23.3 PRELIMINARY DESIGN AND COST ESTIMATE

23.3.1 Rehabilitation Design

(1) Bridge Design

(a) Scope of Works for Rehabilitation

This preliminary design recommends scheme, "**Transverse and Slanted Prestressing Cable Strengthening** (Large Scale Rehabilitation)" mentioned in **Section 23.2** Comparative Study. The major improvement measures in this scheme are as follows:

- Rehabilitation of gerber hinge portion with slanted prestressing cables.
- Reconstruction of diaphragm and partial reconstruction of deck slab at gerber hinge portion.
- Installation of transverse prestressing cables at diaphragm of gerber hinge.
- Additional elastomeric bearing pads at diaphragm.
- Repair and sealing of concrete cracks, honeycomb and spalling.

Figure 23.3.1-1 shows the general view of the rehabilitation works.

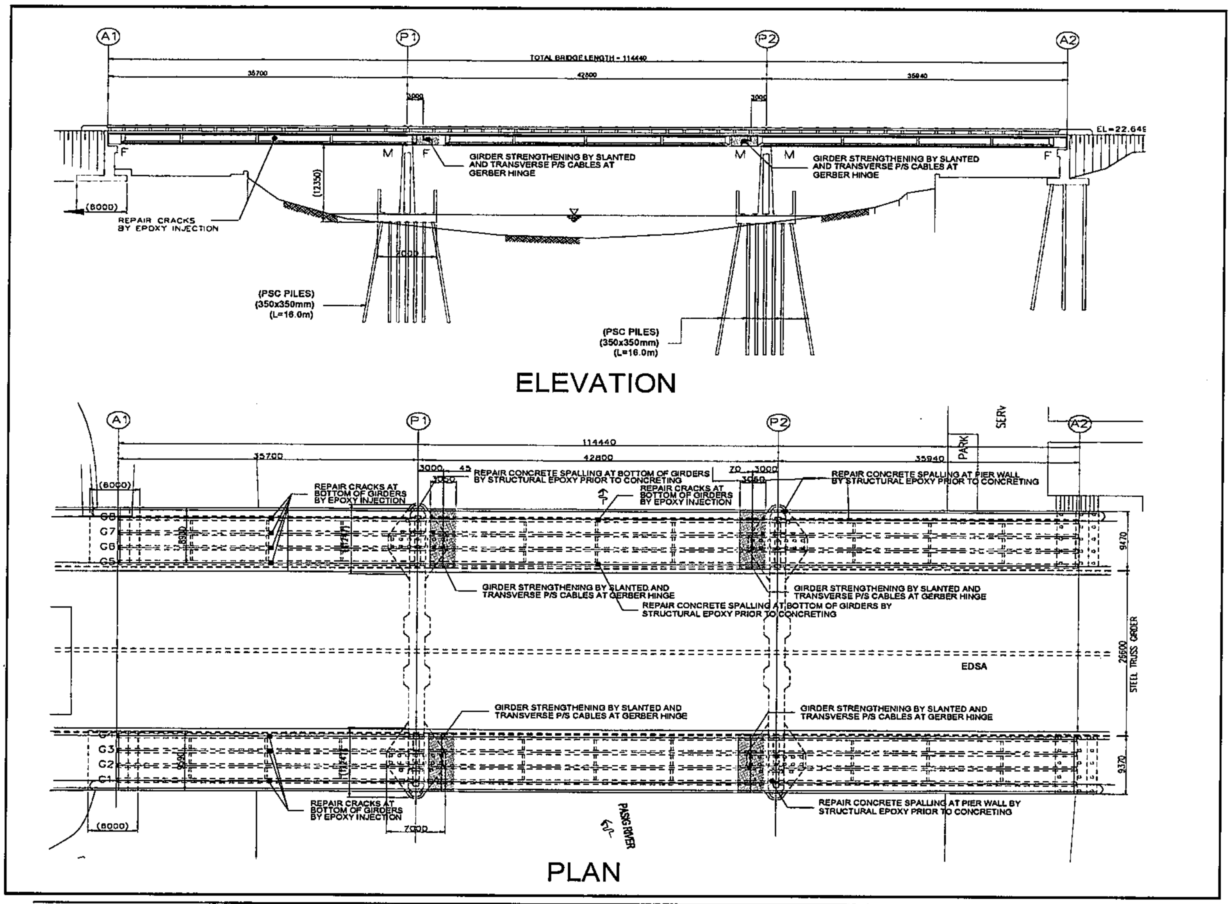


Figure 23.3.1-1 General View of Rehabilitation Works

(b) Design Criteria for Structure

Criteria for materials and loads are shown in **Table 23.3.1-1.**

Table 23.3.1-1 Design Criteria

I. SPECIFICATION	- AASHTO Standard Specification for Highway Bridges, 16 Edition 2000 including Division IA, Seismic Design - Specification for Highway Bridges, Japan Road Association, 1994
II. MATERIALS	- Prestressed Concrete, fc' = 39MPa - Reinforced Concrete, (New) fc' = 28 MPa - Reinforcing Steel (New), Fy = 415MPa - Prestressing cables : (Type F70TS = JIS G 3536 - Area of Strand = 383.80mm fpu = 1860 MPa - Carbon Fiber Reinforce Polymer (CFRP) Tensile – B – Modulus = 300,000 N/mm^2
III. LOADS	- Deadloads Reinforced Concrete = 24.5 kN/cu.m Steel = 77 kN/cu.m Earth Compacted = 19 kN/cu.m - Highway Loads AASHTO MS – 18 Loading - Impact Loads I = 15.24/L + 38, Where L = Span in meters - Sidewalk Loads For Span more than 20m Sidewalk Loading shall be 2.50 KPa - Earthpressure Mononobe – Okabe Method

(c) Design of Superstructure

Rehabilitation Works

Cracks at exterior gerber hinge parts were the major damage of this bridge. To recover this defect, the required measures are:

- To strengthen the damaged gerber hinge, and
- To equally distribute the loads from the deck slab to the hinge.

Under these requirements, the rehabilitation devices are as shown in **Figure 23.3.1-2**. The detail of the rehabilitation is presented in **Appendix 23.3.1-1.**

For strengthening of gerber hinge, slanted prestressing cables will be installed outside of the girder around the cracks at the hinge.

For equal distribution of loads, the diaphragm at the gerber hinge part will be widened and transverse prestressing cables will be installed.

For safety to failure of existing bearings, additional elastomaric bearing pads will be installed on the diaphragm.

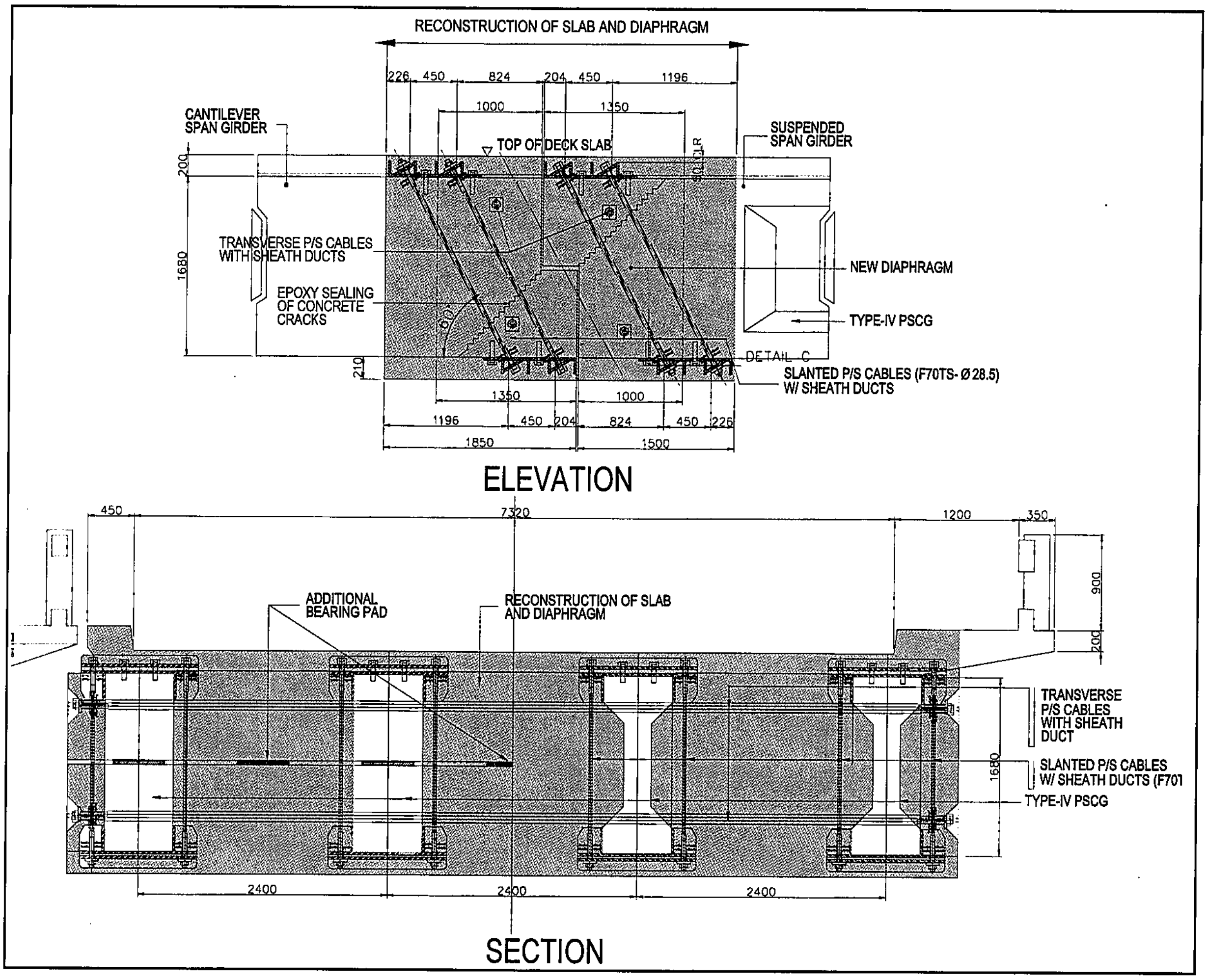


Figure 23.3.1-2 Rehabilitation of Gerber Hinge

Result of Structural Analysis

Result of structural analysis are shown in **Table 23.3.1-2**

Table 23.3.1-2 Result of Structural Analysis

SLANT SHEAR CABLE		
DEMAND	CAPACITY	
	EXISTING	REHABILITATION
1190 kN	740 kN	2108.32kN
REMARKS	14 - 12 mmø bar spacing : 300mm c to c	28.5 mmø bar qty: 8 pcs / girder @ gerber hinge
DIAPHRAGM		
DEMAND FORCE WITH ADDITION OF SUPPORT	CAPACITY	
	EXISTING	REHABILITATION
932.46 kN-m	675.63 kN-m	1127.04 kN-m
REMARKS	3 - 25 mmøbar	2 - 28.5 mmø cable

Summary of structural analysis are presented in **Appendix 23.3.1-2**.

Major Quantity

Major quantities for this rehabilitation work are shown in **Table 23.3.1-3**

Table 23.3.1-3 Major Quantity for Rehabilitation

Description		Unit	Quantity
A. Repair/Sealing of Concrete Cracks			
SPL	Epoxy Injection	l.s.	1.00
SPL	Replacement of New Concrete (Spalling with Exposed Rebars)	l.s.	1.00
B. New Diaphragm/Concrete Slab/Reconstruction of Fender			
101(3)	Removal of Concrete Slab	sq.m.	173.00
101(3)a	Removal of Concrete Diaphragm	cu.m.	42.00
301(1)	Tact Coat	ton	1.00
310	Asphalt	ton	15.00
405(1)a	Structural Concrete for Slab	cu.m.	25.00
405(3)	Structural Concrete for New Diaphragm	cu.m.	167.00
404	Reinforcing Steel Bars	kgs	26,592.00
416(1)	Slanted Prestressing Bar	kgs	2,622.00
	Anchorage	each	256.00
	Transverse P/S Cables	kgs	1,408.00
	Bearing Pads	each	12.00
C. Guardrail Post			
	Removal of Concrete Railing/Post	cu.m	42.91
	Removal of Concrete Sidewalk	sq.m.	18.55
	New Concrete Railing/Post	tonne	42.91
	New Concrete Railing	tonne	3.00
	New Concrete Post	kgs.	10.00
	New Concrete Sidewalk	sq.m.	20.55

(2) Highway Design

(a) Scope of Works

The highway works include the following items:

- Approach roads of the bridge
- Improvement of two (2) intersections

(b) Design Criteria for Highway

The highway design was carried out based on the following criteria and standards:

- Design Guidelines and Standards for Public Works and Highways, Volume – II
- A Policy on Geometric Design of Highways and Streets, 2000 (AASHTO)
- Highway Capacity Manual, Special Report, Transportation Research Board, 1999
- Road Structure Ordinance, Japan Road Association, 1983 (JRA)

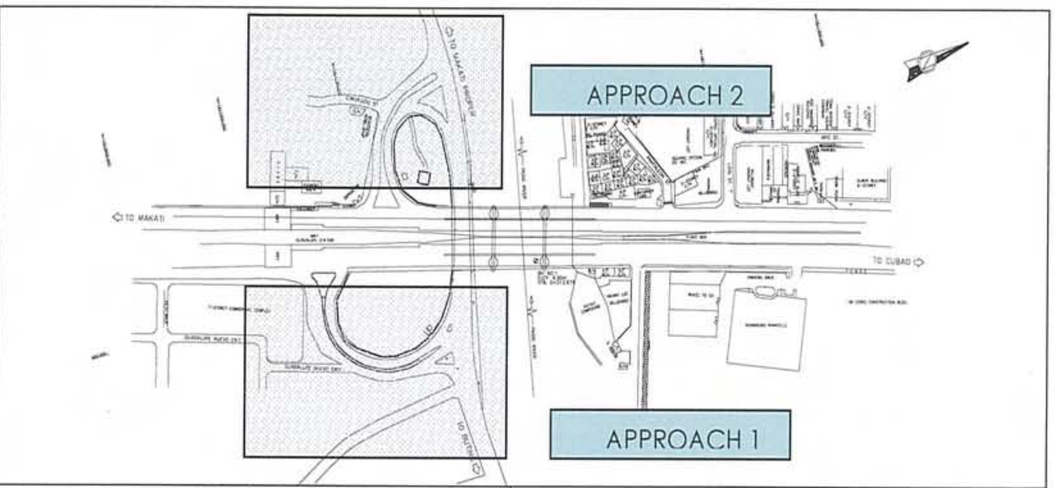
(c) Intersections

Guadalupe Bridge approach intersections, Approach 1 poses no problem of an excessive wide area along J.P. Rizal. The only problem is the jeepney terminal being used along the loop towards the intersection. With proper traffic management, intersection does not need to be improved at this stage. The other approach (Approach 2) intersection towards Makati proper, road width is constricted due to several residential houses are in placed at both sides, thus lane widths are put to minimum to accommodate four (4) lanes in both directions. At this stage, right-of-way poses greater problem, thus improvement would be considered in conjunction with some other road networks which are planned along the Pasig River in the future.

Table 23.3.1-4 shows the existing condition of approaches/ intersections of Guadalupe Bridge.

Table 23.3.1-4 Existing Conditions of Approaches /Intersections of Guadalupe Bridge

PLAN



	APPROACH 1	APPROACH 2
Traffic	• **Jeepney terminal stop near the intersection contributes to the greater traffic congestion.**	• Traffic to and from J.P. Rizal are heavy underneath the bridge due to narrower road going to Makati proper.
Pedestrian	• Pedestrian crossing markings are in place and it is properly enforced.	• Pedestrian crossing markings are in place and it is properly enforced.
Geometric and Pavement	• **Lane width is properly used, however right turn is much difficult due to limited road space for right turn.** • Sidewalks are adequate. • Pavement is quite in good condition with several patches.	• **Narrow road, a constricted four (4) lanes to be accommodated along J.P. Rizal towards Makati proper.** • Sidewalks are kept to a minimum width. • Pavement is quite in good condition with several patches.
Traffic Signals, Markings and Signs	• Signalized intersection. • Some of pavement markings are worn out. • **Insufficient traffic signs.**	• Signalized intersection. • Pavement markings are in placed. • **Insufficient traffic signs.**
Recommen-dation	• No improvement is necessary, however right turn movement should be regulated by traffic enforcer to provide efficient movement.	• No improvement is necessary, however proper traffic management should be implemented to efficiently move traffic. Right-of- way widening should be considered in the future.

(d) Approach Road and Access Road

The existing alignment dictates the alignment of improvement design; the horizontal and vertical alignment of the center line of the bridge will be maintained.

Access Roads or driveways of nearby buildings should be discouraged to place entrances along the major road since this will obstruct efficient traffic flow especially along approach ramps of the bridge.

The existing site ocular inspections of both approaches are shown in **Appendix 23.3.1-3 (1/2 to 2/2)**.

(3) Design of Protection to Vessel Collision

There are two kinds of vessel collision: collision with superstructure and collision with substructure.

(a) Safety Measure for Superstructure

For collision to superstructure, the vessel collision avoidance system is not required as the bridge has sufficient vertical clearance.

(b) Safety Measure for Substructure

The protection system will be to install fender system attached to the piers as shown in **Figure 23.3.1-3.**

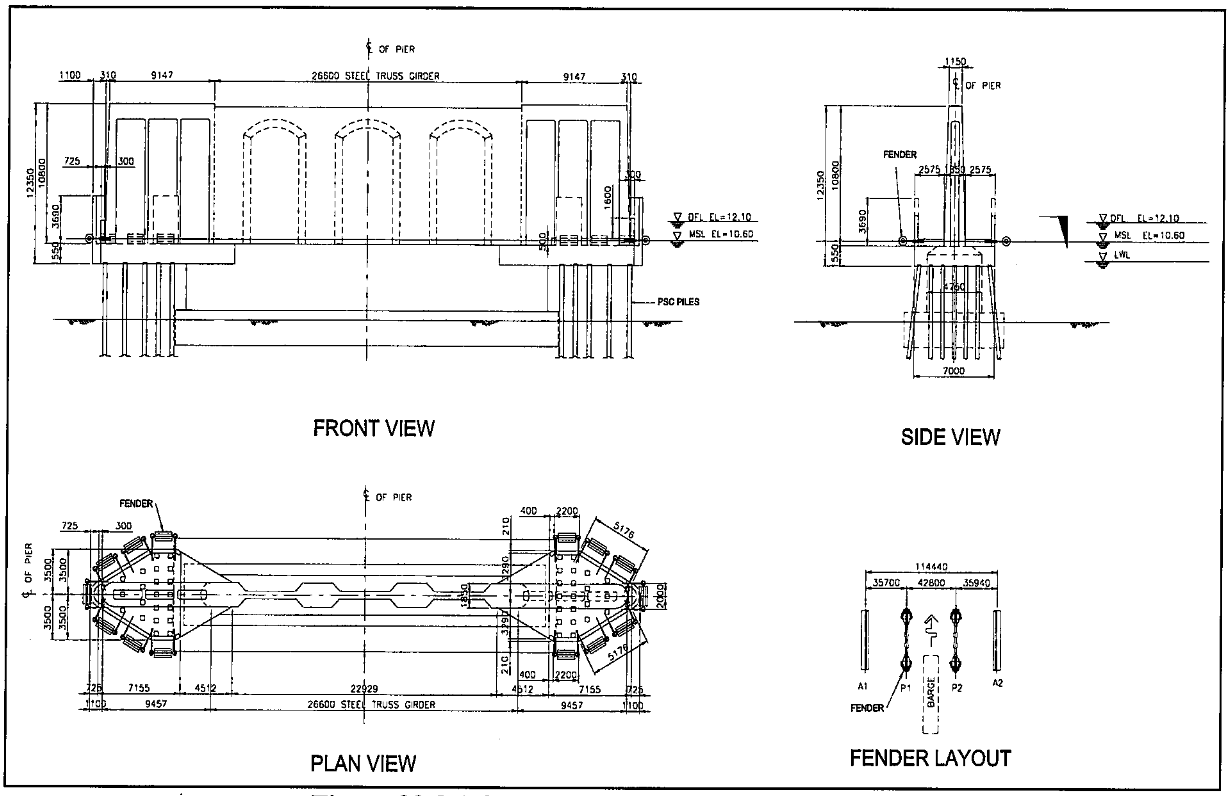


Figure 23.3.1-3 Layout of Vessel Collision Fender

23.3.2 Construction Plan and Traffic Management

(1) Construction Method

The rehabilitation work is partial construction of the superstructure. All of the works will be carried out on partially provided scaffolding and the construction materials/equipments are transferred by boom crane from bridge surface to the scaffolding as shown **Figure 23.3.2-1.** The details of construction method are shown in **Appendix 23.3.2-1.**

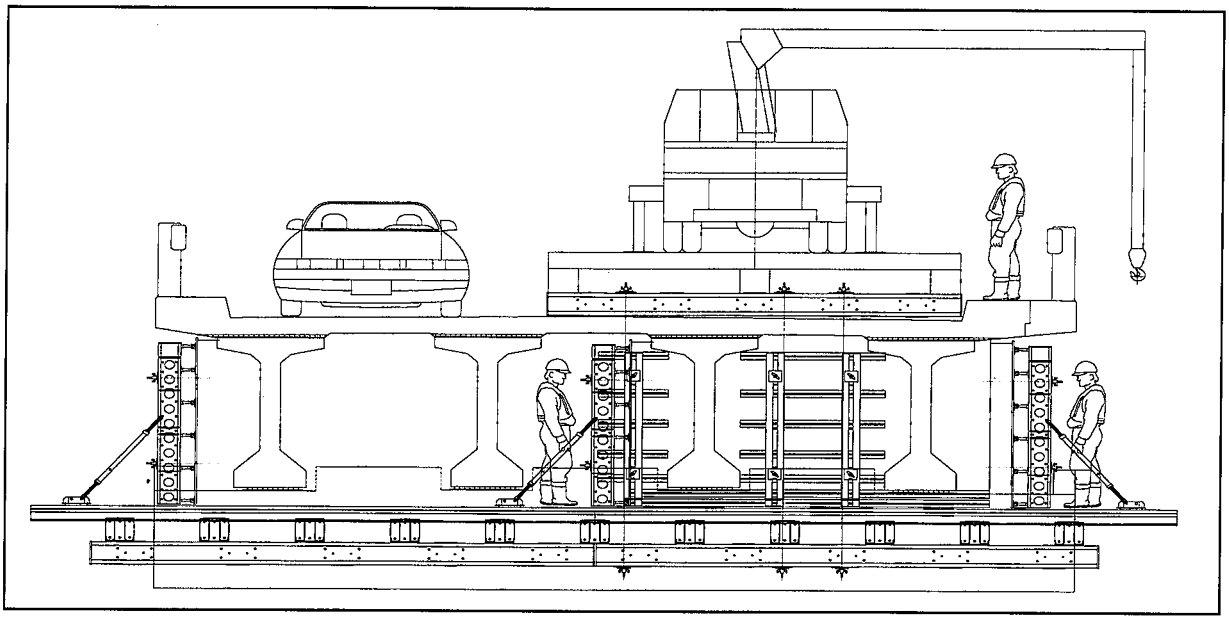


Figure 23.3.2-1 Construction Method

(2) Traffic Management

The construction is carried out from upstream side to downstream side as shown in **Figure 23.3.2-2**

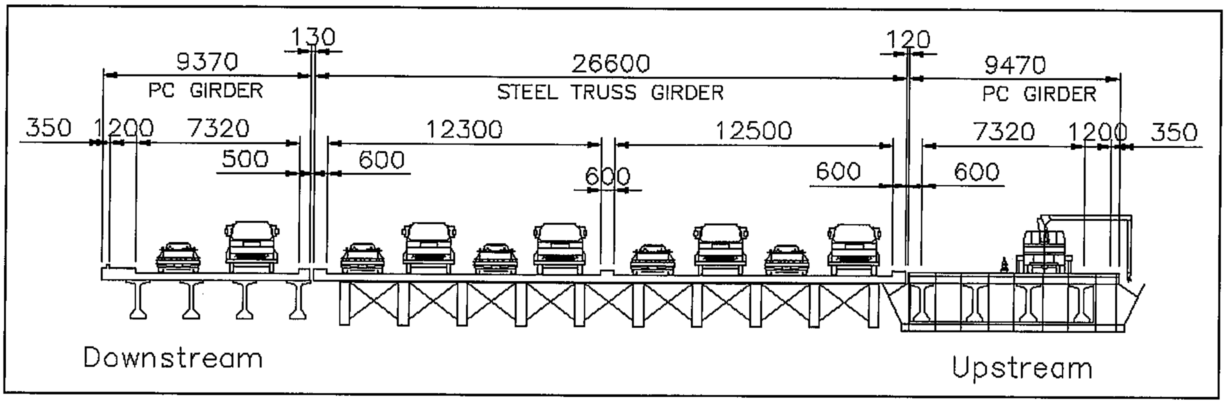


Figure 23.3.2-2 Traffic Control during Construction

In this construction method, the traffic constraints will be as follows:

- Partial closure of affected traffic lane is necessary during repair work.
- Lane vehicle load will be limited during removal and reconstruction of existing diaphragm and deck slab; and stressing operation.
- Rerouting of traffic is necessary during removal and reconstruction of existing diaphragm and deck slab.
- Temporary full closure (2-lanes) is necessary during stressing operation and concreting.

The traffic lanes will be controlled as shown in **Figure 23.3.2-3** during construction work.

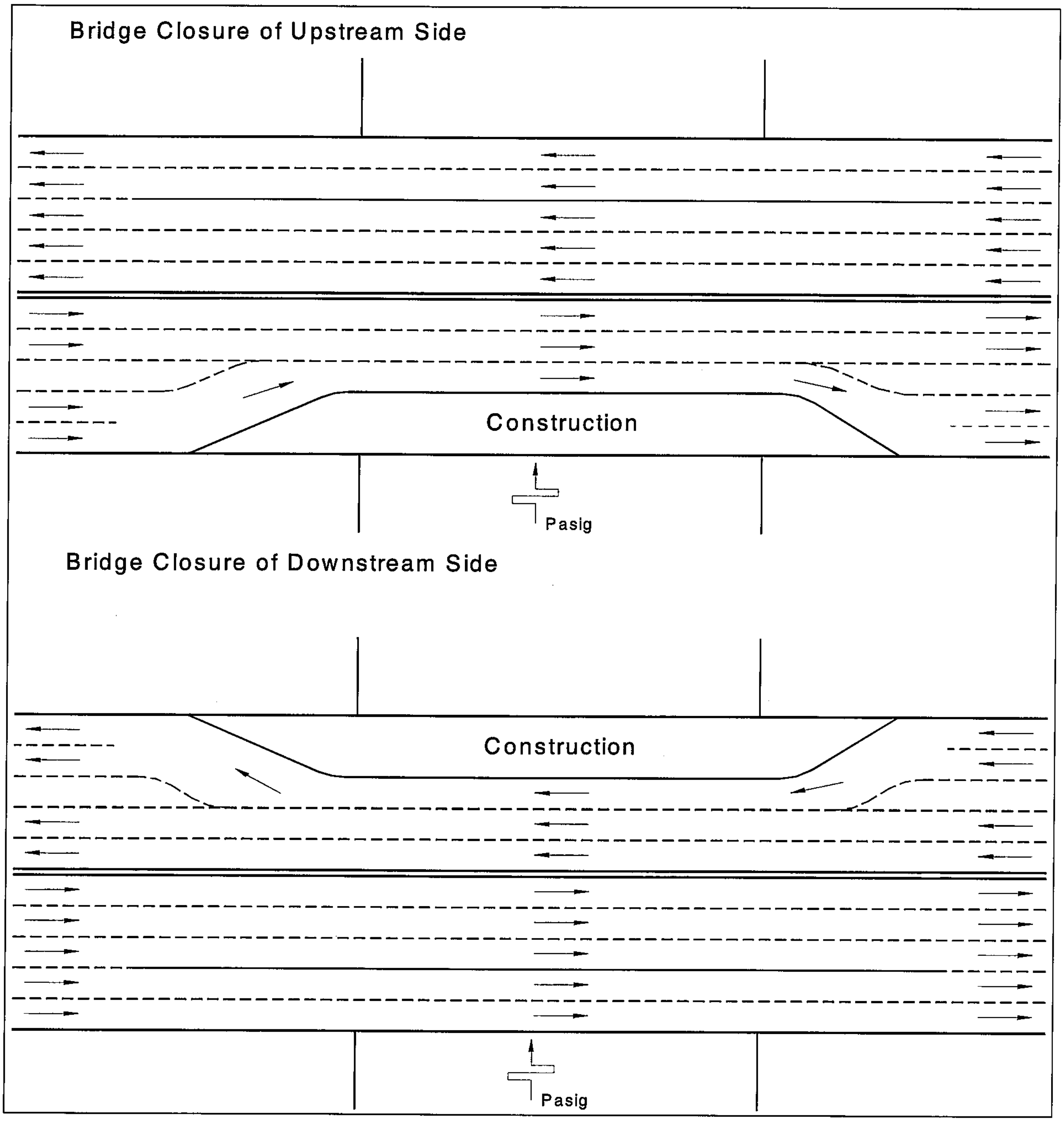


Figure 23.3.2-3 Traffic Lane Control

23.3.3 Preliminary Cost Estimate

The total project costs consist of total construction cost and engineering services cost. The construction cost was estimated by accumulation of each work item which is the combination of labor costs, material costs and equipment costs considering the construction method and procedure.

(1) Construction Cost

Construction cost was estimated by accumulating the cost of each work item which is the multiplication of unit cost and quantity of each work. The unit costs of each item are estimated from the combination of the basic unit prices of the labor wages, material prices and equipment operation cost considering the construction method and procedure.

Unit costs were estimated from the previous similar practices in Manila. In order to cover the unforeseen works and conditions at this moment, and considering the allowance of some changes in the detailed design stage, a contingency of 5% of the total construction cost was taken in to account.

The unit cost by construction item is shown in **Table 23.3.3-1**

Table 23.3.3-1 Unit Cost by Construction Items

June 2003 Prices

Item No.	Description	Unit	Unit Cost(PP)	Components (%)		
				Foreign	Local	Taxes
Annex I – CONSTRUCTION COST FOR REHABILITATION						
A. Repair/Sealing of Concrete Cracks						
SPL	Epoxy Injection	l.s.	3,876,789.46	73%	15%	12%
SPL	Replacement of New Concrete (Spalling with Exposed Rebars)	l.s.	583,269.69	65%	25%	10%
B. New Diaphragm/Concrete Slab/Reconstruction of Fender						
101(3)	Removal of Concrete Slab	sq.m.	500.00	65%	21%	14%
101(3)a	Removal of Concrete Diaphragm	cu.m.	575.00	65%	21%	14%
301(1)	Tack Coat	ton	25,000.00	76%	21%	14%
310	Asphalt	ton	3,100.00	76%	10%	14%
405(1)a	Structural Concrete for Slab	cu.m.	4,500.00	65%	10%	14%
405(3)	Structural Concrete for New Diaphragm	cu.m.	6,000.00	65%	21%	14%
404	Reinforcing Steel Bars	kgs.	50.00	65%	21%	14%
416(1)a	Transverse P/S Cable	kgs.	604.27	65%	21%	14%
416(1)	Prestressing Bar with Anchor	kgs.	604.27	65%	21%	14%
407(1)	Bearing Pads	each	15,000.00	65%	21%	14%
C. Guardrail Post						
101(4)	Removal of Concrete Railing/Post	l.m.	150.00	65%	21%	14%
101(4)a	Removal of Concrete Sidewalk	sq.m.	160.00	65%	21%	14%
401(1)a	New Concrete Railing/Post	l.m.	3,500.00	65%	21%	14%
401(1)	New Concrete Railing	l.m.	1,500.00	65%	21%	14%
401(b)	New Concrete Post	each	2,000.00	65%	21%	14%
601	New Concrete Sidewalk	sq.m.	350.00	65%	21%	14%
D. Gondola and Falsework						
SPL	Gondola and Falsework	l.s.	5,149,532.35	68%	18%	14%
E. Traffic Management						
SPL	Traffic Management	l.s.	1,500,000.00	71%	15%	14%
F. Contingencies						
xxx	Contingencies	l.s.	807,970.77	75%	15%	10%
G. Facilities						
xxx	Temporary Facilities	l.s.	2,960,034.00	65%	21%	14%
H. Mobilization/Demobilization						
xxx	Mobilization//demobilization	l.s.	484,782.46	75%	15%	10%

Detailed computation is presented in **Appendix 23.3.3-1.**

Total Construction Cost

The total construction cost of the bridge rehabilitation estimated on the basis described above is shown in **Table 23.3.3-2**.

Table 23.3.3-2 Estimated Construction Cost

June, 2003 Prices

Items		Cost(x MP)
Superstructure	Foreign	14.00
	Local	3.80
	Tax	2.70
Total Construction Cost		**20.50 MP**

(2) Road Right-Of-Way Acquisition Cost

No acquisition of Right-of-way for this bridge.

(3) Engineering Cost

Engineering service cost consists of the engineering design services at the detailed design stage and the construction supervision at the construction stage. The engineering service cost varies depending on the scale of the project, tender processing and contract method.

Based on previous experiences, the engineering service costs for the project are estimated as 5% and 8% of the total construction cost for the detailed design and construction supervision respectively.

The estimated engineering cost is shown in **Table 23.3.3-3**

Table 22.3.3-3 Estimated Engineering Cost

June, 2003 Prices

Items		Cost (x MP)
Detailed Design	Foreign	0.60
	Local	0.40
	Tax	0.10
	Subtotal	1.00
Construction Supervision	Foreign	0.90
	Local	0.60
	Tax	0.20
	Subtotal	1.60
Total Engineering Cost	**Total**	**2.70**

(4) Project Cost

The total project cost consist of construction cost, land acquisition cost and engineering service cost. The summary of the estimated project cost is given in **Table 23.3.3-4**

Table 23.3.3-4 Summary of Estimated Project Cost

June, 2003 Prices

Items		Cost (x MP)
Construction Cost	Foreign Local Tax	14.00 3.80 2.70
	Subtotal	20.50
Engineering Cost	Foreign Local Tax	1.50 0.90 0.30
	Subtotal	2.70
Grand Total	Foreign Local Tax	15.50 4.70 2.90
Grand Total		**23.10**

23.4 TRAFFIC ANALYSIS AND ECONOMIC EVALUATION

23.4.1 Traffic Analysis

(1) Alternative Road Networks and Bridge Plans

There are several road network plans that can be considered in relation to Guadalupe Bridge. In this study, the following alternative cases of the road network for the traffic assignment are considered: (See **Table 23.4.1-1**)

Do Nothing Case (No rehabilitation Case)

2007 – 2012 Limitation of vehicle load on Guadalupe bridge

2013 afterward Full closure of Guadalupe Bridge

Do Something Case (Rehabilitation case)

2007 – 2045 No limitation of vehicle use on Guadalupe Bridge

2045 afterward Replacement of Guadalupe Bridge

Table 23.4.1-1 Alternative Road Networks and Bridge Plans

Name of Bridge	Year	Do Nothing Case	Do Something Case
Guadalupe Bridge	2007 – 2012	* Vehicle load limitation on Guadalupe Bridge	* No limitation of vehicle load
	2013 - 2045	* Full closure of Guadalupe Bridge (Both side)	* No limitation of vehicle load
	2046 afterward	* Full closure of Guadalupe Bridge (Both side)	* Replacement of Guadalupe Bridge (Both side)

(2) Traffic Assignment Method

The traffic assignments to road networks with the Bridge Plans are made using STRADA highway – type assignment model as shown in **Section 5.3** in **Chapter 5**.

(3) Results of Traffic Assignment

Table 23.4.1-2 shows the traffic demand forecast on bridges on Pasig River.

Table 23.4.1-2 Traffic Demand Forecast on Guadalupe Bridges of Pasig River by Alternative Cases

Unit: PCU / day

No.	Bridge Name	Do Nothing (A)		Do Something (B)		A-B	
		2010	2020	2010	2020	2010	2020
9	Makati-Mandaluyong Bridge	75,000	90,100	59,600	73,600	16,000	16,500
10	Guadalupe Bridge	179,200	180,100	232,000	241,100	-52,800	-61,000
11	C-5 Bridge	123,900	149,400	98,900	129,400	25,000	20,000
12	Bambang Bridge	50,100	67,500	39,700	59,200	10,400	8,400

Based on this table, comparison of future traffic demand with and without vehicle load limitation is made and shown in **Figure 23.4.1-1**. **Figure 23.4.1-2** and **Table 23.4.1-3** shows the vehicle composition by vehicle type of the traffic demand on Guadalupe Bridge. It is noted that share of bus traffic is comparatively large.

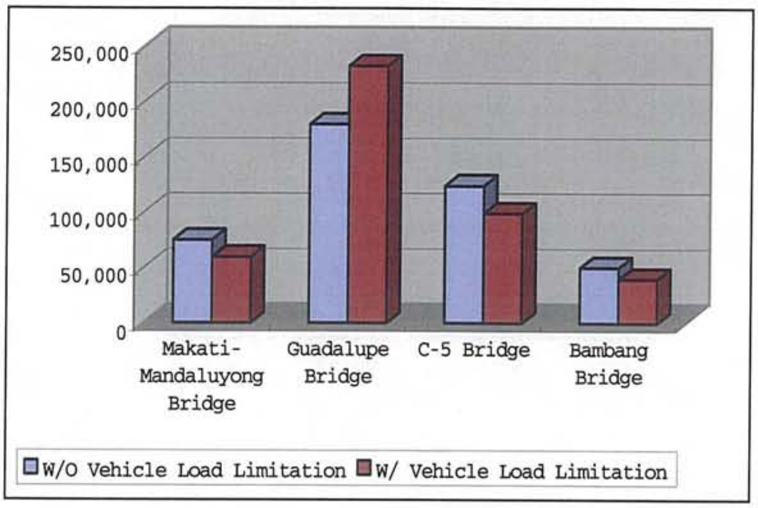


Figure 23.4.1-1 Comparison of Traffic Volume with and without Vehicle Load Limitation in 2010

Table 23.4.1-3 Vehicular Traffic Volume and its Composition, 2010

Unit: PCU / day

	AADT	Composition (%)
P.Car	195,900	81.2
Jeepney	0	0.0
Bus	39,800	16.5
Truck	5,400	2.2
Total	241,100	100.0

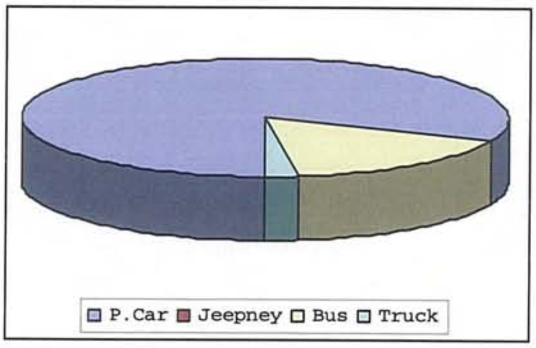


Figure 23.4.1-2 Vehicular Traffic Composition, 2010

23.4.2 Economic Evaluation

(1) Presumptions

(a) Evaluation Period

The evaluation period is assumed to be 30 years from 2007 to 2037.

(b) Implementation Schedule of the Project

From the implementation schedule mentioned in the previous sections, the project will be implemented according to the following schedule:

- Detailed engineering 2004
- Implementation 12 months in 2005 and 2006
- Open to traffic 2007

(c) Economic Indicator

The economic evaluation of the project principally employed the benefit cost analysis which is evaluating the investment efficiency through comparison between benefits and costs derived from with and without the Guadalupe Bridge rehabilitation project.

It is expressed as the benefit cost stream during evaluation period with the following economic indicators used in this Study:

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

(d) Discount Rate

The discount rate is assumed to be 15 %.

(2) Project Cost

(a) Project Cost

The project cost, which is already calculated in the previous section, is expressed as the financial cost. It is therefore necessary to convert from financial cost to economic cost using a conversion factor.

In this Study, the economic cost is estimated by deducting from the financial cost the government taxes as shown in **Table 23.4.2-1**.

Table 23.4.2-1 Economic Cost Estimate

(Unit: '000)

Description		Economic Cost	Financial Cost
1	Rehabilitation Cost	17,800	20,500
1-1	Superstructure	17,800	20,500
1-2	Substructure	0	0
2	Consultancy	2,400	2,700
2-1	Detailed Design	1,000	1,100
2-2	Construction Supervision	1,400	1,600
	Total	20,200	23,100

(b) Maintenance Cost

According to the maintenance data gathered in this Study the present maintenance cost for the bridges in Metro Manila are estimated to about 1.0% of the construction cost. In this study, therefore, the maintenance cost of the Guadalupe Bridge is assumed to be 1.0% of the construction cost.

(3) Economic Benefits

(a) Type of Benefit

The most significant benefit of the bridge rehabilitation project is the reduction of traffic cost which consists of the vehicle operating cost (VOC) and the travel time cost (TTC). The VOC can be further sub-divided into the two (2) types: vehicle running cost (VRC) and vehicle fixed cost (VFC).

The benefit is estimated through "with and without" comparison of the traffic costs derived from the above mentioned situations:

(b) Basic Vehicle Operating Cost

The basic vehicle operating cost (BVOC) is estimated annually by PMO-FS Office in DPWH. The latest BVOC was estimated in April 2002. In this study, this VBOC with some modification by inflation between April 2002 and April 2003 is utilized and shown in **Table 23.4.2-2**.

Table 23.4.2-2 Basic Vehicle Operating Cost (Excluding Tax)

Vehicle Type	Running (P/1000km)	Fixed [P/Min]	Time [P/Min]
Car /Taxi / Jeep	4,441	0.245	0.991
Jeepney	2,991	1.181	1.468
Bus	7,453	1.794	5.561
Track	9,622	2.107	0
Motor Cycle	822	0.082	0.586

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

(c) Benefit Calculation

Savings in vehicle operating costs and travel time cost were estimated and shown in **Table 23.4.2-3**.

Table 23.4.2-3 Estimation of Benefits

Unit: '000 Pesos/Day

Year	Saving in VRC	Saving in VFC	Saving in VOC	Saving in TCC	*Total Saving*
2007	6,284.9	10,321.9	15,779.0	0	15,779.0
2010	6,785.9	11,144.7	17,930.6	0	17,930.6
2011	23,647.2	8,530.6	32,177.7	18,096.0	50,273.7
2020	31,090.0	11,155.8	42,245.8	23,665.0	65,910.8

(3) Economic Evaluation

(a) Benefit Cost Analysis

Based on the above mentioned benefits and cost estimations, the economic analysis of the Project was made. **Table 23.4.2-4** shows the benefit – cost analysis of the Guadalupe Bridge

Rehabilitation Project during project life period and **Table 23.4.2-5** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of P 174 million and BCR of 8.58 over 30 years life of the Bridge using a discount rate of 15% which is designated by NEDA. The Economic Internal Rate of Return (EIRR) was compiled at 41.8 %.

Table 23.4.2-4 Economic Indications of Benefit Cost Analysis

Net Present Value	₱ 174 million Pesos
BCR	8.58
EIRR	41.8 %

Notes: 1) Project life is assumed to be 30 years
2) Discount rate ids 15%

Table 23.4.2-5 Benefit –Cost Stream of Guadalupe Bridge Large Scale Rehabilitation Scheme

Undiscounted Benefit Cost Stream

000 Pesos

Sq	Year	Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit
1	2004	1,000	0.0	1,000.0	0.0	-1,000.0
2	2005	9,650	0.0	9,650.0	0.0	-9,650.0
3	2006	9,650	0.0	9,650.0	0.0	-9,650.0
4	2007	0	1,260.0	1,260.0	809.9	-450.1
5	2008	0	1,260.0	1,260.0	814.4	-445.6
6	2009	0	1,260.0	1,260.0	818.9	-441.1
7	2010	0	1,260.0	1,260.0	823.3	-436.7
8	2011	0	1,260.0	1,260.0	827.9	-432.1
9	2012	0	1,260.0	1,260.0	832.4	-427.6
10	2013	0	1,260.0	1,260.0	89,699.3	88,439.3
11	2014	0	1,260.0	1,260.0	90,187.2	88,927.2
12	2015	0	1,260.0	1,260.0	90,677.7	89,417.7
13	2016	0	1,260.0	1,260.0	91,170.9	89,910.9
14	2017	0	1,260.0	1,260.0	91,666.8	90,406.8
15	2018	0	1,260.0	1,260.0	92,165.3	90,905.3
16	2019	0	1,260.0	1,260.0	92,666.6	91,406.6
17	2020	0	1,260.0	1,260.0	93,170.6	91,910.6
18	2021	0	1,260.0	1,260.0	93,424.0	92,164.0
19	2022	0	1,260.0	1,260.0	93,678.1	92,418.1
20	2023	0	1,260.0	1,260.0	93,932.8	92,672.8
21	2024	0	1,260.0	1,260.0	94,188.3	92,928.3
22	2025	0	1,260.0	1,260.0	94,444.4	93,184.4
23	2026	0	1,260.0	1,260.0	94,701.3	93,441.3
24	2027	0	1,260.0	1,260.0	94,958.8	93,698.8
25	2028	0	1,260.0	1,260.0	95,217.1	93,957.1
26	2029	0	1,260.0	1,260.0	95,476.0	94,216.0
27	2030	0	1,260.0	1,260.0	95,735.7	94,475.7
28	2031	0	1,260.0	1,260.0	95,865.8	94,605.8
29	2032	0	1,260.0	1,260.0	95,996.2	94,736.2
30	2033	0	1,260.0	1,260.0	96,126.7	94,866.7
31	2034	0	1,260.0	1,260.0	96,257.4	94,997.4
32	2035	0	1,260.0	1,260.0	96,388.3	95,128.3
33	2036	0	1,260.0	1,260.0	96,519.4	95,259.4
34	2037	0	1,260.0	1,260.0	96,650.6	95,390.6

Discounted Benefit Cost Stream

000 Pesos

Sq	Sq	Year	Discounted	Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit
1	1	2004	1.000	1,000.0	0.0	1,000.0	0.0	-1,000.0
2	2	2005	1.150	8,391.3	0.0	8,391.3	0.0	-8,391.3
3	3	2006	1.323	7,296.8	0.0	7,296.8	0.0	-7,296.8
4	4	2007	1.521	0.0	828.5	828.5	532.5	-296.0
5	5	2008	1.749	0.0	720.4	720.4	465.6	-254.8
6	6	2009	2.011	0.0	626.4	626.4	407.1	-219.3
7	7	2010	2.313	0.0	544.7	544.7	356.0	-188.7
8	8	2011	2.660	0.0	473.7	473.7	311.2	-162.5
9	9	2012	3.059	0.0	411.9	411.9	272.1	-139.8
10	10	2013	3.518	0.0	358.2	358.2	25,498.1	25,139.9
11	11	2014	4.046	0.0	311.5	311.5	22,292.9	21,981.4
12	12	2015	4.652	0.0	270.8	270.8	19,490.6	19,219.8
13	13	2016	5.350	0.0	235.5	235.5	17,040.5	16,805.0
14	14	2017	6.153	0.0	204.8	204.8	14,898.4	14,693.6
15	15	2018	7.076	0.0	178.1	178.1	13,025.6	12,847.5
16	16	2019	8.137	0.0	154.8	154.8	11,388.2	11,233.4
17	17	2020	9.358	0.0	134.6	134.6	9,956.7	9,822.1
18	18	2021	10.761	0.0	117.1	117.1	8,681.5	8,564.4
19	19	2022	12.375	0.0	101.8	101.8	7,569.7	7,467.9
20	20	2023	14.232	0.0	88.5	88.5	6,600.2	6,511.7
21	21	2024	16.367	0.0	77.0	77.0	5,754.9	5,677.9
22	22	2025	18.822	0.0	66.9	66.9	5,017.9	4,951.0
23	23	2026	21.645	0.0	58.2	58.2	4,375.3	4,317.1
24	24	2027	24.891	0.0	50.6	50.6	3,814.9	3,764.3
25	25	2028	28.625	0.0	44.0	44.0	3,326.3	3,282.3
26	26	2029	32.919	0.0	38.3	38.3	2,900.3	2,862.0
27	27	2030	37.857	0.0	33.3	33.3	2,528.9	2,495.6
28	28	2031	43.535	0.0	28.9	28.9	2,202.0	2,173.1
29	29	2032	50.066	0.0	25.2	25.2	1,917.4	1,892.2
30	30	2033	57.575	0.0	21.9	21.9	1,669.6	1,647.7
31	31	2034	66.212	0.0	19.0	19.0	1,453.8	1,434.8
32	32	2035	76.144	0.0	16.5	16.5	1,265.9	1,249.4
33	33	2036	87.565	0.0	14.4	14.4	1,102.3	1,087.9
34	34	2037	100.700	0.0	12.5	12.5	959.8	947.3
			Total	16,688.1	6,268.0	22,956.1	197,076.2	174,120.1

Net Present Value	174,120
B/C Ratio	8.585
EIRR	41.80 %

(b) Sensitivity Analysis

The sensitivity analysis is conducted under a worse case scenario incorporating increase and/or decrease of the estimation of costs and benefits. **Table 23.4.2-6** shows the results of the sensitivity analysis.

Table 23.4.2-6 Sensitivity Analysis regarding Costs and Benefits of Guadalupe Bridge Rehabilitation Project (EIRR)

Unit: %

		Benefits				
		20% down	10% down	Base Case	10% up	20% up
Costs	20% down	41.8	43.7	45.3	46.9	48.3
	10% down	40.1	41.8	43.5	45.0	46.4
	Base Case	38.5	40.2	41.8	43.4	44.7
	10% up	37.1	38.8	40.4	41.8	43.2
	20% up	35.9	37.6	39.1	40.5	41.8

Note: Project life is assumed to be 30 years

(c) Summary of Economic Analysis

The implementation of the Guadalupe Bridge Rehabilitation project can be justified from the national economic point of view since the economic indicators of all cases are more than the cut-off level of 15% of EIRR in the Philippines.

23.5 ENVIRONMENTAL IMPACT ASSESSMENT

The general approach adopted in the present study is based on the procedural flow of the Environmental Impact Statement (EIS) System prescribed under Article III of the DENR Administrative Order No. 96-37. The EIA Team followed the Participatory Impact Assessment Method (PIAM) wherein the stakeholders were involved in the conduct of the EIA through project briefings and public consultation meetings.

23.5.1 Methodology

The EIA study covered the following modules:

- Physico-Chemical Environment
  - Physiography and Geomorphology
  - Meteorology
  - Hydrology
  - Water Quality
  - Air Quality
  - Noise Level
- Terrestrial Biology
- Socio-Economics

(1) Physico-Chemical Environment

(a) Physiography and Geomorphology

The physiographical and geomorphological study for the proposed project was done through field verification of available secondary data. The information used in the preparation of this report were obtained mostly from various government offices/entities among others, the Mines and Geosciences Bureau (MGB), Philippine Institute of Volcanology and Seismology (PHIVOLCS), Bureau of Soils and Water Management (BSWM), Pasig River Rehabilitation Commission (PRRC).

(b) Water Quality

Water quality assessment along the Pasig River, Guadalupe Bridge Section was performed on 24 November 2003. One sampling site was established along the Pasig River, since it is the only water body that would be possibly affected by the proposed Improvement of the said Bridge. Temperature and pH readings were accomplished on-site. Water samples were also collected and brought to the laboratory for chemical analyses. The methodology adopted to assess the amount of BOD, COD, TSS, Oil & Grease, DO, and Fecal and Total Coliform of the samples was based on the Standard Methods for the Examination of Water and Wastewater, 20th Ed.

(c) River Sediments

Sediments obtained from Pasig River were also tested for traces of heavy metals. The samples were assessed for traces of Chromium Hexavalent (Cr+6), Cyanide (CN-), Cadmium (Cd), Arsenic (As), Lead (Pb), Mercury (Hg), and Polychlorinated Biphenyls (PCB) Arocolor 1254. The amount of Cr+6 and CN- of the river sediments were assessed by Photometry. Traces of Cd and Pb were detected through acid digestion and quantitation by Atomic Absorption Spectrophotometry. Arsenic and mercury were derived through Hydride Generation.

(d) Air Quality

The conduct of air quality sampling followed the standard procedure according to the prescribed methodology in the Department of Environment and Natural Resources Department Order 2000-81 (DAO). Sampling was performed within a specified time and flow rate. Total suspended particulate matter and carbon monoxide were sampled on a 1-hour averaging time, whereas, NO_2 and SO_2 were evaluated within a 30-minute time period. TSP, CO, CO_2, and NO_2 sampling was done on November 27, 2003, while SO_2 sampling was performed on December 12, 2003.

(e) Noise Level

Noise level monitoring along Guadalupe Bridge was carried out on January 06, 2004. Noise level was directly measured using a standard sound level meter. Sampling location was the same as that of the air quality. Monitoring was done during the morning time, daytime, evening time, and nighttime. Three (3) readings were recorded within a 5-minute averaging time.

(2) Biological Environment

(a) Flora

Identification of the flora species encountered in the project area was done through gross morphology. This is a type of plant identification that relies greatly on the external features of both vegetative and reproductive parts, since these are easily observable. Flora guidebooks and other related reference materials were used during the conduct of the study for verification.

(b) Terrestrial Fauna

Since the project area is situated within a city, terrestrial wildlife identification, particularly birds, was done through actual observation.

(3) Socio-Economic

(a) Consultation Meetings with the LGUs

Brgy. Barangka Ilaya, Mandaluyong City

The proposed Improvement of Guadalupe Bridge was presented to the local government unit of Brgy. Barangka Ilaya, Mandaluyong City on December 03, 2003. Present during the meeting were the leaders of the barangay headed by their chairman, Ms. Luisa C. Pangilinan. After the short discussion of the project background, the council was given the opportunity to express their perceptions. (Please see **Photo 23.5.1-1** and **23.5.1-2**).

(b) Public Consultation Meeting (PCM)

The EIA Team organized consultation meetings with the LGUs and families to be directly affected by the proposed rehabilitation of Guadalupe Bridge. The Team ensured that all stakeholders and concerned sectors are well informed of the scheduled meetings.

Photo 23.5.1-1 Consultation meeting with *Brgy.* leaders of Brgy. Barangka Ilaya, Mandaluyong City on December 03, 2003

Photo 23.5.1-2 Consultation meeting with the Project-Affected Persons under the Guadalupe Bridge

23.5.2 Brief Description of Data Gathering

Baseline information for the preparation of the report was established through primary and secondary data gathering procedures. Series of field investigations, verifications, validations of information obtained from the concerned government offices/agencies visited by the EIA Team were carried out. The offices/entities include the City Government of Manila, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA), Mines and Geosciences Bureau (MGB), Bureau of Soils and Water Management (BSWM), and Philippine Institute of Volcanology and Seismology (PHIVOLCS). The Team also coordinated with the Pasig River Rehabilitation Project Commission (PRRC).

With respect to the **ambient air quality, water quality, noise level,** and **socio-economic** aspects, actual samplings and perception surveys within the study area were performed to generate baseline data.

23.5.3 Brief Description of Project Environment

The area to be directly affected by the project is Brgy. Barangka Ilaya in Mandaluyong City. This community is located on the north side of the bridge. It is emphasized here that there was no indirect impact identified. Motorists crossing the Bridge, both private and public, as well as passengers are considered to be indirectly affected in terms of possible increase in traffic congestion, and thus were included in the survey

(1) Physico-Chemical Environment

(a) Physiography and Geomorphology

In general, there are two broad geomorphologic units in the MMA, namely, the north-south trending plateau and the flat-lying alluvial (Marikina Flood Plain) and deltaic sediments (Pasig River Delta Plain) which are situated on either sides of the said central elevated portion (Besana and Daligdig, 1993). The Pasig and Marikina Rivers are two major river systems that drain off the area with several tributaries feeding it from the north and east of the MMA. The plateau or the central elevated portion averages about 10 to 30 meters above mean sea level with highest elevation of 70 meters located in Quezon City. While the Pasig River delta plain has an average elevation of less than 5 meters, which is roughly of concave shape, poor drainage and gently sloping towards Manila Bay. This plain is mainly of beach and estuarine deposits in the north and in the south are lagoonal and beach sediments derived from the clastics formerly and actively dumped by the Pasig River itself. Similarly, the Marikina floodplain is composed of alluvial sediments deposited by the Marikina River. The Marikina valley, a northeast-southwest trending floodplain which possibly resulted from repeated movements along the Marikina Valley Fault System (MVFS), has a very low gradient and drains towards the Laguna de Bay

(b) Geological Setting

According to Gervacio (1968), Manila extending south to near Pasay City is within a deltaic plain formed by the Pasig River. The plain coalesced southward with the beach and lagoon deposits of Parañaque and northward with the dominantly estuarine deposits and beach and/or sand bar deposits of Caloocan City and Malabon. Previous data show that the delta materials' composition are of sand, pebbly gravel, silt, mud and clay of various colors and plasticity; in areas covered by sand, silt and clay deposits laid down by seasonal floods. The delta deposit is generally stratified to crossbedded. Inter-lobing or intertonguing of various delta material components has also been a common characteristic that was observed. The deposit is over 70 meters thick near the coast and thins out eastward in the Sta. Mesa and Makati areas. Along the eastern border zone, the deposit rests almost conformably on a firm sequence of tuffaceous rocks (Guadalupe Formation) and westward on slightly compacted, intertonguing pebbly gravel, sands and tuffaceous silts

(c) Seismicity

There are five seismic source zones that have been identified as the loci of major earthquakes that affected the MMA in the past namely: a) the Marikina Valley Fault System; b) Philippine Fault Zone; c) Lubang Fault; d) Casiguran Fault; and, e) the Manila Trench (Punongbayan and others, 1990). One of this is the 1968 major earthquake, which was attributed to the Casiguran Fault and registered a Richter Magnitude of 7.3. This event could be remembered and associated with the collapse of the Ruby Tower Apartment building, which claimed many human lives. Property damages amounted to millions of pesos not to mention the loss of 300 human lives in the MMA alone due to this earthquake. A more recent disaster that hit the MMA is the July 16, 1990 Luzon earthquake which recorded a Richter Magnitude of 7.8. This was associated with the Philippine Fault zone and was felt in Manila at Intensity VII. This earthquake exacted a death toll of more than 1200 lives and 18 billion pesos worth of property damages.

Of the five types of seismic hazards, the MMA is only susceptible to ground shaking, liquefaction and surface rupturing. The other two, landslides and tsunami, may occur but these may not seriously affect the region.

(d) Water Quality

Results of the sampling revealed that the pH of Pasig River is still within the normal range. The BOD and COD levels are also within the standard as per DENR DAO 34 for Class C waters. However, the DO level slightly exceeded the limit. The TSS detected from the sample is fairly high. The considerable quantity of fecal coliform detected from the water samples is expected, since it is very apparent that sewage lines of the inhabitants in the periphery are directly tapped into the River. Oil and grease were not detected. Complete results of the sampling are provided in **Table 23.5.3-1**.

Table 23.5.3-1 Physical Properties of the Pasig River, Guadalupe Bridge Section

	Sampling Results	DENR Effluent Standard For Class "C" Water (DAO 34)
Sampling Station Location	• In the Middle of Pasig River Guadalupe Bridge, Section	
Date and Time of Sampling	1203–1227 HRS 24 November 2003 (LOW TIDE)	
Parameters		
Temperature C	28.9	Max. 3 degrees increase
pH	7.9	6.5 - 8.5
DO, mg/L	5.49 mg/L	Min. 4–5 mg/L
COD mg/L	35.6 mg/L	100 mg/L
BOD, mg/L (5 days, 20°C)	5.9 mg/L	10 mg/L
TSS, mg/L	21.8 mg/L	Max. 30 mg/L increase
Oil and Grease, mg/L	ND	5.0 mg/L
Total Coliform, MPN/mL	180,000 MPN/100 mL	5,000 MPN/1000 mL
Fecal Coliform, MPN/mL	22,000 MPN/ 100 mL	

(e) River Sediments

Sediment sampling was also undertaken by the EIA Team to determine the amount of trace metals in Pasig River. It can be discerned from **Table 23.5.3-2** that all parameters tested exceeded the permissible limit set by the DENR, particularly the lead content. This is not surprising since a number of commercial industrial companies along the riverbank probably disposed their effluents directly into the river.

Table 23.5.3-2 Pasig River Sediment Test Result, Guadalupe Bridge Section

Trace Metal/Element	Result Value	DENR Standard
Chromium Hexavalent (Cr+6)	0.09 ppm	0.05 mg/L
Cyanide (CN-)	0.20 ppm	0.05 mg/L
Cadmium (Cd)	ND	0.01 mg/L
Lead (Pb)	27.30 ppm	0.05 mg/L
Arsenic (As)	ND	0.05 mg/L
Mercury (Hg)	0.23 ppm	0.002 mg/L
Polychlorinated Biphenyls (AROCLOR 1254)	ND	–

Note: "–" Means the standard of the substance is not considered necessary for the present time, considering the stage of the country's development and DENR capabilities, equipment and resources (DENR Administrative Order No. 34, Series of 1990)
ND - Not Detected

(f) Meteorology

The Port Area (MCO) in Manila is the nearest synoptic meteorological station to the Guadalupe Bridge. Based on the Modified Corona's Classification, the climate in Manila City belongs to Type I, which is characterized by the wet and the dry seasons. From December to April, the project area experiences a relatively dry period. The rainy season concurs with the Southwest Monsoon from July to September. The recorded annual rainfall in the area is almost close to **2205.4 mm**. The month of August receives the highest amount of precipitation of **486.0 mm**. As well, this month has the longest number of rainy days with **22**. From a low of **26.5ºC** in January, the mean monthly temperature in Port Area could heat up to a very high of **33.5ºC** during the month of May. The annual average mean temperature is **28.2°C**. The highest relative humidity of **81%** is felt in August, while a low of **65%** is experienced from March to April. The warmest months are from March to June.

(g) Ambient Air Quality

The relatively high TSP level of 332 µg/Ncm recorded in the area exceeded the permissible limit set by the DENR. This may be attributed to the number of diesel-powered vehicles that crossed the bridge during the time of sampling. The concentration of CO, NO2, SO2 are within the DENR standard. However, level of CO2 recorded was fairly high (Please refer to **Table 23.5.3-3**).

Table 23.5.3-3 Observed Ambient Air Quality Along Guadalupe Bridge

Parameters	Date & Time of Sampling	Averaging Time	Concentration in µg/Ncm	
			Sampling Results	*DENR Standards*
TSP	27 November 2003 0934–1034 HRS	1 hr	332 µg/Ncm	***230***
SO_2	12 December 2003 1030–1100 HRS	30 min	5.3 µg/Ncm	***180***
NO_2	27 November 2003 0934–1004 HRS	30 min	96.6 µg/Ncm	***150***
CO	27 November 2003 0934–1004 HRS		4.8 ppm	***30 PPM***
CO_2	27 November 2003 0934–1034 HRS	1 hr	628 ppm	-

Note: "–" Means the standard of the substance is not considered necessary for the present time, considering the stage of the country's development and DENR capabilities, equipment and resources (DAO 34, Series of 1990)

(h) Noise Level

The values obtained along the bridge in all the sampling periods exceeded the permissible limit set by the DENR. This is probably due to the instantaneous peaks generated by the vehicles crossing the bridge at the time of sampling, particularly trucks and other diesel-powered vehicles as shown in the photos below. (Please see **Table 23.5.3-4**).

Table 23.5.3-4 Observed Noise Level Along Guadalupe Bridge

		Noise Levels in dB (A)	
Time	*DENR Standards*	Date & Time of Monitoring	Monitoring Results
	B		
Morning (0500–0900 HRS)	60	06 January 2004 0801–0808 HRS	94.96
Daytime (0900–1800 HRS)	65	06 January 2004 1003–1008 HRS	86.91
Evening (1800–2200 HRS)	60	06 January 2004 1928–1933 HRS	89.26
Nighttime (2200–0500 HRS)	55	06 January 2004 2220–2225 HRS	90.16

SOURCE : Rules and Regulations of the National Pollution Control Commission (NPCC), 1978

(2) Biological Environment

(a) Terrestrial Flora

The plants observed in the project area are mostly built-up type and considered minimal. It is also important to note here that the proposed improvement of Guadalupe Bridge will have no significant impact to the flora environment.

(b) Terrestrial Fauna

The commonly observed species in the project area is *Collocalia esculenta* (glossy swiftlet), which is endemic to the Philippines. Other species noted are *Lanius cristatus* (brown shrike), *Sterna* sumatrana (black-naped tern), and *Passer montanus* (urasian tree sparrow). The proposed improvement of Jones Bridge is not expected to have any significant impact to the faunal environment.

(3) Socio-Economic Environment

The results of field investigation and interview surveys conducted are presented and discussed in this section. Based on site inspection, a total of **18** Project-Affected Families (PAFs) were identified. These PAFs belong to Barangay Barangka Illaya.

Aside from the PAFs that will be directly affected as a result of the rehabilitation of Guadalupe Bridge, other stakeholders were identified and included in the survey. They are the users of the bridge, which include the drivers and passengers of (i) private vehicles, and (ii) public utility buses. As such, two (2) sets of questionnaires were prepared, one for PAFs and the other for motorists. A total of **100** respondents (**16** PAFs and **84** motorists) were interviewed. **Table 23.5.3-5** shows the number of PAFs and motorists inverviewed.

Table 23.5.3-5 Number of PAFs and Motorists Interviewed

	Number	Interviewed	%
Brgy. Barangka Ilaya	18	16	88.9

(a) Project Affected Familes (PAFs)

Number and Type of Dwelling

There are two (2) main types of dwellings/structures occupied by the PAFs. These are the shanty type and the makeshift dwellings. The shanty types are either used as residential or as commercial (for vending). Please see **Photo 25.5.3-1** and **25.5.3-2.**

Table 23.5.3-6 and **Figure 23.5.3-1** shows the number and type of dwelling of Project-Affected Families under the Guadalupe Bridge.

Photo 25.5.3-1 Photo showing the shanties below the northern foot of Guadalupe Bridge in Barangay Barangka Ilaya, Mandaluyong City

Photo 25.5.3-2 Interview with the ambulant residents (dwelling in makeshifts) under the Guadalupe Bridge

Table 23.5.3-6 Number and Type of Dwellings of Project-Affected Families

Type of Dwellings	Frequency	Percent
Shanty	9	56.3
Makeshift	5	31.3
Shanty (for vending only)	2	12.5
Total	16	100.00

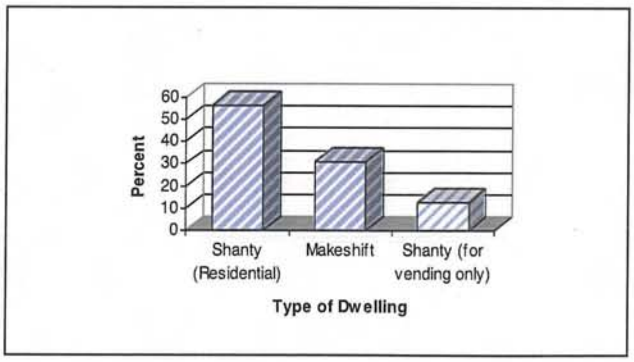


Figure 23.5.3-1 PAFs' Type of Dwelling

Household Size

As seen from **Table 23.5.3-7** and **Figure 23.5.3-2**, majority of the PAFs have a household size of 1 to 4 and 5 to 7. No family has more than five children

Table 23.5.3-7 Household Size of Project-Affected Families

Size	Frequency	Percent
1 to 4	9	56.3
5 to 7	7	43.8
8 to 10	-	-
>10	-	-
Total	16	100.00

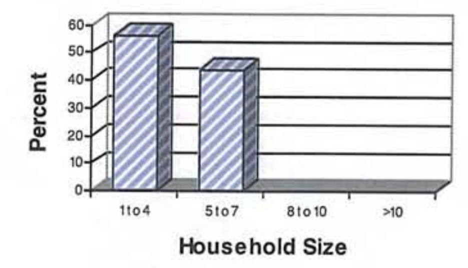


Figure 23.5.3-2 Household Size of PAFs

Household Income

Table 23.5.3-8 shows that the main sources of income of the PAFs are unskilled and skilled labor, and small businesses. Some families are also wage earners.

Table 23.5.3-8 Source of Income of Project-Affected Families

Source	Frequency	Percent
Business	3	18.8
Unskilled Labor	6	37.5
Buy/Sell	1	6.3
Skilled Labor	4	25.0
Wages/Salaries	2	12.5
Total	16	100.00

In terms of household income, results show that **56.3%** of the PAFs have annual household incomes below the poverty threshold set by NEDA (for a family of four (4)), and **43.8%** above the said threshold. (Please refer to **Table 23.5.3-9** and **Figure 23.5.3-3**).

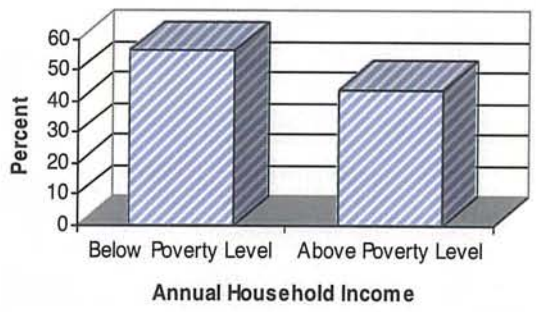


Figure 23.5.3-3 PAFs Annual Household Income

Table 23.5.3-9 Annual Household Income of Project-Affected Families

Income	Frequency	Percent
Below Poverty Threshold*	9	56.3
Above Poverty Threshold*	7	43.8
Total	16	100.00

Note: * - Based on the NEDA annual per capita poverty threshold as of year 2000 for a family of six (6), which is equivalent to P82,938.00

History of Residency

As shown in **Figure 23.5.3-4**, occupancy of the bridge started in the 60's and increased towards the nineties, and the 2000s. Similar to the other bridges under the present study, this trend seems ironic because it was during this decade, specifically in the year 1992 when the law (R. A. 7279) prohibiting illegal settling in danger areas such as river banks, was enacted. Please refer to **Table 23.5.3-10 and Figure 23.5.3-4.**

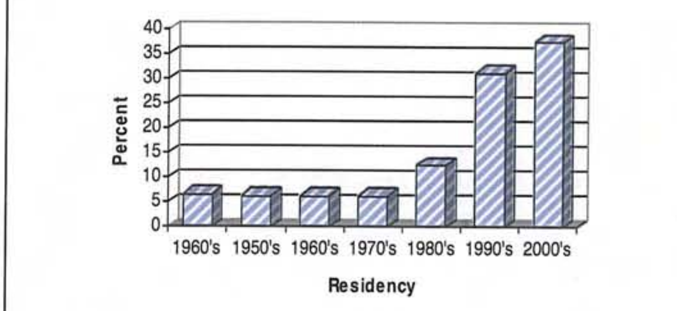


Figure 23.5.3-4 PAFs' History of Residency

Table 23.5.3-10 Residency of Project-Affected Persons

Year	Frequency	Percent
1950's	1	6.3
1960's	1	6.3
1970's	1	6.3
1980's	2	12.5
1990's	5	31.3
2000's	6	37.5
Total	16	100.00

Availability of Basic Social Services

Another factor which was considered in assessing the socio-economic profile or status of the PAFs is their accessibility to basic social services such as drinking water, power/electricity, toilet facility, health facility, and educational facility, and as an additional indicator, their waste disposal practices. Majority of PAFs obtain their drinking through illegal means. A very small number purchase water for drinking based on the surveys, majority of the PAFs have illegal water and power connections,

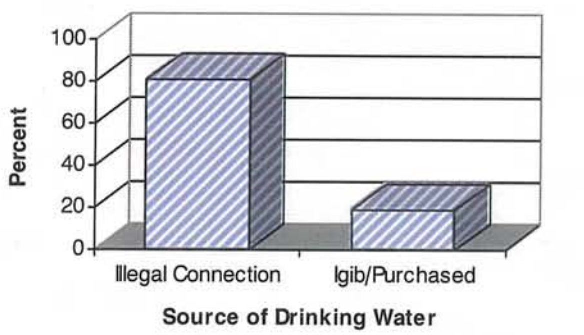


Figure 23.5.3-5 PAFs' Source of Drinking Water

and do not have toilet facilities, which strongly indicate their low and miserable status of living (Please refer to **Figure 23.5.3-5 to Figure 23.5.3-7**).

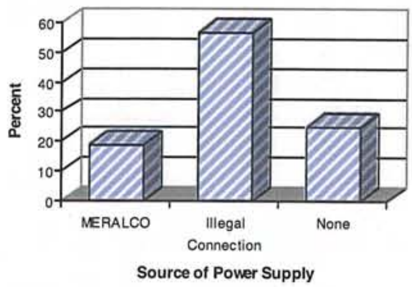


Figure 23.5.3-6 PAFs' Source of Power Supply

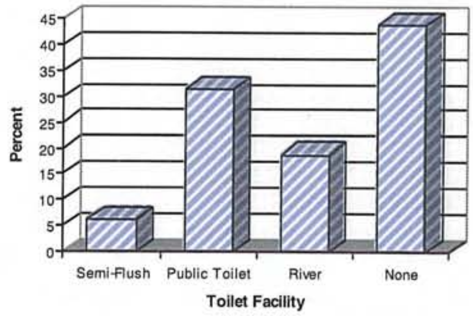


Figure 23.5.3-7 PAFs' Toilet Facilities

In terms of health and educational facility, all PAFs have access to all types of health facilities such as health centers, private clinics, and hospitals. This is because they are located within one of the busiest and progressive districts of the City of Mandaluyong. In terms of waste disposal practices, all the PAFs dispose of their solid wastes through the City Garbage Collector.

(b) Motorists

__Perceived Causes of Traffic Congestion and Condition of Guadalupe Bridge__

When asked about the traffic situation along Guadalupe Bridge, the respondents cited their perception regarding the various causes of congestion. The answers are shown in **Table 23.5.3-11** and **Figure 23.5.3-8**.

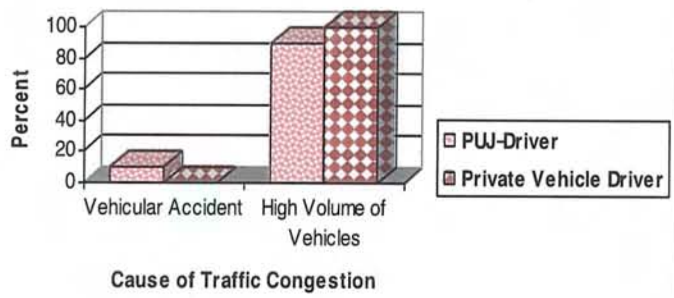


Figure 23.5.3-8 Perceived Causes of Traffic Congestion

Table 23.5.3-11 Perceived Causes of Traffic Congestion Along Guadalupe Bridge

Type of Respondent	Vehicular Accident		High Volume of Vehicles		Total	
	No.	%	No.	%	No.	%
PUB-Driver	5	10.2	44	89.8	49	100.0
PV-Driver	-	-	35	100.0	35	100.0
Total	5	6.0	79	94.0	84	100.0

(4) Social Acceptability

Based on the interview surveys, a high **81.3%** of the PAFs, and **100%** of all the motorists interviewed expressed full support to the proposed improvement of the Guadalupe Bridge. (Please refer to **Table 23.5.3-12** and **Figure 23.5.3-9**).

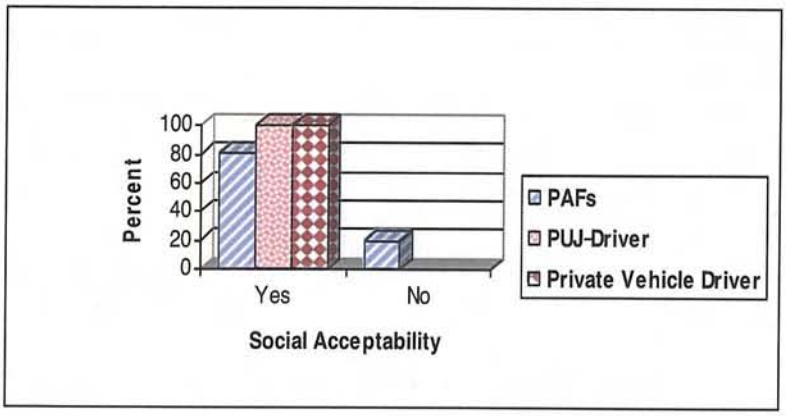


Figure 23.5.3-9 Social Acceptability of the Project

Table 23.5.3-12 Social Acceptability Crosstabulation

Type of Respondent	Yes		Total	
	No.	%	No.	%
PAFs	13	81.3	3	18.7
PUB-Driver	49	100.0	49	100.0
PV-Driver	35	100.0	35	100.0
Total	84	100.0	84	100.0

(a) PAFs' Willingness to Relocate

Based on the interviews only **37.5%** of the PAFs expressed willingness to be relocated from their present dwelling areas. The low percentage is due to the fact that 50% of these PAFs have been previously relocated but went back to the bridge (Please refer to **Table 23.5.3-13** and **Figure 23.5.3.10**).

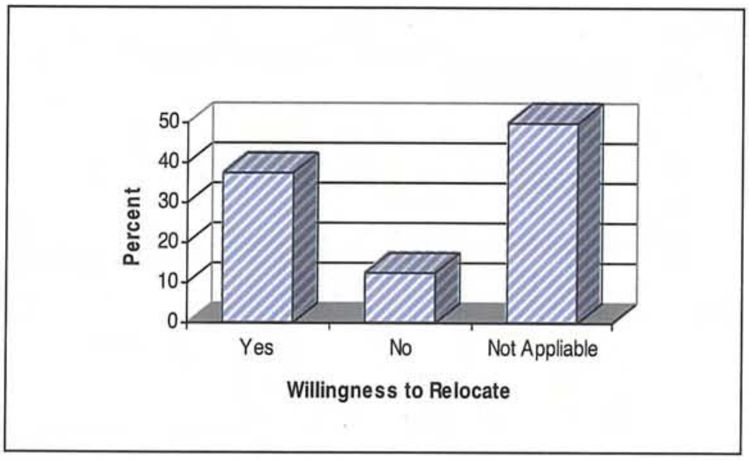


Figure 23.5.3-10 PAFs Willingness to Relocate

Table 23.5.3-13 Willingness to Relocate

	Frequency	Percent
Yes	6	37.5
No	2	12.5
Not applicable*	8	50.0
Total	16	100.00

Note: * - PAFs have been previously awarded relocation sites but still went back to the bridge

(b) PAFs' Preferred Relocation Site

When asked about their preferences regarding the relocation site, **14.3%** percent of the PAFs responded that they would prefer a relocation site within the City of Mandaluyong and **28.6%** said they would favor any other available relocation site. The question was not applicable to **57.1%** of the respondents because as previously mentioned, they were already awarded relocation sites but returned to the bridge. As such, arrangements with the City of Mandaluyong and the housing agency which relocated them must be undertaken first, to clarify if they would still be eligible for relocation to another site. (Please refer to **Table 23.5.3-14** and **Figure 23.5.3-11**).

Table 23.5.14 Project Affected Families Preferred Relocation Site

Site	Frequency	Percent
Relocation w/in the city	2	14.3
Not Applicable	8	57.1
Anywhere available relocation site	4	28.6
Total	14	100.00

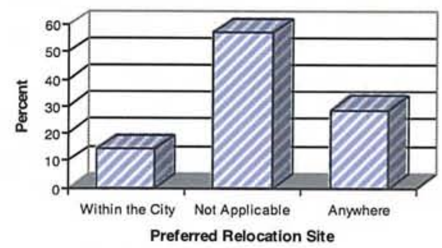


Figure 23.5.3-11 PAFs' Preferred Relocation Site

(c) Resettlement Requirements

The rehabilitation works along Guadalupe Bridge would entail displacement of **16** informal settlers occupying the portions under and along the sides of the said bridge. Although the work involved would be mainly the strengthening of the structure, it is important to ensure the safety of these people once the construction activities commence.

To accomplish this, Resettlement Action Plan (RAP) has to be prepared and implemented for the Project-Affected Families residing at various sections of the bridge. Under the Implementing Rules and Regulations (IRR) of Section 28 of the same Act (R.A. 7279), it is not only the LGUs' responsibility to relocate project affected persons or families. Section 2 of the said IRR states that one of the conditions for demolition to be allowed is when government infrastructure projects with available funding are about to be implemented. Section 3 of the same IRR states that relocation operations shall be the responsibility of the LGU concerned or the government agency authorized to demolish.

In any case, coordination between the DPWH, the City Government of Mandaluyong, and the housing agencies would be extremely necessary for the resettlement plan to be successfully carried out. Extra effort would also be necessary to determine if the previously relocated PAFs who went back to the bridge are still eligible for relocation to another site.

23.5.4 Impacts and Mitigation Measures

The predicted impacts and corresponding mitigation measures are presented in **Table 23.5.4-1**. The Environmental Management and Monitoring Program is shown on **Table 23.5.4-2**.

Table 23.5.4-1 Impacts and Mitigation Matrix

Parameters to be Monitored	Impacts	Duration and Degree of Impacts	Mitigating/Enhancement Measures
REHABILITATION PHASE PHYSICAL ENVIRONMENT			
Hydrology & Water Quality	Possible increase in the turbidity due to the movement and positioning of construction barges that will create eddies thus disturbing river sediments at the shallow portion of the Pasig River	Short-term, negative	• The impact is unavoidable but temporary in nature. Condition of the Pasig River is expected to return to normal as soon as the rehabilitation works are completed
	Possible impediment of river flow due to indiscriminate disposal of replaced steel structures	Short-term, negative	• Replaced steel structures must be properly stockpiled and regularly hauled to the designated disposal site to avoid impediment of river flow
	Possible increase in the level of oil and grease and other waste contaminants in the river	Long-term, negative	• Contractors will be required to conduct daily routine check up of heavy equipment and machinery to ensure these are in good working condition to avoid spillage of oil and grease into the River and prohibited from washing the construction equipment along the River to prevent further contamination of the waterway
	Possible increase in level of chemical pollutants due to the painting and cleaning of corroded steel floor systems	Long-term, negative	• Safety nets or tarpaulin materials must be installed below the Guadalupe Bridge during painting and cleaning of corroded steel floor systems to prevent spillage of paints and other chemicals into the River that may further pollute the waterway
Air Quality & Noise Level	Possible increase in exhaust gas emission levels	Short-term, negative	• Contractors will be required to conduct daily routine equipment and machinery check-ups to ensure that these are in the optimum working conditions; and • Regular tune-up and maintenance of construction equipment and machinery will be complied with to minimize exhaust gas emissions
	Possible increase in existing noise level along Guadalupe Bridge and its immediate vicinity	Short-term, negative	• Noise suppressors, such as mufflers will be installed whenever deemed necessary to maintain the noise generated by the various heavy equipment and other construction machinery to permissible limits; and • High noise generating construction activities will be scheduled during daytime to minimize disturbance to the residents surrounding the area
REHABILITATION PHASE SOCIO-ECONOMIC ENVIRONMENT			
Human Settlement	Displacement of informal settlers on the side and under the northeast approach of Guadalupe Bridge	Long-Term, negative	• Relocation of affected informal settlers in close coordination with the City Government of Manila
	Opportunity for **18** Project-Affected Families (PAFs) to be resettled and thus enjoy security of tenure and access to basic social services	Long-Term, positive	• Ensure that relocation and resettlement procedures are in accordance with international (World Bank and JBIC) and local policies and thus protect the interest of these PAFs, and ensure that their lives are not worsened off by the proposed project.
Income of Drivers	Possible decrease in the earnings of public transport drivers due to traffic congestion	Short-Term, negative	• This impact is unavoidable but temporary in nature. A sound traffic management re-routing plan duly-approved by the Metro Manila Development Authority (MMDA) will be implemented to minimize the effect of traffic congestion during implementation of the project, in which a two-way two-lane traffic management scheme will maintained to avoid traffic congestion within the construction site
Safety	Hazard to motorists using Guadalupe Bridge	Short-Term, negative	• Traffic enforcers and flagmen will be designated at critical construction sites to ensure safety of motorists; • Illuminated warning signs, lighting, and barricades will be installed along the entire stretch of Guadalupe Bridge;
Employment	Generation of temporary employment for qualified laborers within the affected areas during the construction	Short-Term, positive	• Qualified workers and laborers from the affected barangays will be given priority in hiring during the construction stage of the project
OPERATION PHASE SOCIO-ECONOMIC ENVIRONMENT			
Safety	Improved safety of motorists crossing Guadalupe Bridge	Long-Term, positive	• Inspection and maintenance of the newly rehabilitated bridge will be done on a regular basis to ensure optimum level service to road users

Table 23.5.4-2 Environmental Monitoring Program Matrix: Rehabilitation Stage

Parameters to be Monitored	Stations to be Monitored	Frequency of Monitoring	Methods of Analysis/Execution	DENR Standards	Implementor
PHYSICAL					
Water Quality BOD, TSS, Oil & Grease	Pasig River	Twice a year during construction period	Standard DENR EMPASS-EQD water quality analysis.	Class "C" **BOD - <10 mg/L** **TSS- <30 mg/L increase** **Oil & Grease - <3mg/L**	DENR-NCR
Air Quality TSP, NO_2, and SO_2	Guadalupe Bridge	Twice a year during construction period	Standard EMPASS-EQD water quality analysis.	TSP – 300 μg/Ncm^3 NO_2 – 470 μg/Ncm^3 SO_2 – 375 μg/Ncm^3	DENR-NCR
Noise Level	Guadalupe Bridge	Twice a year during construction period	Standard EMPASS-EQD water quality analysis.	Morning – 65 dB(A) Daytime – 70 dB(A) Evening – 65 dB(A) Nighttime – 60 dB(A)	DENR-NCR
SOCIAL					
Compliance of Contractor to occupational health and safety rules and regulation	Within the construction site	Daily	Site inspection of work areas including sanitation facilities	Based on EMP	DENR-NCR
Safety of motorists using Guadalupe Bridge	Guadalupe Bridge	Daily	Regular site inspection within the construction area	Based on DPWH and PCG Standard Operating Procedures	DPWH
Structural Integrity of the Guadalupe Bridge	Guadalupe Bridge	Based on standard DPWH maintenance procedures	Standard DPWH bridge maintenance works	Based on DPWH Standard Operating Procedures	DPWH