7.6 PRELIMINARY DESIGN OF ON/OFF RAMPS

7.6.1 Location of On/Off Ramps

There is always demand to provide many access ramps to elevated expressways. While this meets the desires to local traffic in general, it carries many incidental dangers, such as ramps closely spaced which create congested weaving areas and interference. Adequate space between on/off ramps shall be provided as specified. Ramps may closely intervene streets, unless the ramps are carefully placed.

If land use underneath a viaduct is considered, ramp placement shall be carefully considered since ramps usually interfere with land use under a viaduct.

To maximize the functionality of expressway, location of on/off ramps shall be identified at the best location taking into account the following factors, viz;

- Available R.O.W. width for provision of the ramps
- Condition of connection roads
- Traffic condition and capacity
- Topographical condition
- Distance from adjacent ramp
- Constructability
- Cost
- Impact to the vicinity

Table 7.6.1 summarizes the number of lanes and booths for each on/off ramp estimated based on traffic volume of the 2010 year.

There are 13-on/off ramps along C-3 route, 11-on/off ramps along R-3 route, one-on/off ramp along R-4 route, 9-on/off ramps along R-7 route, two-on/off ramps along R-9 route and one-on/off ramp along R-10 route. Total number of 37-on/off ramps are proposed and placed at the most effective location for collecting/distributing the traffic to MMUES.

7.6.2 Recommended Types of On/Off Ramps

The types and configuration of each on/off ramp were studied applying the design speed and minimum radius as shown in Table 7.1.4 in the previous section.

The outputs of study are reported in Appendix 7.3. The conceptual configuration of on/off ramp are shown in Figure 7.6.1 for Expressway R-3 and R-7, and Figure 7.6.2 for Expressway C-3, R-4, R-9 and R-10.

TABLE 7.6.1 NUMBER OF LANES AND BOOTHS FOR ON/OFF RAMPS

(Peak Hour Ratio = 6.5%)

Exp. Route	Ramp No.	Station	Provided Ramp	Year 2010 Traffic Volume (pcu/day)		No. of Lanes at Each Ramp	No. of Booths at On-Ramp	Connecting Road
C-3	1	-1 km-450	OFF	13,600		2	-	Pres. Quirino
	2	0 km + 400	OFF	30		1	-	Pres. Quirino
		0 km + 700	ON	8,600		1	2	
		1 km + 000	OFF	270		1	-	
	3	3 km + 550	ON	3,600		1	2	R. Magsaysay Blvd.
	4	5 km + 000	OFF	3,400		1	-	G. Araneta Avenue
		5 km + 250	OFF	4,700		1	-	
		6 km + 100	ON	2,800		1	2	
	5	7 km + 800	ON	200		1	2	G. Araneta Avenue
		8 km + 150	OFF	400		1	-	
	6	10 km + 600	OFF	1,000		1	-	C-3 Road
	7	12 km + 600	ON	1,700		1	2	C-3 Road
		13 km + 050	OFF	700		1	-	
R-3	8	0 km + 500	ON	4,900		1	2	South Super H-way
		0 km + 950	ON	21,600		1	2	
		1 km + 400	OFF	16,600		1	-	
	9	3 km + 600	ON	4,700		1	2	South Super H-way
		4 km + 000	OFF	6,300		1	-	
	10 *1	2 km + 600	ON, OFF	6,500	4,400	1	2	Buendia Avenue
	11 *2	10 km + 900	ON, OFF	4,000	4,900	1	2	Doña Soledad
	12 *3	14 km + 400	ON, OFF	2,000	1,900	1	2	Sucat Road
	13 *4	18 km + 150	ON	28,400		2	4	Alabang-Zapote Rd.
		18 km + 350	OFF	27,400		2	-	
	14	20 km + 200	ON, OFF	6,900	9,400	2	4	South Luzon Exp.
R-4	15 *5	2 km + 200	ON, OFF	11,200	11,600	2	4	C-3 Road
R-7	16	-1 km + 200	ON, OFF	9,900	4,800	1	2	Quezon Avenue
	17	1 km + 300	ON	1,400		1	2	Quezon Avenue
	18	2 km + 300	OFF	6,300		1	-	Quezon Avenue
		2 km + 700	ON	4,300		1	2	
		3 km + 600	OFF	18,800		1	-	
		4 km + 050	ON	12,800		1	2	
	19	6 km + 100	ON, OFF	4,500	4,000	1	2	Commonwealth Ave.
	20	8 km + 950	ON, OFF	3,500	5,000	1	2	Commonwealth Ave.
	21	11 km + 050	ON, OFF	10,500	8,400	2	4	Commonwealth Ave.
R-9	22	1 km + 550	ON, OFF	9,800	9,500	1	2	EDSA
	23	4 km + 500	ON, OFF	11,400	12,200	2	6	North Luzon Exp.
R-10	24	3 km + 300	ON, OFF	11,600	9,000	2	4	R-10 Road

Note : *1 : BUENDIA ACCESS RAMP
*2 : BICUTAN ACCESS RAMP
*3 : SUCAT ACCESS RAMP
*4 : ALABANG ACCESS RAMP
*5 : MAKATI ACCESS RAMP

FIG. 7.6.1 THE LOCATIONS OF ON & OFF RAMPS (Exp. R-3 & R-7)
FEASIBILITY STUDY ON METRO MANILA
URBAN EXPRESSWAY SYSTEM
LEGEND:
EXPRESSWAY
INTERCHANGE
ON - RAMP
OFF - RAMP
EXISTING ROAD
P.N.R.
MANILA BAY
LAGUNA DE BAY

FEASIBILITY STUDY ON METRO MANILA
URBAN EXPRESSWAY SYSTEM
FIG. 7.6.2 THE LOCATIONS OF ON & OFF RAMPS(Exp.C-3,R-4,R-9,R-10)
LEGEND :
EXPRESSWAY
INTERCHANGE
ON - RAMP
OFF - RAMP
EXISTING ROAD
PNR
LAGUNA DE BAY
MANILA BAY

7.7 PRELIMINARY DESIGN OF AT-GRADE ROADS

As the proposed routes for the expressways, the existing roads were fully utilized to mitigate the adverse social inputs, particularly R.O.W. acquisitions. Substructures for the expressways were planned to be constructed in the center islands of existing at-grades roads.

Accordingly, number of lanes and lane width were forced to be reduced to accomodate the spaces for these substructures. The adjustment of these existing roads were carefully examined accounting for the following:

- Traffic congestion on at-grade roads
- Intersection configuration
- Additional spaces for left-turn traffic at intersections
- Maximum utilization of spaces below elevated expressway

Table 7.7.1 summarizes the existing at-grade routes affected by substructures of expressways and adjustment of number of lanes/lane width.

TABLE 7.7.1 ADJUSTMENT OF EXISTING AT-GRADE ROAD

Expressway Route	Name of Street	EXISTING CONDITION		WITH EXPRESSWAY	
		No. of Lanes	Lane Width (m)	No. of Lanes	Lane Width (m)
C-3	Pres. Quirino Avenue (M. Adriatico – SSH)	(L) (R) 2 + 2 = 4	3.5	(L) (R) 3 + 2 = 5	3.0
	Pres. Quirino Avenue (SSH – PNR)	3 + 3 = 6	3.5	2 + 2 = 4	3.0
	Magsaysay Blvd. (PNR – Shaw Blvd.)	4 + 4 = 8	3.0	4 + 3 = 7	3.0
	Aurora Blvd. (Shaw Blvd. – Araneta Ave.)	4 + 4 = 8	3.0	4 + 3 = 7	3.0
	G. Araneta Avenue (Aurora Blvd. – Quezon Ave.)	3 + 3 = 6	3.5	3 + 3 = 6	3.25
	G. Araneta Avenue (Quezon Ave. – Sgt. Rivera)	3 + 3 = 6	3.5	3 + 3 = 6	3.25
	C-3 Road (Araneta Ave. – A. Bonifacio)	3 + 3 = 6	3.5	3 + 3 = 6	3.25
	C-3 Road (A. Bonifacio – Rizal Ave. Ext.)	3 + 3 = 6	3.5	2 + 2 = 4	3.25
	C-3 Road (Riza Ave. Ext. – A. Mabini)	3 + 3 = 6	3.5	3 + 3 = 6	3.25
	C-3 Road (A. Mabini – R-10 Road)	3 + 3 = 6	3.25	3 + 3 = 6	3.25
R-3	SSH (Pres. Quirino Ave. – EDSA)	3 + 5 = 8	3.5	3 + 4 = 7	3.25
	SLE (Bicutan I/C – Sucat I/C)	3 + 2 = 5	3.5	3 + 3 = 6	3.25
	SLE (Sucat I/C – Alabang I/C)	2 + 2 = 4	3.5	3 + 3 = 6	3.25
	SLE (Over Alabang I/C – END)	2 + 2 = 4	3.65	2 + 2 = 4	3.65
R-7	Quezon Avenue (D. Tuazon Ave. – Araneta Ave.)	4 + 4 = 8	3.0	4 + 4 = 8	3.0
	Quezon Avenue (Araneta Ave. – Elliptical Road)	4 + 4 = 8	3.0	3 + 3 = 6	3.0
	Commonwealth Avenue (Elliptical Road – END)	3 + 3 = 6	3.5	3 + 3 = 6	3.0
R-9	A. Bonifacio (C-3 Road – EDSA)	3 + 3 = 6	3.5	3 + 3 = 6	3.0
	North Luzon Expressway (EDSA – Toll Barrier)	3 + 3 = 6	3.5	3 + 3 = 6	3.5
	North Luzon Expressway) (Toll Barrier – END)	3 + 2 = 5	3.5	3 + 3 = 6	3.5
R-10	R-10 Road (C-3 Road – Moriones)	5 + 5 = 10	3.5	4 + 4 = 8	3.25

Note:

▒▒▒▒ = Number of lanes reduced due to Expressway

CHAPTER 8

EXPRESSWAY OPERATION, MANAGEMENT AND MAINTENANCE

CHAPTER 8

EXPRESSWAY OPERATION, MANAGEMENT AND MAINTENANCE

8.1 EXPRESSWAY OPERATION

8.1.1 Toll Rate System and Toll Collection System

1) Distance-proportional Toll Rate Vs. Flat Toll Rate

In general, there are two kinds of toll rate systems. One is the distance-proportional toll rate in which toll rates are determined in accordance with the distance traveled. Under this system, an expressway user is issued a ticket as he enters an expressway and pays toll fee at an exit. The other is the flat toll rate system in which the fixed toll fee is charged to the same type of vehicle regardless of the distance traveled. Under this system, an expressway user is required to stop his vehicle only at an entrance of an expressway to pay a toll. The latter system was recommended for MMUES due to the following reasons:

- To minimize vehicle stoppage at a toll booth to handle heavy traffic smoothly and effectively.
- To lessen provision of toll collection facilities. Under the flat toll rate system, a toll plaza can be provided only at an entrance of an expressway.
- To lessen toll collection cost. A large number of personnel who are required for issuing tickets under the distance-proportional toll rate system are not required under the flat toll rate system.
- To attract traffic with longer trip length to encourage functional complement between expressway and surface street

2) Toll Collection System

As the flat toll rate system was recommended, the toll collection system to be adopted is the so-called "open system" in which toll fee is collected as an expressway user enters the toll booth and receipt is issued. Toll collection is made manually and is registered by means of an electronic cash register (ECR) equipped in each toll booth. Amount of tolls collected and number of receipt issued is compared with actual vehicle traffic volume counted with an automatic traffic counter equipped at each toll booth.

8.1.2 Toll Collection Organization and Staffing

Three kinds of Offices will be established as shown in Figure 8.1.1. Central Toll Management Office (CTMO) will be responsible for overall management of toll collection including supervision of Field Toll Operation Offices and Toll Plazas, auditing of financial reports submitted by these Offices, policies and strategies formulation for toll collection and revenue increase measures, etc. CTMO will be organized with minimal number of key staff in order to reduce management cost.

Field Toll Operation Office (FTOO) will be established for every 6 to 10 toll plazas (or 16 to 20 toll booths) and responsible for management of toll collection of Toll Plazas under its jurisdiction, bookkeeping, checking of tolls collected in comparison with vehicles entered to an expressway, safekeeping of tolls until such time they are deposited in the bank, supply of materials to Toll Plazas and dispatching personnel to respective Toll Plaza. FTOO will be operated on a 24-hour basis.

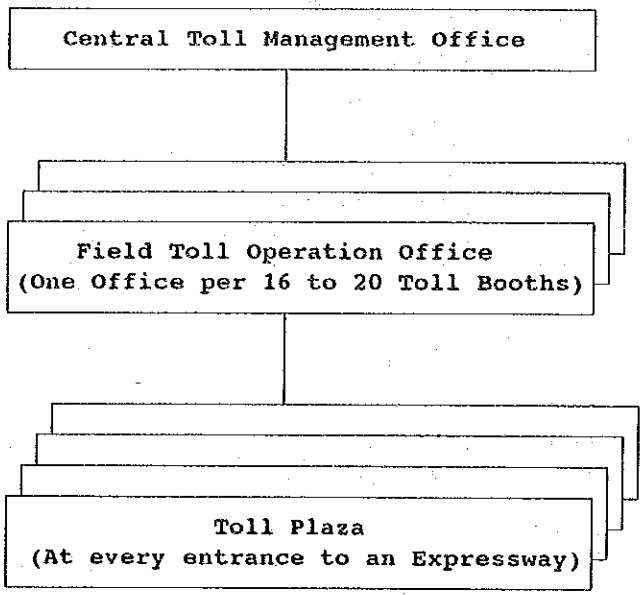


FIGURE 8.1.1 TOLL OPERATION OFFICES

Toll Plaza (TP) will be operated on a 24-hour basis by three shifts and responsible for toll collection at toll booths, issuing receipts to expressway users, registering tolls collected and collection of traffic data, safekeeping of tolls until such time they are transferred to FTOO and submitting data collected such as registered tolls and traffic data to FTOO.

Staff requirement for each Office is presented in Table 8.1.1.

TABLE 8.1.1 STAFF REQUIREMENT FOR TOLL OPERATION OFFICES

OFFICE		POSITION	NUMBER OF STAFF
Central Toll Management Office		General Manager	1
		Deputy Manager	1
		Auditor	1
		Comptroller	1
		Financial Analyst	1
		Secretary	1
		Auditing Clerk	2
		Clerk/Typist	3
		Janitor	1
		Total	12
Field Toll Operation Office		Office Manager	1
		Deputy Office Manager	1
		Accountant (x)	3
		Cashier (x)	3
		Bookkeeper (x)	3
		Supply Officer (x)	3
		Dispatcher (x)	3
		Electrician (x)	3
		Accounting Clerk (x)	6
		Clerk/Typist (x)	3
		Security Guard (x)	6
		Janitor (x)	3
		Total	38
Toll Plaza	2-booth	Chief Supervisor	1
		Assistant Supervisor (x)	3
		Teller (2+2) x 3 (x)	12
		Security Guard (x)	3
		Total	19
	4-booth	Chief Supervisor	1
		Assistant Supervisor (x)	3
		Teller (4+3) x 3 (x)	21
		Security Guard (x)	3
		Total	28
	6-booth	Chief Supervisor	1
		Assistant Supervisor (x)	5
		Teller (6+4) x 3 (x)	30
		Security Guard (x)	3
		Total	39
	8-booth	Chief Supervisor	1
		Assistant Supervisor (x)	6
		Teller (8+6) x 3 (x)	42
		Security Guard (x)	6
		Total	55

Note : (x) 3-shift

8.2 EXPRESSWAY MANAGEMENT

To always maintain smooth and safe flow of traffic, an appropriate traffic control and management system must be developed. Major causes of traffic congestion on an expressway are traffic accidents, broken-down vehicles, and heavy traffic and another area of traffic congestion is at an exit where expressway traffic merges with at-grade street traffic.

8.2.1 Traffic Accident Management

Traffic accident data on Tokyo-Kanagawa expressways are presented in Tables 8.2.1 and 8.2.2. Daily accident rate per 1,000 expressway traffic varies from 0.019 to 0.027. Considering the driving manner of drivers in Metro Manila, the daily accident rate might be higher than that in Tokyo-Kanagawa. Assuming that the traffic accident rate on urban expressways in Metro Manila is 0.030, an average of 1.5 traffic accidents would occur at an expressway traffic level of 50,000 veh/day.

Predominant type of traffic accident is rear-end collisions, followed by minor accidents between vehicles and minor collision with expressway facilities on Tokyo-Kanagawa Expressways.

In anticipation of traffic accidents on expressways, such proper traffic accident management system must be established as follows:

- Traffic Management Center (TMC) shall be established. All accident information will be reached to TMC. TMC will instruct an expressway patrol car or an expressway traffic police patrol car nearest to the accident site by way of radio to investigate the accident. TMC will also arrange to send an ambulance car and/or a towing vehicle, if necessary.

- Emergency telephones should be installed at an interval of about 500 meters. Drivers should be educated to use the emergency telephone to inform the matter to TMC as soon as an accident occurs.

- Two kinds of expressway patrol groups should be organized, one by the expressway operator and the other by traffic police. Major responsibility of the former will be investigation of damages to expressway facilities, and preparation of accident report which will be signed by the latter. Responsibility of the latter will be investigation of an accident, and preparation and signing of traffic accident report.

- The most important matter is to move vehicles involved in an accident to the shoulder so as to open through lanes for traffic as soon as possible.

- Damage caused by collision of a vehicle with an expressway facility must be repaired urgently. Cost for repair must be shouldered by a person who caused an accident. The expressway patrol group is responsible for preparation of necessary documents in coordination with the expressway maintenance team.

TABLE 8.2.1 NUMBER OF TRAFFIC ACCIDENTS ON TOKYO – KANAGAWA EXPRESSWAYS

Year	No. of Years Since First Section Opened For Traffic	Expressway Length (km)	Expressway Traffic (veh/day)	No. of Traffic Accidents			
				Per Year	Per Day	Per km Per Day	Per 1,000 vch. Per Day
1963	1	13.4	19,700	142	0.39	0.029	0.020
1964	2	32.0	61,200	478	1.31	0.041	0.021
1965	3	32.0	78,400	659	1.81	0.057	0.023
1966	4	34.9	90,000	720	1.97	0.056	0.022
1967	5	47.2	132,900	1,090	2.99	0.063	0.022
1968	6	60.9	212,100	2,065	5.66	0.093	0.027
1972	10	101.3	497,800	4,747	13.01	0.128	0.026
1977	15	131.7	596,800	4,672	12.80	0.097	0.021
1982	20	145.6	770,500	5,362	14.69	0.101	0.019
1987	25	200.9	930,900	8,506	23.30	0.116	0.025

SOURCE : 30 – Year History of Metropolitan Expressway Public Corporation, Japan

TABLE 8.2.2 TYPE OF ACCIDENTS ON TOKYO – KANAGAWA EXPRESSWAYS

Year	No. of Traffic Accident Per Year	Type of Accident				
		Rear–end Collision	Minor Accidents Between Vehicles	Minor Collision With Expressway Facility	Overturning	Others
1977	4,672	47%	28%	21%	1%	3%
1987	8,506	46%	21%	26%	2%	5%
1989	11,439	50%	21%	24%	1%	4%

SOURCE : 30 – Year History of Metropolitan Expressway Public Corporation, Japan

8.2.2 Broken-down Vehicle Management

Data on broken-down vehicles of Tokyo-Kanagawa Expressways are presented in Tables 8.2.3 and 8.2.4. The daily rate of broken-down vehicles ranges from 0.080 to 0.296 per 1,000 vehicles and is high during the first 5 years after opening of an expressway. It would be much higher on Metro Manila expressways than that on Tokyo-Kanagawa expressways, since many obsolete vehicles are in use in Metro Manila. Assuming that the daily rate of vehicle break-down is 0.300 on Metro Manila expressways, an average of 15 vehicles would break down daily on an expressway with traffic level of 50,000 veh/day.

"Engine trouble" and "out of gas" are predominant type of vehicle break-down on Tokyo-Kanagawa expressways, followed by "flat tire".

The broken-down vehicle management system will be as follows:

- Vehicle break-down will be informed to TMC by way of an emergency telephone installed at an about 500-meter interval on an expressway.
- TMC will send an expressway patrol car or a towing vehicle depending on the nature of vehicle break-down.
- One person in an expressway patrol car should be a mechanic who can repair minor engine trouble. An expressway patrol car should be so equipped that it can supply fuel for "out of gas" vehicles.
- The expressway operator should either own towing vehicles or contract with a private company so that a towing vehicle can be sent to the site at anytime in need.
- Drivers should be educated to remove a broken-down vehicle from through lanes to keep them always open for traffic.

8.2.3 Traffic Control

1) Enforcement of Traffic Rules and Regulations

The expressway patrol group and the expressway police patrol group shall jointly enforce traffic rules and regulation and traffic control measures as follows:

- Enforcement of speed limit: Speed limit will be enforced by way of patrol or vehicular speed controller.
- Enforcement of restrictions on vehicle type and weight limit: Type of vehicles which are not allowed to use expressways should include slow moving vehicles, motorcycles, tricycles, jeepneys and trailers. Axle load scale will be installed at selected toll plaza where heavy vehicles or overloaded trucks are expected. Restrictions cover total weight, axle load, width, height, length of vehicles.
- Regulation of traffic entry at ramps: In order to prevent congestions or to mitigate traffic congestions on expressways, traffic entry to expressways will be regulated at relevant toll plaza.

TABLE 8.2.3 NUMBER OF BROKEN–DOWN VEHICLES ON TOKYO–KANAGAWA EXPRESSWAYS

Year	No. of Years Since First Section Opened For Traffic	Expressway Length (km)	Expressway Traffic (veh/day)	No. of Broken–down Vehicles			
				Per Year	Per Day	Per km Per Day	Per 1,000 vch. Per Day
1963	1	13.4	19,700	1,569	4.30	0.321	0.218
1964	2	32.0	61,200	6,617	18.13	0.567	0.296
1965	3	32.0	78,400	8,418	23.06	0.721	0.294
1966	4	34.9	90,000	8,785	24.07	0.690	0.267
1967	5	47.2	132,900	9,768	26.76	0.567	0.201
1968	6	60.9	212,100	13,227	36.24	0.595	0.171
1972	10	101.3	497,800	30,180	82.68	0.816	0.166
1977	15	131.7	596,800	23,845	65.33	0.496	0.109
1982	20	145.6	770,500	22,572	61.84	0.425	0.080
1987	25	200.9	930,900	27,240	74.63	0.371	0.080

SOURCE : 30 – Year History of Metropolitan Expressway Public Corporation, Japan

TABLE 8.2.4 TYPE OF VEHICLE BREAK–DOWN ON TOKYO – KANAGAWA EXPRESSWAYS

Year	No. of Years Since First Section Opened For Traffic	No. of Broken–Down Vehicles	Type of Vehicle Break–down			
			Engine Trouble	Out of Gas	Flat Tire	Others
1963	1	1,569	32%	32%	18%	18%
1964	2	6,617	28%	30%	20%	22%
1965	3	8,418	29%	27%	21%	23%
1966	4	8,785	31%	26%	21%	22%
1967	5	9,768	26%	27%	19%	24%
1972	10	30,180	33%	17%	15%	35%
1982	20	22,572	36%	12%	11%	41%
1987	25	27,240	36%	11%	12%	41%

SOURCE : 30 – Year History of Metropolitan Expressway Public Corporation, Japan

2) Traffic Information System

To provide in time traffic condition on expressways to expressway users as well as potential expressway users on at-grade roads is quite important not only for effective and efficient utilization of expressways but also for convenience of expressway users.

Figure 8.2.1 shows concept of Traffic Information System (TIS). The very sophisticated TIS would not be needed at the beginning of expressway operation, say first 4 to 5 years. During this period, fundamental research on the system based on traffic data collected should be made and the system suitable for Metro Manila expressways should be developed.

Following equipment will be required to complete the system:

For Data Collection

- Vehicle detectors: road side type and/or over head type of ultrasonic vehicle detectors are installed every 300-meter intervals along expressways. The date collected are transmitted to the central data processing unit through telecommunication lines.

- Closed circuit TV for surveillance: CCTV cameras are installed at strategic points such as merging and diverging sections and curved sections and at 1 km interval along expressways.

At Traffic Management Center

- Computer unit for data processing
- Traffic condition display panel
- Traffic regulation display panel
- Unusual event display panel
- CCTV monitors
- Operator's console
- Emergency telephone board
- Radio console for management

Along expressway, toll plazas and at-grade roads

- Character information board: the board displays traffic condition on expressways and is installed along expressways.

- Graphic information board: traffic condition on expressways is graphically shown on the board. The boards are installed along expressways and on at-grade roads near the entrance to an expressway.

- Character information board: the board is installed on at-grade road (near the entrance to an expressway) and indicate whether the entrance is open or closed.

3) Traffic Management at an Exit

Traffic management at an exit where expressway traffic merges with at-grade road traffic must be done carefully. Depending on traffic level of ramp traffic and at-grade road traffic, installation of traffic signal should be planned.

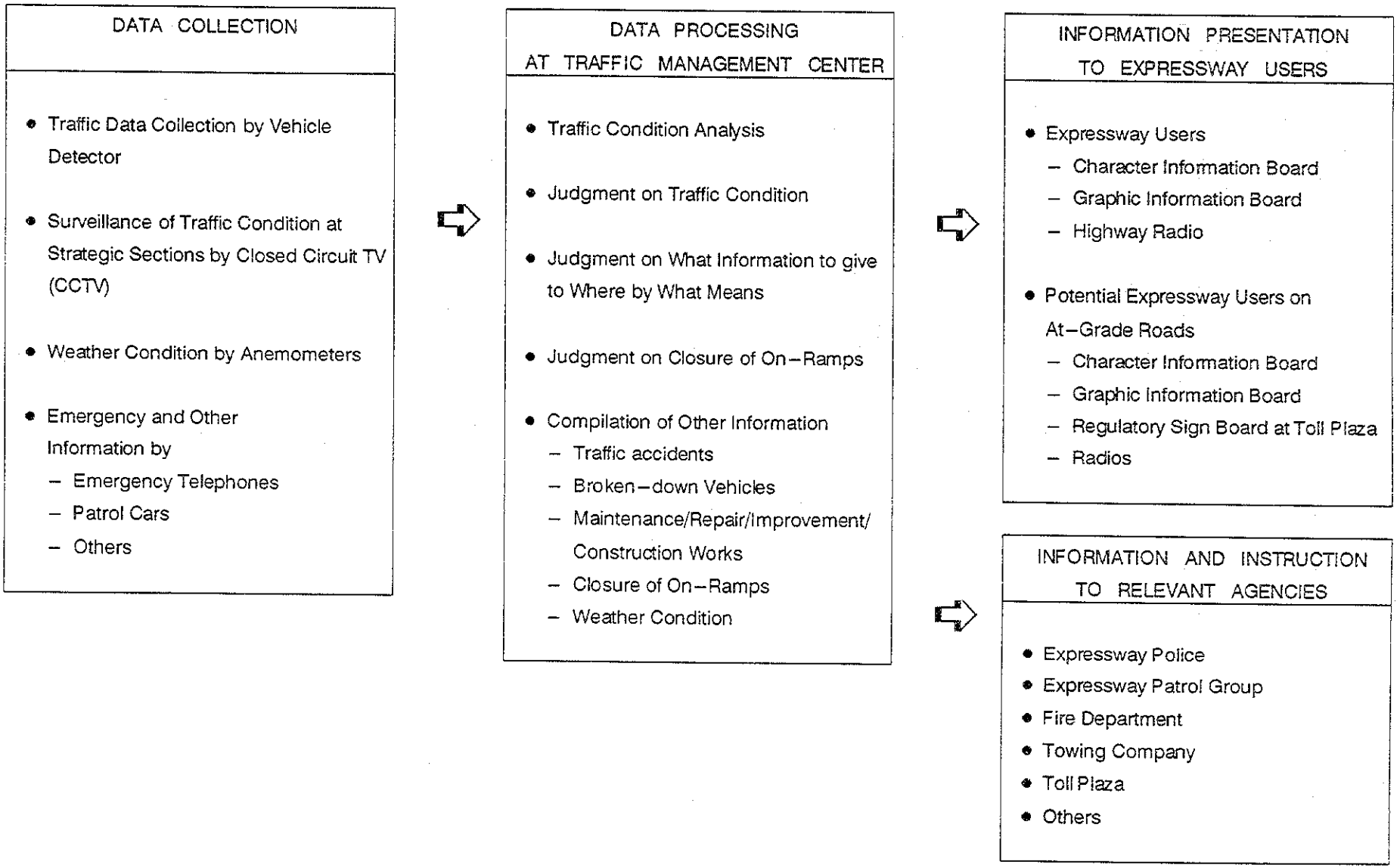


FIGURE 8.2.1 CONCEPT OF TRAFFIC INFORMATION SYSTEM

8.2.4 Organization and Staffing Requirement

Conceptual organization for traffic management is shown in Figure 8.2.2. All data and information collected in the field will be transmitted to and processed by Traffic Control Division which will make decision on actions to be taken. Traffic Control Division will inform decisions made to respective groups and agencies for their immediate action.

Expressway Patrol Group will consist of 4 teams for every 25-km expressway section. Expressway patrol will be made on 24-hour basis by three shifts. Expressway Patrol Group will be required to do their duties in close coordination with Expressway Police Patrol Group.

Research and System Development Division will be responsible for traffic control and traffic information systems development.

Staffing requirement for the first five years is shown in Table 8.2.5.

TABLE 8.2.5 STAFFING REQUIREMENT FOR TRAFFIC MANAGEMENT

Division	Position	No. of Staff
Traffic Control Division	Head of Division	1
	Assistant Head of Division	1
	Traffic Management Specialist (x)	9
	Radio Operator (x)	6
	Emergency Telephone Board Operator (x)	3
	Secretary	1
	Clerk/Typist (x)	6
	Janitor (x)	3
	Total	30
Research and Systems Development Division	Head of Division	1
	Assistant Head of Division	1
	Chief Traffic Engineer	1
	Traffic Engineer	5
	Systems Analyst	4
	Computer Operator	4
	Secretary	1
	Clerk/Typist	2
	Janitor	1
	Total	20
Expressway Patrol Group (For 25-km Expressway Section)	Chief Patrol Officer	1
	Assistant Chief Patrol Officer	1
	Patrol Man (4-Teams x 2 men x 3) (x)	24
	Driver (x)	12
	Total	38

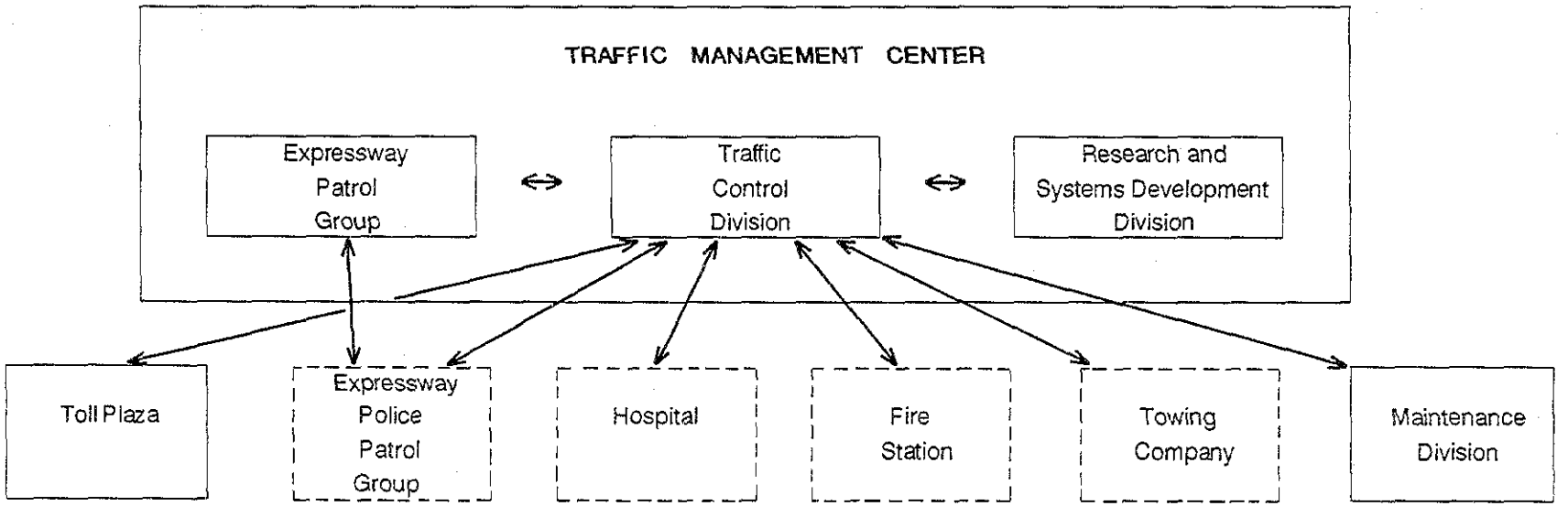


FIGURE 8.2.2 CONCEPTUAL ORGANIZATION FOR TRAFFIC MANAGEMENT

8.3 EXPRESSWAY MAINTENANCE

Expressway facilities must be always maintained in good condition to ensure safety and comfort of expressway users and to prolong economic life of facilities.

8.3.1 Major Maintenance Activities

As MMUES is mostly elevated structures, maintenance efforts for the first 5 years will be addressed to inspection and routine maintenance works. During the second 5 years, periodic maintenance work, particularly pavement repair and overlay will increase. Repair works for structure will be increasingly required in the third 5 years and thereafter.

Major maintenance works are as follows:

Inspection

- Daily inspection to identify maintenance needs, damages, obstacles on the expressways, etc.
- Intensive inspection to judge structural soundness, probably every 5 years.
- Emergency inspection just after an earthquake, a typhoon, a fire below or nearby expressway, vehicular collision with an expressway substructure, etc. to evaluate damaged portions.

Routine Maintenance

- Cleaning of road surface, storm water drainage system, traffic control facilities, toll collection facilities, lighting facilities, etc.
- Repainting road markings
- Crack sealing of deck slabs of superstructure and other concrete structures
- Sealing and patching of AC pavement
- Minor repair of expressway facilities

Periodic Maintenance and Repair

- Repair of expansion joints, deck slabs, and other parts of viaducts
- Repair of toll collection facilities
- Repair of traffic control facilities
- Repair of other facilities
- Overlay of pavement
- Repainting of steel structures

Emergency Maintenance and Repair

- Damages made by vehicle collision with expressway facilities and calamities

Improvement

- Installation of additional noise barriers and other facilities related to environmental protection
- Improvement of traffic safety facilities
- Improvement of merging area between an off-ramp and an at-grade road
- Installation of facilities for traffic information system

Inspection should be done by an expressway operator. Other maintenance works, particularly periodic maintenance works and improvement works, can be contracted with private contractors.

8.3.2 Organization and Staffing Requirement

Organizational set-up for the maintenance division is proposed as shown in Figure 8.3.1.

Inspection Section: Daily inspection will be done by this section. Two inspection teams per 25-km section of expressways will be organized. Condition of expressway facilities and needs of maintenance/repair will be reported to Maintenance Planning and Programming Section.

Maintenance Planning and Programming Section: Based on the reports from Inspection Section, planning and programming of maintenance works will be prepared.

Material Procurement and Supply Section: Materials required for maintenance works will be procured and supplied to Maintenance Work Section.

Maintenance Work Section: Routine maintenance work and emergency maintenance and repair works will be implemented by this section.

Bidding and Contract Section: Periodic maintenance works and improvement works will be contracted to contractors. Preparation of bid documents, bidding, contracting and supervision of contractors' works will be done by this section.

Legal Section: This section mainly deals with persons who made damages to expressway facilities by vehicle collision. Cost of repair will be negotiated and collected from them. Also responsible for legal aspects of contracts with contractors.

Staffing requirement is shown in Table 8.3.1.

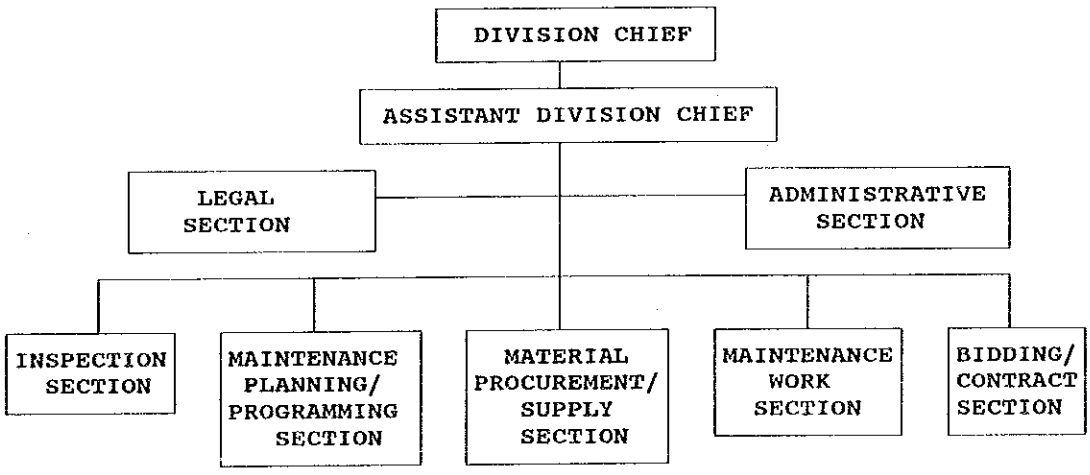


FIGURE 8.3.1 PROPOSED ORGANIZATION FOR MAINTENANCE DIVISION

TABLE 8.3.1 STAFF REQUIREMENT FOR MAINTENANCE DIVISION

SECTION	POSITION	NO. OF STAFF
Management	Division Chief	1
	Assistant Division Chief	1
Inspection	Section Chief	1
	Inspectors	6
	Driver	2
Planning/ Programming	Section Chief	1
	Planning/Programming Engineer	4
Material Procurement/Supply	Section Chief	1
	Procurement/Supply Officer	3
Maintenance Work	Section Chief	1
	Foreman	4
	Laborer	20
	Driver	4
Bidding/Contract	Section Chief	1
	Cost Estimator	1
	Document Specialist	2
	Assistant Engineer	2
Legal Section	Section Chief	1
	Support Officer	4
Administrative	Section chief	1
	Secretary	1
	Accountant	1
	Cashier	1
	Clerk/Typist	2
	Driver	3
	Janitor	1
T o t a l		70

CHAPTER 9

COST ESTIMATES

CHAPTER 9

COST ESTIMATES

The project costs consisting of construction cost, right-of-way acquisition and compensation cost, detailed engineering cost, construction supervision cost, expressway operating cost and expressway maintenance cost were estimated on the basis of April 1993 price level with breakdown of foreign currency component, local currency component and tax component. Foreign currency component includes costs of imported equipment and spare parts, the foreign currency portion of locally purchased goods, wages of expatriate personnel, and foreign overheads and profits. The local currency component includes costs of local materials and supplies, local wages, local supervision, local transport and freight, and local overheads and profits. The foreign exchange rates used were as follows:

₱1.00 = ¥4.50 = US$0.0392

9.1 CONSTRUCTION COST

Construction costs were estimated in accordance with the procedure shown in Figure 9.1.1. Construction costs were estimated broken down into three components, namely; expressway structure cost, expressway miscellaneous costs and at-grade road reconstruction costs.

9.1.1 Unit Costs For Major Construction Items

Unit costs of major construction items were established by analyzing prevailing material, labor and equipment unit prices as well as those of on-going projects and Approved Agency Estimates of recently bidden projects.

Unit costs of major construction items are shown in Table 9.1.1. Unit prices of main materials, labor, and equipment are presented in Tables 9.1.2, 9.1.3 and 9.1.4, respectively.

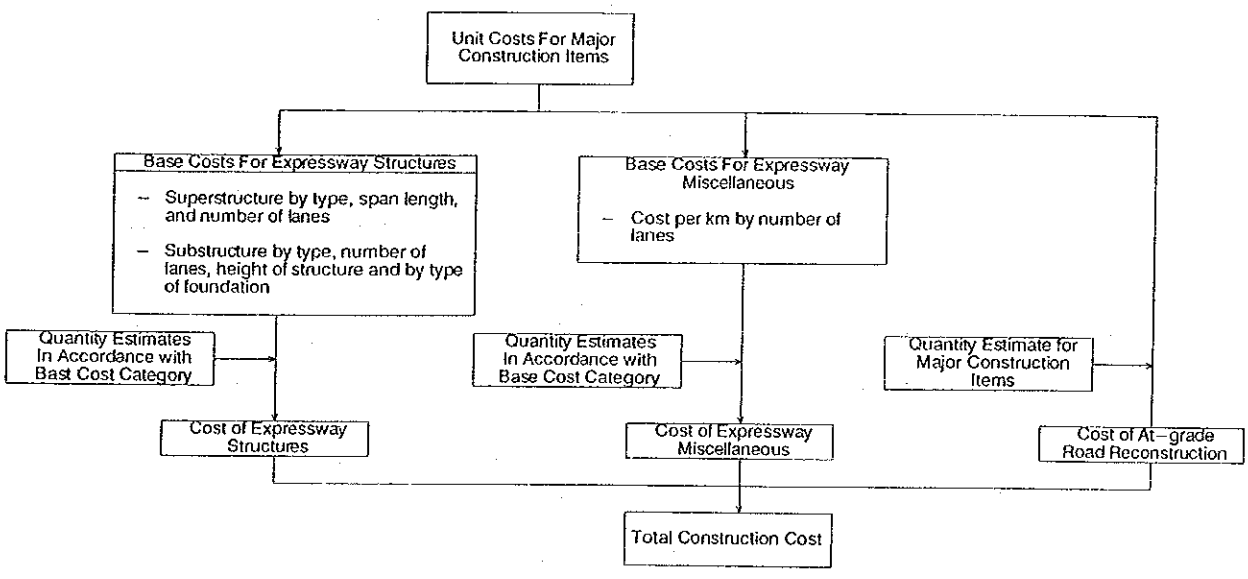


FIGURE 9.1.1 PROCEDURE OF CONSTRUCTION COST ESTIMATE

TABLE 9.1.1 UNIT COSTS OF MAJOR CONSTRUCTION ITEM

(April 1993 Prices)

CONSTRUCTION ITEM	UNIT	UNIT COST (₱)	PRICE COMPONENT (%)		
			F	L	T
1. Earth Work					
1.1 Clearing and Grubbing	ha.	34,000.0	54	23	13
1.2 Removal of Existing PCC Pavement	sq. m.	110.0	57	25	18
1.3 Removal of Existing Curb and Gutter	L.M.	163.0	55	28	17
1.4 Removal of Existing Sidewalk	sq. m.	105.0	57	25	18
1.5 Removal of Existing RCP (Ø 0.61 m)	L.M.	950.0	60	25	15
1.6 Excavation (Structure)	cu. m.	305.0	60	25	15
1.7 Excavation (Pipe Culvert)	cu. m.	220.0	55	30	15
1.8 Roadway Excavation Surplus (Common)	cu. m.	278.0	54	30	16
1.9 Embankment (for Roadway)	cu. m.	90.0	58	24	18
1.10 Embankment (Borrow)	cu. m.	200.0	58	24	18
2. Pavement					
2.1 Aggregate Subbase Course	cu. m.	430.0	55	27	18
2.2 Aggregate Base Course	cu. m.	600.0	55	27	18
2.3 Bituminous Prime Coat (Cut Back Asphalt MC-70)	Ton	16,540.0	58	22	20
2.4 Bituminous Tack Coat (Emulsified Asphalt)	Ton	17,040.0	58	22	20
2.5 Bituminous Concrete Surface Course (Hot Laid)	Ton	1,835.0	58	22	20
2.6 PCC Pavement (t = 23 cm.)	sq. m.	690.0	53	29	18
2.7 PCC Pavement (t = 27 cm.)	sq. m.	990.0	53	29	18
3. Structure					
3.1 Reinforcing Steel (Grade-40)	kg.	28.8	48	40	12
3.2 Reinforcing Steel (Grade-60)	kg.	29.8	48	40	12
3.3 Structural Concrete Class-A (3,000 psi)	cu.m.	4,135.0	51	31	18
3.4 Structural Concrete Class-A (4,000 psi)	cu.m.	4,510.0	53	29	18
3.5 Structural Concrete Class-B (Lean Concrete)	cu.m.	2,710.0	50	33	17
3.6 P.C. Girder (AASHTO Type L = 30 m)	Each	369,000.0	55	27	18
3.7 P.C. Girder (AASHTO Type L = 35 m)	Each	500,000.0	55	27	18
3.8 P.C. Girder (AASHTO Type L = 40 m)	Each	617,000.0	55	27	18
3.9 P.C. Girder (T-type L = 30 m)	Each	535,000.0	58	24	18
3.10 P.C. Girder (T-type L = 35 m)	Each	686,000.0	58	24	18
3.11 P.C. Girder (T-type L = 40 m)	Each	785,000.0	58	24	18
3.12 P.C. Pile (40 x 40 cm)	L.M.	2,960.0	53	30	17
3.13 Bored RC Pile (Ø = 0.9 m)	L.M.	11,545.0	60	22	18
3.14 Bored RC Pile (Ø = 1.0 m)	L.M.	13,442.0	60	22	18
3.15 Bored RC Pile (Ø = 1.2 m)	L.M.	23,175.0	60	22	18
3.16 Metal Bridge Railing	L.M.	2,050.0	62	20	18
4. Drainage					
4.1 R.C. Pipe Culvert (Ø 61 cm)	L.M.	980.0	50	35	15
4.2 R.C. Pipe Culvert (Ø 76 cm)	L.M.	1,210.0	51	34	15
4.3 R.C. Pipe Culvert (Ø 91 cm)	L.M.	1,800.0	52	33	15
4.4 Manhole (Ø 61 cm)	Each	11,955.0	53	34	13
4.5 Manhole (Ø 76 cm)	Each	14,500.0	53	34	13
4.6 Manhole (Ø 91 cm)	Each	18,000.0	53	34	13
4.7 Cast Iron Pipe (Ø 20 cm)	L.M.	1,355.0	60	22	18
4.8 Galvanized Iron Pipe (Ø 15 cm)	L.M.	1,118.0	60	22	18
5. Miscellaneous					
5.1 Concrete Curb and Gutter (Type A)	L.M.	452.7	52	30	18
5.2 Concrete Curb and Gutter (Type B)	L.M.	452.7	52	30	18
5.3 Concrete Sidewalk (t = 10 cm)	sq. m.	342.0	50	32	18
5.4 Road Sign (Regulatory)	Each	7,800.0	42	46	12
5.5 Pavement Marking (Reflective)	sq. m.	475.2	43	44	13
5.6 Overhead Road Sign	Each	346,000.0	55	27	18
5.7 Street Lighting	Km.	2,800,000.0	55	27	18
5.8 Emergency Telephone	Km.	150,000.0	60	22	18
5.9 Toll Booth (2 booths)	Each	10,000,000.0	60	22	18
5.10 Toll Booth (4 booths)	Each	18,000,000.0	60	22	18
5.11 Toll Booth (6 booths)	Each	27,000,000.0	60	22	18

Note : F – Foreign, L – Local, T – Tax

TABLE 9.1.2 COST OF MAIN MATERIALS

(April 1993 Prices)

MATERIAL	UNIT	UNIT PRICE	COMPONENT (%)		
			F	L	T
1. Market Price of Purchased Material					
1.1 Portland Cement	bag	120.00	50.0	35.0	15.0
1.2 Reinforcing Steel Bar (Grade – 40)	kg.	13.50	70.0	12.0	18.0
1.3 Reinforcing Steel Bar (Grade – 60)	kg.	14.50	70.0	12.0	18.0
1.4 High Tensile Strand	Kg.	45.30	70.0	12.0	18.0
1.5 Asphalt Cement (Penetration 85/100)	M.T.	7,650.00	50.0	35.0	15.0
1.6 Cutback Asphalt (MC – 70)	M.T.	7,875.00	50.0	35.0	15.0
1.7 Diesel Fuel	liter	7.00	62.0	19.0	19.0
1.8 Lumber (Yacal/Guijo)	bd. ft.	16.50	30.0	55.0	15.0
2. Processed Material					
2.1 Fine Aggregate for Concrete	cu.m.	260.00	62.0	22.0	16.0
2.2 Coarse Aggregate for concrete	cu.m.	300.00	62.0	22.0	16.0
2.3 Aggregate for Subbase Course	cu.m.	250.00	64.0	19.0	17.0
2.4 Aggregate for Base Course	cu.m.	362.00	63.0	21.0	16.0
2.5 Concrete Class A (3,000 psi)	cu.m.	2,350.00	55.0	30.0	15.0
2.6 Concrete Class A (4,000 psi)	cu.m.	2,590.00	55.0	30.0	15.0
2.7 Concrete Class B	cu.m.	2,110.00	56.0	29.0	15.0
2.8 RCPC (Ø 61 cm.)	L.M.	650.00	55.0	31.0	14.0
2.9 RCPC (Ø 76 cm.)	L.M.	790.00	55.0	31.0	14.0
2.10 RCPC (Ø 91 cm.)	L.M.	1,180.00	55.0	31.0	14.0

TABLE 9.1.3 LABOR COST

(April 1993 Prices)

LABOR CATEGORY	DAILY RATE
Foreman	₱ 180.00
Assistant Foreman	₱ 150.00
Heavy Equipment Operator	₱ 150.00
Light Equipment Operator	₱ 135.00
Driver	₱ 135.00
Carpenter	₱ 135.00
Skilled Labor	₱ 130.00
Unskilled Labor	₱ 126.00

TABLE 9.1.4 HOURLY COST OF CONSTRUCTION EQUIPMENT

(April 1993 Prices)

	CONSTRUCTION EQUIPMENT		HOURLY COST	COMPONENT (%)		
				F	L	T
1.	Crawler Tractor (Bulldozer)	250 HP	1,352.0	67.0	21.0	12.0
2.	Crawler Tractor (Bulldozer)	200 HP	1,185.0	67.0	21.0	12.0
3.	Wheel Tractor	60 HP	488.0	60.0	28.0	12.0
4.	Motor Scraper 11 cu. yd.	144 HP	1,205.0	65.0	23.0	12.0
5.	Wheel Type Loader 2 cu. yd.	105 HP	412.0	66.0	22.0	12.0
6.	Wheel Type Loader 1 1/2 cu. yd.	80 HP	343.0	65.0	23.0	12.0
7.	Motor Grader	145 HP	408.0	66.0	22.0	12.0
8.	Motor Grader	183 HP	640.0	66.0	22.0	12.0
9.	Road Roller Tandem 8–10 t	60 HP	619.0	65.0	24.0	11.0
10.	Rubber Tire Roller 20 t	100 HP	570.0	65.0	24.0	11.0
11.	Vibratory Roller		836.0	66.0	23.0	11.0
12.	Asphalt Finisher 100 t/H	130 HP	2,296.0	61.0	22.0	17.0
13.	Asphalt Distributor 600 liter	200 HP	757.0	60.0	23.0	17.0
14.	Concrete Finisher 50 t/H	100 HP	897.0	67.0	22.0	11.0
15.	Crushing Plant 100 t/H	200 HP	324,844.0 /M			
16.	Asphalt Plant 50 t/H	150 HP	4,385.0 /M	61.0	23.0	11.0
17.	Concrete Batching Plant 80 cu. m/H	107 HP	384,000.0 /M	59.0	23.0	18.0
18.	Dump Truck 12 t		832.0	67.0	19.0	14.0
19.	Truck Mounted Crane	80 t	2,208.0	68.0	19.0	13.0
20.	Truck Mounted Crane	60 t	1,790.0	68.0	20.0	12.0
21.	Truck Mounted Crane	40 t	1,295.0	68.0	20.0	12.0
22.	Crawler Crane	60 t	1,546.0	68.0	19.0	13.0
23.	Crawler Crane	30 t	860.0	67.0	20.0	13.0
24.	Hydraulic Type Excavator ½ cu. yd.		591.0	66.0	23.0	11.0
25.	Hydraulic Type Excavator ¾ cu. yd.		709.0	66.0	22.0	12.0
26.	Hydraulic Type Excavator 1.83 cu. yd.		1,468.0	69.0	18.0	13.0
27.	Concrete Mixer 7 cu. ft	7.5 HP	10,367.0 /M	35.0	55.0	10.0
28.	Concrete Mixer 16 cu. ft	18 HP	14,789.0 /M	51.0	35.0	14.0
29.	Concrete Vibrator	3.5 HP	7,736.0 /M	33.0	60.0	7.0
30.	Concrete Saw	7 HP	174.3	50.0	38.0	12.0
31.	Motor Generator 15 KW		12,185.0 /M	59.0	28.0	13.0
32.	Water Pump 2½ to 3 inches		5,703.0	41.0	47.0	12.0

Note : /M = /Month

SOURCE : ACEL Equipment Guidebook
November 1992

9.1.2 Base Costs For Expressway Structures and Miscellaneous

Base costs for superstructure were estimated for three different span lengths and five different number of lanes as shown in Table 9.1.5 (refer to Appendix 9.1.1 for detailed computation).

Base costs for substructures with different type of foundation were estimated for various types, structural heights and number of lanes of superstructure as shown in Table 9.1.6 (refer to Appendix 9.1.1 for detailed computation).

Base costs for expressway miscellaneous which includes pavement marking, road signs, street lighting, emergency telephone and communication system, noise barrier, etc. were estimated for 1-lane, 2-lane and 4-lane expressways as shown in Table 9.1.7 (refer to Appendix 9.1.1 for detailed computation).

9.1.3 Quantity Estimate

Quantities were estimated based on plan and profile drawings at a scale of 1:2,500 prepared for expressways, interchanges and access ramps. Drawings of the same scale for Pasig River bridges were also prepared for quantity estimates of the said bridges.

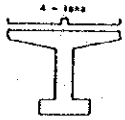
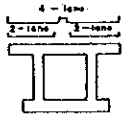
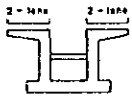
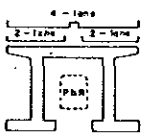
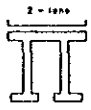
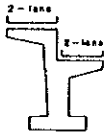
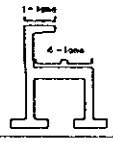
Quantities for expressway structures and miscellaneous were estimated in accordance with base cost category. Quantities for at-grade reconstruction were estimated for major construction items.

TABLE 9.1.5 BASE COST OF SUPER STRUCTURE

No. of Lanes	Span Length (meter)	Cost Per Span (Million Pesos in April 1993 Prices)
1-lane (AASHTO Girder)	30	1.93
	35	2.46
	40	2.96
1-lane (Curbed PC Box Girder)	30	2.70
	35	3.44
	40	1.14
2-lane (AASHTO PC Girder)	30	2.84
	35	3.58
	40	4.29
3-lane (AASHTO PC Girder)	30	3.68
	35	4.63
	40	5.53
4-lane (AASHTO PC Girder)	30	5.45
	35	6.90
	40	8.26
6-lane (AASHTO PC Girder)	30	6.79
	35	8.57
	40	10.21

TABLE 9.1.6(1) BASE COST OF SUBSTRUCTURE/FOUNDATION

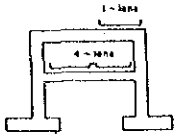
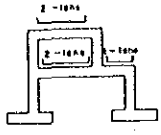
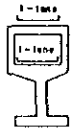
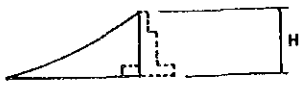
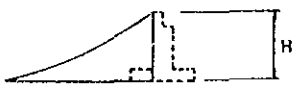
UNIT: Million Pesos

	Foundation	2nd Level (L)			3rd Level (H)		
		30 m	35 m	40 m	30 m	35 m	40 m
4 – lane 1 – Column 	Spread	2.53	3.03	3.54	4.17	5.00	5.83
	L = 10 m	3.24	3.88	4.53	5.12	6.14	7.16
	L = 15 m	3.59	3.97	5.03	5.59	6.71	7.82
	L = 20 m	3.95	4.74	5.52	6.06	7.27	8.49
2 – lane 1 – Column 	Spread	1.07	1.29	1.50	1.67	2.00	2.34
	L = 10 m	1.43	1.71	2.00	2.11	2.35	2.74
	L = 15 m	1.60	1.93	2.25	2.34	2.60	3.03
	L = 20 m	1.78	2.14	2.49	2.56	2.82	3.29
1 – lane 1 – Column 	Spread	0.74	0.89	1.04	1.42	1.70	1.98
	L = 10 m	0.98	1.18	1.37	1.77	2.13	2.48
	L = 15 m	1.10	1.32	1.54	1.95	2.34	2.73
	L = 20 m	1.22	1.46	1.71	2.13	2.55	2.98
4 – lane (or 2–lane + 2–lane) 2 – Column 	Spread	2.59	3.11	3.62	4.82	5.78	6.75
	L = 10 m	3.36	4.03	4.70	5.77	6.93	8.08
	L = 15 m	3.74	4.49	5.24	6.25	7.50	8.75
	L = 20 m	4.13	4.95	5.78	6.73	8.07	9.42
Center Ramp 	Spread	3.78	4.54	5.29	5.67	6.81	7.94
	L = 10 m	4.73	5.67	6.62	7.10	8.51	9.93
	L = 15 m	5.20	6.24	7.28	7.80	9.36	10.92
	L = 20 m	5.68	6.81	7.95	8.52	10.22	11.93
Double Deck 	Spread	4.83	5.80	6.76	–	–	–
	L = 10 m	5.90	7.08	8.25	–	–	–
	L = 15 m	6.43	7.71	9.00	–	–	–
	L = 20 m	6.96	8.35	9.75	–	–	–
4 – lane (or 2–lane + 2–lane) 2 – Column 	Spread	2.49	2.99	3.49	3.77	4.53	5.28
	L = 10 m	3.88	4.66	5.44	5.63	6.75	7.88
	L = 15 m	4.58	5.50	6.41	6.55	7.86	9.17
	L = 20 m	5.27	6.33	7 38	7.48	8.98	10.47
2 – lane 2 – Column 	Spread	1.50	1.80	2.10	2.34	2.81	3.28
	L = 10 m	2.42	2.91	3.39	3.57	4.30	5.00
	L = 15 m	2.89	3.46	4.04	4.27	5.11	5.96
	L = 20 m	3.35	4.02	4.69	4.94	5.93	6.92
2–lane + 2–lane 1 Column 	Spread	4.25	5.10	5.95	6.63	7.96	9.28
	L = 10 m	5.26	6.31	7.36	7.76	9.31	10.86
	L = 15 m	5.76	6.91	8.07	8.50	10.20	11.91
	L = 20 m	6.26	7.52	8.77	9.24	11.10	12.94
4–lane + 1 – lane Special 	Spread	3.75	4.50	5.25	5.63	6.75	7.88
	L = 10 m	4.76	5.71	6.66	7.14	8.57	9.99
	L = 15 m	5.26	6.32	7.37	7.89	9.48	11.06
	L = 20 m	5.77	6.92	8.07	8.66	10.38	12.11
2(3)–lane + 2(3)–lane Double Deck 	Spread	5.64	6.77	7.90	–	–	–
	L = 10 m	6.94	8.33	9.72	–	–	–
	L = 15 m	7.59	9.11	10.63	–	–	–
	L = 20 m	8.25	9.89	11.54	–	–	–

Note : (L) – 2nd Level, (H) – 3rd Level or more

TABLE 9.1.6(2) BASE COST OF SUBSTRUCTURE/FOUNDATION

UNIT: Million Pesos

	Foundation	2nd Level (L)			3rd Level (H)		
		30 m	35 m	40 m	30 m	35 m	40 m
4 – lane + 1 – lane Double, 2 – column 	Spread	4.77	5.72	6.68	7.16	8.58	10.02
	L = 10 m	5.95	7.14	8.34	8.93	10.71	12.51
	L = 15 m	6.55	7.85	9.16	9.83	11.78	13.74
	L = 20 m	7.14	8.57	9.99	10.71	12.86	14.99
2 – lane + 2 – lane + Ramp 2 – column 	Spread	4.25	5.10	5.95	6.38	7.65	8.93
	L = 10 m	5.32	6.38	7.44	7.98	9.57	11.16
	L = 15 m	5.85	7.02	8.19	8.78	10.53	12.24
	L = 20 m	6.38	7.66	8.93	9.57	11.49	13.40
1 – lane Double Deck 	Spread	3.11	3.74	4.36	–	–	–
	L = 10 m	3.82	4.59	5.35	–	–	–
	L = 15 m	4.18	5.01	5.85	–	–	–
	L = 20 m	4.53	5.44	6.35	–	–	–
4 – lane Abutment 	Spread	1.91	2.29	2.67	–	–	–
	L = 10 m	2.50	3.00	3.50	–	–	–
	L = 15 m	2.80	3.36	3.92	–	–	–
	L = 20 m	3.09	3.71	4.33	–	–	–
2 – lane Abutment 	Spread	1.23	1.48	1.73	–	–	–
	L = 10 m	1.59	1.91	2.22	–	–	–
	L = 15 m	1.77	2.12	2.47	–	–	–
	L = 20 m	1.94	2.33	2.72	–	–	–
1 – lane Abutment Double Deck 	Spread	0.41	0.49	0.57	–	–	–
	L = 10 m	0.59	0.70	0.82	–	–	–
	L = 15 m	0.67	0.81	0.94	–	–	–
	L = 20 m	0.76	0.92	1.07	–	–	–
4 – lane Approach 	H = 2.0 M	5.33					
	H = 3.0 M	8.56					
	H = 4.0 M	12.47					
2 – lane Approach 	H = 2.0 M	3.91					
	H = 3.0 M	6.60					
	H = 4.0 M	9.90					
1 – Approach 	H = 2.0 M	3.58					
	H = 3.0 M	6.14					
	H = 4.0 M	9.29					

Note : (L) – 2nd Level, (H) – 3rd Level or more

TABLE 9.1.7 BASE COST OF EXPRESSWAY MISCELLANEOUS

No. of Lanes	Cost Per Km. (Million Pesos in April 1993 Prices)
1-lane	4.20
2-lane	5.90
4-lane	12.30

9.1.4 Construction Cost

Construction costs of each expressway route by section were estimated based on quantities and base costs or unit costs of construction items (details are presented in Appendix 9.1.2).

Construction cost of the First Stage Expressways was estimated at 22,360 million pesos in April 1993 prices, composing of 11,752 million pesos (or 52.6%) of foreign currency component, 6,963 million pesos (or 31.1%) of local currency component, and 3,645 million pesos (or 16.3%) of tax component. Construction cost by expressway route is shown in Table 9.1.8, and by section of each expressway route in Table 9.1.9.

Construction cost by construction phasing is as follows (see Table 9.1.10):

Phase-1 (27.4 km)	11,571 Million Pesos (51.7%)
Phase-2 (31.2 km)	10,789 Million Pesos (48.3%)
Total (58.6 km)	22,360 Million Pesos (100.0%)

TABLE 9.1.8 CONSTRUCTION COST BY EXPRESSWAY ROUTE

Unit: Million Pesos in April 1993 Prices

Expressway Route No.	Length km	Construction Cost			
		Total	Foreign	Local	Tax
Route C-3	15.93	7,075.83	3,709.58	2,212.98	1,153.28
Route R-3	20.20	7,997.59	4,213.46	2,477.00	1,307.13
Route R-4	2.44	1,342.76	708.40	412.46	221.90
Route R-7	12.25	3,231.35	1,694.23	1,016.23	520.89
Route R-9	4.51	1,497.63	785.61	469.49	242.53
Route R-10	3.30	1,214.94	640.25	374.92	199.77
TOTAL	58.63	22,360.10 (100.0%)	11,751.53 (52.6%)	6,963.08 (31.1%)	3,645.50 (16.3%)

TABLE 9.1.9 CONSTRUCTION COST BY ROUTE AND SECTION

Unit: Million Pesos in April 1993 Prices

ROUTE		SECTION	SECTION LENGTH (km)	Construction Cost Total	Foreign	Local	Tax
Route C-3	(1)	From Adriatico Ave. to R-3 I/C	1.245	220.47	115.83	68.37	36.27
	(2)	R-3 I/C	0.330	278.29	145.74	86.90	45.65
	(3)	R-3 I/C to R-4 I/C	1.725	818.29	429.71	254.55	134.04
	(4)	R-4 I/C	0.455	413.88	217.14	128.65	68.09
	(5)	R-4 I/C to R-6 I/C	1.715	882.36	461.86	276.33	144.17
	(6)	R-6 I/C	0.295	133.93	69.88	42.11	21.94
	(7)	R-6 I/C to R-7 I/C	2.340	890.42	467.71	277.62	145.09
	(8)	R-7 I/C	0.410	403.31	211.03	127.16	65.12
	(9)	R-7 I/C to R-9 I/C	2.790	998.48	523.69	312.83	161.96
	(10)	R-9 I/C	0.480	372.48	194.59	117.80	60.09
	(11)	R-9 I/C to R-10 I/C	3.955	1,559.00	817.54	487.78	253.68
	(12)	R-10 I/C	0.190	104.92	54.86	32.88	17.18
		TOTAL	15.930	7,075.83	3,709.58	2,212.98	1,153.28
Route R-3	(0)	C-3 I/C	0.330		(Included in Route C-3)		
	(1)	From C-3 I/C to Buendia Avenue	2.105	917.16	483.52	282.56	151.08
	(2)	Buendia Access Ramp	(1.990)	254.91	135.54	77.03	42.34
	(3)	Buendia Avenue to EDSA	2.265	1,033.45	542.70	320.95	169.80
	(4)	EDSA Access Ramp	(1.540)	294.22	168.02	73.39	52.81
	(5)	EDSA to C-5	3.600	1,230.29	639.19	394.00	197.10
	(6)	C-5 to Bicutan	2.810	801.90	421.28	250.34	130.28
	(7)	Bicutan Access Ramp	(1.270)	129.12	68.78	39.07	21.27
	(8)	Bicutan to Sucat	3.460	1,097.31	576.34	342.89	178.08
	(9)	Sucat Access Ramp	(1.620)	135.12	71.65	41.37	22.10
	(10)	Sucat to Alabang	3.815	1,390.24	731.30	433.26	225.68
	(11)	Alabang Access Ramp	(1.850)	205.17	107.96	63.63	33.58
	(12)	Alabang to SLE	1.815	508.70	267.18	158.51	83.01
		TOTAL	20.200	7,997.59	4,213.46	2,477.00	1,307.13
Route R-4	(0)	C-3 I/C	0.110		(Included in Route C-3)		
	(1)	From C-3 I/C to Pasig River	0.060	1.26	0.66	0.38	0.22
	(2)	Pasig River Bridge (1)	0.160	122.57	65.23	36.79	20.55
	(3)	Pasig River Bridge (1) to Pasig River Bridge (2)	0.300	1.55	0.81	0.47	0.27
	(4)	Pasig River Bridge (2)	0.135	98.72	52.59	29.59	16.54
	(5)	Pasig River to Makati Access I/C	1.405	653.57	343.82	201.87	107.88
	(6)	Makati Access I/C	0.270		(Included in (5) above)		
	(7)	Makati Access Ramp	(1.450)	465.09	245.29	143.36	76.44
		TOTAL	2.440	1,342.76	708.40	412.46	221.90
Route R-7	(1)	From Welcome Rotonda to C-3 I/C	1.090	164.05	86.82	50.33	26.90
	(2)	C-3 I/C	0.360		(Included in Route C-3)		
	(3)	C-3 I/C to EDSA	2.880	1,009.03	530.35	314.66	164.02
	(4)	EDSA to QMC	0.620	226.37	118.35	71.42	36.60
	(5)	QMC Underpass	1.540	615.77	315.02	209.13	91.62
	(6)	QMC to C-5	2.128	436.99	232.05	131.96	72.98
	(7)	C-5 I/C	0.362	168.19	86.12	55.79	26.28
	(8)	C-5 I/C to END	3.270	610.95	325.52	182.94	102.49
		TOTAL	12.250	3,231.35	1,694.23	1,016.23	520.89
Route R-9	(1)	C-3 I/C	0.400		(Included in Route C-3)		
	(2)	From C-3 I/C to END (Including EDSA Ramp)	4.110	1,497.63	785.61	469.49	242.53
		TOTAL	4.510	1,497.63	785.61	469.49	242.53
Route R-10	(1)	From Moriones to C-3 I/C	3.180	1,214.94	640.25	374.92	199.77
	(2)	C-3 I/C	0.120		(Included in Route C-3)		
		TOTAL	3.300	1,214.94	640.25	374.92	199.77
GRAND TOTAL			58.630	22,360.10	11,751.53	6,963.08	3,645.50

TABLE 9.1.10 CONSTRUCTION COST BY CONSTRUCTION PHASE

UNIT: Million Pesos in April 1993 Prices

	CONSTRUCTION PHASE	SECTION LENGTH (km)	CONSTRUCTION COST TOTAL	FOREIGN	LOCAL	TAX
PHASE – 1						
1.	C–3 (Adriatico–R–3 I/C)	1.245	220.47	115.83	68.37	36.27
2.	C–3 (R–3 I/C)	0.330	278.29	145.74	86.90	45.65
3.	C–3 (R–3 I/C – R–4 I/C)	1.725	818.29	429.71	254.55	134.04
4.	C–3 (R–4 I/C)	0.455	413.88	217.14	128.65	68.09
5.	C–3 (R–4 I/C – R–6 I/C)	1.715	882.36	461.86	276.33	144.17
6.	C–3 (R–6 I/C)	0.295	133.93	69.88	42.11	21.94
7.	C–3 (R–6 I/C – R–7 I/C)	2.340	890.42	467.71	277.62	145.09
8.	C–3 (R–7 I/C)	0.410	403.31	211.03	127.16	65.12
9.	C–3 (R–7 I/C – R–9 I/C)	2.790	998.48	523.69	312.83	161.96
10.	C–3 (R–9 I/C)	0.480	372.48	194.59	117.80	60.09
11.	R–3 (C–3 I/C to Buendia Avenue)	2.435	917.16	483.52	282.56	151.08
12.	R–3 (Buendia Access Ramp)	(1.990)	254.91	135.54	77.03	42.34
13.	R–3 (Buendia Avenue – EDSA)	2.265	1,033.45	542.70	320.95	169.80
14.	R–3 (EDSA Access Ramp)	(1.540)	294.22	168.02	73.39	52.81
15.	R–3 (EDSA to Bicutan)	6.410	2,032.19	1,060.47	644.34	327.38
16.	R–3 (Bicutan Access Ramp)	(1.270)	129.12	68.78	39.07	21.27
17.	R–9 (C–3 I/C to END)	4.510	1,497.63	785.61	469.49	242.53
	TOTAL	27.405	11,570.59	6,081.82	3,599.15	1,889.63
PHASE – 2						
1.	R–3 (Bicutan – Sucat)	3.460	1,097.31	576.34	342.89	178.08
2.	R–3 (Sucat Access Ramp)	(1.620)	135.12	71.65	41.37	22.10
3.	R–3 (Sucat – SLE)	5.630	1,898.94	998.48	591.77	308.69
4.	R–3 (Alabang Access Ramp)	(1.850)	205.17	107.96	63.63	33.58
5.	R–7 (Welcome Rotonda to C–3 I/C)	1.090	164.05	86.82	50.33	26.90
6.	R–7 (C–3 I/C to EDSA)	3.240	1,009.03	530.35	314.66	164.02
7.	R–7 (EDSA to QMC Underpass)	2.160	842.14	433.37	280.55	128.22
	SUB–TOTAL	15.580	5,351.76	2,804.97	1,685.20	861.59
8.	R–4 (C–3 I/C to Makati Access I/C)	2.440	877.67	463.11	269.10	145.46
9.	R–4 (Makati Access Ramp)	(1.450)	465.09	245.29	143.36	76.44
10.	R–7 (QMC to END)	5.760	1,216.13	643.69	370.69	201.75
11	C–3 (R–9 I/C to R–10 I/C)	3.955	1,559.00	817.54	487.78	253.68
12.	C–3 (R–10 I/C)	0.190	104.92	54.86	32.88	17.18
13.	R–10 (C–3 I/C to Moriones Avenue)	3.300	1,214.94	640.25	374.92	199.77
	SUB–TOTAL	15.645	5,437.75	2,864.74	1,678.73	894.28
	TOTAL	31.225	10,789.51	5,669.71	3,363.93	1,755.87
	GRAND TOTAL	58.630	22,360.10	11,751.53	6,963.08	3,645.50

9.2 DETAILED ENGINEERING AND CONSTRUCTION SUPERVISION COSTS

Detailed engineering cost and construction supervision cost for ordinary road projects usually correspond to 3 to 5% and 5 to 9% of construction cost, respectively. For this study, detailed engineering cost and construction supervision cost were estimated at 2.5% and 4.0% of construction cost, respectively, considering that standardized structures can be adopted, construction sites are located within limited areas, construction cost per km. is quite high, etc.

Estimated costs for detailed engineering and construction supervision by construction phase are summarized in Table 9.2.1.

TABLE 9.2.1 DETAILED ENGINEERING AND CONSTRUCTION SUPERVISION COSTS

Unit: Million Pesos in April 1993 Prices

Construction Phase	Detailed Engineering Cost	Construction Supervision Cost
Phase-1	290.0	470.0
Phase-2	280.0	430.0
Total	570.0	900.0

9.3 RIGHT-OF-WAY ACQUISITION AND COMPENSATION COST

Right-of-way acquisition costs and compensation cost were estimated based on the following assumptions:

- Some expressways pass over the proposed or partially completed at-grade roads where road right-of-way is not yet acquired at present. Right-of way acquisition of such at-grade road sections was assumed to be done by the at-grade road project, but not by an expressway project.
- Public lands such as PNR right-of-way were assumed to be utilized by this project without any cost. However, relocation of squatters within such public lands is to be done by this project.
- Right-of-way acquisition unit cost per square meter was established based on the 1990 zonal value provided by city/municipal governments.
- Compensation costs were roughly estimated by classifying facilities into residential houses, squatter shanties, commercial buildings, factories, warehouses, permanent buildings of 3 to 4 stories and gas stations.

Estimated quantities and costs of right-of-way acquisition and compensation cost are attached in Appendix 9.3.1.

Summary of right-of-way acquisition and compensation costs is shown in Table 9.3.1, whereas Table 9.3.2 shows costs by section of each expressway route.

TABLE 9.3.1 SUMMARY OF RIGHT-OF-WAY ACQUISITION AND COMPENSATION COSTS

Unit: Million Pesos in April 1993 Prices

Construction Phase	ROW Acquisition and Compensation Cost
Phase-1	1,040.0
Phase-2	1,173.0
Total	2,213.0

TABLE 9.3.2 ROW ACQUISITION AND COMPENSATION COSTS BY SECTION

Unit: Million Pesos in April 1993 Prices

Section/Route	Phase-1	Section/Route	Phase-2
1. C-3 (Adriatico-R-3 I/C)	0	1. R-3 (Bicutan-Sucat)	0
2. C-3 (R-3 I/C)	76.0	2. R-3 (Sucat Access Ramp)	176.0
3. C-3 (R-3 I/C-R-4 R/C)	72.0	3. R-3 (Sucat-SLE)	156.0
4. C-3 (R-4 I/C)	112.0	4. R-3 (Alabang Access Ramp)	319.0
5. C-3 (R-4 I/C-R-6 I/C)	138.0		
6. C-3 (R-6 I/C)	138.0	5. R-7 (Welcome Rotonda to C-3 I/C)	0
7. C-3 (R-6 I/C-R-7 I/C)	0		
8. C-3 (R-7 I/C)	235.0	6. R-7 (C-3 I/C to EDSA)	0
9. C-3 (R-7 I/C-R-9 I/C)	0	7. R-7 (EDSA to QMC Underpass)	19.0
10. C-3 (R-9 I/C)	94.0		
11. R-3 (C-3 I/C to Buendia Avenue)	9.0	Sub-Total	670
12. R-3 (Buendia Access Ramp)	0	8. R-4 (C-3 I/C to Makati Access I/C)	442.0
13. R-3 (Buendia Avenue - EDSA)	3.0	9. R-4 (Makati Access Ramp)	0
14. R-3 (EDSA Access Ramp)	0	10. R-7 (QMC to END)	0
15. R-3 (EDSA - Bicutan)	32.0	11. C-3 (R-9 I/C-R-10 I/C)	28.0
16. R-3 (Bicutan Access Ramp)	131.0	12. C-3 (R-10 I/C)	33.0
17. R-9 (C-3 I/C to END)	0	13. R-10 (C-3 I/C-Moriones Avenue)	0
		Sub-Total	503.0
Total	1,040.0	Total	1,173.0

9.4 SUMMARY OF INVESTMENT COST

Investment cost by construction phase is summarized as shown in Table 9.4.1. Total investment cost was estimated at 26,043 million pesos in April 1993 prices, consisting of 13,371 million pesos of Phase-1 cost and 12,672 million pesos of Phase-2 cost.

TABLE 9.4.1 SUMMARY OF INVESTMENT COST

Unit: Million Pesos in April 1993 Prices

	Phase-1	Phase-2	Total
Detailed Engineering Cost	290	280	570
ROW Acquisition/Compensation Cost	1,040	1,173	2,213
Construction Cost	11,571	10,789	22,360
Construction Supervision Cost	470	430	900
Total	13,371	12,672	26,043

9.5 OPERATING AND MAINTENANCE COSTS

Based on the discussion in Chapter 8, operating and maintenance costs were estimated.

9.5.1 Operating Cost

Operating cost of Central Toll Management Office, Field Toll Operation Office, Toll Plaza, and Traffic Control and Management was estimated as presented in Appendix 9.5.1 and summarized as follows:

Annual Operating Cost Per Km of Expressway

• Central Toll Management	₱	47,600.00
• Field Toll Operation Office	₱	265,920.00
• Toll Plaza	₱	731,600.00
• Traffic Control	₱	85,400.00
• Research/System Development	₱	52,800.00
• Expressway Patrol Group	₱	177,120.00
Total		₱1,360,440.00
Say		₱1,360,000.00

Annual operating cost per km. of expressway was estimated at 1.36 million pesos in April 1993 prices.

9.5.2 Maintenance Cost

Maintenance cost was estimated based on the discussion in Chapter 8, and data on South/North Luzon Expressways and Bangkok Expressway as presented in Appendix 9.5.2 and summarized as follows:

Annual Maintenance Cost Per Km. of Expressway

• Maintenance Division	₱	150,000.00
• Expressway Cleaning	₱	66,000.00
• Routine Maintenance	₱	307,000.00
• Electricity	₱	37,000.00
• Structure Maintenance/Repair	₱	460,000.00
Total		₱1,020,000.00

Annual maintenance cost per km of expressway was estimated at 1.02 million pesos in April 1993 prices, which was applied for the first 10 years. As maintenance cost is expected to increase after 10 years due to major repairs of structure and pavement, maintenance cost was estimated to be doubled after 10 years.

CHAPTER 10

PROJECT EVALUATION

CHAPTER 10

PROJECT EVALUATION

10.1 ENGINEERING EVALUATION

10.1.1 Type of Structure Required and Capability of Local Contractors

The project requires various kinds of structures with different heights. Table 10.1.1 shows length of expressway sections which require the second, third and 4th level structures. Filipino contractors experienced third level structures with successful results. It is expected that they can construct 4th level structures without assistance of foreign contractors.

TABLE 10.1.1 EXPRESSWAY SECTIONS BY STRUCTURAL HEIGHT

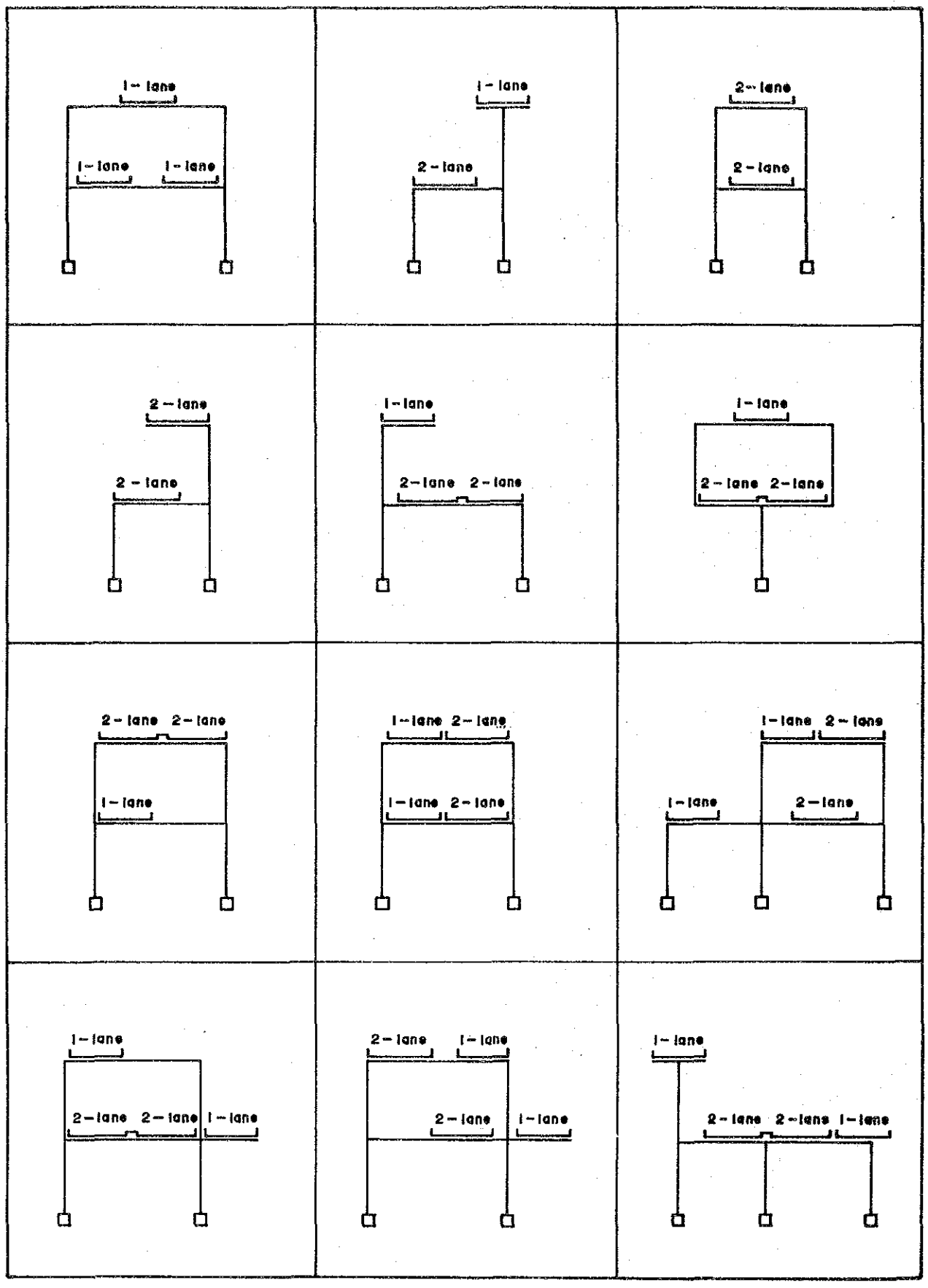
UNIT: Km

STRUCTURAL HEIGHT	EXPRESSWAY ROUTE						
	C-3	R-3	R-4	R-7	R-9	R-10	TOTAL
2nd Level	10.9	15.1	1.0	6.4	2.2	3.1	38.7
2nd/3rd Level (Double Deck)	2.5	-	0.6	-	1.5	-	4.6
3rd Level	2.3	3.1	0.8	0.8	0.6	-	7.6
4th Level	-	0.5	-	-	-	-	0.5
Others (At-grade, Depressed, etc.)	0.2	1.5	-	5.1	0.2	0.2	7.2
T O T A L	15.9	20.2	2.4	12.3	4.5	3.3	58.6

Two types of superstructures were proposed. One is the AASHTO-type PC girder which is commonly used in the Philippines and is proposed to be used for most of thru lanes of expressways. The other is the PC Box girder which has been constructed by Filipino contractors and is proposed to be used for Pasig River bridges and interchange ramps with small radius.

Various types of substructure are required. For thru lanes of expressways, substructures are not so complex, but interchanges require very complex structures as shown in Figure 10.1.1. Under this study, all substructures were assumed to be reinforced concrete structure, however, steel structure may be more advantageous for very complex substructure in order not to disturb existing traffic and to shorten construction period.

FIGURE 10.1.1 STRUCTURAL TYPES REQUIRED AT INTERCHANGES



Two types of pile foundation were proposed. One is PC or RC piles which were proposed to be used only in the areas where noise and vibration would not create any problem. The other is bored piles of which active utilization was recommended from the viewpoint of environmental aspect during construction. Both types of piles have been commonly used in the Philippines.

As mentioned above, all types of structures have been constructed in the Philippines, therefore, engineering problems are not expected for implementation of MMUES.

10.1.2 Impacts on the Philippine Construction Industry

Some foreign contractors may be involved in construction of MMUES, however, majority of portions would be constructed by Filipino contractors. About 3 to 4 billion pesos will be invested annually for over 15 years, therefore, many Philippine contractors will gain technical, managerial and financial capabilities, through implementation of this project.

Engineering firms will also enjoy job opportunities and their capabilities will be greatly strengthened.

10.2 ECONOMIC EVALUATION

10.2.1 Methodology

The procedure taken in the economic evaluation of the Project is outlined in Figure 10.2.1. Although the construction of the Project is expected to generate varied economic impacts extensively over the metropolis, quantitative assessment is limited to savings in vehicle operating costs and passenger time costs due to the construction of the expressway.

Three types of economic indicators are used in the economic analysis for the National Economic Development Authority (NEDA) and for the International Financing Organization, as follows:

(1) Economic Internal Rate of Return (EIRR): The EIRR shows the discount rate which gives the break even point between the present value of benefit and that of cost as given by the following formula:

$$B(R)-C(R)=0$$

$$B(R)=\sum_{i=1}^{n}\frac{bi}{(1+R)^i}$$

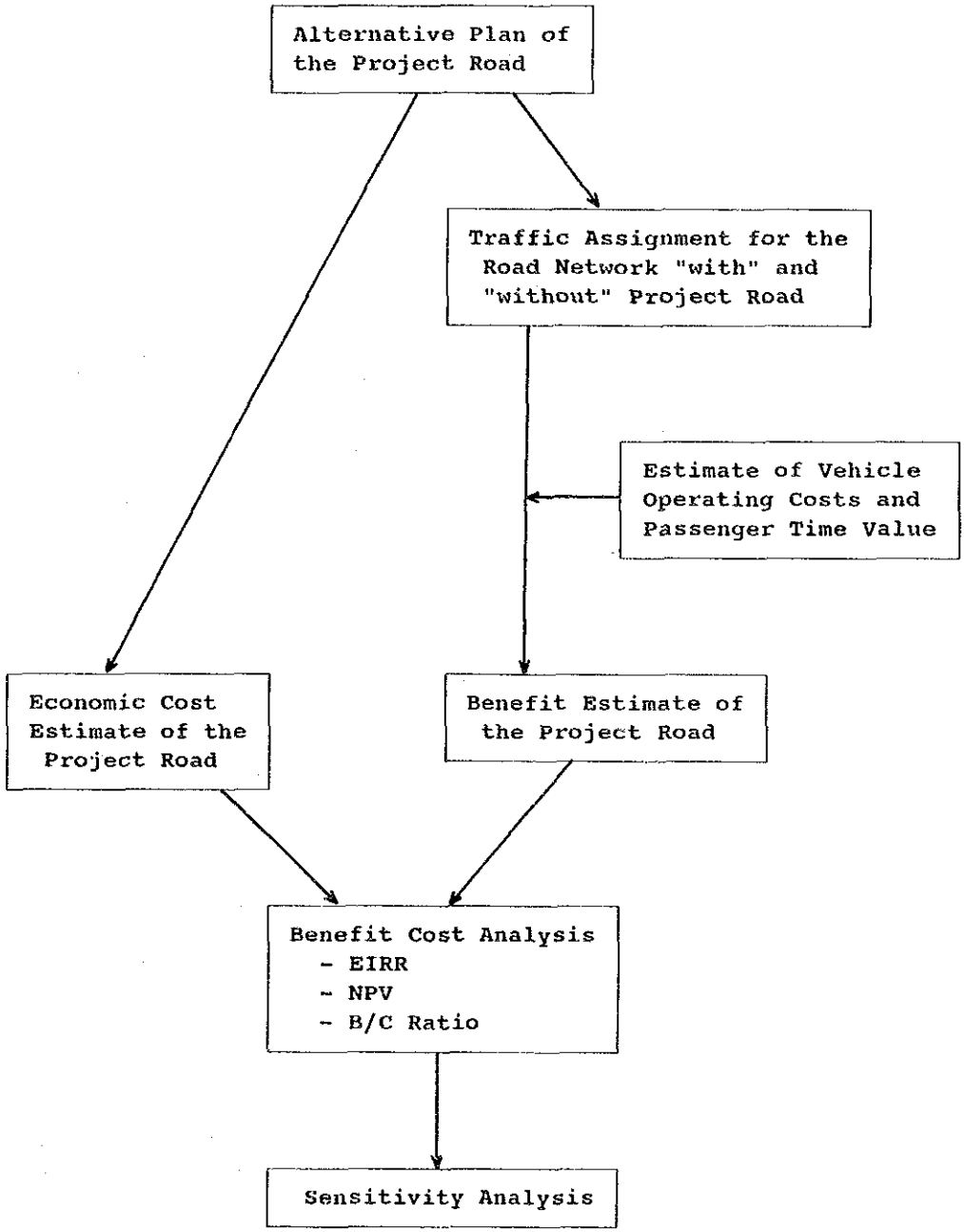
$$C(R)=\sum_{i=1}^{n}\frac{ci}{(1+R)^i}$$

R : Internal Rate of Return
Ci : Cost in the year (1)
bi : Benefit in the year (i)
n : Project life in years

In order for the project to be economically feasible, the EIRR should be more than the opportunity cost of capital in the Philippines which is generally pegged by NEDA at 15%.

(2) Net Present Value (NPV): The NPV will indicate the difference between the discounted costs and benefits using the rate of opportunity cost of capital. A positive NPV means the project is economically feasible.

FIGURE 10.2.1 PROCEDURE FOR ECONOMIC EVALUATION OF THE PROJECT ROAD



(3) Benefit-Cost (B/C) Ratio: The B/C ration is obtained by dividing the present value of benefit with that of the cost. The formula is given as follows:

$$\text{Benefit-Cost Ratio} = \frac{B}{C}$$

$$B = \sum_{i=1}^{n} \frac{bi}{(1+r)^i}$$

$$C = \sum_{i=1}^{n} \frac{ci}{(1+r)^i}$$

where r : Discount rate
Ci : Cost in the year (1)
bi : Benefit in the year (i)
n : Project life in years

Among the three economic indicators, the EIRR is mainly used to establish the investment timing and the best combination of the different alternatives in this study.

10.2.2 Estimate of the Economic Project Cost

1) Procedure

The Project Cost if composed of those for land acquisition, constructing road and structure, and maintenance and operation, which are estimated and explained in detail in Chapter 8. However, for the economic evaluation, these costs are to be converted into economic costs since the former defined as financial costs include taxes and often do not reflect real costs to the economy.

In the Philippines, the experience of a large number of infrastructure project studies as well as the availability of comprehensive NEDA guidelines on economic evaluation of infrastructure projects facilitate the conduct of the above work. Adjustments are made in the following areas:

(a) Exclusion of taxes and duties: Taxes and duties which are included in the financial costs are excluded.

(b) Opportunity cost of labours: Taking into account the abundance in non-skilled labour, its economic costs is considered 70% of its financial cost.

(c) Shadow price of foreign exchange: Due to the scarcity of foreign exchange, economic cost of the foreign component is assumed to be 125% of that expressed in terms of financial price.

The results of the conversion of the financial costs to economic costs are shown in Table 10.2.1.

2) Project Cost Stream

The estimated project costs, then, were distributed according to the implementation schedule of the Project which is shown in Table 10.2.2.

TABLE 10.2.1 ESTIMATE OF ECONOMIC COST OF THE PROJECT

(₱ Million)

	Financial Cost					Economic Cost
	Local Component			Foreign Component	Total	
	Tax	Non-Skilled Labor	Others			
1. Construction Cost (PHASE 1:1995-2002)						
1) Detailed Design	29.00	–	87.00	174.00	290.00	295.80
2) ROW Acquisition	104.00	–	936.00	0.00	1040.00	936.00
3) Civil Works	1890.00	129.56	3469.44	6082.00	11571.00	10845.57
4) Construction Supervision	47.00	–	141.00	282.00	470.00	479.40
Total	2070.00	129.56	4633.44	6538.00	13371.00	12556.77
2. Construction Cost (PHASE 2:1997-2005)						
1) Detailed Design	28.00	–	84.00	168.00	280.00	285.60
2) ROW Acquisition	117.00	–	1056.00	0.00	1173.00	1056.00
3) Civil Works	1756.00	121.07	3241.93	5670.00	10789.00	10118.57
4) Construction Supervision	43.00	–	129.00	258.00	430.00	438.60
Total	1944.00	121.07	4510.93	6096.00	12672.00	11898.77
3. Maintenance						
1) 2002-2005	13.44	0.45	55.55	42.56	112.00	106.89
2) 2006-2011	43.06	1.44	177.96	136.34	358.80	342.44
3) 2012-2013	21.07	0.70	87.10	66.73	175.60	167.59
5) 2016-2026	24.84	0.83	102.67	78.66	207.00	197.56
4) 2014-2015	157.87	5.26	652.54	499.93	1315.60	1255.61
Total	260.28	8.68	1075.82	824.22	2169.00	2070.09
4. Operation Cost						
1) 2002-2005	17.90	7.13	82.39	41.78	149.20	136.80
2) 2005-2015	201.10	80.04	925.44	469.22	1675.80	1536.53
Total	219.00	87.17	1007.83	511.00	1825.00	1673.33

TABLE 10.2.2 STREAM OF ECONOMIC PROJECT COST

(P Million)

Item Year	Construction Cost	Maintenance Cost	Operational Cost	Total
1995	147.90	0.00	0.00	147.90
1996	194.70	0.00	0.00	194.70
1997	1413.30	0.00	0.00	1413.30
1998	3197.72	0.00	0.00	3197.72
1999	3199.31	0.00	0.00	3199.31
2000	3698.87	0.00	0.00	3698.87
2001	3561.85	0.00	0.00	3561.85
2002	2413.20	26.72	34.20	2474.13
2003	3325.70	26.72	34.20	3386.63
2004	1708.12	26.72	34.20	1769.04
2005	1594.87	26.72	34.20	1655.79
2006	0.00	57.07	73.17	130.24
2007	0.00	57.07	73.17	130.24
2008	0.00	57.07	73.17	130.24
2009	0.00	57.07	73.17	130.24
2010	0.00	57.07	73.17	130.24
2011	0.00	57.07	73.17	130.24
2012	0.00	83.80	73.17	156.96
2013	0.00	83.80	73.17	156.96
2014	0.00	98.78	73.17	171.95
2015	0.00	98.78	73.17	171.95
2016	0.00	114.15	73.17	187.31
2017	0.00	114.15	73.17	187.31
2018	0.00	114.15	73.17	187.31
2019	0.00	114.15	73.17	187.31
2020	0.00	114.15	73.17	187.31
2021	0.00	114.15	73.17	187.31
2022	0.00	114.15	73.17	187.31
2023	0.00	114.15	73.17	187.31
2024	0.00	114.15	73.17	187.31
2025	0.00	114.15	73.17	187.31
2026	0.00	114.15	73.17	187.31
Total	24455.54	2070.11	1673.37	28198.91

10.2.3 Estimate of Vehicle Operating Costs

1) General

Vehicle operating costs (VOC) are the major input to the estimate of the Project benefit. DPWH provides a guideline and quantification method of estimating the VOC of different types of vehicles under the prevailing local conditions. The representative vehicles which are classified and analyzed economic evaluation are the following four types:

1) Passenger Car
2) Jeepney
3) Bus
4) Trucks

2) Vehicle Operating Costs

Vehicle operating costs consists of two components which are;

a. Running Costs
b. Fixed Costs

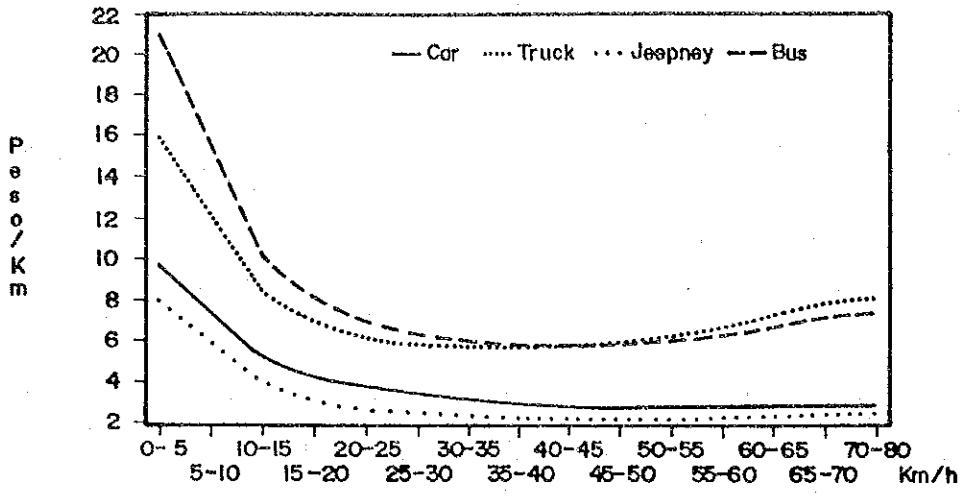
To get the running cost per vehicle type simply add the fuel cost, lubricant cost, tire cost, maintenance and repair costs and depreciation cost of each vehicle type. Basic fixed cost is total fixed cost less insurance cost multiplied by the reduction factor for commercial use and fleet reduction factor. To get the total fixed cost, just add the time related depreciation cost, opportunity cost of capital, crew cost, overhead, taxes and licenses cost and insurance cost. Results of the total vehicle operating cost by vehicle type are shown in Table 10.2.3 and Figure 10.2.2.

TABLE 10.2.3 VEHICLE OPERATING COSTS

(Peso/Km)

km/h	Car	Truck	Jeepney	Bus
0 - 5	9.665	15.883	7.881	20.836
5 - 10	7.235	12.158	5.831	15.761
10 - 15	5.086	8.318	3.892	10.122
15 - 20	4.204	6.871	3.125	8.011
20 - 25	3.715	6.158	2.699	6.923
25 - 30	3.423	5.841	2.468	6.321
30 - 35	3.219	5.697	2.333	5.962
35 - 40	3.089	5.684	2.256	5.836
40 - 45	3.002	5.796	2.222	5.838
45 - 50	2.942	6.014	2.221	5.939
50 - 55	2.905	6.323	2.249	6.122
55 - 60	2.889	6.739	2.305	6.378
60 - 65	2.891	7.219	2.373	6.704
65 - 70	2.903	7.818	2.468	7.157
70 - 80	2.883	8.121	2.499	7.389

FIGURE 10.2.2 VEHICLES OPERATING COSTS



3) Time Cost

Time cost is calculated using the family income approach method with the following assumptions:

a. Travelers will be willing to pay in order to save travel time.

b. The traveler's value of travel time is a function of his personal income.

c. The traveler's value of travel time is a function of his travel purpose.

Time cost of each type of vehicle is calculated by the following formula:

$$Cj = Nj * Ij * \Sigma Ti * Pi$$

where :

Cj : Time Cost of vehicle "j"
Nj : Average occupancy of vehicle "j"
Ij : Hourly income of passenger of vehicle "j"
Ti : Composition Ratio of Trip Purpose "i"
Pi : Time value factor of Trip Purpose "i"

Then each item of the formula is determined as follows:

A. Average Occupancy (Ni)
   a. Private Car : 1.6 Passengers/pcu
   b. Public vehicle : 16.6 Passengers/pcu

B. Hourly Income (Ij)

The hourly income is calculated by the annual income of families and annual working hours.

C. Time Value of Vehicles

The time value factor by each trip purpose is determined based on the aforementioned assumption and tabulated with the composition ratio of each trip purpose to the total trip as shown in Table 10.2.4.

TABLE 10.2.4 (1) TIME VALUE FACTOR AND COMPOSITION RATIO BY TRIP PURPOSE

Trip Purpose (i)	Time Value Factor (Pi)	Composition Ratio (Ti) (Ti)
Business	100%	4%
To work	50%	18%
To home	50%	48%
To school	No value	16%
Private	No value	14%
Total		100%

Therefore: Σ Pi*Ti = 37%

TABLE 10.2.4 (2) TIME VALUE OF VEHICLES

	2000	2010	2020
a. Private Car:	42.00	60.00	74.00
b. Public Vehicle:	85.00	120.00	148.00

(pesos/pcu/h)

10.2.4 Estimate of Benefits

The benefits of the Project comprising the savings in VOC and travel time are estimated by synchronizing the traffic assignment and calculation of the traffic cost of each road link. This is mainly due to the impact of the Project which is expected to extend widely over the network. Traffic cost of each link is estimated based on the link traffic volume, link travel speed, and VOC and time cost on a link. Thus, the benefit of the Project is the difference between the total traffic cost of the entire road network "without the Project" and that of "with the Project".

The result is shown in Table 10.2.5. The estimated benefits amount to ₱7.6 million, ₱12.7 million, and ₱37.2 million for years 2002, 2006, and 2010, respectively or 3.4%, 4.5%, and 11.9% of the total traffic costs of the entire road system of Metro Manila in respective years. Savings in time cost shares approximately 2/3 of the benefit, while the rest is that of vehicle operating cost. The benefit increases sharply in the future as traffic congestions on at-grade roads increase.

10.2.5 Benefit-Cost Analysis

Comparison of the benefit and cost over the economic life of the Project which is assumed to be 20 years after the completion of the Project (refer to Table 10.2.6), gives the following results:

- Economic Internal Rate of Return : 24.1%
- B/C Ratio of 15% Discount Rate : 2.87
- Net Present Value at 15% Discount Rate : ₱22.4 billion

In order to further assess the economic stability of the Project, a sensitivity test was undertaken by changing the value of cost and benefit. As shown in Table 10.2.7, EIRR of the Project registers still high (18.5%) even if the benefit reduces by 30% and the cost increases by 30%.

TABLE 10.2.7 EIRR SENSITIVITY TEST OF THE PROJECT

EIRR (%)

		BENEFIT				
		−30%	−20%	−10%	Base Case	+10%
COST	+30%	18.5	19.6	20.7	21.6	22.5
	+20%	19.2	20.3	21.4	22.4	23.3
	+10%	19.9	21.1	22.2	23.2	24.1
	Base Case	20.8	22.0	23.1	24.1	25.1
	−10%	21.7	23.0	24.1	25.2	26.2

TABLE 10.2.5 ESTIMATED BENEFIT OF THE PROJECT

P million/day

	2002			2006			2010		
	At-Grade	Express-way	Total	At-Grade	Express-way	Total	At-Grade	Express-way	Total
1. W/O Project									
1) VOC	123.0	–	123.0	150.6	–	150.6	170.0	–	170.0
2) Time Cost	100.3	–	100.3	130.9	–	130.9	143.3	–	143.3
Total	223.3	–	223.3	281.5	–	281.5	313.3	–	313.3
2. W/ Project									
1) VOC	117.7	2.7	120.4	134.7	11.2	145.9	136.0	20.0	156.0
2) Time Cost	94.7	0.6	95.3	118.2	4.7	122.9	113.5	6.6	120.1
Total	212.4	3.3	215.7	252.9	15.9	268.8	249.5	26.6	276.1
3. Benefit									
1) VOC	5.3	−2.7	2.6	15.9	−11.2	4.7	34.0	−20.0	14.0
2) Time Cost	5.6	−0.6	5.0	12.7	−4.7	8.0	29.8	−6.6	23.2
Total	10.9	−3.3	7.6	28.6	−15.9	12.7	63.8	−26.6	37.2
Reduction of Traffic Cost (Total) : 3/1x100	4.9%	–	3.4%	9.8%	–	4.5%	20.4%	–	11.9%

TABLE 10.2.6 COMPARISON OF BENEFIT AND COST OVER THE PROJECT LIFE

P Million

Year	Discounted		Undiscounted	
	Cost	Benefit	Cost	Benefit
1995	147.9	0.0	147.9	0.0
1996	169.3	0.0	194.7	0.0
1997	1122.8	0.0	1484.9	0.0
1998	2220.3	0.0	3376.7	0.0
1999	1931.6	0.0	3378.3	0.0
2000	1905.7	0.0	3833.1	0.0
2001	1528.3	0.0	3535.0	0.0
2002	863.4	686.1	2296.6	1825.0
2003	1019.9	706.9	3120.0	2162.5
2004	465.2	710.7	1636.7	2500.0
2005	376.6	701.4	1523.4	2837.5
2006	28.6	682.4	133.1	3175.0
2007	24.9	1062.6	133.1	5685.2
2008	21.6	1374.7	133.1	8458.2
2009	18.8	1627.5	133.1	11515.7
2010	16.4	1139.8	133.1	9275.0
2011	14.2	1312.3	133.1	12280.4
2012	14.5	1448.3	155.9	15586.0
2013	12.6	1552.8	155.9	19216.3
2014	11.9	1630.0	168.7	23197.8
2015	10.3	1683.8	168.7	27558.7
2016	9.7	1717.7	181.9	32329.8
2017	8.4	1734.5	181.9	37543.7
2018	7.3	1737.0	181.9	43235.7
2019	6.4	1727.3	181.9	49443.9
2020	5.5	1707.5	181.9	56209.0
2021	4.8	1679.4	181.9	63574.9
2022	4.2	1644.4	181.9	71588.5
2023	3.6	1603.9	181.9	80300.7
2024	3.2	1559.1	181.9	89765.7
2025	2.7	1510.9	181.9	100042.0
2026	2.4	1460.3	181.9	111192.3
Total	11983.0	34401.3	27975.0	880500.5

B/C Ratio	2.87
NPV	22419
EIRR	24.1 %

10.3 FINANCIAL ANALYSIS

10.3.1 Objective

The purpose of the financial analysis is to appraise the financial feasibility of the projects. The analysis focuses on the viability of the projects itself and the financial soundness of the expressway management body during the project life.

1) Viability of the Project

The viability of the project was analyzed by calculating the FIRR (Financial Internal Rate of Return). The FIRR is the discount rate that makes the expenses and the revenues during the project life equal. It is calculated according to the following formula:

$$\sum_{i=1}^{n} \frac{Bi-Ci}{(1+r)^{i-1}} = 0$$

where n : project life
Bi : revenues in the i-th year
Ci : cost in the i-th year
r : interest rate (FIRR)

The costs and benefits taken into account for the calculation of the FIRR are as follows:

Cost	Revenue
• Total Investment cost including Detailed Engineering and Design and initial capital	• Expressway operating revenue toll income
• Operating cash expenses	• Residual Value of the fixed assets at the end of the project life
• Maintenance cash expenses	

The project is regarded as financially feasible if the calculated FIRR exceeds the weighted average interest rate of the total funds for the project investments.

2) Financial Soundness of the Expressway Management Body

The financial soundness of the expressway management body is appraised on its projected financial statements. Profit and loss, financial cash flow, and financial program were analyzed on the basis of various assumptions made for implementing body, source of fund, financing conditions and so on.

10.3.2 Financial Viability of the Project

In order to assess the range of viability of the project from the financial viewpoint, the FIRR was calculated as summarized in Table 10.3.1. The cost and revenue were compared over the assumed project life of fifty years wherein the interest on the capital investment during the construction period is included.

The estimated FIRR for the base case (₱20 toll) is only 3.9% which will decrease sharply as expected revenues decrease or costs increase. If the revenue increase by 20% and cost decreases by 10%, the FIRR increase to 5.9%. This implies private sector is hardly possible.

TABLE 10.3.1 SENSITIVITY OF FINANCIAL VIABILITY OF THE PROJECT

FIRR (%)

Cost \ Revenue	−20%	−10%	Base Case	+10%	+20%
+30%	0.8	1.5	2.2	2.9	3.5
+20%	1.2	2.0	2.7	3.4	4.0
+10%	1.8	2.6	3.3	3.9	4.5
Base Case	2.3	3.1	3.9	4.6	5.2
−10%	3.0	3.8	4.6	5.2	5.9

10.3.3 Financial Soundness

On the basis of the analysis of the overall financial viability of the project, it is assumed that the project would be undertaken with the public sector's initiative. A series of cash flow analysis was made to determine the financial soundness of the project wherein major assumptions on financial conditions made are as follows:

(1) Equity	:	27%, 35% of the total investment
(2) Interest Rate of Long-Term Loan	:	3%, 4.5% per year
(3) Repayment Condition	:	25 years including 5 years grace period 30 years including 5 years grace period
(4) Short-Term loan	:	14.6% per year
(5) Income Tax	:	3% of the net income

The results of the analysis are summarized in Table 10.3.1. Under the base case (equity of 27%, average interest rate of long-term loan with 3% per year and 25 years repayment period including 5 years grace period, interest rate of short-term loan with 14.6% per year and inclusion of income tax), the first year when single year net profit would be generated is 2018 or 12 years after the full operation and the first year when the accumulated net profit would be generated is 2026 or 20 years after the full operation. If the average interest rate of long-term loan increases to 4.5% per year, the project would hardly become viable.

On the other hand, when financial conditions improve such that either longer repayment period or equity increase is possible, the financial features of the project will become more attractive.

TABLE 10.3.2 RESULTS OF FINANCIAL ANALYSIS OF THE PROJECT

Item	Base Case	Case 2	Case 3	Case 4
A. Revenue	As Estimated	Same as Base Case	Same as Base Case	Same as Base Case
B. Project Cost	As Estimated	Same as Base Case	Same as Base Case	Same as Base Case
C. Financial Condition				
1) Equity; % to Total Invest. Cost	27%	27%	27%	35%
2) Average Interest Rate of Long-term Loan	3%	4.5%	3%	3%
3) Repayment Condition	25 yrs. including 5 yrs. grace	25 5	30 5	30 5
4) Short-Term Loan; Int. Rate	14.6%	14.6%	14.6%	14.6%
5) Government Subsidy	None	None	None	None
D. Financial Performance Index of the Project				
1) First Year of Generating Net Profit	2018	2025	2013	2010
2) First Year of Generating Accumulated Net Profit	2026	–	2018	2012

FIGURE 10.3.3 FINANCIAL FEATURES OF BASE CASE

BASE CASE Equity:Loan=2.7:7.3(3%)

PROFIT and LOSS (Unit:Mil.Pesos)

ITEM/YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Operation Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	264.7	409.4	563.5	608.2	684.1
Maintenance Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28	28	28	28	59.8
Operation Cost	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.3	37.7	37.7	37.7	79.8
Depreciation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	204.6	204.6	204.6	204.6	398.5
OPERATION PROFIT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.2	139.1	293.2	337.9	146.0
Other Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Subsidy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest Expense	0.0	0.0	0.0	0.0	0.0	3.5	9.5	46.3	115.6	198.1	308.1	455.0
Short Term	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.8	0.0	7.8	31.8	96.0
Long Term	0.0	0.0	0.0	0.0	0.0	3.5	7.8	41.0	115.6	190.3	276.4	359.0
Tax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.8	0.8
NET PROFIT	0.0	0.0	0.0	0.0	0.0	-3.5	-9.5	-51.9	23.5	94.4	27.0	-309.7
ACCUMULATED	0.0	0.0	0.0	0.0	0.0	-3.5	-12.9	-64.9	-41.3	53.1	80.0	-229.7

FINANCIAL CASH FLOW

ITEM/YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CASH IN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	199.4	343.7	497.8	542.5	544.5
Operating Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.2	139.1	293.2	337.9	146.0
Other Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	204.6	204.6	204.6	204.6	398.5
CASH OUT	145.0	197.0	1516.0	3406.3	3411.8	3937.0	3790.4	2577.9	3541.8	1822.9	1697.1	0.0
INVESTMENT	145.0	197.0	1516.0	3406.3	3411.8	3937.0	3790.4	2577.9	3541.8	1822.9	1697.1	0.0
Initial Investment	145.0	197.0	1516.0	3406.3	3411.8	3937.0	3790.4	2577.9	3541.8	1822.9	1697.1	0.0
Re-Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Additional Investment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual Value												
CASH FLOW	-145.0	-197.0	-1516.0	-3406.3	-3411.8	-3937.0	-3790.4	-2378.5	-3198.1	-1325.1	-1154.6	544.5

FINANCIAL PROGRAM

ITEM/YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
SOURCE	-145.0	-197.0	-1516.0	-3406.3	-3411.8	-3937.0	-3790.4	-2378.5	-3198.1	-1325.1	-1154.6	544.5
Long Term Loan(1)	105.9	143.8	1106.7	2486.6	2490.6	2874.0	2767.0	1881.9	2585.5	1330.7	1238.9	0.0
Long Term Loan(2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operation Profit	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.2	139.1	293.2	337.9	146.0
Depreciation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	204.6	204.6	204.6	204.6	398.5
Other Revenue	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Subsidy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EQUITY	39.2	53.2	409.3	919.7	921.2	1063.0	1023.4	696.0	956.3	492.2	458.2	0.0
USE	145.0	197.0	1516.0	3406.3	3411.8	3948.5	3829.8	2763.6	3938.9	2538.3	2896.9	1988.7
Investment	145.0	197.0	1516.0	3406.3	3411.8	3937.0	3790.4	2577.9	3541.8	1822.9	1697.1	0.0
Principal Repayment	0.0	0.0	0.0	0.0	0.0	5.3	23.9	107.3	192.1	370.1	678.0	1256.1
Long Term	0.0	0.0	0.0	0.0	0.0	5.3	12.5	67.8	192.1	316.7	460.4	598.7
Short Term	0.0	0.0	0.0	0.0	0.0	0.0	11.5	39.4	0.0	53.4	217.6	657.3
Interest Expense	0.0	0.0	0.0	0.0	0.0	6.2	15.5	78.5	205.0	345.3	521.9	732.6
Long Term	0.0	0.0	0.0	0.0	0.0	6.2	13.8	72.7	205.0	337.5	490.1	636.6
Short Term	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.8	0.0	7.8	31.8	96.0
NET CASH FLOW	0.0	0.0	0.0	0.0	0.0	-11.5	-39.4	13.7	-53.4	-217.6	-657.3	-1444.2
ACCUMULATED RESERVE	0.0	0.0	0.0	0.0	0.0	-11.5	-50.9	-37.2	-90.7	-308.2	-965.6	-2409.8
SHORT TERM LOAN	0.0	0.0	0.0	0.0	0.0	11.5	39.4	0.0	53.4	217.6	657.3	1444.2

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
868.7	1053.2	1237.8	1422.4	1606.9	1791.5	1976.1	2160.6	2345.2	2529.8	2714.3	2898.9	3083.5	3268.0	3452.6
59.8	59.8	59.8	59.8	59.8	87.9	87.8	103.5	103.5	119.6	119.6	119.6	119.6	119.6	119.6
79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8	79.8
398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5
330.6	515.1	699.7	884.3	1068.8	1225.3	1410.0	1578.8	1763.4	1931.9	2116.4	2301.0	2485.6	2670.1	2854.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
624.3	828.6	1021.4	1221.5	1385.2	1541.0	1690.5	1830.1	1962.3	2084.0	2195.7	2293.9	2376.4	2441.0	2484.3
210.9	343.4	505.8	682.5	864.2	1040.8	1214.9	1381.1	1540.1	1688.3	1826.8	1951.6	2060.7	2152.0	2222.0
413.4	485.2	515.7	539.0	521.0	500.3	475.6	448.9	422.3	395.6	369.0	342.3	315.6	289.0	262.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.3	6.8
-293.6	-313.5	-321.7	-337.2	-316.4	-315.7	-280.5	-251.2	-198.9	-152.0	-79.3	7.2	109.0	225.9	363.7
-523.4	-836.8	-1158.5	-1495.7	-1812.1	-2127.8	-2403.3	-2659.5	-2858.4	-3010.4	-3089.7	-3082.5	-2973.5	-2747.6	-2383.9

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
729.1	913.6	1098.2	1282.8	1467.3	1623.8	1808.5	1977.3	2161.9	2330.4	2514.9	2699.5	2884.1	3068.6	3253.2
330.6	515.1	699.7	884.3	1068.8	1225.3	1410.0	1578.8	1763.4	1931.9	2116.4	2301.0	2485.6	2670.1	2854.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
729.1	913.6	1098.2	1282.8	1467.3	1623.8	1808.5	1977.3	2161.9	2330.4	2514.9	2699.5	2884.1	3068.6	3253.2

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
729.1	913.6	1098.2	1282.8	1467.3	1623.8	1808.5	1977.3	2161.9	2330.4	2514.9	2699.5	2884.1	3068.6	3253.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
330.6	515.1	699.7	884.3	1068.8	1225.3	1410.0	1578.8	1763.4	1931.9	2116.4	2301.0	2485.6	2670.1	2854.7
398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5	398.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3081.0	4377.9	5773.1	7201.9	8595.9	9945.1	11268.3	12525.7	13725.9	14842.5	15881.8	16814.1	17623.8	18287.5	18782.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2137.0	3174.0	4352.9	5563.5	6807.7	8017.2	9210.0	10348.4	11437.0	12452.6	13400.8	14255.6	15003.3	15623.9	16095.0
692.3	822.1	888.6	888.6	888.6	888.6	888.6	888.6	888.6	888.6	888.6	888.6	888.6	883.3	876.1
1444.2	2351.9	3464.3	4674.9	5919.1	7128.6	8321.3	9459.8	10548.4	11564.0	12512.1	13366.9	14114.6	14739.7	15218.9
944.0	1203.9	1420.2	1638.4	1788.2	1927.9	2058.3	2177.2	2288.9	2389.9	2481.1	2558.6	2620.5	2664.5	2687.1
733.1	860.5	914.4	955.8	924.0	887.1	843.4	796.1	748.8	701.6	654.3	607.0	559.7	512.5	465.2
210.9	343.4	505.8	682.5	864.2	1040.8	1214.9	1381.1	1540.1	1688.3	1826.8	1951.6	2060.7	2152.0	2222.0
-2351.9	-3464.3	-4674.9	-5919.1	-7128.6	-8321.3	-9459.8	-10548.4	-11564.0	-12512.1	-13366.9	-14114.6	-14739.7	-15218.9	-15528.9
-4761.7	-8225.9	-12900.8	-18819.9	-25948.5	-34269.8	-43729.6	-54278.0	-65842.0	-78354.1	-91721.0	-105835.7	-120575.3	-135794.2	-151323.1
2351.9	3464.3	4674.9	5919.1	7128.6	8321.3	9459.8	10548.4	11564.0	12512.1	13366.9	14114.6	14739.7	15218.9	15528.9

2022	2023	2024	2025	2026	TOTAL
3550.0	3650.0	3660.0	3700.0	3770.0	53269
119.6	119.6	119.6	119.6	119.6	2169
79.8	79.8	79.8	79.8	79.8	1826
398.5	398.5	398.5	398.5	398.5	9186
2952.1	3052.1	3062.1	3102.1	3172.1	40088
0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0
2502.9	2498.9	2458.6	2389.9	2236.1	39203
2267.2	2289.9	2276.2	2234.0	2152.0	31047
235.7	209.0	182.3	155.8	84.0	8156
10.9	13.2	16.2	17.6	20.8	93
438.3	540.1	587.3	694.6	915.3	792
-1945.6	-1405.5	-818.2	-123.5	791.7	-36889

2022	2023	2024	2025	2026	TOTAL
3350.6	3450.6	3460.6	3500.6	3570.6	49274
2952.1	3052.1	3062.1	3102.1	3172.1	40088
0.0	0.0	0.0	0.0	0.0	0
398.5	398.5	398.5	398.5	398.5	9186
0.0	0.0	0.0	0.0	0.0	23043
0.0	0.0	0.0	0.0	0.0	26043
0.0	0.0	0.0	0.0	0.0	26043
0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0
				-8854.6	-8855
3350.6	3450.6	3460.6	3500.6	12425.2	32086

2022	2023	2024	2025	2026	TOTAL
3350.6	3450.6	3460.6	3500.6	12425.2	32086
0.0	0.0	0.0	0.0	0.0	19012
0.0	0.0	0.0	0.0	0.0	0
2952.1	3052.1	3062.1	3102.1	3172.1	40088
398.5	398.5	398.5	398.5	398.5	9186
0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	7032
19034.9	19041.3	18762.3	18240.4	17411.5	301798
0.0	0.0	0.0	0.0	0.0	26043
16349.8	16380.8	16162.7	15730.0	15029.7	230164
820.8	696.5	572.0	428.3	289.9	17510
15528.9	15684.3	15590.7	15301.7	14739.8	14740
2685.1	2660.5	2599.6	2510.4	2381.8	45591
417.9	370.6	323.4	276.4	229.8	31047
2267.2	2289.9	2276.2	2234.0	2152.0	8156
-15684.3	-15590.7	-15301.7	-14739.8	-13840.9	-226481
-167007.4	-182598.2	-197899.9	-212639.7	-226480.5	-1942879
15684.3	15590.7	15301.7	14739.8	13840.9	226494

10.4 ENVIRONMENTAL IMPACT

1) Impact on Land Use

First Stage Expressways of MMUES will strengthen accessibility to Manila CBD, the southern area, Quezon City and northern area. Economic activities in Manila CBD is rather stagnant as indicated by the decrease of employment (1980 to 1990). By improved accessibility owing to the expressways, Manila CBD will be revitalized.

Urbanization of the areas in the south, Quezon City and in the north will be further accelerated. Proper adjustment of the local development plan will be required to comply with impacts of expressways as well as to make expressways more functional.

2) Impact on Air Quality

Traffic emissions are the principal source of air pollution in Metro Manila. Particular matter is the most serious air pollutant in the region and motor vehicles are the dominant source, particularly those that use diesel. Lead is the second most serious air pollutant, and it is emitted mainly by cars and private utility vehicles. High emission rates of these pollutants are promoted by slow and stop-go traffic conditions. At present, the gaseous pollutants (SO_2, NO_2 and CO) are not yet observed to be at serious levels.

Without an expressway system, traffic congestion will worsen and air pollution will worsen even more. By diverting private traffic into the expressways, the at-grade roads will be decongested. An expressway network will have a favorable impact on air pollution by speeding up traffic flow, improving fuel efficiency, and reducing vehicular emission rates. There are two favorable affects. Air pollution (especially PM, lead and CO) from vehicles using the expressway will be significantly lower than without the expressway. In addition, air pollution from at-grade traffic will also be lower compared to without an expressway.

3) Impact on Water Quality

Impact on Surface Hydrology:

No major changes in ground surface relief and streamflow regimes are expected.

Effects on Runoff Rates:

Most of the MMUES will pass through already urbanized areas where much paving and ground compaction have already occured. This effect will be minimal.

Effect on River Pollution:

Relocation of squatters from riverbanks along Pasig River (Expressway Route R-4) will reduce pollution from both dumping of garbage and disposal of domestic wastes directly into waterways. However, the river is already too polluted from other sources so that overall impact of removing squatter sources may be small.

Impact on Cleaning and Maintenance of Waterways:

The Pasig River is wide enough for dredging and maintenance to be done easily. Expressways Route R-4 along the Pasig riverbank will not affect access to the river for navigation and river maintenance.

Impact of Construction on Drains and Down Stream Water Quality:

Most of the expressway system will follow existing road alignments and will be elevated. Earthwork/grading will therefore be minimal. Excavation for the supporting columns of the expressway structures is the main source of waste soil and silt runoff. Construction specifications will provide for proper waste disposal. Provided that spoils are properly disposed, silt runoff will be minimal.

Impact on Groundwater:

In the Guadalupe Plateau, groundwater (in confined aquifers) is found at depths from 15 to 60 meters. Although excavation will not reach these aquifers, piling (estimated to be from 20 to 30 meters) could create passageways for polluted surface water (particularly along rivers) to contaminate the groundwater.

4) Impact on Noise and Vibration

Impact of Project Construction on Noise Level:

Relatively high levels of noise will occur during construction, and these may exceed the 65 db and 75 db acceptable noise levels set for residential and commercial areas, respectively. There is minimal risk of hearing loss from short-duration exposure to high noise levels during project construction. Bore piling should be used instead of driven piles in noise-sensitive areas.

Impact of Expressway Operation on Noise Level:

Existing noise levels in the MMR are reported to be generally above the 50 db level that can cause annoyance. Proposed expressway routes are mostly along existing traffic corridors where traffic noise is already present.

In sensitive areas where effects of traffic noise may become significant (near schools and hospitals, or where traffic noise levels rise above 75 db) noise shields along such expressway sections will have to be installed.

Vibration Effects:

No significant adverse effects (in terms of annoyance to people or structural damage to buildings) due to traffic-induced vibration are expected. Pile foundations will transmit vibration waves deep into the ground. Where there are buildings located within 5 to 10 meters from the road edge, bore piling is recommended to reduce vibration during construction.

5) Impact of Relocation and ROW Acquisition

Squatters and Relocation

About 4,310 squatter families who have settled within the right-of-way of PNR along Expressway Routes C-3 and R-3, and Pasig River bank along Expressway Route R-4, will be affected. Relocation is a significant social impact which can be traumatic for those affected. However, areas along the PNR railway line and the bank of Pasig Rivers are considered danger zones, and are not covered by an existing moratorium on squatter relocation. Squatter removal from these areas will, overall, be beneficial in terms of reducing public safety hazards. But problems in finding suitable resettlement sites for such large number of families could arise.

Improper relocation can generate public resistance. It can also create adverse environmental effects, such as pollution from domestic wastes and increased safety hazards from unplanned settlements.

Relocation should be implemented in accordance with the recently passed law, RA 7279 of 1992 which stipulates rules and procedures for squatter relocation.

Other approaches such as multiple utilization of PNR right-of-way need to be examined.

Right-of-way Acquisition

About 149,300 square meters of land must be acquired mostly at interchange sites and new alignment sections along Expressway Route C-3 and Route R-4. In line with land acquisition, affected are about 260 residential houses, 80 commercial buildings, 11 factories, 5 warehouses and 1 permanent building of 4-story. In order to mitigate adverse social impacts, the following measures are required or tested:

- land valuation should be made at the prevailing market prices
- the Government should be responsible for arranging appropriate and comparable relocation site
- the Government should provide soft loan for costs additionally required for moving and purchasing new houses/business facility
- space under an expressway should be developed as one of the relocation site of affected people
- the Government should provide loans and incentives for private developers who are willing to implement urban re-development at interchange sites

6) Impact on Traffic Safety and Hazards

Traffic Accidents:

An expressway system to divert high speed traffic from urban streets and intersections has the potential to reduce pedestrian accident rates. However, accidents involving vehicles could increase due to faster traffic speeds on the expressways (estimated to be 40 to 45 kph). Overspeeding and poor speed modulation are main reasons for reported traffic accidents in Metro Manila at present. Enforcement of speed limits on the expressways, adequate lighting, and adequate space provision for stranded vehicles are needed during expressway operation.

Hazards posed to Pedestrians and Traffic During Project Construction:

Construction of elevated structures, including installation of massive pre-fabricated components, could pose hazards to pedestrians and vehicles nearby. Construction hazards can be minimized by providing adequate clearance for construction work. Appropriate warning signs and provisions for adequate lighting will be incorporated in the construction contract specifications.

10.5 OVERALL EVALUATION

On the basis of the analysis and assessment made on the First Stage of MMUES, it was concluded that the Project should be implemented to cope up with growing traffic demand, and rapid urbanization in the areas outside EDSA. At-grade road development is increasingly difficult due to right-of-way problem, particularly in the inner core area inside EDSA, therefore, construction of the First Stage of MMUES fully utilizing the existing public spaces is one of the drastic measures that the Government should pursue. Evaluation results are summarized as follows:

(1) Economic Feasibility

The Project is economically feasible. Economic internal rate of return (EIRR) was estimated to be 24.0%, which is well above the opportunity cost of capital (15%) in the Philippines. Even in the case of 30% increase in cost and 30% decrease in benefits, EIRR was 18.7%.

(2) Financial Feasibility

When the Project is implemented utilizing funds with low interest rate (say about 3.0% per annum), the Project is financially viable. It implies that if the Project is implemented with the participation of only private sector funding, the project is very difficult to be justified from the financial viewpoint.

(3) Toll Level, Economic/Financial Viability and Expressway Traffic Volume

Impacts of toll fee to economic and financial viability as well as expressway traffic volume are shown in Table 10.5.1 and illustrated in Figure 10.5.1.

When toll rate becomes high, FIRR is improved, and EIRR maintains the level of more than 15%, but expressway traffic volume significantly decreases. The Government should decide toll rate in due consideration of above relations and other factors such as transport policies, impacts on expressway users, transport charges on other transport modes, and political considerations.

(4) Technical Feasibility

The Project was evaluated as technically feasible. Local contractors can be extensively involved in the construction of MMUES.

(5) Environmental Impacts

No significant adverse impacts on environment were observed except for relocation of squatters and right-of-way acquisition. The Government has to make every effort to mitigate social impact.

(6) Traffic Impact

The First Stage Expressways greatly contribute to mitigation of at-grade road traffic congestion. Significant reduction (30 to 50%) in traffic volume was observed for roads directly under an expressway.

Reduction in traffic volume was observed in the wide range of areas, especially on roads in Manila CBD.

TABLE 10.5.1 TOLL LEVEL, ECONOMIC/FINANCIAL VIABILITY AND EXPRESSWAY TRAFFIC VOLUME

	TOLL LEVEL		
	₱10	₱20	₱30
EIRR (%)	27.4	24.0	21.3
FIRR (%)	0.6	3.9	4.7
EXPRESSWAY TRAFFIC VOLUME (pcu/day)			
Year 2006	186,000	137,000	108,000
Year 2010	244,000	196,000	147,000

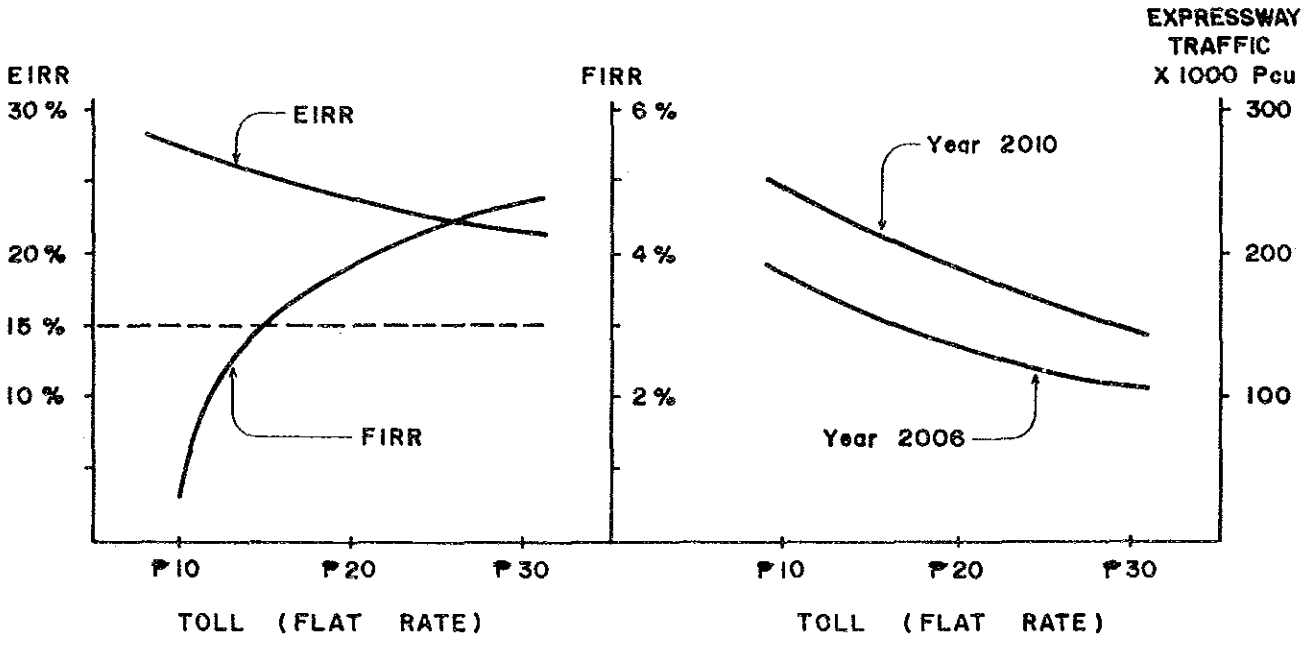


FIGURE 10.5.1 TOLL LEVEL, ECONOMIC/FINANCIAL VIABILITY AND EXPRESSWAY TRAFFIC VOLUME

CHAPTER 11

PROJECT IMPLEMENTATION

CHAPTER 11
PROJECT IMPLEMENTATION

This Chapter discusses the implementation strategy and plan of Metro Manila Urban Expressway System, Stage-1 (the Project) focusing on financial and structural arrangements.

Firstly, the ideal implementation schedule of the Project based on economic evaluation and traffic demand was proposed, and the financial requirement including annual investments were estimated according to the proposed ideal schedule.

Then, the possible financial options were addressed with review on present practices in other countries.

Finally, the three most probable implementation methods under different financial alternatives, implementation by Government fund, implementation by Government-owned corporation and implementation by private sector, were briefly discussed.

11.1 IMPLEMENTATION SCHEDULE AND FINANCIAL REQUIREMENT

11.1.1 Overall Implementation Schedule

The expressway routes under each implementation phase/stage are graphically demonstrated in Figure 11.1.1. The overall project components are shown in Table 11.1.1.

TABLE 11.1.1 OVERALL PROJECT COMPONENTS

STAGE/PHASE	LENGTH (KM)	PROJECT COST (MP)	YEARS REQUIRED
Phase-1	27.4	13,371.0	7
First Stage Phase-1	31.4	12,671.0	8
Total	58.7	26,047.0	11
Second Stage	66.1	20,750.0	10
Third Stage	23.4	8.425.0	7
Total	148.2	63,217.0	19

Note: Second and Third Stages are based only on preliminary rough estimates, not on Feasibility Study.

Based on the favorable evaluation in terms of economic assessment, though conditionally justified from financial viewpoint, an ideal implementation schedule was proposed taking into consideration the following factors.

- Forecasted traffic demand on expressways
- Estimated traffic congestion on at-grade roads
- Possible allocation of annual fund requirement
- Time duration required for each implementation activity

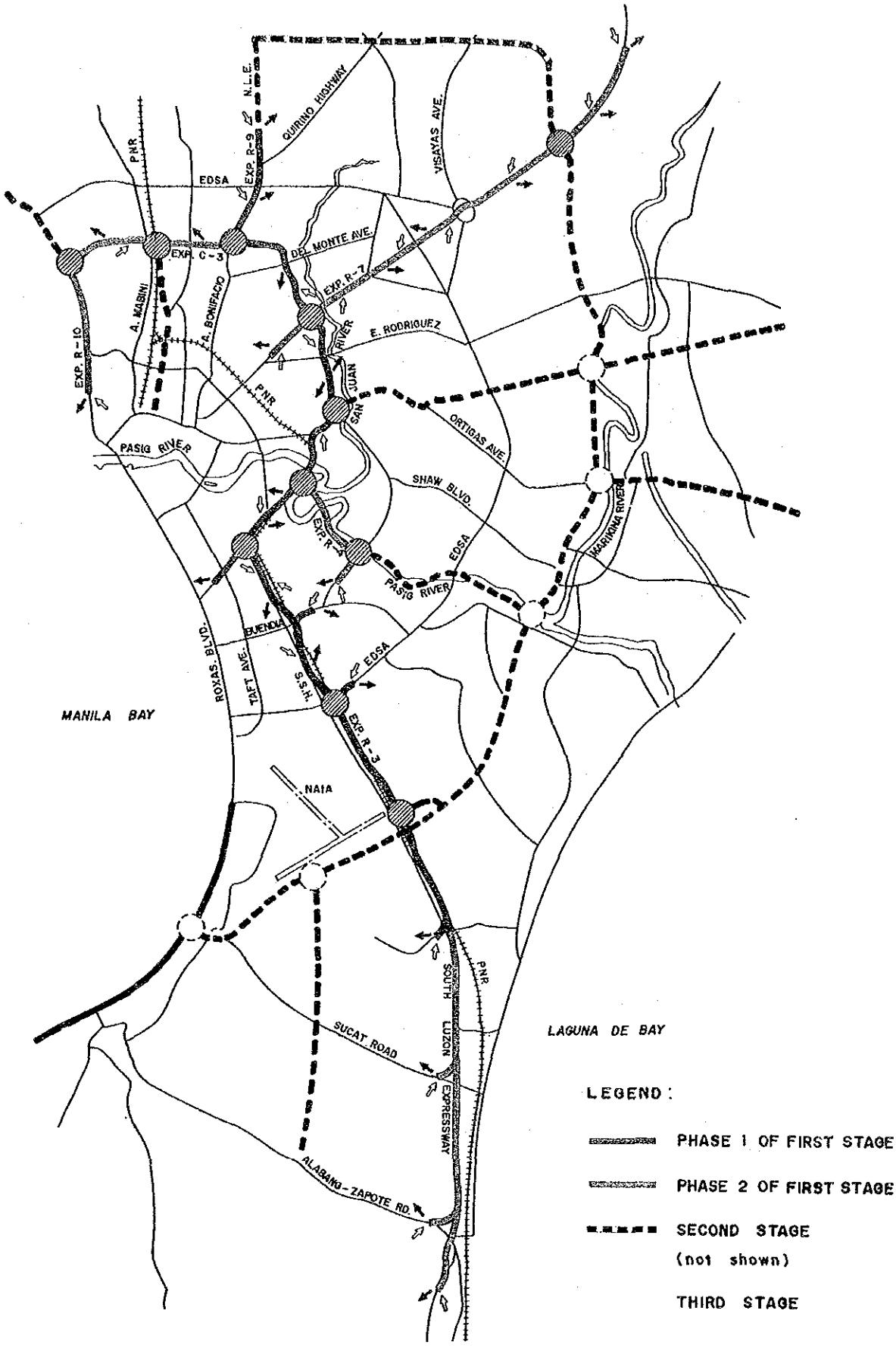


FIG. II.1.1 EXPRESSWAY ROUTES BY IMPLEMENTATION PHASING

FEASIBILITY STUDY ON METRO MANILA URBAN EXPRESSWAY SYSTEM

The proposed overall implementation schedule indicates that 19 years will be required to complete the whole stretch of Metro Manila Urban Expressway System (MMUES). The First Stage of MMUES (the Project) consisting of Phase-1 and 2 will require 11 years, 7 years for Phase-1 from 1995 to 2001 and 8 years for Phase-2 from 1995 to 2005, (overlap of 4 years), as presented in Figure 11.1.2.

11.1.2 Financial Requirement First Stage

The implementation of the First Stage component of MMUES is subdivided into two phases as shown in Figure 11.1.1. The length of each route, the construction cost and R.O.W. acquisition cost including compensation cost are presented in Table 11.1.2.

TABLE 11.1.2 CONSTRUCTION COST AND R.O.W. ACQUISITION COST, FIRST STAGE

Unit: MP in April 1993 Prices

	ROUTE	LENGTH KM	CONST. COST (MP)	R.O.W. ACQUISITION (MP)
Phase 1	Route C-3 from R-3 to R-7	11.8	5,411.9	865.0
	Route R-3 from Quirino Ave. to Bicutan I/C	11.8	4,661.1	175.0
	Route 9 from C-3 to End	4.5	1,497.6	0
	SUB-TOTAL	27.4	11,570.6	1,040.0
Phase 2	Route C-3 from R-9 I/C to R-10 I/C	4.1	1,663.9	61.0
	Route R-3 from Bicutan I/C to Alabang	9.1	3,336.5	651.0
	Route R-4	2.4	1,342.8	442.0
	Route R-7 from Welcome Rotonda to End	12.3	3,231.4	19.0
	Route R-10 from C-3 I/C to Moriones Ave.	3.3	1,214.9	0
	SUB-TOTAL	31.2	10,789.5	1,173.0
	T O T A L	58.6	22,360.1	2,213.0

The project costs including engineering fee are summarized in Table 11.1.3. Total investment cost was estimated at 26,043 million pesos in April 1993 prices, consisting of 13,337 million pesos for Phase-1 and 12,672 million pesos for Phase-2.

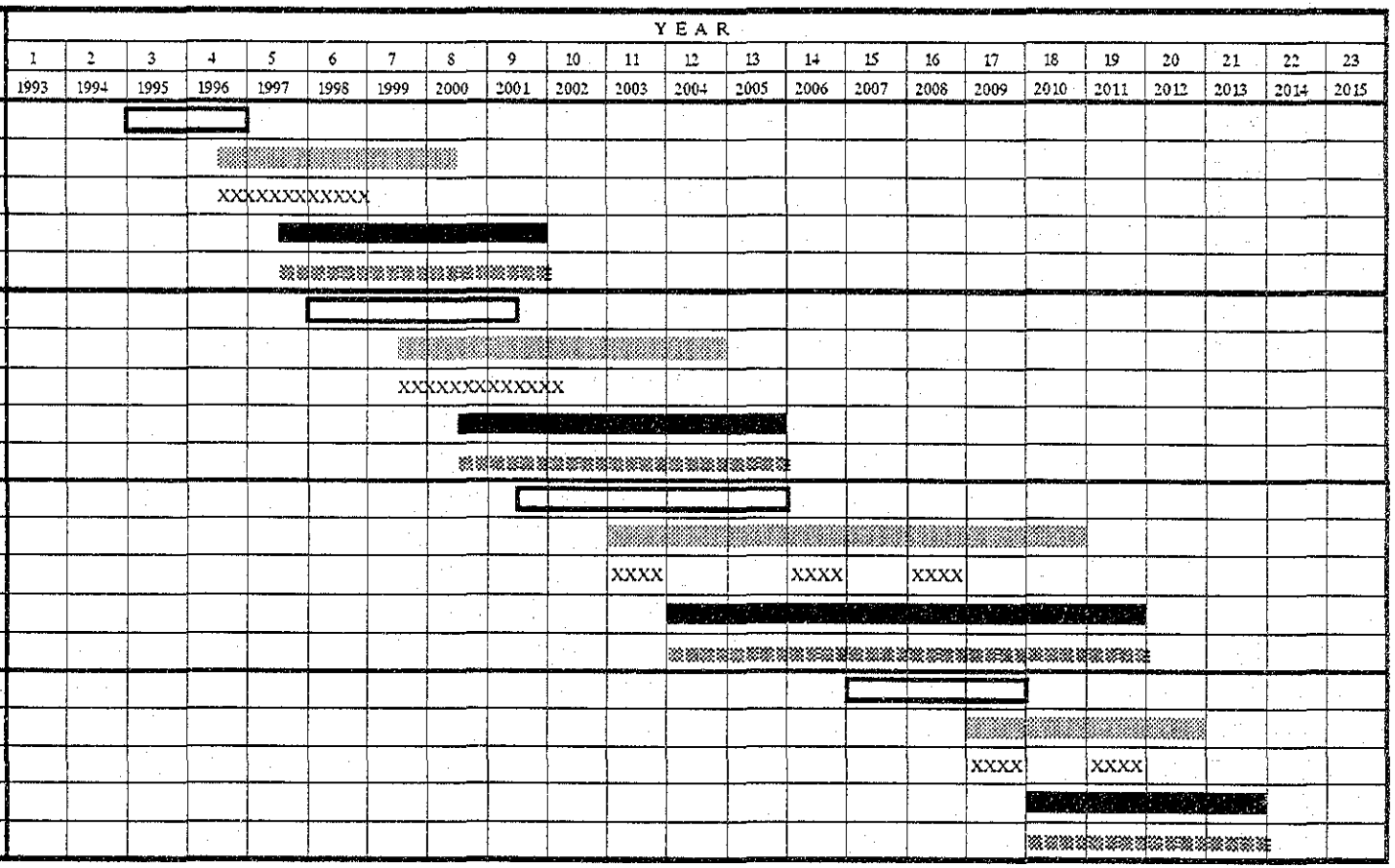
TABLE 11.1.3 SUMMARY OF PROJECT COST, STAGE-1

Unit: MP in April 1993 Prices

	Phase-1	Phase-2	Total
Detailed Engineering Cost	290	280	500
R.O.W. Acquisition Cost	1,040	1,173	2,213
Construction Cost	11,571	10,789	22,360
Construction Supervision Cost	470	430	900
T O T A L	13,371	12,672	26,043

FIGURE 11.1.2 OVERALL IMPLEMENTATION SCHEDULE

STAGE	PHASE	ACTIVITY	COST (Million ₱)
FIRST STAGE L = 58.7 km ₱26,043 M	Phase 1 L = 27.5 km ₱13,371 M	Detailed Engineering	290
		ROW Acquisition	1,040
		Tendering	–
		Construction	11,571
		Construction Supervision	470
	Phase 2 L = 31.2 km ₱12672 M	Detailed Engineering	280
		ROW Acquisition	1,173
		Tendering	–
		Construction	10,789
		Construction Supervision	340
SECOND STAGE L = 66.1 km ₱28,750 M		Detailed Engineering	600
		ROW Acquisition	3,140
		Tendering	–
		Construction	24,050
		Construction Supervision	960
THIRD STAGE L = 23.4 km ₱8,425 M		Detailed Engineering	195
		ROW Acquisition	220
		Tendering	–
		Construction	7,700
		Construction Supervision	310



Aside from the project cost mentioned above, the annual operating and maintenance costs were estimated as follows (in April 1993 prices). (Refer to Chapter 9).

- Annual Operating Cost ; 1.36 million pesos per km of expressway
- Annual Maintenance Cost ; 1.02 million pesos per km of expressway for the first 10 years
  2.04 million pesos per km of expressway after 10 years

11.1.3 Annual Investment Requirement for First Stage

The annual investment requirement covering detailed design, R.O.W. acquisition, civil works and construction supervision costs were estimated in compliance with the proposed implementation schedule.

Table 11.1.4 summarizes the annual investment requirement for First Stage with the breakdown for Phase 1 and Phase 2. The maximum annual requirement of 3,322 million pesos for Phase-1 may occur in the years of 1998 and 1999 and 3,541 million pesos for Phase-2 in 2003. As a whole for First Stage, the maximum requirement will be 3,936 million pesos in the year of 2000.

Table 11.1.5 and 11.1.6 presents the detailed annual investment requirement with the breakdown of detailed design, R.O.W. acquisition, civil works and construction supervision costs for Phase-1 and Phase-2, respectively. Table 11.1.7 shows the same for Phase-1 plus Phase-2.

TABLE 11.1.4 SUMMARY OF ANNUAL INVESTMENT REQUIREMENT FOR FIRST STAGE

Project Cost

Unit: MP in April 1993 Prices

	TOTAL	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Phase−1	13,371.0	145.0	197.0	1,516.0	3,322.25	3,322.25	3,062.2	1,806.15				
Phase−2	12,671.0				84.0	89.50	874.0	1,984.25	2,577.85	3,541.85	1,822.85	1,697.10
Total	26,042.0	145.0	197.0	1,516.0	3,406.25	3,411.7	3,936.95	3,790.40	2,577.85	3,541.85	1,822.85	1,697.10

Note: 1) Figures show only the project cost consisting of detailed engineering fee, R.O.W. acquisition, civil works and construction supervision. No contingency and escalation cost were included.

2) Annual operating and maintenance costs were estimated as follows.

These annual operating and maintenance costs will be required after 2002 for Phase−1 and after 2006 for Phase−2.

Unit: MP in April 1993 Price

	Phase−1 (27.4 km)	Phase−2 (31.2 km)
Operating Cost (1.36 MP/Km/year)	37.3	42.4
Maintenance Cost (1.02 MP/Km/year)	27.9	31.8
Total	65.2	74.2

TABLE 11.1.5 ANNUAL INVESTMENT REQUIREMENT : FIRST STAGE (PHASE 1)

April 1993 Prices
UNIT : Million Pesos

PHASE			COST	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	D/D	TOTAL	290.00	145.00	145.00									
		F	174.00	87.00	87.00									
		L	87.00	43.50	43.50									
		TAX	29.00	14.50	14.50									
	ROW	TOTAL	1040.00		52.00	312.00	312.00	312.00	52.00					
		F	0.00		0.00	0.00	0.00	0.00	0.00					
		L	936.00		46.80	280.80	280.80	280.80	46.80					
		TAX	104.00		5.20	31.20	31.20	31.20	5.20					
	Civil Works	TOTAL	11571.00			1157.10	2892.75	2892.75	2892.75	1735.65				
		F	6082.00			608.20	1520.50	1520.50	1520.50	912.30				
		L	3599.00			359.90	899.75	899.75	899.75	539.85				
		TAX	1890.00			189.00	472.50	472.50	472.50	283.50				
	C/S	TOTAL	470.00			47.00	117.50	117.50	117.50	70.50				
		F	282.00			28.20	70.50	70.50	70.50	42.30				
		L	141.00			14.10	35.25	35.25	35.25	21.15				
		TAX	47.00			4.70	11.75	11.75	11.75	7.05				
	TOTAL	TOTAL	13371.00	145.00	197.00	1516.10	3322.25	3322.25	3062.25	1806.15				
		F	6538.00	87.00	87.00	636.40	1591.00	1591.00	1591.00	954.60				
		L	4763.00	43.50	90.30	654.80	1215.80	1215.80	981.80	561.00				
		TAX	2070.00	14.50	19.70	224.90	515.45	515.45	489.45	290.55				

TABLE 11.1.6 ANNUAL INVESTMENT REQUIREMENT : FIRST STAGE (PHASE 2)

April 1993 Prices
UNIT : Million Pesos

PHASE			COST	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2	D/D	TOTAL	280.00				84.00	56.00	84.00	56.00	0.00	0.00	0.00	0.00
		F	168.00				50.40	33.60	50.40	33.60	0.00	0.00	0.00	0.00
		L	84.00				25.20	16.80	25.20	16.80	0.00	0.00	0.00	0.00
		TAX	28.00				8.40	5.60	8.40	5.60	0.00	0.00	0.00	0.00
	ROW	TOTAL	1173.00				0.00	33.50	234.50	259.65	343.55	176.05	125.75	0.00
		F	0.00				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		L	1056.00				0.00	30.15	211.05	233.70	309.30	158.55	113.25	0.00
		TAX	117.00				0.00	3.35	23.45	25.95	34.25	17.50	12.50	0.00
	Civil Works	TOTAL	10789.00				0.00	0.00	535.20	1605.60	2149.30	3236.70	1631.10	1631.10
		F	5670.00				0.00	0.00	280.50	841.50	1128.00	1701.00	859.50	859.50
		L	3363.00				0.00	0.00	168.50	505.50	673.30	1008.90	503.40	503.40
		TAX	1756.00				0.00	0.00	86.20	258.60	348.00	526.80	268.20	268.20
	C/S	TOTAL	430.00				0.00	0.00	21.00	63.00	85.00	129.00	66.00	66.00
		F	258.00				0.00	0.00	12.60	37.80	51.00	77.40	39.60	39.60
		L	129.00				0.00	0.00	6.30	18.90	25.50	38.70	19.80	19.80
		TAX	43.00				0.00	0.00	2.10	6.30	8.50	12.90	6.60	6.60
	GRAND TOTAL	TOTAL	12672.00				84.00	89.50	874.70	1984.25	2577.85	3541.75	1822.85	1697.10
		F	6096.00				50.40	33.60	343.50	912.90	1179.00	1778.40	899.10	899.10
		L	4632.00				25.20	46.95	411.05	774.90	1008.10	1206.15	636.45	523.20
		TAX	1944.00				8.40	8.95	120.15	296.45	390.75	557.20	287.30	274.80

TABLE 11.1.7 ANNUAL INVESTMENT REQUIREMENT : FIRST STAGE (PHASE 1 + PHASE 2)

April 1993 Prices
UNIT : Million Pesos

PHASE			COST	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 + 2	D/D	TOTAL	570.00	145.00	145.00	0.00	84.00	56.00	84.00	56.00	0.00	0.00	0.00	0.00
		F	342.00	87.00	87.00	0.00	50.40	33.60	50.40	33.60	0.00	0.00	0.00	0.00
		L	171.00	43.50	43.50	0.00	25.20	16.80	25.20	16.80	0.00	0.00	0.00	0.00
		TAX	57.00	14.50	14.50	0.00	8.40	5.60	8.40	5.60	0.00	0.00	0.00	0.00
	ROW	TOTAL	2213.00	0.00	52.00	312.00	312.00	345.50	286.50	259.65	343.55	176.05	125.75	0.00
		F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		L	1992.00	0.00	46.80	280.80	280.80	310.95	257.85	233.70	309.30	158.55	113.25	0.00
		TAX	221.00	0.00	5.20	31.20	31.20	34.55	28.65	25.95	34.25	17.50	12.50	0.00
	Civil Works	TOTAL	22360.00	0.00	0.00	1157.10	2892.75	2892.75	3427.95	3341.25	2149.30	3236.70	1631.10	1631.10
		F	11752.00	0.00	0.00	608.20	1520.50	1520.50	1801.00	1753.80	1128.00	1701.00	859.50	859.50
		L	6962.00	0.00	0.00	359.90	899.75	899.75	1068.25	1045.35	673.30	1008.90	503.40	503.40
		TAX	3646.00	0.00	0.00	189.00	472.50	472.50	558.70	542.10	348.00	526.80	268.20	268.20
	C/S	TOTAL	900.00	0.00	0.00	47.00	117.50	117.50	138.50	133.50	85.00	129.00	66.00	66.00
		F	540.00	0.00	0.00	28.20	70.50	70.50	83.10	80.10	51.00	77.40	39.60	39.60
		L	270.00	0.00	0.00	14.10	35.25	35.25	41.55	40.05	25.50	38.70	19.80	19.80
		TAX	90.00	0.00	0.00	4.70	11.75	11.75	13.85	13.35	8.50	12.90	6.60	6.60
	GRAND TOTAL	TOTAL	26043.00	145.00	197.00	1516.10	3406.25	3411.75	3936.95	3790.40	2577.85	3541.75	1822.85	1697.10
		F	12634.00	87.00	87.00	636.40	1641.40	1624.60	1934.50	1867.50	1179.00	1778.40	899.10	899.10
		L	9395.00	43.50	90.30	654.80	1241.00	1262.75	1392.85	1335.90	1008.10	1206.15	636.45	523.20
		TAX	4014.00	14.50	19.70	224.90	523.85	524.40	609.60	587.00	390.75	557.20	287.30	274.80

11.2 FINANCING OPTIONS

The Stage 1 of Metro Manila Urban Expressway System, 58.6 km in length, alone requires 26,042 million pesos of the huge investment within 11 years, calling for the maximum annual investment of 3,937 million pesos in the year of 2000. There is a need to consider more extensive use of alternative funding sources in the implementation of the Project which is planned to be operated as a toll road.

MMUES is a toll road which can be built, owned and operated by the Government or Government agency, or a private company with the Government permission, or by a joint venture involving both. These options may include the following.

- Option 1: Government Fund Financing (Implementation by the Government)
- Option 2: Government Subsidy Financing (Implementation by Public Corp.)
- Option 3: Private Financing (Implementation by Private Sector in the form of Build-Operate-Transfer or Build-Transfer)

The characteristics of these financial options are described reviewing the present practices in Japan, Indonesia and Thailand.

11.2.1 Government Fund Financing

Throughout the world the financing of public infrastructure including highways is becoming increasingly difficult. This is because of the demands on government for greater social equity and lower levels of taxation. The financing of the Project from general taxation or specific taxation may not be practical.

For the implementation of the Project, borrowings from the international lending institutions may be inevitable such as the Oversea Economic Corporation Fund of Japan, World Bank, Asian Development Bank, etc. In this case, the debt services of the Government of the Philippines will increase.

It is, however, recommendable from the economic viewpoints of the nation as a whole since the borrowings from these institutions are, in general, soft loan as the official development aids to the developing country. The planned implementation of the Project, though it might be slow but steady, is expected in accordance with the financial arrangements with these institutions to be programmed.

Moreover, the social requirements of expressways to be met as a public infrastructure can be easily pursued since the project will be built, operated and managed by the Government.

11.2.2 Government Subsidy Financing

In principle, this option is same as Option 1. The Government will establish the Government-owned subsidized public corporation with the special objectives of financing, building, operating and managing of the Project.

In this option, soft loans as the official development assistance from international lending institutions can be expected. These loans from multilateral or bilateral resources may be converted into a corporation equity. Also, the investments from private sectors, foreign and local, may be expected in the form of equity and debts. With this public corporation system, private sector involvement may be possible under the reasonable agreement to be met as public infrastructure.

As examples of this option, the outline of Metropolitan Expressway Public Corporation, Tokyo, Japan (MEPC) and Indonesia Highway Corporation (P.T. Jasa Marga) are described hereunder. Refer to Appendix 11.2.1 for detail.

(1) Metropolitan Expressway Public Corporation, Tokyo, Japan

The Metropolitan Expressway Public Corporation (MEPC) was established in 1959, with the objectives of promoting construction of motorway in Central Tokyo and the vicinity.

The main activities of MEPC includes the following:

- Construction and management of expressways
- Urban redevelopment related to expressways
- Improvement of streets along expressways
- Construction and management of parking lots
- Construction and management of facilities below elevated expressways

MEPC receives investments from the national and local governments which comprise the capital of the corporation.

Annual revenues consists of the followings:

- Metropolitan Expressway Bonds (Government underwritten bonds and privately offered bonds)
- Express Toll Receipt
- Income from consigned business (funds from the national and local governments)
- Infrastructure Improvement Program Revenues (Interest-free loan from the national and local public bodies)

(2) Indonesia Highway Corporation

The Government has created in 1978 the Indonesia Highway Corporation (P.T. Jasa Marga), a state-owned company in charge of financing, constructing, operating and monitoring toll roads throughout Indonesia.

In financing the project, the Government is responsible for land acquisition, and Jasa Marga seeks the fund from;

- Toll revenues
- Government equity
  The Government has converted into equity in Jasa Marga the soft loans from multilateral or bilateral sources.

- Bonds on domestic financial market since 1983
- Joint-operation with private firms
- Joint-venture with private-investors
  The investment in toll roads by private investors should be in cooperation with P.T. Jasa Marga in the form of joint venture or joint-operation. The joint venture agreement is based on a "Build, Operation, Transfer" scheme.

11.2.3 Private Financing

Under the continuing financial constraint, it is increasingly difficult for the central government to construct and maintain road systems because traditional public finance resources are insufficient to meet needs. Funding constraints and traffic congestion both suggest the private funding through road pricing may be a transport policy option worth considering and attractive to government.

In the case of transport infrastructure projects, a whole series of financial package are possible, ranging from those financed entirely with private funds to those fully financed by government. In drawing up a financial package classification, the distribution of construction and operating costs as well as the contractual relation between government and private sectors involved should be taken into account.

On this basis, four major types of financial package for private sector involvement can be defined;

Type 1 : All-private solution
Funding, operation and management are exclusively private. This type of solution is feasible only when the project is profitable enough and the public service requirement are warranted to be met.

Type 2 : Private Financing with Government Guarantee
Funding, operation and management is the responsibility of a private body. Guarantees may be provided by the government.

Type 3 : Private Finance with Government Involvement
The investment is financed with private capital. The expressway is also built by a private body. But, in view of public service requirements to be met, government may be fully or partly responsible for operation and management.

Type 4 : Private resources with Government Responsibility
Private resources are used for financing but construction, operation and risk guarantees are responsibility of government.

The typical present practice of private sector involvement in highway projects are "Built, Operation, Transfer" scheme which may fall into either Type 1 or 2 depending on guarantees provided by the government. While, "Built, Transfer" scheme may be classified as Type 3. Type 4 has not been practiced yet.

The Second Stage Expressway System Project, Thailand, is presently being implemented under "BOT" scheme with the following conditions.

- Consortium : Bangkok Expressway Company Limited (BECL)
- Responsibility : BECL is responsible for alternative design, construction, operation and maintenance during the concession period, and shall turn it over in good state of repair
- Concession Period : 30 years
- Project Cost : Approximately US$ 1 Billion
- Financing : Equity 20%
  Credit 80%
- Toll : The toll can be revised in accordance with the Consumer Price Index for the Bangkok Metropolis
- Franchise : BECL may install, develop, construct or sub-let any ancillary facilities such as shops, premises, building, car parks, gasoline stations, advertising display, etc.

11.3 IMPLEMENTATION BY THE GOVERNMENT

11.3.1 Financial Structure

As discussed in Chapter 11.2, the Government of the Philippines may request the long-term soft loan as the official development aids from international lending institutions if the Government will implement the Project. One of the most probable source may be OECF.

When the government and governmental institutions of developing countries face difficulties in implementing their development programme and projects owing to financial and other constraints, OECF assists their development efforts, principally by providing long term, low-interest project loans.

Project loans, one of the typical types of OECF loans, provide funds needed for materials and equipment, civil works, consulting services, etc, for a development project, such as the construction of roads.

A loan's procurement conditions are determined by the Japanese Government on a case to case basis. In recent years, the procurement condition have been untied. "General United" means that the countries eligible for procurement under the loan are any developing country and any DAC member country.

OECF introduced its "Fixed-Percentage Financing Criteria", under which OECF can provide loans covering part of the local currency needed.

The criteria determine the upper limit for the amount of an OECF loan by multiplying the total project cost by a certain percentage that will be determined depending on the per capita GNP of the Borrower's country.

The following is a typical example of financial scheme.

According to the present practice, the share of the Project cost to be shouldered by the Government of the Philippines (GOP) and by OECF may be as follows.

Detailed Engineering Cost	:	30% for GOP, 70% for OECF
R.O.W. Cost	:	100% for GOP
Construction Cost	:	10% for GOP, 90% for OECF
Construction Supervision	:	30% for GOP, 70% for OECF

Based on these assumption, GOP and ILI (portion to be shouldered by International Lending Institutions such as OECF) were estimated as shown in Table 11.3.1.

TABLE 11.3.1 SHARE OF PROJECT COST

Unit: MP in April 1993 Price

	Phase-1			Phase-2		
	GOP	ILI	TOTAL	GOP	ILI	TOTAL
Detailed Eng'g.	87	203	290	84	190	280
R.O.W. Acquisition	1,040	-	1,040	1,173	-	1,173
Construction	1,157	10,414	11,571	1,079	9,710	10,789
Const. Supervision	141	329	470	129	301	470
T o t a l	2,425	10,946	13,371	2,465	10,207	12,672

11.3.2 Implementing Agency

The implementation agency will be the Department of Public Works and Highways or its attached governmental institution. Considering the magnitude of capital investment required for the Project, it is recommended that a special bureau/agency, tentatively named "Metro Manila Expressway Authority" (MMEA) shall be created to implement the Project.

The organization of MMEA is proposed in Figure 11.3.1.

The Government is responsible for financing the Project and acquiring R.O.W. while MMEA is responsible for planning, constructing, operating and maintaining the project under the guidance of DPWH in close coordination with agencies concerned such as Toll Regulatory Board.

Professional consultants and contractors will be contracted for engineering services and civil works, respectively, by contract system.

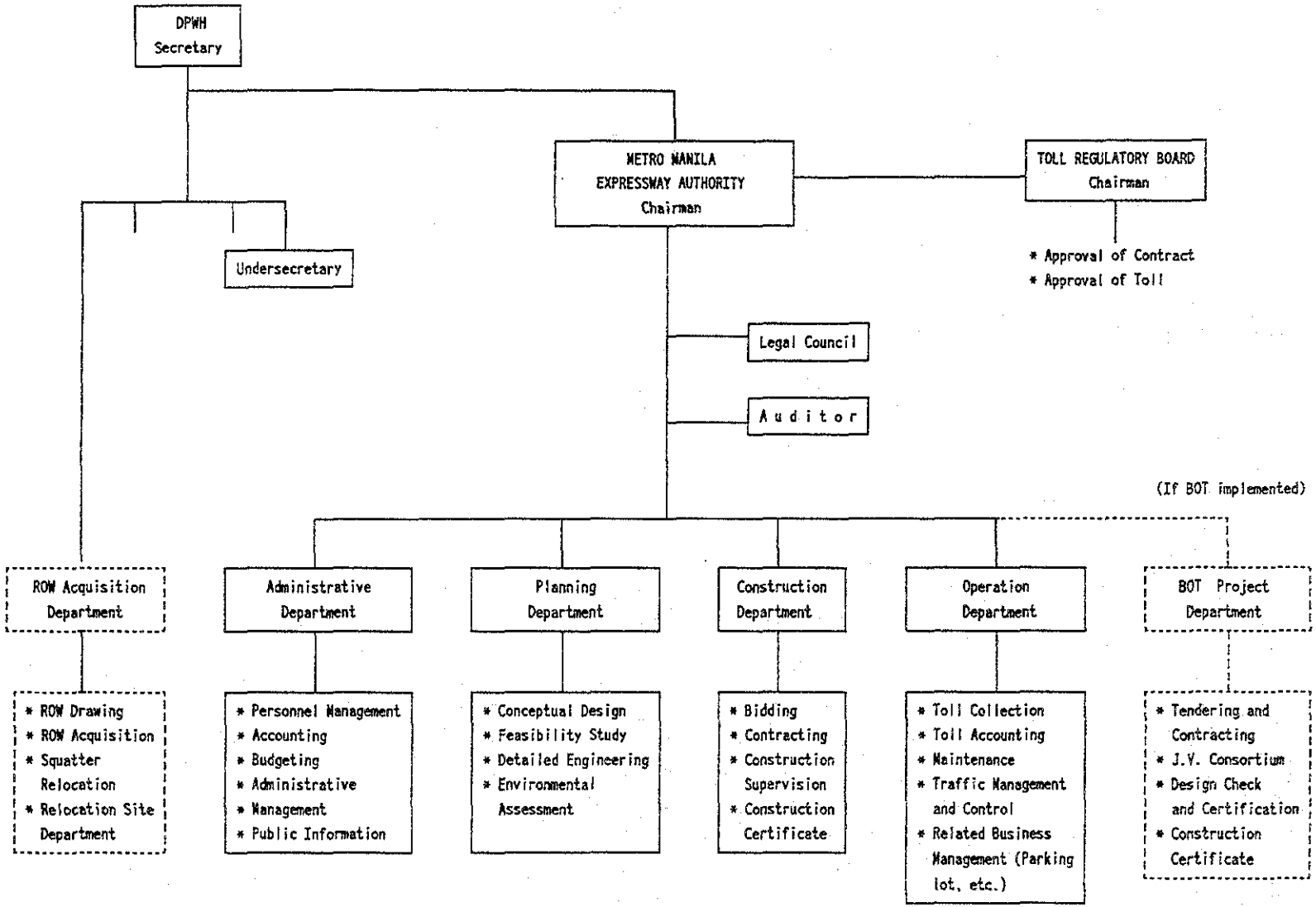


FIGURE 11.3.1 PROPOSED ORGANIZATION FOR METRO MANILA EXPRESSWAY AUTHORITY

11.4 IMPLEMENTATION BY A PUBLIC CORPORATION

11.4.1 Financial Structure

Under this scheme, the Government of the Philippines shall create a company with the special objectives of financing, constructing and operating of Metro Manila Urban Expressway similar to the Metropolitan Expressway Public Corporation of Japan (MEPC) and P.T. Jasa Marga in Indonesia. The company is tentatively named "Metro Manila Expressway Public Corporation" (MMEPC).

Since the proposed MMEPC is a state-owned company, equity investment and loans required for the Project can be expected from the central and local government, local banking company and foreign lending institutions. One of the possible sources as foreign lending institution may be OECF.

One of the OECF's principal operations is to provide loans to and equity investment in corporations engaged in development projects in developing countries, aside from loans to government or governmental agencies discussed in Chapter 11.3. OECF considers projects in the following categories suitable for such equity investment.

- Project expected to facilitate economic development in the country through foreign exchange earnings or savings, contributing to employment creation, promoting rural development, etc.
- Project requested or expected to be implemented by the government or a governmental agency of the developing country concerned.
- Project scheduled to be participated in by international organization, such as IFC, ADB, etc. or a governmental financial institution of an advanced country.
- Equity investments are limited to the investment in a Japanese investment corporation especially established for the project or in a local corporation with a business relationship with a Japanese corporation. Amount of equity investment, decided on a case to case basis, may not exceed 50% of Japanese corporation's investment or 25% of total investment.

Figure 11.4.1 shows a typical example of investment scheme used where OECF makes equity investment.

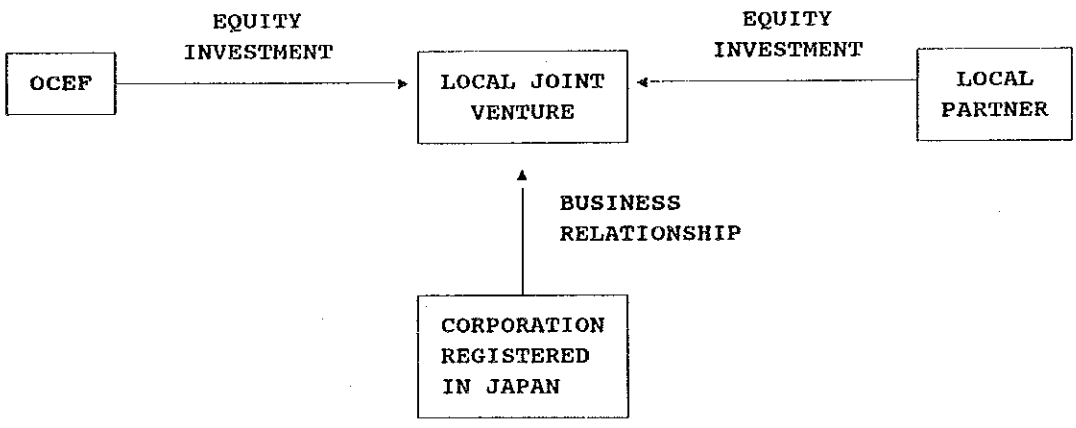


FIGURE 11.4.1 EQUITY INVESTMENT IN LOCAL CORPORATION

Equity investment can be, therefore, expected from the central and local Governments, international lending institutions, foreign and local private sectors. Equity necessary for the Project may be roughly estimated 20% of the Project Cost or 5 billion pesos.

Even under this scheme, the R.O.W. acquisition shall be done by the Government utilizing the Government Fund. The engineering service and civil work costs shall be shouldered by MMEPC utilizing soft loans extended from international lending institutions.

The share of the Project cost to be shouldered by the Government of the Philippines (GOP), Metro Manila Public Corporation (MMPC) and international lending institutions (ILI) were estimated as shown in Table 11.4.1, based on share ratio discussed in Chapter 11.3.

TABLE 11.4.1 SHARE OF PROJECT COST

	PHASE 1				PHASE 2			
	G.O.P.	MMEPC	ILI	TOTAL	G.O.P.	MMEPC	ILI	TOTAL
Detailed Engineering	–	87	203	290	–	84	190	284
R.O.W. Acquisition	1,040	–	–	1,040	1,173	–	–	1,173
Construction	–	1,157	10,414	11,571	–	1,079	9,710	10,789
Construction Supervision	–	141	329	470	–	129	301	470
TOTAL	1,040	1,385	10,946	13,371	1,173	1,292	10,207	12,672

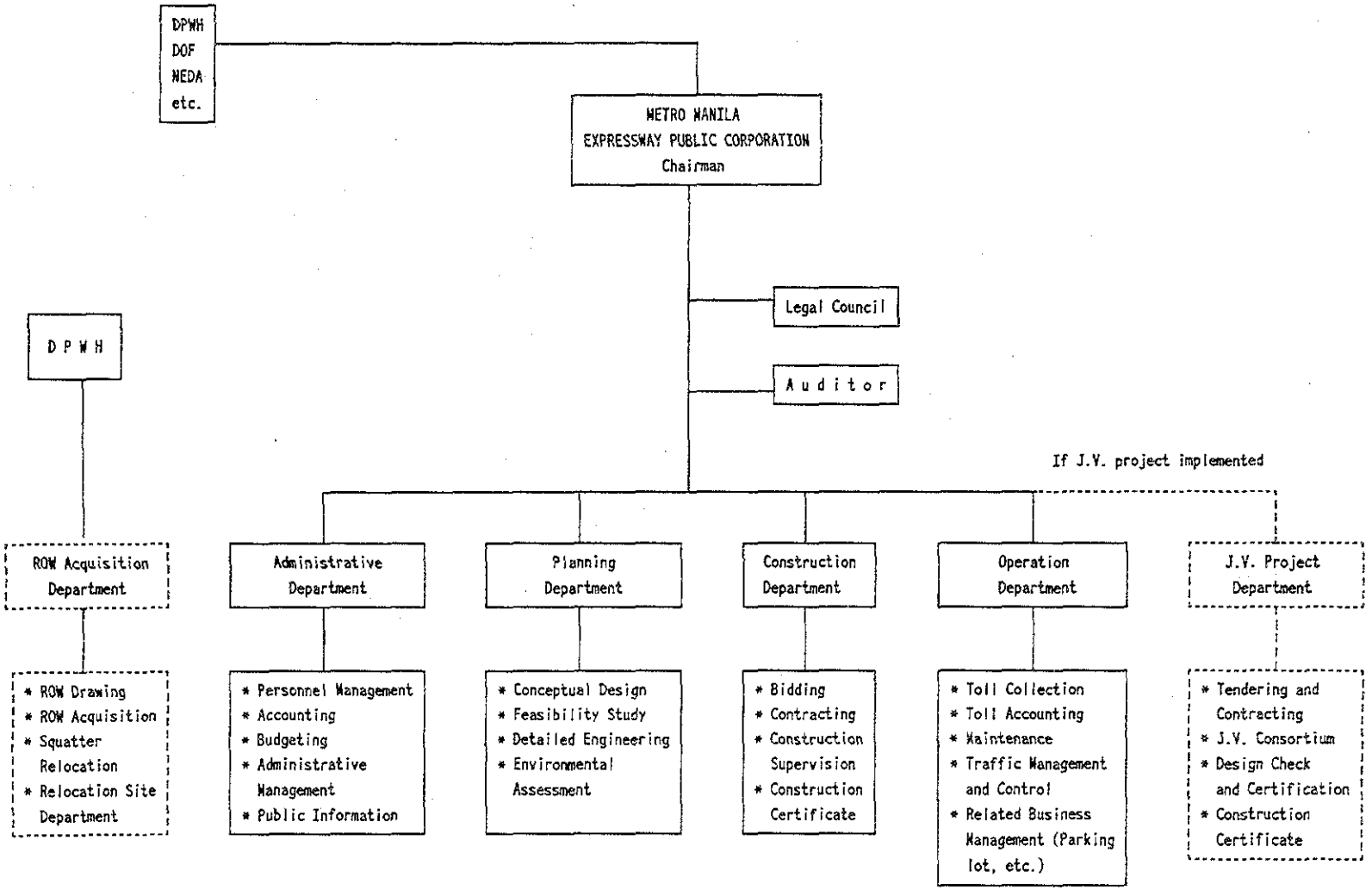
11.4.2 Implementing Agency

Metro Manila Expressway Public Corporation (MMEPC) will be guided by concerned departments such as Department of Public Works and Highways, Department of Finance, National Economic Development Authority, etc.

A structural organization of MMEPC is proposed as shown in Figure 11.4.2.

Although right-of-way acquisition is the responsibility of DPWH, MMEPC may undertake the work in lieu of DPWH.

MMEPC may implement a portion of expressway system in the form of joint-venture or joint-operation with a private investor. The joint-venture agreement is, in principal, similar with "Build, Operate, Transfer" scheme or "Build, Transfer" scheme, which is discussed in Chapter 11.5.



Note: 1) ROW acquisition is the responsibility of DPWH, but MMEPC may conduct if required.
2) When MMEPC implement under Joint Agreement with private company, J.V. project Department is required.

FIGURE 11.4.2 PROPOSED ORGANIZATION FOR METRO MANILA EXPRESSWAY PUBLIC CORPORATION

11.5 IMPLEMENTATION BY A PRIVATE SECTOR

11.5.1 Financial Structures

There are mixed solutions between government and private financing as discussed in Chapter 11.2. It is, however, assumed in the implementation of the Project that a private investor is entirely responsible for funding, operation and management of the Project. However, the right-of-way acquisition is still in hand of the Government taking into consideration the nature of work.

When the Project is implemented by a private investor, the total investment cost required for an investor includes capitalized interest during construction, initial working capital and reserve funds for debt service and operating losses, in addition to the project cost.

These additional investment costs depend on capital structure and financial condition such as debt: equity ratio, term and conditions of short and long term borrowings, etc. and therefore roughly estimated as follows.

- Estimated Project Cost ; R.O.W. Acquisition Cost 2.2 BP
  Engineering Cost 1.4 BP
  Civil Works Cost 22.4 BP
  T o t a l 26.0 BP
- Equity ; 20% of Project Cost except R.O.W. acquisition, 4.8 BP
- Capitalized Interest ; 15% of Project Cost except R.O.W. acquisition, 3.6 BP
- Working Capital ; One-half year's cash operating requirement 1.7 BP
- Reserve Fund for Debt Service ; One year debt serve, 3.0 BP
- Reserve Fund for Operating Losses; To cover operating losses during initial years of operation, if necessary; 4.0 BP

11.5.2 Implementing Rules and Regulation on BOT Scheme

(1) BOT Law and Rules

Republic Act No. 6957, known as the BOT Law is entitled "An Act Authorizing the Financing, Construction, and Maintenance of Infrastructure Projects by the Private Sector, and for other purposes". This Act was approved by the President on July 9, 1990.

The Act states that "it is the declared policy of the State to recognize the indispensable role of the private sector as the main engine for national growth and development and provide the most appropriate favorable incentives to mobilize private sources for the purposes".

The Act specifies the Terms of BOT and BT schemes as follows:

- Build Operate and Transfer Scheme (BOT Scheme)

  A contractual arrangement whereby the contractor undertakes the construction, including financing, of a given infrastructure facility, and the operation and maintenance thereof. The contractor operates the facility over a fixed term during which it is allowed to change facility users appropriate tolls, fees, rentals, and charges sufficient to enable the contractor to recover its operating and maintenance expenses and its investment in the project plus a reasonable rate of return thereon.

- Build-and-Transfer Scheme (BT Scheme)

  A contractual agreement whereby the contractor undertakes the construction, including financing, of a given infrastructure facility, and its turnover after completion to the government agency or local government unit concerned which shall pay the contractor its total investment expended on the project, plus a reasonable rate of return thereon.

Pursuant to the BOI Law, the Implementing Rules and Regulations (IRR) was formulated to carry out the provision of the said Act, by DPWH, DOF, DILG, NEDA, and duly accredited organizations representing the private Philippine construction industry, on April 3, 1991.

(2) Major Requirements and Observations

The characteristics of transport infrastructure are such that it does not seem very attractive to private investors because of the following factors, aside from financial, construction, operation and commercial risks.

- A long amortization period
- A long period between the start of capital formation and the start of financial returns
- The irreversibility of the investment
- Political influence on construction and service

In view of the considerable risks arising from the characteristics listed above, only limited interest in infrastructure investment can be expected. It is therefore, necessary that the Government provides incentives. These may consist of;

- Revenue guarantees
- Compensation guarantees for certain revenue losses
- Award of other profitable services
- Protection from competition from substitute services

To challenge the Metro Manila Urban Expressway System Project, a private investor shall obey the Build-Operate-Transfer Law and Implementing Rules and Regulations. Described hereunder are review and observation on the Law and Regulations. Refer to Appendix 11.5.1 for details.

Ownership Structure of the Contractor for BOT Scheme

- Requirements

  IRR Section 1.1 specifies;

  The ownership structure of the contractor of an infrastructure facility whose operation requires a public utility franchise must be in accordance with the Constitution.

  IRR Section 10.1a.1. specifies;

  Thus, at least 60% of the capital of the contractor/applicant must be of Filipino citizenship.

- Observation

  In order to comply with this requirement, the maximum allowable foreign ownership of the contractor is 40%. This restriction on foreign ownership may severely limit available financing from possible foreign investors.

Facilities to be provided by the Government

- Requirements

  IRR Section 6.3 specifies;

  The Agency/LGU shall indicate the facilities associated with subject project which are to be provided by the government. These facilities may include, but not be limited to Right-of-Way. The cost of the same may be partly or wholly be financed and/or shouldered by the Contractor as part of its bid and cost recovery-scheme.

- Observations

  The responsibility and cost of relocation of households and right-of-way acquisition affected by the project is recommended to be that of the Government of the Philippines.

  From the perspective of BOT scheme, the government shall acquire the land and make sure it is available prior to commencement of the project, otherwise the government shall shoulder the costs caused due to the delay in the acquisition of the land.

Contents of the Bid

IRR Section 11 specifies;

- Requirements

  One of the main responsibility of the Agency/LGU is to prescribe the minimum design and performance standards and specifications as well as economic parameters. These shall also be used by the Agency/LGU in comparatively evaluating the bids.

- Observations

  Taking into consideration the magnitude of BOT Projects, required technical soundness of the facility, and the uniform basis and fairness in evaluation of bids, it is recommended that the Agency/LGU shall conduct the detailed feasibility study and call for tender proposals based on such study, as mentioned as an alternative method in IRR Section 10.

11.5.3 Implementing Agency

(1) Existing Agencies

Toll Regulatory Board (TRB)

In March 1977, Presidential Decree No. 1112 created the Toll Regulatory Board with the following primary function. After the enaction of the BOT Law, the TRB is now attached to DPWH with the Secretary of DPWH as the Chairman.

- To grant authority to operate a toll facility
- To issue the toll operation certificate
- To issue, modify and promulgate from time to time the rates of toll that will be charged to direct users of toll facilities
- To enter into contracts --- for the construction, operation and maintenance of toll facilities such as, but not limited to, national highways, roads, bridges and public thoroughfares

Project Management Office for BOT Scheme (PMO-BOT)

Pursuant to the provision of the BOT Law, the DPWH created on November 1991, a Project Management Office for Build-Operate-and-Transfer Scheme (PMO-BOT) whose functions are to initiate, promote, supervise and perform such acts related to the implementation of the Department's BOT projects.

The PMO-BOT, headed by the Project Director under the Undersecretary of the DPWH, composes three divisions; administrative, technical evaluation and contract management.

(2) Proposed Implementing Agency

Considering the magnitude of the Project and its efficient implementation, a special agency such as Metro Manila Expressway Authority as discussed in Chapter 11.3 is recommended to be created.

11.5.4 Implementation Procedure

In implementing the Project under BOT scheme, the Government of the Philippines will be involved in various stages of projects, represented by the Department of Public Works and Highways as the project's proponent.

The project implementation essentially involves the following stages, as graphically demonstrated in Figure 11.5.1.

- Planning Stage
- Tender and Contract Stage
- Construction Stage
- Operation Stage, and
- Transfer Stage

The administrative and legislative procedures on each stage are briefly discussed hereafter.

(1) Planning Stage

1) Selection of Candidate Projects

Among proposed projects listed in potential BOT projects, the initial selection of candidate BOT projects is done by the DPWH in consultation with other government agencies, particularly with the NEDA.

Candidate projects are required to be included in the medium-term infrastructure program.

2) Initial Technical Study (Pre-Feasibility Study)

Once the initial selection is done, the initial technical study (pre-feasibility study) shall be undertaken including the following, among others.

- Technical Evaluation
- Economic Evaluation
- Financial Evaluation
- Environmental Evaluation
- Legal Evaluation

Since the initial or pre-feasibility study is conceptual in nature, the output of the study may not be able to provide enough information/data to establish required minimum design and performance standards and specifications, as well as economic parameters.

The initial or pre-feasibility study may be done with DPWH's resources or with the services of professional consultants.

3) Evaluation of Feasibility as BOT projects

If the pre-feasibility study indicates that the project is feasible on financial aspects and may be able to attract potential private participation, the DPWH can proceed to the next step.

At this stage, the project shall be duly approved by the Congress.

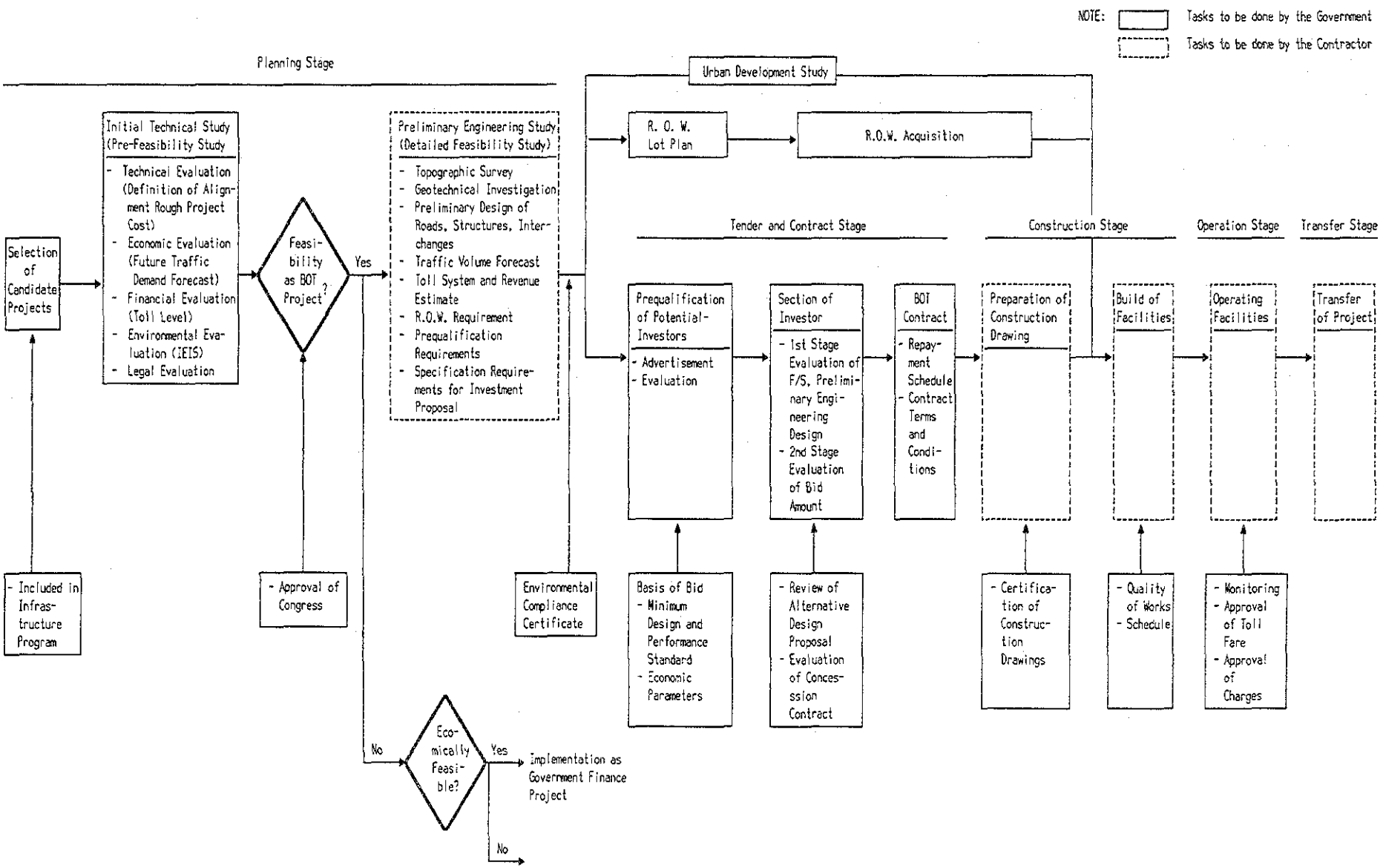


FIGURE 11.5.1 IMPLEMENTATION PROCEDURE OF BOT SCHEME PROJECT

4) Preliminary Engineering Study (Detailed Feasibility Study)

IRR Section 11 prescribes that the feasibility study shall be a part of bid, but also approves an alternative that the Agency/LGU may conduct the feasibility study and, in some cases, even the detailed engineering design, and call for proposals based on such feasibility study/detailed engineering design.

Taking into consideration the magnitude of BOT projects, required technical soundness of the facility, and the uniform basis and fairness in evaluation of bids, the detailed feasibility study shall be carried out by the DPWH. The study may be done with services of professional consultants.

To establish the minimum design and performance standards and specifications as well as economic parameters which shall be observed by the bidder/contractor in preparing its bids, the detailed feasibility study shall include the following, among others.

- Marketability
- Technical Soundness (Preliminary Engineering Design)
  This task includes topographic survey and soil investigation. The estimate should be undertaken within a range of ± 20% of the final quantities.
- Economic Feasibility
  The project should yield an economic internal rate of return which is at least equal to the social discount rate, currently 15%.
- Financial Viability
  The project should give a financial rate of return which is at least equal to the effective cost of capital.
- Operational Feasibility
- Environmental Standards
  Although the DPWH will conduct the detailed feasibility study mentioned above, the responsibility for the validation and integrity of the study shall still be lodged with the bidder.

5) Right-of-Way Acquisition

Immediately after the completion of the preliminary engineering study, the acquisition of right-of-way required for the project shall be commenced, and shall be completed before the actual start of construction of the project.

6) Urban Development Study

The study on urban development or urban renewal shall be conducted in accordance with the proposed BOT project which may bring the significant impact in the areas influenced by the project.

Particularly, the study on urban renewal and traffic rerouting nearby ramps and interchanges shall be conducted. Also, present land use along proposed expressway routes shall be examined.

(2) Tender and Contract Stage

1) Prequalification of Contractors

The DPWH shall prepare the Bidding Document for the project to guide the prospective bidders in preparing and submitting their prequalification application and bid proposal, including the following:

- Project Objective and Description
- Minimum Design and Performance Standards and Specifications, and Economic Parameters
- Draft Contract including Terms and Conditions
- Prequalification Criteria and Procedures
- Instruction to Bidders, including Bid Form
- Bid Evaluation Criteria

Prequalification of potential bidders shall be done according to a predetermined criteria, which include the following:

- Legal Requirements
- Experience or Track Record (Firm and Key Personnel Experienced)
- Capability (Organization and Financing)

2) Selection of the Contractor

Prebid Conference

A prebid conference shall be conducted by DPWH to clarify the scope of work, bidding documents, bid evaluation procedures, contract terms and conditions, and any other matter.

Bid Evaluation

The evaluation of bids will be in two stages. The first is the evaluation of the Feasibility Study, including Preliminary Engineering Design.

The second stage is the evaluation of the bid amounts.

3) Contract Terms and Conditions

The contract terms and conditions shall consist of the following, among others.

- Obligations and Authorities of BOT Contractor
  - Franchise
  - Financing
  - Detailed Engineering Design

- Construction
- Operation
- Maintenance
- Toll/Fees/Rentals/Charges
- Revenue Sharing

- Obligations and Authorities of DPWH

  - Grant of Franchise
  - Approval of Detailed Engineering Design
  - Approval of Tolls/Fees/Rental/Charges
  - Provision of Right-of-Way and Other Facilities
  - Project Supervision
  - Audit of Collection

(3) Construction Stage

The construction stage includes preparation of detailed engineering design by the contractor. This task shall be done by a separate professional consultant subject to the approval of the Government. It is preferable that an Independent Design Checker shall be engaged.

The BOT contractor shall be responsible for the selection of the construction contractor. The Government will qualify the BOT contractor during the prequalification of tender.

The Government shall exercise technical supervision over the project activities of "the contracts" to inspect and check whether the project is constructed in accordance with the plans and specifications. It is recommended that Independent Certificate Engineer shall be employed.

The Contractor shall build the facility in accordance with the minimum design and performance standards and specifications.

(4) Operation Stage

The Government shall inspect and check whether the project is operated and maintained in accordance with the plans, specifications, standards and costs approved by the Government. The Government shall approve the fairness and equity of the tolls.

The contractor shall operate the facility in order to provide the desired outputs in accordance with the agreed conditions.

(5) Transfer Stage

During the lifetime of the franchise, the contractor shall undertake the necessary maintenance and repair of the facility in accordance with the conditions prescribed in the contract, so that at the end of the contract period the facility can be turned over to the Government in an orderly fashion.

CHAPTER 12

RECOMMENDATIONS

CHAPTER 12

RECOMMENDATIONS

12.1 IMPLEMENTATION STRATEGY

Whether the project is to be implemented by the BOT or by the Public Corporation or by the Government is one of the most important decisions to be made by the Government at the earliest possible time.

As the project requires huge amount of investment, the private sector's participation in funding the project is one of the ways to implement the Project in order to reduce the Government's financial burden. The project should be advertised as the BOT or BT project to select an interested consortium in accordance with the BOT Law and its Implementation Rules and Regulations, utilizing materials of this feasibility study.

However, as this report suggests, the financial viability is not expected so high to recover the investment when the project is financed only by the private sector. Therefore, negotiation with a consortium would be tough and take long time, as a consortium would propose various terms and conditions to hedge various risks. Judgment on prospect of negotiation would be made as early as possible so as not to delay the project.

While inviting the private sector for participation in the Project, the Government should start to create the public corporation which can implement, operate and manage MMUES. The public corporation should be given a function to supervise and manage the private sector participants. In case that the private sector participation could not be successful, the project can be immediately implemented by the public corporation.

12.2 ROW ACQUISITION

Many road projects in Metro Manila are encountering road right-of-way acquisition problems, resulting in suspension of implementation or prolonged implementation. First Stage expressways involves extensive right-of-way acquisition at certain sections and at all interchange sites where commercial, residential and industrial facilities are built up. To realize smooth and successful implementation of the project, drastic measures must be taken and some new methods must be experimented.

There are two kinds of issues, i.e., land purchase issues and squatter issues.

1) Land Purchase Issue

The Government organized the Presidential Task Force on Right-of-Way Acquisition (TF-ROWA) in February, 1993 and basic policies were set as follows:

- Adequate negotiations with land owner/occupant
- Purchase price should be reasonable (current market price)
- Expropriation as last option for land acquisition

Previously, one of the most common complaint was about the purchase price which was regarded as very low compared with prevailing market value. New policy to purchase land at current market value will make land acquisition much easier.

Another critical problem on the part of affected families and business owners is that they are unable to locate or afford comparable living or commercial space. Most of them wish to find the place proximity to the present one.

The Government should make additional efforts to arrange relocation sites as well for affected families and business owners, and provide them long term soft loans for additional costs encountered in relation to moving and building new houses or business facilities.

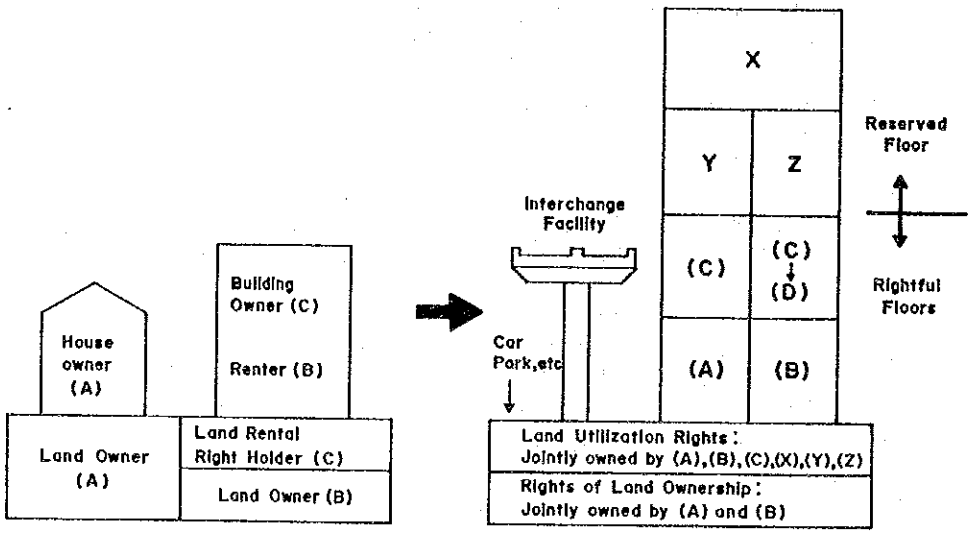
For this particular project, the following new approaches should be experimented:

Combined Development of an Expressway and Relocation Facilities

An expressway is elevated, and space under an expressway can be utilized, therefore, combined development of an expressway and relocation facilities with proper fire protection measures should be planned. If necessary, an expressway can be raised further to accommodate relocation facilities. Thus, affected families and business owners can be provided with the relocation sites proximity to the present place. This method can be applicable for those expressway sections where the right-of-way is newly acquired. Joint effort of DPWH and probably National Housing Authority (NHA) will be required.

Urban Redevelopment Scheme at Interchange Sites

Proposed interchange sites are mostly located at the commercial areas, however, buildings are still low at 2 to 3 stories. Interchange sites can be redeveloped with the participation of the private sector. Conceptual illustration of this scheme is shown in Figure 12.2.1. The Government will provide subsidy or loans to the private sector, so that the private sector is encouraged to undertake this kind of development.



< Rights Conversion System >

FIGURE 12.2.1 CONCEPT OF URBAN REDEVELOPMENT SCHEME

Factories/Warehouses

When factories or warehouses are affected, one of the possible solution is to raise, vertical elevation of an expressway and the space under an expressway is to be reserved untouched for factory/warehouse operation. Substructure locations must be so selected that factory/warehouse operation is not affected. In this case, the right to utilize space over a factory/warehouse will be negotiated.

2) Squatter Issue

As a rule, prior to eviction of squatters and demolition of shanties, a relocation site is prepared by the Government for squatters. However, a relocation site is usually far from the place where they are settling as well as employment place so they often come back to the same place and become squatters again.

For this project, many squatters in the PNR right-of-way are affected. One of the possible solution is maybe to utilize the 30-meter PNR right-of-way for multiple purposes, i.e., 10-meter for exclusive use for PNR, 8 to 10-meters for low cost housing for squatters and another tenants, the second level for future PNR viaduct and the third level for an expressway

12.3 AT-GRADE ROAD DEVELOPMENT

The planned at-grade road development projects shall be timely implemented well ahead of implementation of expressway projects. At-grade roads which are not yet developed, however, over which expressways are proposed to be constructed shall be given high priority. These roads are important by themselves to complete the major road network in Metro Manila and listed below:

- Missing sections of C-2, C-3 and C-5
- Widening of R-10

Major roads are extremely scarce in the areas outside EDSA. Additional distributor roads should be constructed not only to support rapid urbanization in these areas but also to make MMUES more efficient. However, no plan for these roads is formulated yet. Additional distributor roads which should be studied urgently are as follows:

In the southern area

- a north-south direction road located inbetween R-1 Extension and South Luzon Expressway (of which right-of-way will be utilized by Expressway Route R-2)
- an east-west road which will be connected with Bicutan I/C and Ninoy Aquino Avenue or Multinational Avenue
- widening of Alabang-Zapote Road
- a road which connects Nichols-Mckinley Road, C-5 and C-6 in Taguig

In the eastern area

- an east-west direction road inbetween Ortigas Avenue Extension and Marcos Highway
- a road which connects C-5 with Marcos Highway in a short distance

In the northern area

- a road which provides access to Marikina
- a road which serves as an alternative route of Quirino Highway

12.4 COORDINATION WITH OTHER AGENCIES

The project must be implemented with close coordination with other agencies concerned. Some of the important matters to be coordinated are as follows:

Philippine National Railway (PNR): Some sections of Expressway Route C-3 and Route R-3 will be constructed within the right-of-way of PNR. DPWH shall discuss with PNR regarding the manners of utilization of PNR's right-of-way as well as terms and conditions and the agreement between two agencies should be reached as soon as possible.

Department of Transportation and Communication (DOTC): DOTC is currently studying possible LRT lines for future construction. Future LRT lines should be planned in due consideration of MMUES. Proper coordination between DPWH and DOTC should be maintained, so that different modes of transportation are systematically integrated and developed harmoniously to provide efficient transportation network for Metro Manila.

Local Government Units (LGUs): DPWH should officially inform the proposed alignment of expressways to respective LGUs, so that LGUs can amend zoning ordinance along the proposed expressway alignment and effectively control any development within the expressway right-of-way.

Relocation of squatters should be implemented in close coordination between DPWH and respective LGUs.

National and Local Traffic Police: During the construction stage, the traffic re-routing plan is to be formulated and must be implemented properly with active cooperation of national and local traffic police.

Prior to operation of an expressway, the expressway patrol group should be organized to enforce traffic routes and regulations on expressways.

Department of Environmental and Natural Resources (DENR): During construction and operation, environmental impacts should be closely monitored and, whenever necessary, additional measures to mitigate adverse environmental impacts should be introduced.

12.5 TOLL RATE AND MEASURES TO INCREASE REVENUE

As the Project was justified economically feasible, toll rate will be decided focusing on financial viewpoint and other factors such as the government policies on transportation, fare rates of public transport modes, reaction of citizens and political considerations.

As the financial viability of the Project is not so favorable, all necessary measures to *increase revenue should be planned as follows:*

- Development of commercial/residential facilities for lease under available space of expressways
- Re-development of interchange sites in cooperation with the private sector
- Construction of related roads to an expressway to be entrusted by the national and/or local governments utilizing the existing human resources
- Posting of advertisements

12.6 REVENUE POOLING SYSTEM FOR REPAYMENT

There are two kinds of system for repayment of debt. One is the individual expressway route based system, wherein revenue from a certain expressway route is used for repayment of debt of the said route only, but not for any other routes. As soon as repayment of the said route is completed, it will be operated as a toll-free expressway. The other is so-called the "Revenue Pooling System", wherein revenue from all expressway routes, which are forming one system of expressway network, is pooled and repayment of debt of respective route is made from the pooled revenue.

Disadvantages of the individual route based system are as follows:

- Implementation of less profitable routes would be delayed, or would not be realized, although these routes are highly desired to be constructed from the viewpoints of forming an effective expressway network as well as promoting and guiding sound urban expansion.
- Urban expressways will be expanded year by year while forming a single network. The routes constructed earlier would have lower tolls and would become toll-free sooner in the shorter period than those constructed later. This implies a mixture of different tolls and a mixture of toll and toll-free routes within a single unit of a network, which results in inconvenience for expressway users and much difficult operation of expressways

The individual route based system is applicable to those roads which are independently functioning. Whereas, MMUES forms a network and routes comprising of MMUES are inter-related and is to be developed in three stages in a time span of about 19 years, therefore, *the Revenue Pooling System should be adopted to assure smooth traffic flow, consistent* tolls, convenience for expressway users and the steady development of envisioned expressway network.

12.7 SOME EXAMPLES OF UTILIZATION OF SPACE UNDER EXPRESSWAYS

Spaces under expressways should be positively utilized. As of 1988, Metropolitan Expressway Public Corporation (MEPC), Japan, opened 200.9 km of expressways, 36 km under which were available for utilization amounting to about 650,000 sq. meters in land area and utilized the following purposes:

Utilization of Space Under Expressway	% Share
Managed by MEPC	
• For Expressway Management Facilities	20.5
• For Pay Parking Space	3.7
• For Commercial Facilities leased to previous land owners/business operators	1.0
• Others	36.4
Managed by Other Agencies	
• Parks	11.1
• Public Facilities	4.4
• Public Parking Space	15.6
• Others	7.3

SOURCE: 30-Year History of MEPC

MMUES is mostly built as elevated structures, and most of spaces under expressways are used for traffic lanes of at-grade roads or on/off ramps. However, space under expressways of the following sections can be available for other purposes and should be effectively utilized:

Purposes of Utilization	Candidate Sections
• For purposes of: - Expressway Management Facilities - Parking Space - Parks - Community Centers - Playground	• Expressway Route C-3 from Route R-6 Interchange to R-7 Interchange • Expressway Route R-3 from Quirino Ave. to EDSA • Expressway Route R-7 from Araneta Ave. to EDSA • Expressway Route R-10 from Moriones Ave. to C-3
• For commercial or residential facilities for those who are affected by this project	• Those section which will be built in newly acquired right-of-way such as the section from R-4 Interchange to R-6 Interchange of Expressway Route C-3 and the section from Route C-3 Interchange to Pasig River of Expressway Route R-4