CHAPTER 9

URBAN EXPRESSWAY IMPLEMENTATION AND RECOMMENDATIONS

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9.1 IMPLEMENTATION PLAN

1) DPWH's Plan of Project Implementation Closely Related to Expressways

DPWH is currently placing high priority on opening up of an at-grade C-5. C-5 segments and its related roads are under various implementation stages as shown in Figure 9.1.2. Three (3) segments of C-5 and a section of R-10 from C-4 to C-5 are proposed to be implemented by BOT scheme, which means that these will be constructed as access controlled toll roads. If so constructed, all of these can constitute parts of Metro Manila Urban Expressway System.

All these segments proposed for BOT projects are included in the second or third stage of MMUES, however, as soon as BOT agreement is reached, these can be implemented simultaneously or even ahead of the first stage of MMUES.

2) Implementation Scenario

As discussed 1) above, some segments of MMUES are proposed for BOT projects, however, implementation of these by BOT scheme is not guaranteed yet at this moment, thus two (2) implementation scenarios were prepared as follows:

Scenario-1: Implementation by the Government

All MMUES projects will be implemented by the Government through DPWH or a new body attached to the Government in accordance with proposed stages (See Figure 9.1.1).

First Implementation Package

First Stage of MMUES: about 60 kms.

Second Implementation Package

Second Stage of MMUES: about 66 kms.

Third Implementation Package

Third Stage of MMUES: about 70 kms.
and Metro Manila Tollway
by PNCC

Scenario-2: Implementation by the Government and the private sector

This scenario assumes that projects mentioned in 1) above are implemented by BOT scheme as planned and the rest of MMUES projects are implemented by the Government or a new body attached to the Government. Under this scenario, implementation packages are as follows (See Figure 9.1.2):

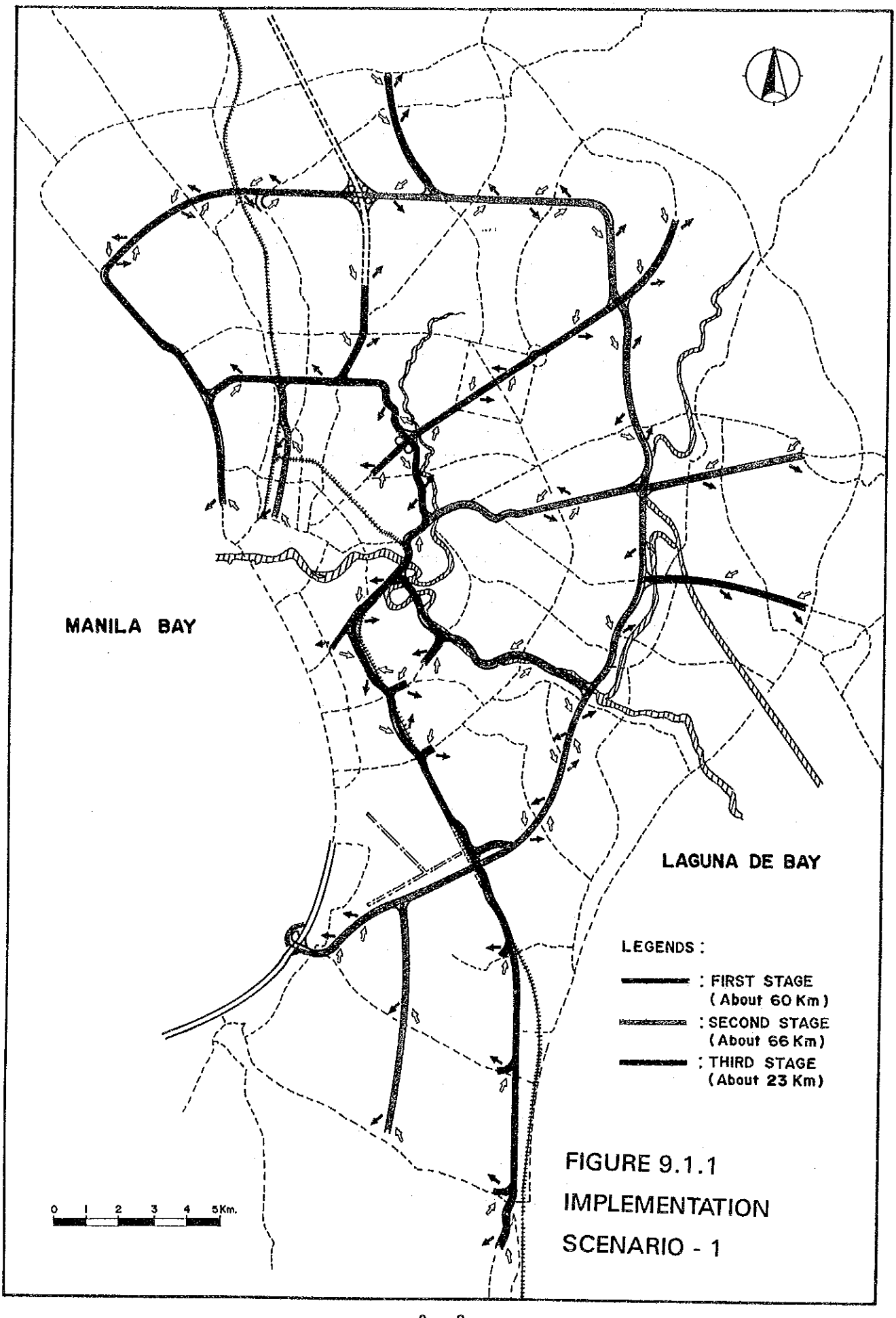
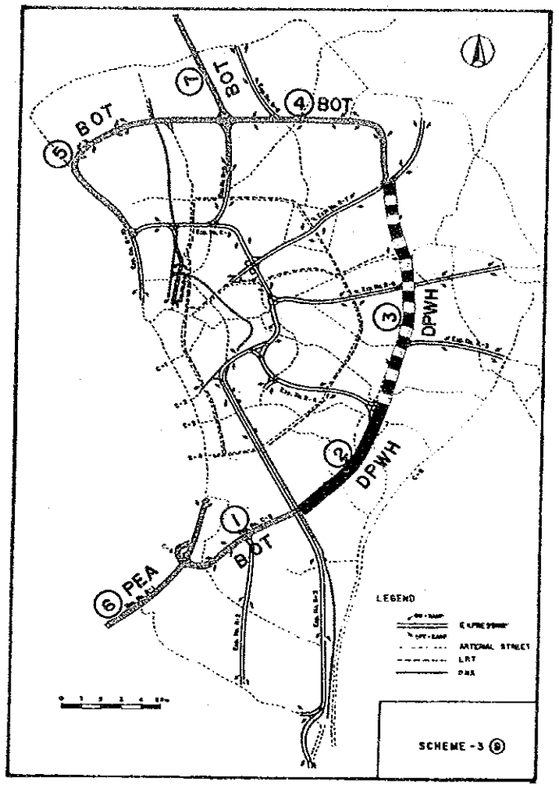


FIGURE 9.1.1
IMPLEMENTATION
SCENARIO - 1

FIGURE 9.1.2 IMPLEMENTATION SCENARIO - 2

DPWH's SCENARIO FOR C-5 AND ITS RELATED ROADS DEVELOPMENT



C - 5

① From R-1 Ext. to SLE by BOT (Mostly at-grade with access control)

② From SLE to R-4 by DPWH with OECF assistance of which construction is on-going with partially access controled standard.

③ From R-4 to Commonwealth Ave. by DPWH. Existing at-grade road is to be widened to an access-free 6-lane divided road.

④ From Commonwealth Ave. to NLE by BOT (at-grade with grade-separation at intersections and across controlled)

⑤ From NLE to R-10 and R-10 section from C-4 to C-5 by BOT (same standard as ④ above)

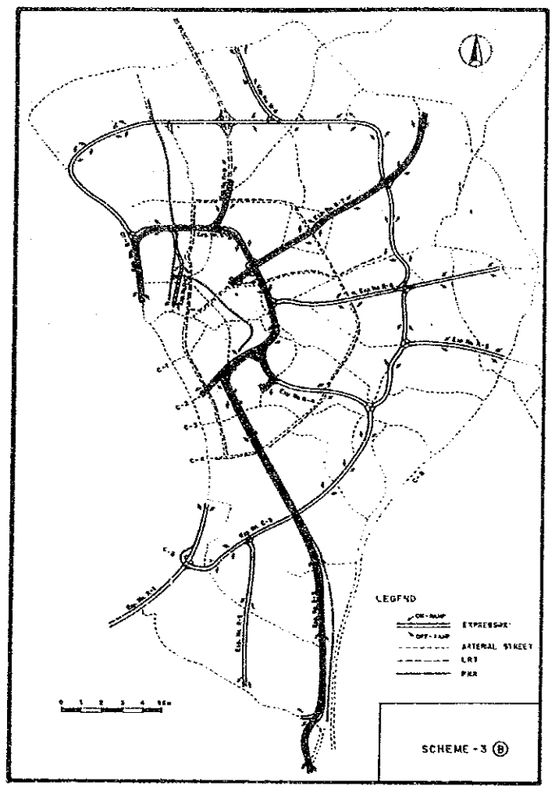
R-1 Extension

⑥ To be converted to a toll road by PEA

NLE

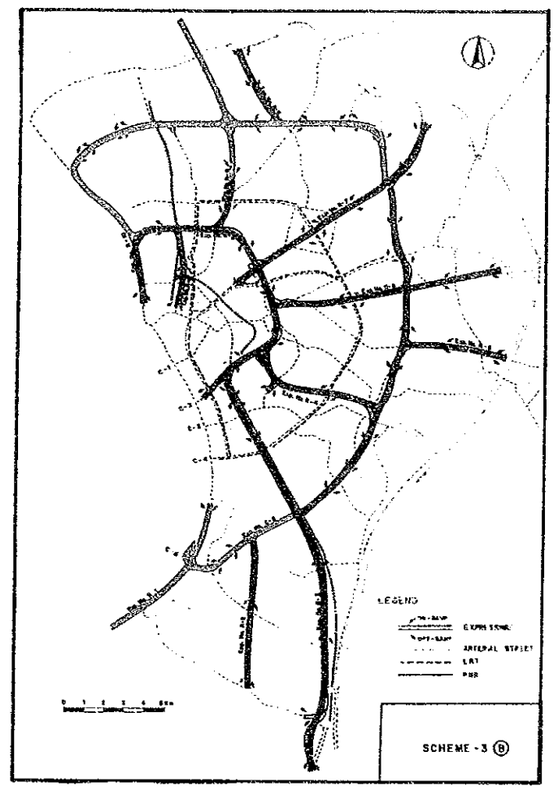
⑦ Existing NLE to be improved and widened by BOT

METRO MANILA URBAN EXPRESSWAY SYSTEM
— FIRST STAGE —



- First Stage of Metro Manila Urban Expressway System to be implemented by DPWH or new body attached to the Government (Toll Authority or Expressway Public Corporation, or Such) as a foreign assisted project.

IMPLEMENTATION SCENARIO - 2



First Implementation Package

- First Stage of Metro Manila Urban Expressway System (▬▬)
- C-5 and its Related Roads (▬▬)

Second Implementation Package (▬▬)

- Conversion of a Section from SLE to R-4 into a full access-controlled expressway.
- Construction of an Elevated Expressway along C-5 from R-4 to Commonwealth Ave.
- Construction of Remaining Radial Expressways.

Third Implementation Package (▬▬)

- Metro Manila Tollway and its Connections.

First Implementation Package (about 91 km)

- First stage of MMUES by the Government
- Part of C-5 and its related roads by BOT

Second Implementation Package (about 59 km)

- Remaining radial expressways of MMUES
- Conversion of a C-5 section from SLE to R-4 into a full access controlled expressway
- Construction of an elevated expressway along C-5 from R-4 to Commonwealth Ave.

Third Implementation Package (about 46 km)

- Metro Manila Tollway (by PNCC)

3) Implementation Schedule

Intensive investment and fast track construction will be required to complete MMUES, as most expressways are proposed to be constructed over existing major roads and period for traffic disturbance must be minimized. Present level of investment for highway sector in Metro Manila must be drastically increased. Implementation schedule was prepared on the basis of that average investment for this project be about 3.0 billion pesos per year and completion of MMUES be within about 20 years or by 2012.

Overall implementation schedule for scenario-1 and scenario-2 is presented in Figure 9.1.3 and Figure 9.1.4, respectively. Outline of implementattion schedule is as follows:

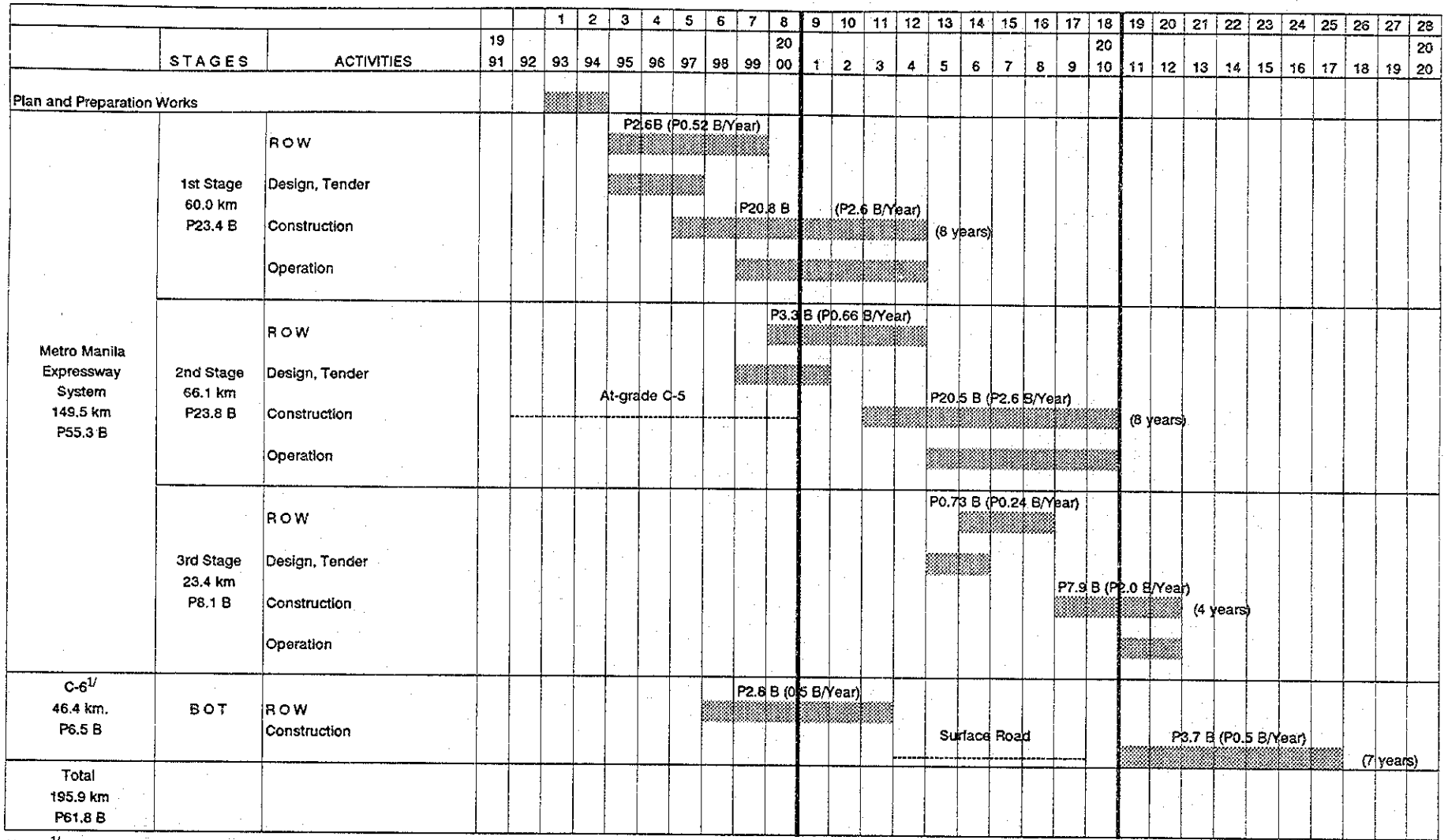
Scenario-1

- Completion of First Stage : year 2004
- Completion of Second Stage : year 2010
- Completion of Third Stage : year 2012
- Investment Requirement : Average 3.1 billion pesos per year for 18 years

Scenario-2

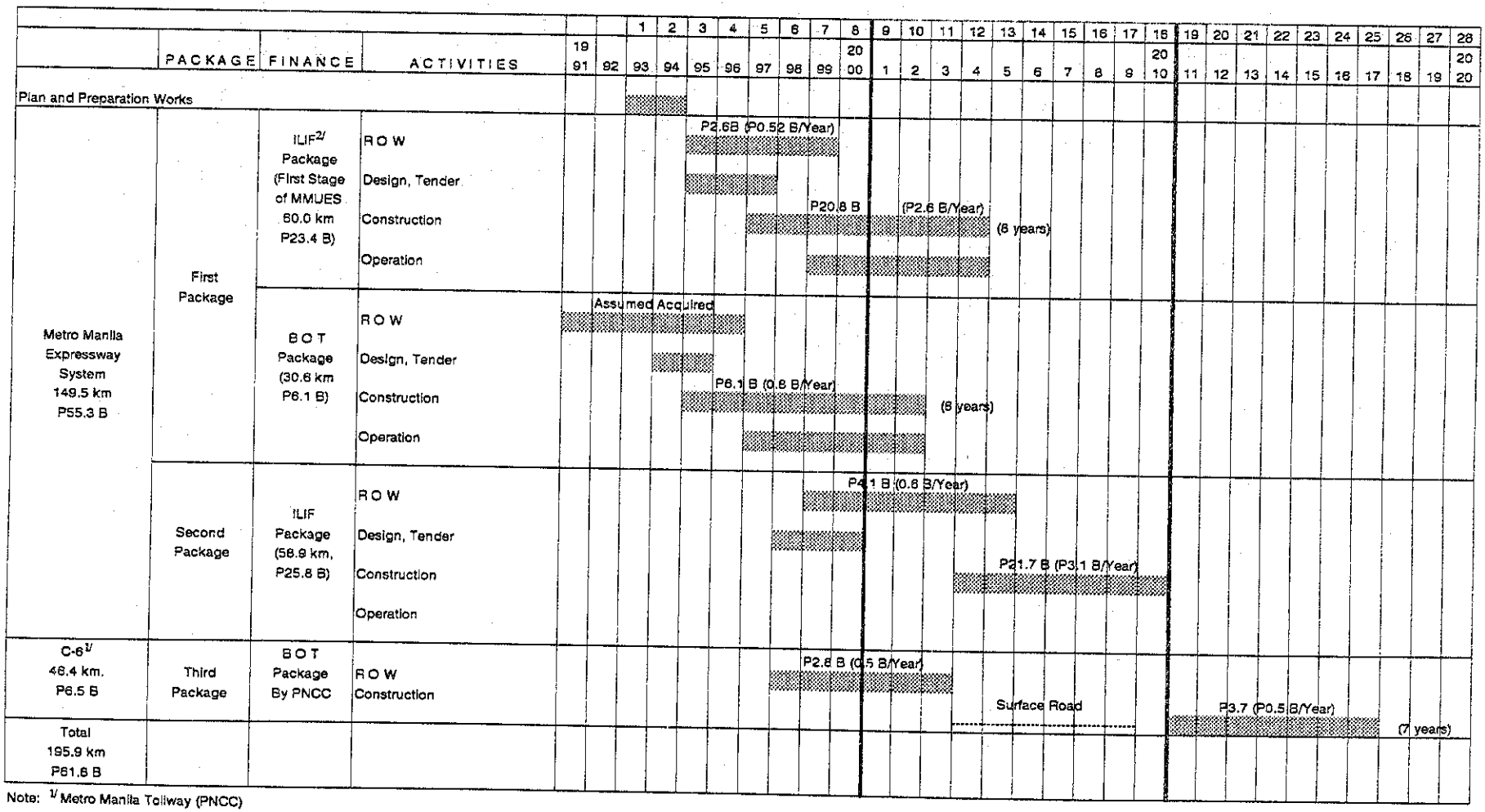
- Completion of First Package : year 2004
- Completion of Second Package : year 2010
- Investment requirement (excluding BOT portion) : Average 3.1 billion pesos per year for 16 years

FIGURE 9.1.3 OVERALL IMPLEMENTATION SCHEDULE
(SCENARIO-1)



Note: 1/ Metro Manila Tollway (PNCC)

FIGURE 9.1.4 OVERALL IMPLEMENTATION SCHEDULE
(SCENARIO-2)



Note: 1/ Metro Manila Tollway (PNCC)

2/ ILIF: International Lending Institution Finance

9.2 FINANCING

Financing structure relevant to the MMUES involves three alternatives; public sector funding, private sector funding and combined public/private sector funding which are briefly explained as follows:

1) Public Sector Funding

Public funding can be provided from general taxation, from specific taxation, from general borrowing or from specific borrowing. Of which the specific borrowing is slightly different insofar as it implies that the borrowing is secured against the revenue stream available from the facility, though underwritten by government in some form.

2) Private Sector Funding

If a project is to be funded completely in the private sector it implies that no guarantees of any sort, either implicit or explicit, are available from the public sector. Generally the public sector will be involved in as much as the permission for concession to construct and operate a facility would normally be granted by a public sector body who would also normally lay down certain requirements to be met by the concessionaire.

The provider of a true sector facility is likely to obtain funding from a variety of sources. The three main categories are equity, bonds and loans. The proportions of each are likely to vary during the construction and operating periods; for example, in the first instance, it may be necessary to provide a high proportion of equity finance and start the project with a low debt/equity ratio unless loans can be guaranteed by suitable parent companies or other guarantors. It is likely that bonds would be issued during the construction period of a facility, unless guaranteed, but once a facility is operating, bonds could be used to refiance bank loans. Refinancing is always likely to be a requirement in any toll infrastructure facility since amortization of loans is unlikely to be achieved within the normal term of bank (which is generally less than twelve years).

The most difficult element in any private financing structure is likely to be the provision of sufficient equity or guarantees. In the absence of a true owner for the facility, non recourse bank lending i.e. loans not backed by another party such as the government can be utilized, but in practice true non recourse bank loans, particularly for infrastructure projects, are both rare and difficult.

3) Combined Public/Private Sector Funding

As mentioned above, pure private sector funding for infrastructure projects is very rare and generally there exists in any funding package for an infrastructure project some degree of public sector, i.e. government, underwriting. This underwriting can take form of revenue support (guarantee of minimum traffic levels), or funding guarantees, either or interest or capital or both, and is necessary to make operation of a facility feasible at an acceptable toll rate.

The mix of financing instruments between the public and private sectors can be very diverse where private and public sector capital coexist at varying proportions, according to the rules of private enterprise. The different

sectors require bank loans or borrowing from the financial markets with a public guarantee.

The funding instruments available for use in a public/private sector funding package still fall within the three classifications of equity, loans and bonds. However, given some form of public sector underwriting, the mix of financial instruments could be substantially different from a purely private situation.

In Japan, public/private financing has been a popular practice and is becoming common place in the US.

9.3 IMPLEMENTATION ORGANIZATION

1) Executing Body

Several types of body for implementing and operating MMUES can be considered as follows:

a) The Government through DPWH

A special Bureau will be created in DPWH. The Bureau implements and operates MMUES either by itself or by contract.

b) A New Body attached to the Government

A new body such as "Metro Manila Expressway Authority" will be created which implements and operates MMUES either by itself or by contract. It will be attached to and under the control of DPWH.

c) Private Sector

A part of MMUES will be implemented by BOT Scheme. A single or several concessionaries may be employed.

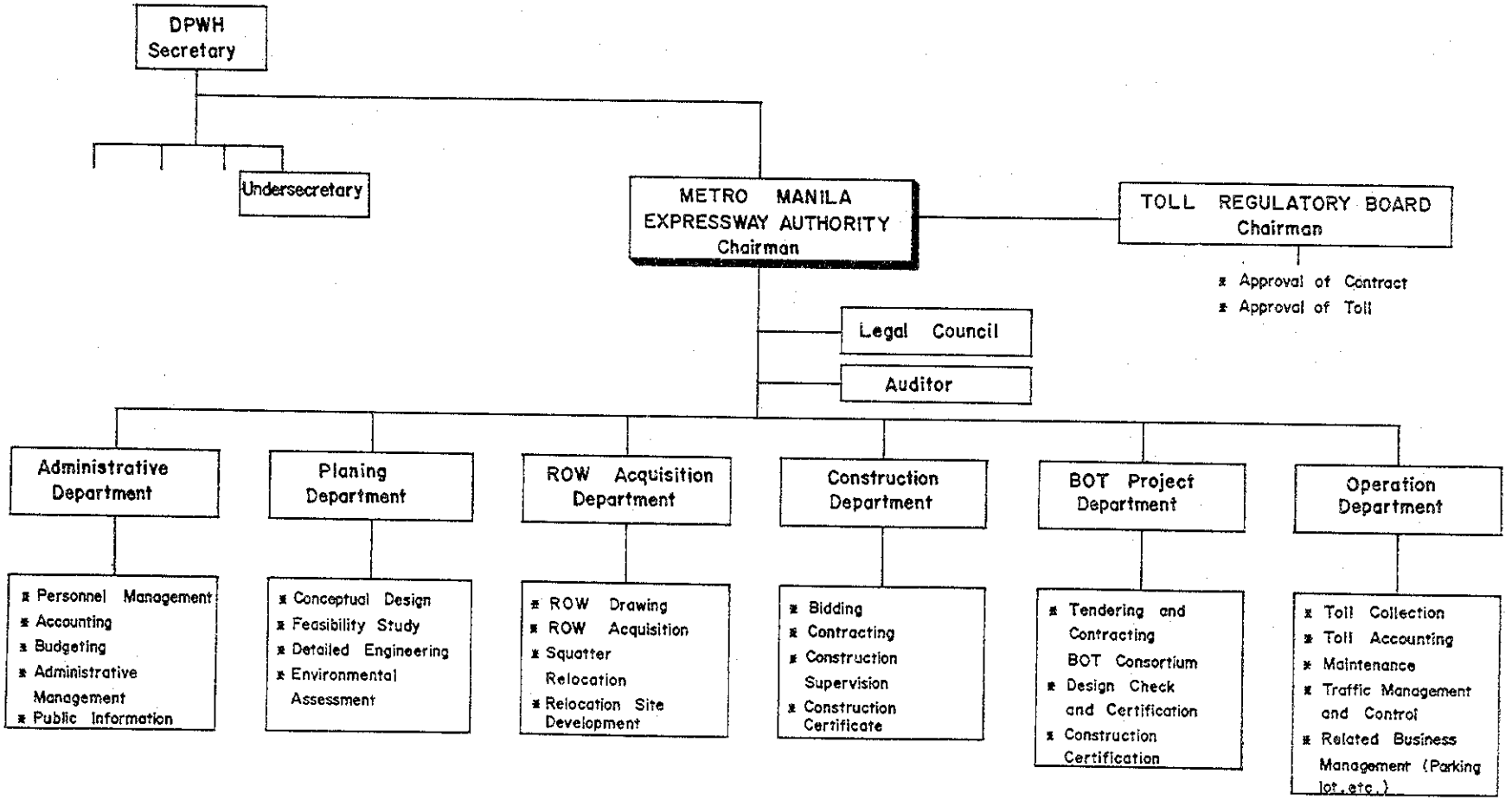
Considering the magnitude of capital investment required for MMUES, funds must be prepared from various sources such as the Government, local governments, international lending institutions as well as the private sector. Therefore, several operators may have to involve in MMUES operation. From the viewpoints of raising funds, realizing uniform operation and efficient traffic management and control, a single body attached to the Government should preferably be created to supervise and control several operators, which may be tentatively named "Metro Manila Expressway Authority".

2) Proposed Organization of Metro Manila Expressway Authority

Metro Manila Expressway Authority (MMEA) would be attached to DPWH. MMEA will implement and operate major portion of MMUES by itself and concurrently supervise and control BOT consortiums' implementation and operation.

MMEA should have an organization as follows: (See Figure 9.3.1):

- Legal Council: All issues related to legal matters will be studied and concluded, particularly terms and conditions proposed by BOT consortium.
- Auditor: Auditing of MMEA business itself as well as checking of BOT consortiums' financial statements.
- Administrative Department
- Planning Department: prepares conceptual design, feasibility studies, preliminary design based on which BOT consortiums submit their proposal, detailed design of segments to be implemented by MMEA and establish design standards to be uniformly adopted for MMUES.



Note : Metro Manila Expressway Authority ---- Tentative name only

FIGURE 9.3.1 PROPOSED ORGANIZATION FOR METRO MANILA EXPRESSWAY AUTHORITY

- ROW Acquisition Department: prepares ROW drawing and acquires ROW including BOT segments, develops squatter relocation sites and relocates squatters.

- Construction Department: responsible for construction of segments to be implemented by MMEA. Selects contractors, supervises contractors work and issue construction certificates.

- BOT Project Department: Responsible for selection of BOT consortium, review of detailed design prepared by BOT consortium and final inspection of completed work to issue construction certificates.

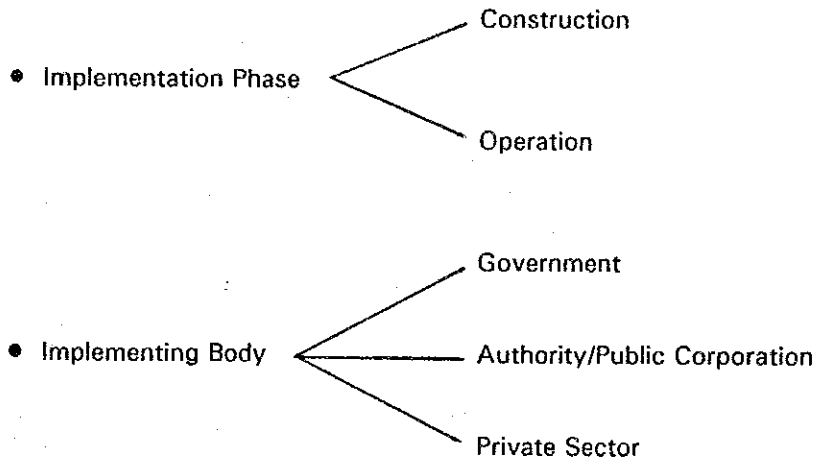
- Operation Department: Responsible for toll collection, toll accounting, maintenance, traffic management and control, traffic safety, related business management such as parking lot operation under an expressway, etc, and all other matters related to operation.

9.4 INSTITUTIONAL ARRANGEMENT

Institutional aspects relevant to the effective implementation of the MMUES are broadly at following two phases:

(a) Urban Planning Phase: Absence of effective statutory basis to sustain urban plans makes it difficult not only to secure alignments and necessary ROW of the MMUES but also integrated transport/urban development. As the MMUES is considered to be a key infrastructure which affect future landuse of Metro Manila, a statutory framework for controlled/coordinated urban development is critically needed.

(b) Project Implementation Phase: If the MMUES is to be implemented on a private or private/public venture. Institutional framework for development of the MMUES has to be clarified.



The main disadvantage of relying on the conventional 100% government funding is its dependence on the national budget. In the short to medium term horizon, the project is unlikely to be built on the basis of 100% public funding considering that the Government already suffers from severe fiscal constraints, and even if such an amount can be raised, the allocation of a huge chunk of the infrastructure budget for an urban expressway which would benefit urban motorists may not be politically defensible.

The second approach involving substantial or full government participation is the creation of a tollway authority. This option suffers from the main disadvantage of the conventional public works undertaking, i.e., does not address the budget deficit. Moreover, this would entail congressional action and runs counter to the current policy of reducing the bureaucracy. Its main attraction lies in the potential long-term profits which could be earned by the government.

The third mode of implementation falls under the general heading of BOT. In the Philippine context, the BOT climate is somewhat mixed. The market is foreseen to be strong with many alternative projects in different sectors and a dominant private sector. But the climate is clouded by the high (in excess of 15% p.a.) interest rates on domestic loans and high inflation, two factors which deter investments with long payback periods. The local capital market is relatively thin and many still be incapable of supporting the financing requirements of large projects.

9.5 SUMMARY OF FINDINGS AND RECOMMENDATIONS

On the basis of the analysis and assessment made on the recommended Metro Manila Urban Expressway System (MMUES), the findings and recommendation are summarized as follows.

(1) Urban Expressway Network

- MMUES composing of two (2) circumferential expressways (C-3 and C-5) and eleven (11) radial expressways is recommended with favorable assessment in the aspects of better conformity to future private transport demand, salutary impact on at-grade roads traffic and cost effectiveness, though a little inferior in revitalization of Manila CBD.

- MMUES involves about 150 kms. of expressways with 17 interchanges, 11 entrances and exits, 47 on-ramp and 51 off-ramps.

- Total length of the proposed expressways in Metro Manila is about 196 kms. including 46 kms. of Metro Manila Tollway (C-6) to be implemented by PNCC.

(2) Overall Effects of MMUES

- The project would encourage the desired urban development along north-south directions. The conventional radial-circumferential major roads network will be effectively integrated with the expressways with north/south ladder pattern.

- The inner north-south axis of expressway relieve the congested inner areas and SSH corridor, and provide vital links between north and south intercity expressways, between international port airport and industrial centres. The inner axis is expected more to strengthen the existing urban and transport function of Metro Manila.

- The outer axis, on the other hand, intends more to encourage effective urban development in the areas outside EDSA where suburbanization has been in rapid progress with insufficient transport infrastructure. As EDSA functions as a strong urban development axis, future Metro Manila requires a similar strong transport infrastructure where development of new urban centers is encouraged.

(3) Economic Evaluation

- The first year benefit of Stage I will exceed the annual average project cost around year 2000 and Stage II around year 2005 for the P10 toll situation. As toll level becomes higher, the benefits sharply decrease.

- From the economic viewpoint, the proposed expressways should not charge a toll of more than P10 for Stage I and 20 for Stage II, which should be implemented no earlier than late 1990's and late 2000s.

- The project is economically feasible, but its economic viability is considered less significant compared with that of at-grade major roads because of huge differences in construction costs.

(4) Financial Evaluation

- From the financial/viewpoint, the most profitable solution is to charge a toll of P20 for Stage I network and P30 for Stage II. Both stages would not be able to generate sufficient revenue to cover the project cost. Roughly about a half of the project cost can be covered by toll revenue.

- The project is difficult to be justified from financial viewpoint. Taking into account of that the size of the investment is large, expressway users are mostly private transport, its economic viability is less significant than that of at-grade roads, the project should be basically financed by itself with minimal financial commitment of the Government.

- Financial viability of the project (when it is assumed that the project cost is to be more or less covered by toll revenue) is greatly affected by congestions on at-grade roads and time value of road users, because the key factor that expressways attract the traffic is faster travel time. Present Metro Manila situation does not warrant attractive expressway patronage at toll rate which is sufficient to cover the investment.

(5) Traffic Impact

- The overall private transport demand on Metro Manila is estimated to be 2.7 and 3.7 million pcu per day, while an expected expressway traffic is 130 and 350 thousand pcu per day at P10 toll for year 2000 and 2010, respectively.

- For year 2000, Stage I network (60 kms) will be effectively utilized with 70 thousand pcu per day in a critical section and 30 to 40 thousand in most sections. For year 2010, Stage II network (60 plus 66 kms.) will attract similar traffic volume of Stage I. Further expansion of network toward the outskirt would not be justifiable before year 2010.

- The impact are significant on the at-grade roads in the corridors where expressways will be built, particularly South Super Highway, C-2, Quezon Avenue, southern section of C-5, including radial roads such as A. Bonifacio, E. Rodrigues, Shaw Boulevard etc. However, traffic on most sections of EDSA (C-4) would not be lessened due to traffic destination located along EDSA and expected increase of local traffic alongside EDSA.

- It is noted that construction of planned at-grade road projects is in urgent need, therefore shall be timely pursued so that even implementation of toll expressways could be delayed. These projects include C-3, C-5, R-2 (Parañaque), R-6 (widening of Santolan Road), R-8 (Mindanao Avenue between C-5 and C-6), R-10, among others.

(6) Impact on Urban Development/Landuse

- MMUES will encourage urban development pattern of dispersed car-oriented suburban centers outside EDSA as a whole. In locality, urban reform near expressway ramps and access roads will be required to provide accessibilities.

- Stage I network will strengthen CBD function of the inner core area such as Manila and Makati and facilitate suburbanization towards the south (Paranaque, Muntinlupa) and north-east (Quezon).

- Stage II network will enhance development of suburban centers outside EDSA (Guadalupe Plateau, Calabarzon) where expressways will extend, and integrate these sub-centers to each other.

(7) Environmental Impact

- Although little adverse environmental impacts are expected from the project, rapid urbanization to be induced by expressway system may require coordination and integration of city development plans with the system to maximize the benefits of the project at local community level and to minimize adverse environmental impact.

- Total number of households affected by the project is roughly estimated to be 9,200, among which squatter is 5,500 (mostly South Super Highway and Pasig River). Private land acquisition will be mainly in the sites proposed for 17 interchanges and those areas needed for new routes and widening (mostly along R-2 and R-6).

- Right of way acquisition cost is roughly estimated to be P6.7 billion or 12% of total project cost.

(8) Engineering and Implementation Difficulty

- The elevated structure is proposed for the most section of expressways taking advantages of existing roadway spaces and to mitigate R.O.W. acquisition.

- No special structural problems will be expected except structural complexity where more than third level structures are inevitable. These includes about 10 kms strech of double deck structure (mostly along R-5 and R-6) and 6 kms of third level structure (mostly along R-3 and R-4).

- Among total length of 150 kms, of MMUES, sections requiring R.O.W. acquisition is roughly measured to be 23 kms. (mostly along R-2 and R-3) or 15% of the total. In these sections, implementation difficulty may be expected.

- The project cost is roughly estimated to be P55 billion, among which civil work cost is P49 billion or 88% of the total.

(9) Public Transportation Facilities on Expressway

- No special facilities for expressway bus services is considered although potential demand is expected for provincial and urban buses. Expressway bus service could encourage diversion from private car use.

- Jeepney services may be restricted from using expressways because of their short trip demand.

(10) Stage Development

- As MMUES requires huge amount of capital investment and the financial analysis reveals marginal viability in the early project implementation, three stages development plan is proposed.

- Stage 1 involves total length of 60 kms composing of C-3, R-3, R-7, R-9 and a part of R-4 and R-10 with the roughly estimated project cost of P23 billion, Stage II includes 66 kms of C-5, R-2, R-6 and part of R-4 with P24 billion, and Stage III, 23 kms. of R-5, R-8 and a part of C-5 and R-10 with 8 billion, totalling 150 kms with P55 billion.

- Aside from these, Metro Manila Tollway of 46 kms (C-6) may be implemented in a optimum timing which is presumed to be the simultaneous phase with Stage II or a little latter.

(11) Implementation Schedule

- The completion target of the project is proposed to be Year 2004, 2010 and 2012 for Stage I (60 km), Stage II (66 km) and Stage III, respectively.

- A portion of C-5 and R-10 planned as BOT Project by DPWH (31 kms.), but a part of Stage I and II is planned to be implemented at any time when BOT arrangement is concluded.

- Metro Manila Tollway (C-6) of 48 kms. is assumed to be implemented not earlier than Year 2010. However, at-grade road along this alignment is recommended to be implemented at the earliest possible time when R.O.W. acquisition is cleared.

(12) Financing

- The total project cost is roughly estimated to be P55 billion for 150 kms of MMUES, therefore, investment requirement is a little more than P3 billion per year for 16 to 18 years.

- Considering the intensive investment required for the project, the combined public/private sector funding system would be recommended.

- Private participation in form of BOT or similar shall be encouraged at the maximum extent providing that public interest is protected. The full utilization of soft loan from international lending institutions shall be positively pursued.

(13) Organization

- From viewpoints of raising funds required for MMUES, a single and exclusive body attached to the Government would be prefered to ensure uniform operation and efficient traffic management.

- A body shall be capable of planning, design and construction supervision and R.O.W. acquisition as well as BOT type project implementation.

- A body shall be responsible for preparing a basic plan which shall clearly show the basic concept of requirements including minimum level of facilities needed, major design elements, expected construction timing as well as minimum requirements for financial arrangements. Particularly for sections where private sector funding are planned, such basic plan shall be prepared so that interesting tenderers can offer their tender proposal based on the plan.

(14) Operation and Maintenance

- Expressways requires effective management of the system and facilities. Ineffectiveness in management would directly affect adversely safety, traffic efficiency, financial profile of expressways as well as the economy expected to be derived from the project.

- The flat rate system which is usually adopted for urban expressways is prefered because of minimum stopping time at toll booths, less number of toll collection facilities required and attraction of longer trip traffic.

(15) ROW Acquisition

- Relocation of households affected by the project is a significant social impact which can be traumatic for these affected. The effect of R.O.W. acquisition is mainly financial in view of the high cost of private land along commercial and residential areas affected.

- To ensure the smooth implementation of the project, a new and drastic system for R.O.W. acqusition shall be developed. For example, private land valuation for R.O.W. acquisition shall be based on prevailing market prices, and also the Government shall be solely responsible for arranging new relocation sites for these affected.

- It shall be noted that the construction cost of elevated expressway is considerably higher than R.O.W. acquisition cost even based on prevailing market prices, though pain of affected households can not be compensated.

(16) Improvement of At-Grade Roads

- The planned at-grade roads projects shall be timely implemented well ahead of construction of related expressways. Particularly these includes missing sections of C-2, C-3 and C-5, and additional distributor roads outside EDSA, among others.

- Construction of at-grade roads along R-2 and C-6 alignments is suggested. At least, proposed alignments shall be fixed and R.O.W. shall be acquired.

- Grade separations at intersections shall be designed to be compatible with proposed expressways.

APPENDICES

APPENDIX 5.2.1

IMPLEMENTATION SCHEDULE OF MAJOR ROADS

ON-GOING, COMMITTED AND PROPOSED ROAD PROJECTS

No. 1

ROAD NAME	CONTRACT PACKAGE	FUND SOURCE	LENGTH (KM)	COST (MP)	R O W (M)	STATUS	IMPLEMENTATION SCHEDULE
R-1	• Roxas/Buendia Flyover	Local Fund	0.425	82.0	-	48% Completed	
	• Roxas/EDSA Flyover	Local Fund	0.423	82.0	-	47% Completed	
	• Roxas/Seaside Flyover	Local Fund			-	(No Plan Yet)	
R-2	• Completed (No Project)						
R-3	• Completed (No Project)						
R-4	• Package A-3 From Kalayaan Avenue to C-5	OECF 14th Yen C-5/R-4 Project, Package A	2.4	122.0	30.0	50% Completed	
	• R-4 From C-5 To C-6				30.0	(No Plan Yet)	
R-5	• Shaw Boulevard Extension From Vargas Bridge To Manila-East Road in Taytay	Proposed for OECF Funding	7.3 km	180.1	40.0	D.E. Completed	
R-6	• Completed (No Project)						
R-7	• Completed (No Project)						
R-8	• Completed (No Project)						
R-9	• Completed (No Project)						
R-10	• Part of Package II From End of R-10 Phase I (Dagat-Dagatan Spine Road to C-4)	OECF 11th Year R-10 and its Related Roads Project	1.1	72.0	50.0	70.5% Completed	
	• R-10 Widening From C-1 to Dagat-Dagatan Spine Road	OECF 15th Yen MMUTP, Phase II	6.24	162.5	50.0	D.E. Completed	
	• R-10 From C-4 To C-5	(Proposed for BOT)			70.0	No Plan Yet	
	• R-10 From C-5 To C-6	(Proposed for BOT)			70.0	No Plan Yet	
C-1	• Completed (No Project)						
C-2	• Package III From R-10 To Vitas Bridge and From Vitas Bridge To Gov. Forbes Avenue	OECF 11th Yen R-10 And Its Related Projects	1.6	48.2	25.0 And 20.0	54.6% Completed	
C-3	• Package I From R-10 To A. Mabini Street	OECF 11th Yen R-10 And Its Related Projects	3.1	44.5	40.0	One Way Completed	
	• Package IV-B From A. Mabini Street To Rizal Avenue Extension	OECF 11th Yen R-10 And Its Related Projects	0.9	40.0	32.0 to 40.0	Contract Terminated To Be Done By Administration	
	• Segment 10 and II From Rizal Ave. Ext. To Araneta Ave.	OECF 13th Yen C-3 Project	2.4	78.9	32.0 to 40.0	35% Completed	

ON-GOING, COMMITTED AND PROPOSED ROAD PROJECTS

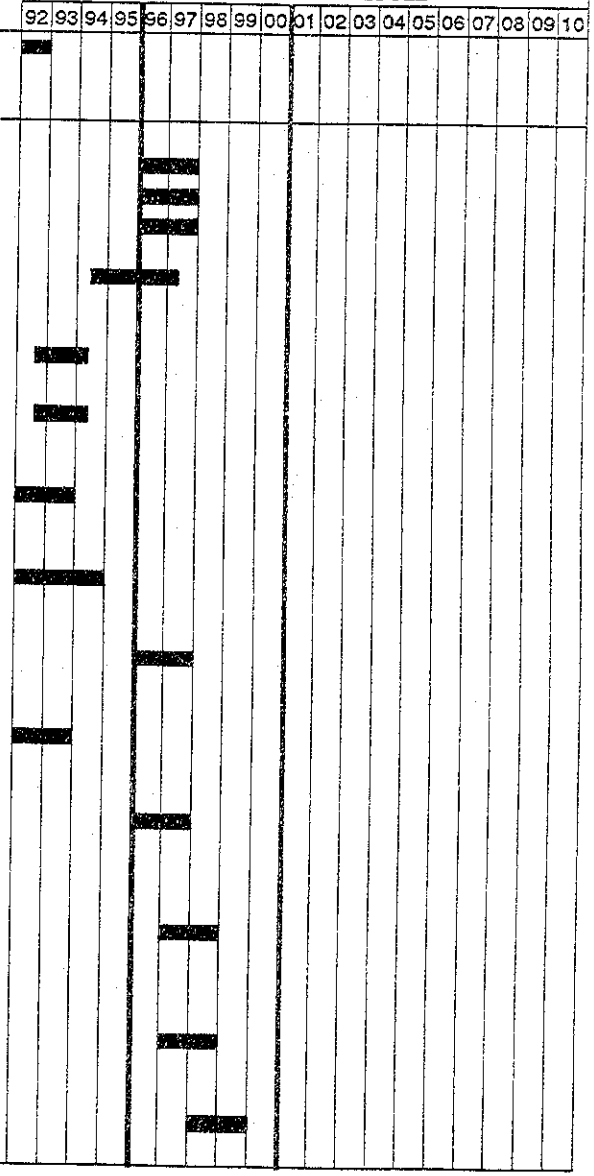
No. 2

ROAD NAME	CONTRACT PACKAGE	FUND SOURCE	LENGTH (KM)	COST (MP)	ROW (M)	STATUS	IMPLEMENTATION SCHEDULE 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10
C-3 (Continued)	• Segment 7, 8 and 9 From Segment Emilio Rivera To San Juan Bridge	OECF 13th Yen C-3 Project	4.7	85.0	32.0 to 40.0	Completed	
	• Segment 3, 4, 5 and 6 From San Juan Bridge to Gil Puyat Ave.	OECF 15th Yen MMUTP, Phase II	5.5	279	32.0 to 40.0	D.E. Completed	Segment 5
	Buendia Parallel Roads	IBRD 5th MMUTP, Phase I	3.0	32.6	20 36 12	Rebidded	
C-4	• Pasay Interchange	OECF 16th Yen Loan No. PH-P102		400	-	D.E. On-Going	
	• Ayala Interchange	(Local/OECF)			-	(No Plan Yet)	
	• R-4 Interchange	(Local/OECF)			-	(No Plan Yet)	
	• Boni Interchange	OECF 17th Yen (PH-P116)	0.425	89.7	-	Res. of Award For Approval Deferred Until After Elections	
	• Shaw Interchange	OECF 17th Yen (PH-P116)		235.0	-	Preq. For OECF Concurrence	
	• Santolan Interchange	Locally Funded	0.393	92.0	-	80% Completed	
	• P. Tuazon Underpass	Locally Funded	0.275	63.0	-	57% Completed	
	• Kamias/East/South Interchange	Locally Funded	0.710	243.0	-	66% Completed	
	• West/North Avenue Interchange					(No Plan Yet)	
	• Roosevelt Interchange					(No Plan Yet)	
	• C-4 (EDSA Extension) From R-1 (To Roxas) To R-2 (Taft Avenue)	Locally Funded	1.0	82.8	50 to 60	97% Completed	
	• Package IV-A, C-4 From Rizal Extension to Dagat-Dagatan	OECF 11th Yen (PH-P59)	1.9	48.0	32.0 to 40.0 (50.0)	Original Contract Terminated, And Rebidded	

ON-GOING, COMMITTED AND PROPOSED ROAD PROJECTS

No. 3

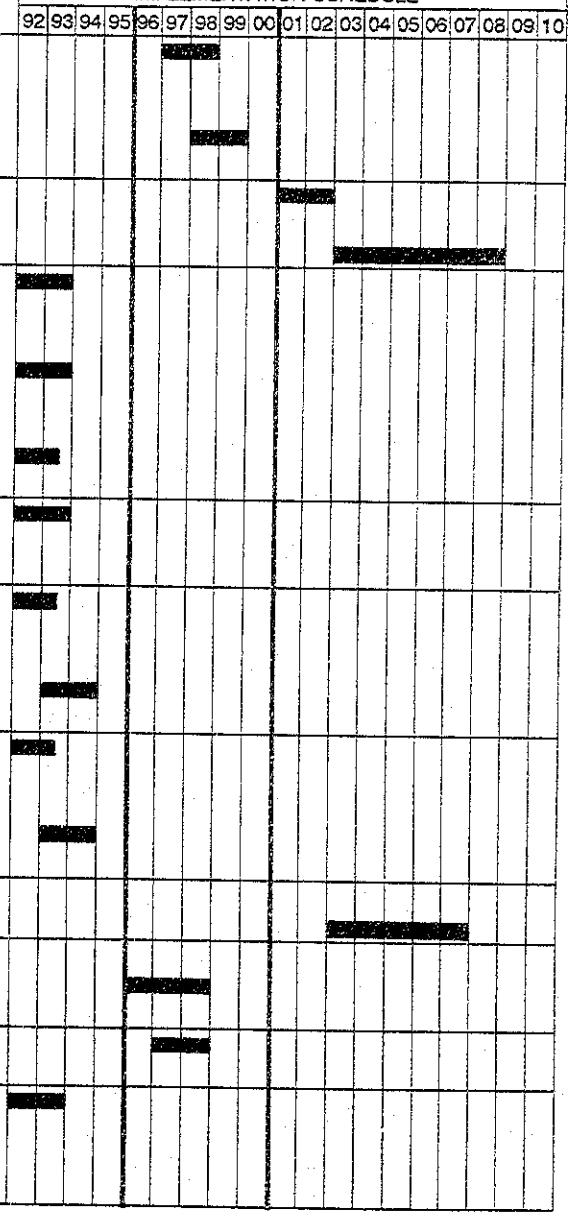
ROAD NAME	CONTRACT PACKAGE	FUND SOURCE	LENGTH (KM)	COST (MP)	R O W (M)	STATUS	IMPLEMENTATION SCHEDULE
C-4 (Continued)	• Package II From Dagat-Dagatan To R-10	OECF 11th Yen	2.0	P144.0	32.0 (50.0)	(70% Completed)	
C-5	• Southern Segments						
	B-1	Proposed For BOT	0.8	360.1	60.0	D.E. Completed	
	B-2	Proposed For BOT	1.9	219.0	60.0	D.E. Completed	
	B-3	Proposed For BOT	2.62	111.6	60.0	D.E. Completed	
	B-4	OECF 14th Yen C-5/R-4 Project	2.2	556.1	Varies	D.E. Completed	
	B-5	OECF 14th Yen C-5/R-4 Project	4.3	215.0	60.0	Bidded	
	B-6	OECF 14th Yen C-5/R-4 Project	1.4	89.5	60.0	Bidded	
	• Package A-2 (Pasig Segment) From R-4 To Pasig Bridge	OECF 14th Yen C-5/R-4 Project	1.1	168.1	40.0	58% Completed	
	• A-1-2 (Quezon City Segment) From E. Rodriguez Ave. To Katipunan Ave	OECF 14th Yen C-5/R-4 Project	1.1	-	40.0	Deferred	
	• E. Rodriguez Avenue From Shaw Blvd. to P. Tuazon	Proposed for OECF 19th Yen	6.5	165.0	40.0	D.E. On-going	
	• A-1-1 (Quezon City Segment) From P. Tuazon To Aurora Boulevard	OECF 14th Yen C-5/R-4 Project	1.3	97.6	32.0 to 37.0	50% Completed	
	• Katipunan Avenue From Aurora Blvd. To Don Mariano Marcos Highway	Proposed For OECF 19th Yen	4.0	176.0	40.0	D.E. On-Going	
	• Luzon Avenue From Don Mariano Marcos Avenue To Republic Avenue	Proposed For OECF 19th Yen	3.5	144.0	60.0	D.E. On-Going	
	• Republic Avenue From Luzon Avenue to Quirino Highway	Proposed For OECF 19th Yen	3.7	275.0	98.0	D.E. On-Going	
	• Republic Avenue From Quirino Highway To NLE	Proposed For OECF 19th Yen	3.3	301.0	98.0	D.E. On-Going	



ON-GOING, COMMITTED AND PROPOSED ROAD PROJECTS

No. 4

ROAD NAME	CONTRACT PACKAGE	FUND SOURCE	LENGTH (KM)	COST (MP)	R O W (M)	STATUS	IMPLEMENTATION SCHEDULE
C-5 (Continued)	• C-5 From NLE to McArthur Highway	Proposed For OECF 19th Yen	2.82	280.0	60.0	D.E. On-Going Design 95%	
	• C-5 From McArthur Highway To R-10	Proposed for B.O.T.			60.0	No Plan Yet	
C-6	• C-6 From Quirino Highway To San Mateo • Other Sections of C-6		10.0	221.80	38	D.E. Completed (No Plan Yet)	
Paranaque-Dr. A Santos Ave. C. Sucat Road	• Package I From OMSE Interchange To Rainbow St.	IBRD 5th MMUTP, Phase I	1.0	38.1	29-30	20% Completed	
	• Package II From Rainbow Street To Olivarez Compd.	IBRD 5th MMUTP, Phase I	5.6	95.0	29-30	30% Completed	
	• Package III From Olivarez Compd. To Ninoy Aquino Ave	IBRD 5th MMUTP, Phase I	1.1	46.3	29-30	54.5% Completed	
Ortigas Avenue	• Ortigas Avenue Extension From Rosario Bridge To Daang Cainta Junction	IBRD, 5th MMUTP, Phase I	6.5	139.7	22-30	22% Completed	
Mindanao Avenue	• Stage I From North Ave. To Tandang Sora Ave.	OECF, 15th Yen MMUTP, Phase II	2.64	85.0	38.0	8.2% Completed	
	• Stage II From Tandang Sora Ave. To Gen. Luis Rd	OECF, 15th Yen MMUTP, Phase II	5.46	65.0	38.0	D.E. Completed	
Congressional Avenue	• Stage I Construction of Missiong Section	OECF, 15th Yen MMUTP, Phase II	1.00	15.0	30.0	48.6% Completed	
	• Stage II From EDSA to Visayas Avenue	OECF, 15th Yen MMUTP, Phase II	2.5	60.0	30.0	D.E. Completed	
Manila-Bataan Coastal Road	Located in the Coastal Areas of Bulacan, Pampanga and Bataan	Proposed for B.O.T.	5.10	1,200		F/S Completed	
Manila-Cavite Expressway	Construction of Zapote Bypass, Gen. Tirona Ext. and Manila-Cavite Expressway (Coastal)	Proposed for B.O.T.	15.4	970	60	D.E. On-going	
Visayas Avenue	Extension of Visayas Avenue From Tandang Sora To Fairview	Proposed OECF	6.73	139.70	38.0	F/S Completed	
Nagtahan Parallel Road	Parallel Road (Aciente and Anonas Sts.) From Nagtahan To Valencia Street	IBRD, 5th MMUTP, Phase I	1.4	28.9	6-20	48% Completed	



ON-GOING, COMMITTED AND PROPOSED ROAD PROJECTS

ROAD NAME	CONTRACT PACKAGE	FUND SOURCE	LENGTH (KM)	COST (MP)	R O W (M)	STATUS	IMPLEMENTATION SCHEDULE 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10
Kalayaan Ave. Extension	Kalayaan Avenue Extension	IBRD, 5th MMUTP, Phase I	0.53	15.9	17-20	4.62%	
P. Tuazon	From EDSA To Katipunan Road	OECF 15th Yen MMUTP, Phase II	2.44	40.0	16.0-22.2	D.E. Completed	
Old Sta. Mesa	From R. Magsaysay To V. Mapa	OECF 15th Yen MMUTP, Phase II	1.05	12.5	14.0	D.E. Completed	
West Rembo	From Pateros Bridge To Guadalupe Bridge	OECF 15th Yen MMUTP, Phase II	4.10	28.0		D.E. Completed	
SLE West Service Road	From Nichols To Sucat Interchange	OECF 15th Yen MMUTP, Phase II	9.4	77.0		D.E. Completed	
Zobel Roxas/ Onyx Sts.	Zobel Street From SLE To Tejerou Street Onyx Street From Z. Roxas To P. Gil	OECF 15th Yen MMUTP, Phase II	1.0	34.0		D.E. Completed	
LRT Back Access Road	From LRT Depot To Airport Road	OECF MMUTP, Phase II	0.72	17.0		D.E. Completed	
Nagtahan Link Road	Pres. Quirino Avenue at the vicinity of Plaza Dilao and Aurora thru the wide V. Mapa and and Old Sta. Mesa	Local	1.95	290.0		D.E. Completed	
Pasong Tamo Extension	Pasong Tamo Extension - Nichols	Proposed OECF	1.1	26.6	17.4		
Del Monte Avenue	Runs Parallel and In Between Quezon Boulevard and A. Bonifacio Avenue	Proposed OECF	3.64	37.5	18.40		
New Diliman Creek Crossing 1 and 2	From Eulogio Rodriguez Avenue to the other side of the creek R. Roxas District	Proposed OECF	2.8	43.4	12 - 15		
Don Bosco Connection To MSE	Hen. Mojica and Hen. Mercado Sts. on other side of SSH up to Evangelista	Proposed OECF	0.31	2.9	10.40		
P. Cruz	From Aglipay Street to Acacia Lane	Proposed OECF	1.47	9.9	10.70		
Pasay Road	Reconstruction of Asphalt Pavement From Pasong Tamo to EDSA	Proposed OECF	1.50	10.0	19.0		
6th Avenue	From M. H. Del Pilar to A. Bonifacio	Proposed OECF	1.0	5.1	9.2		
T. Bugallon	From Cavite To J. Santos	Proposed OECF	0.30	2.1	11		
Cavite Road	FRom Rizal Avenue To S. Reyes Street	Proposed OECF	0.8	6.6	15		

APPENDIX 5.5.1

PHYSICAL POSSIBILITY OF AN INTRODUCTION OF AN EXPRESSWAY ALONG EDSA

PHYSICAL POSSIBILITY OF INTRODUCTION OF AN EXPRESSWAY ALONG C-4 (EDSA)

1. Interchanges along C-4 and LRT Line-3

Interchanges Along C-4

Present status of interchanges along C-4 is as follows:

	PRESENT STATUS	TYPE OF INTERCHANGE
• Balintawak Interchange	Completed	Clover-leaf (C-4 through: over)
• Kamuning-East/South	Under Construction	C-4 through: Overpass
• Cubao Interchange	Completed	C-4 through: Underpass
• P. Tuazon Interchange	Under Construction	C-4 through: Underpass
• Santolan Interchange	Under Construction	C-4 through: Overpass
• Ortigas Interchange	Completed	C-4 through: 2nd Level Overpass C-4 Left Turn: 3rd Level Overpass
• Shaw Interchange	C-4 Through - Completed Shaw Overpass - Construction to start	C-4 through: Underpass Shaw through: Overpass
• Boni Interchange	Construction to start	Boni through: Underpass
• Buendia Interchange	Completed	Buendia Left Turn: Overpass
• Ayala Interchange	Under Study	
• Pasay Interchange	D.E. Completed	C-4 through: Overpass
• MSDR Interchange	Completed	C-4 through: 3rd level overpass Semi: Rotary 2nd level

Another interchanges to be constructed in 2 to 3 years are as follows:

- North/West Avenue Interchange
- Roosevelt Interchange
- R-4 Interchange

Location and typical cross sections of C-4 at existing and on-going interchanges are shown in Figure D-1.

LRT: Line-3

LRT: Line-3 will be constructed along C-4. According to the present loan, Line-3 will start at the C-4/North-East Avenue intersection in Quezon City and end at F.B. Harrison St. near Roxas Blvd. in Pasay City and occupy 8 to 9-meter strip along the road centerline.

Line-3 will be constructed at ground level with grade separation at major intersections.

2 PHYSICALLY AVAILABLE SPACE WHICH CAN ACCOMMODATE ANOTHER STRUCTURE

Physically available space which can accommodate another structure at interchanges is shown in Table D-1.

	PHYSICALLY AVAILABLE SPACE (ONE SIDE)	CURRENT PURPOSE OF USE
Kamuning-East/South Avenue	9.5 m	Left/Right turn lanes and sidewalk
Cubao	13.6 m	- do -
P. Tuazon	13.0 m	- do -
Santolan	9.5 m	- do -
Ortigas	(LRT may occupy one side of this space)	
Shaw	13.6	- do -
Buendia	14.4	C-4 through lanes and sidewalk
Pasay	5.45 (1.75)	Right-turn lane and sidewalk (sidewalk)
MSDR	8.15	Local access and sidewalk

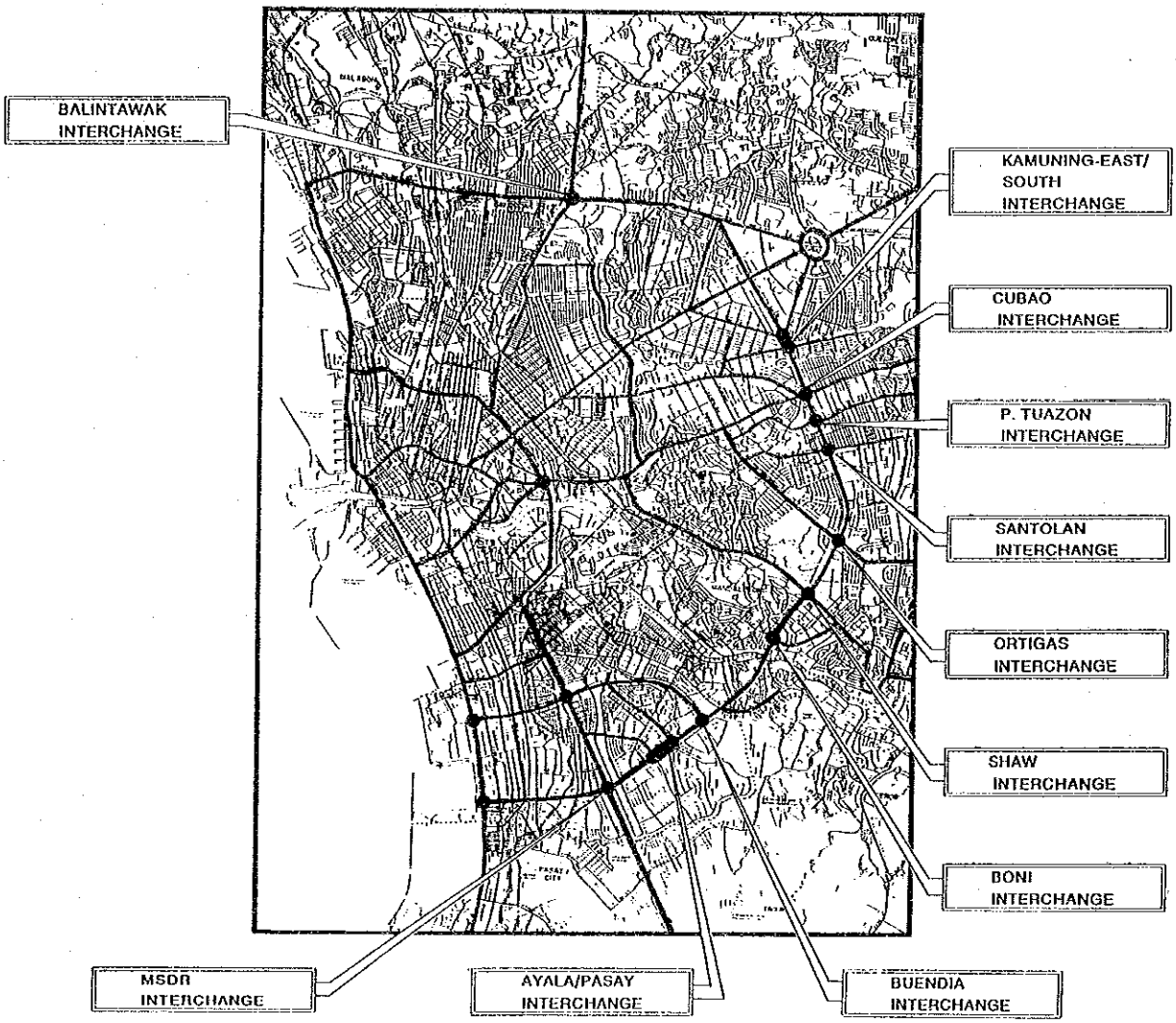
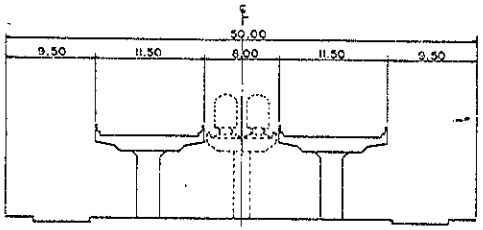
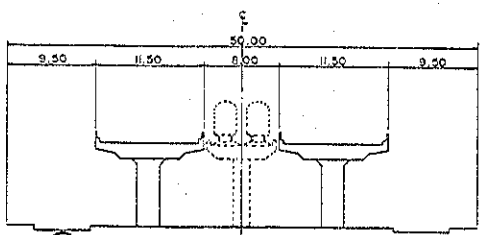

BALINTAWAK INTERCHANGE
KAMUNING-EAST/ SOUTH INTERCHANGE
CUBAO INTERCHANGE
P. TUAZON INTERCHANGE
SANTOLAN INTERCHANGE
ORTIGAS INTERCHANGE
SHAW INTERCHANGE
BONI INTERCHANGE
MSDR INTERCHANGE
AYALA/PASAY INTERCHANGE
BUENDIA INTERCHANGE

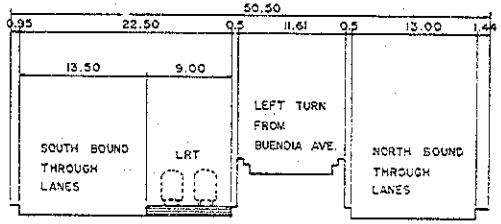
FIGURE D - 1 TYPICAL CROSS SECTION OF INTERCHANGES ALONG C - 4 (EDSA)



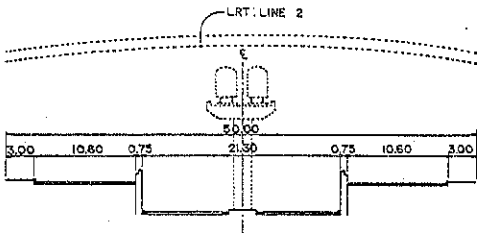
① KAMUNING - EAST/SOUTH AVE. INTERCHANGE



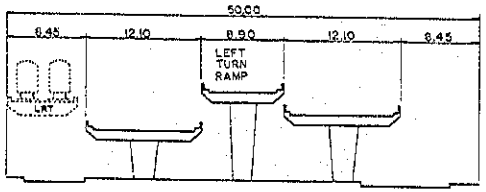
④ SANTOLAN INTERCHANGE



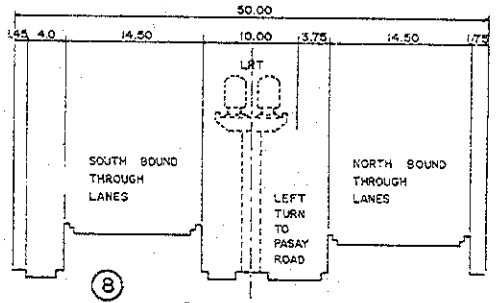
⑦ BUENDIA INTERCHANGE



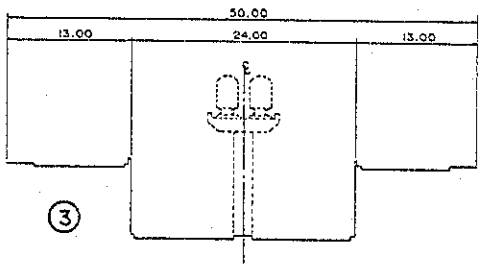
② CUBAO INTERCHANGE



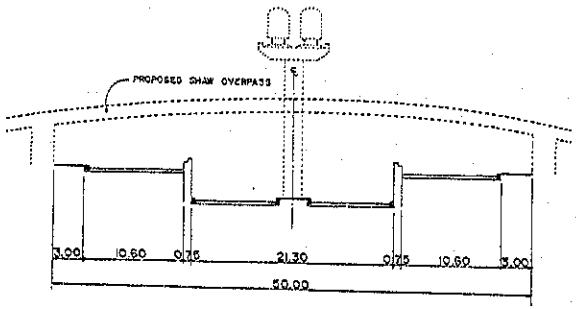
⑤ ORTIGAS INTERCHANGE



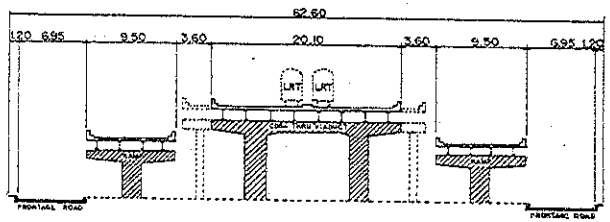
⑧ PASAY INTERCHANGE



③ P. TUAZON INTERCHANGE



⑥ SHAW INTERCHANGE



⑨ MSDR INTERCHANGE

3. ALTERNATIVES FOR INTRODUCTION OF AN EXPRESSWAY

There are two options with regards to C-4's future development as follows:

Option-1: Grade separation at intersections will be further implemented and no expressway will be introduced.

Option-2: An expressway along C-4 will be introduced.

These two options will be studied in detail in the next stage of this Study. Physical possibility of introduction of an expressway is studied hereunder.

Four alternative schemes were developed as follows:

Alternative-1 (See Figure D-2)

An at-grade expressway (4-lane) will be constructed. Through traffic lanes will be access controlled and connected with the existing through lanes of overpass/underpass interchanges.

Access control will be done by constructing a separator.

Alternative-2 (See Figure D-3)

Instead of an at-grade expressway, an elevated expressway (4-lane) will be constructed and joined with existing interchanges.

Alternative-3 (See Figure D-4)

Utilizing physically available space, an expressway will be constructed.

Alternative-4 (See Figure D-5)

An expressway and LRT Line-3 will be constructed as one integrated structure utilizing the space provided for LRT Line-3.

FIGURE D - 2

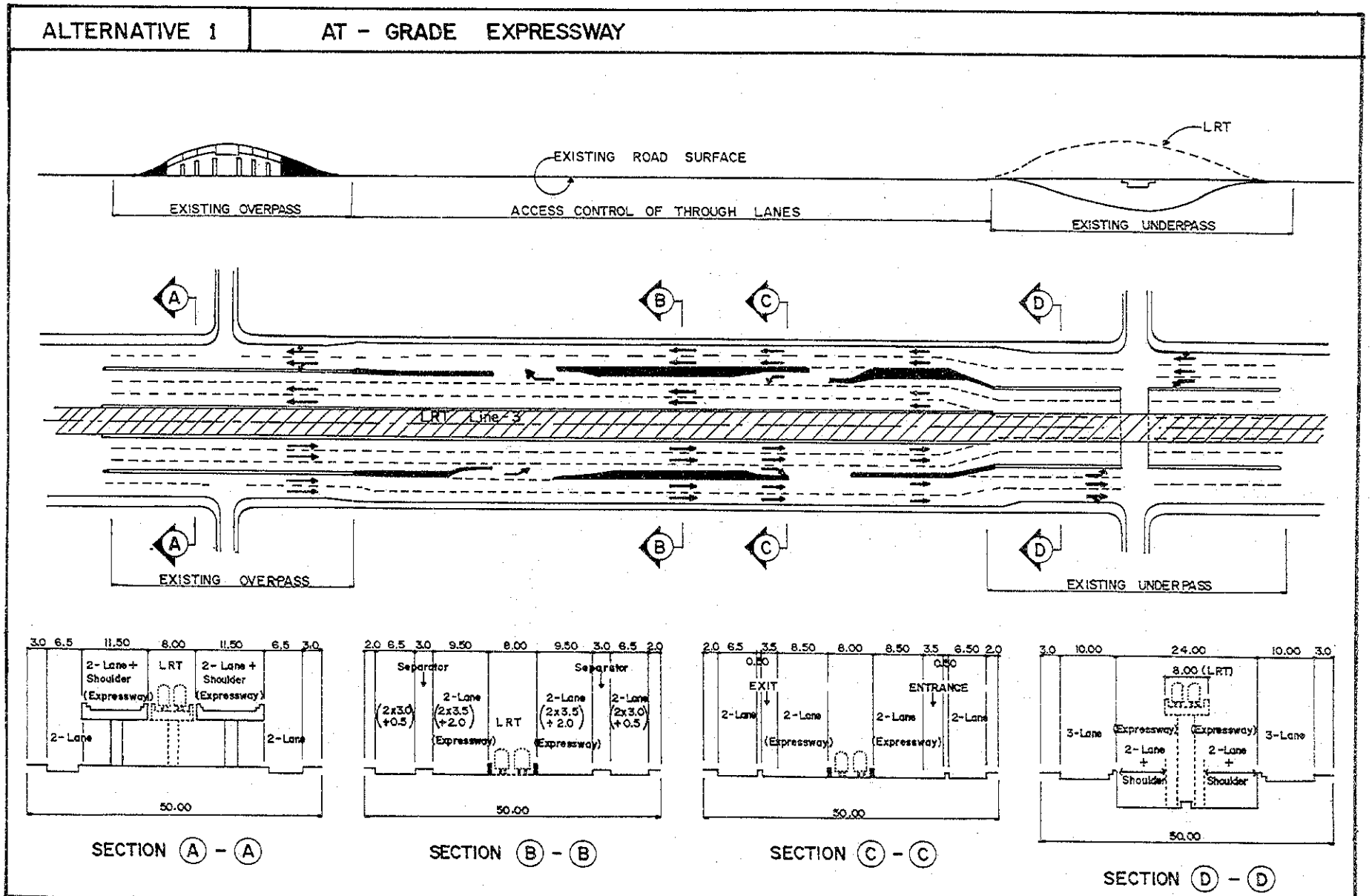
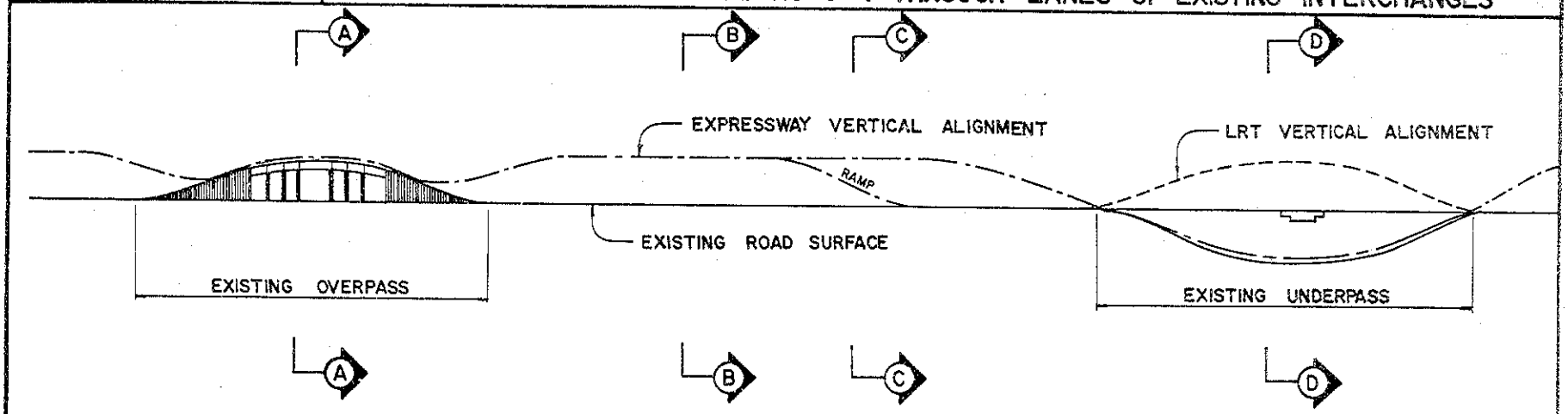
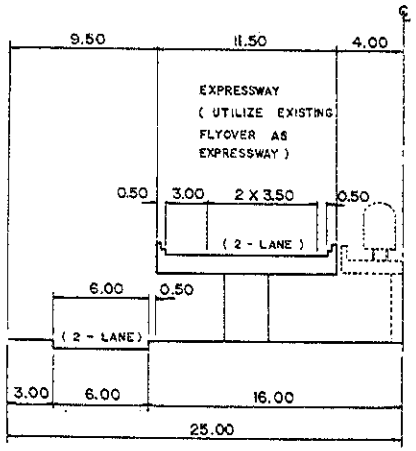

ALTERNATIVE 1
AT - GRADE EXPRESSWAY
LRT
EXISTING ROAD SURFACE
EXISTING OVERPASS
ACCESS CONTROL OF THROUGH LANES
EXISTING UNDERPASS
A
B
C
D
LRT Line-3
EXISTING OVERPASS
EXISTING UNDERPASS
3.0 6.5 11.50 8.00 11.50 6.5 3.0
2- Lane + Shoulder (Expressway)
LRT
2- Lane + Shoulder (Expressway)
2- Lane
2- Lane
50.00
SECTION (A) - (A)
2.0 6.5 3.0 9.50 8.00 9.50 3.0 6.5 2.0
Separator
Separator
(2x3.0 +0.5)
2-Lane (2x3.5 +2.0) (Expressway)
LRT
2-Lane (2x3.5 +2.0) (Expressway)
(2x3.0 +0.5)
50.00
SECTION (B) - (B)
2.0 6.5 3.5 8.50 8.00 8.50 3.5 6.50 2.0
0.50
EXIT
ENTRANCE
0.50
2-Lane
2-Lane (Expressway)
2-Lane (Expressway)
2-Lane
50.00
SECTION (C) - (C)
3.0 10.00 24.00 10.00 3.0
8.00 (LRT)
3-Lane
(Expressway)
(Expressway)
3-Lane
2-Lane + Shoulder
2-Lane + Shoulder
50.00
SECTION (D) - (D)

FIGURE D - 3

ALTERNATIVE - 2 | ELEVATED EXPRESSWAY UTILIZING C-4 THROUGH LANES OF EXISTING INTERCHANGES





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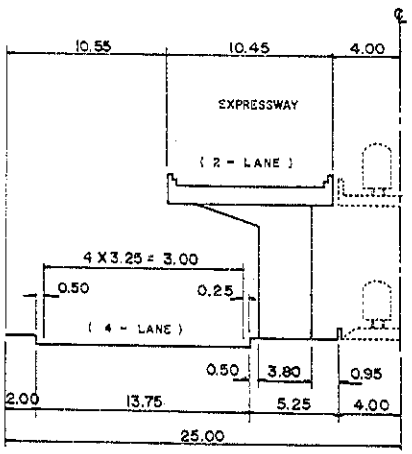

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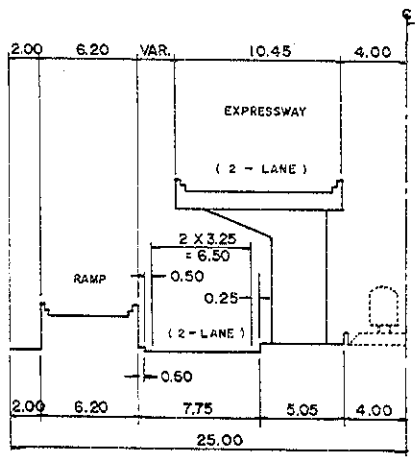

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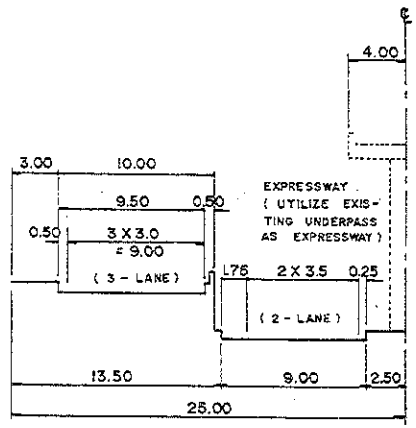
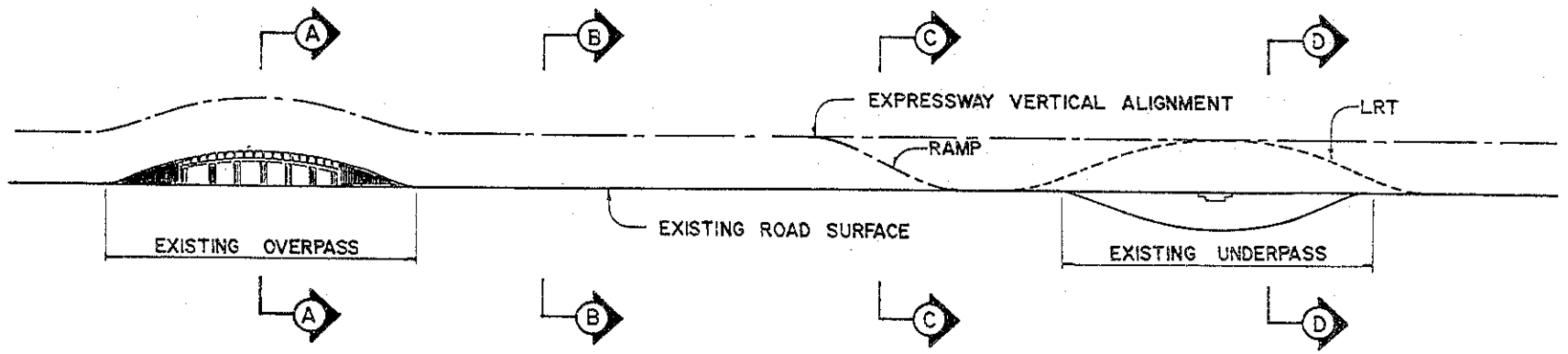
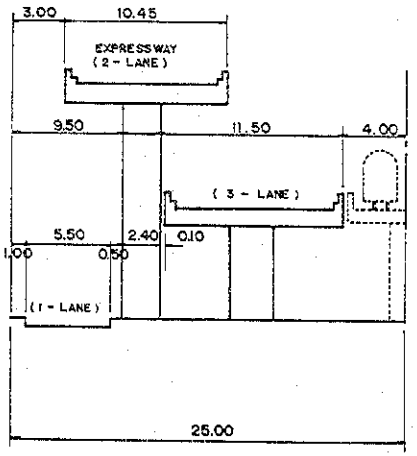


SECTION (D) - (D)

FIGURE D - 4

ALTERNATIVE - 3	ELEVATED EXPRESSWAY UTILIZING AVAILABLE SPACE





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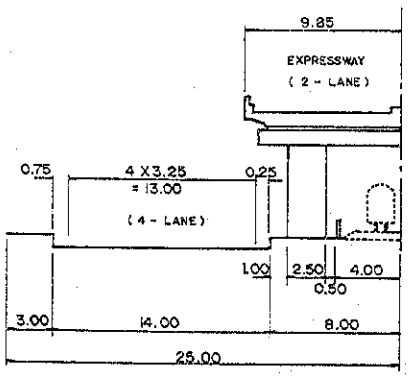

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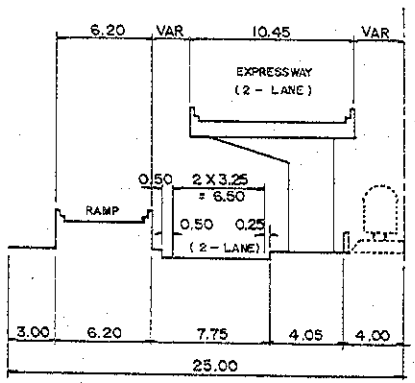

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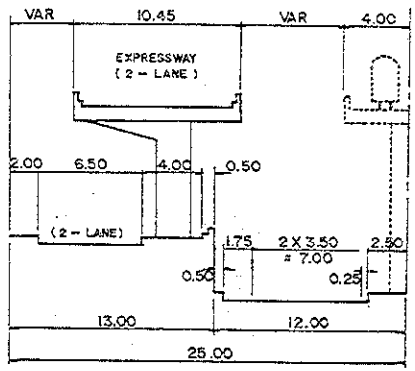
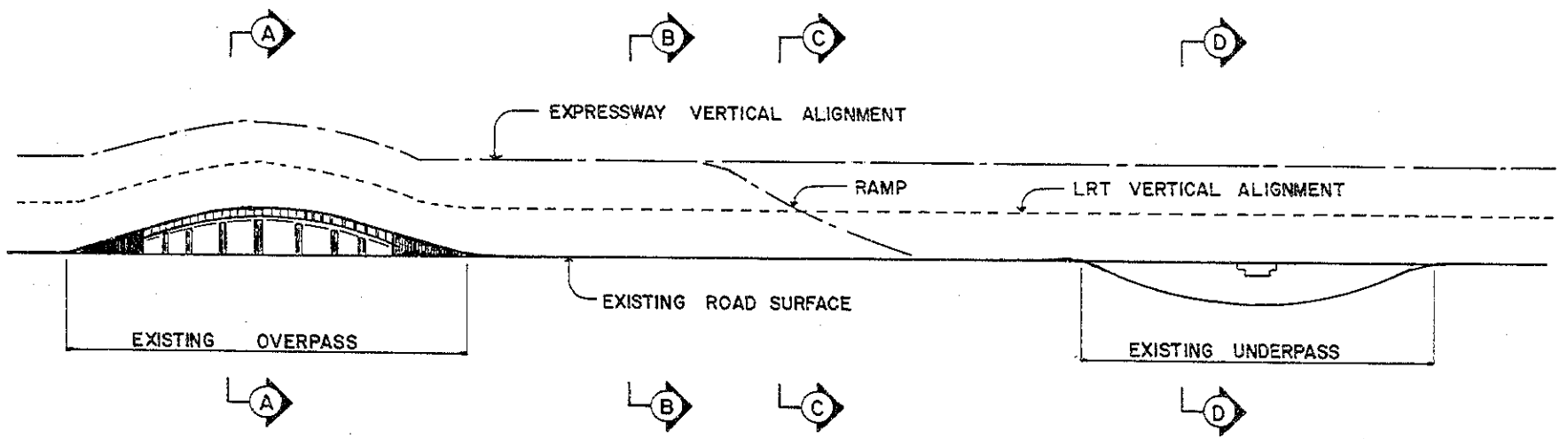


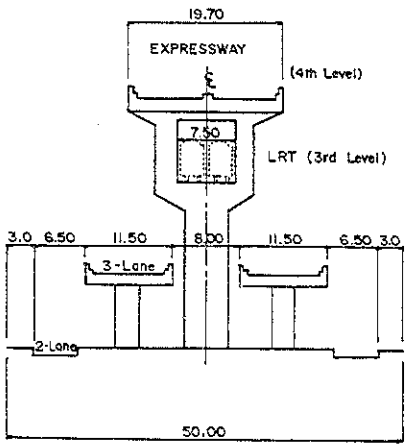
SECTION (D) - (D)

FIGURE D-5

ALTERNATIVE - 4

INTEGRATED STRUCTURE FOR EXPRESSWAY AND LRT





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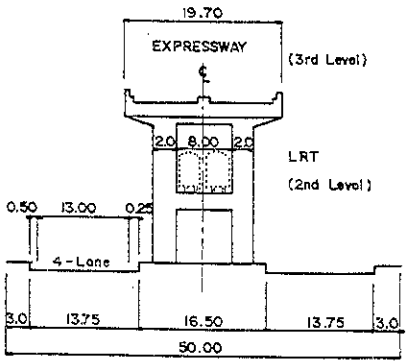
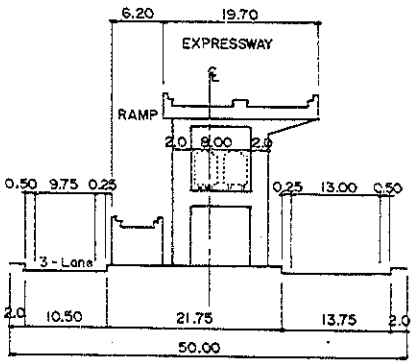
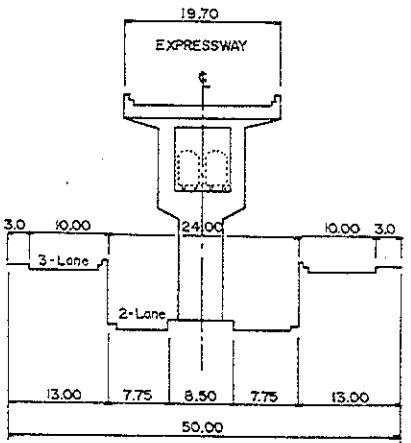


SECTION (B) - (B)



SECTION (C) - (C)



SECTION (D) - (D)

4. EVALUATION OF ALTERNATIVES

Evaluation of alternative is presented in Table D-2.

TABLE D-2 EVALUATION OF ALTERNATIVES

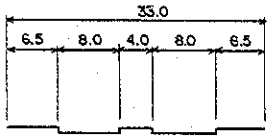
ALTER-NATIVE	NUMBER OF LANES ACCOMMODATED (ONE DIRECTION)		CRITICAL INTERCHANGE FOR INTRODUCTION OF AN EXPRESSWAY	OTHER REMARKS	POSSIBILITY
	EXPRESSWAY	SURFACE ROAD			
1	2-Lane (Not more than 2-Lane can be accommodated)	2-Lane (not more than 2-Lane can be accommodated)	-	• Overall transport capacity of C-4 may not increase • Option-1 might be preferable	• Possible, but transport capacity wise, no significant impact
2	2-Lane (3-Lane cannot be accommodated at underpass inter-changes)	• At overpass interchanges 2-Lane • At underpass interchanges 3-Lane • Between interchanges 4-Lane	-	• Overall transport capacity of C-4 may not increase • Option-1 might be preferable	• Possible, but transport capacity wise, no significant impact
3	2-Lane (3-Lane expressway will be structurally difficult at existing interchanges)	• At overpass interchanges 1 - Lane (at-grade) 3-Lane (overpass) • At underpass interchanges 2 - Lane (at-grade) 2-Lane (underpass) • Between interchanges 4-Lane	• Ortigas interchange • Pasay interchange • MSDR interchange (No space for an express-way at above 3 inter-changes)	• At existing interchanges, an ex-pressway must be constructed close to buildings • Buses and turning vehicles at intersections will suffer traffic congestion, especially at overpass interchanges	• Almost impossible
4	2-Lane or 3-Lane	• At overpass interchanges 2-Lane (at-grade) 3-Lane (overpass) • At underpass interchanges 3-Lane (at-grade) 2-Lane (underopass) • Between interchanges 4-Lane	• Ortigas interchange (no space for an express-way)	• 2nd level for LRT and 3rd level for Expressway (at existing overpass interchanges, LRT will be 3rd level, and Expressway will be 4th level) • Agreement between DPWH and DOTC required	• Very difficult

APPENDIX 5.5.2

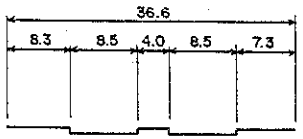
EXISTING/PROPOSED CROSS SECTIONS OF AT-GRADE ROADS ALONG CANDIDATE CORRIDORS

EXISTING / PROPOSED CROSS SECTION ALONG CANDIDATE EXPRESSWAY CORRIDORS

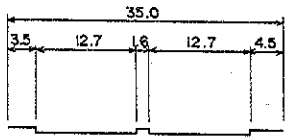
M. Adriatico ∽ South Super Highway



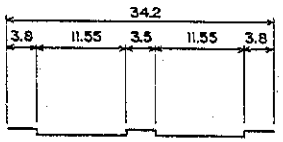
Quezon Ave. ∽ Andalucia



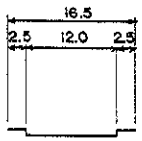
Abad Santos



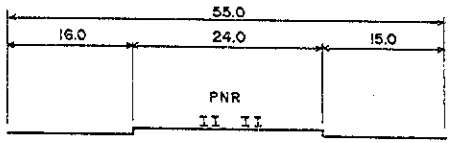
South Super Highway ∽ Pasig River



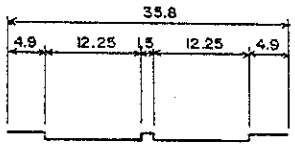
Tayuman
(Andalucia ∽ Juan Luna)



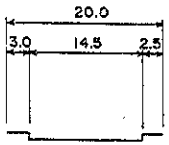
Antipolo



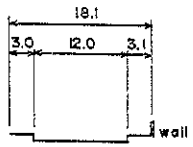
Magsaysay ∽ Jacobo



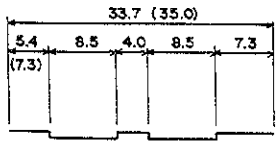
Tayuman
(Juan Luna ∽ Vitas Bridge)



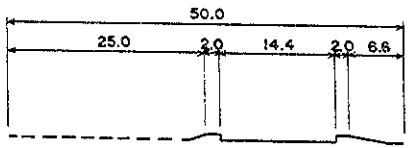
F. Huertas



Jacobo ∽ Quezon Ave.



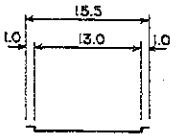
Vitas Bridge ∽ R-10



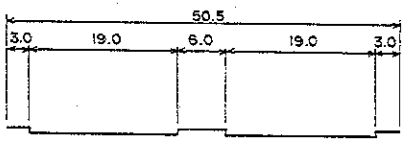
(C-2 RELATED ROADS)

Route No. C-2

A. Mabini ∽ Rizal Ave. Extension



All Section Expect Section from
A. Mabini to Rizal Ave. Extension

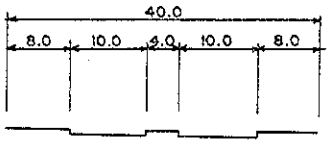


Route No. C-4

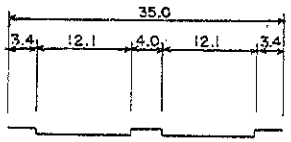
App. 5.5.2-1

EXISTING / PROPOSED CROSS SECTION ALONG CANDIDATE EXPRESSWAY CORRIDORS

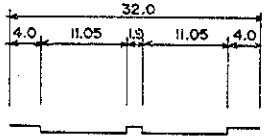
R-10 ∽ A. Mabini (Existing)



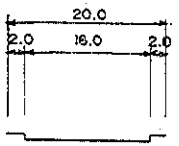
Buendia Avenue
(Ayala Avenue ∽ South super Highway) (Existing)



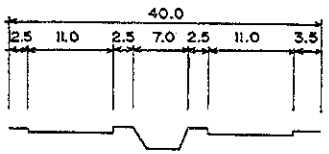
A. Mabini ∽ Araneta Ave. (Proposed)



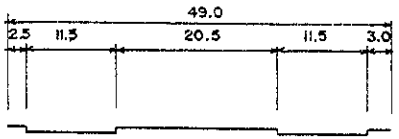
South Super Highway ∽ Tramo Ave. (Existing)



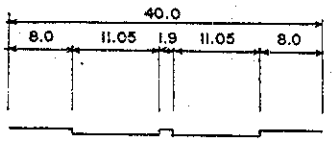
SGR. Rivera ∽ Quezon Ave. (Existing)



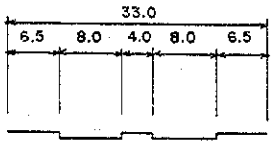
Tramo Ave. ∽ Roxas Blvd. (Existing)



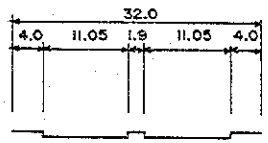
Quezon Ave. ∽ Aurora Blvd. (Existing)



South Super Highway ∽ M. Adriatico (Existing)

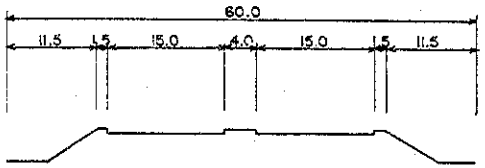


Aurora Blvd. ∽ Buendia Ave. (Proposed)

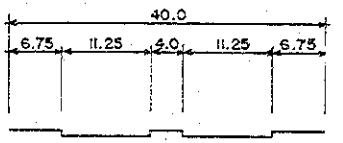


ROUTE NO. C-3

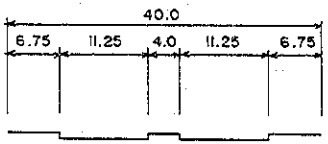
R-1 ∽ R-4 (Proposed)



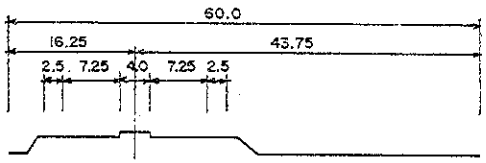
R-4 ∽ Aurora Blvd.
(Existing, to be widened to this cross section)



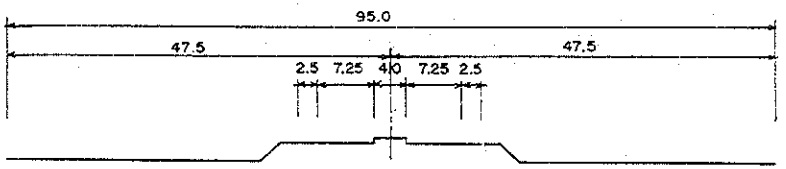
Aurora Blvd. ∽ Commonwealth Ave.
(Existing, to be widened to this cross section)



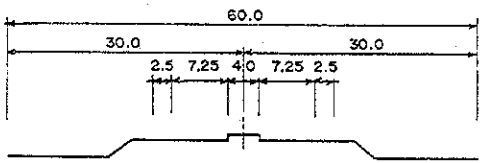
Luzon Ave.
(Commonwealth Ave. ∽ Republic Ave.) (Proposed)



Republic Ave. (Luzon Ave. ∽ North Luzon Expressway) (Proposed)



C-5 (North Luzon Expressway ∽ R-10) (Proposed)

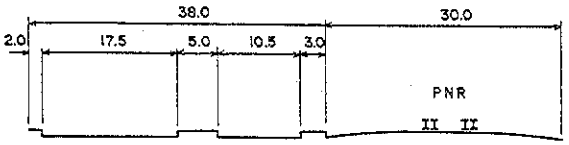


ROUTE NO. C-5

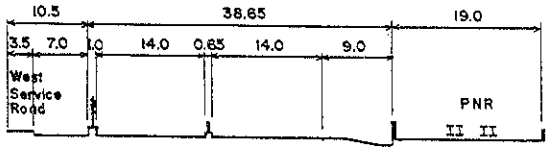
EXISTING / PROPOSED CROSS SECTION ALONG CANDIDATE EXPRESSWAY CORRIDORS

Route No. R-3

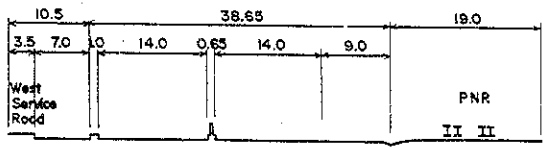
Quirino Ave. ∽ EDSA



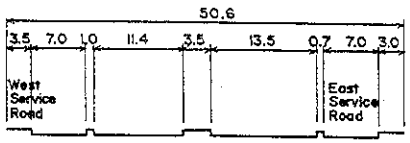
NAIA



C-5 ∽ Bicutan I.C.

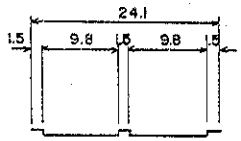


Bicutan I.C. ∽ Alabang I.C.



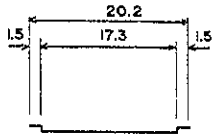
Route No. R-5

Ortigas Ave. Extension

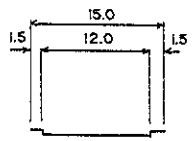


Route No. R-6

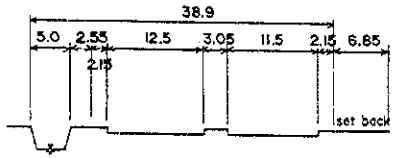
Santolan Road
(Ortigas Ave ∽ EDSA)



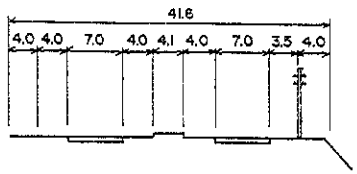
(EDSA ∽ C-5)



Marcos Highway
(De Lapaz ∽ A. Tuazon)

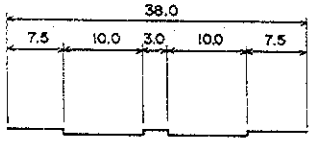


Marcos Highway
(A. Tuazon ∽ Sumulong Hwy)



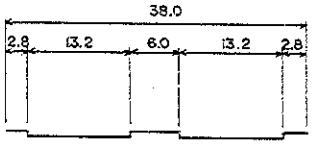
Route No. R-7(A)

Visayas Ave.



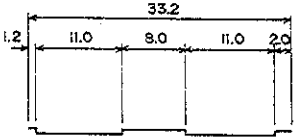
Route No. R-7(B)

Fairview Ave.

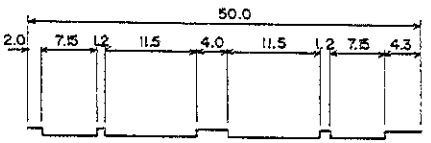


Route No. R-10

Bonifacio Drive

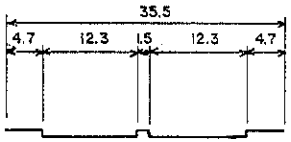


Marlones ∽ C-4

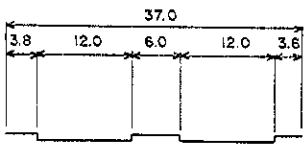


EXISTING / PROPOSED CROSS SECTION ALONG CANDIDATE EXPRESSWAY CORRIDORS

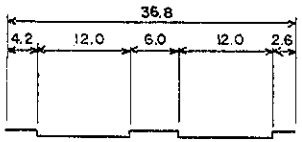
España Avenue



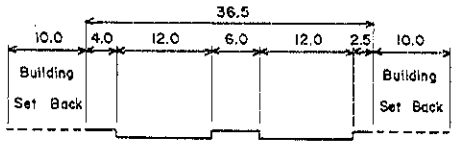
E. Rodriguez ∽ C-3



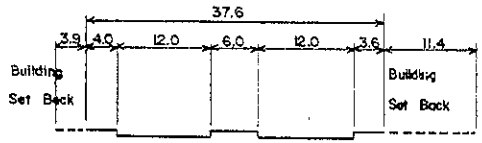
C-3 ∽ San Juan River



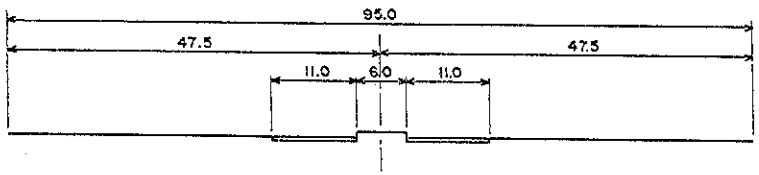
San Juan River ∽ EDSA



EDSA ∽ University Ave.

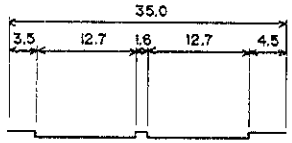


Commonwealth Avenue

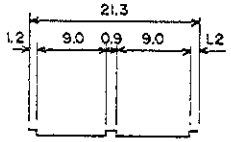


Route No. R-7

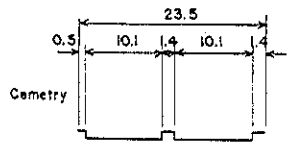
Abad Santos



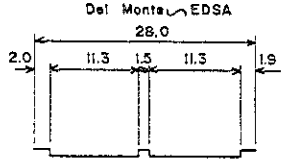
Blumentritt



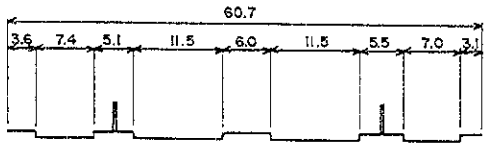
Blumentritt ∽ Del Monte



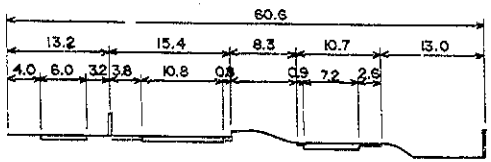
Del Monte ∽ EDSA



North Luzon Expressway
(EDSA ∽ Toll Plaza)

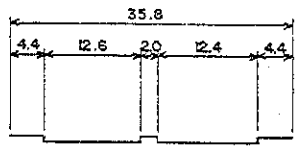


North Luzon Expressway



Route No. R-9

Abad Santos



Route No. R-10

App. 5.5.2-4

APPENDIX 5.8.1
URBAN EXPRESSWAY NETWORK IN OTHER CITIES

URBAN EXPRESSWAY NETWORK IN OTHER CITIES

Urban expressway networks of Bangkok, Jakarta, Tokyo and Osaka are shown in Figures in the succeeding pages, all of which are drawn at the same scale and portion of Metro Manila also attached for comparison.

Bangkok

Expressway network is formed almost equivalent to C-2 alignment in Metro Manila.

Jakarta

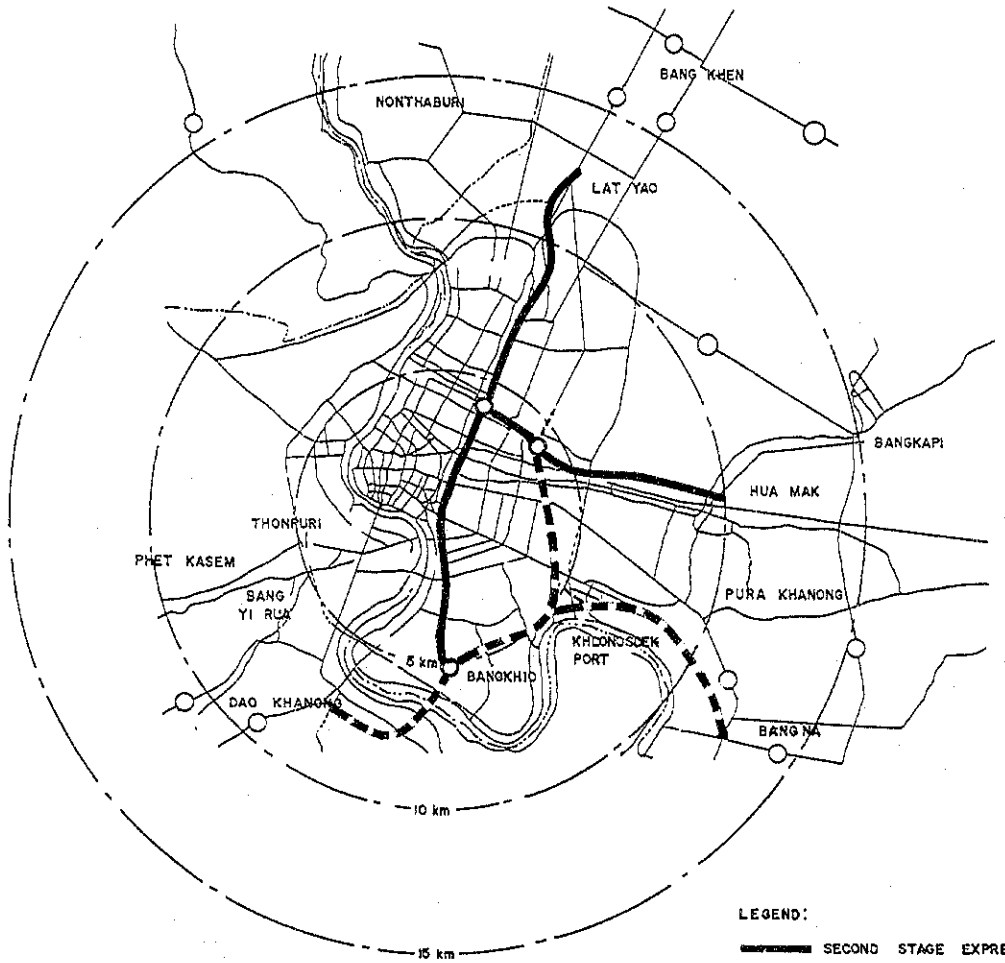
Inner Ring of Jakarta Expressway is located almost equivalent to C-4 location in Metro Manila.

Tokyo

Expressway network in Tokyo Central Area is formed in the area smaller than that surrounded by C-2 in Metro Manila.

Osaka

Expressway network in Osaka Central Area is formed in the area smaller than that surrounded by C-2 in Metro Manila.



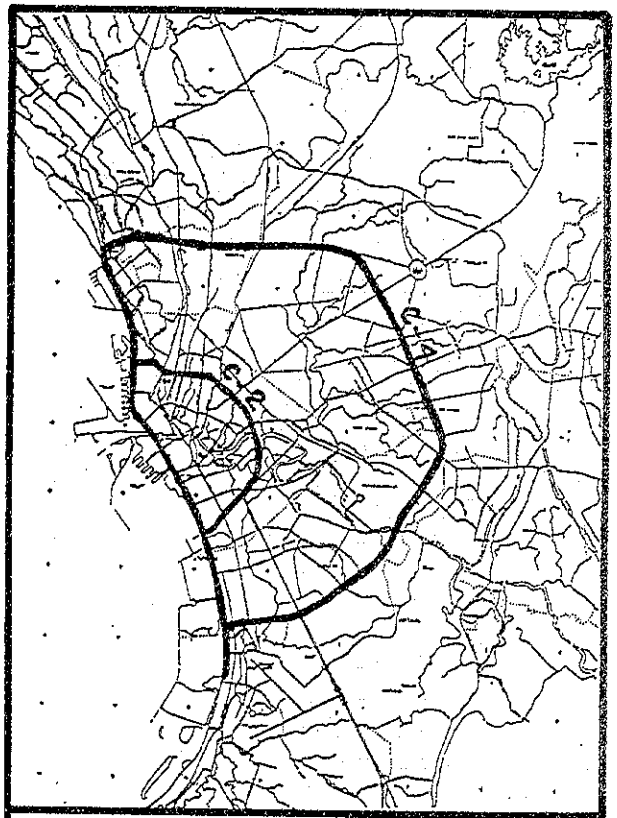
LEGEND:

SECOND STAGE EXPRESSWAY SYSTEM

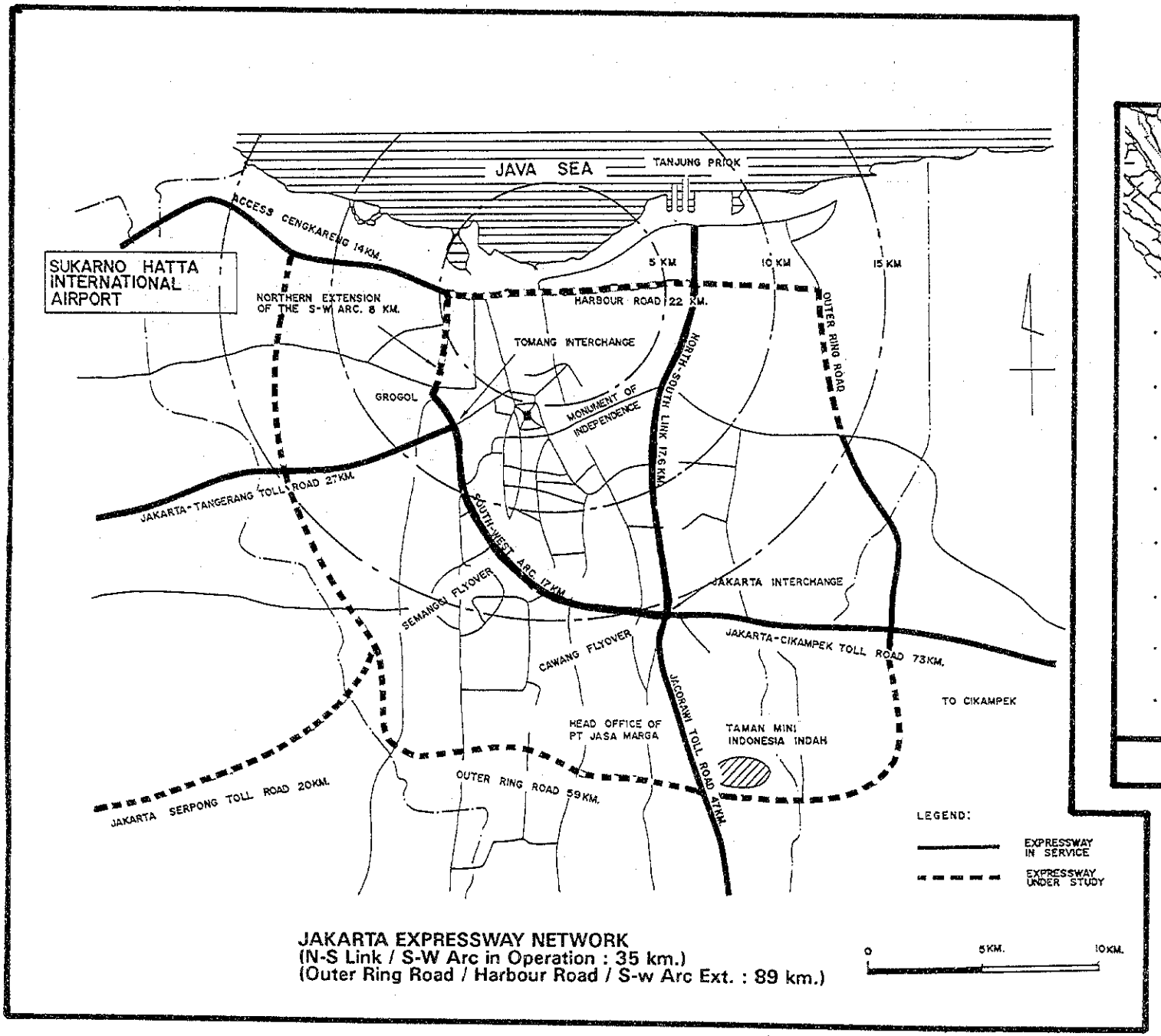
FIRST STAGE EXPRESSWAY SYSTEM

0 1 2 3 4 5

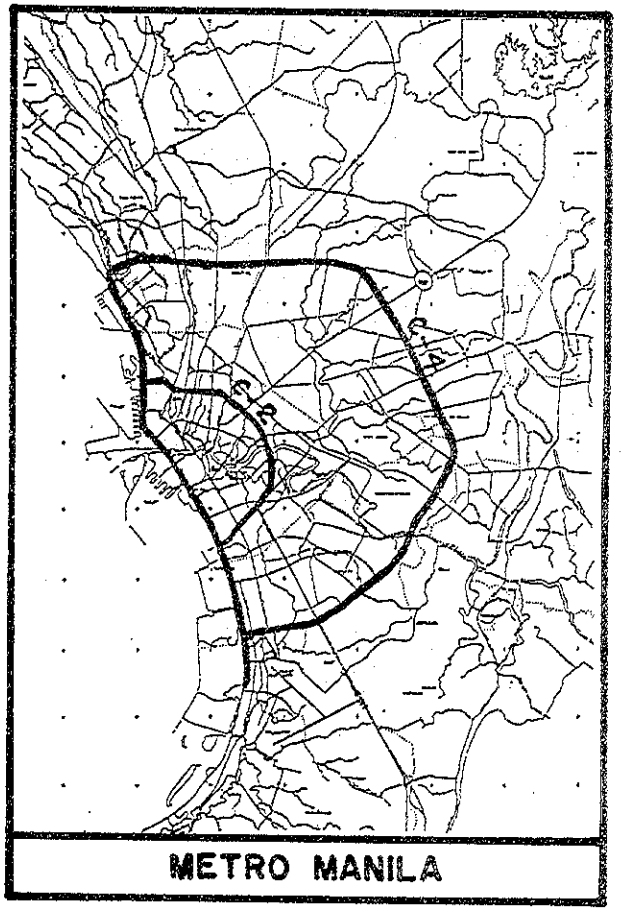
BANGKOK URBAN EXPRESSWAY NETWORK
(First Stage in Operation : 27 km.)
(Second Stage under Construction : 32 km.)

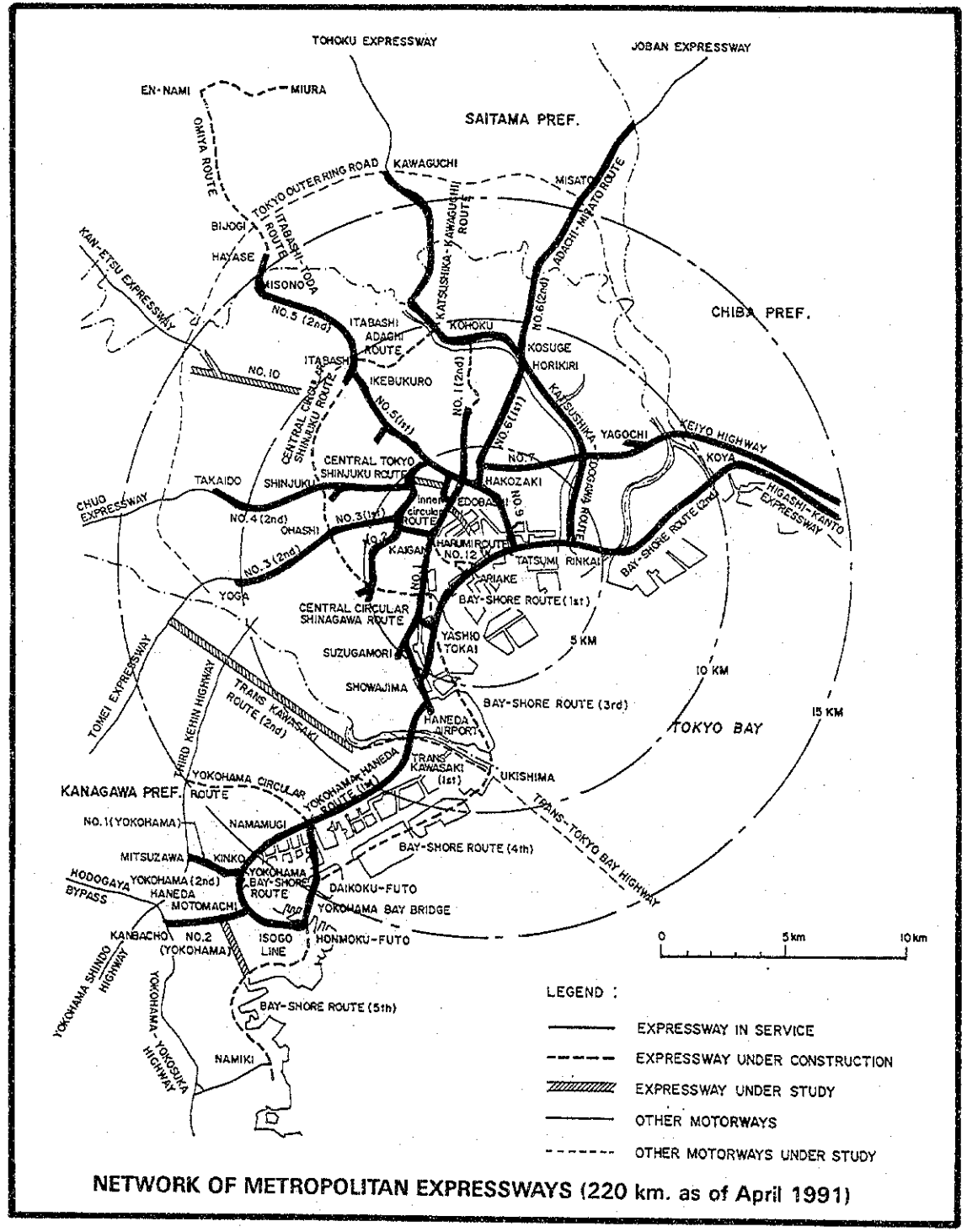


METRO MANILA

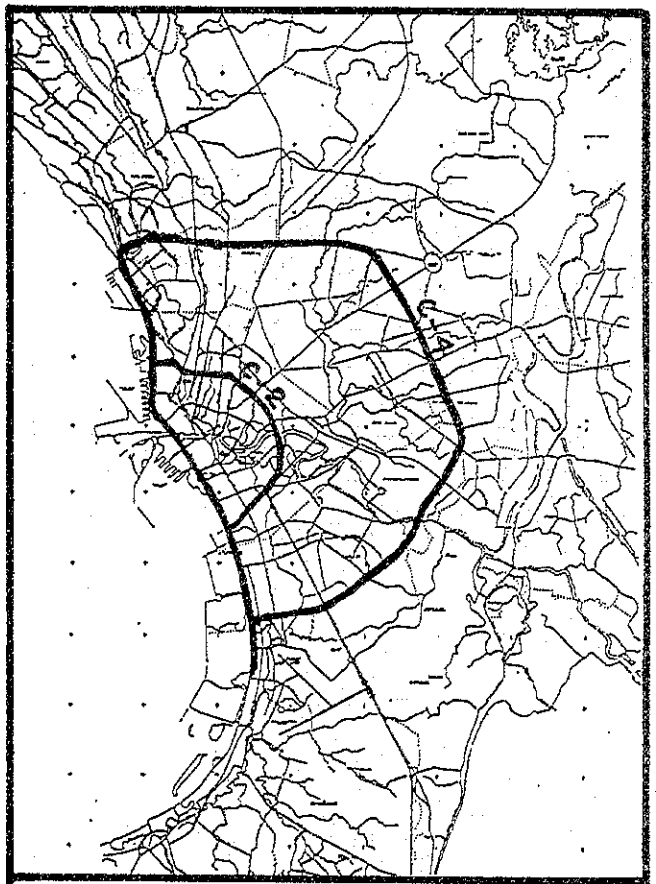


JAKARTA EXPRESSWAY NETWORK
(N-S Link / S-W Arc in Operation : 35 km.)
(Outer Ring Road / Harbour Road / S-w Arc Ext. : 89 km.)

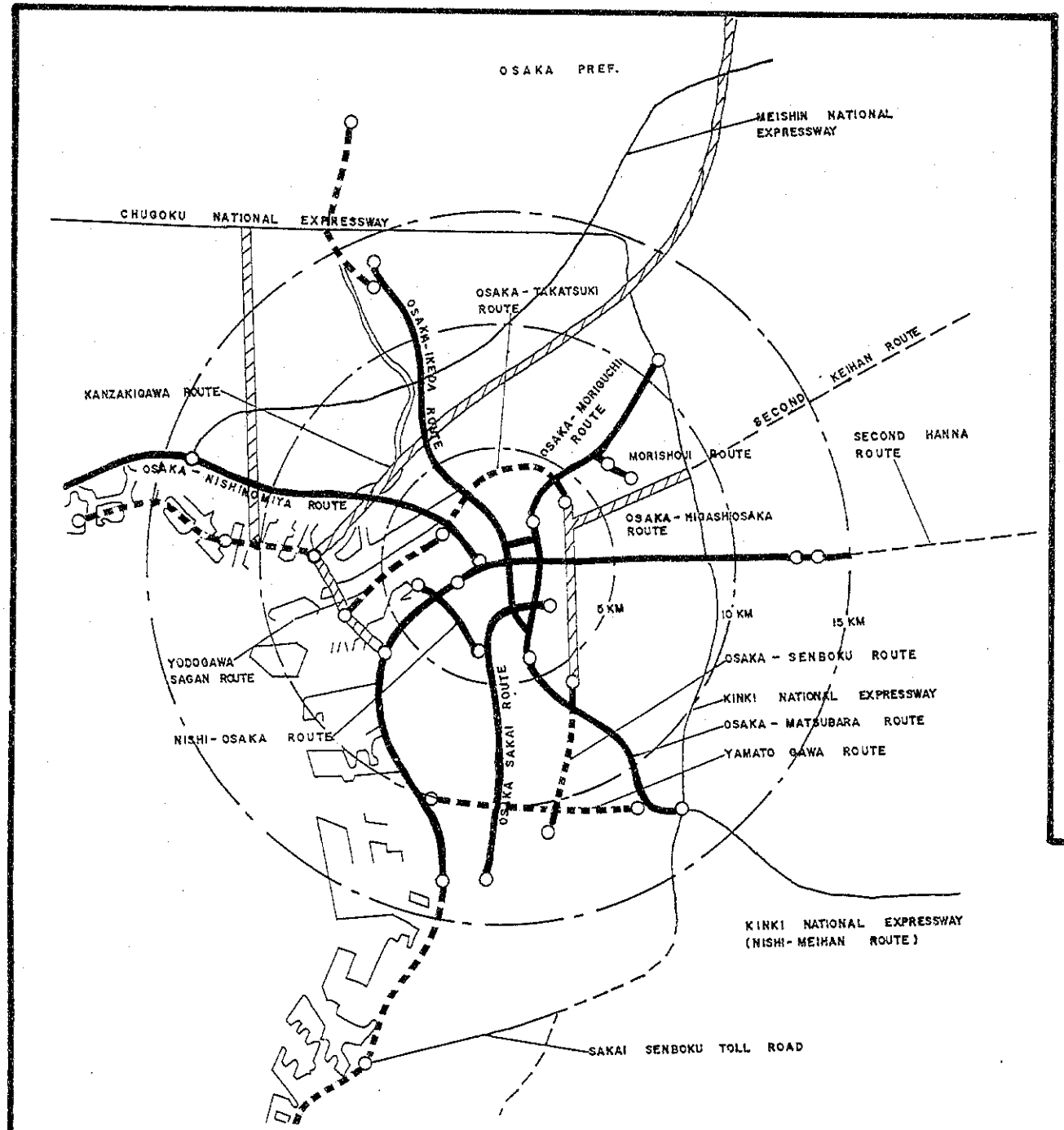


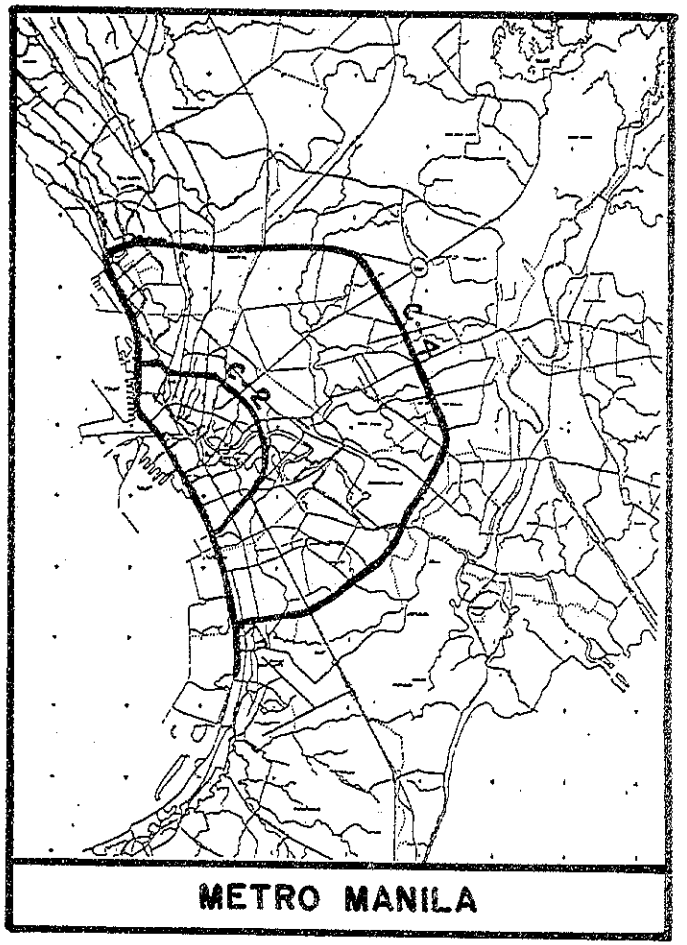


NETWORK OF METROPOLITAN EXPRESSWAYS (220 km. as of April 1991)



METRO MANILA





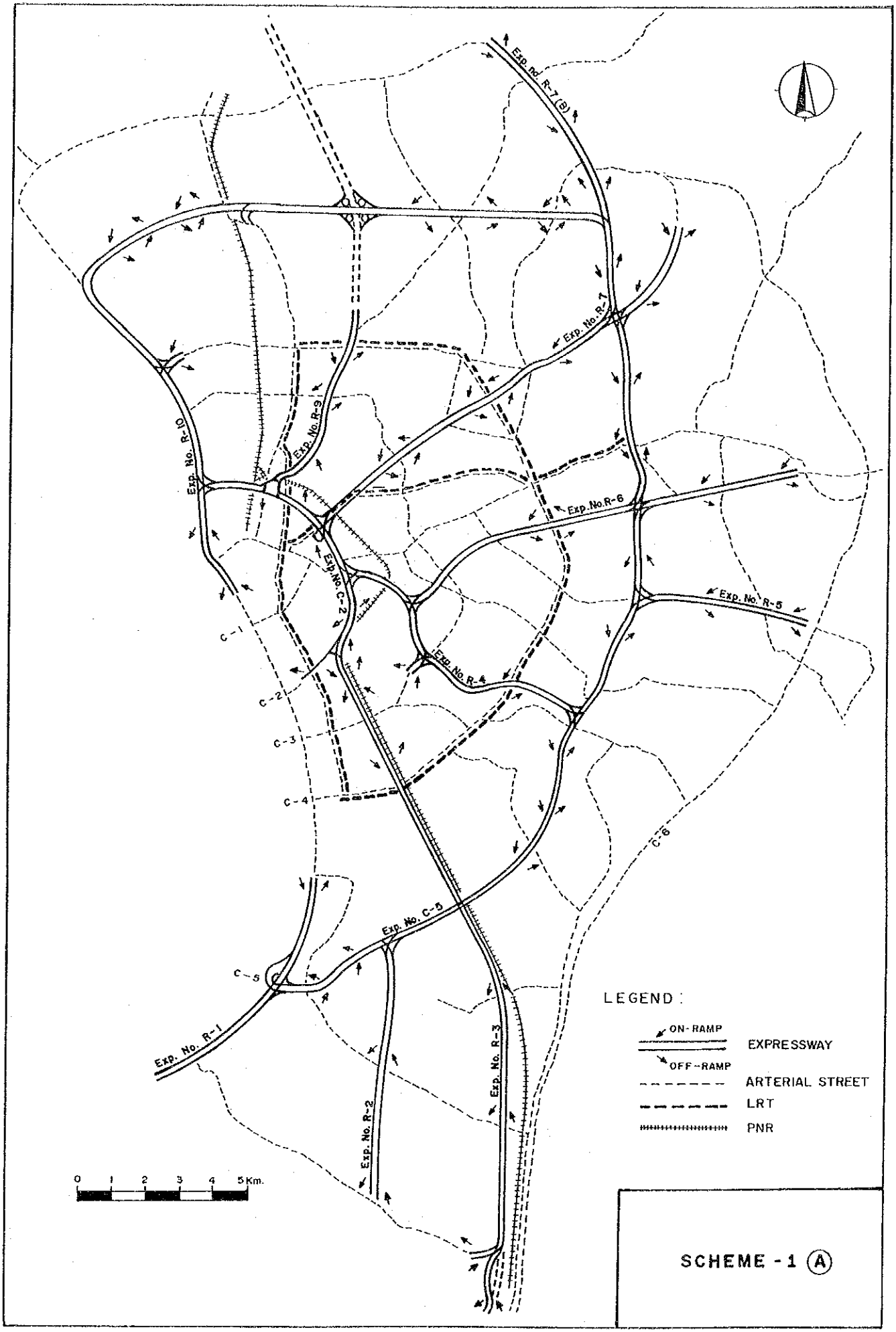
LEGEND:

- Expressway in operation
- Expressway under construction
- Expressway under study
- Other motorways
- Other motorways under study

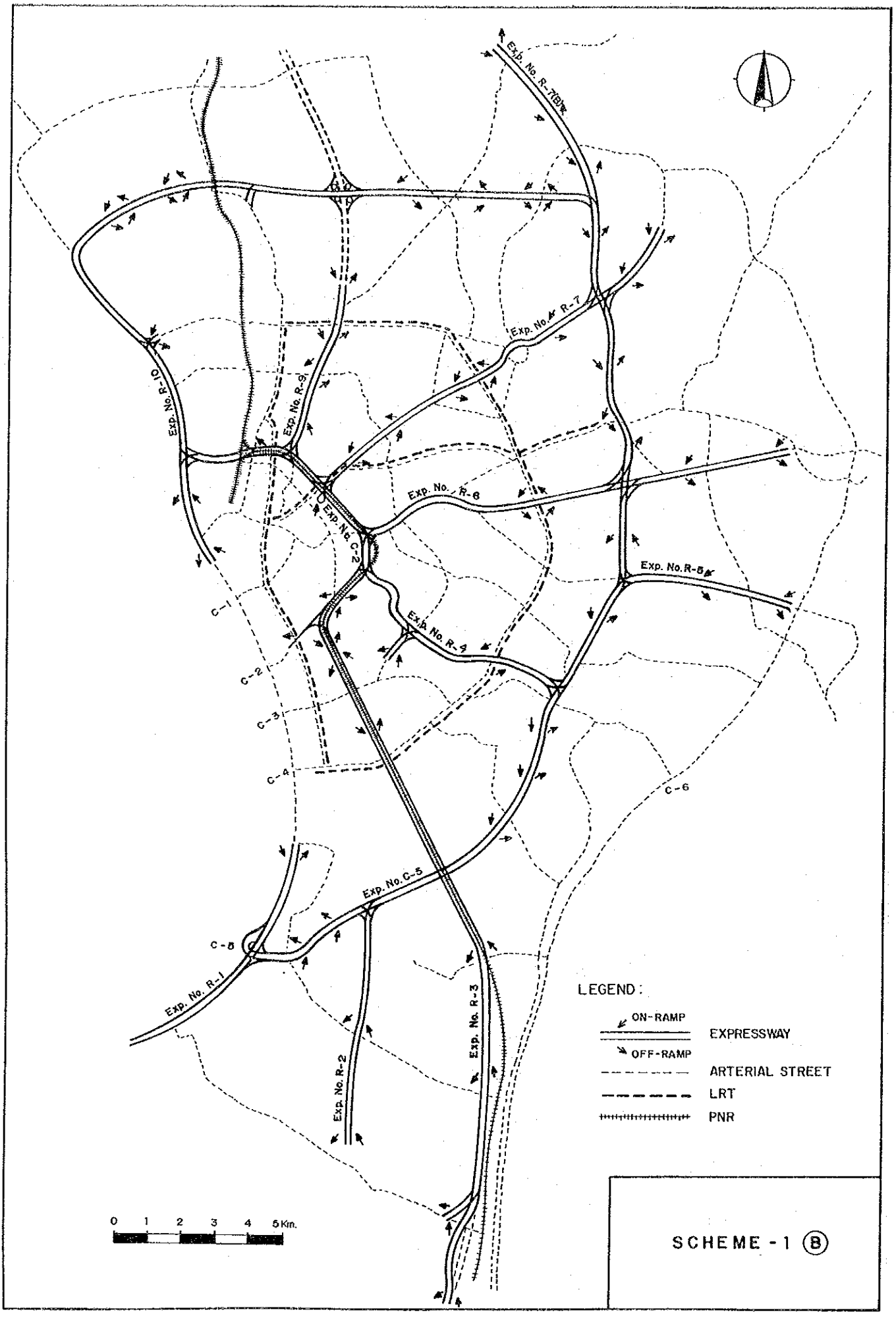
5Km. 10Km.

NETWORK OF HANSHIN EXPRESSWAY (153 km. as of April 1991)

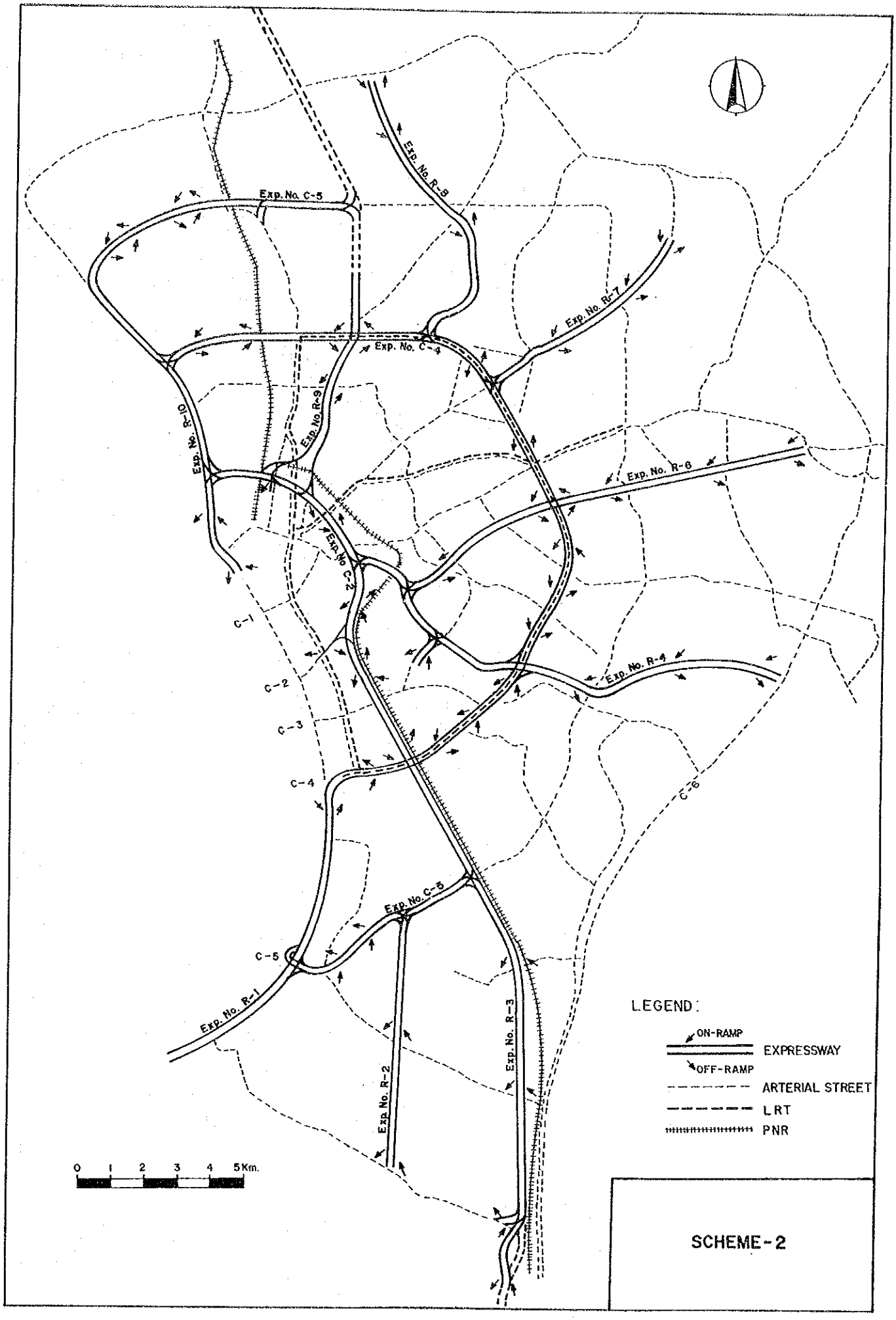
APPENDIX 6.1.1
ALTERNATIVE SCHEMES

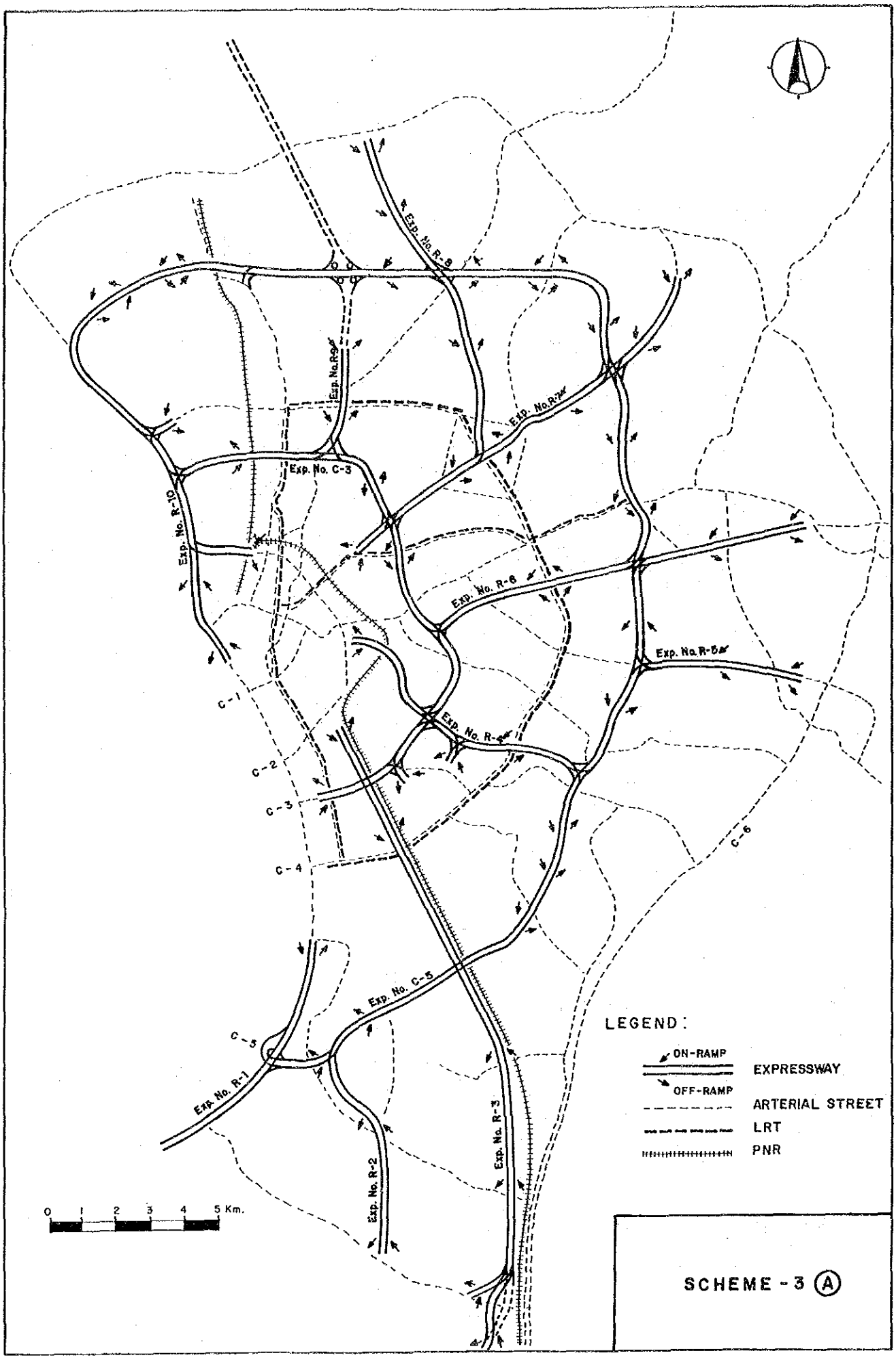

Exp. No. R-7 (B)
Exp. No. R-7
Exp. No. R-10
Exp. No. R-9
Exp. No. R-6
Exp. No. C-2
Exp. No. R-5
Exp. No. R-4
C-1
C-2
C-3
C-4
C-6
Exp. No. C-5
C-5
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
0 1 2 3 4 5Km.
LEGEND :
ON-RAMP
EXPRESSWAY
OFF-RAMP
ARTERIAL STREET
LRT
PNR
SCHEME - 1 (A)

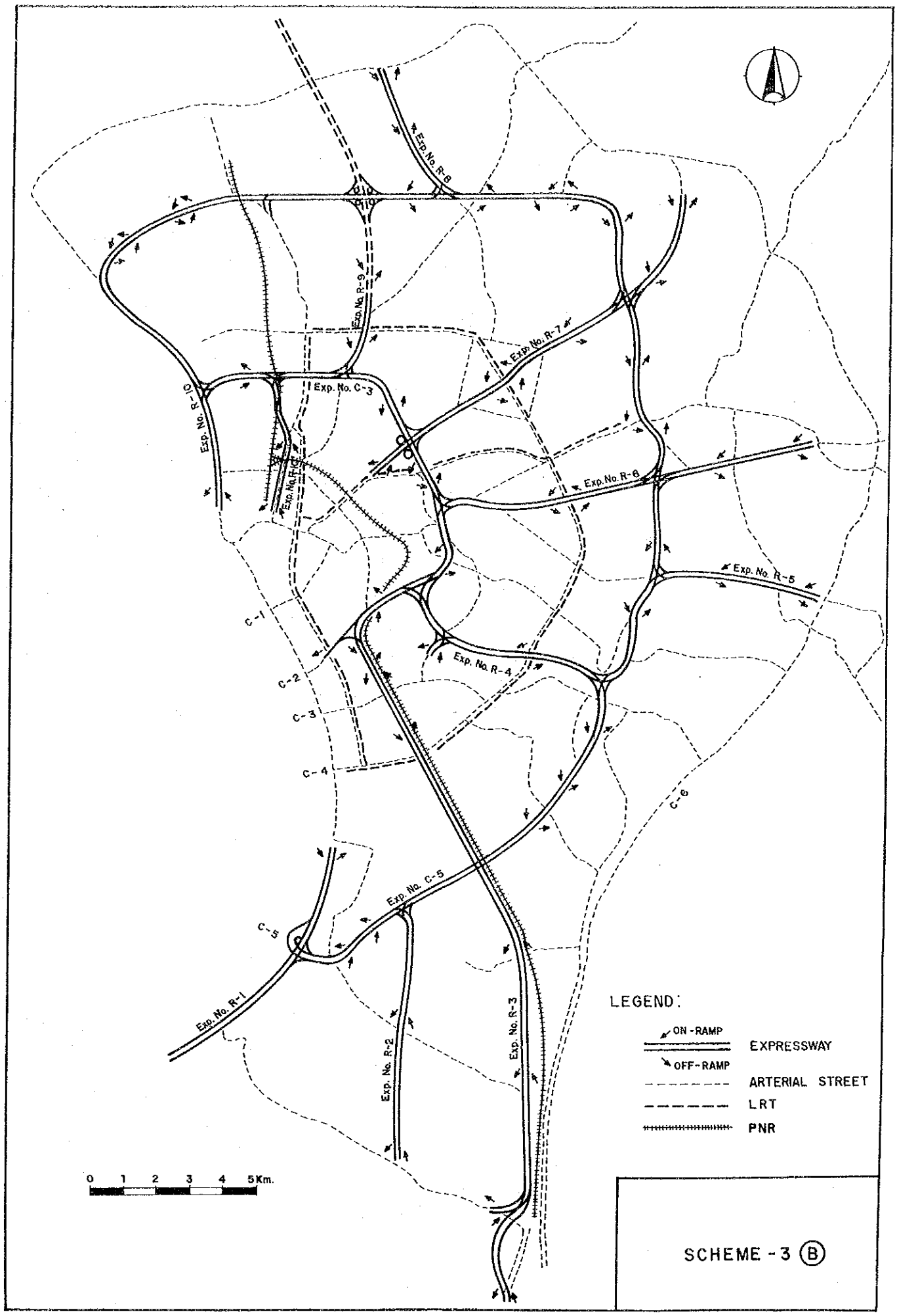
App. 6.1.1-1


Exp. No. R-7B
Exp. No. R-10
Exp. No. R-9
Exp. No. R-7
Exp. No. R-6
Exp. No. C-2
Exp. No. R-8
Exp. No. R-4
C-1
C-2
C-3
C-4
C-6
Exp. No. C-5
C-5
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
LEGEND :
ON-RAMP
OFF-RAMP
EXPRESSWAY
ARTERIAL STREET
LRT
PNR
0 1 2 3 4 5Km.
SCHEME - 1 (B)

App. 6.1.1-2


Exp. No. C-5
Exp. No. R-3
Exp. No. R-7
Exp. No. C-4
Exp. No. R-10
Exp. No. R-9
Exp. No. R-6
Exp. No. C-2
C-1
C-2
C-3
C-4
C-6
Exp. No. R-4
Exp. No. C-3
C-5
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
0 1 2 3 4 5Km.
LEGEND:
ON-RAMP
EXPRESSWAY
OFF-RAMP
ARTERIAL STREET
LRT
PNR
SCHEME-2


Exp. No. R-9
Exp. No. R-9
Exp. No. R-7
Exp. No. C-3
Exp. No. R-10
Exp. No. R-6
Exp. No. R-5
Exp. No. R-4
C-1
C-2
C-3
C-4
C-6
Exp. No. C-5
C-5
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
0 1 2 3 4 5 Km.
LEGEND :
ON-RAMP
OFF-RAMP
EXPRESSWAY
ARTERIAL STREET
LRT
PNR
SCHEME - 3 (A)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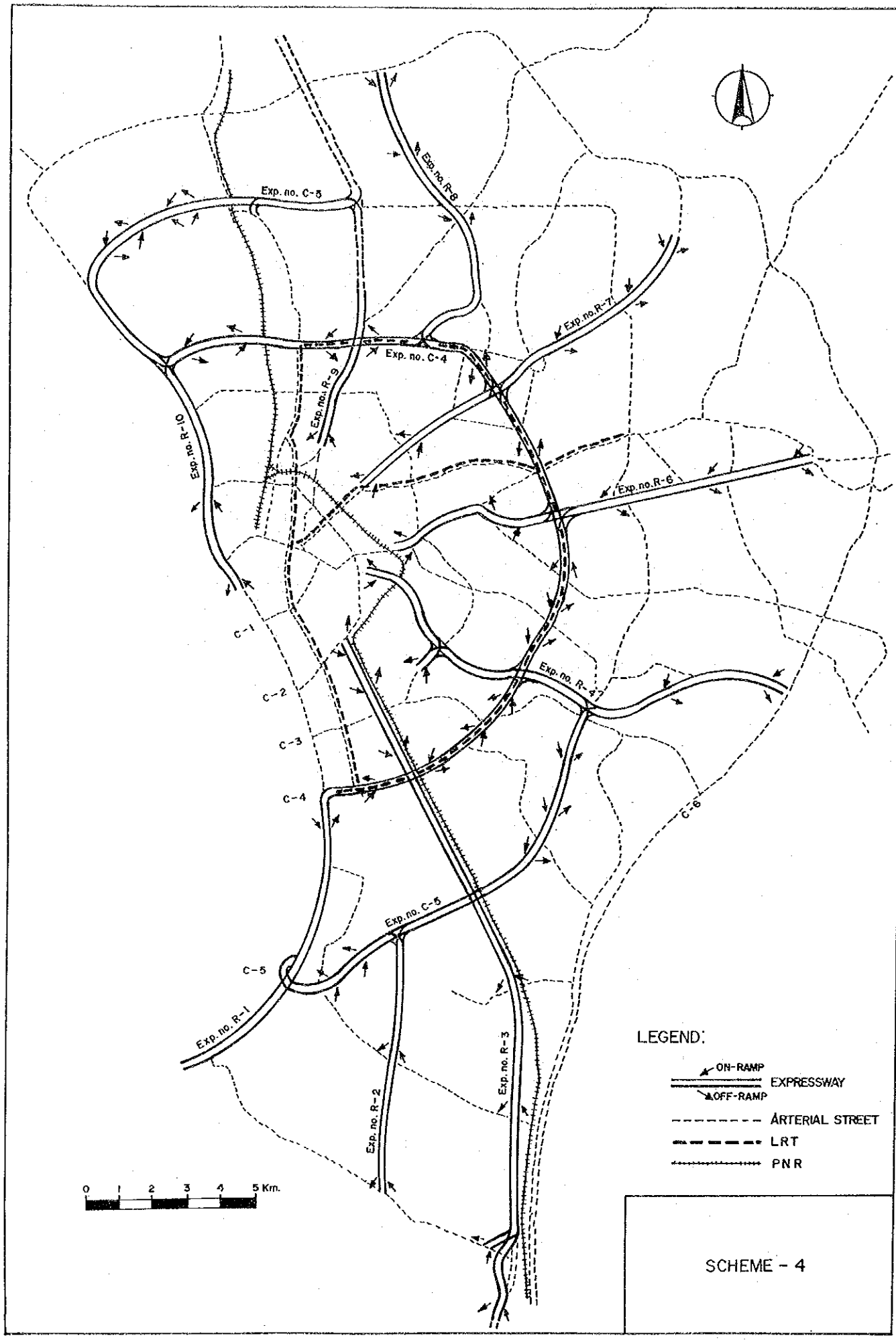
Exp. No. R-9
Exp. No. R-7
Exp. No. C-3
Exp. No. R-10
Exp. No. R-6
Exp. No. R-5
Exp. No. R-4
C-1
C-2
C-3
C-4
C-6
C-5
Exp. No. C-5
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
0 1 2 3 4 5Km.
LEGEND:
ON-RAMP
OFF-RAMP
EXPRESSWAY
ARTERIAL STREET
LRT
PNR
SCHEME - 3 (B)

App. 6.1.1-5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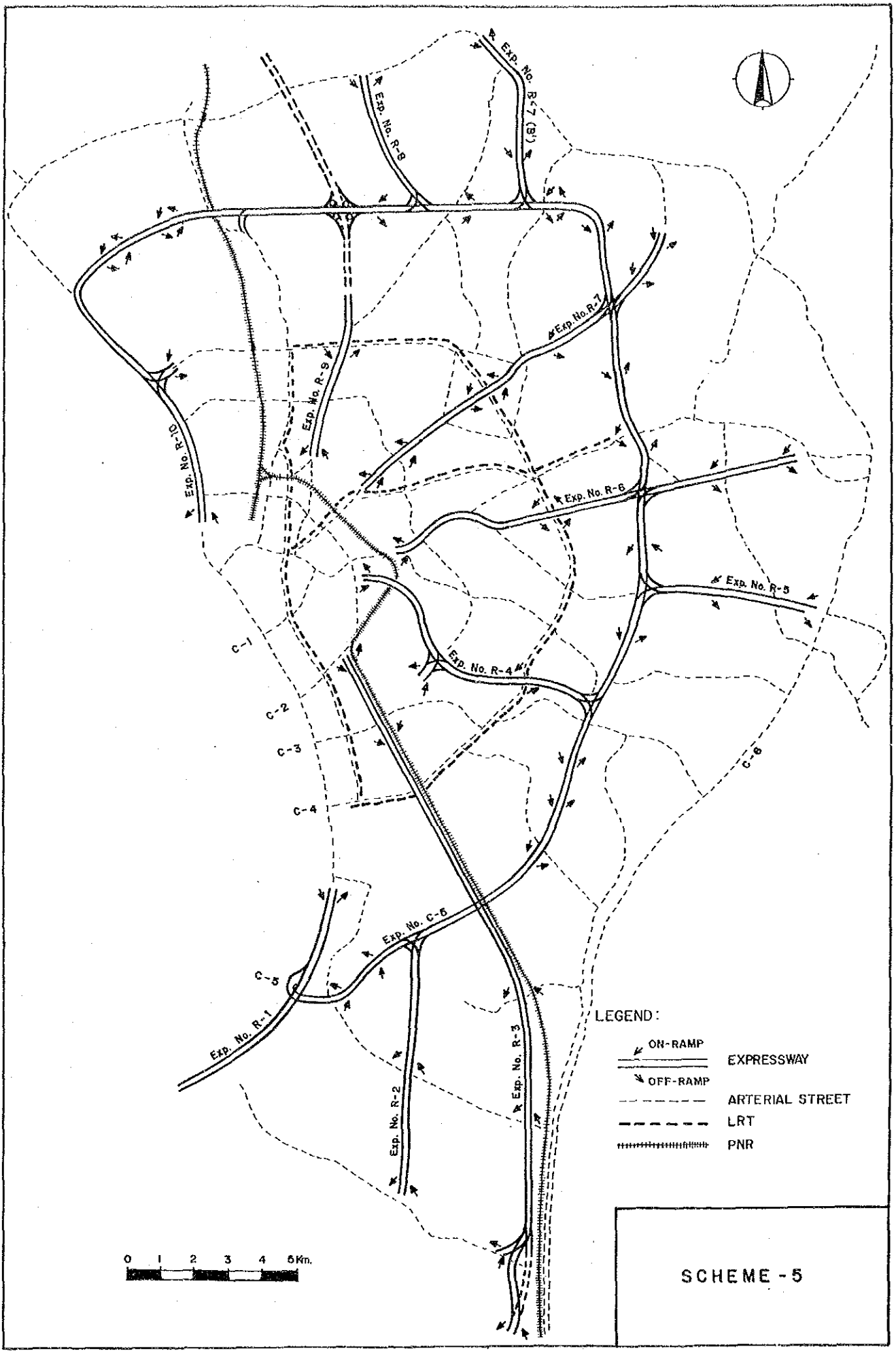
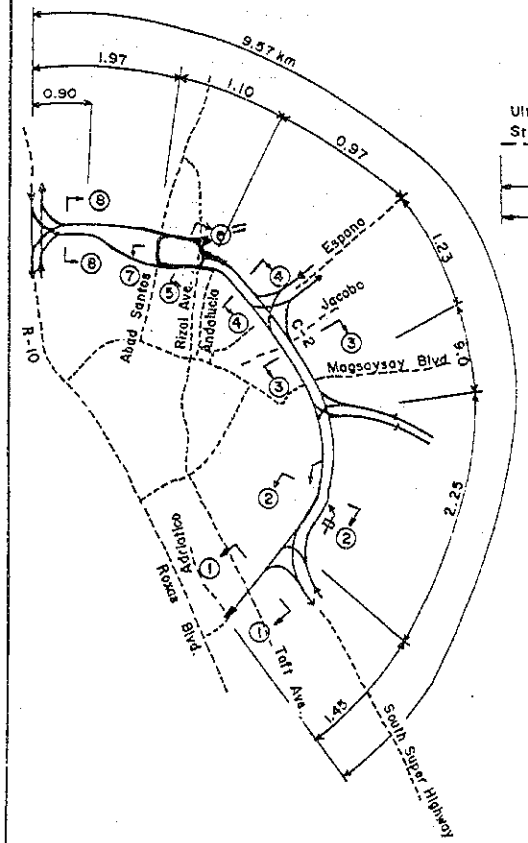
Exp. no. R-8
Exp. no. R-7
Exp. no. C-4
Exp. no. R-9
Exp. no. R-10
Exp. no. R-6
C-1
C-2
C-3
C-4
Exp. no. R-4
C-6
Exp. no. C-5
C-5
Exp. no. R-1
Exp. no. R-2
Exp. no. R-3
0 1 2 3 4 5 Km.
LEGEND:
ON-RAMP
EXPRESSWAY
OFF-RAMP
ARTERIAL STREET
LRT
PNR
SCHEME - 4

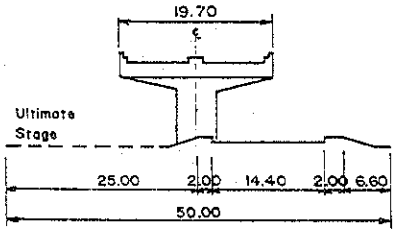

Exp. No. R-8
Exp. No. R-7 (B')
Exp. No. R-7
Exp. No. R-9
Exp. No. R-10
Exp. No. R-6
Exp. No. R-5
Exp. No. R-4
C-1
C-2
C-3
C-4
C-6
C-5
Exp. No. C-6
Exp. No. R-1
Exp. No. R-2
Exp. No. R-3
LEGEND:
ON-RAMP
EXPRESSWAY
OFF-RAMP
ARTERIAL STREET
LRT
PNR
0 1 2 3 4 5Km.
SCHEME - 5

App. 6.1.1-7

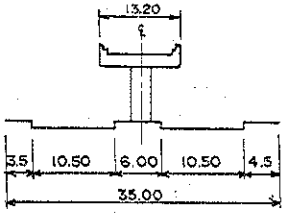
APPENDIX 6.3.1

RESULTS OF PRELIMINARY ENGINEERING STUDY

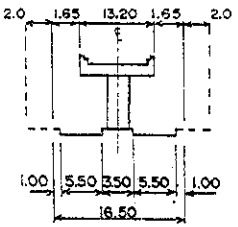




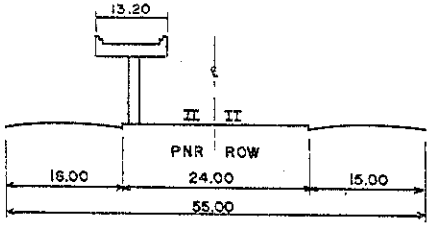
Section ⑧ C-2



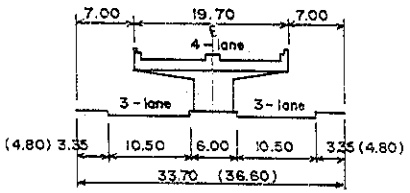
Section ⑦ Abad Santos



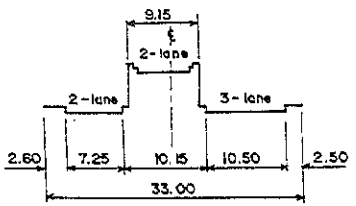
Section ⑤ Tayuman



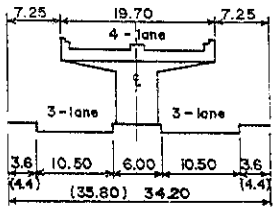
Section ⑥ Antipolo



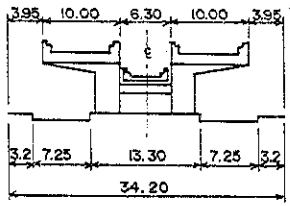
Section ④ Jacobo to Andalucia



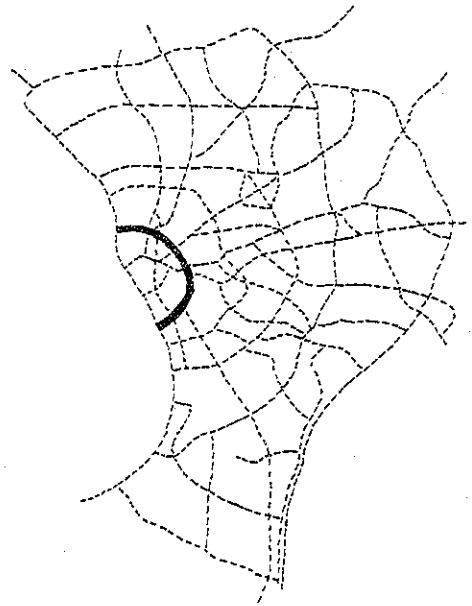
Section ① Quirino Ave.
Adriatico to South Super Highway



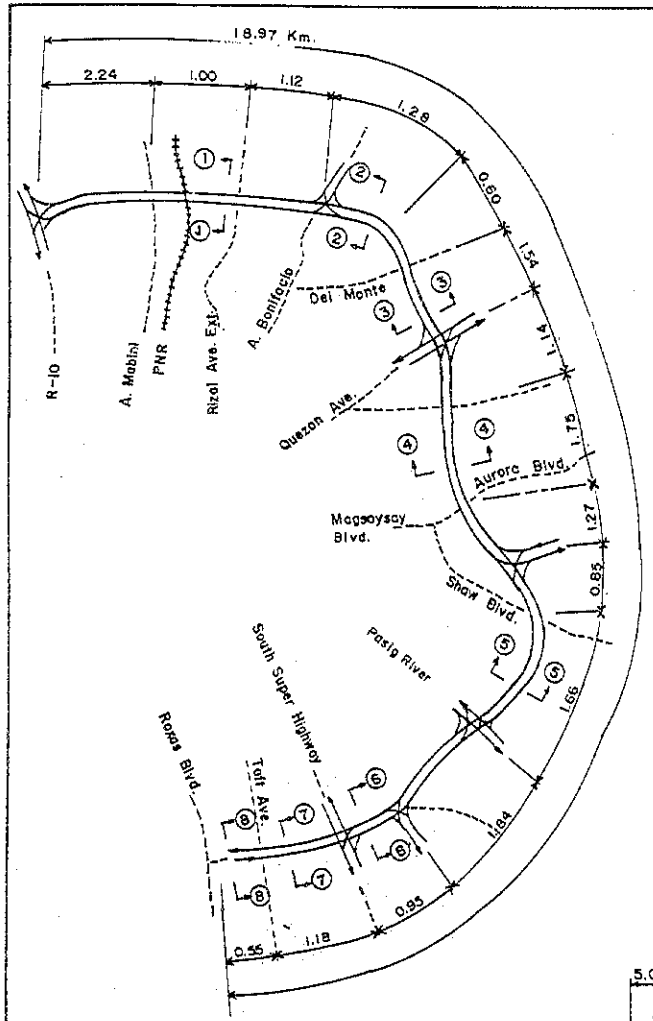
Section ② & ③
South Super Highway to Jacobo



Ramp Section



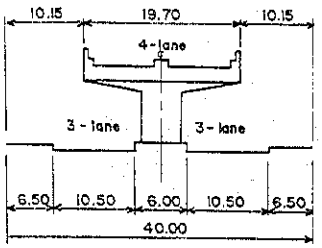
ROUTE C-2 (Along C-2)



Section ① & ④

① R-10 to Rizal Ave. Ext.

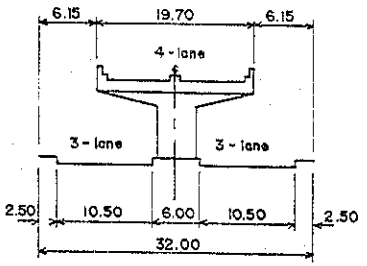
④ Quezon Ave. to Aurora Blvd.



Section ② & ⑤

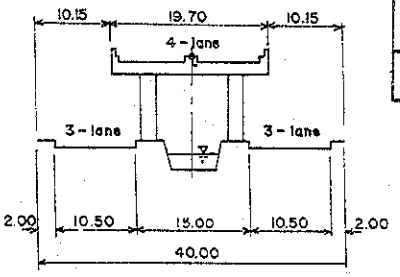
② Rizal Ave. Ext. to Araneta Ave.

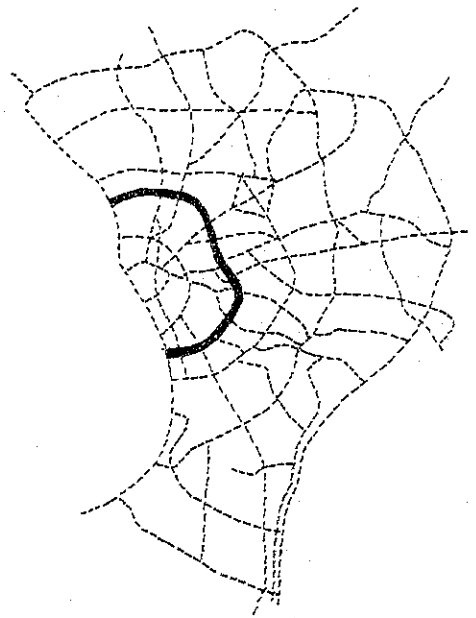
⑤ Aurora Blvd. to Buendia Ave.



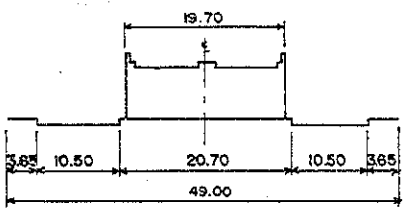
Section ③

SGT. Rivera to Quezon Ave.

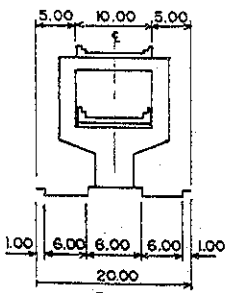




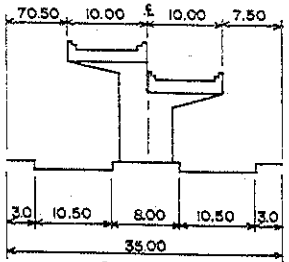
ROUTE C-3 ⓐ (All along C-3)



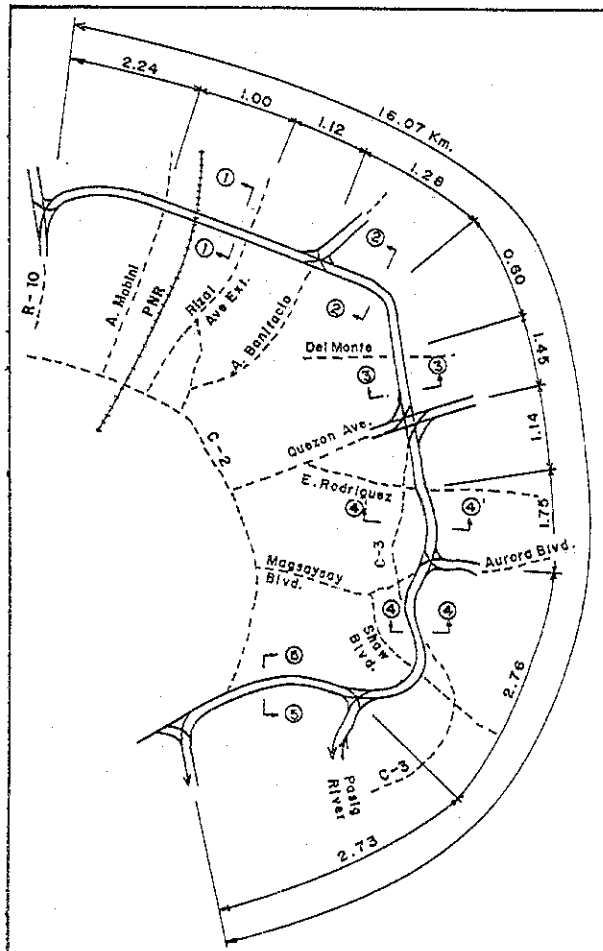
Section ⑧ Buendia Ave.



Section ⑦ Buendia Ave.



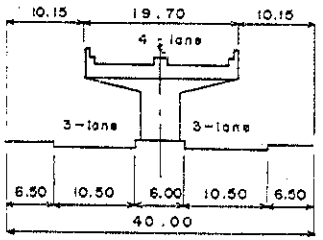
Section ⑥ Buendia Ave.



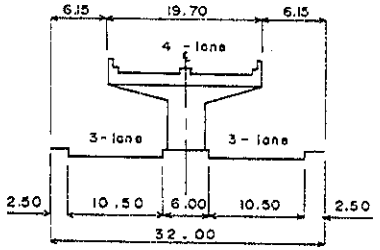
Section ① & ④'

① R-10 to Rizal Ave. Extension

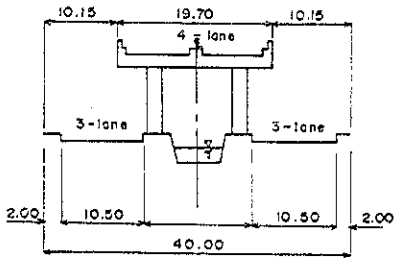
④' Quezon Ave. to Aurora Blvd.

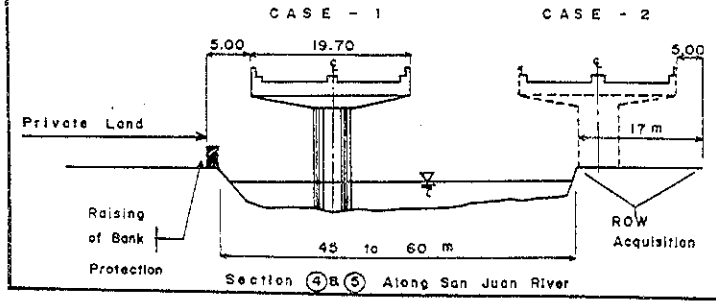


Section ② Rizal Ave. Extension to Araneta Ave

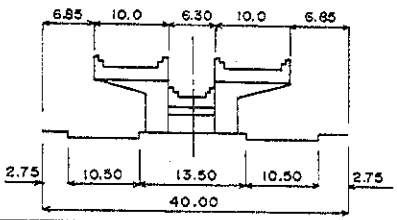


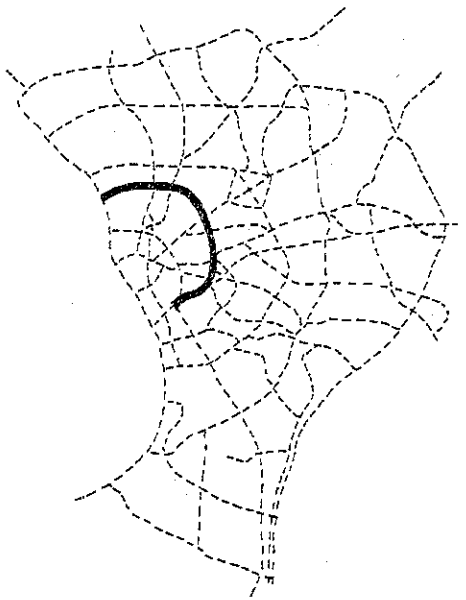
Section ③ SGT. Rivera to Quezon Ave.



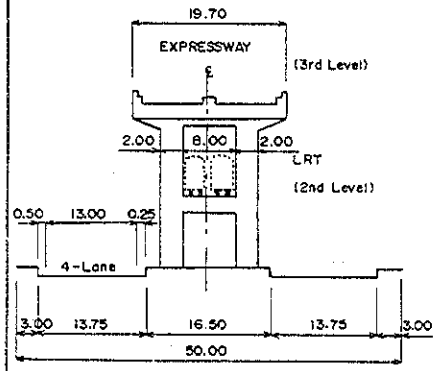


Ramp Section

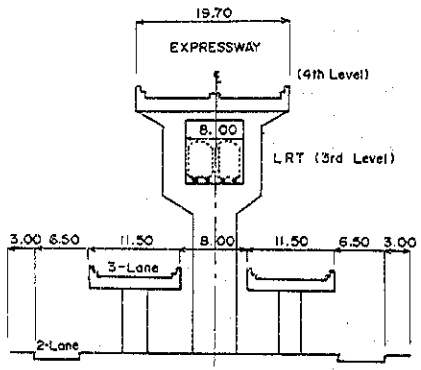




ROUTE C-3 ⓑ (Along San Juan River & C-3)

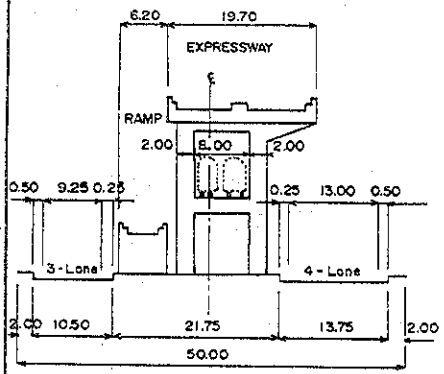


Normal Section

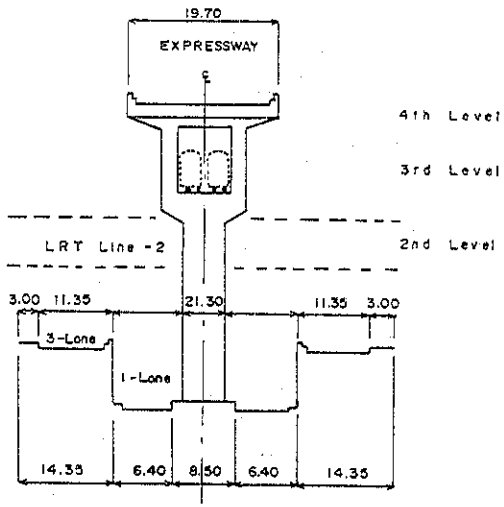


Intersection ①

- Kamuning – East / South Ave. Interchange
- Santolan Interchange

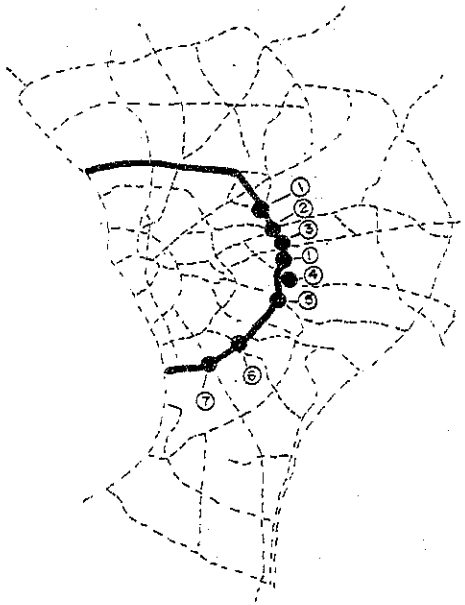


Ramp Section

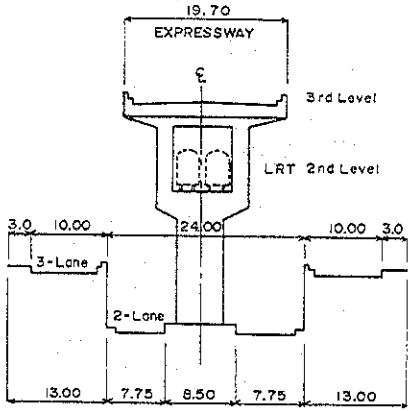


Intersection ②

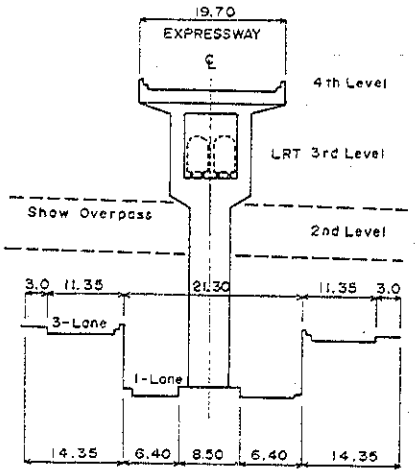
- Cubao Interchange



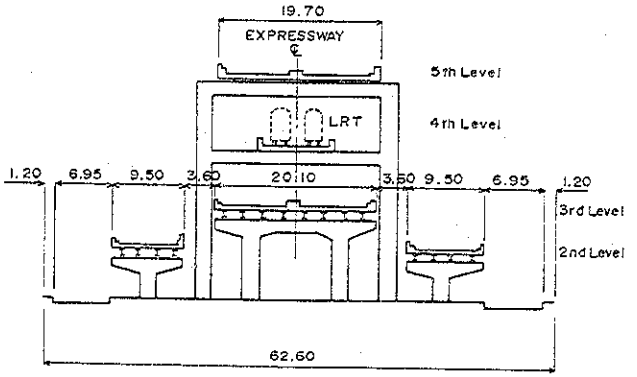
ROUTE C-4 (Along C-4)



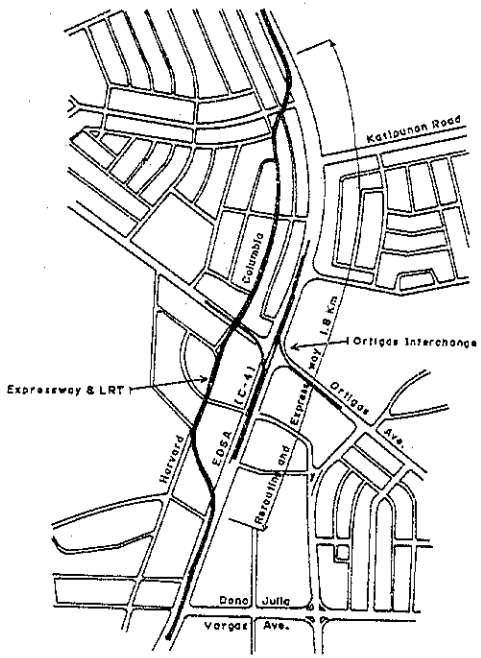
Intersection ③ P. Tuazon Interchange



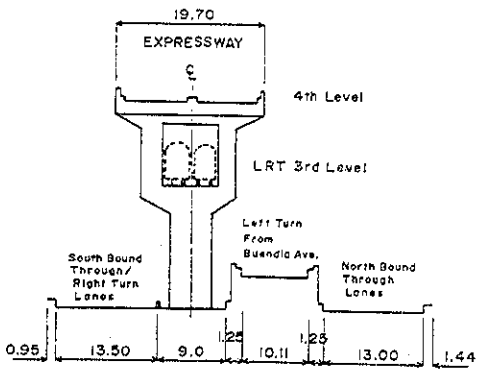
Intersection ⑤ Shaw Interchange



Intersection ⑥ MSDR Interchange

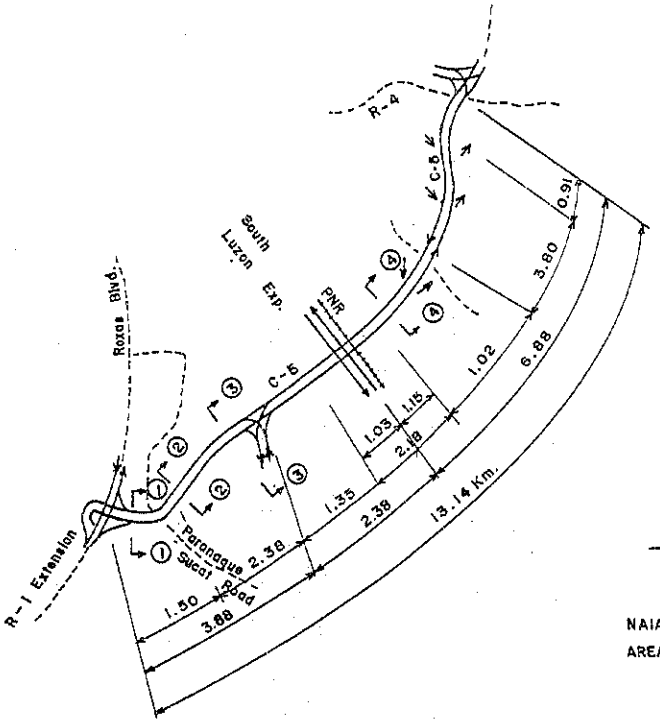


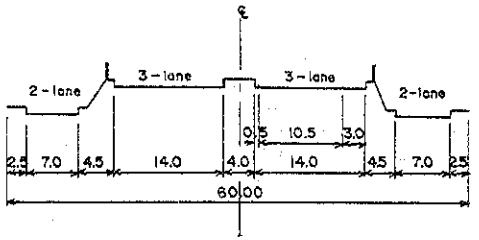
Intersection ④ Ortigas Interchange (Rerouted)



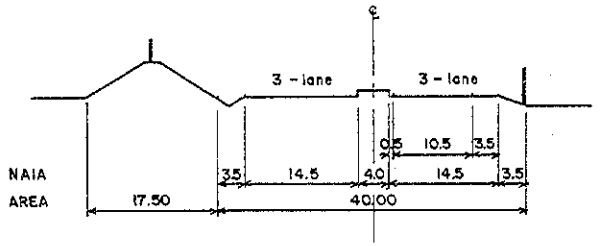
Intersection ⑥ Buendia Interchange

App. 6.3.1-6

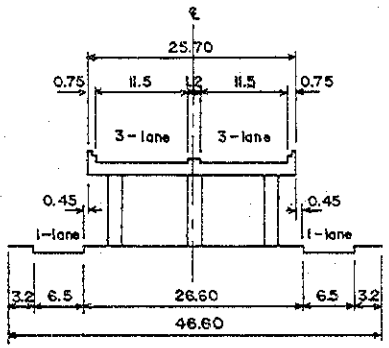




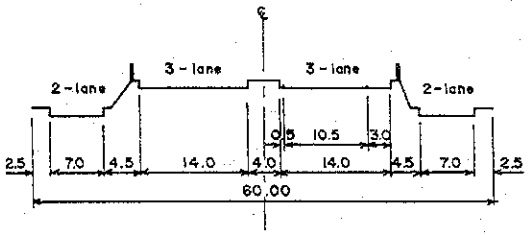
Section ④ South Luzon Expressway to R-4



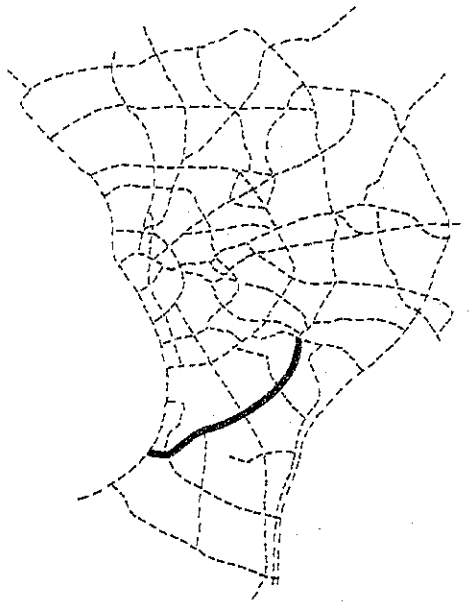
Section ③ NAIA Area to South Luzon Expressway



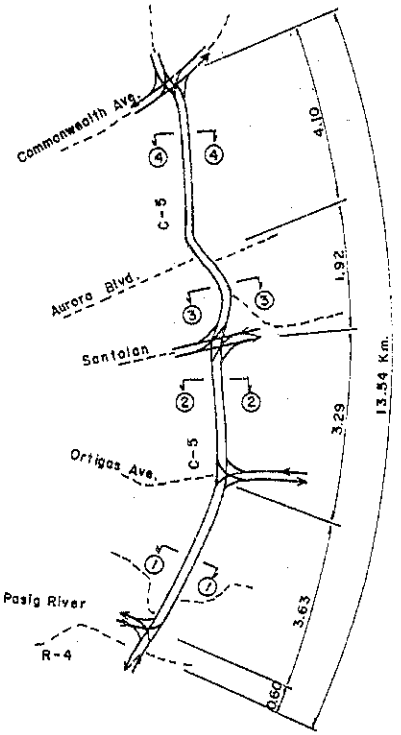
Section ① R-1 Extension to Paranaque - Sucat Road

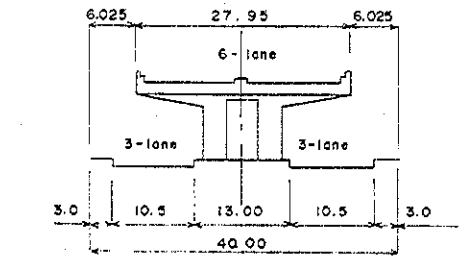


Section ② Paranaque - Sucat Road to NAIA Area



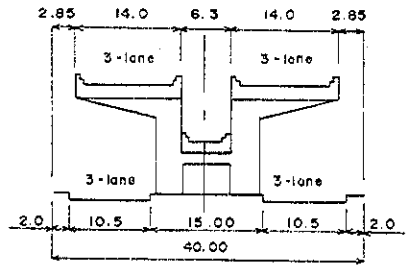
ROUTE C-5 from R-1 to R-4 (Along C-5)



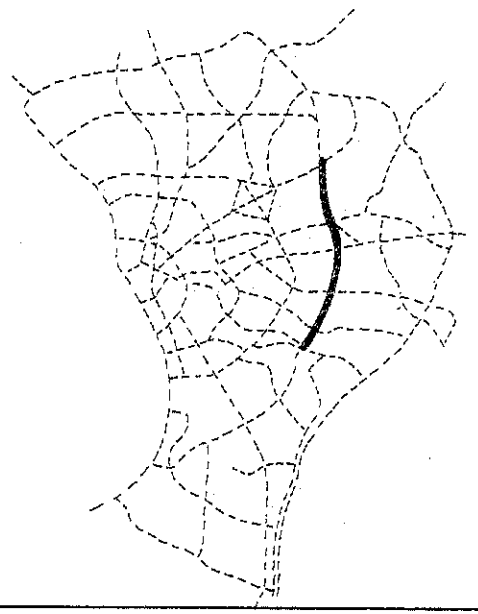


Section ①, ②, ③ & ④

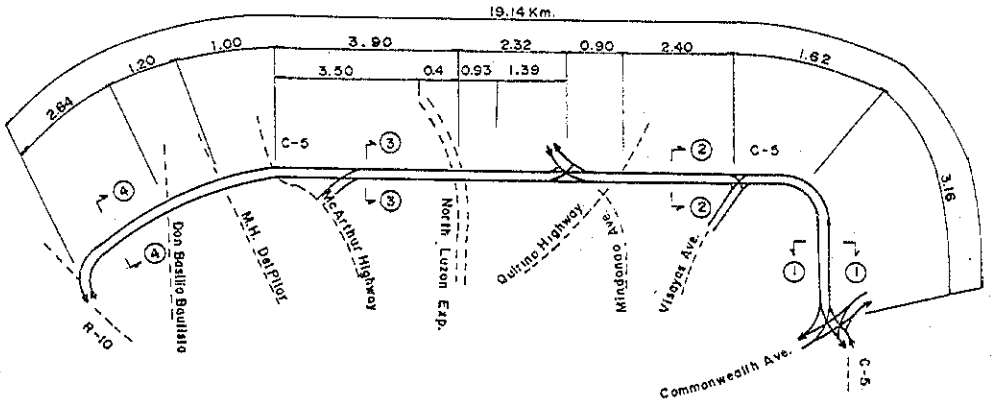
R-4 to Commonwealth Ave.

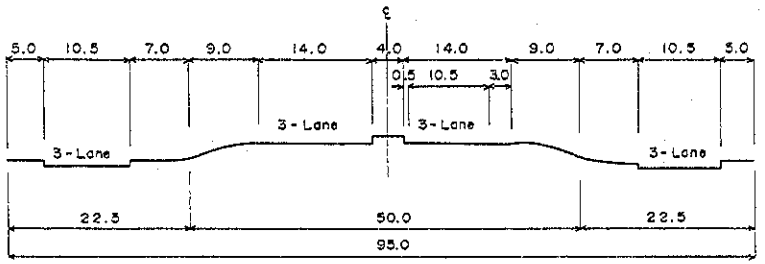


Ramp Section

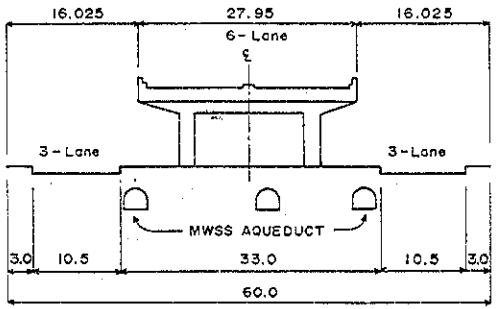


ROUTE C-5 from R-4 to R-7 (Along C-5)

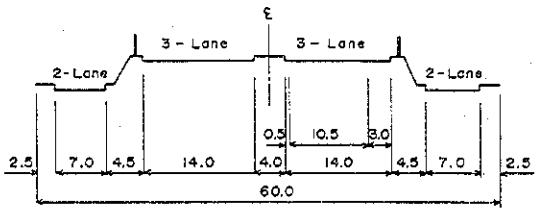




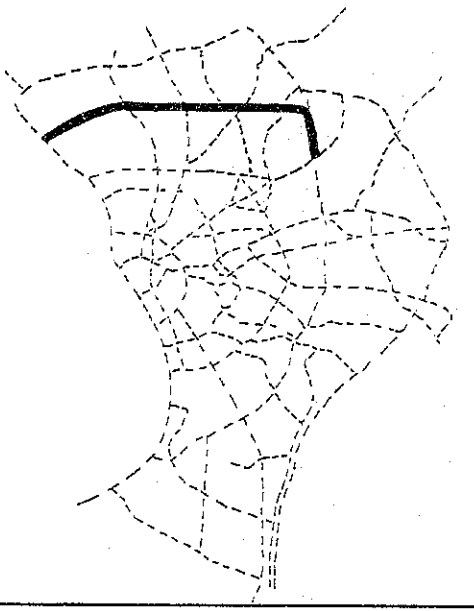
Section ② Along Republic Ave. (Luzon Ave. to North Luzon Expressway)



Section ① Along Luzon Ave. (Commonwealth Ave. to Republic Ave.)



Section ③ & ④ North Luzon Expressway to R-10)

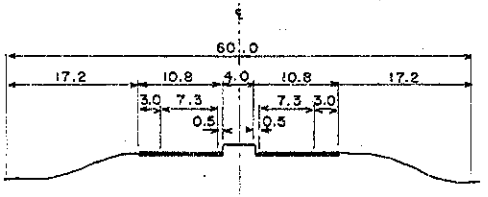


ROUTE C-5 from R-7 to R-10 (Along C-5)

Route R-1

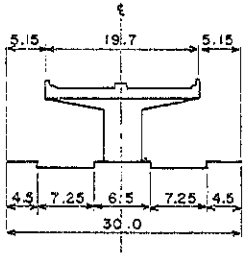
(R-1 Extension / Manila-Cavite Expressway

R-1 Extension Completed

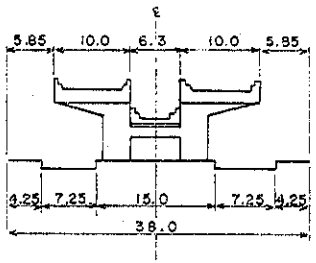


Route R-2

New Alignment



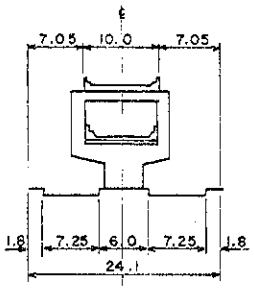
Normal Section

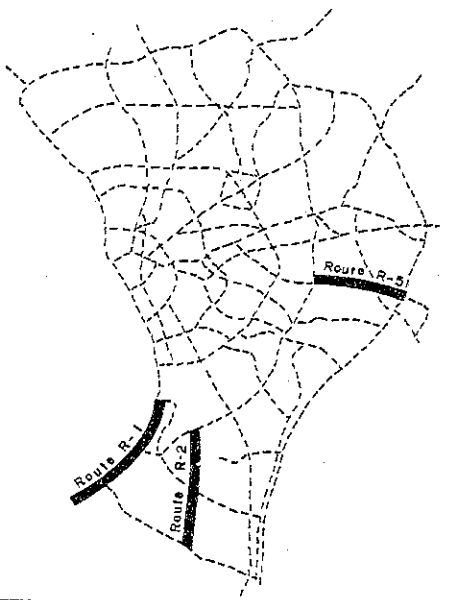


Ramp Section

Route R-5

Ortigas Ave. Extension





ROUTE R-1 (Along R-1 Ext.)

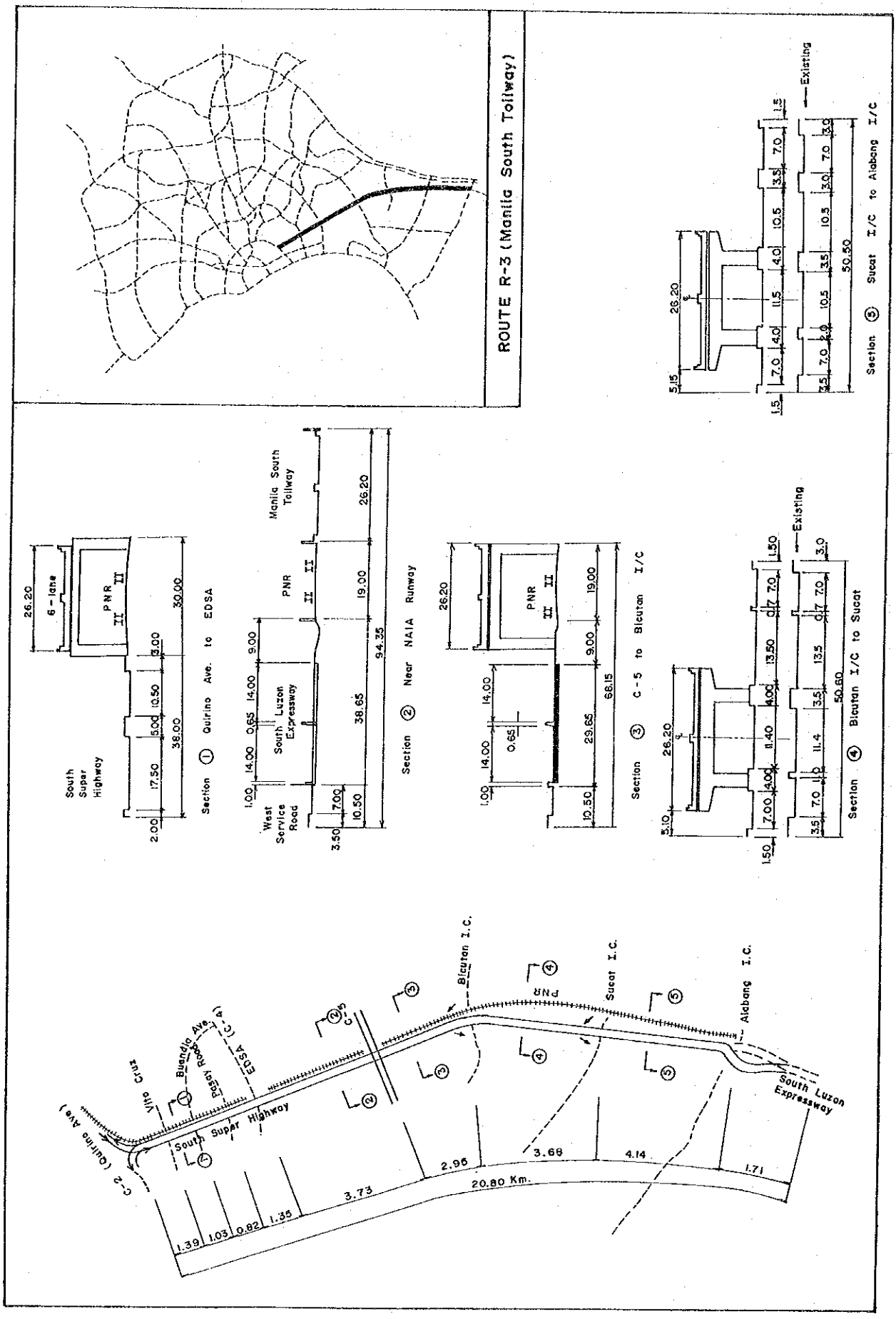
ROUTE R-2 (New Alignment)

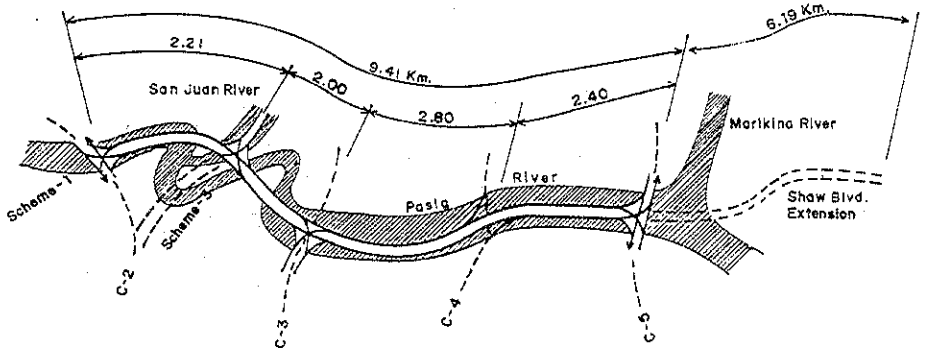
ROUTE R-5 (Along Ortigas Ave. Ext.)

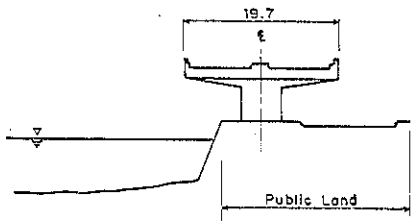
Route R-1 : Completed

Route R-2 : L = 7.35 km.

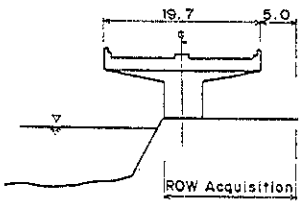
Route R-5 : L = 5.30 km.


ROUTE R-3 (Manila South Tollway)
Section ① Quirino Ave. to EDSA
Section ② Near NAIA Runway
Section ③ C-5 to Bicutan I/C
Section ④ Bicutan I/C to Sucat
Section ⑤ Sucat I/C to Alabang I/C
Existing
6 - lane
PNR
South Super Highway
Manila South Tollway
South Luzon Expressway
West Service Road
C-5
C-4
C-2 (Quirino Ave)
Vito Cruz
Buendia Ave.
Pasay Road
EDSA
Bicutan I.C.
Sucat I.C.
Alabang I.C.
South Luzon Expressway
20.80 Km.

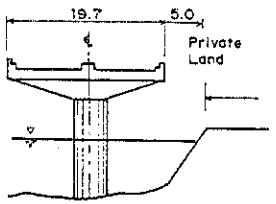




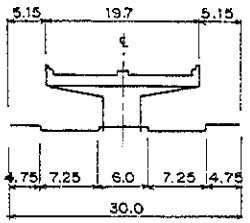
Type - 1



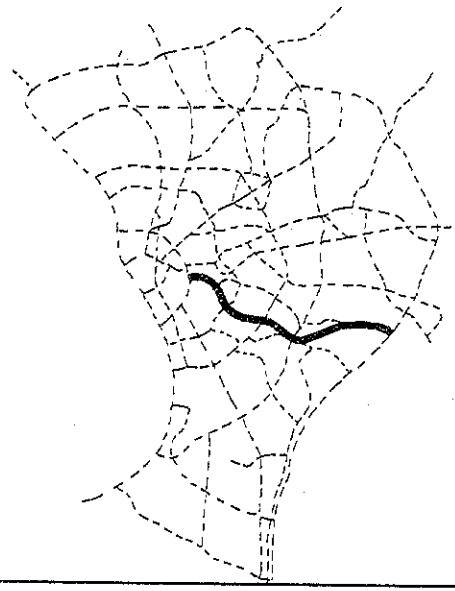
Type - 2



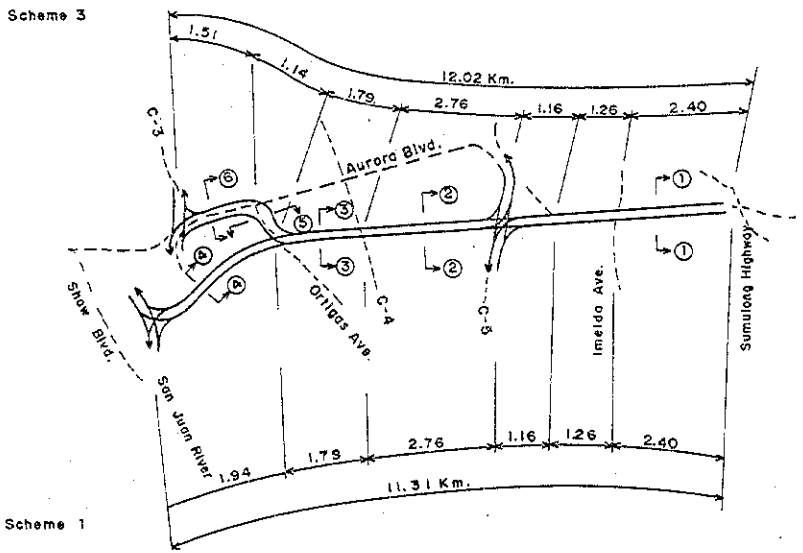
Type - 3

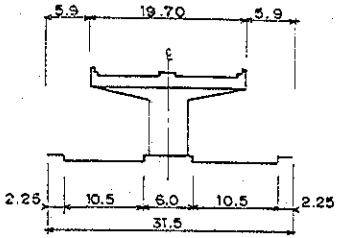


Type - 4

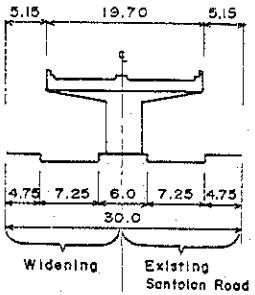


ROUTE R-4 (Along Pasig River)

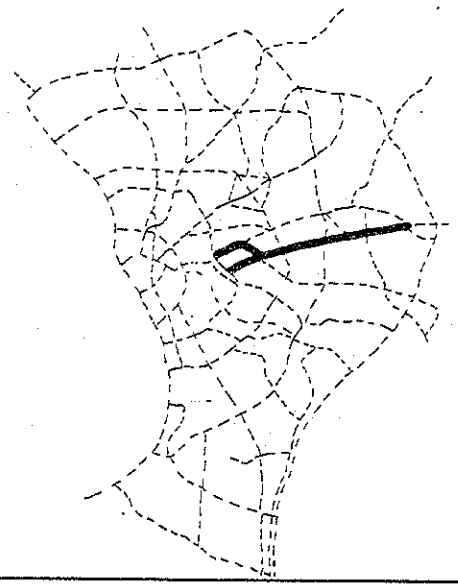




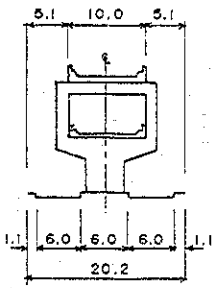
Section ① Marcos Highway



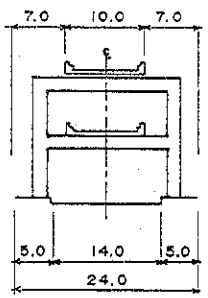
Section ② Santolan Road



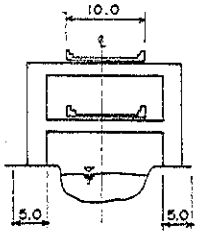
ROUTE R-6 (Along Santolan Road)



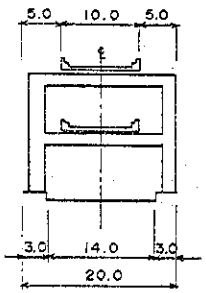
Section ③ Santolan Road



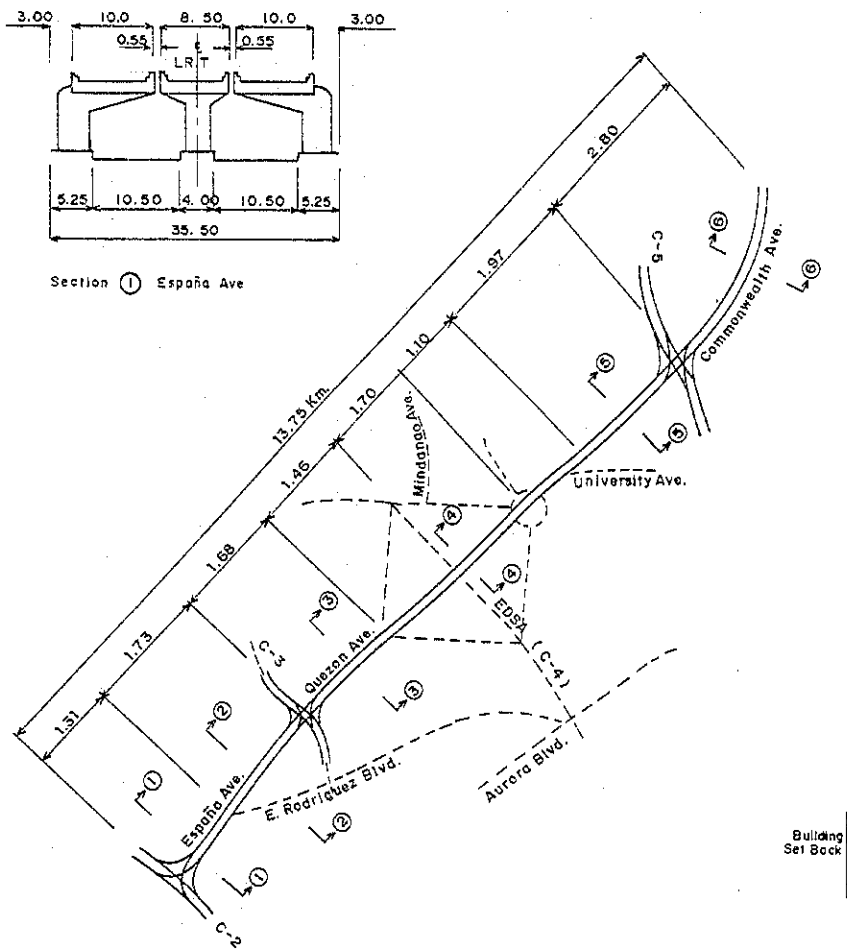
Section ④ New Link



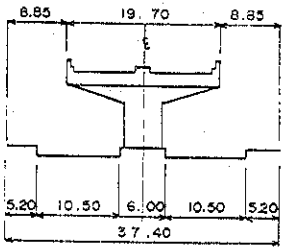
Section ⑤ Utilize River



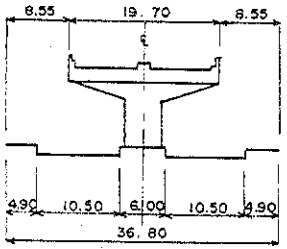
Section ⑥ Aurora Blvd.



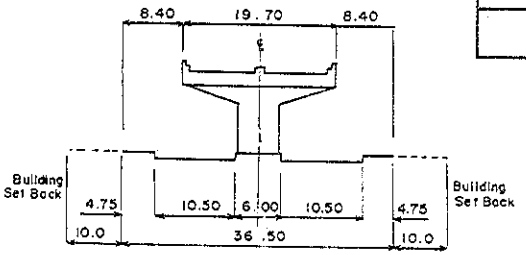
Section ① España Ave



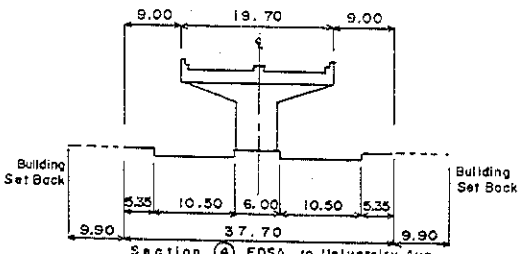
Section ② E. Rodriguez to C-3



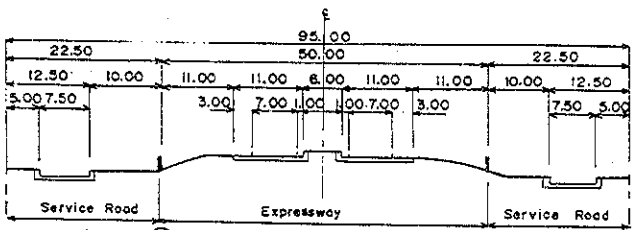
Section ③ C-3 to San Juan River



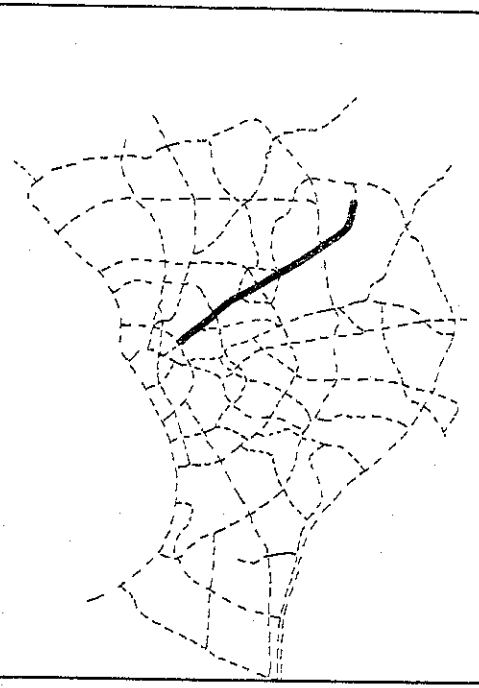
Section ③ San Juan River to EDSA



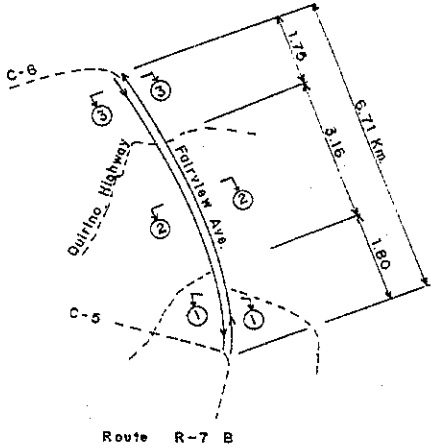
Section ④ EDSA to University Ave.



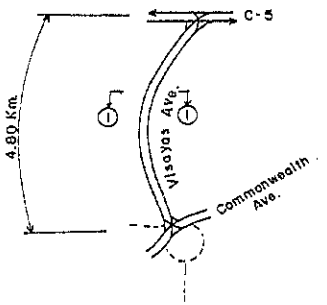
Section ⑤ Commonwealth Ave.



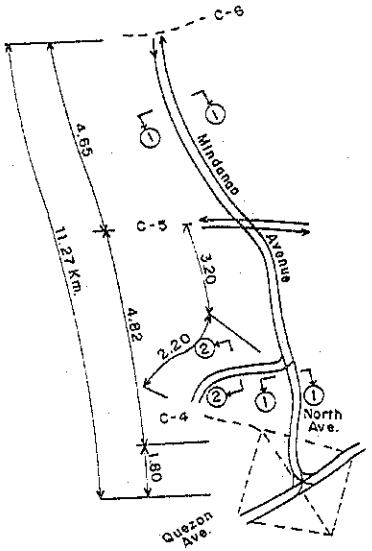
ROUTE R-7 (Along Quezon Ave.)



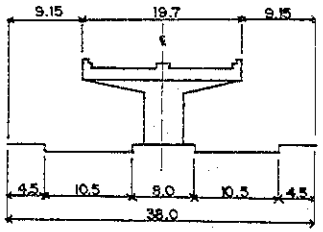
Route R-7 B



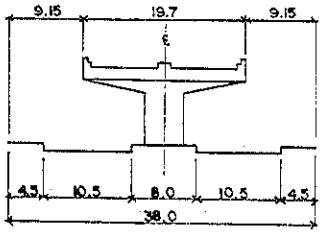
Route R-7 A



Route R-8



Section ① New Alignment
Section ② Utilize Existing Fairview Avenue
Section ③ Utilize C-6 ROW



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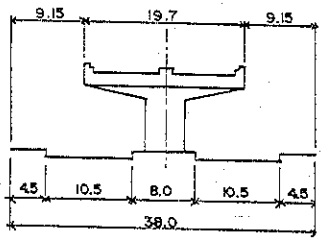

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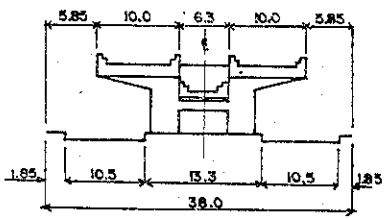
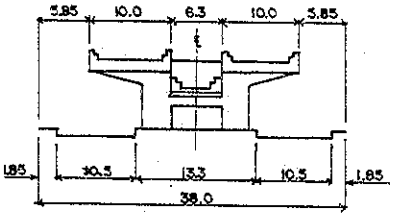


Ramp Section



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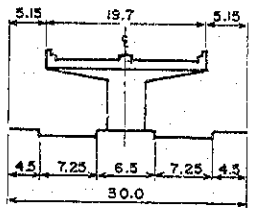

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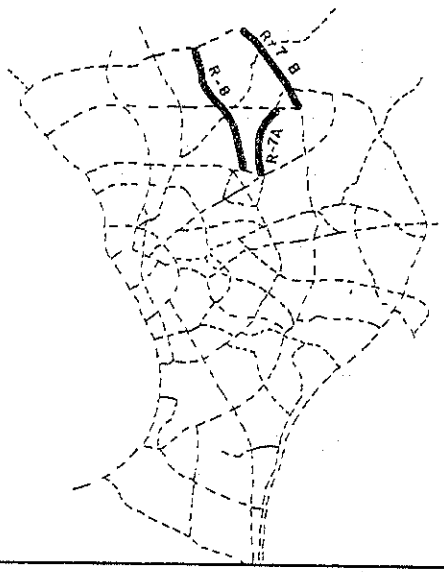
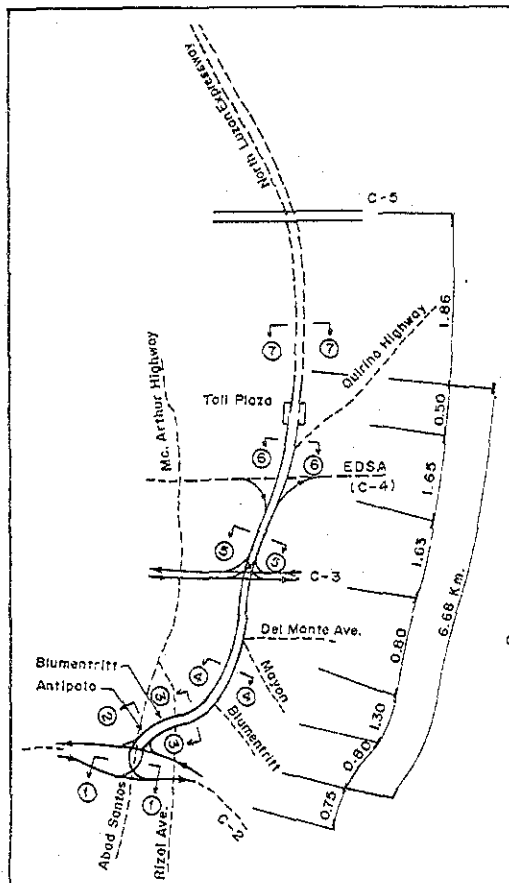


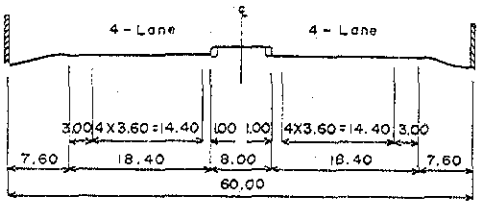
ROUTE R-7A (Along Visayas Ave.)

ROUTE R-7B (Along Fairview Ave.)

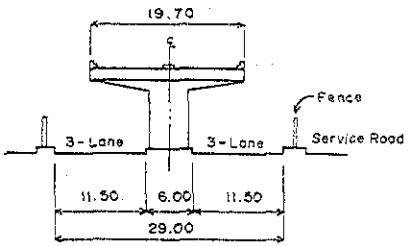
ROUTE R-8 (Along Mindanao Ave.)

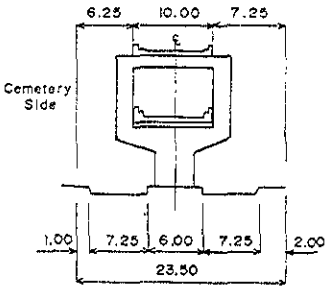


Section ⑦
North Luzon Expressway
(Widening to 8-Lane)

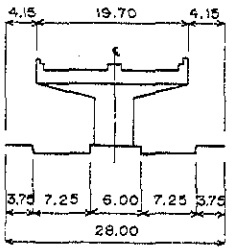


Section ⑥
North Luzon Expressway
From EDSA to Toll Plaza

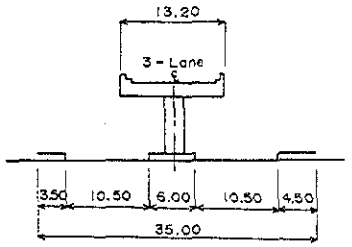




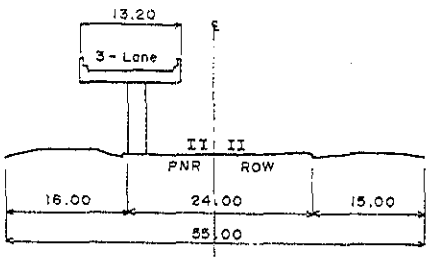
Section ④ Blumentritt to Del Monte



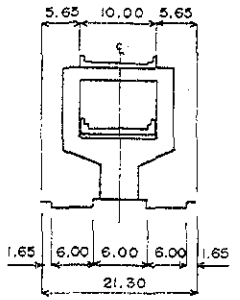
Section ⑤ Del Monte to EDSA



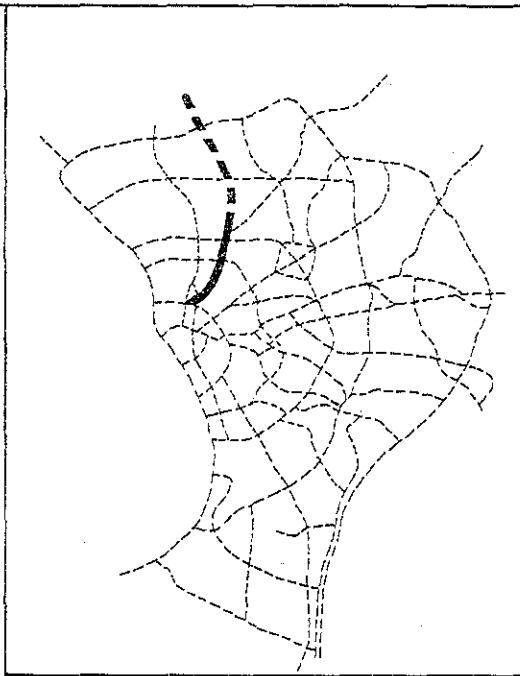
Section ① Abad Santos



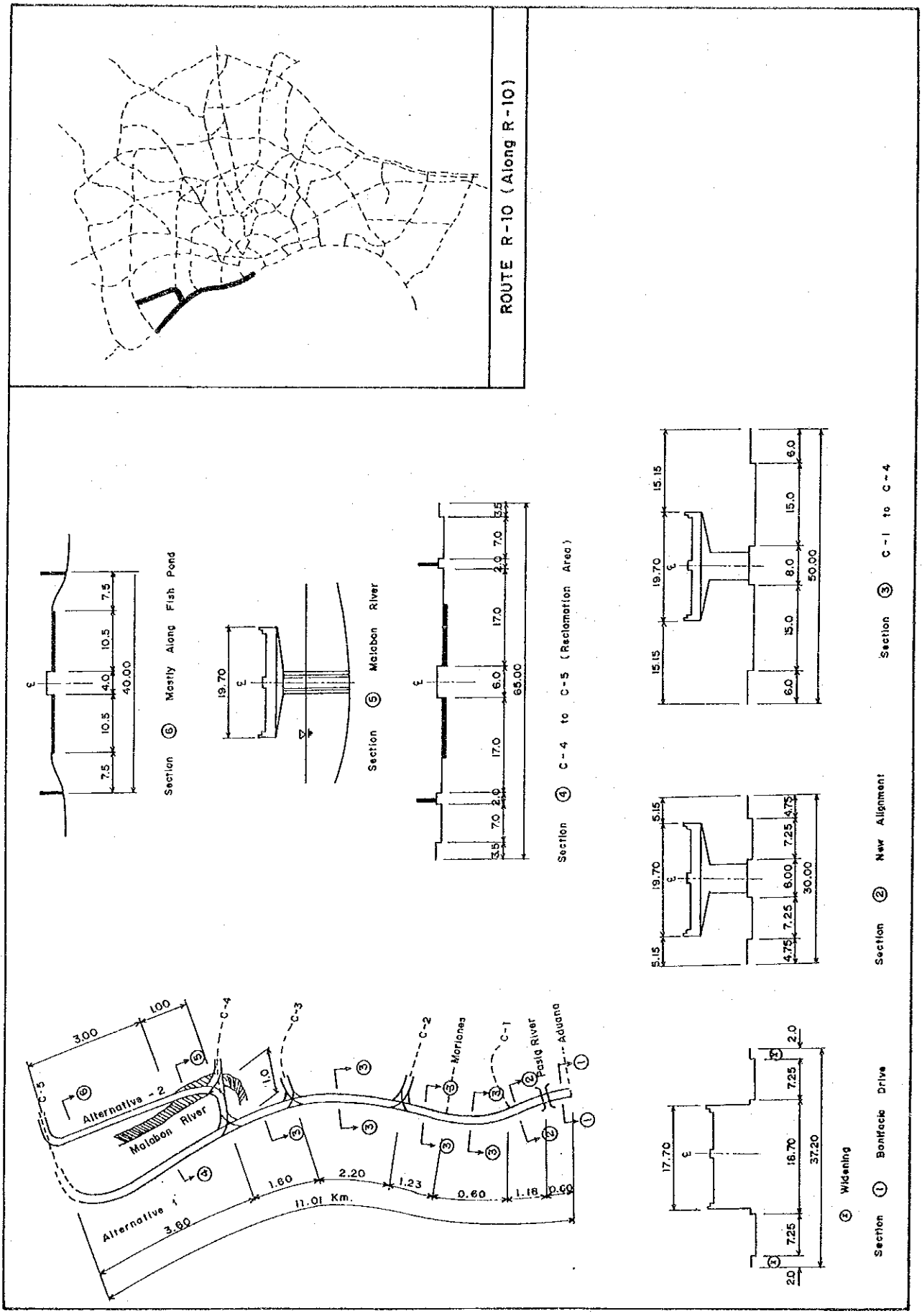
Section ② Antipolo

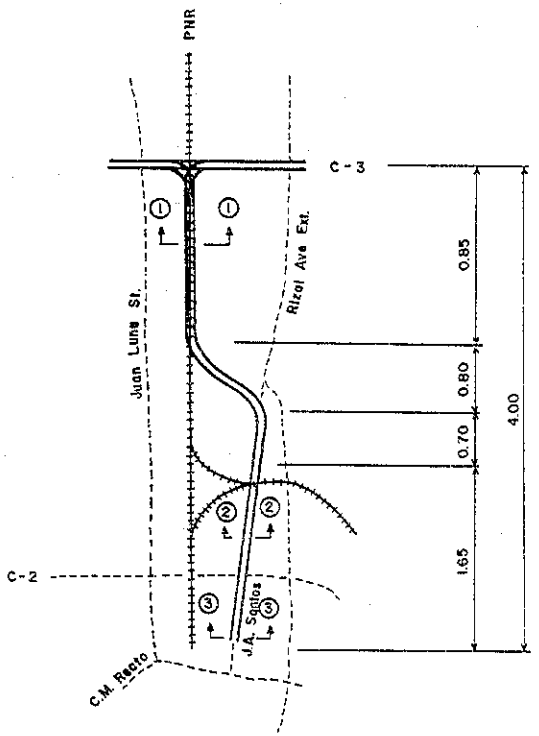


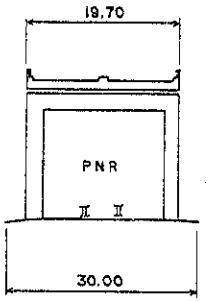
Section ③ Blumentritt



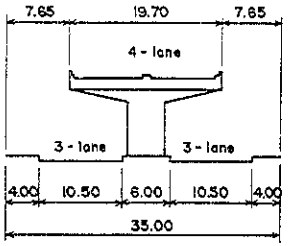
ROUTE R-9 (Along A. Bonifacio Ave.)


ROUTE R-10 (Along R-10)
Section ① Bonifacio Drive
② Widening
Section ② New Alignment
Section ③ C-1 to C-4
Section ④ C-4 to C-5 (Reclamation Area)
Section ⑤ Malabon River
Section ⑥ Mostly Along Fish Pond
Alternative - 2
Alternative - 1
Malabon River
Pasig River
Mariones
Aduana
C-1
C-2
C-3
C-4
C-5
11.01 Km.
3.60
1.60
2.20
1.23
0.60
1.18
0.60
3.00
1.00
1.0
15.15
19.70
50.00
30.00
37.20
65.00
40.00

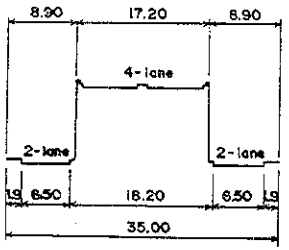




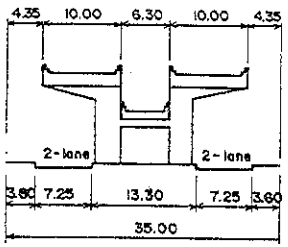
Section ① PNR



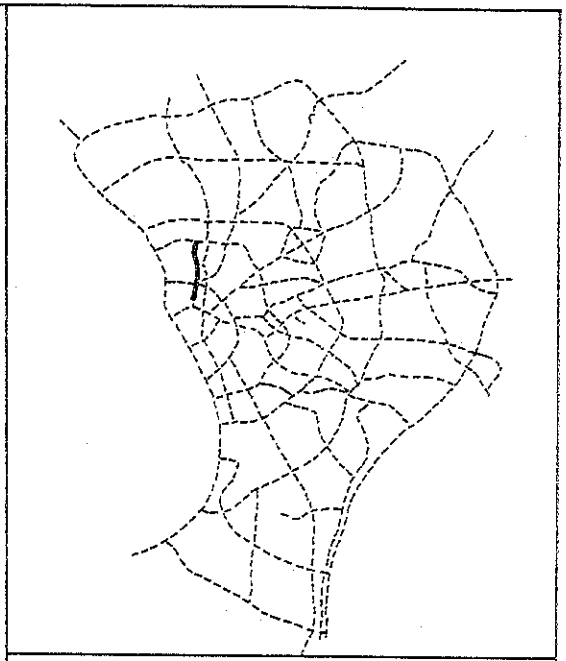
Section ② J.A. Santos



Section ③ C-2 ∽ C.M. Recto



Ramp Section



ROUTE R-10 (A) (Along PNR & A. Santos)

APPENDIX 8.4.1
SUMMARY IMPACT ASSESSMENT MATRIX

SUMMARY IMPACT ASSESSMENT MATRIX

LAND USE PARAMETERS	BASELINE CONDITION AND IMPACTS	IMPACT ASSESSMENT AND MITIGATION
What is the probable land use effect on the MMR areas within the Coastal Margin and Guadalupe Plateau?	The MMUES is designed to address the worsening traffic condition in Metro-Manila's core area (inside EDSA). It will also strengthen the North-South transport axis (one by Routes R-3, C-3 and R-9; and the other by Routes R-2, C-5 and R-8).	The basic design of the MMUES is compatible with the MMA's Regional Development Framework Plan which has identified the Guadalupe Plateau as the area in the region most suited to development. The spinal transport corridors formed by C-3 and C-5, including R-7, will promote the MMA's desired development pattern. The MMUES design also strengthens the north-south transport axis which will promote the desired direction of development toward the north-east and southern zones (and less emphasis on the eastern zone formed by the Marikina Valley). Improvement of traffic in the inner core area of the MMR will promote redevelopment of the Coastal Margin, which is a positive effect.
To what extent can the MMUES accelerate present urbanization in the Marikina Valley?	Expressway Route R-6 (in combination with completion of C-5's existing at-grade sections and the PNCC's proposed C-6 or Metro Manila Tollway project)would provide more convenient access to the Marikina Valley . Collectively, these would accelerate present pace of urbanization in the Valley.	Parts of the Marikina Valley are vulnerable to flooding and existing waste management infrastructure is inadequate. Still, The increased urbanization of the Marikina Valley seems inevitable. What is important is to carefully regulate the process to prevent it from becoming uncontrolled, and to coordinate the provision of infrastructure (transport, flood control, wastewater treatment). The potential environmental problems due to rapid urbanization of the Marikina Valley needs to be approached from a regional and multisectoral basis, rather than from a transport development basis alone. Coordination and regulation of development are the key mitigation measures.
To what extent can the MMUES increase urbanization in the Laguna (upper lakeshore) Lowlands?	The MMUES Routes will not traverse this area.	
To what extent is present industrial activity along C-5 and E. Rodriguez Jr (across Marikina River) likely to expand as a result of the MMUES?	Expressway Routes C-5 and R-5 (extension from C-5 along Ortigas Avenue) may intensify the existing (light to medium) industrial activities in the vicinity.	Added industrial wastes and effluents from this area--especially from food processing industries--could increase organic pollution of the Lower Marikina River (which connects with the Pasig). Control of the intensity of industrial development in the area is important as part of overall land use management and to anticipate possible effects of an expressway which could further attract industries.

What other localized land use effects may result from the project?	Part of the MMUES is construction of seventeen on-off ramps.	The on-off ramps will not be designed as conventional cloverleaf interchanges and will therefore not require large spaces or alter the land use in the sites. Some degree of commercialization of the areas close to the ramps may be induced, but this will not be significant.
What land use regulation measures need to be coordinated with expressway development in the MMR?	A zoning ordinance established in 1981 is the basis for regulating land use in the MMR.	The existing zoning ordinance is able to regulate *types* of land uses, but is not fully capable of regulating *intensity* of development for each land use type. Guidelines and regulatory standards governing intensity of permitted land uses should be provided to supplement the existing Zoning Ordinance.
AIR QUALITY PARAMETERS		
To what degree do vehicular emissions contribute to air pollution problems in Metro-Manila?	Traffic emissions are the principal source of air pollution in Metro-Manila. Particulate 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.	
What is the probable overall effect of the MMUES on traffic conditions and air pollution in Metro-Manila?	Without an expressway system, traffic congestion will worsen and air pollution will worsen even more. With an expressway, there are two effects to consider. By diverting private traffic into the expressways, the at-grade roads will be decongested. However, existing road capacities will be reduced by the expressway structures. As long as capacity reduction is less than 30%, travel time savings will be generated. The MMUES Master Plan estimated that travel time (a measure of congestion) in existing roads will be reduced by about 19%, and travel speed will improve by 10%.	An expressway network will have a favorable impact on air pollution by speeding up traffic flow, improving fuel efficiency, and reducing vehicular emission *rates*. The estimated daily private transport demand in year 2010 is 3.7 million pcu, and roughly 15 to 20% of this is the potential expressway traffic (based on estimated time value and assumed level of expressway toll). There are two favorable effects. 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.

What is the expected effect of particulate matter (PM) emissions?	In 1991, about 12,000 tons of particular matter were emitted, mostly by vehicles that use diesel fuel. Unless conditions improve, PM emissions are expected to grow by a factor of 2.19 by year 2005, based on current growth trends in vehicle population.	An estimated 65% of particulate matter emissions come from trucks, buses, jeepneys and taxis. These vehicles are likely to remain dominant users of existing at-grade roads. Increasing the average traffic speed on these roads by 10% will reduce PM emission *rates* to some extent. Diversion of trucks into the expressways will reduce PM emissions from these vehicles. Overall, the expected reduction in PM emission rates may not be enough to offset the increase in the total number of vehicles so that *total* future emissions will still rise (although not as much as without the MMUES). Solving PM pollution in Metro-Manila will require other measures, such as removing the subsidy on diesel fuel, phasing out of dilapidated buses and jeepneys that are heavy smoke belchers, and intensification of DENR's anti-smoke belching campaign.
What is the expected effect on lead emissions?	Gasoline engines generate almost all of the lead emissions from vehicles. Baseline projections show that lead emissions will increase by a factor of 2.32 by year 2005, mainly as a result of increasing vehicle population. In a recent study (Vehicular Emission Control Planning Project of DENR-ADB, 1992), it was found that lead concentrations along ADB-EDSA exceeded the guideline of 1.5 ug/m^3 during 4 out of 7 months of observations.	Recent estimates show that 58% of lead emissions come from utility vehicles, and 39% from cars. Most of the lead-emitting utility vehicles are private vehicles (vans, pick-ups) which use gasoline. These types of private vehicles are expected to use the expressways. Because of improved traffic flow, lead emissions from these vehicles will be lower. Total lead emissions may still rise due to increasing vehicle population and fuel consumption, but not as much as without the expressway system. Also, high lead concentrations at present traffic congested areas will be reduced as more of the lead emitting private vehicles are diverted into the expressways. Also, atmospheric dispersion of lead emissions will be aided by the fast traffic on the elevated expressways. In future, measures such as phasing in of lead-free fuel may become necessary.

What is the expected effect on emissions of gaseous pollutants, such as SO_2, NO_2, and CO?	Diesel engines produce six times more SO2 than gasoline engines, while gasoline engines produce 30 times more CO than diesel engines. NO_2 emissions from gasoline and diesel engines are not far apart. NO_2 is a key agent in the occurence of photochemical smog. Although at present these three pollutants are not observed to be at serious levels, emissions are expected to double in about 15 years at which time their effects will become more significant.	Private cars (which use gasoline) are expected to use the expressways more than other types of vehicles. Consequently, CO emissions *rates* from cars using the expressways will go down since emissions of CO are far greater for idling, low speeds and rapid changes of speed than at moderate steady speeds (about 43 kph on the proposed expressways). However, NO_2 emission would increase because this gas tends to be produced in larger amounts at higher speeds and rapid accelerations. To the extent that at-grade traffic flow is also improved, SO_2 emission *rates* from public vehicles (which use diesel) may be reduced also. Overall, smog is not seen as a significant threat in the MMR. The region's tropical maritime climate is characterized by good ventilation and infrequent occurence of temperature inversions (that trap polluted air near the ground).
Will objectionable odors be generated?	There will be no sources of objectionable odors during construction and operation of the project.	
WATER QUALITY PARAMETERS		
Will the project affect surface hydrology, such as the pattern of surface drainage and streamflows?	Except for Routes the alternative riverbank alignments for portions of C-3 and R-4, most of the proposed MMUES will follow existing transport corridors and road alignments.	No major changes in ground surface relief and streamflow regimes are expected. Earlier options to use the Pasig River for R-4 and the San Juan River for C-3 have been eliminated due to probable adverse flooding effects caused by backwater and reduction in streamflow capacity.
Will there be effects on runoff rates due to paving and compaction of ground?	Most of the MMUES will pass through already urbanized areas where much paving and ground compaction have already occured.	For most of the MMR, this effect will be minimal.
For the alternative using riverbank alignment (i.e., R-4 and part of C-3), what will be the effect on river pollution?	Parts of riverbanks, particularly along the San Juan River, are presently occupied by squatters. Throwing of garbage into rivers contributes to pollution and also clogs the waterway.	Relocation of squatters from riverbanks will reduce pollution from both dumping of garbage and disposal of domestic wastes directly into waterways, particularly the San Juan River. However, the river is already too polluted from other sources so that overall impact of removing squatter sources may be small.

For the alternative riverbank alignments, will access to waterways for cleaning and maintenance be affected?	The Pasig River is wide enough for dredging and maintenance to be done easily. The San Juan River (only 45 to 60 m wide) is too shallow and not navigable except by small boats.	Expressway route R-4 along the Pasig riverbank will not affect access to the river for navigation and river maintenance. The bottom of the San Juan River is *adobe* and dredging will have little benefit. Also, the San Juan river gradient is probably steep enough to prevent much deposition. Cleaning--mostly of floating garbage--is natural through flushing of the river during the rainy season. Access by small boats will not be prevented by a riverbank elevated expressway.
Will construction activities cause excessive silt runoff which could clog drains and impair downstream 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.
Will the project affect 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. No pumping of groundwater during construction is expected.	Where depth to groundwater is less than 30 meters, possibility of contamination of groundwater by polluted surface water resulting from excavation and piling activities should be avoided (particularly along the San Juan River alignment). This precauting is applicable mainly during construction, as all excavations and piles will be sealed to prevent contact of polluted surface water with the groundwater. Thus, the effect on groundwater is not expected to be significant.
NOISE AND VIBRATION		
Will the project construction increase noise levels?	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. These standards apply to areas directly fronting a 4-lane road or wider.	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.
Will people be exposed to serious noise levels during operation of the project?	Existing noise levels in the MMR are reported to be generally above the 50 db level that can cause annoyance. Out of the 150 km length of proposed MMUES, 73 km will pass through areas in which land use is residential or where clearance between expressway and building line is less than 5 meters. Proposed expressway routes are mostly along existing traffic corridors where traffic noise is already present.	Elevating the expressway will itself have the effect of mitigating traffic noise. 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 some expressway sections may have to be installed. Available data show that traffic noise is attenuated rapidly from about 70 db to 55 db at a distance of 100 m from the road's edge (with traffic speed of 50-60 kph and traffic volume of 6000 veh/hr).

Will vibration effects be significant?	Traffic-induced vibration is generated on the road and adjacent structures by passage of vehicles, and is mainly influenced by traffic volume. The poorer the road pavement condition, or where traffic consists of heavy vehicles, the greater the vibration effects. Vibration caused by at-grade traffic is potentially higher than that resulting from elevated traffic. Pile driving (using impact equipment) during construction can generate significant vibration effects.	No significant adverse effects (in terms of annoyance to people or structural damage to buildings) due to traffic-induced vibration are expected. This is because much of the MMUES will be *massive* elevated structures which will have the effect of reducing vibration. 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. For at-grade expressways, maintenance of road pavement surface during operation will reduce traffic-induced vibration.
IMPACTS OF RELOCATION AND ROW ACQUISITION		
What is the estimated magnitude of squatter relocation involved?	The MMUES will utilize parts of the PNR right of way for the SSH portion and the riverbanks of the Pasig and San Juan Rivers. In these areas, numerous squatters are present. First estimates of the number of squatter *households* at the Routes where most affected squatters found are given below: C-3 San Juan River 800 R-3 SSH/MST 2,500 R-4 Pasig River 1,400 R-10A Abad Santos 800 *Total* 5,500 A recently passed law, RA 7279 of 1992, stipulates rules and procedures for squatter relocation.	Relocation is a significant social impact which can be traumatic for those affected. However, areas along the PNR railway line and the banks of the San Juan and 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. Roughly, if 5,500 households are to be relocated and assuming that half of them are resettled in Bulacan and the rest in Cavite, an estimate of relocation cost is P184 million. If housing in relocation sites is also provided--such as a basic row house costing about P25,000 per unit--an added cost of roughly P137 million will be required. What is important to note is that the cost of relocating squatters could be very high. Other approaches to squatter relocation need to be examined. An alternative is to use the space under the elevated expressways for housing.

What are the effects in terms of private land acquisition?	Private land acquisition will be mainly in the sites proposed for the 17 Interchanges, and those areas needed for new routes.	The effect is mainly financial in view of the high cost of private land acquisition along prime commercial and residential areas affected. Resistance from private landowners can become a problem. Zonal valuations (for tax purposes) used for valuing private land acquisition are significantly lower than prevailing market prices. This effect could be significant for the new routes, especially R-2 which will cross prime residential areas in Paranaque.
Will the proposed expressways limit local area access or cut off existing communities?	Access-limited expressways (including road widening) may have the effect of limiting local access routes because of more widely spaced crossings. They may also divide existing communities that are cut across by the road.	Proposed expressways (except the new route R-2) are along existing routes, and will therefore not cut across existing communities or residential subdivisions. Elevated structures will not affect local area access routes below.
TRAFFIC SAFETY AND HAZARDS		
What is the effect of the proposed expressways on traffic safety conditions?	Metro-Manila accounts for 75 to 80% of reported traffic accidents. The high density of intersections along main streets is an important factor. 75% of pedestrian accidents occur at intersections and near intersections.	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.
Are there hazards posed to pedestrians and traffic during project construction?	Construction of elevated structures, including installation of massive prefabricated 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.

OTHER ECOLOGICAL VALUES		
Are there any important ecological values threatened by the project?	Environmental impacts on *biodiversity* (e.g., endangered plant and animal species) and *natural resources* (e.g., forests) are judged insignificant. This is because much of the MMUES will follow existing road alignments where surrounding areas are already highly urbanized. There are no known unique or endangered species of plants and animals in the project area as a whole; nor are natural forest areas, wildlife habitats, or man-made parks going to be intersected by the proposed expressway routes.