PART I GENERAL

1. INTRODUCTION

BACKGROUND

Metro Manila is the center of social, economic and political activities of the country. The expansion of population as well as socio-economic activities in the region have continued to produce far-reaching and complex problems, namely; disorderly development of urban areas, aggravation of urban environment and progressive traffic congestion.

Metro Manila is physically divided into three areas namely the Northern, Southern and Eastern areas, by two rivers: Pasig River and Marikina River, as shown in Location Map. The life line transport facilities like bridges over the two rivers have deteriorated resulting to hampering social and economic activities.

There are three major problems of existing bridges over Pasig and Marikina Rivers:

- Most bridges are seriously and heavily deteriorated because of old age and increasing truck axle loads.
- Existing bridges are major traffic bottlenecks in Metro Manila because of their insufficient traffic capacity.
- The damages caused by the vessel collisions due to large sized vessels, insufficient navigation clearances and lack of protection facilities were very serious.

The existing bridges represent major traffic bottlenecks due to their insufficient structural soundness and limited traffic capacities. The improvement of the traffic function of these bridges, including abutting intersections, is urgently needed in order to provide reliable river crossing facilities with enough capacity.

These bridges must be physically repaired, rehabilitated, strengthened or replaced. Although simple repair works for critical bridges have been conducted, these are only stopgap measures owing to low recognition of importance of routine maintenance, timely rehabilitation and insufficient budget. Thus, more effective and permanent measures are urgently pursued.

To cope with the above issues, the Government of the Philippines (GOP) through the Department of Public Works and Highways (DPWH) sought a technical assistance from the Government of Japan for the conduct of the study titled "The Study on the Improvement of Existing Bridges along Pasig River and Marikina River in the Republic of the Philippines ("the Study").

In response to the request of GOP, GOJ decided to conduct the study through the Japan International Cooperation Agency (JICA), which is the official agency responsible for the implementation of the technical cooperation program of GOJ. JICA organized a study team to be engaged in the Study. The JICA Study Team, in close collaboration with the DPWH Counterpart Team, commenced the work in June 2002 and completed in May 2004.

OBJECTIVES OF THE STUDY

The objectives of the Study are;

- To conduct a study on the improvement of existing bridges along Pasig River and Marikina River, and
- To transfer technology on the improvement of existing bridges through the Study.

STUDY BRIDGES

The study bridges are 17 bridges, 12 along Pasig River and 5 along Marikina River, and the newly proposed Second Ayala Bridge.

REPORTS

The Final Report is organized with:

- Executive Summary
- Main Text
- Appendix
- Drawings

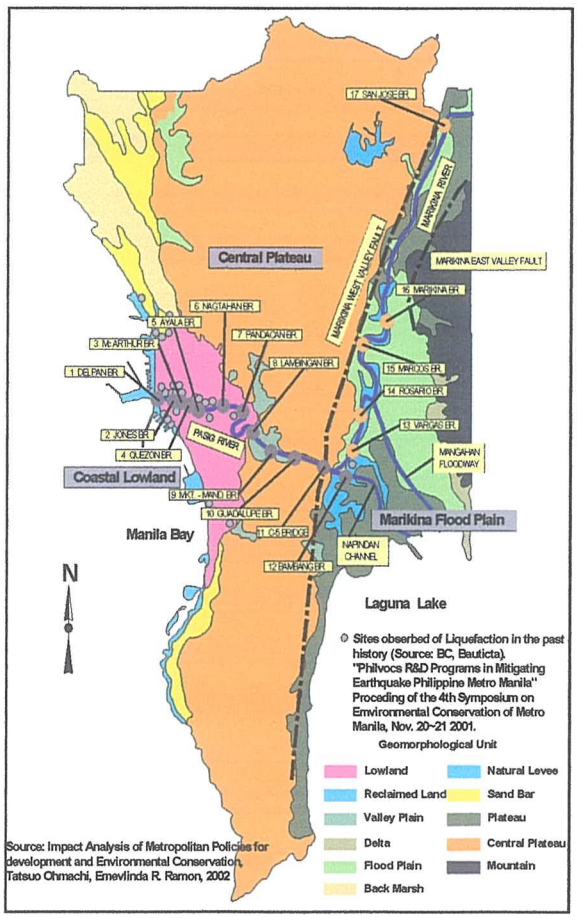
2. PROFILE OF THE STUDY AREA

TOPOGRAPHY

The topography of Metro Manila is characterized as flat to rolling. Elevation is low and predominantly flat along the coastal area. Towards the east, the landscape gradually rises and assumes a rolling characteristic. Ground elevation ranges between 10-30 meters above mean sea level (AMSL), with gradients ranging from 0% to 15%. The Guadalupe Plateau makes up the eastern portion of the metropolis.

GEOMORPHOLOGY

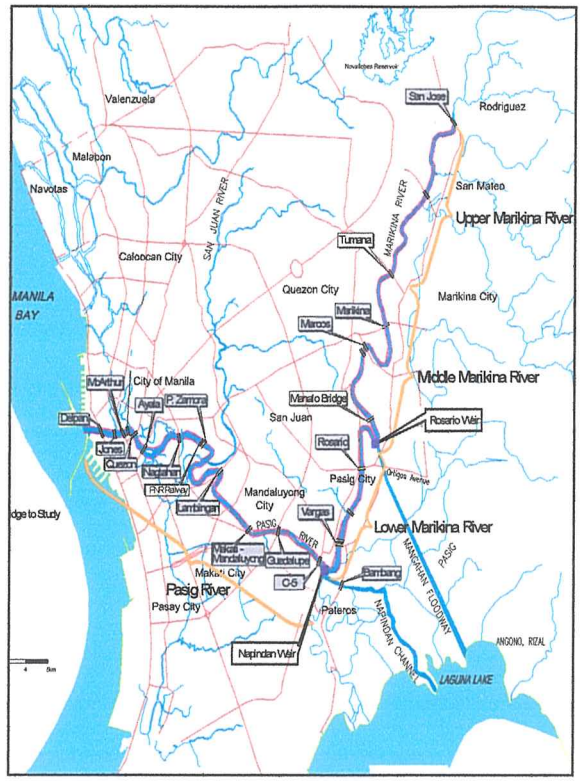
The geomorphological units in Metro Manila can be subdivided into three (3) major types; (i) the Central Plateau; (ii) the Marikina Flood Plain; and (iii) the Coastal Lowland. Metro Manila is bounded in the east by the Sierra Madre Mountain Range, and the Laguna de Bay and the Taal Ignimbrite Plain to the south.



Topography of Metro Manila

RIVER MORPHOLOGY

The river channel from the river mouth (draining in Manila Bay) to the confluence point of the Napindan Channel is called the Pasig River, and the upstream reaches from the Napindan junction is called the Marikina River. The Marikina River is also connected to the Laguna Lake through the Mangahan Floodway.



Pasig–Marikina River System

HYDROLOGY

The Pasig-Marikina River basin has a catchment area of 621 km^2. The principal tide level in Manila Bay are;

- Highest Tide Level (HTL) = DL+12.1 m
- Mean Springs High Water Level = DL+11.4 m
- Mean Higher High Water (MHHW) = DL+11.1 m
- Mean Sea Level (MSL) = DL+10.6 m
- Datum Level = DL+10.0 m

The water of Laguna Lake is planned to be regulated within 10.5 m. to 12.5 m. in elevation, although the average water level was estimated at 11.2 m.

3. BRIDGE ADMINISTRATION

ORGANIZATION

The DPWH is established into Central, Regional (16) and Districts (176) with a well developed structure at all levels to undertake all function allocated to the Department.

The offices of the DPWH Central Office in-charge of bridge project are:

- Planning Service (PS)
- Bureau of Design (BOD)
- Bureau of Construction (BOC)
- Bureau of Maintenance (BOM)
- Bureau of Research and Standards (BRS)
- Special Project Office such as URPO, PJHL, JBRD, etc.

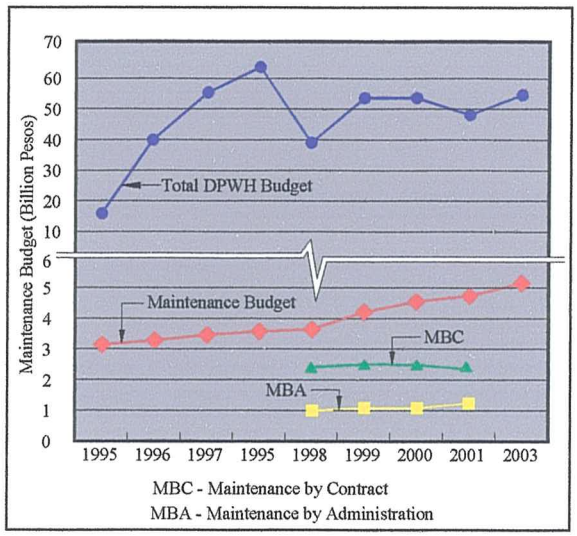
RECOMMENDED INSPECTION PROCEDURE

Inspection procedures are essentially a set of techniques intended to determine the physical condition and assess the soundness of bridges, covering all stages from construction to improvement.

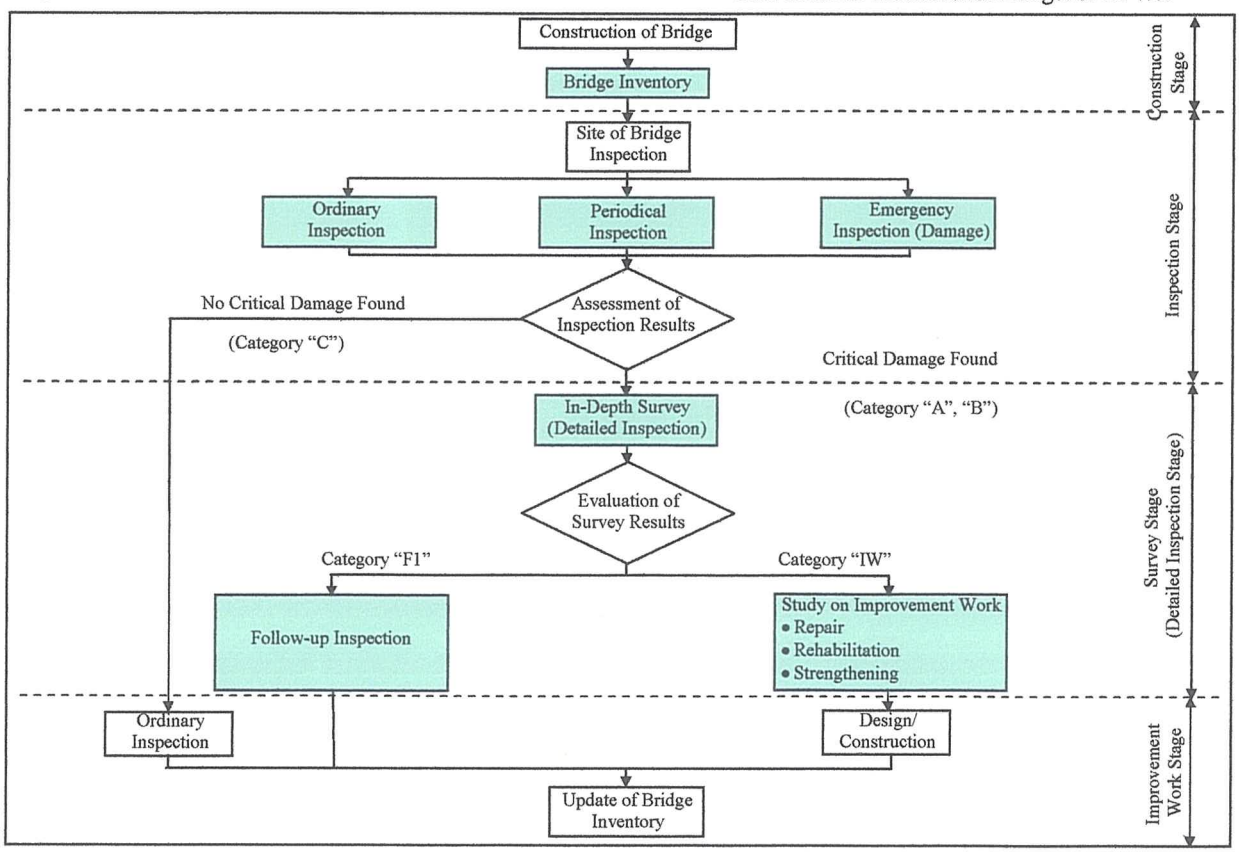
The type of inspection may vary over the useful life of a bridge in order to reflect the objectives and intensity of inspection required at the time of inspection. The general procedure of bridge inspection is recommended.

BUDGET

The total annual appropriations of the DPWH over the past years are shown below together with the amounts allocated for bridge maintenance budget.



Past Trend of Maintenance Budget of DPWH

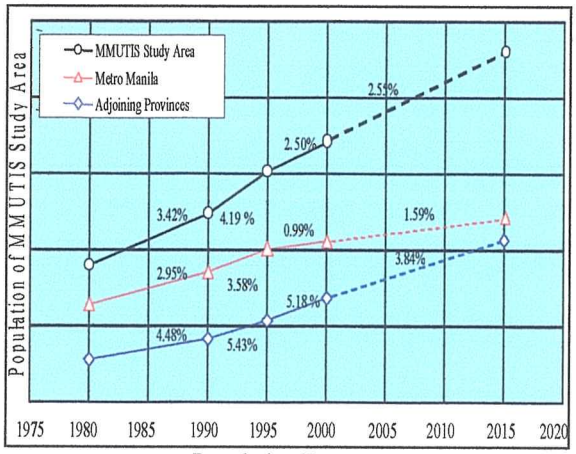


General Procedure and Type of Bridge Inspection

4. SOCIO-ECONOMIC PROFILE

POPULATION

Metro Manila or the National Capital Region (NCR), with an area of about 636 sq. km. has been constantly growing rapidly. Total population of MMUTIS study area including adjoining areas of 16.3 million residents in 2000 shares more than 20% of the country's population and its share has been increasing. The population of Metro Manila is expected to increase from 9.9 million in 2000 to 12.6 million in 2015 with an average annual growth rate of 1.6% while that of adjoining to provinces is expected to increase from 6.3 million to 11.1 million in 2015.



Population Forecast

ECONOMY

The Gross Regional Domestic Product (GRDP) of NCR was expanded with the annual growth rate of 12.9% from 1990 to 2000, and 8.2% from 2000 to 2015.

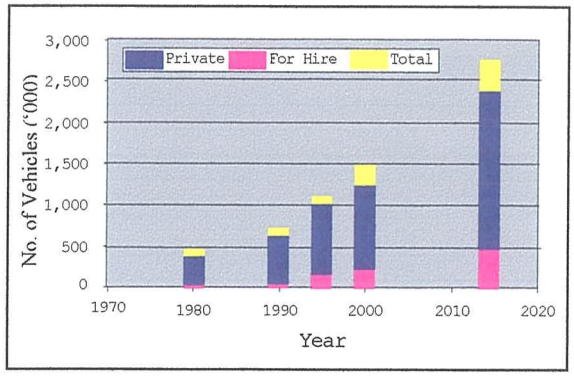
Gross Regional Domestic Product (GRDP)

		1990	1995	2000	2015
At Current Prices	Philippines	1,077,237	1,905,951	3,308,318	10,396,000
	NCR	347,609	623,939	1,169,989	3,815,400
At Constant 1985 Prices	Philippines	720,691	802,224	958,411	1,935,900
	NCR	221,753	242,167	294,390	594,800

		Annual Growth Rate (%)	
		'90 – '00	'00 – '15
At Current Prices	Philippines	11.9%	9.9%
	NCR	12.9%	8.2%
At Constant 1985 Prices	Philippines	2.9%	4.8%
	NCR	4.0%	4.8%

VEHICLE OWNERSHIP

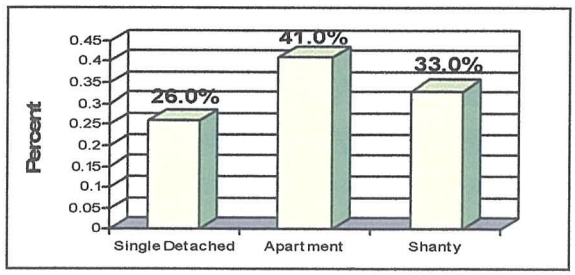
Motorization has increased rapidly. The increase in private utility vehicle, private trailer and for-hire motorcycles (termed tricycles) was especially high. The estimated future car ownership is expected to increase from 1.4 million in 2000 to 2.8 million in 2015 with an average annual growth rate of 4.6%.



Trend and Forecast of Car Ownership

HOUSEHOLD INTERVIEWED

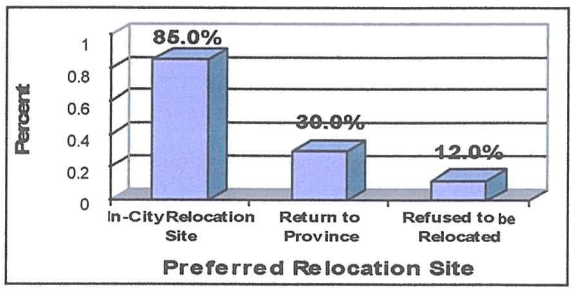
The most common type of dwelling among the informal settlers living under and at the side of the bridges is shown in the figure below.



Type of Dwelling

HOUSEHOLD WILLINGNESS TO RELOCATE

Majority, or 85.0% are willing to be relocated if the project is implemented, but they prefer to be transferred within the City proper. Some 12.0% refuse to be relocated, and some 30% are willing to go back to their provinces.



Willingness to Relocate

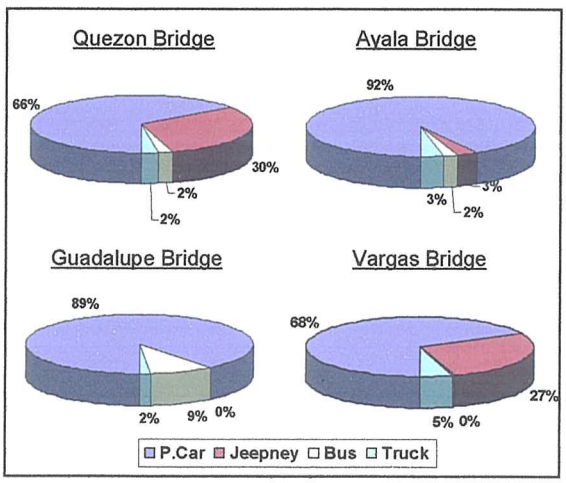
5. TRAFFIC FORECAST

PRESENT TRAFFIC

Vehicle Composition

The vehicle composition on the bridges demonstrates various functions of the bridges depending on their location.

- Quezon Bridge plays the function of local traffic with large share of jeepney traffic.
- Ayala Bridge has the largest share of passenger car traffic because of the business activities.
- Guadalupe Bridge has a large share of bus traffic but no jeepney traffic due to jeepney restriction.
- Vargas Bridge plays the function of local traffic with large share of jeepney traffic.



Vehicle Composition on Major Bridge

Traffic Volume

From the traffic survey data, the following observations can be made;

- Guadalupe Bridge has the heaviest traffic volume among 17 bridges of Pasig and Marikina Rivers at 188,700 PCU/day.
- C-5 Bridge and Quezon Bridge have the second and third heaviest traffic volume.
- As for the Marikina River, Rosario Bridge has the heaviest traffic volume among five (5) bridges.
- The traffic volume on weekday is about 20% larger than that on weekend.

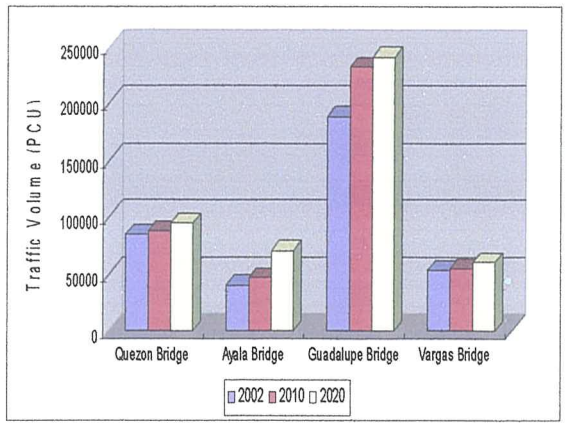
FUTURE TRAFFIC DEMAND

The future traffic projection crossing the Pasig River and Marikina River revealed a high demand in the future.

- The traffic volume on the bridges of the Pasig River is expected to increase from 0.8 million in 2002 to 0.9 million in 2010 and 1.5 million in 2020.
- Similarly, the traffic volume on the bridges of the Marikina River is expected to increase from 0.28 million in 2002 to 0.56 million in 2010 and 1.1 million in 2020.
- However, the traffic volume on the Ayala Bridge is expected to increase from 40,390 in 2002 to 47,100 in 2010 and 70,900 in 2020.

Forecasted Traffic Volume on Bridges (ADT)

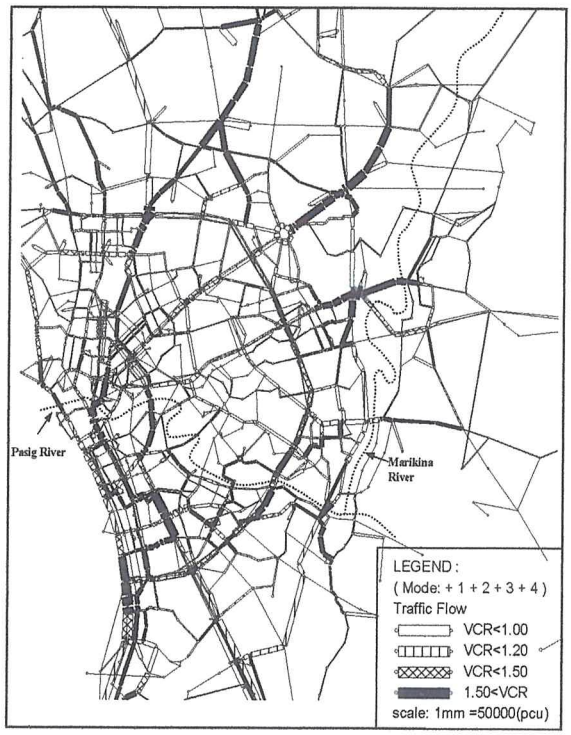
		2002	2010	2020
Pasig River				
1	Delpan Bridge	63,303	74,500	86,700
2	Jones Bridge	57,216	61,700	67,000
3	Mc Arthur Bridge	46,323	61,000	86,600
4	Quezon Bridge	85,137	88,000	94,800
5	Ayala Bridge	40,390	47,100	70,900
6	Nagtahan Bridge	83,148	111,000	117,300
7	Pandacan Bridge	18,790	27,300	39,000
8	Lambingan Bridge	31,973	41,000	85,900
9	Makati-Mandaluyong Bridge	41,755	57,600	73,700
10	Guadalupe Bridge	188,659	232,000	241,100
11	C-5 Bridge	92,184	98,900	129,400
12	Bambang Bridge	20,779	40,000	59,200
	Total	769,657	940,100	1,151,600
Marikina River				
13	Vargas Bridge	53,599	54,700	60,200
14	Rosario Bridge	85,059	99,600	163,600
15	Marcos Bridge	75,983	95,600	145,000
16	Marikina Bridge	54,508	122,800	148,300
17	San Jose Bridge	6,211	15,800	38,400
	Total	275,360	388,500	555,500
	Grand Total	1,045,017	1,328,600	1,707,100



Traffic Volume on Major Bridges (ADT)

Traffic Assignment to Road Network

The forecasted traffic volume of the road network in 2010 is shown below.



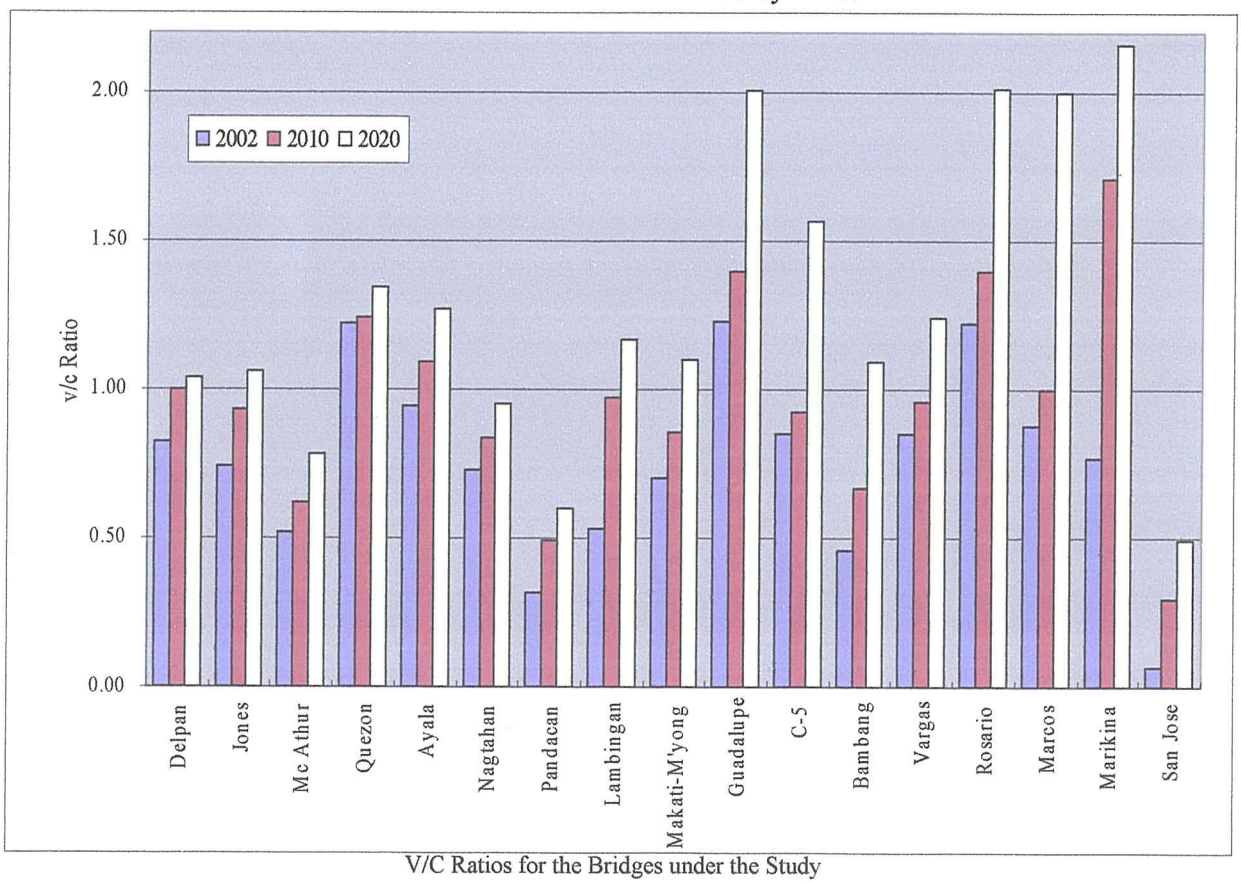
Forecasted Traffic Volume and Congestion, Road Network in 2010

Congestion Degree

Based on the hourly traffic capacity and the peak hour traffic volume, the level of service (LOS), density and congestion degree (V/C) are calculated. From this figure, the following observations can be deduced:

- The present traffic on the bridges along the major arterial roads such as Nagtahan, Guadalupe, C-5, Rosario, and Marcos Bridges are heavily congested so that the LOS of these bridges are "E" or "F" which means almost saturated situation of traffic.
- The present LOS of the Ayala Bridge is assessed as "D" level which means just before saturation level. After a few years, the LOS of the Ayala Bridge is expected to become "E" level and then "F" level in year 2010.

The present LOS of all bridges along the Pasig River is over level "C" and the Marikina River level "E" (except San Jose Bridge). It is expected that the LOS will become "F" level by 2010. It is thus recommended to construct new bridges both on the Pasig and Marikina Rivers by 2010.



V/C Ratios for the Bridges under the Study