400	9700-10000	9200-9500	8700-9100	8600-9000
IB	9400-9700	9000-9300	8500-8800	8000-8300	7900-8200
IC	8700-9000	8300-8600	7800-8100	7300-7600	7200-7500
IIA	6900-6500	6600-7000	6600-6900	5800-6100	5600-6000
IIB	6200-6500	5900-6200	5900-6200	5100-5400	4900-5200
IIC	5500-5800	5200-5500	5200-5500	4400-4700	4200-5400
IIIA	3900-4300	3600-4000	-	3500-3800	-

Cont'd… Table 4.26 Schedule of Base Unit Construction for Building & Other Improvements

Type*	Supermarket / Shopping Bldg.	Motel	Accessoria Row House	Cold Storage	Gymnasium / Recreational Cockpit
IA	8500-8900	8200-8500	8000-8400	7800-8000	7750-8000
IB	7800-8100	7500-7800	7300-7600	7100-7400	7000-7300
IC	7100-7400	6800-7100	6600-6900	6400-6700	6300-6600
IIA	5600-5900	5300-5500	5000-5300	4900-5200	4800-5100
IIB	4800-5300	4600-4900	4300-4600	4200-4500	4100-4400
IIC	4100-4600	3900-4200	3600-3900	3500-3800	3400-3700
IIIA	-	3000-3300	2900-3200	-	2700-3000

Type*	Boarding House / Convent / Dormitory	Hangar Industrial Bldg.	Accessory Bldg. N/ Laundry / Guardhouse / Servants Qtr	Market	Factory
IA	7300-7500	7200-7500	7100-7400	6700-7000	5900-6200
IB	6500-6900	6500-6800	6400-6700	6000-6300	5200-5500
IC	5900-6200	5800-6100	5700-6000	5300-5000	4500-4800
IIA	4400-4700	4300-4600	4200-4500	4100-4400	3800-4100
IIB	3700-4000	3600-3900	3500-3600	3600-3700	3200-3500
IIC	3000-3300	2900-3200	2800-3100	2900-3000	2500-2600
IIIA	2400-2700	-	2300-2600	2200-2500	1800-2100

Type*	Warehouse	Open Shed	Swimming Pool per Cu. M.
IA	5700-6000	4000-4800	4700
IB	5000-5700	4000-4200	-
IC	4300-4600	3500-3700	-
IIA	3400-3700	3000-3100	-
IIB	2800-3200	2400-2600	-
IIC	2200-2400	1000-2100	-
IIIA	1700-2000	1400-1700	-

Source: Assessor's Office (Municipality of Malabon)

Note: * I. Reinforced Concrete:
- A. Structure steel and reinforced concrete column, beams, the rest same as IB
- B. Columns, beams walls, floors and roofs all reinforced concrete
- C. Same as B but walls are hallow blocks reinforced concrete or tiles roofing

II. Mixed Concrete:
- A. Concrete columns, beams and walls but wooden floor joists, flooring are roof framing and G.I roofing; even if walls are CHB, kitchen and T & B are in reinforced concrete slabs.
- B. Concrete columns and beams – but hollow block walls and G.I roofing.
- C. Concrete columns and wooden beams, hollow block walls wooden floor joists, floor and roof framing and G.I roofing and second floor wooden walls.

III. Strong Materials:
- A. First group wooden structural framings, floorings walls and G.I. roofing
- B. First group wooden structural framing, flooring walls, on the first floor, and tanguile walls on the second floor and G.I. roofing.
- C. First group wooden post, girders, girsts, windowsill and head, apitong floor joist and roof framing, tanguile floor and sidings and G.I. roofing.
- D. Third group wooden structural framings, floorings and sidings and G.I. roofing.
- E. Same as D but structural members are substandard.

Most of the structures of the estimated 319 households that will be affected by the alignment in Barangay Longos, Malabon, are of mixed concrete and wood. According to the Assessor's Office of Malabon, these houses, measuring about 9 sq m, cost ₱7,000/sq m. For this area alone, the estimated replacement cost is about ₱20.1 million as shown in Table 4.27.

Table 4.27 Replacement Cost

Type of Structure	Number of Households	Replacement Cost[1] (₱/sq m)	Cost / Household[2] (₱)	Total Replacement Cost (₱)
Mixed	319	7,000	63,000	20,097,000

Note: [1] Based on the Schedule of Base Unit Construction Cost for Building and Other Improvements in Pesos per Square Meter, Assessor's Office, Municipality of Malabon.
[2] For a floor area of 9 sq m

(6) Assessment of Social Impact

Potential Number of Affected Families/Beneficiaries

The potential number of project beneficiaries is huge as they generally cover the whole commuters and road users of Metro Manila and other areas.

The total population of PAPs is estimated to be over 75,000. The adverse effect of resettlement on this population can be mitigated by sound resettlement planning and carried out according to established policy guidelines. Effective resettlement planning is expected to improve the quality of life of affected persons.

Diversity of Client Group

Within the case study area, the client group is very diverse in terms of living conditions, education, skills, attitude to government's projects, social affiliations, and preference for relocation. This implies that solutions have to provide options taking into account varying needs. The living conditions of informal dwellers of R10 is a picture of extreme poverty. Houses are usually made of scrap materials. The average income of families is about ₱6,000-7,000 per month. This is way below the poverty threshold for a family of six in Metro Manila, which is ₱ 14,299 as set by the NEDA. Any program to address resettlement needs to consider affordability by the people.

Preference for Location as an Economic Choice

Majority of the informal dwellers on R10 and on the C5 Link are migrants from various parts of the country. They come to Manila to find employment. While some are waiting to find jobs, the most practical way of living is by renting or squatting in an affordable or rent-free land. The squatter settlement offers them the following privileges:

- It offers flexibility and ease of entry
- It is affordable
- Land is free and putting up a temporary structure is manageable
- It is near the source of employment whether casual or regular

Demand for Fair and Just Compensation

The affected households on C3 are landowners. While just compensation is equated with a fair market value for their property, the valuation is usually rather low resulting in the owners' resistance to sell their lands. An independent appraiser can be hired to assess the value of land. Compliance with the law on land acquisition, such as RA 8974, can prevent problems and protect the affected families.

Relocation Related to Employment Opportunities

Since the main issue of the people is the ability to earn a living, where an off-city site is inevitable, the people should be linked to sources of employment.

Affordability and Poverty Reduction

Affordability is the main concern to sustainable housing and basic improvement, and for the majority of informal dwellers on R10 and on the C5 Link, this can only be achieved with an increase in income. The need to incorporate urban poverty reduction with infrastructure development needs to be considered and should be part of the urban development plan.

Community Participation as Part of Development Process

Studies suggest that a key to effective design and implementation of resettlement or development project is to ensure community involvement at all stages. There is concrete evidence of successful government projects where communities were part of the institutional framework and where communities participated in deciding the options that best suited their needs. When there is social acceptability and community ownership of the project these enhance the project's smooth implementation.

In the vicinity of R10, there is a strong community organization that facilitates community needs and accesses resource information. Organizations, like the Kaisahang Navotas, Tondo (KANATO), ZOTO, and homeowners' associations, must be supported in their efforts to develop their communities and address their priorities.

Need for an Acceptable Resettlement Site

Resettlement places constraints on people, affecting them psychologically and financially. An in-city resettlement site must be explored, preferably in areas nearer to the economic base of affected families. Where an off-city site is inevitable, this must be linked to livelihood opportunities. On R10, the community has started lobbying for their needs and preference with the City of Manila. In consultation with

the barangay captain and key persons in Barangay Tonsuoya, families on the C5 Link have no resistance to resettlement as long as the Government provides an acceptable resettlement site.

(7) Budget Requirement

Table 4.28 shows that the proposed budget for the expressway alignment amounts to more than ₱ 1.7 billion, covering ROW cost, the resettlement for the C5 Link PAFs, and compensation for land and structures of landowners affected within the proposed ROW, among others. Of this figure, however, only ₱ 29 million, representing the budget for Barangay Longos, will be shouldered by the Case Study Expressway project. The rest will be shouldered by the Government's road widening projects. It must also be noted that PAFs on R10 will be resettled in the existing resettlement site in Bitungol, which is already developed. Thus, there is no budget for the acquisition of a resettlement site for R10 PAFs.

(8) Next Steps

The following activities need to be undertaken:

- Review of the DPWH Resettlement Action Plan /Activities and Policies
- Recommendations on Resettlement Planning

Table 4.28 Cost of Resettlement and Compensation for R10/C5 Link/C3

Unit: ₱ mil

Item	R10	R10 Extn. (C5 Link)		C3/R9	Total
		Letre Road (Bgy. Longos, Malabon)			
Informal Settlers					
1. Compensation for Land	231.0[2]	4.1[1]	241.8[2]		476.9
2. Resettlement Site: Land Acquisition and Development	Already available and developed		301.0[3]		168.0
3. Replacement					
– ₱7,000/sq m[4] x 9 sq m[5] = ₱63,000/PAF	286.7	20.1	176.4		483.2
4. Relocation and Transfer					
– ₱10,000/PAF	45.5	3.2	28.0		76.7
5. Livelihood Assistance & Skills Training					
– ₱10,000/PAF x 50% of PAFs	22.8	1.6	14.0		38.4
6. One-month Rent Assistance					
– ₱2,000/PAF x # of renters[6]	4.6		1.4		6.0
Subtotal	**590.6**	**29.0**	**762.6**		**1,382.2**
Formal Settlers					
1. Compensation for Land & Structure					
– C3 Road: 62 landowners				338.0[7]	338.0
– EDSA connection: Commercial bldg				10.0	10.0
Subtotal				**348.0**	**348.0**
Total ROW Cost	**590.6**	**29.0**	**762.6**	**348.0**	**1,730.2**

Notes: [1] The part of Bgy Longos that will be affected by the alignment covers 3,168 sq m valued at ₱ 1,300/sq m, it being a flood-prone area.
[2] Based on updated cost provided by the LGU; covers land acquisition only.
[3] The estimated cost per PAF by the DPWH for serviced lots only is ₱ 60,000.
[4] Based on the Schedule of Base Unit Construction Cost for Buildings and Other Improvements, Assessor's Office, Municipality of Malabon, and applied to the other PAFs.
[5] Average floor area in Bgy Longos based on an ocular observation by the Study Team in October 2002 and applied to other PAFs.
[6] No. of renters: R10 Road (50% of PAFs) and C5 link (20% of PAFs)
[7] Compensation for land and structures is based on a 1997 appraisal + 10% additional cost for the present value of money; includes ROW cost (1.98 km).