21.4 TRAFFIC ANALYSIS AND ECONOMIC EVALUATION

21.4.1 Traffic Analysis

(1) Alternative Road Networks and Bridge Plans

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

Do Nothing Case (No Rehabilitation Case)

2008 -2010 Limitation of vehicle load on Quezon Bridge without Second Ayala Bridge

2011 - Afterward Full closure of Quezon Bridge because the Bridge life is terminated

Do Something Case (Rehabilitation Case)

2008 -2010 No limitation of vehicle load on Quezon Bridge without Second Ayala Bridge

2011 - Afterward No limitation of vehicle load on Quezon 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 assignment model as shown in **Section 5.3** in Chapter 5.

(3) Results of Traffic Assignment

Table 21.4.1-1 shows the traffic demand forecast on bridges on Pasig River.

Table 21.4.1-1 Traffic Demand Forecast on Quezon Bridge in 2010 and 2020

Unit: PCU/Day

No.	Bridge Name	2010		2020	
		Do Nothing	Do Something	Do Nothing	Do Something
1	Delpan Bridge	74,500	74,500	95,500	88,300
2	Jones Bridge	62,300	61,700	64,100	64,000
3	McArthur Bridge	61,700	61,000	122,200	74,600
4	Quezon Bridge	73,600	79,000	0	86,300
5-1	Ayala Bridge	49,800	47,100	57,800	51,000
5-2	Second Ayala Bridge	0	0	40,800	33,900
Total		321,900	323,300	380,400	398,100

Figure 21.4.1-1 show the vehicle composition of Quezon Bridge. This figure shows that the share of heavy vehicles consisting of large busses and trucks to the total traffic is about 7%.

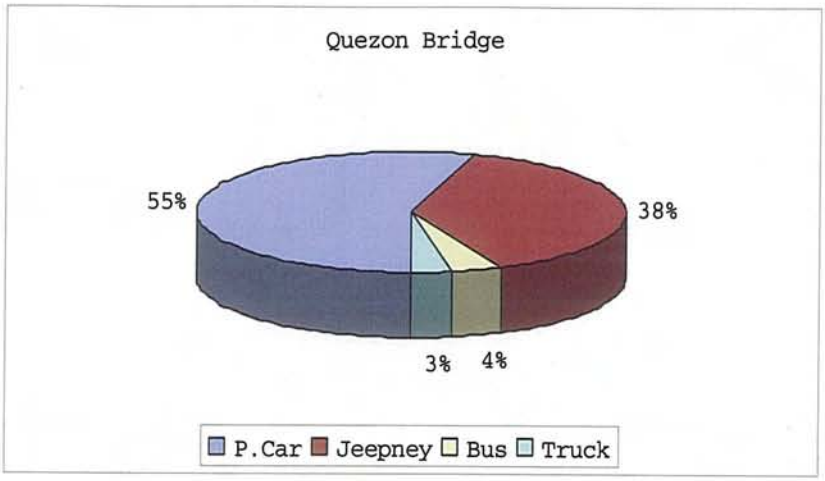

Figure 21.4.1-1 Vehicle Composition of Quezon Bridge (PCU)

21.4.2 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 with the following schedule:

- Detailed engineering 2005
- Implementation 18 months in 2006 and 2007
- Open to traffic 2008

(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 Quezon 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 to by deducting from the financial cost the government taxes as shown in **Table 21.4.2-1.**

Table 21.4.2-1 Economic Cost Estimate

(Unit: '000)

Description		Economic Cost	Financial Cost
1	Construction Cost	102,100	119,600
1-1	Superstructure	101,800	119,200
1-2	Substructure	300	400
2	Consultancy	14,000	15,600
2-1	Detailed Design	5,400	6,000
2-2	Construction Supervision	8,600	9,600
	Total	116,100	135,200

(b) Maintenance Cost

According to the maintenance data gathered study 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 Quezon 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 costs derived from the following situations:

2008 – 2011	Reduction of large bus and truck operating cost and travel time cost due to rerouting of those traffic
2012 - 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 21.4.2-2**).

Table 21.4.2-2 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
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 21.4.2-3**.

Table 21.4.2-3 Estimation of Benefit

Unit: '000 Pesos/Year

Year	Saving in VOC (1)	Saving in VFC (2)	Saving in VOC (1 + 2)	Saving in TCC (3)	Total Saving
2008	23,677	4,303	27,980	3,484	31,464
2011	24,686	4,486	29,172	3,632	32,804
2012	35,155	34,691	69,846	28,089	97,935
2020	48,783	40,591	89,373	38,978	128,351

(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 21.4.2-4** shows the benefit – cost analysis of the Quezon Bridge Rehabilitation Project during project life period and **Table 21.4.2-5** shows the benefit cost stream. The results of the economic analysis show that a Net Present Value (NPV) of P 223 million and BCR of 2.81 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 computed at 34.3 %.

Table 21.4.2-4 Economic Indications of Benefit Cost Analysis

Net Present Value	₱223 million Pesos
BCR	2.81
EIRR	34.3%

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

Table 21.4.2-5 Benefit – Cost Stream of Quezon Bridge Rehabilitation Project

Undiscounted Benefit Cost Stream

000 Pesos

Sq	Year	Construction Cost	O & M Cost	Cost Total	Benefit	Benefit - Cost
1	2004	0.0	0.0	0.0	0.0	0.0
2	2005	5,400.0	0.0	5,400.0	0.0	-5400.0
3	2006	36,916.7	0.0	36,916.7	0.0	-36916.7
4	2007	73,833.3	0.0	73,833.3	0.0	-73833.3
5	2008	0.0	9,625.0	9,625.0	31,464.0	21,839.0
6	2009	0.0	9,625.0	9,625.0	31,904.5	22,279.5
7	2010	0.0	9,625.0	9,625.0	32,351.2	22,726.2
8	2011	0.0	9,625.0	9,625.0	32,804.0	23,179.0
9	2012	0.0	9,625.0	9,625.0	97,935.3	88,310.3
10	2013	0.0	9,625.0	9,625.0	101,266.7	91,641.7
11	2014	0.0	9,625.0	9,625.0	104,722.3	95,097.3
12	2015	0.0	9,625.0	9,625.0	108,306.9	98,681.9
13	2016	0.0	9,625.0	9,625.0	112,025.6	102,400.6
14	2017	0.0	9,625.0	9,625.0	115,883.7	106,258.7
15	2018	0.0	9,625.0	9,625.0	119,886.8	110,261.8
16	2019	0.0	9,625.0	9,625.0	124,040.5	114,415.5
17	2020	0.0	9,625.0	9,625.0	128,350.9	118,725.9
18	2021	0.0	9,625.0	9,625.0	130,159.2	120,534.2
19	2022	0.0	9,625.0	9,625.0	131,996.7	122,371.7
20	2023	0.0	9,625.0	9,625.0	133,863.8	124,238.8
21	2024	0.0	9,625.0	9,625.0	135,761.1	126,136.1
22	2025	0.0	9,625.0	9,625.0	137,689.1	128,064.1
23	2026	0.0	9,625.0	9,625.0	139,648.5	130,023.5
24	2027	0.0	9,625.0	9,625.0	141,639.6	132,014.6
25	2028	0.0	9,625.0	9,625.0	143,663.2	134,038.2
26	2029	0.0	9,625.0	9,625.0	145,719.8	136,094.8
27	2030	0.0	9,625.0	9,625.0	147,810.0	138,185.0
28	2031	0.0	9,625.0	9,625.0	147,810.0	138,185.0
29	2032	0.0	9,625.0	9,625.0	147,810.0	138,185.0
30	2033	0.0	9,625.0	9,625.0	147,810.0	138,185.0
31	2034	0.0	9,625.0	9,625.0	147,810.0	138,185.0
32	2035	0.0	9,625.0	9,625.0	147,810.0	138,185.0
33	2036	0.0	9,625.0	9,625.0	147,810.0	138,185.0
34	2037	0.0	9,625.0	9,625.0	147,810.0	138,185.0

Discounted Benefit Cost Stream

000 Pesos

Sq	Sq	Year	Discounted	Construction Cost	O & M Cost	Cost Total	Benefit	Benefit - Cost
1	1	2004	1.000	0.0	0.0	0.0	0.0	0.0
2	2	2005	1.150	4,695.7	0.0	4,695.7	0.0	-4695.7
3	3	2006	1.323	27,914.3	0.0	27,914.3	0.0	-27914.3
4	4	2007	1.521	48,546.6	0.0	48,546.6	0.0	-48546.6
5	5	2008	1.749	0.0	5,503.1	5,503.1	17,989.6	12,486.5
6	6	2009	2.011	0.0	4,785.3	4,785.3	15,862.2	11,076.9
7	7	2010	2.313	0.0	4,161.2	4,161.2	13,986.3	9,825.1
8	8	2011	2.660	0.0	3,618.4	3,618.4	12,332.2	8,713.8
9	9	2012	3.059	0.0	3,146.4	3,146.4	32,015.2	28,868.8
10	10	2013	3.518	0.0	2,736.0	2,736.0	28,786.3	26,050.3
11	11	2014	4.046	0.0	2,379.2	2,379.2	25,885.7	23,506.5
12	12	2015	4.652	0.0	2,068.8	2,068.8	23,279.8	21,211.0
13	13	2016	5.350	0.0	1,799.0	1,799.0	20,938.4	19,139.4
14	14	2017	6.153	0.0	1,564.3	1,564.3	18,834.3	17,270.0
15	15	2018	7.076	0.0	1,360.3	1,360.3	16,943.4	15,583.1
16	16	2019	8.137	0.0	1,182.9	1,182.9	15,243.9	14,061.0
17	17	2020	9.358	0.0	1,028.6	1,028.6	13,716.2	12,687.6
18	18	2021	10.761	0.0	894.4	894.4	12,095.2	11,200.8
19	19	2022	12.375	0.0	777.7	777.7	10,666.0	9,888.3
20	20	2023	14.232	0.0	676.3	676.3	9,406.0	8,729.7
21	21	2024	16.367	0.0	588.1	588.1	8,295.0	7,706.9
22	22	2025	18.822	0.0	511.4	511.4	7,315.5	6,804.1
23	23	2026	21.645	0.0	444.7	444.7	6,451.8	6,007.1
24	24	2027	24.891	0.0	386.7	386.7	5,690.3	5,303.6
25	25	2028	28.625	0.0	336.2	336.2	5,018.8	4,682.6
26	26	2029	32.919	0.0	292.4	292.4	4,426.6	4,134.2
27	27	2030	37.857	0.0	254.2	254.2	3,904.5	3,650.3
28	28	2031	43.535	0.0	221.1	221.1	3,395.2	3,174.1
29	29	2032	50.066	0.0	192.2	192.2	2,952.3	2,760.1
30	30	2033	57.575	0.0	167.2	167.2	2,567.2	2,400.0
31	31	2034	66.212	0.0	145.4	145.4	2,232.4	2,087.0
32	32	2035	76.144	0.0	126.4	126.4	1,941.2	1,814.8
33	33	2036	87.565	0.0	109.9	109.9	1,688.0	1,578.1
34	34	2037	100.700	0.0	95.6	95.6	1,467.8	1,372.2
			Total	81,156.6	41,553.4	122,710.0	345,327.3	222,617.3

Net Present Value	222,617
B/C Ratio	2.814
EIRR	34.3%

(b) Sensitivity Analysis

The sensitivity analysis is conducted under a worst case scenario incorporating increase and/or decrease of the estimation of costs and benefits. **Table 21.4.2-6** shows the results of the sensitivity analysis.

Table 21.4.2-6 EIRR Sensitivity Analysis regarding Costs and Benefits of Quezon Bridge Rehabilitation

(Unit: %)

		Benefits				
		20% down	10% down	Base Case	10% up	20% up
Costs	20% down	34.3	37.3	40.1	42.8	45.4
	10% down	31.5	34.3	36.9	39.5	41.9
	Base	29.2	31.8	34.3	36.7	39.0
	10% up	27.2	29.7	32.1	34.3	36.5
	20% up	25.5	27.9	30.1	32.2	34.3

(c) Summary of Economic Analysis

The implementation of the Quezon 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.

21.5 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.

21.5.1 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, Quezon 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 Quezon 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) Public Consultation Meeting (PCM)

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

(b) 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 Quezon Bridge.

(c) Consultation Meetings with the LGUs

Barangay 384 Zone 39, Quiapo, Manila City

Discussion with the Barangay Council of Brgy. 384 was held on December 01, 2003. In attendance during the meeting are some barangay officials headed by *Chairwoman* Ms. Tessie Sharief. The meeting started with the brief explanation of the proposed rehabilitation project, after which, the participants were provided to opportunity to express their perceptions about the undertaking. The following were the issues and concerns pointed out by the LGUs:

- Possible effect of closure of the bridge to motorists to accommodate rehabilitation works;
- Hazards of falling concrete debris from the worn out portion on the side of the Bridge;
- Alternative source of livelihood for the informal settlers to be relocated to prevent them from returning;
- Financial assistance to the council to accommodate affected but unqualified informal settlers to the barangay hall while rehabilitation works are in progress; and
- Permanent relocation site for the informal settlers;

In the course of the discussion, the EIA Team also provided the LGUs with some answers and clarifications to the queries presented. They are enumerated as follows:

- A well-coordinated traffic management and re-routing plan will be prepared to minimize the effect to motorists;
- Informal settlers will have to be temporarily relocated until the rehabilitation works are completed and no settlers will be allowed to stay within the area, although a permanent relocation site would be necessary to address the perennial informal settling problem, particularly under the bridges;
- DPWH shall coordinate with City Government of Manila regarding provision of relocation sites to families that will be displaced by the Project.

Photo 21.5.1-1 Consultation meeting with Brgy. 384 Zone 39 Officials

Photo 21.5.1-2 Shown on this photograph (center of photo) is Brgy. 384 Zone 39 Chairwoman, Ms. Tessie Sharief

Photo 21.5.1-3 Barangay Council Member Casan G. Amir, raising an issue during the meeting.

Photo 21.5.1-4 Consultation meeting with the Projects-Affected Families, held under the Quezon Bridge

21.5.2 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.

21.5.3 Brief Description of Project Environment

Quezon Bridge encompasses three (3) barangays located within two (2) Congressional Districts in the City of Manila. Brgy. 384 Zone 39 and Brgy. 306 Zone 30 Quiapo, Manila, which are located on the northeast approach of the Bridge belong to the 3rd Congressional District. Brgy. 659which is on the southwest approach of Quezon Bridge is under the 5th Congressional District.

(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.

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

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. 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)

(c) Seismicity

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.

(d) Water Quality

Results of the laboratory analyses indicated that most of the parameters evaluated are within the standard as per DENR DAO 34 for Class C waters. Amount of suspended solids found in the sample is relatively low. The COD and BOD levels are also within the permissible limit. The pH is within the normal range. The considerable amounts of fecal and total coliform detected from the water sample are expected, since it is very apparent that sewage lines of the inhabitants in the periphery of the River are directly tapped into the River. Oil & grease were not detected (Please refer to **Table 21.5.3-1**).

Table 21.5.3-1 Physical and Chemical Properties of the Pasig River, Quezon Bridge Section Quiapo, Manila City

	Sampling Results	DENR Effluent Standard For Class "C" Water (DAO 34)
Sampling Station Location	• Pasig River, Quezon Bridge Section, Quiapo, Manila	
Date and Time of Sampling	1007–1029 HRS, 24 November 2003 (LOW TIDE)	
Parameters		
Temperature °C	29.20	Max. 3 degrees increase
pH	7.73	6.5 - 8.5
DO, mg/L	2.6 mg/L	Min. 4–5 mg/L
COD mg/L	26.7 mg/L	100 mg/L
BOD, mg/L (5 days, 20°C)	4.9 mg/L	10 mg/L
TSS, mg/L	43.0 mg/L	Max. 30 mg/L increase
Oil and Grease, mg/L	ND	5.0 mg/L
Total Coliform, MPN/mL	500,000 MPN/100 mL	<20% increase
Fecal Coliform, MPN/mL	110,000 MPN/ 100 mL	None for Class C

(e) 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.

Results of the analyses show that most of the parameters tested exceeded the limit set by the DENR, particularly the lead content. This strongly suggests that Pasig River has probably been a recipient of all sorts of chemical and industrial wastes from nearby point sources, not only from direct disposal into the river, but also from disposals to its tributaries. (Please refer to **Table 21.5.3-2**).

Table 21.5.3-2 Pasig River Sediment Test Result, Quezon Bridge Section Quiapo, Manila City

Trace Metal/Element	Result Value	DENR Standard
Chromium Hexavalent (Cr+6)	0.28 ppm	0.05 mg/L
Cyanide (CN-)	0.38 ppm	0.05 mg/L
Cadmium (Cd)	ND	0.01 mg/L
Lead (Pb)	29.5 ppm	0.05 mg/L
Arsenic (As)	ND	0.05 mg/L
Mercury (Hg)	1.24 ppm	0.002 mg/L
Polychlorinated Biphenyls (AROCLOR 1254)	ND	0.003 mg/L

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

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).

(f) Meteorology

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

TSP and CO_2 were monitored within a 1-hour period, while SO_2 and NO_2 were observed within a 30-minute duration. Results of the sampling showed that most of the air pollutants are still within the permissible limits based on the DAO 2000-81. However, the observed TSP level of 290 µg/NCM is near the maximum permissible limit (300 µg/NCM). The recorded level of CO_2 at Quezon Bridge is also significantly high at 654 ppm. The considerable amounts of TSP and carbon dioxide in the atmosphere can be attributed to the emissions from the diesel-powered vehicles plying the bridge (Please see **Table 21.5.3-3**).

Table 21.5.3-3 Observed Ambient Air Quality at Quezon Bridge Quiapo, Manila

Parameters	Date & Time of Sampling	Averaging Time	Concentration in µg/Ncm	
			Sampling Results	*DENR Standards*
	Quezon Bridge		Quezon Bridge	
TSP	27 November 2003 1030–1130 HRS	1 hr	290 µg/Ncm	*230*
SO_2	12 December 2003 1030–1100 HRS	30 min	15.3 µg/Ncm	*180*
NO_2	27 November 2003 1030–1130 HRS	30 min	162 µg/Ncm	*150*
CO	27 November 2003 1030–1130 HRS	1 hr	3.5 ppm	*30 ppm*
CO_2	27 November 2003 1030–1130 HRS	1 hr	654 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)
ppm parts per million

(h) Noise Level

Noise level monitoring at Quezon 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 area, particularly diesel-powered jeepneys (Please see **Table 21.5.3-4**).

Table 21.5.3-4 Observed Noise Level Along Quezon Bridge Quiapo, Manila

		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	98.1
Daytime (0900–1800 HRS)	70	18 December 2003, 1425–1430 HRS	88.0
Evening (1800–2200 HRS)	65	18 December 2003, 1910–1915 HRS	93.0
Nighttime (2200–0500 HRS)	60	18 December 2003, 2231–2236 HRS	92.4

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

(i) Land Use

Brgy. 384 and 306 located on the northeast approach of Quezon Bridge are categorized under the 3rd Class Commercial Areas. Commercial establishments lined both sides of the Quezon Boulevard Extension from Carlos Palanca Sr. and extend up to Claro M. Recto. The area on the other side of Pasig River, Brgy. 659 is intended for institutional purposes. The Arroceros Mini Forest Park occupies the largest area of the barangay.

(2) Biological Environment

(a) Terrestrial Flora

The vegetation in the area is concentrated within the Arroceros Mini Forest Park, located on the south approach of Quezon Bridge. It is important to note here that the improvement works at Quezon Bridge will not have impact to the flora environment mentioned.

(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).

(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 59 Project-Affected Families (PAFs) were identified. These PAFs belong to two (2) barangays, namely Barangay 384 Zone 39, and barangay 306Zone 30.

Aside from the PAFs that will be directly affected as a result of the rehabilitation of Quezon 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) public utility jeepneys, (ii) private vehicles, (iii) trucks, and (iv) Mega taxis, commonly known as "FX". As such, two (2) sets of questionnaires were prepared, one for PAFs and the other for motorists. A total of **100** respondents (57 PAFs and 43 motorists) were interviewed. **Table 21.5.3-5** shows the number of PAFs and motorists interviewed.

Table 21.5.3-5 Number of Stakeholders Interviewed

	Number	Interviewed	%
Brgy. 384 Zone 39	37	35	94.59
Brgy. 306 Zone 30	22	22	100.00
Motorists	43	43	100.00
TOTAL	100	100	

(a) Project Affected Families (PAFs)

Number and Type of Dwelling

As observed during the field investigation and interview surveys, there are three (3) main types of dwellings/structures occupied by the PAFs. These are the apartments, shanties, and makeshifts. The apartments are structures made of wood and light materials, have common roofing, and are composed of around three (3) to (4) door units. The shanties are made of light materials such as second hand roofing with worn tires piled on top used for holding the roof in place, old plywood, and other small pieces of used lumber. The apartments and shanties are found at the west side of Quezon Bridge (Please see **Photo 21.5.3-1** to **21.5.3-4**).

Photo 21.5.3-1 Shanty-Type of dwelling

Photo 21.5.3-2 Apartment-Type of dwelling (Note the very constricted passageways between the units)

Photo 21.5.3-3 Makeshift-type of dwelling. These structures are only put up during night time.

Photo 21.5.3-4 Here is were the makeshift dwellers keep their materials during day time (side of bridge)

Makeshifts are temporary shelters which are only put up late in the afternoon to be utilized as sleeping quarters during the night. These are made up of bamboo poles, plastic sheets, scrap wood, and blankets/bed sheets. During day time, these makeshifts are stored somewhere else, mostly at the side of the bridge. **Table 21.5.3-6** and **Figure 21.5.3-1** shows the number and type of dwelling of the PAFs.

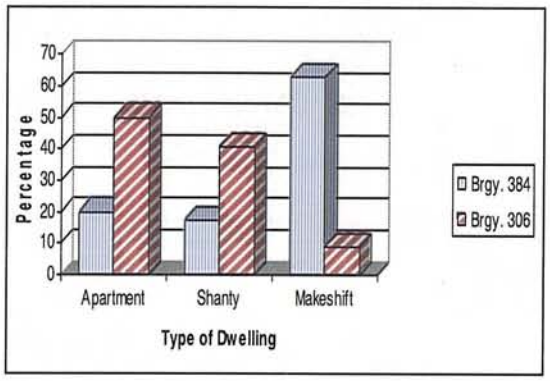

Figure 21.5.3-1 PAFs' Type of Dwelling

Table 21.5.3-6 Number and Type of Dwelling of Project-Affected Persons

Barangay	Apartment		Shanty		No structure/ demolished/ makeshift/ gypsy style		Total	
	No.	%	No.	%	No.	%	No.	%
384 Zone 39	7	20.0	6	17.1	22	62.9	35	100.0
306 Zone 30	11	50.0	9	40.9	2	9.1	22	100.0
Total	18	31.6	15	26.3	24	42.1	57	100.0

Household Size

Majority of PAFs interviewed have a household size of 1 to 4; 77.3% for Brgy. 306 Zone 30, and 54.3% for Brgy. 384 Zone 39. The rest have 5 to 7; 22.7% for Brgy. 306 Zone 30 and 37.1% for Brgy. 384 Zone 39, and only a few (5.7% from Brgy. 384 Zone 39) have 8 to 10 members (Please see **Table 21.5.3-7** and **Figure 21.5.3-2**). This trend is quite different from other urban areas where informal settlers abound, wherein most of the families have a minimum of 5 to 7 members.

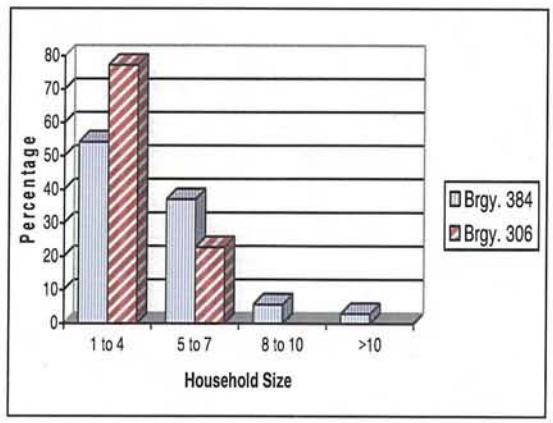

Figure 21.5.3-2 Household Size of PAFs'

Table 21.5.3-7 Household Size of Interviewed Project-Affected Persons

Barangay	1 to 4		5 to 7		8 to 10		>10		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
384 Zone 39	19	54.3	13	37.1	2	5.7	1	2.9	35	100.0
306 Zone 30	17	77.3	5	22.7	-	-	-	-	22	100.0
Total	36	63.2	18	31.6	2	3.5	1	1.8	57	100.0

Household Income

The main sources of income of the PAFs are business and unskilled labor. The PAFs mainly engage in vending, selling plastic wares, plastic bags, and food. Unskilled labor here refers to the male members of the family engaged in carpentry work, masonry, and the likes. In terms of household income, results of the survey show interesting trends. In Brgy. 384 Zone 39 wherein majority depend on makeshifts for shelter, there are more PAFs with annual household incomes above the NEDA poverty threshold than those which fall below the said threshold. In Brgy. 306 Zone 30, it is the other way around, since there are more PAFs falling below the poverty threshold than those above it (Please **Table 21.5.3-8** and **Figure 21.5.3-3**).

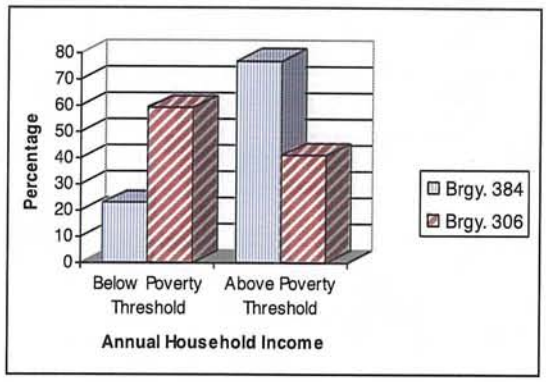

Figure 21.5.3-3 PAFs' Annual Household Income

Table 21.5.3-8 Annual Household Income of Project-Affected Persons

Barangay	Below Poverty Threshold*		Above Poverty Threshold*		Total	
	No.	%	No.	%	No.	%
384 Zone 39	8	22.9	27	77.1	35	100.0
306 Zone 30	13	59.1	9	40.9	22	100.0
Total	21	36.8	36	63.2	57	100.0

Note: * - Based on the NEDA annual per capita poverty threshold as of year 2000 for a family of four (4), which is equivalent to P55,292.00

History of Residency

Among the informal settlers at the Quiapo Bridge area, results of the survey shows that majority occupied the area in the 1990s. 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

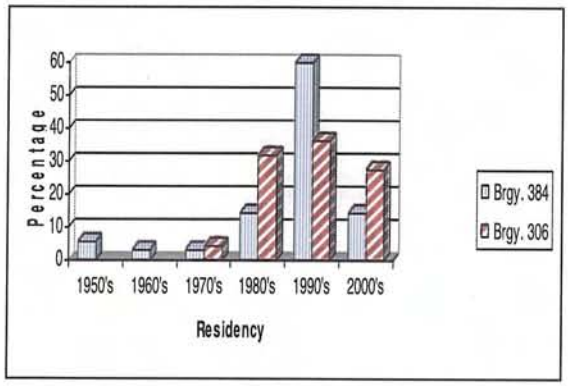

Figure 21.5.3-4 PAFs' History of Residency

(Please refer to **Table 21.5.3-9** and **Figure 21.5.3-4**).

Table 21.5.3-9 Residency of Project-Affected Persons

Barangay	1950's		1960's		1970's		1980's		1990's		2000's		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
384 Zone 39	2	5.7	1	2.9	1	2.9	5	14.3	21	60.0	5	14.3	35	100.0
306 Zone 30	-	-	-	-	1	4.5	7	31.8	8	36.4	6	27.3	22	100.0
Total	2	3.5	1	1.8	2	3.5	12	21.1	29	50.9	11	19.3	57	100.0

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. Based on the surveys, majority of the PAFs have illegal water and power connections, and do not have toilet facilities, which strongly indicate their low and miserable status of living (Please refer to **Figure 21.5.3-5 to 21.5.3-7**).

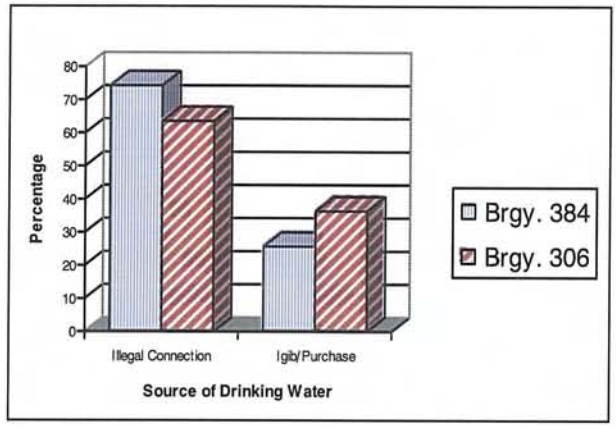

Figure 21.5.3-5 PAFs' Source of Drinking Water

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 Manila. In terms of waste disposal practices, all the PAFs dispose of their solid wastes through the City Garbage Collector.

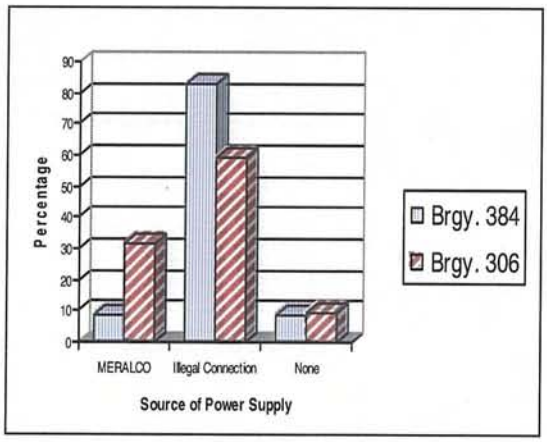

Figure 21.5.3-6 PAFs' Source of Power Supply

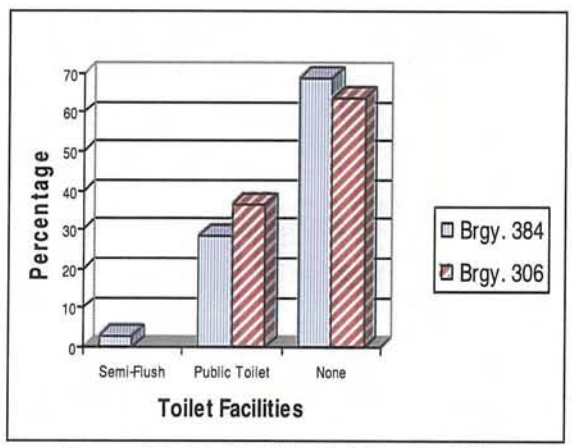

Figure 21.5.3-7 PAFs' Toilet Facilities

(b) Motorists

Perceived Causes of Traffic Congestion and Condition of Quezon Bridge

When asked about what they think are the main causes of traffic congestion along Quezon Bridge, majority answered that "vehicular accident" is the top leading cause. This is followed by poor traffic management and lastly by high volume of vehicles. Surprisingly, insufficient traffic capacity was not cited as a reason. In terms of their observation on the condition of the bridge, the top two (2) answers are, "insufficient traffic capacity" and "highly deteriorated and needs repair" (Please refer to **Table 21.5.3-10** and **Figure 21.5.3-8**).

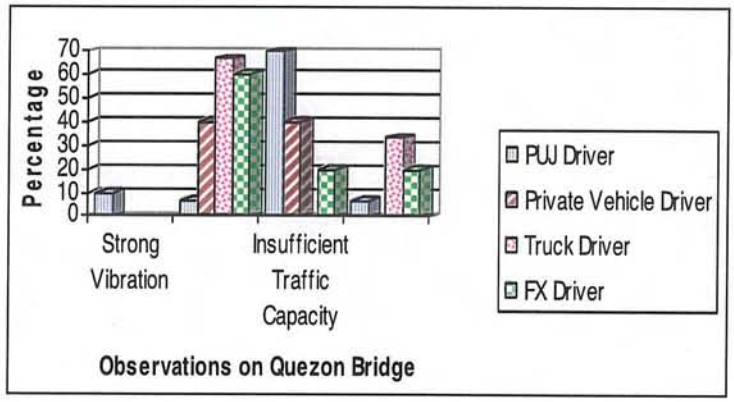

Figure 21.5.3-8 Perceived Condition of Quezon Bridge

Table 21.5.3-10 Perceived Condition of the Quezon Bridge

Type of Respondent	Strong Vibration		Highly Deteriorated, Needs repair		Insufficient Traffic Capacity		Insufficient Lighting		No Traffic/Police Enforcer		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
PUJ-Driver	3	10.0	2	6.7	21	70.0	2	6.7	2	6.7	30	100.0
PV-Driver	-	-	2	40.0	2	40.0	1	20.0	-	-	5	100.0
Truck Driver	-	-	2	66.7	-	-	-	-	1	33.3	3	100.0
FX Driver	-	-	3	60.0	1	20.0	-	-	1	20.0	5	100.0
Total	3	7.0	9	20.9	24	55.8	3	7.0	4	9.3	43	100.0

Social Acceptability

Based on the interview surveys, a very high **100%** of the PAFs and **98.0%** of the motorists expressed full support to the proposed improvement of the Quezon Bridge. Only **2.0%** of the motorists expressed disapproval over the proposed undertaking (Please see **Table 21.5.3-11** and **Figure 21.5.3-9**).

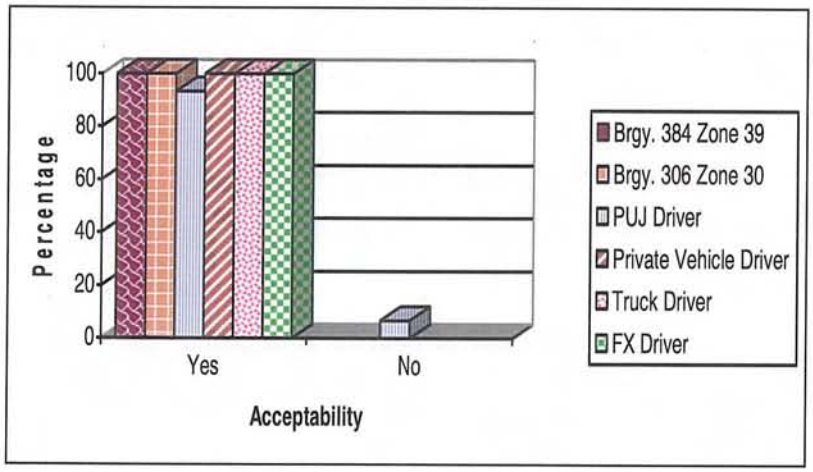

Figure 21.5.3-9 Acceptability Among PAF's and Motorists

Table 21.5.3-11 Acceptability Among PAFs and Motorists Using Quezon Bridge

Type of Respondent	Yes		No		Total	
	No.	%	No.	%	No.	%
Brgy. 384, Zone 39	35	100.0	0	0	35	100.0
Brgy. 306, Zone 30	22	100.0	0	0	22	100.0
PUJ-Driver	28	93.3	2	6.7	30	100.0
PV-Driver	5	100.0	0	0	5	100.0
Truck Driver	3	100.0	0	0	3	100.0
FX Driver	5	100.0	0	0	5	100.0
TOTAL	**98**	**98.0**	**2**	**2.0**	**100**	**100.0**

PAFs' Willingness to Relocate

When asked if they were willing to be relocated, an overwhelming majority of the PAFs (**85.7%** from Brgy. 384 Zone 39 and **90.9%** from Brgy. 306 Zone 30) expressed willingness to be relocated from their present dwelling areas (Please see **Table 21.5.3-12** and **Figure 21.5.3-10**).

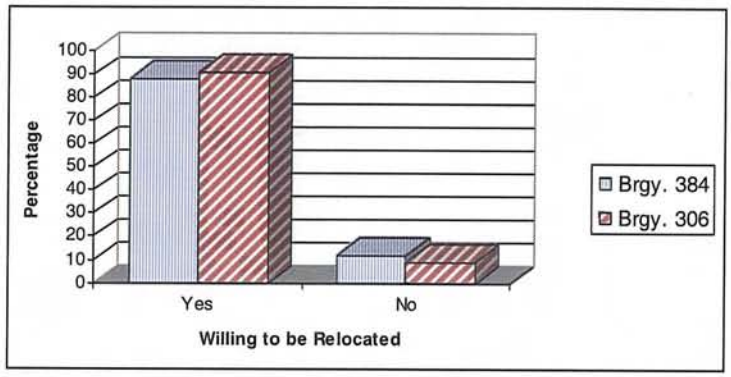

Figure 21.5.3-10 PAFs' Willingness to Relocate

Table 21.5.3-12 Willingness to Relocate

Barangay	Yes		No		Not Applicable		Total	
	No.	%	No.	%	No.	%	No.	%
384 Zone 39	30	85.7	4	11.4	1	2.9	35	100.0
306 Zone 30	20	90.9	2	9.1	-	-	22	100.0
Total	50	87.7	6	10.5	1	1.8	57	100.0

PAFs' Preferred Relocation Site

When asked about their preferences regarding the relocation site, majority of the PAFs (78.1% from Brgy. 384 Zone 39 and 55.0% from Brgy. 306 Zone 30) responded that they would prefer a relocation site within the City of Manila. Only a few favored any other relocation site (Please see **Table 21.5.3-13** and **Figure 21.5.3-11**).

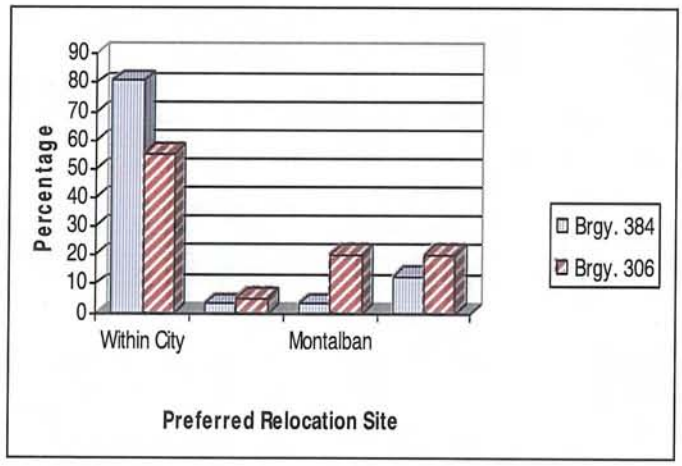

Figure 21.5.3-11 PAFs' Preferred Relocation Site

Table 21.5.3-13 Preferred Relocation Site

Barangay	Within the City of Manila	Return to province		Montalban		Not Applicable*		Anywhere where there is available relocation site				Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
384 Zone 39	25	78.1	1	3.1	1	3.1	1	3.1	4	12.5	32	100.0
306 Zone 30	11	55.0	1	5.0	4	20.0	-	-	4	20.0	20	100.0
Total	36	69.2	2	3.8	5	9.6	1	1.9	8	15.4	52	100.0

Resettlement Requirements

The rehabilitation works along Quezon Bridge would entail displacement of **57** 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. Under World Bank policies, displacement of more than **200** persons shall require the provision of a relocation site to maintain the social networks, prevent tightly-knit kin groups from being dispersed, and help maintain productive group-actions. It is assumed that a similar policy applies to JBIC-financed projects such as this one. Such being the case, it would be best if these informal settlers can be resettled to a place where they can have security of tenure, and access to basic social services.

To accomplish this, a comprehensive and workable Resettlement Action Plan (RAP) has to be prepared and implemented for the Project-Affected Families residing at various sections of the bridge. In accordance with Section 29 of R.A. 7279, the LGUs, such as the City Government of Manila are the entities responsible for providing socialized housing to underprivileged and homeless citizens residing in danger areas, including riverbanks and other public places such as sidewalks and roads within their respective jurisdictions.

21.5.4 Impacts and Mitigation Measures

The predicted impacts and corresponding mitigation measures are presented in **Table 21.5.4-1**. The Environmental Management and Monitoring Program is shown on **Table 21.5.4-2**.

Table 21.5.4-1mpacts 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 Quezon 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 Quezon 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 Quezon Bridge	Long-Term, negative	• Relocation of affected informal settlers in close coordination with the City Government of Manila
	• Opportunity for **59** 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 Quezon 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, lighting, and barricades will be installed along the entire stretch of Quezon 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 Quezon 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 21.5.4-2 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	Quezon Bridge	Twice a year during construction period	Standard EMPASS-EQD water quality analysis.	TSP – 300 $\mu g/Ncm^3$ NO_2 – 470 $\mu g/Ncm^3$ SO_2 – 375 $\mu g/Ncm^3$	DENR-NCR
Noise Level	Quezon 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 Quezon Bridge and vessels navigating along Pasig River underneath the bridge	Quezon 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 Quezon Bridge	Quezon Bridge	Based on standard DPWH maintenance procedures	Standard DPWH bridge maintenance works	Based on DPWH Standard Operating Procedures	DPWH