20.3 PRELIMINARY DESIGN AND COST ESTIMATE

20.3.1 Rehabilitation Design

(1) Bridge Design

(a) Scope of Works for Rehabilitation

Both sides of exterior girder heights are slightly higher than those of the interior and damages found are almost due to vessel collisions. One of the most important measures in this improvement is to avoid vessel collisions to the structural member of the superstructure. This preliminary design recommend scheme, "**Additional Girders** (Large Scale Rehabilitation)" mentioned in **Section 20.2.** Comparative Study of Rehabilitation Method.

The major improvement measures of this scheme are as follows:

- Provide additional exterior girders with new bearing shoes adjacent to the existing exterior girder.
- Replacement of ruptured sway bracings.
- Repair and retain existing exterior girder to function as vessel collision protection.
- Remove and reconstruct existing deck slab, sidewalk, railing and expansion joints.
- Cleaning and Painting the whole steel structures.

Figure 20.3.1-1 shows the general view of the works.

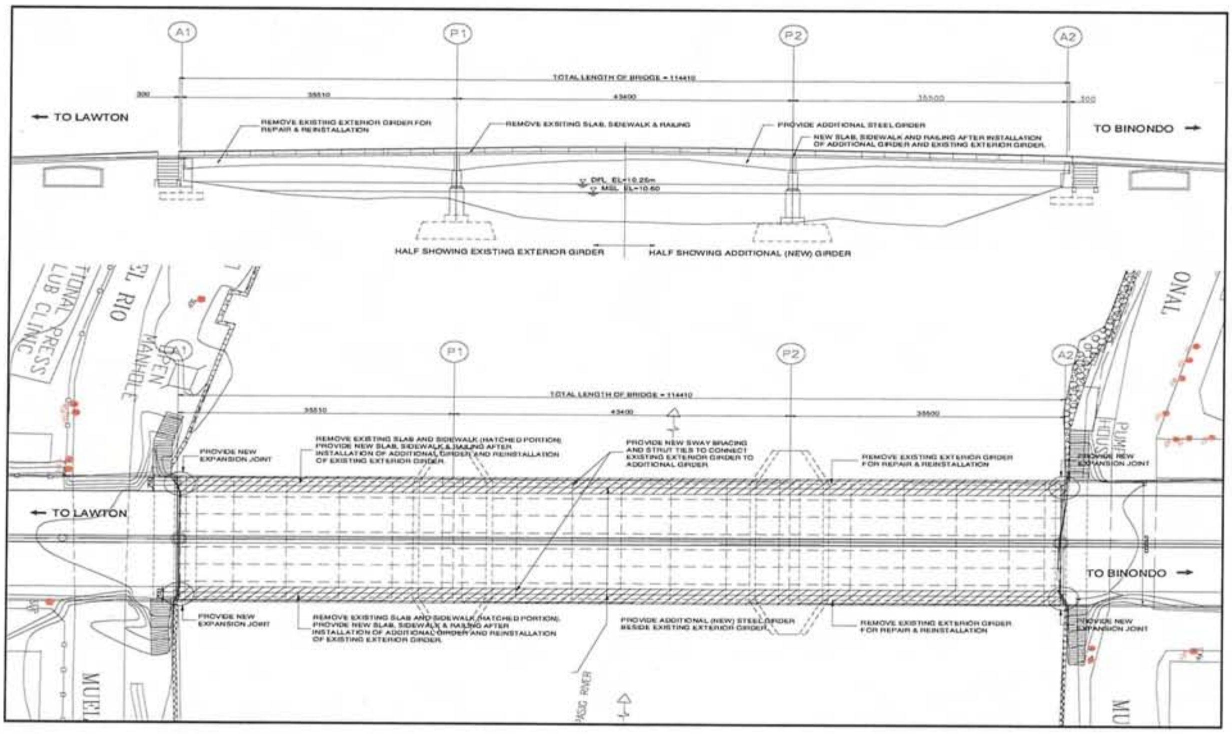


Figure 20.3.1-1 General View of Strengthening Works

(b) Design Criteria for Structure

Criteria for materials and loads are shown in **Table 20.3.1-1.**

Table 20.3.1-1 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	- Concrete; Fc' = 21 MPa - Reinforcing Steel; Fy = 275 MPa - Structural Steel, 248MPa A36 (36,000psi) Steel Plates & Rolled Shape, - Bolt; AASHTO M164 (ASTM A325) - Welds; AD1.1 – 183, E70xx Series
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 = Length in meters - Sidewalk Loads For Span more than 20M Sidewalk Loading shall be 2.50 KPa - Earthpressure Mononobe – Okabe Method

(c) Design of Superstructure

Standard Cross Section

This scheme is to retain existing exterior girder to function as vessel collision protection, adding new exterior girders adjacent to the existing exterior girder as shown in **Figure 20.3.1-2**. Therefore the total width and alignment of the bridge are kept the same as the existing one. The detail of the rehabilitation is shown in **Appendix 20.3.1-1 (1/2 to 2/2)**.

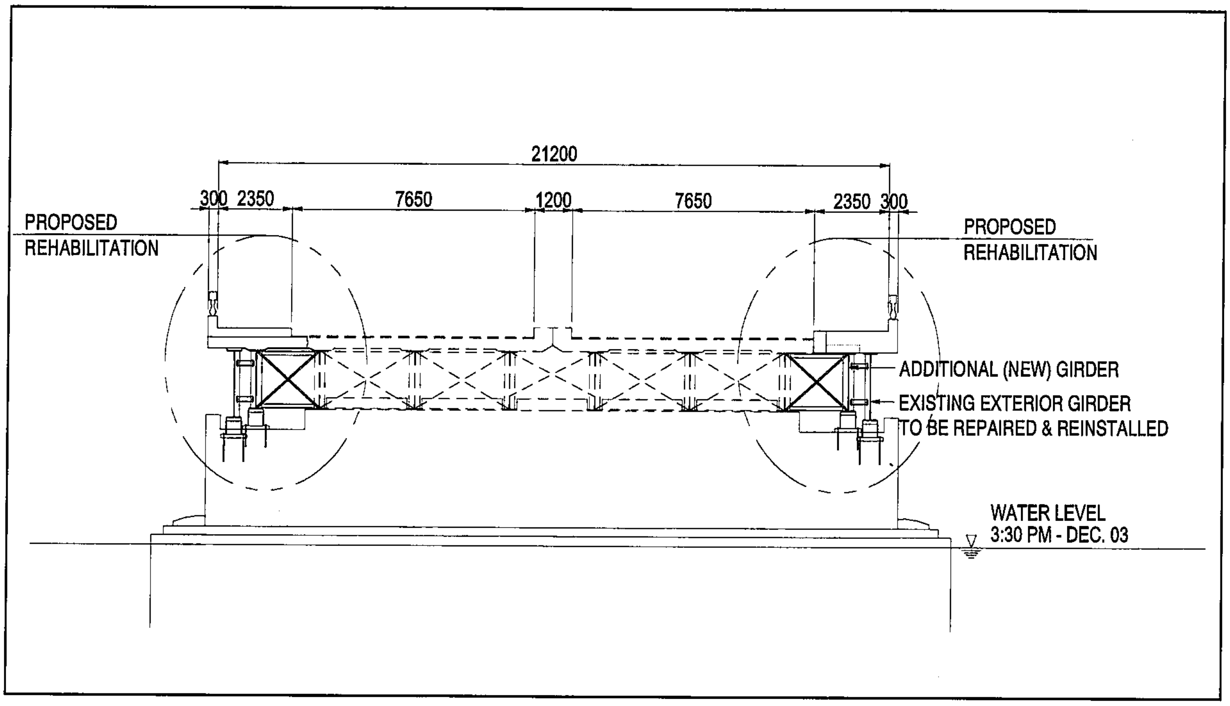


Figure 20.3.1-2 Standard Cross Section

Major Rehabilitation of Members

Additional (New) Steel Girder

The additional girders are installed next to the existing exterior girders keeping space to install new bearing shoes. The height of the new girder is the same as the existing interior girders. The section of the new girder is as shown in **Figure 20.3.1-3.**

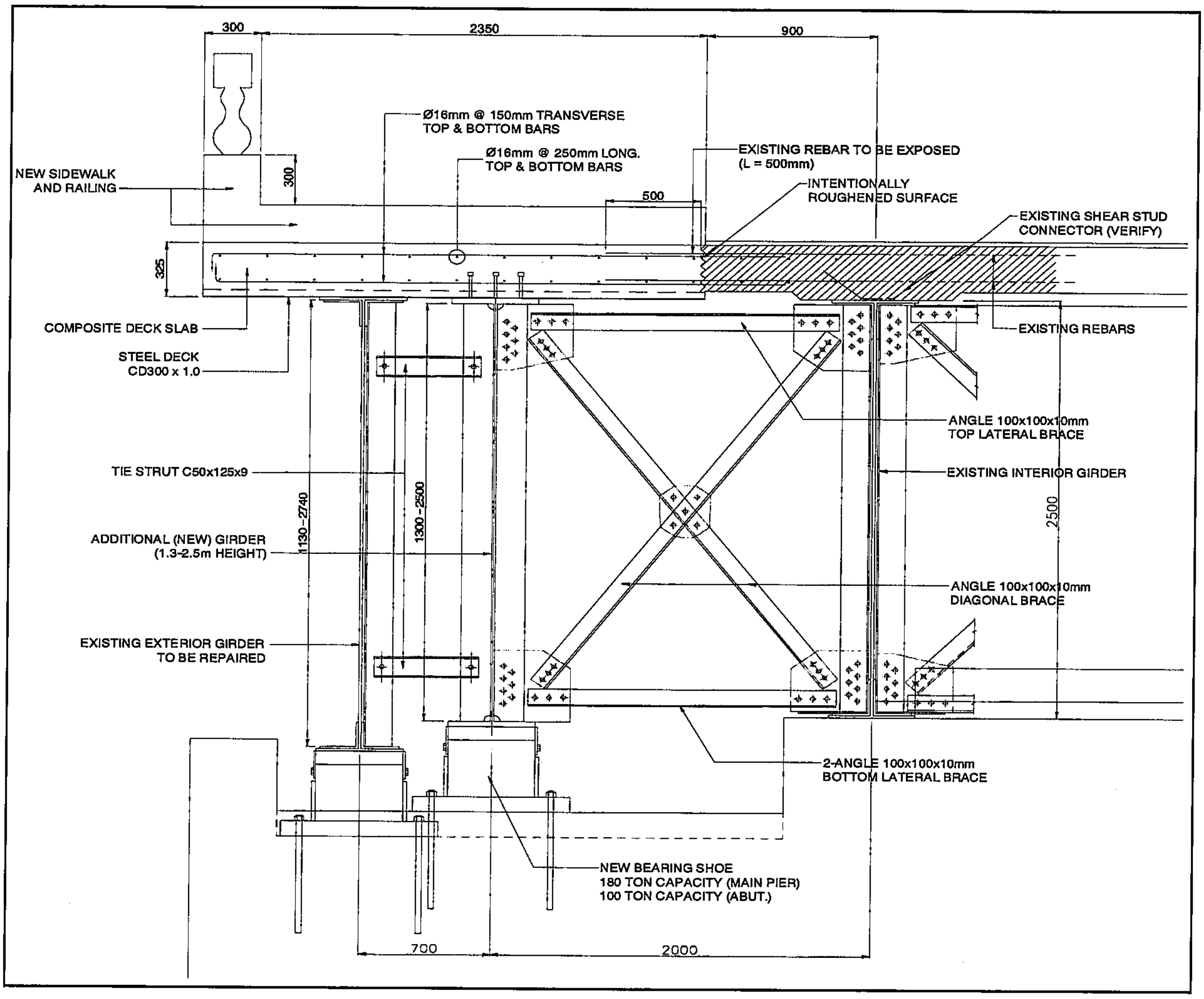


Figure 20.3.1-3 Additional Girder and New Sidewalk Details

The purpose of retaining existing exterior girder is to prevent vessel collision. To avoid load transfer from deck to the retained exterior girder, the joint between the girder and the deck is detailed with gap provision. The loads from the deck slab are then carried by the additional new girder. However, horizontal connections between the additional and the existing girders are provided for stability purpose.

Replacement of Sway Bracing

Effectively to support loads from the deck slab by additional and existing interior girders, all sway bracings between new and existing girders are removed and replaced with new ones.

Replacement of Sidewalk and Railing

The new deck slab is composite type with steel deck to shorten construction period as shown in **Figure 20.3.1-4**. The Railing shall be preserved. After deck construction they shall be reused in order to preserve historical significance.

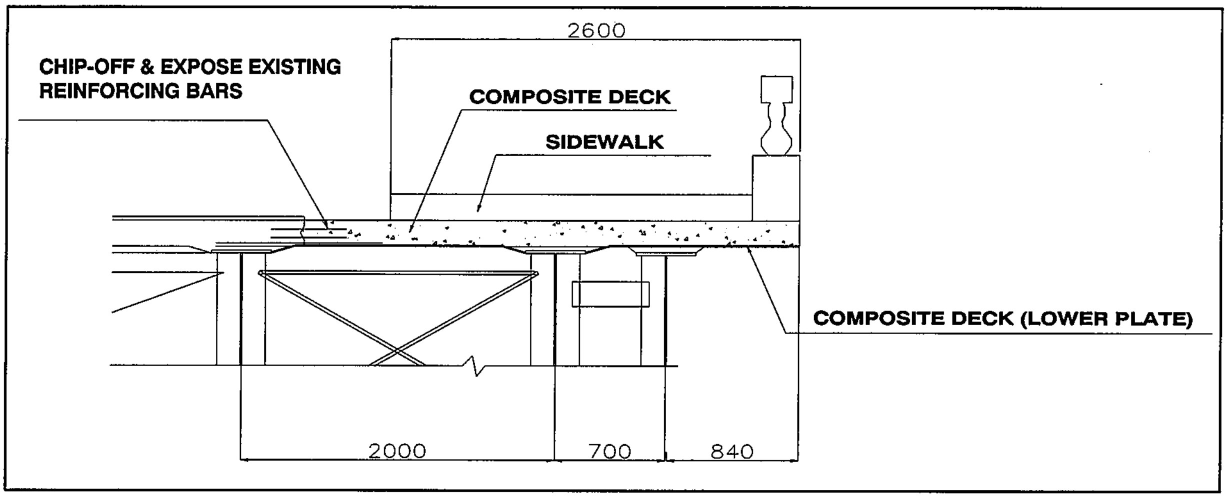


Figure 20.3.1-4 New Sidewalk and Railing

Result of Structural Analysis

For the results of structural analysis refer to **Appendix 20.3.1-2 (1/7 to 7/7)**. The detail of additional steel girders are shown in **Figure 20.3.1-5.**

Major Quantity

Major quantity for this rehabilitation work is shown in **Table 20.3.1-2**

Table 20.3.1-2 Major Quantity for Rehabilitation

Description	Unit	Unit Price	Components (%)		
			Foreign	Local	Taxes
A. Steel Structures (Furnish/Fabricate, Transport & Erection)					
Steel I Girder (1.3m – 2.5m height)	kgs	150.00	14,729,700.00	2,189,550.00	2,985,750.00
B. Scaffolding (including scaffolding for painting)					
Scaffoldings/Temporary Works	sq.m.	750.00	1,290,300.00	341,550.00	265,650.00
C. Siteworks					
Removal of Deck Slab and Railing	l.m.	6,300.00	4,389,840.00	1,418,256.00	945,504.00
Deck Slab	sq.m.	35,000.00	6,097,000.00	1,969,800.00	1,313,200.00
Existing Exterior Girders Repair	kgs.	50.00	4,909,900.00	729,850.00	995,250.00
Bridge Surface	sq.m	2,500.00	1,529,500.00	201,250.00	281,750.00
Railing Works	l.m.	50,000.00	7,475,000.00	2,415,000.00	1,610,000.00
Painting (includes cleaning)	sq.m.	4,020.00	27,103,402.80	4,028,884.20	5,493,933.00
Steel Pipe Downspout, 100 mm dia	l.m.	1,028.16	130,987.58	42,319.07	28,212.71
Decorative Railing	l.m.	14,792.00	2,517,598.40	374,237.60	510,324.00
Expansion Joint	l.m.	130,000.00	1,491,100.00	221,650.00	302,250.00
Clogged Drainage with Missing Steel Grating		17,298.93	89,954.44	29,062.20	19,374.80
Epoxy Injection	l.s.	11,636,630.63	8,494,740.36	1,745,494.20	1,396,395.68
Replacement of New Concrete (Spalling with Exposed Rebars	l.s.	3,490,989.19	2,478,602.32	523,648.38	488,738.49

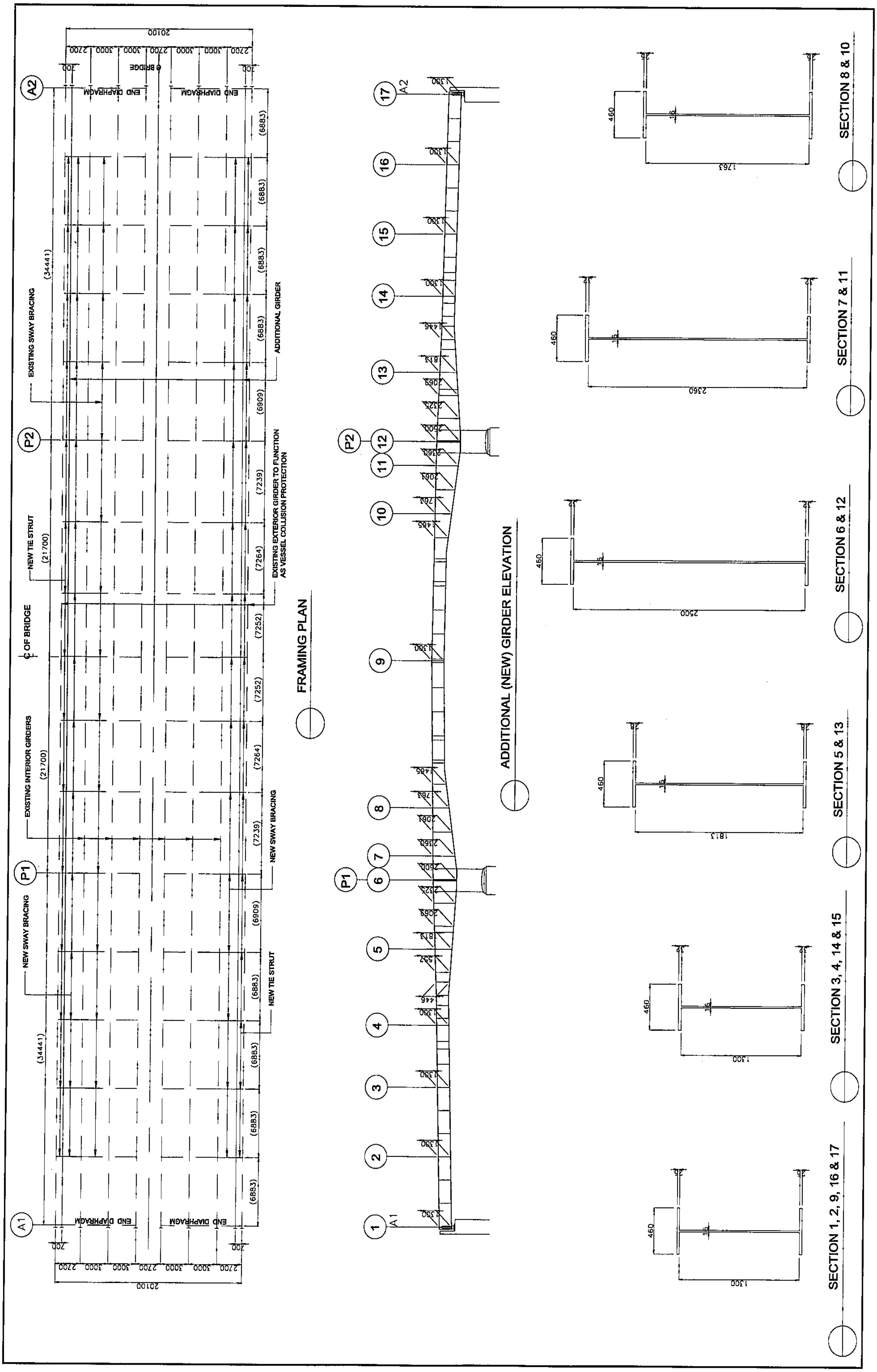


Figure 20.3.1-5 Detail of Additional (New) Girder

(2) Highway Design

(a) Scope of Works

The highway works include 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, 2001 (AASHTO)
- Highway Capacity Manual, Special Report, Transportation Research Board, 1999
- Road Structure Ordinance, Japan Road Association, 1983 (JRA)

(c) Intersections

The problem with the existing intersections is the excessively wide area in one of the approach at Magallanes Drive. This has the tendency to pose traffic and pedestrian safety and create traffic confusion problems. The other approach intersection at Plaza Cervantes create the bottleneck after the bridge due to its narrower road, intersections are closely spaced and almost open to all traffic with poor traffic management.

The basic concept of an intersection design should be to keep its area to the minimum extent possible. SU Type Vehicle minimum turning movements were considered in the intersection improvement design.

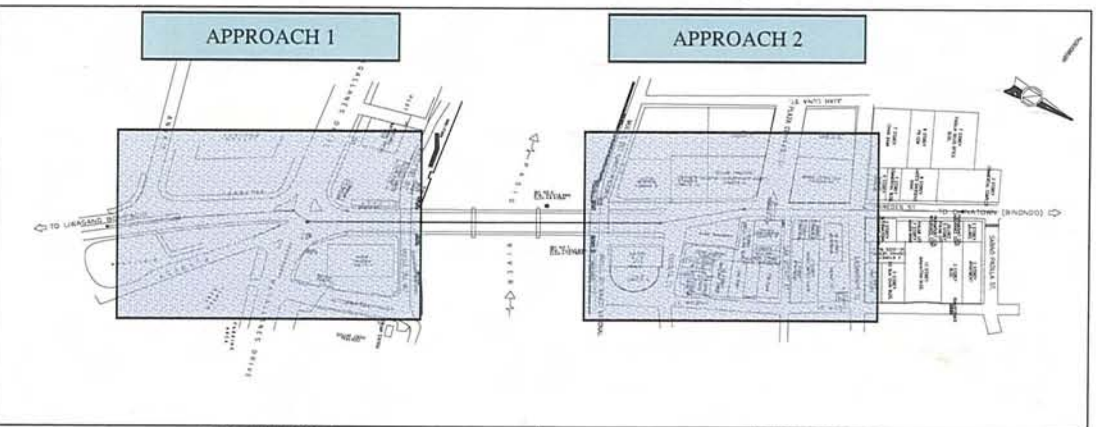
Table 20.3.1-3 shows the existing condition of approaches/ intersections.

Figure 20.3.1-6 to **Figure 20.3.1-9** present before and after improvement of the Jones Bridge approach intersections.

The existing intersection is temporarily provided with barrier fence to discourage left turning movements due to the heavy traffic coming from the flyover.

Padre Burgos Blvd. and Magallanes Drive intersection shall be improved to reduce wide area of the roads that are unused to avoid confusion of traffic movements. Magallanes Drive is used as parking and jeepney terminals.

Table 20.3.1-3 Existing Conditions of Approaches /Intersections of Jones Bridge

PLAN		
	APPROACH 1	**APPROACH 2**
Traffic	• Traffic from Flyover are very heavy due to bottleneck at Plaza Cervantes, creating no. of lanes (3-lanes) greater than the specified two (2) lanes flyover. • **Magallanes Drive are used as parkings and jeepney terminals.** • No left turning traffic allowed	• **Bottleneck traffic is observed at this intersection.** • Some vehicles making U-turn from the bridge going to the service road towards Muelle del Banco to avoid congestion thus creating more traffic conflicts. • Roadside parking is allowed at Plaza Cervantes and adjacent to Escolta St. affecting flow of traffic.
Pedestrian	• **Uncontrolled pedestrian crossing.** • No pedestrian marking is in placed	• **Uncontrolled pedestrian crossing.** • No pedestrian crossings are in placed
Geometric and Pavement	• **Excessively wide intersection** • Pavement surface are worn out.	• Road lanes are not properly configured at Plaza Cervates.
Traffic Signal, Markings and Sign	• Unsignalized intersection. • Pavement markings is worn out. • Insufficient traffic signs.	• Intersection is signalized. • Pavement markings are worn out. • Insufficient traffic signs.
Recommen-dation	• Major improvement is necessary to re-channelized the intersection to provide a through road from the flyover to the bridge and vice-versa.	• Major improvement is necessary to reconfigure the lane distribution along Plaza Cervantes. • Roadside parking would be reduced.

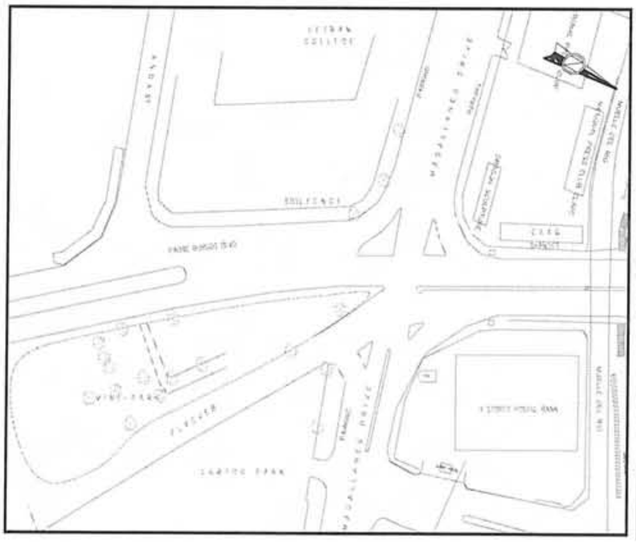


Figure 20.3.1-6 Existing Approach 1 Intersection before Improvement

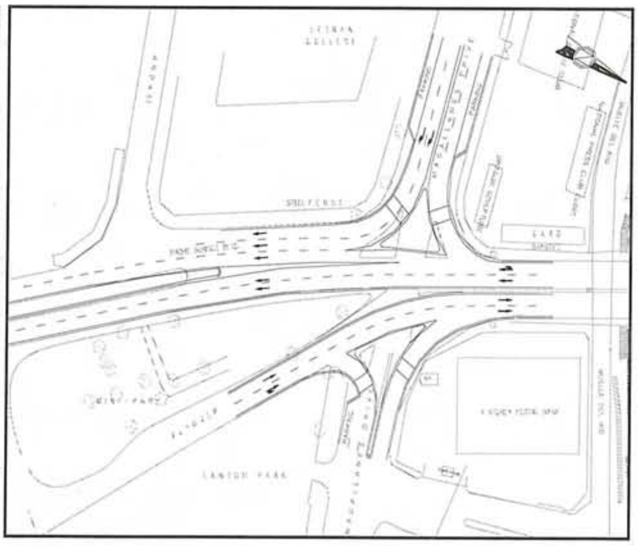


Figure 20.3.1-7 Existing Approach 1 Intersection after Improvement

Modification of the island shall be done to improve the through road leading to the bridge and also right turning movements to and from Magallanes Drive.

Improvement of the approach road will include overlaying of the existing pavement along Padre Burgos Blvd. towards the intersection of Magallanes Drive.

Pavement markings, traffic signs and guide signs shall be installed.

The existing intersection just after the Jones Bridge is affected by the narrowing of road at Paredes St. and the intersections at Plaza Cervantes and Dasmarinas St.

Intersection geometric layout Along San Gabriel (Plaza Cervantes) shall include divisional island to channelized turning movements.

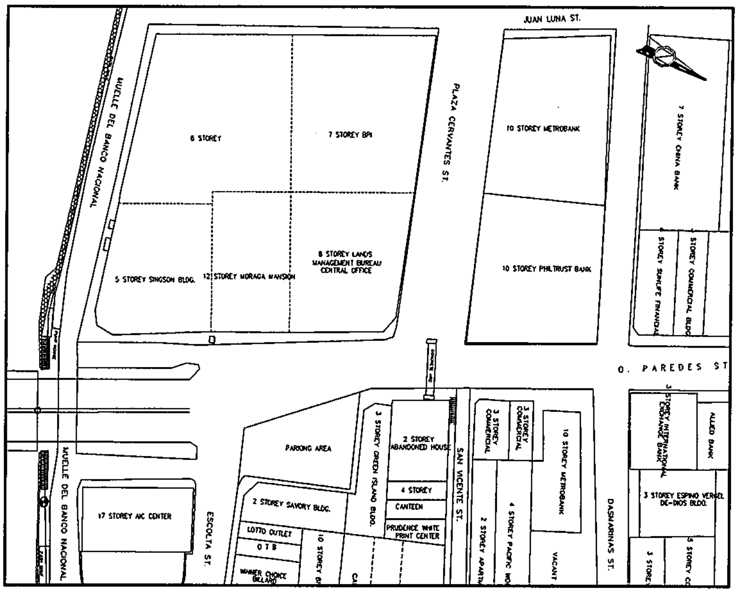


Figure 20.3.1-8 Existing Approach 2 Intersection before Improvement

Concrete median barrier shall be provided towards the intersection of Q. Paredes St. and Dasmarinas St. Through direction from Plaza Cervantes towards San Vicente St. shall be blocked by the said barrier, this movement shall not be allowed to facilitate faster movement of traffic along Q. Paredes St. This will also eliminate one crossing intersection just after the bridge.

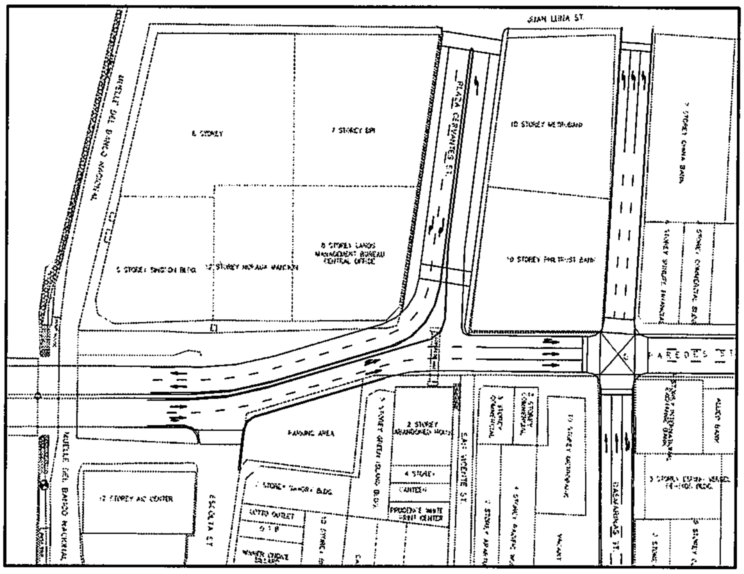


Figure 20.3.1-9 Proposed Approach 2 Intersection After Improvement

Traffic going to east side of Q. Paredes shall use available road network such as Muelle Del Banco, a road crossing underneath the bridge.

Improvement of the approach road will include overlaying of the existing pavement along Q. Paredes St. towards the intersection of Dasmarinas St.

Pavement markings, traffic signs and guide signs shall be installed.

(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 is maintained.
Access Roads or driveways of nearby buildings should be discourage 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 20.3.1-3 (1/2 to 2/2).**

(3) Design of Protection to Vessel Collision

(a) Safety Measure for Superstructure

There are two kinds of vessel collision: collision to superstructure and to substructure. One of the countermeasures to superstructure mentioned in **Section 20.3.1, Item 1 (c),** is retaining exterior girder as a collision protector.

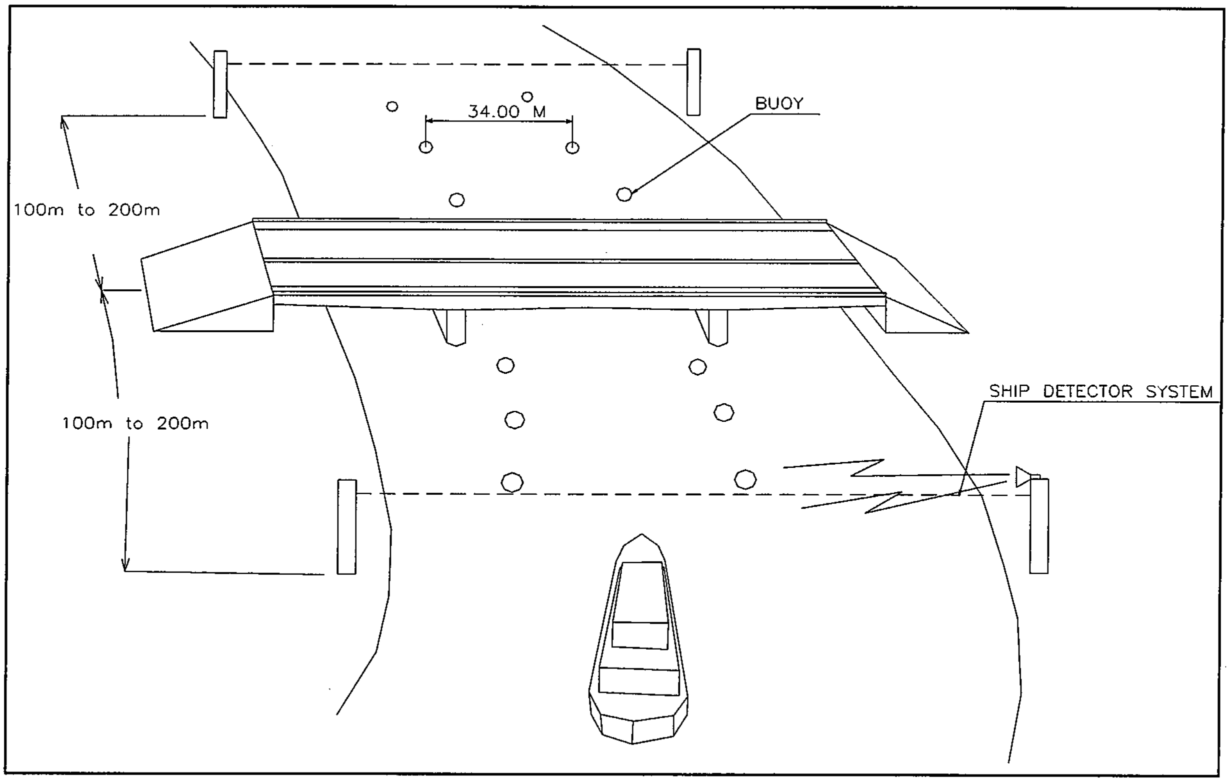


Figure 20.3.1-10 Layout of Vessel Collision Protection

Though the superstructure is protected by retained exterior girder, the Study recommends to adopt the vessel collision avoidance system as mentioned in **Chapter 10. Figure 20.3.1-10** shows layout of the system.

(b) Safety Measure for Substructure

The protectors are installed to the fender support that is added to the piers as shown in **Figure 20.3.1-11.**

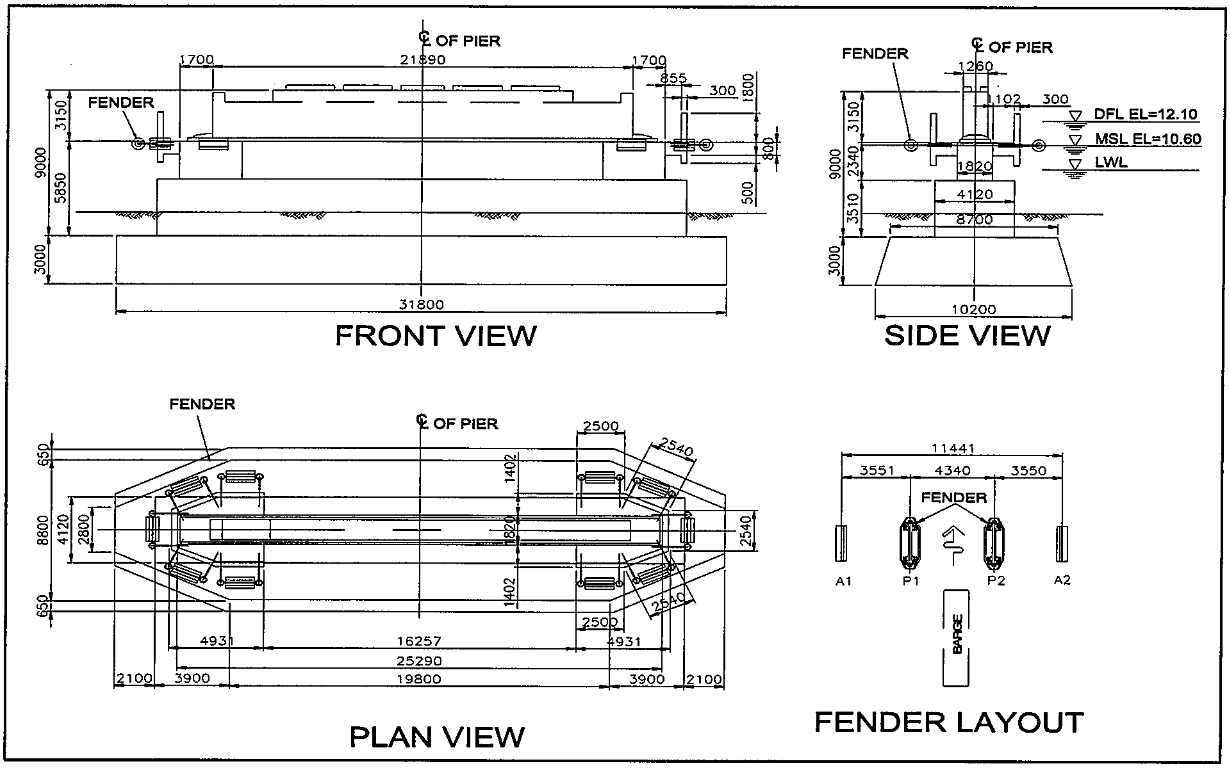


Figure 20.3.1-11 Layout of Vessel Collision Fenders

20.3.2 Construction Plan and Traffic Management

(1) Construction Method

After removal of sidewalk, sway bracings and installation of bearings for additional new girder, the girder is carried by trailer and erected by truck crane as shown **Figure 20.3.2-1.** Then replacement of sidewalk at upstream side follows. Downstream side construction shall be carried out after completion of the upstream construction in same way. The details of construction method are shown in **Appendix 20.3.2-1 (1/2 to 2/2).**

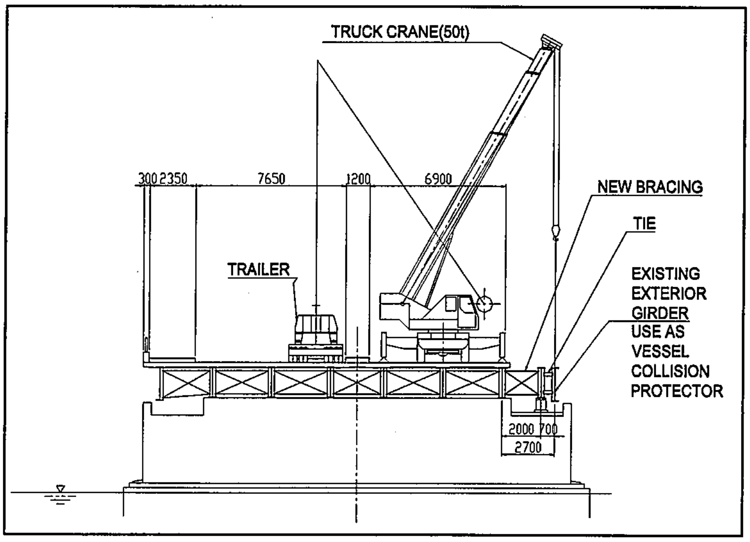


Figure 20.3.2-1 Construction Method

In this construction method, the traffic will be controlled as shown in **Figures 20.3.2-2** and **20.3.2-3** in accordance with the construction work.

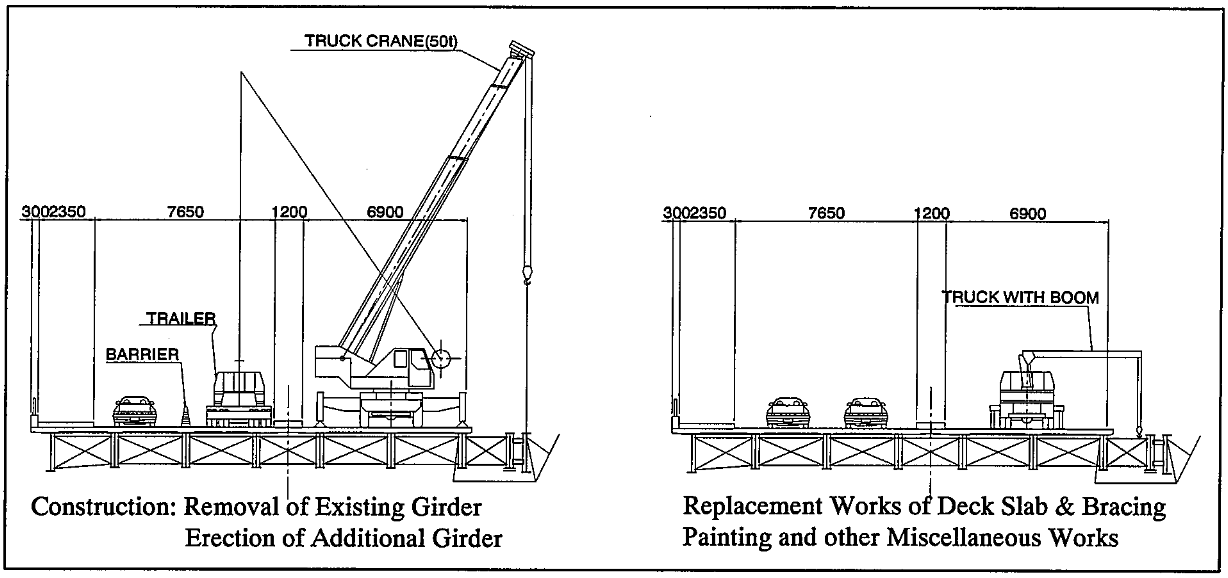


Figure 20.3.2-2 Traffic Control during Construction

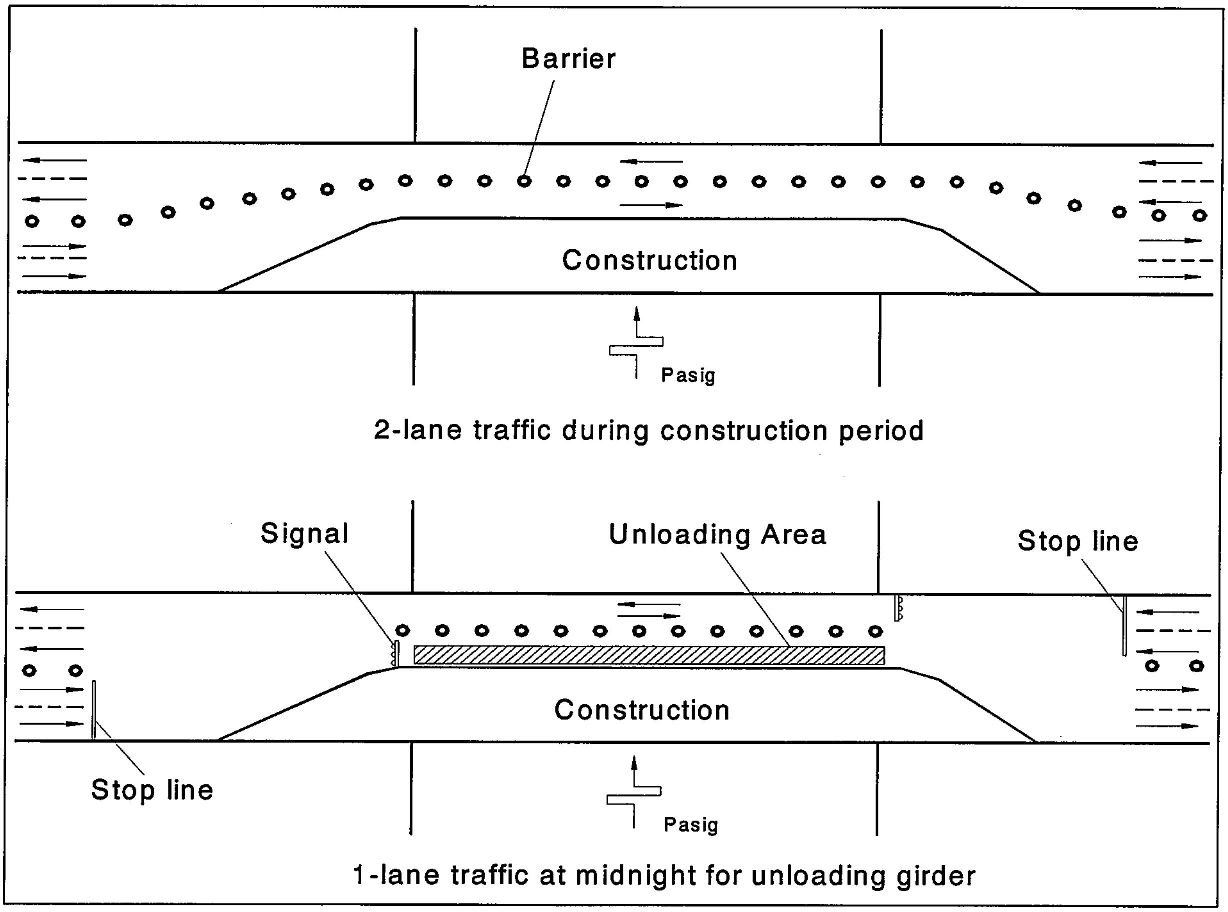


Figure 20.3.2-3 Traffic Lane Control

The Traffic constraints are as follows:

- Only 2 lanes can be used during construction of the bridge,
- At mid night temporary traffic is limited to 1 lane,

- Vehicle load will be limited during construction,
- The remaining 2 lanes of traffic shall detour to the other half section of the bridge, and
- The detour traffic shall carry heavy vehicles

20.3.3 Preliminary Cost Estimate

The total project costs consist of total construction cost and engineering service. 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% was taken in account to the total construction cost.

The unit cost by construction item is shown in **Table 20.3.3-1**

Detailed computation is presented in **Appendix 20.3.3-1.**

<u>Total Construction Cost</u>

The total construction cost for the bridge estimated on the basis described above is shown in **Table 20.3.3-2.**

Table 20.3.3-2 Estimated Construction Cost

June, 2003 Prices

Items		Cost(x MP)
Superstructure	Foreign	115.30
	Local	23.40
	Tax	23.10
	Subtotal	161.80
Highway	Foreign	1.60
	Local	0.50
	Tax	0.30
	Subtotal	2.40
Total Construction Cost		**164.10 MP**

Table 20.3.3-1 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. Steel Structures (Fabricate & Transport)						
408(1)	Steel I Girder (1.3m – 2.5m height)	kgs.	150.00	74%	11%	15%
B. Scaffolding (including scaffolding for painting)						
SPL	Scaffoldings/Temporary Works	sq.m.	750.00	68%	18%	14%
C. Siteworks						
101(3)	Removal of Deck Slab	l.m.	6,300.00	65%	21%	14%
SPL	Deck Slab	sq.m.	35,000.00	65%	21%	14%
408(1)	Additional Gutter	kgs.	50.00	74%	11%	15%
SPL	Bridge Surface	sq.m.	2,500.00	76%	10%	14%
401(1)	Railing Works	l.m.	50,000.00	65%	21%	14%
411	Painting (includes cleaning)	sq.m.	4,020.00	74%	11%	15%
500(1)	Steel Pipe Downspout, 100mmø	l.m.	1,028.16	65%	21%	14%
401(3)	Decorative Railing	l.m.	14,792.00	74%	11%	15%
SPL	Expansion Joint	l.m.	130,000.00	74%	11%	15%
503(1)a	Clogged Drainage with Missing Steel Grating	each	17,298.93	65%	21%	14%
SPL	Epoxy Injection	l.s.	11,636,630.63	73%	15%	12%
SPL	Replacement of New Concrete (Spalling with Exposed Rebars)	l.s.	3,490,989.19	71%	14%	14%
			Sub-Total	71%	15%	15%
D. Total Direct Cost				71%	14%	15%
E. Indirect Cost						
	Traffic Management					
	Temporary Facilities					
	Mobilization/demobilization					
	40% if Total Direct Cost			71%	15%	14%
Annex II - ROADWAY IMPROVEMENT						
Earthworks						
101(3)a	Removal of Island	cu.m.	114.15	65%	21%	14%
101(3)b	Removal of Curb and Gutter	l.m.	85.62	65%	21%	14%
101(3)c	Removal of Plant Box	sq.m.	82.62	65%	21%	14%
101(3)d	Removal of Sidewalk	sq.m.	154.06	65%	21%	14%
101(3)e	Removal of Parking Space	sq.m.	99.21	65%	21%	14%
Surface Course						
301(1)	Tack Coat	tonne	25,000.00	76%	10%	14%
310	Asphalt	tonne	3,100.00	76%	10%	14%
Miscellaneous						
311	Concrete	sq.m.	272.93	65%	21%	14%
600(1)	Concrete Curb	l.m.	562.46	65%	21%	14%
600(1	Combination of Concrete Curb and Gutter	l.m.	1,100.00	65%	21%	14%
612(1)	Pavement Markings	sq.m.	862.13	65%	21%	14%
xxx	Contingencies	l.s.	112,817.66	75%	15%	10%

(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 scales 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 20.3.3-3**

Table 20.3.3-3 Estimated Engineering Cost

June, 2003 Prices

Items		Cost (x MP)
Detailed Design	Foreign	4.50
	Local	2.90
	Tax	0.80
	Subtotal	8.20
Construction Supervision	Foreign	7.20
	Local	4.60
	Tax	1.30
	Subtotal	13.10
Total Engineering Cost	**Total**	**21.30**

(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 20.3.3-4**

Table 20.3.3-4 Summary of Estimated Project Cost

June, 2003 Prices

Items		Cost (x MP)
Construction Cost	Foreign	116.90
	Local	23.90
	Tax	23.40
	Subtotal	164.10
Engineering Cost	Foreign	11.70
	Local	7.50
	Tax	2.10
	Subtotal	21.30
Grand Total	Foreign	128.60
	Local	31.30
	Tax	25.60
Grand Total		**185.40**

20.4 TRAFFIC ANALYSIS AND ECONOMIC EVALUATION

20.4.1 Traffic Analysis

(1) Alternative Road Networks and Bridge Plans

There are several road network plans that can be considered in relation to Jones Bridge. In this study, the following alternatives cases of the road network together with the Bridge Plans for the traffic assignment are considered:

Do Nothing Case (No Rehabilitation Case)

2007 – 2010 Limitation of vehicle load on Jones Bridge without Second Ayala Bridge

2011 Afterward Full closure of Jones Bridge and with Second Ayala Bridge because the bridge life is terminated

Do Something Case (Rehabilitation Case)

2007 – 2010 No limitation of vehicle load on Jones Bridge without Second Ayala Bridge

2011 Afterward No limitation of vehicle load on Jones Bridge and with Second Ayala Bridge. **Table 20.4.1-1** shows the alternative road networks and bridge plans

Table 20.4.1-1 Alternative Road Networks and Bridge Plans

Name of Bridge	Year	Case 1 (Do Nothing Case)	Case 2 (Do Something Case)
Jones Bridge	2007 – 2010	* Vehicle load limitation on Jones Bridge	* No limitation of vehicle load
	2011 Afterward	* Full closure of Jones Bridge	* No limitation of vehicle load
Second Ayala Bridge	2007 – 2010	* Without Second Ayala Bridge	* Without Second Ayala Bridge
	2011 Afterward	* With Second Ayala Bridge	* With Second Ayala Bridge

(2) Traffic Assignment Method

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

(3) Results of Traffic Assignment

Table 20.4.1-2 shows the traffic demand forecast of Jones Bridge and related bridges.

Table 20.4.1-2 Traffic Demand Forecast on Jones Bridge in 2010 and 2020

No.	Bridge Name	2010		2020	
		Case 1 (Do Nothing)	Case 2 (Do Something)	Case 1 (Do Nothing)	Case 2 (Do Something)
1	Delpan Bridge	75,200	74,500	99,000	88,300
2	Jones Bridge	60,200	61,700	0	64,000
3	Mc Arthur Bridge	61,000	61,000	87,100	74,600
4	Quezon Bridge	79,800	79,000	97,400	86,300
5-1	Ayala Bridge	47,100	47,100	71,200	51,000
5-2	Second Ayala Bridge	0	0	27,900	33,900
Total		323,300	323,300	382,600	398,100

Figure 20.4.1-1 shows the vehicle composition of Jones Bridge. According to this figure, the share of heavy vehicles consisting of large busses and trucks to total traffic is only 3%.

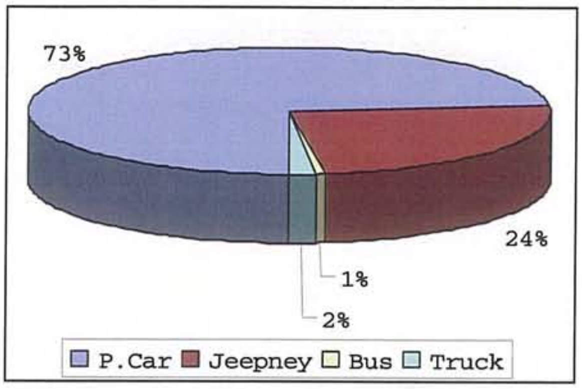


Figure 20.4.1-1 Vehicle Composition of Jones Bridge (PCU)

20.4.2 Economic Evaluation

(1) Presumptions

(a) Evaluation Period

The evaluation period is assumed to be 40 years from 2007 to 2047.

(b) Implementation Schedule of the Project

According to the implementation schedule mentioned in the previous sections, the project will be implemented as the following schedule:

- Detailed Engineering 2004
- Implementation 18 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 the evaluation of investment efficiency through comparison between benefits and costs derived from with and without the Jones 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 the conversion factor.

Taking into account the master plan stage, in this study the economic cost is estimated by deducting from the financial cost the government taxes as shown in **Table 20.4.2-1.**

Table 20.4.2-1 Economic Cost Estimate

(Unit: '000 Pesos)

Description		Economic Cost	Financial Cost
1	Construction Cost	140,714	164,100
1-1	Superstructure	138,614	161,800
1-2	Substructure	0	0
1-3	Highway	2,100	2,400
2	Consultancy	19,200	21,300
2-1	Detailed Design	7,400	8,200
2-2	Construction Supervision	11,800	13,100
	Total	159,914	185,400

(b) Maintenance Cost

According to the maintenance data gathered in this Study the present maintenance cost for the bridges in the Metro Manila are estimated to about 1.0% of the construction cost. In this study, therefore, the maintenance cost of the Jones 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 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 cost derived from the following situations:

2007 – 2010 Reduction of bus and truck operating cost and travel time cost due to rerouting of these traffic

2011 Afterward Reduction of vehicle operating cost and travel time cost due to rerouting of all traffic

(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 in this study. (See **Table 20.4.2-2**).

Table 20.4.2-2 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
Truck	9,622	2.107	0
Average	4,279	0.539	1.096

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

(c) Benefit Calculation

Saving in vehicle operating costs and travel time cost were estimated and are shown in **Table 20.4.2-3.**

Table 20.4.2-3 Estimation of Benefits

Unit: '000 Pesos/Year

Year	Saving in VRC (A)	Saving in VFC (B)	Saving in VOC (A+B)	Saving in TCC (C)	Total Saving (A+B+C)
2007	16,005	5,817	21,822	4,710	26,532
2010	18,422	6,696	25,118	5,421	30,539
2011	68,770	32,399	101,169	21,241	122,410
2020	86,029	47,536	133,565	31,164	164,729

(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 20.4.2-4** show the benefit – cost analysis of the Jones Bridge Rehabilitation Project during project life period and **Table 20.4.2-5** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of P235.42 million and BCR of 1.97 over 30 years life of the Bridge using a discount rate of 15% which is designated by the NEDA. The Economic Internal Rate of Return (EIRR) was computed at 24.0%.

Table 20.4.2-4 Economic Indications of Benefit Cost Analysis

Net Present Value	235.42 million Pesos
BCR	1.971
EIRR	24.0%

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

(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 20.4.2-6** shows the results of the sensitivity analysis.

(c) Summary of Economic Analysis

The implementation of the Jones 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.

Table 20.4.2-5 Benefit – Cost Stream of Jones Bridge Rehabilitation Project

Undiscounted Benefit Cost Stream

000 Pesos

Sq	Year	Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit
1	2004	4,000.0	0.0	4,000.0	0.0	-4000.0
2	2005	85,566.0	0.0	85,566.0	0.0	-85566.0
3	2006	173,233.0	0.0	173,233.0	0.0	-173233.0
4	2007	0.0	6,680.0	6,680.0	26,532.1	19,852.1
5	2008	0.0	6,680.0	6,680.0	27,805.6	21,125.6
6	2009	0.0	6,680.0	6,680.0	29,140.2	22,460.2
7	2010	0.0	6,680.0	6,680.0	30,539.0	23,859.0
8	2011	0.0	6,680.0	6,680.0	122,409.7	115,729.7
9	2012	0.0	6,680.0	6,680.0	126,476.3	119,796.3
10	2013	0.0	6,680.0	6,680.0	130,688.1	124,008.1
11	2014	0.0	6,680.0	6,680.0	135,050.6	128,370.6
12	2015	0.0	6,680.0	6,680.0	139,569.6	132,889.6
13	2016	0.0	6,680.0	6,680.0	144,251.1	137,571.1
14	2017	0.0	6,680.0	6,680.0	149,101.2	142,421.2
15	2018	0.0	6,680.0	6,680.0	154,126.4	147,446.4
16	2019	0.0	6,680.0	6,680.0	159,333.4	152,653.4
17	2020	0.0	6,680.0	6,680.0	164,729.3	158,049.3
18	2021	0.0	6,680.0	6,680.0	169,401.0	162,721.0
19	2022	0.0	6,680.0	6,680.0	173,038.6	166,358.6
20	2023	0.0	6,680.0	6,680.0	176,787.5	170,107.5
21	2024	0.0	6,680.0	6,680.0	180,651.0	173,971.0
22	2025	0.0	6,680.0	6,680.0	184,632.7	177,952.7
23	2026	0.0	6,680.0	6,680.0	188,736.3	182,056.3
24	2027	0.0	6,680.0	6,680.0	192,965.6	186,285.6
25	2028	0.0	6,680.0	6,680.0	197,324.4	190,644.4
26	2029	0.0	6,680.0	6,680.0	201,816.8	195,136.8
27	2030	0.0	6,680.0	6,680.0	206,446.9	199,766.9
28	2031	0.0	6,680.0	6,680.0	209,514.3	202,834.3
29	2032	0.0	6,680.0	6,680.0	209,514.3	202,834.3
30	2033	0.0	6,680.0	6,680.0	209,514.3	202,834.3
31	2034	0.0	6,680.0	6,680.0	209,514.3	202,834.3
32	2035	0.0	6,680.0	6,680.0	209,514.3	202,834.3
33	2036	0.0	6,680.0	6,680.0	209,514.3	202,834.3

Discounted Benefit Cost Stream

000 Pesos

Sq	Year	Discounted	Construction Cost	O & M Cost	Cost Total	Benefit	Cost-Benefit
1	2004	1.000	4,000.0	0.0	4,000.0	0.0	-4000.0
2	2005	1.150	74,405.2	0.0	74,405.2	0.0	-74405.2
3	2006	1.323	130,989.0	0.0	130,989.0	0.0	-130989.0
4	2007	1.521	0.0	4,392.2	4,392.2	17,445.3	13053.1
5	2008	1.749	0.0	3,819.3	3,819.3	15,897.9	12,078.6
6	2009	2.011	0.0	3,321.1	3,321.1	14,487.8	11,166.7
7	2010	2.313	0.0	2,888.9	2,887.9	13,202.9	10,315.0
8	2011	2.660	0.0	2,511.3	2,511.3	46,018.3	43,507.0
9	2012	3.059	0.0	2,183.7	2,183.7	41,345.3	39,161.6
10	2013	3.518	0.0	1,898.9	1,898.9	37,149.7	35,250.8
11	2014	4.046	0.0	1,651.2	1,651.2	33,382.4	31,731.2
12	2015	4.652	0.0	1,435.8	1,435.8	29,999.5	28,563.7
13	2016	5.350	0.0	1,248.5	1,248.5	26,961.6	25,713.1
14	2017	6.153	0.0	1,085.7	1,085.7	24,233.1	23,147.4
15	2018	7.076	0.0	944.1	944.1	21,782.5	20,838.4
16	2019	8.137	0.0	820.9	820.9	19,581.2	18,760.3
17	2020	9.358	0.0	713.9	713.9	17,603.8	16,889.9
18	2021	10.761	0.0	620.7	620.7	15,741.7	15,121.0
19	2022	12.375	0.0	539.8	539.8	13,982.4	13,442.6
20	2023	14.232	0.0	469.4	469.4	12,422.0	11,952.6
21	2024	16.367	0.0	408.1	408.1	11,037.8	10,629.7
22	2025	18.822	0.0	354.9	354.9	9,809.7	9,454.8
23	2026	21.645	0.0	308.6	308.6	8,719.7	8,411.1
24	2027	24.891	0.0	268.4	268.4	7,752.3	7,483.9
25	2028	28.625	0.0	233.4	233.4	6,893.4	6,660.0
26	2029	32.919	0.0	202.9	202.9	6,130.7	5,927.8
27	2030	37.857	0.0	176.5	176.5	5,453.4	5,276.9
28	2031	43.535	0.0	153.4	153.4	4,812.5	4,659.1
29	2032	50.066	0.0	133.4	133.4	4,184.8	4,051.4
30	2033	57.575	0.0	116.0	116.0	3,639.0	3,523.0
31	2034	66.212	0.0	100.9	100.9	3,164.3	3,063.4
32	2035	76.144	0.0	87.7	87.7	2,751.6	2,663.9
33	2036	87.585	0.0	76.3	76.3	2,392.7	2,316.4
		Total	209,394.2	33,165.9	242,559.1	477,979.3	235,420.2

Net Present Value	235,420
B/C Ratio	1.971
EIRR	24.0%

Table 20.4.2-6 Sensitivity Analysis regarding Costs and Benefits of Jones Bridge Rehabilitation Project (EIRR)

Unit: %

		Benefits				
		20% down	10% down	Base Case	10% up	20% up
Cost	20% down	24.0	25.8	27.4	29.0	30.4
	10% down	22.3	24.0	25.6	27.0	28.4
	Base Case	20.9	22.5	24.0	25.4	26.8
	10% up	19.7	21.2	22.6	24.0	25.3
	20% up	18.6	20.1	21.5	22.8	24.0

Note: Project life of the project is assumed to be 30 years.

20.5 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.

20.5.1 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, Jones 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.

Particulate in ambient air was taken using High Volume Sampler and collected from a glass fiber filter. The TSP was determined gravimetrically. To quantify the SO_2, a measured volume of air was bubbled through a solution of potassium tetrachloromercurate (TCM). The complex was made to react with pararosaniline to form the intensely colored pararosalinic methyl sulfonic acid. The intensity of the color produced was measured by means of spectrophometer. The NO2 in ambient air was taken using a Kimono Handy Gas Sampler and collected from a fritted-trip bubbler and absorbed in an azo-dye forming agent. The intensity of the color, which is an indication of NO_2 was measured spectrophotometrically. Carbon Monoxide (CO) air on the other hand was drawn from ambient air and measured directly using Multi Rae Gas Analyzer.

(e) Noise Level

Noise level monitoring along Jones Bridge was carried out on December 18, 2003. 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) Project-Affected Persons

<u>**Consultation Meeting**</u>

It is important to note that there are **NO persons that will be displaced** during the rehabilitation of Jones Bridge because within the study period, there were no settlers within the immediate vicinity of the bridge (Please see **Photo 20.5-1** and **20.5-2**). As such, consultation meeting was confined to the barangay officials who have jurisdiction over Jones Bridge and its immediate vicinities (Please see **Photo 20.5-3** and **20.5-4**).

Photo 20.5-1 Photograph showing that there are no Encroachments at the Site of the Jones Bridge

Photo 20.5-2 The only structure in the immediate vicinity of the Jones Bridge is pumping station of the Metro Manila Development Authority (MMDA)

Photo 20.5-3 Consultation with Brgy. Council Member Andrew Ariola (center) and *Kgwd.* Charles Ong of Brgy. 291, Binondo Manila

Photo 20.5-4 Consultation meeting with Brgy. Chairman Ronald Nival of Barangay 656 Zone 69.

Consultation Meeting with the National Historical Institute (NHI)

The EIA Team, through a consultation meeting held last 04 December 2003 requested the NHI for their official position regarding the historical value of Jones Bridge. NHI's official position on this matter is attached as **Appendix 19.5.2-1.**

20.5.2 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.

20.5.3 Brief Description of Project Environment

Jones Bridge encompasses two (2) barangays. Brgys. 291 on the northwest approach and Brgy. 656 on the southeast approach, in Binondo, Manila. Since there are no directly affected persons involved, assessment of impact was focused on the users of the bridge, that is, the motorists, who are expected to be indirectly affected by the possible increase in noise levels, TSP levels and other air pollutants such as SO_X and NO_X due to the operation of various equipment and machinery during the construction phase of the project, and increase in traffic congestion. These consist of areas where motorists using the Jones Bridge pass through.

(1) Physico-Chemical Environment

(a) Physiography and Geomorphology

The MMA is divided into six (6) physiographic zones, namely, *Manila Bay, Coastal Margin, Guadalupe Plateau, Marikina Valley, Laguna Lowlands* and *Laguna de Bay* (Besana and Daligdig, 1993). The study area is the low-lying flat strip of land between the Manila Bay Zone on its west and the elevated Guadalupe Plateau on its eastern boundary. This is designated as the Coastal Margin zone with an average elevation of less than five (5) meters above mean sea level (amsl). This zone includes the CAMANAVA area (Caloocan, Navotas, Malabon, and Valenzuela), Pasay City, Paranaque City, Las Pinas City, the reclaimed portions of Manila Bay and the City of Manila.

There are two broad geomorphologic units in the MMA, namely, the north-south trending plateau and the flat-lying alluvial (Marikina flood plain) and delta sediments (Passage River delta plain) which are situated on either sides of the central elevated portion (Baseman and Daligdig, 1993). The Pasig and Marikina Rivers are two major river systems that drain off the area with several tributaries feeding the area 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 Jones City.

The Pasig River delta plain has an average elevation of less than 5 meters, a roughly 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 lagoons and beach sediments derived from the clastics formerly and actively dumped by the Pasig River itself.

(b) Geological Setting

It is said that downtown Manila was a submerged area with the sea reaching up to the foothills of the north-trending Sierra Madre Range on the east. It has been interpreted that volcanism and the deposition of tuff (Guadalupe Tuff) dictated much of the geologic make-up of the Greater Manila Area (GMA). Violent volcanic outburst occurred intermittently and during intervening tranquil periods, the previously accumulated volcanic materials were re-deposited subaqueously.

The uplift of the Tagaytay Ridge due to tectonic movements has also caused the tilting and eventual fracturing of the tuff in the Guadalupe area. This Guadalupe Tuff fracturing led to the development of the northwesterly-flowing Pasig River. This river later captured the lower stretch and altered the downstream course of the more developed Marikina River. After this stream capture the sediments washed by the Marikina River from its headwaters along the Sierra Madre Range through the Pasig River were deposited in the form of a delta along the fringes of Manila Bay.

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.

The geologic structures that have significant effect to the Metropolitan Manila Area are the Marikina Valley Fault System. This system consists of two nearly parallel northeasterly-trending faults with a downthrown block, averaging 4.50 kilometres wide, in between. According to Gervacio (1968), the structural development of the Luzon Central Valley was caused by the Miocene Orogeny uplifting of the Sierra Madre Range; post-orogenic movements brought about the collapse of the Central Valley, now designated as the Central Plain of Luzon, of which the Marikina Valley forms an integral part of its southern extension.

(c) Seismicity

The geotectonic setting of the Philippines makes it vulnerable to various types of seismic-related hazards. According to Punongbayan, et al. (1990), records show that in the past, the MMA has experienced numerous earthquakes. Of these detected and recorded events, 28 were considered major earthquakes. Statistically on the average, the MMA is likely to be hit by a perceptible (Intensity IV) earthquake every year and by a destructive earthquake once every 15 years. An estimate of the average return period for an Intensity VIII earthquake such as the one that affected Baguio City and the rest of Luzon including the MMA last 16 July 1990, is about 79 years based on five events that happened from year 1599 to 1970.

There are five seismic source zones that have been identified as the loci of major earthquakes that affected the MMA in the past which include the Marikina Valley Fault System, Philippine Fault Zone, Lubang Fault, Casiguran Fault, and the Manila Trench One of this is the 1968 major earthquake, which was attributed to the Casiguran Fault and registered a Richter Magnitude of 7.3. 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.

In areas like the City of Manila, where it is underlain by loosely-compacted, water-saturated fine sediments, earthquakes could also cause liquefaction wherein the underlying foundation temporarily assume a semi-liquid state. Associated liquefaction effects like differential settlement, sand fountaining, lateral spreading and ground undulation may also cause damage to bridges, roads and other infrastructure. Data show that liquefaction has selectively affected various areas in the MMA in the many of the earthquakes that have occurred, the more recent of which is the July 16, 1990 Luzon earthquake. Moreover, based on past events and other geological and geotechnical data, a liquefaction hazard map of the MMA have therefore been generated wherein three potential zones have been identified and classified, namely high, moderate and low. Identified liquefaction-prone areas are those on the shore of Manila including the newly-reclaimed areas, the Pasig River delta plain, the Marikina alluvial Plain and those lying on the floodplain deposits and abandoned meanders of the Pasig and Marikina Rivers. Various points within these areas have been subjected to liquefaction in the past and are therefore likely to be affected again in the future (Daligdig and Besana, 1992).

(d) Pedology

The actual drilling data retrieved and core analyses conducted in connection with the foundation exploration of projected building structures in and around Manila after the catastrophic earthquake that hit the area in August 1968 has provided a clearer picture and understanding of the nature of its subsoil and underlying rock strata since most of the city is already covered by infrastructure. According to Oca (1968), the commercial districts of Sta. Cruz, Sampaloc, Quiapo, Escolta, Intramuros, Port Area, Ermita, Paco and Malate which are all in the City of Manila, are generally underlain by transported materials deposited as deltaic sediments on top of the tuff bedrock. These sediments consist of plastic clays, silts, sands and gravels with an intimate admixture of marine shells, corals and decayed plants. Layers are typically lenticular hence they *intertongue* with one another. As explained further, lateral persistency among individual beds is very poorly developed that even a thick bed may terminate abruptly in as short a distance as 3 meters. Bed thickness of 61 meters up to more than 90 meters have been noted, the thickest being along the banksof Pasig River in Quiapo, Rizal Avenue, Escolta and Port Area.

Moreover, bluish gray to greenish, plastic "fat" clays, about 12 to 18 meters thick, form an important interval within the transported sediments. The clay layers are either sandy or pebbly and fragments of seashells and corals compose the matrix. Where there is considerable amount of decayed plant remains, the particular layer exhibits a brownish hue.

(e) Water Quality

The results of both the laboratory tests and field measurements performed show that the pH level of the sample is within the standard as per DENR DAO 34 for Class C waters. The COD, BOD, and the oil and grease content of the River are also well within the permissible limit. The considerable quantity of fecal coliform detected from the water sample is expected, since it is very apparent that sewage lines of the inhabitants in the periphery are directly tapped into the River (Please refer to **Table 20.5.3-1**).

Table 20.5.3-1 Physical Properties of the Pasig River, Jones Bridge Section Manila City

Sampling Station Location	• Under Jones Bridge in the middle of Pasig River Manila	**DENR Effluent Standard For Class "C" Water (DAO 34)**
Date and Time of Sampling	0946–1001 HRS 24 November 2003 (LOW TIDE)	
Parameters	**Sampling Results**	
Temperature C	29.67	Max. 3 degrees increase
pH	7.77	6.5 - 8.5
DO mg/L	5.4 mg/L	Min. 4–5 mg/L
COD mg/L	35.60 mg/L	100 mg/L
BOD, mg/L (5 days, 20°C)	6.1 mg/L	10 mg/L
TSS, mg/L	28.2 mg/L	Max. 30 mg/L increase
Oil and Grease, mg/L	N.D.	5.0 mg/L
Total Coliform, MPN/mL	1,600,000 MPN/100 mL	5,000 MPN/1000 mL
Fecal Coliform, MPN/mL	1,600,000 MPN/100 mL	

(f) River Sediments

River sediment sampling was also undertaken by the EIA Team to determine the amount of trace metals in Pasig River. Sediments were collected from the River and then brought to the laboratory for assessment.

As observed from the laboratory results, levels of most of the toxic and deleterious substances such as chromium, lead, cyanide and mercury exceeded the DENR standard (Please see **Table 20.5.3-2**). This may be explained by the continuous increase in loadings (industrial waste, chemical and infectious wastes, liquid and solid domestic wastes) contributed by various factories and human settlements, not only those along the main Pasig River, but by its tributaries as well. Based on the Pasig River Rehabilitation Project Feasibility Study, the only way to prevent worsening of the condition, as indicated by high levels of toxic substances even in the river sediments, is to reduce the present loadings to the system.

Table 20.5.3-2 Pasig River Sediment Test Result, Jones Bridge Section Manila City

Trace Metal/Element	Result Value	DENR Standard
Chromium Hexavalent (Cr+6)	0.10	0.05
Cyanide (CN-)	0.50	0.05
Cadmium (Cd)	N.D.	0.01
Lead (Pb)	21.9	0.05
Arsenic (As)	N.D.	0.05
Mercury (Hg)	0.32	0.02
Polychlorinated Biphenyls (AROCLOR 1254)	N.D.	–

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)
Figures are in mg/L
ND - None Detected

It may also be possible that some of the pollutants found present may have been influenced by the tidal cycle of Manila Bay, wherein flow reversal from Laguna de Bay reportedly occurs when water levels in the lake fall below eleven (11) meters (Pasig River Rehabilitation Project Feasibility Study, 1991).

(g) Meteorology

The Port Area (MCO) in Manila is the nearest synoptic meteorological station to the Jones 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.

The principal air streams that significantly affect the study area are the Northeast Monsoon, Southwest Monsoon, and the Southeasterly and Northeasterly Winds. The Northeast Monsoon predominates only from November to December. The Southwest Monsoon on the other hand prevails from July to September. The Northeasterly wind is felt from November to December, while the Southeasterly wind is experienced from February to April. The North Pacific Trades is the southern portion of the North Pacific anti-clyclone. Having passed over a vast expanse of the North Pacific Ocean, this air stream is classified as a maritime tropical air mass. This air stream, which is extremely warm, is generally dominant over the entire Philippines in April and early May. It commonly arrives in the country from an easterly direction but may come from any direction from northeast to southeast.

(h) Ambient Air Quality

The observed levels of the air pollutants in both stations are well within the permissible limits based on the DAO 2000-81, except for TSP **(656.2 μg/Ncm)** which was way beyond the DENR maximum permissible limit of **230 μg/Ncm.** Significant increase in the concentrations of TSP was probably due to the emissions from the diesel-powered vehicles plying the route at the time of sampling. The rest remain way below the set standards (Please see **Table 20.5.3-3**).

Table 20.5.3-3 Observed Ambient Air Quality Along Jones Bridge

Parameters	Date & Time of Sampling	Averaging Time	Concentration in μg/Ncm	
			Sampling Results	*DENR Standards*
	Sta. 1		Sta. 1	
TSP	27 November 2003 1030–1130 HRS	1 hr	656.2 μg/Ncm	*230*μg/Ncm
SO_2	12 December 2003 1030–1100 HRS	30 min	16.7 μg/Ncm	*180*μg/Ncm
NO_2	27 November 2003 1030–1130 HRS	30 min	75.5 μg/Ncm	*150*μg/Ncm
CO	27 November 2003 1030–1130 HRS	1 hr	3.7 ppm	*30 ppm*
CO_2	27 November 2003 1030–1130 HRS	1 hr	683 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)

(i) Noise Level

Noise level monitoring at Jones Bridge was performed on December 18, 2003. Sound level was measured during the morning time, daytime, nighttime and evening time. Results of the monitoring revealed that the level of noise recorded at the sampling exceeded the permissible limits set by the DENR for areas intended for commercial purposes. The relatively high level of noise recorded during the sampling may be due to the instantaneous peaks from the vehicles passing by the area, particularly diesel-powered jeepneys (Please see **Table 20.5.3-4**).

Table 20.5.3-4 Observed Noise Level Along Jones Bridge

		Noise Levels in dB (A)	
Time	*DENR Standards*	Date & Time of Sampling	Sampling Results
	B	Sta. 1	
Morning (0500–0900 HRS)	65	18 December 2003, 0643–0647 HRS	91.5
Daytime (0900–1800 HRS)	70	18 December 2003, 1425–1430 HRS	90.3
Evening (1800–2200 HRS)	65	18 December 2003, 1910–1915 HRS	96.9
Nighttime (2200–0500 HRS)	60	18 December 2003, 2231–2236 HRS	94.0

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

Brgy. 291 located on the northwest approach of Jones Bridge, are categorized under the Commercial 3 (C3) Areas and Brgy. 656 on the southeast portions is classified as Cultural or Heritage areas. This is based on the Land Use Map of the City of Manila.

(2) Biological Environment

(a) Terrestrial Flora

There is no significant vegetation cover observed in the project area within the vicinity of Jones Bridge. As such, the proposed improvement of Jones 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).

Rehabilitation works along Jones Bridge is not expected to have any significant impact to the faunal environment.

(3) Socio-Economic Environment

As previously mentioned, there are NO project –affected persons at the site of the Jones Bridge. As such, interview surveys were conducted on other stakeholders such as .drivers and passengers of (i) public utility jeepneys, (ii) private vehicles, (iii) trucks, and (iv) mega taxis, commonly known as "FX". A total of **102** motorists were interviewed (Please see **Table 20.5.3-5**).

Table 20.5.3-5 Profile of Respondent Users of Jones Bridge

Type of Respondent	Number	Place of Origin	Place of Destination
PUJ-Driver	48	T.M. Kalaw; City Hall; Divisoria; Libertad; Baclaran, Manila and Pasay;	T.M. Kalaw; City Hall; Divisoria; Baclaran, Manila (vis-à-vis)
PV-Driver	22	Binondo; T.M. Kalaw; City Hall; Taft; Binondo; Arroceros; Mabini; Manila, Cavite; Pasay; and Caloocan	Tayuman; City Hall; Binondo, Manila; Cavite; Pasay; Caloocan; and Parañaque;
Truck Driver	3	Binondo; City Hall, Manila and Parañaque	Pasay; Parañaque; Binondo, Manila (vis-à-vis)
FX Driver	29	T.M. Kalaw; Baclaran, Manila, Alabang, Muntinlupa; Cavite; Pasay; Parañaque; Laguna	Divisoria, Abad Santos, Manila
TOTAL	**102**		

(a) Result of Interviews with Motorists

<u>Perceived Causes of Traffic Congestion</u>

When asked about what they think are the main causes of traffic congestion along Jones Bridge, majority answered that "high volume of vehicles" is the top leading cause. This is followed by "vehicular accidents" and lastly by "bridge repair". In terms of their observation on the condition of the bridge, the top two (2) answers are, "strong vibration" and "bridge too old" (Please see **Table 20.5.3-6** and **Figure 20.5.3-1**).

Table 20.5.3-6 Perceived Causes of Traffic Congestion Along Jones Bridge

Type of Respondent	Vehicular Accident		Bridge Repair		High Volume of Vehicles		Poor Traffic Management		Total	
	No.	%	No.	%			No.	%	No.	%
PUJ-Driver	21	41.2	2	3.9	27	52.9	1	2.0	51	100.0
PV-Driver	4	17.4	-	-	19	82.6	-	-	23	100.0
Freight Truck Driver	1	33.3	-	-	2	66.7	-	-	3	100.0
FX Driver	7	28.0	-	-	17	68.0	1	4.0	25	100.0
Total	33	32.4	2	2.0	65	63.7	2	2.0	102	100.0

Perceived Condition of Jones Bridge

When asked about the condition of the Jones Bridge, the motorists gave the following observations: (i) strong vibration, and "bridge too old". Please see **Table 20.5.3-7** and **Figure 20.5.3-2**.

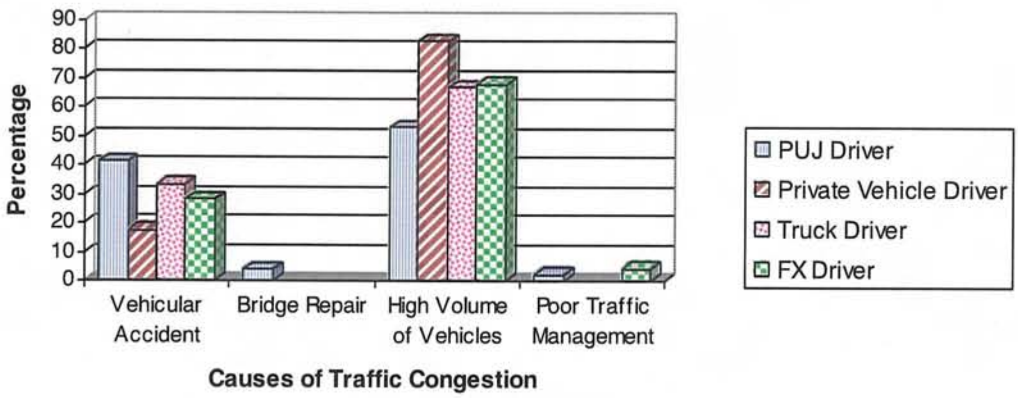


Figure 20.5.3-1 Perceived Causes of Traffic Congestion

Table 20.5.3-7 Perceived Condition of Jones Bridge

Type of Respondent	Strong Vibration		None		Bridge too old		Total	
	No.	%	No.	%	No.	%	No.	%
PUJ-Driver	50	98.0	-	-	1	2.0	51	100.0
PV-Driver	12	52.2	11	47.8	-	-	23	100.0
Freight Truck Driver	2	66.7	1	33.3	-	-	3	100.0
FX Driver	15	60.0	10	40.0	-	-	25	100.0
Total	79	77.5	22	21.6	1	1.0	102	100.0

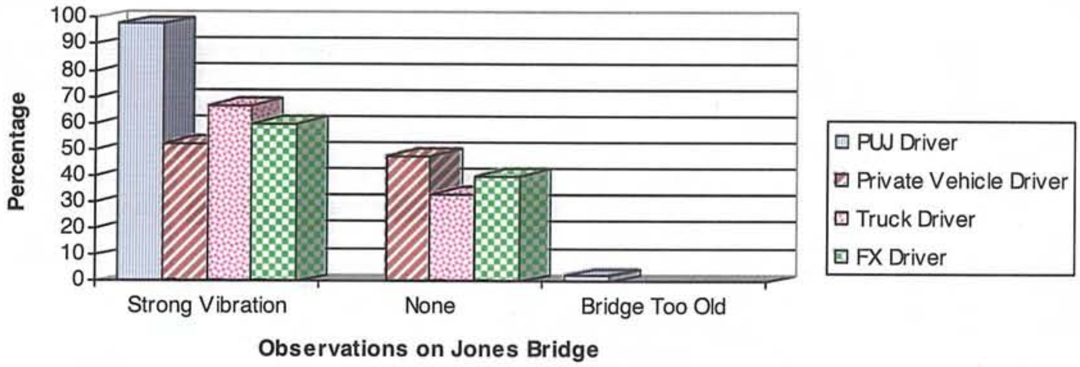


Figure 20.5.3-2 Perceived Condition of Jones Bridge

Perceived Positive and Negative Impacts

When asked about what they perceive as the positive and negative impacts of the proposed improvement works along Jones Bridge during its construction and operational phases, the most common perceived positive impact is the increase in job opportunities during the rehabilitation/construction period. Apparently this refers to the job requirements in terms of local labor during the construction works. All of them also agreed that the negative impacts would be a temporary decrease in income of the drivers due to probable aggravation of the traffic congestion along the bridge once rehabilitation works commence.

The main positive impact that is perceived by the PAFs after the rehabilitation works is the improvement of the safety of the motorists using the Jones Bridge. An increase in air and noise pollution during the operation stage was cited by the majority as a negative impact of the operational stage (Please refer to **Table 20.5.3-8** and **Table 20.5.3-9** for the list of perceived positive and negative impacts among the motorists, respectively).

Table 20.5.3-8 Perceived Impacts During the Rehabilitation of Jones Bridge

Type of Respondent	Positive Impacts	Negative Impacts
PUJ-Driver	Job opportunity	Incomes of drivers will be reduced due to heavy traffic
PV-Driver	Job opportunity	Will worsen traffic congestion; incomes of drivers will be reduced due to heavy traffic
Freight Truck Driver	Job opportunity	Will worsen traffic congestion
FX Driver	Job opportunity	Will worsen traffic congestion; incomes of drivers will be reduced due to heavy traffic

Table 20.5.3-9 Perceived Impacts After the Rehabilitation of Jones Bridge

Type of Respondent	Positive Impacts	Negative Impacts
PUJ-Driver	Will enhance traffic flow; will improve safety of motorists; will prevent the bridge to collapse	Increase in air and noise pollution
PV-Driver	Will enhance traffic flow; will improve safety of motorists	Increase in air and noise pollution
Freight Truck Driver	Will improve safety of motorists	Increase in air and noise pollution
FX Driver	Will improve safety of motorists	Increase in air and noise pollution

(c) Social Acceptability

Similar to the results obtained from other bridges under the present study, a very high **99%** of the motorists expressed full support to the proposed improvement of the Jones Bridge. Only **1.0%** of the motorists expressed disapproval over the proposed undertaking (Please see **Table 20.5.3-10** and **Figure 20.5.3-3**).

Table 20.5.3-10 Social Acceptability Among Motorists Using Jones Bridge

Type of Respondent	Yes		No		Total	
	No.	%	No.	%	No.	%
PUJ-Driver	50	98.0	1	2.0	51	100.0
PV-Driver	23	100.0	-	-	23	100.0
Freight Truck Driver	3	100.0	-	-	3	100.0
FX Driver	25	100.0	-	-	25	100.0
Total	101	99.0	1	1.0	102	100.0

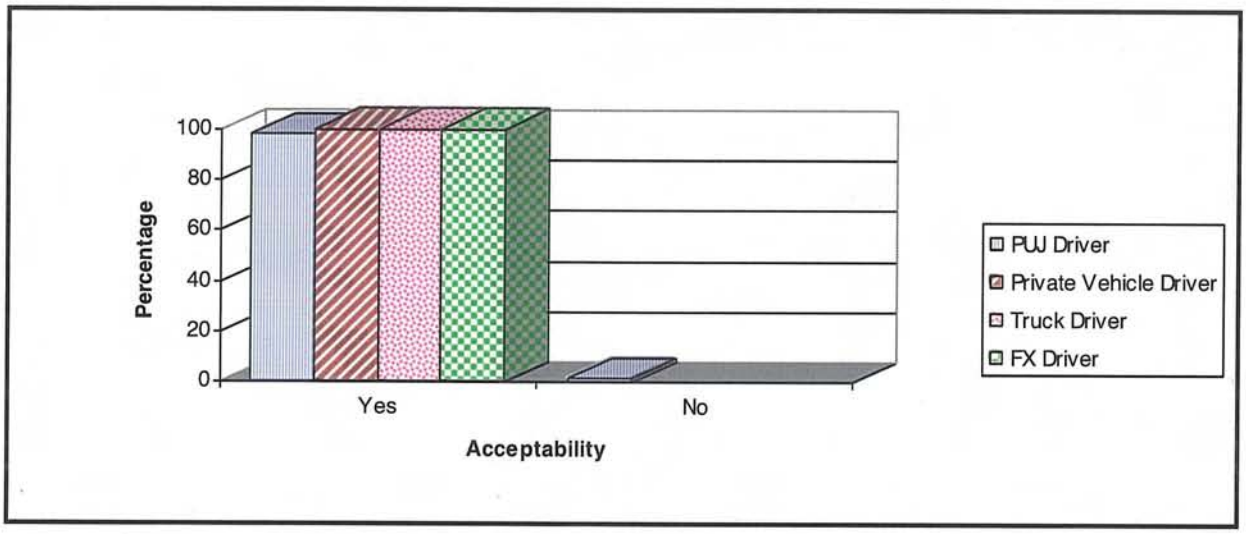


Figure 20.5.3-3 Acceptability Among Motorist

(c) Resettlement Requirements

Since there are **NO** persons to be displaced, resettlement will not be necessary.

20.5.4 Impacts and Mitigation Measures

The predicted impacts and corresponding mitigation measures are presented in **Table 20.5.4-1**. The Environmental Management and Monitoring Program is shown on **Table 20.5.4-2**.

Table 20.5.4-1 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 Jones 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 Jones 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			
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; and • A two-way two-lane traffic management scheme will maintained to avoid traffic congestion within the construction site
Employment Opportunity	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
Safety	Hazard to motorists using Jones Bridge and vessels navigating along Pasig River underneath the Bridge	Short-term, negative	• Traffic enforcers and flagmen will be designated at critical construction sites to ensure safety of motorists; • Illuminated warning signs and barricades will be installed along the entire stretch of Jones Bridge • Adequate lighting will be installed along the entire stretch of Jones Bridge to provide illumination during nighttime; and • River navigation safety management schemes will be adopted to prevent untoward accidents along Pasig River
OPERATION PHASE SOCIO-ECONOMIC ENVIRONMENT			
Safety	Improved safety of motorists crossing Jones 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 20.5.4-2 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	Jones 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	Jones 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 Jones Bridge and vessels navigating along Pasig River underneath the bridge	Jones Bridge and Pasig River	Daily	Regular site inspection within the construction area	Based on DPWH and PCG Standard Operating Procedures	DPWH
Structural Integrity of the Jones Bridge	Jones Bridge	Based on standard DPWH maintenance procedures	Standard DPWH bridge maintenance works	Based on DPWH Standard Operating Procedures	DPWH