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THE FEASIBILITY STUDY ON THE TRANSPORT INFRASTRUCTURE DEVELOPMENT PROJECT IN CALCUTTA FINAL REPORT VOLUME II MAIN REPORT

SEPTEMBER 1992

JAPAN INTERNATIONAL COOPERATION AGENCY



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**THE FEASIBILITY STUDY ON
THE TRANSPORT INFRASTRUCTURE
DEVELOPMENT PROJECT IN CALCUTTA
FINAL REPORT VOLUME II
MAIN REPORT**

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PREFACE

In response to a request from the Government of India, the Government of Japan decided to conduct a feasibility study on The Transport Infrastructure Development Project in Calcutta and entrusted the study to the Japan International Cooperation Agency (JICA).

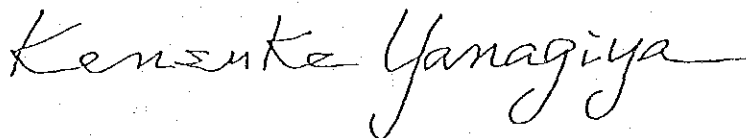
JICA sent to India a study team headed by Dr. Juro Koderu, Yachiyo Engineering Co., Ltd., two times between September, 1991 and September, 1992.

The team held discussions with the officials concerned of the Government of India, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of India for their close cooperation extended to the team.

September, 1992



Kensuke Yanagiya
President
Japan International Cooperation Agency

**THE FEASIBILITY STUDY
ON
THE TRANSPORT INFRASTRUCTURE DEVELOPMENT PROJECT
IN
CALCUTTA**

FINAL REPORT

**VOLUME I : SUMMARY
VOLUME II : MAIN REPORT
VOLUME III : TECHNICAL REPORT
VOLUME IV : DRAWINGS**

CONTENTS

CHAPTER 1 INTRODUCTION

1.1	Background of the Study.....	1
1.2	Study Area and Target Year.....	1
1.3	Policy and Objectives of the Study.....	3
1.4	Study Approach.....	7
1.4.1	Study Approach.....	7
1.4.2	Reports.....	9
1.5	Study Organization.....	9
1.5.1	Counterpart Team.....	9
1.5.2	Advisory Committee, Japanese Government.....	11
1.5.3	Study Team.....	11

CHAPTER 2 BACKGROUND INFORMATION

2.1	Project Area and Administrative Organizations.....	13
2.2	Socioeconomic Conditions.....	17
2.2.1	Population.....	17
2.2.2	Occupation Distribution.....	18
2.2.3	State Domestic Product and Per Capita Income.....	19
2.2.4	Motor Vehicle Registration.....	21
2.2.5	Future Socioeconomic Conditions.....	21
2.3	Land Use.....	23
2.3.1	Development Patterns.....	23
2.3.2	Land Use Composition.....	24

2.4	Mass Transportation Systems.....	27
2.4.1	Railway.....	27
2.4.2	Metro.....	30
2.4.3	Trams.....	30
2.4.4	Buses.....	33
2.4.5	Ferry Services.....	33
2.5	Highway and Street Network.....	35
2.5.1	National Highways.....	37
2.5.2	State and District Roads.....	38
2.5.3	Metropolitan Road System.....	39
2.6	Other Transportation Infrastructure.....	44
2.6.1	Parking Facilities.....	44
2.6.2	Pavement Conditions and Road Markings.....	45
2.7	Transportation Projects Under Implementation or Committed.....	47
2.8	Environment.....	49
2.8.1	Air Pollution.....	49
2.8.2	Historic Buildings.....	52

CHAPTER 3 FIELD SURVEY

3.1	Soil Investigation.....	54
3.1.1	Survey Methodology.....	54
3.1.2	Field Survey Results.....	56
3.2	Topographic Survey.....	60
3.2.1	Topographic Survey Extent and Methodology.....	60
3.2.2	Topographical Mapping Produced.....	61
3.3	Underground Utilities Survey.....	62
3.3.1	Methodology.....	62
3.3.2	Survey Results.....	62

CHAPTER 4 TRAFFIC SURVEYS AND FUTURE TRAFFIC ESTIMATES

4.1	Surveys.....	72
4.1.1	Background.....	72
4.1.2	Survey Methodology.....	72
4.1.3	Results of Traffic Surveys.....	78
4.1.4	Results of Parking Survey.....	93
4.1.5	Results of Pedestrian Surveys.....	94
4.2	Estimation of Future Traffic Demand.....	97
4.2.1	Methodology.....	97
4.2.2	Intersection Traffic Volumes.....	103

CHAPTER 5 TRANSPORT INFRASTRUCTURE IMPROVEMENT ALTERNATIVES

5.1 Summary of Existing Problems..... 105

5.1.1 Traffic Volume and Vehicle Type..... 105

5.1.2 Traffic Control at Intersections..... 106

5.1.3 Intersection Geometry..... 107

5.1.4 Parking Facilities..... 108

5.1.5 Conflict of Trams and Buses with Vehicular
Movements..... 108

5.1.6 Pedestrians and Hawkers at Intersections..... 108

5.1.7 Pavement Conditions..... 109

5.1.8 Traffic Control Devices..... 109

5.2 Conditions at Study Intersections..... 110

5.2.1 Location and Conditions..... 110

5.2.2 Problems at Each Study Intersection..... 111

5.3 Improvement Options for each Study Intersection..... 117

5.3.1 Basic Policy..... 117

5.3.2 Selection Criteria for Improvement Options..... 117

5.3.3 Improvement Option Plans..... 120

5.3.4 Alternative Intersection Improvement Proposals
for Feasibility Assessment..... 125

5.4 Parking Facilities Improvements..... 127

5.4.1 Parking Characteristics..... 127

5.4.2 B.B.D. Bag Parking..... 129

5.4.3 Esplanade Parking..... 130

**CHAPTER 6 ASSESSMENT OF INTERSECTION IMPROVEMENT PLANS
USING TRAFFIC FLOW SIMULATION**

6.1 Purpose..... 131

6.2 Procedure..... 131

6.2.1 Selection of Simulation Model..... 131

6.2.2 Setting up of Alternative Improvement Plans by
Simulation Route..... 133

6.2.3 Data Input..... 135

6.2.4 Verification of Model..... 136

6.3 Simulating Future Traffic Conditions Under
the 'Do-Nothing' Case..... 143

6.4 Simulation Results for the Alternative Plans..... 146

CHAPTER 7 PRELIMINARY DESIGNS

7.1	Design Standards.....	149
7.1.1	Road Design Standards.....	149
7.1.2	Structural Design Standards.....	152
7.1.3	Bridge Type.....	154
7.2	Intersection Improvements.....	156
7.2.1	Intersection No. 1 - Moulali.....	156
7.2.2	Intersection No. 2 - Esplanade.....	157
7.2.3	Intersection No. 3 - Gariahat.....	158
7.2.4	Intersection No. 4 - Shyambazar.....	159
7.2.5	Intersection No. 5 - Rabindra Sadan.....	160
7.2.6	Intersection No. 6 - Beck Bagan.....	160
7.2.6'	Intersections No. 5 (Rabindra Sadan) and No. 6 (Beck Bagan).....	161
7.2.7	Intersection No. 7 - Maniktala.....	162
7.2.8	Intersection No. 8 - Park St.....	162
7.2.9	Intersection No. 9 - Lock Gate.....	164
7.2.10	Intersection No. 10 - Mullikbazar.....	165
7.3	Off-Street Parking Facilities.....	166
7.3.1	B.B.D. Bag North Parking Facility.....	166
7.3.2	Esplanade Parking Facility.....	169

CHAPTER 8 CONSTRUCTION AND COSTING

8.1	Construction Methods.....	172
8.1.1	Flyovers.....	172
8.1.2	Carparking Structures.....	175
8.2	Preliminary Cost Estimation.....	176
8.2.1	Methodology and Assumptions.....	176
8.2.2	Direct Construction Costs.....	179
8.2.3	Indirect Costs.....	185
8.2.4	Engineering Services Cost.....	187
8.2.5	Contingency.....	187
8.2.6	Land Acquisition and Compensation Costs.....	187
8.2.7	Results of Preliminary Cost Estimation.....	188
8.2.8	Maintenance Costs.....	189

CHAPTER 9 FEASIBILITY ASSESSMENT AND EVALUATION

9.1	Technical Evaluation of Intersection Improvements....	203
9.1.1	Alternative I.....	203
9.1.2	Alternative II.....	205
9.1.3	Alternative III.....	206
9.2	Economic Evaluation.....	207
9.2.1	Economic Analysis of Intersection Improvements....	207
9.2.2	Economic Analysis of Parking Facilities.....	212
9.2.3	Economic Analysis of Pedestrian Facilities.....	214
9.3	Parking Facilities Evaluation.....	216
9.3.1	Basic Conditions.....	216
9.3.2	Results of Financial Evaluation.....	217
9.3.3	Conclusions.....	219
9.4	Social and Environmental Effects.....	223
9.4.1	Social Effects.....	223
9.4.2	Environmental Effects.....	224
9.5	Selection of Transport Infrastructure Development Projects.....	225
9.5.1	Intersection Improvements.....	225
9.5.2	Parking Structures.....	225
9.5.3	Pedestrian Plaza.....	226
9.6	Implementation Plan.....	228
9.7	Disbursement Schedule.....	231

CHAPTER 10 OTHER TRANSPORT INFRASTRUCTURE IMPROVEMENTS

10.1	Pedestrian Facilities.....	232
10.1.1	Pedestrian Traffic Along B.B. Ganguly Street....	232
10.1.2	Pedestrian Facility Improvements.....	234
10.1.3	Cost Estimate.....	236
10.2	Concrete Pavements.....	237
10.2.1	Background Information and Project Description...	237
10.2.2	Technical Review.....	239
10.2.3	Project Costing.....	242
10.2.4	Preliminary Feasibility Assessment.....	244
10.2.5	Recommendations.....	245
10.3	Traffic Signal Improvements.....	247
10.3.1	Traffic Signal Control.....	247
10.3.2	Traffic Signalization Plan.....	248

CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

11.1	Intersection Improvements.....	252
11.2	Parking Structures.....	255
11.3	Pedestrian Facilities.....	256
11.4	Traffic Signals.....	257
11.5	Concrete Pavement.....	257
11.6	Summary of Recommendations.....	258
11.7	Relevant Future Studies.....	260

ANNEX

- A. LIST OF FIGURES
- B. LIST OF TABLES

CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

In response to the request of the Government of India and the Government of West Bengal, and in accordance with the relevant laws and regulations in force in Japan, the Government of Japan has decided to conduct the Feasibility Study for "The Transport Infrastructure Development Project in Calcutta" (hereinafter referred to as the "Study").

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency for the implementation of technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of India and the Government of West Bengal.

The initial request of the Government of India was to conduct a comprehensive study in order to formulate a "Transportation Master Plan". Such a study would require long period of time to accomplish. Since the traffic situation in Calcutta requires very urgent attention, it was agreed that the study would be changed to that of a feasibility study of designated infrastructure improvements to be completed within a shorter time period.

1.2 Study Area and Target Year

The area covered under this study is shown in Figure 1.2.1, and is defined as the Calcutta Metro-Core. The ten study intersections and the two locations where parking facilities are proposed are located within this core area. The Metro-Core includes the twin cities of Calcutta and Howrah, the 2nd Hooghly Bridge, and the CBD at the centre.

CORE OF CALCUTTA METROPOLITAN DISTRICT

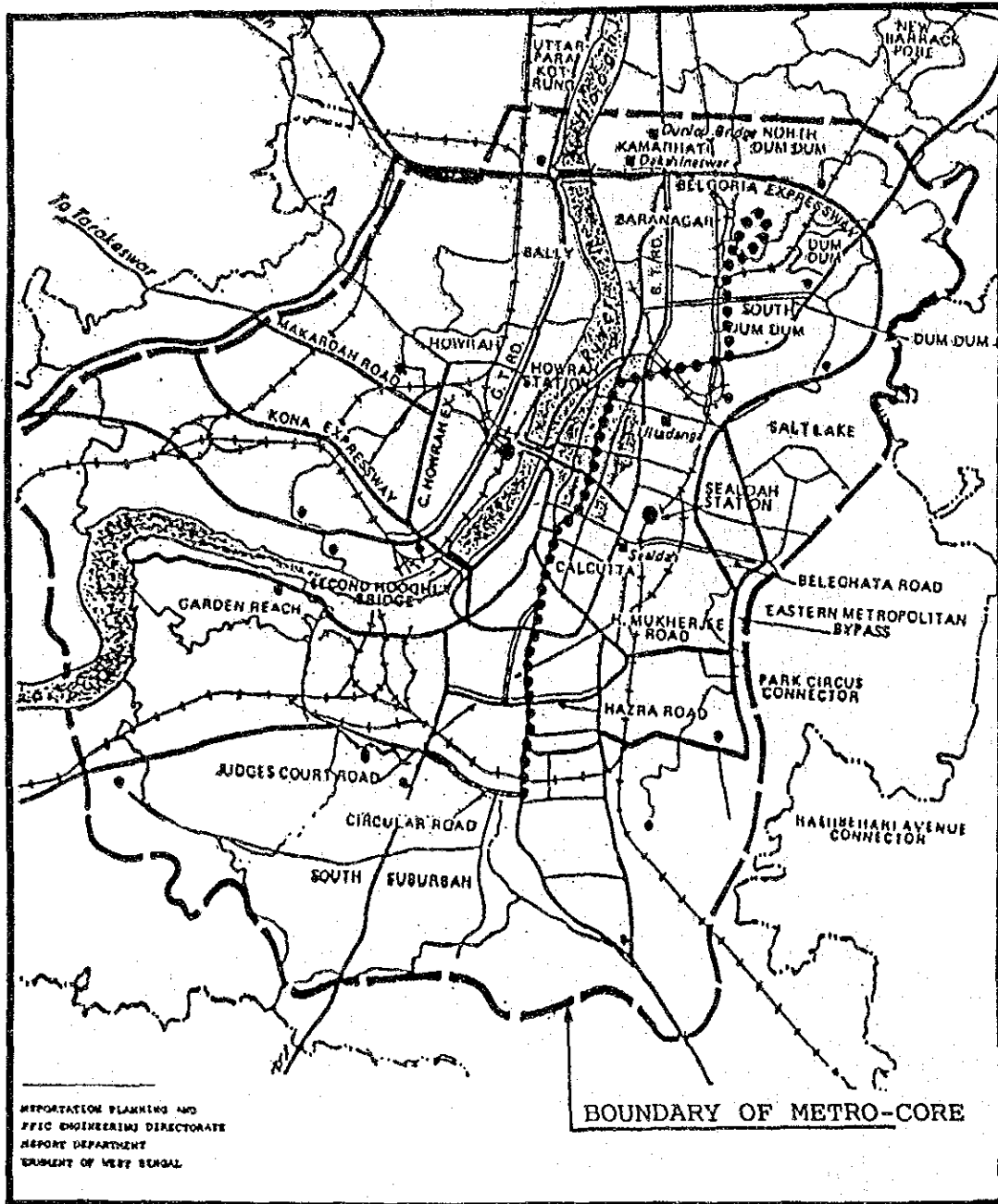


Figure 1.2.1 Study Area

(Source: A Handbook of Transport, 1989, West Bengal Government)

Whilst the Study has primarily focused on the core area, the development of the wider Calcutta Metropolitan District (CMD) has not been overlooked, consequently conditions such as development, land use and transportation facilities in the CMD have been referred to frequently in the Study.

The target year of the Study shall be 1998.

1.3 Policy and Objectives of the Study

The objective of the Study is to conduct a feasibility study on the following projects for the alleviation of traffic congestion in the study area.

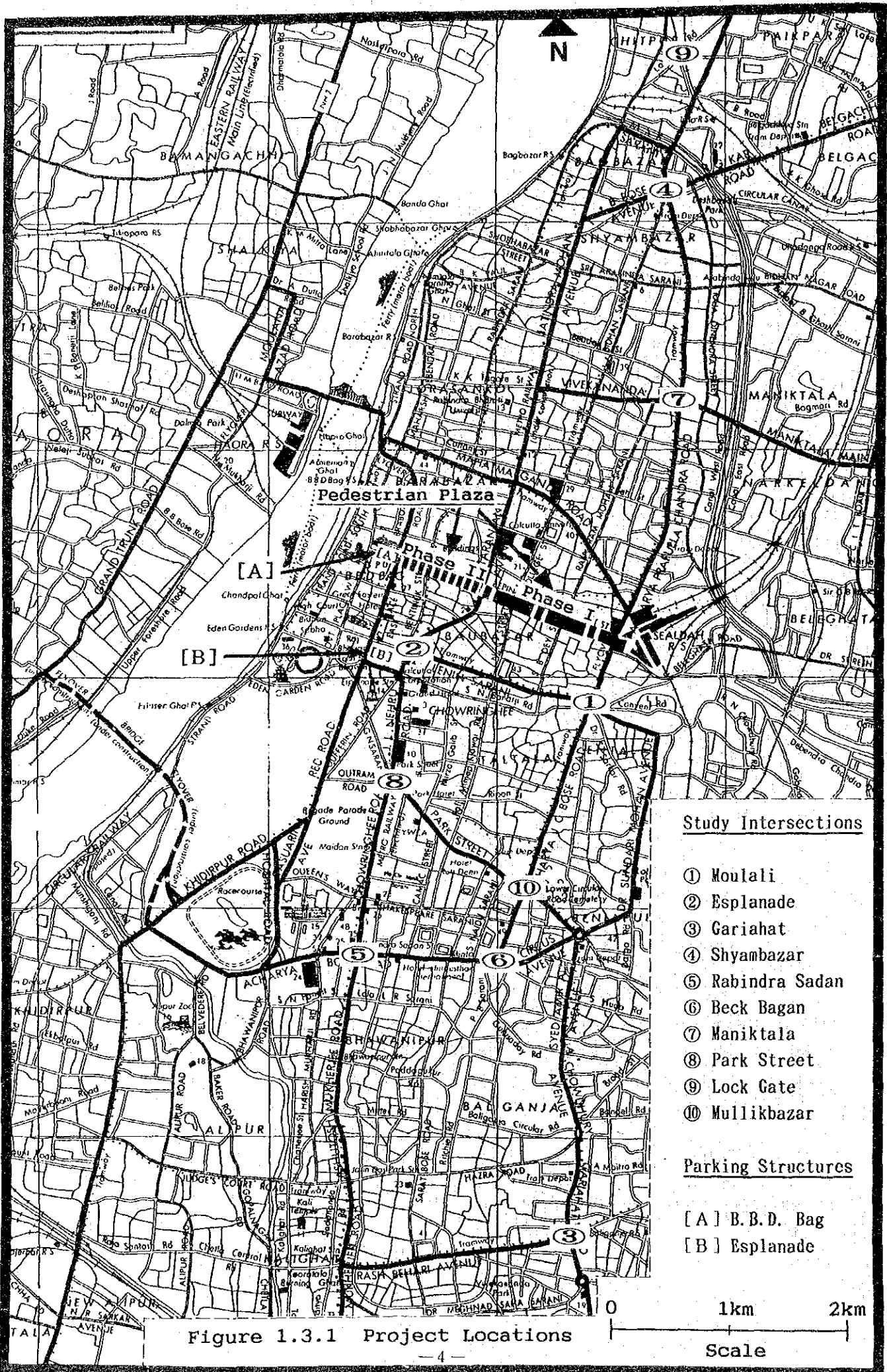
- (i) construction of vehicular flyovers at several different locations,
- (ii) construction of multi-storied car parking structures,
- (iii) other transport infrastructure improvement measures including an elevated pedestrian plaza.

In the course of the study particular emphasis has been given to the improvement of the traffic flow, especially on the following important corridors:

- The main north-south corridor on Jawaharlal Nehru Road, from Acharya Jagadish Chandra Bose Road near Rabindra Sadan to Esplanade;
- The ring road corridor on Acharya Profulla Chandra Road and Acharya Jagadish Chandra Bose Road from Shyambazar to 2nd Hooghly Bridge Approach.

The West Bengal Government provided a tentative list of ten major intersections where vehicular flyovers are considered necessary. They are given below and are shown on Fig. 1.3.1;

- 1) Moulali; Intersection of A.J.C. Bose Road with Lenin Sarani



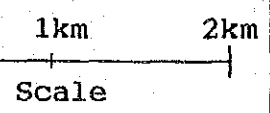
Study Intersections

- ① Moulali
- ② Esplanade
- ③ Gariahat
- ④ Shyambazar
- ⑤ Rabindra Sadan
- ⑥ Beck Bagan
- ⑦ Maniktala
- ⑧ Park Street
- ⑨ Lock Gate
- ⑩ Mullikbazar

Parking Structures

- [A] B.B.D. Bag
- [B] Esplanade

Figure 1.3.1 Project Locations



- 2) Esplanade; Intersections of Chowringhee Road/J.L. Nehru Road with Lenin Sarani/Esplanade Row East and with S.N. Banerjee Road
- 3) Gariahat; Intersection of Gariahat Road with Rash Behari Avenue
- 4) Shyambazar Crossing; Intersection of A.P.C. Roy Road with Bidhan Sarani, R.G. Kar Road, and B. Bose Avenue
- 5) Rabindra Sadan; Intersection of A.J.C. Bose Road with Chowringhee Road
- 6) Beck Bagan; Intersection of A.J.C. Bose Road with Circus Avenue and P.B. Sarani
- 7) Maniktala; Intersection of A.P.C. Roy Road with Maniktala Main Road/Vivekanda Road
- 8) Park Street; Intersection of J.L. Nehru Road/Chowringhee Road with Outram Road, Park St. and G.N. Sarani
- 9) Lock Gate; Flyover on Lock Gate Road above railway line
- 10) Mulikbazar Crossing; Intersection of A.J.C. Bose Road with Park Street

In the course of preliminary discussion held between the Government of West Bengal and the Advisory Committee, intersections 9) and 10) above replaced the following two intersections;

- Intersection of Nazul Islam Avenue (Salt lake) with C.I.T. Road/V.I.P. Road
- Intersection of Lenin Sarani with Nirmal Chandra Street/Rafi Ahmed Kidwai Road

The West Bengal Government also provided two locations, as shown on Fig. 1.3.1 where the feasibility of multistory car parking structures should be assessed, namely;

- A) B.B.D. Bag; opposite Writer's Building on the north side of B.B.D. Bag Square and water tank.
- B) Esplanade; sharing the tram terminus site between Esplanade Row East, Surendra Nath Banerjee Park, Rani Rashmoni Avenue and J.L. Nehru Road.

Under other traffic improvement measures, the West Bengal Government requested that consideration should be given to the following;

- 1) Elevated Pedestrian Plaza between Sealdah Station and B.B.D. Bag.
- 2) Concreting of the following road sections;

Location	Length in Lane.km
A. Cossipore Road	12
B. Strand Road	14
C. Brabourne Road	6
D. New Park Street	8
E. Camac Street	8
F. Gariahat Road	25.5
G. M.Gandhi Road	14
Total	87.5 Lane.km

- 3) Traffic signal improvements.
- 4) Any other transport infrastructure items identified in the course of the study.

1.4 Study Approach

1.4.1 Study Approach

The Study was carried out in four phases over a total of ten calendar months. Figure 1.4.1 shows the work flow sequence adapted for the Study. There are four phases and the main works in each are;

Phase I Preparatory Work in Japan

Phase II Formulation of Short Term Transport
Infrastructure Development Plan

Stage 1 Primary Works in Calcutta

Stage 2 Primary Works in Japan

Phase III Feasibility Study of Transport
Infrastructure Improvement Plans

Stage 1 Secondary Works in Japan

Stage 2 Secondary works in Calcutta

Phase IV Preparation of Final Report

As part of the Study, soil investigations, topographical survey and underground utilities survey were carried out at each of the study intersections.

Comprehensive traffic studies such as origin - destination surveys were not undertaken, since the Study was aimed at examining the feasibility of infrastructure facilities, and not at preparing a transportation master plan. A limited O-D survey was however carried out for cross-river traffic to assist in the assignment of vehicles after the opening of the second Hooghly Crossing. Otherwise, the method of estimation of future traffic volumes was simplified and was based on applying past trends in traffic volume growth to existing traffic volumes.

It is undeniable, however that the conduct of a comprehensive transportation study would be desirable if time and circumstances are allowed. Such a study would facilitate the setting of priorities to improvements not only for

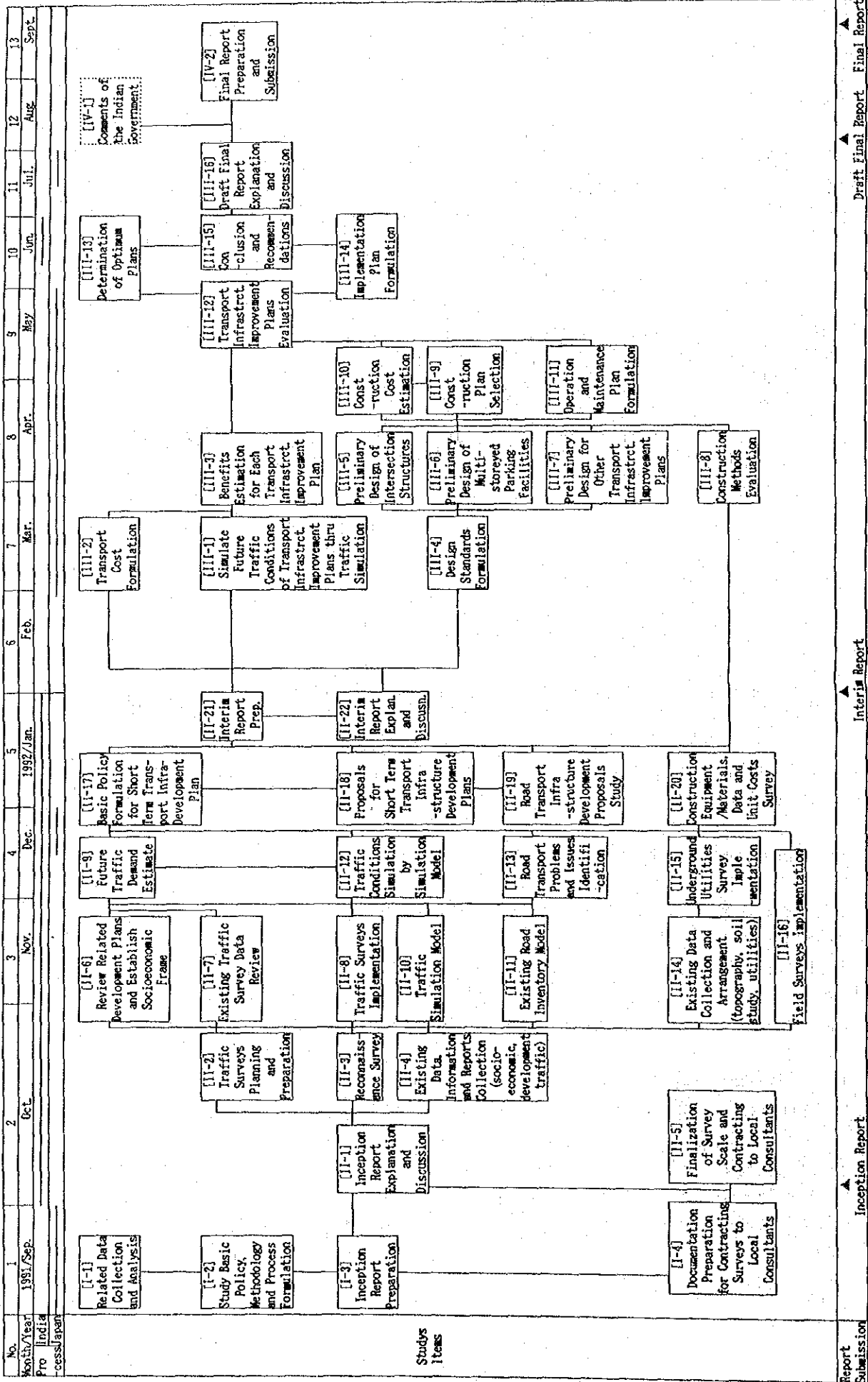


Figure 1.4.1 Study Flow Chart

intersections but also trans-river facilities; estimation of future parking demand and so on.

1.4.2 Reports

The following reports were prepared during the Study and submitted to the Government of West Bengal.

Inception Report

Interim Report

Draft Final Report comprising Volume I "Executive Summary", Volume II "Main Report", Volume III "Technical Report" and Volume IV "Drawings".

Final Report comprising Volumes I to IV above.

1.5 Study Organization

The Study has been jointly executed by a Study Team dispatched by JICA and a Counterpart Team organized by the West Bengal Government. JICA also established an Advisory Committee to supervise the progress of the Study.

1.5.1 Counterpart Team

The Counterpart Team consisted of the members listed below;

- | | |
|---------------------------|---|
| 1. Mr. A.K. Bandopadhyaya | Counterpart Team Leader
Chief Traffic & Transportation Planner/Engineer,
Transport Department |
| 2. Mr. S. Mukherjee | Deputy Commissioner of Police
(Traffic) Calcutta |
| 3. Mr. N.K. Sinha | Superintending
Traffic & Transportation
Planner, Transport Department |

- | | |
|---------------------|--|
| 4. Mr. B.K. Sadhu | Executive Traffic and
Transportation Engineer,
Transport Department |
| 5. Mr. S. Sanyal | Executive Engineer (Drainage)
Calcutta Municipal
Corporation |
| 6. Mr. T. Mukherjee | Executive Engineer (Water
Supply) Calcutta Municipal
Corporation |
| 7. Mr. A. Maikap | Senior Economic Planner
Development and Planning
(T & CP) Department |
| 8. Mr. R. Chowdhury | Deputy Director (Planning &
Design) Hooghly River Bridge
Commission |
| 9. Mr. D.K. Biswas | Executive Engineer (Roads)
Calcutta Municipal Corpora-
tion |
| 10. Mr. S. Roy | Executive Engineer (Roads)
Calcutta Municipal Corpora-
tion |
| 11. Mr. A.K. Bagchi | Senior Engineer
Calcutta Tramways Company
- Coordinator |

The Counterpart team also arranged for necessary discussions to be held with the following important officials.

- | | |
|---------------------------|---|
| 1. Mr. D. Rudra | Secretary
Transport Dept. GOWB |
| 2. Mr. B.K. Saha | Commissioner of Police
Calcutta |
| 3. Mr. Sumantra Chowdhury | Special Secretary
Transport Dept. GOWB |

- | | |
|---------------------|--|
| 4. Mr. M. Mandel | Chief Municipal Engineer
(Civil) Calcutta Municipal
Corporation |
| 5. Mr. S.K. Roy | Director General (P & D)
Calcutta Metropolitan
Development Authority |
| 6. Mr. H.S. Verma | Director General (M.D)
Calcutta Metropolitan
Development Authority |
| 7. Mr. A.K. Ganguly | Principal Chief Engineer
Metro Railway, Calcutta |

1.5.2 Advisory Committee, Japanese Government

- | | |
|----------------------|--|
| Dr. Hirotake Koike | Professor of Civil Engineer-
ing
Utsunomiya University |
| Mr. Seichiro Akimura | Ministry of Construction |
| Mr. Hiroo Ikemoto | The City of Yokohama |

1.5.3 Study Team

The Study Team consisted of the following members;

- | | |
|---------------------|---|
| Dr. Juro Kodera | Team Leader |
| Mr. Hiroo Takeda | Transportation Planning |
| Mr. Tetsuo Horie | Traffic Survey &
Traffic Estimation |
| Mr. Katsunori Fuse | Structure Engineering |
| Mr. Yasuo Nabeshima | Traffic Facility Planning |
| Mr. John Hamilton | Cost Estimation and
Construction Methods |

Mr. Mahmoud-Saleh Riad	Natural Condition Survey
Mr. Kenici Ando	Underground Utility Survey
Mr. Takao Nakaoka	Economic Evaluation

CHAPTER 2
BACKGROUND INFORMATION

Chapter 2 BACKGROUND INFORMATION

2.1 Project Area and Administrative Organizations

The various administrative districts in the Calcutta region are shown in Figure 2.1.1.

Calcutta Metropolitan District (CMD) occupies an area of about 1,400 km² and has been designated for planning and development purposes. CMD closely corresponds to the Calcutta Metropolitan Area (CMA) and the Calcutta Metropolitan Standard Urban Area (CMSUA) which are sometimes used. It extends for about 50 km along the river Hooghly on both sides of the river. Responsibility for urban development within most of CMD is vested with the Calcutta Metropolitan Development Authority (CMDA), an organization under the Ministry of Urban Development which was set up in 1970. CMDA liaises with the other State Government Departments or local authorities to coordinate development schemes and to prepare land use and development plans. The State Government, through the State Planning Board of the Development and Planning Department, prepares development perspectives, policy and funding programs for development of the State including Calcutta.

Development planning, funding and implementation of transportation projects within the CMD is shared between the national, state and local governments. The National Government is sometimes also involved with major projects such as the 2nd Hooghly Bridge. Indian Railways is responsible for the entire railway system including the Metro. The Public Works Department, the Transport Department of the State Government and Municipal Corporation undertake the funding and implementation of transportation projects.

The Department of Transport of the Government of West Bengal is the nodal Department for all transportation functions and is responsible for the administration and control of road, tram and inland waterway transport, including the corporations/companies which run the public sector buses, trams and ferries. Under the control of the Department, private operators are permitted to run transport services. The organisation structure of the Depart-

ADMINISTRATIVE AREAS

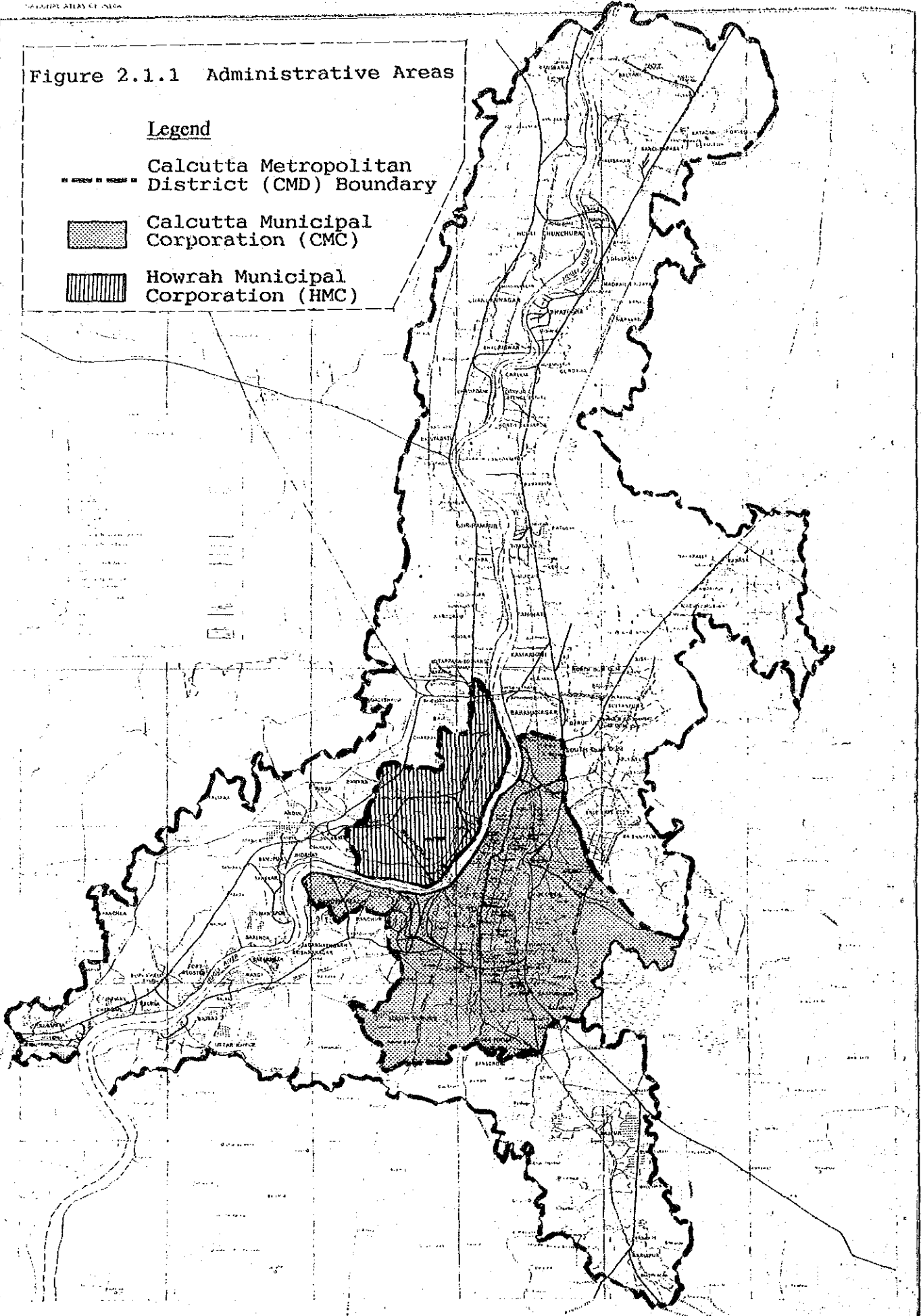
Figure 2.1.1 Administrative Areas

Legend

- Calcutta Metropolitan District (CMD) Boundary

- Calcutta Municipal Corporation (CMC)

- Howrah Municipal Corporation (HMC)



ment of Transport is shown in Fig. 2.1.2 (source: A Handbook on Transport, 1989).

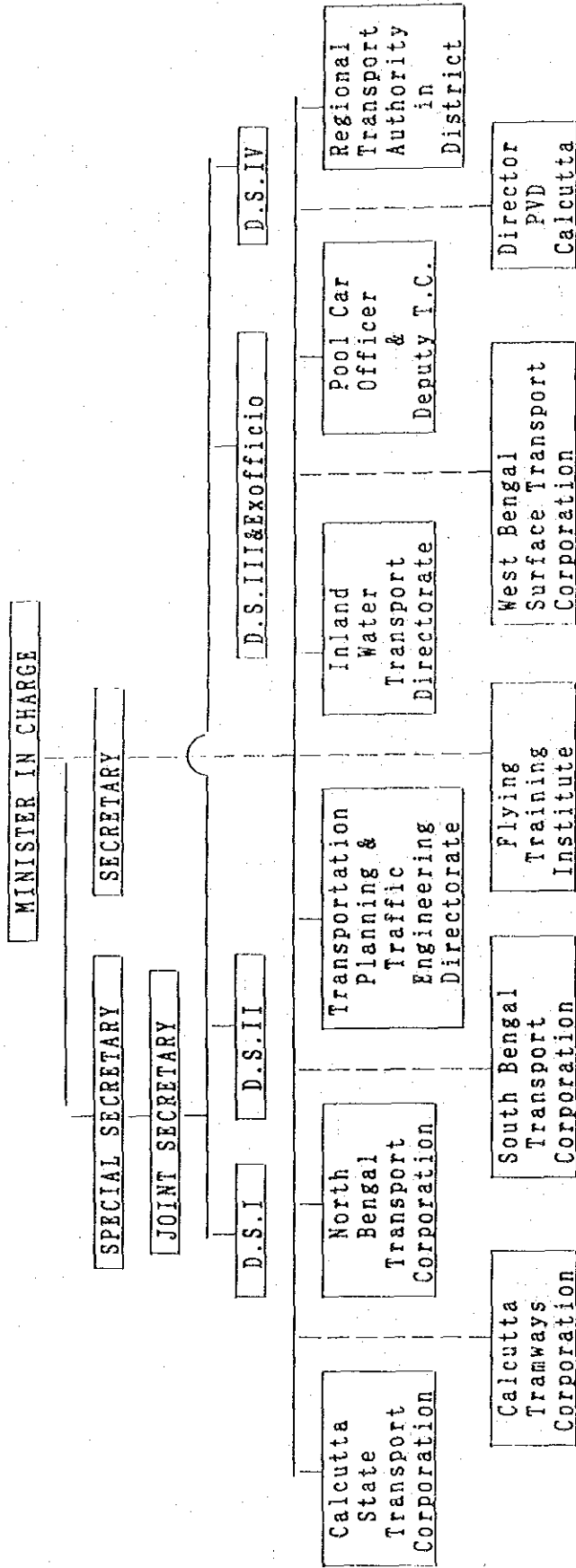
The Metro Railway Authority, South Eastern Railway and Eastern Railway are separate organizations under Indian Railways but the Department of Transport liaises with the railways on matters related to passenger transport.

Within the CMD there are many administrative units at the local government level;

- (a) 3 Municipal Corporations (Calcutta, Howrah and Chandannagar)
- (b) 31 Municipalities
- (c) 3 Notified Areas
- (d) 70 Non-Municipal Urban Units
- (e) 390 Rural Mouzas

The Calcutta Municipal Corporation (CMC) area and the Howrah Municipal Corporation (HMC) area are highlighted in Figure 2.1.1. The city of Calcutta is located within the CMC area. The Metro-Core area, the project area for this Study is shown in Chapter 1 (Figure 1.2.1). It has no administrative function but, is often adopted for transportation planning since it contains the most heavily developed areas of Calcutta and Howrah and the most serious transportation problems occur within this core area.

Figure 2.1.1.2 Organization Chart of Transport Department Govt. of West Bengal



Statutory Authority:

- S.T.A. -- (State level) State Transport Authority
- R.T.A. -- Regional Transport Authorities in districts
- STAT -- State Transport Appellate Tribunal

D.S.: Deputy Secretary
PVD : Public Vehicles Directorate

2.2 Socioeconomic Conditions

2.2.1 Population

Table 2.2.1 shows the population growth trends for India, West Bengal, Calcutta Metropolitan District (CMD) and Calcutta City. They show that the rate of growth for West Bengal has been considerably higher than for India as a whole and that the growth of CMD has been much higher than for the whole of West Bengal. There were about 2.25 million persons in the CMD in 1921, increasing to 9.98 million in 1981. The corresponding figures for the state of West Bengal being 17.47 and 54.58 million respectively.

The growth in population of the city of Calcutta has been significantly slower than in the CMD, particularly between 1951 and 1981. The growth between 1971 and 1981 was very small, indicating that saturation may be occurring.

Table 2.2.1 - Population growth during 1921 - 81
(population in millions)

Year	India	W Bengal	CMD	Calcutta City
1921	251.32 (100)	17.47 (100)	2.25 (100)	1.05 (100)
1931	279.00 (111)	18.90 (108)	2.54 (113)	1.22 (116)
1941	318.66 (127)	23.23 (133)	4.31 (192)	2.17 (207)
1951	361.09 (144)	26.30 (150)	5.14 (228)	2.70 (257)
1961	439.24 (175)	34.93 (200)	6.83 (304)	2.93 (279)
1971	548.16 (218)	44.31 (254)	8.22 (365)	3.15 (300)
1981	685.18 (273)	54.58 (312)	9.98 (444)	3.31 (315)

source: A Perspective Plan for Calcutta: 2011

Table 2.2.2 shows the growth in population of the areas within CMD adjacent to Calcutta City. Population increases in some of these areas, notably the Dum Dum and South Suburban areas, have been particularly large. It appears that as Calcutta City approaches saturation, the burden of absorbing further population growth has been passed to the surrounding areas. By contrast the recent growth in Howrah has been very small, perhaps because the limited capacity of Howrah Bridge has acted as a constraint.

Table 2.2.2 - Population of CMD Areas near Calcutta City
(population in thousands)

Year	Howrah	South Suburban	Garden Reach	Baranagar	South Dum Dum	North Dum Dum
1921	219 (100)	33 (100)	46 (100)	32 (100)	14 (100)	8 (100)
1931	255 (116)	39 (118)	56 (122)	37 (115)	18 (129)	5 (63)
1941	430 (196)	63 (191)	85 (185)	54 (169)	26 (186)	6 (75)
1951	497 (227)	104 (315)	109 (237)	77 (241)	61 (436)	12 (150)
1961	634 (289)	186 (564)	131 (285)	108 (338)	111 (793)	38 (475)
1971	738 (337)	273 (827)	155 (337)	137 (428)	174 (1243)	64 (800)
1981	744 (340)	378 (1145)	191 (415)	170 (531)	230 (1643)	96 (1200)

source: A Perspective Plan for Calcutta:2011

2.2.2 Occupation Distribution

Table 2.2.3 shows the population distribution according to occupation. The main feature of the Table is that primary sector occupations comprise 60 per cent of the total workers in West Bengal but only 9 per cent in the CMD. By comparison, secondary sector occupations comprise 18% and 39% of the totals in West Bengal and CMD respectively. Also reflecting the importance of service industries in the urban area, the tertiary sector provides more employment

than the other sectors combined in the CMD but only 23% of occupations in West Bengal.

Table 2.2.3 Occupations in West Bengal and CMD in 1981
(number of workers in thousands)

Sector/Sub-sector	West Bengal		CMD	
	No.	%	No.	%
Cultivators	4,591	20.8	84	2.8
Agricultural laborers	3,892	25.2	112	3.8
Plantation & Forestry	507	3.3	41	1.4
Mining & Quarrying	146	0.9	40	1.3
Total for Primary Sector	9,136	59.2	277	9.2
Household Industry	543	3.5	86	2.9
Non Household Industry	2,000	13.0	995	33.2
Construction	221	1.4	90	3.0
Total for Secondary Sector	2,764	17.9	1,171	39.1
Trade & Commerce	1,291	8.4	567	19.0
Transport, Communication	625	4.0	291	9.7
Other Service	1,608	10.0	687	23.0
Total for Tertiary Sector	3,524	22.9	1,546	51.6
Total	15,424	100.0	2,993	100.0

source: Plan For Metropolitan Development 1990-2015

2.2.3 State Domestic Product and Per Capita Income

The State Domestic Product of West Bengal in 1988-89 was 124,208.6 million Rs. at 1980-81 prices and made up 7.47% of the Net National Product of India which was 1,662,000 million Rs. This percentage has decreased slightly since 1980-81 when it was 8.04%. Table 2.2.4 shows the State Domestic Product of West Bengal by industry of origin at 1980-81 prices. This Table also shows the Per Capita Income for West Bengal.

Table 2.2.4

Estimate of State Domestic Product of West Bengal by Industry of Origin (at 1980-81 prices)

(Rs. in million)

Industry	1980-81	1984-85	1985-86	1986-87	1987-88	1988-1989
	(P)	(P)	(P)	(P)	(P)	(Q)
1. Agriculture	24,776.40	29,869.50	31,452.40	33,185.90	36,455.00	40,348.60
2. Forestry	716.00	754.70	704.10	468.40	424.80	443.80
3. Fishery	2,883.40	3,055.70	3,183.30	3,466.90	3,727.50	3,872.00
4. Mining and Quarrying	1,642.10	777.50	792.70	816.00	814.50	871.50
5. Manufacturing	2,1967.80	21,698.80	25,414.20	26,619.90	27,158.50	28,801.30
5.1. Registered	12,453.80	11,287.70	14,721.40	15,686.40	15,575.50	16,332.90
5.2. Unregistered	9,514.00	10,411.10	10,692.80	10,933.50	11,583.00	12,468.40
6. Construction	4,227.40	3,815.00	3,666.50	3,757.50	4,452.50	5,120.40
7. Electricity, Gas and Water Supply	806.30	1,110.80	1,297.00	1,315.30	1,432.90	1,561.10
8. Transport, Storage and communications	4,147.70	4,561.20	4,656.20	5,141.60	5,234.80	5,339.70
8.1. Railways	495.60	495.80	641.10	752.60	826.80	892.90
8.2. Transport by other means and storage	3,117.10	3,460.40	3,437.10	3,805.30	3,838.20	3,871.30
8.3. Communications	535.00	605.00	578.00	583.70	569.80	575.50
9. Trade, Hotels and Restaurants	9,157.20	10,256.90	10,558.50	10,872.10	11,192.00	11,521.30
10. Banking and Insurance	4,018.80	4,848.70	4,837.10	5,006.00	5,038.90	5,215.30
11. Real Estate, Ownership of Dwellings and Business Services	6,754.20	7,280.70	7,406.40	7,526.80	7,640.20	7,741.20
12. Public Administration	3,077.50	4,241.30	4,693.80	5,242.00	6,290.40	7,548.50
13. Other Services	4,838.00	5,227.70	5,342.30	5,489.60	5,648.90	5,823.90
Total	89,012.80	97,498.50	104,004.50	108,908.00	115,510.90	124,208.60
Per Capita Income (Rupees)	1,612.00	1,631.00	1,707.00	1,755.00	1,828.00	1,930.00

P = Provisional

Q = Quick

Source: Bureau of Applied Economics and Statistics,

Government of West Bengal.

2.2.4 Motor Vehicle Registration

Figure 2.2.1 shows the growth in the number of registered motor-vehicles in Calcutta. The number of cars and jeeps increased by a factor of 2.136 in the last decade, corresponding to an average annual growth rate of 7.88%. The corresponding increases for total vehicles in the same period were 2.743 and 10.62% respectively.

2.2.5 Future Socioeconomic Conditions

(1) Migration and Population

For estimation of future population the projections prepared in the 1990 report "A PERSPECTIVE PLAN FOR CALCUTTA:2011 (draft)" by the State Planning Board, Development and Planning Department of the Government of West Bengal have been adopted. The population projections were made after considering migration rates, fertility rates and mortality rates. The final projections are shown in Table 2.2.5.

Table 2.2.5 Estimate of Future Population
(population in millions)

year	West Bengal	CMD	Calcutta Municipal Corporation (CMC)
1981	54.58	9.98	4.13
1991	67.42	12.07	4.52
2001	84.2	14.58	5.03
2011	103.46	17.09	5.42
2021	124.08	19.65	5.94

source: A Perspective Plan For Calcutta:2011

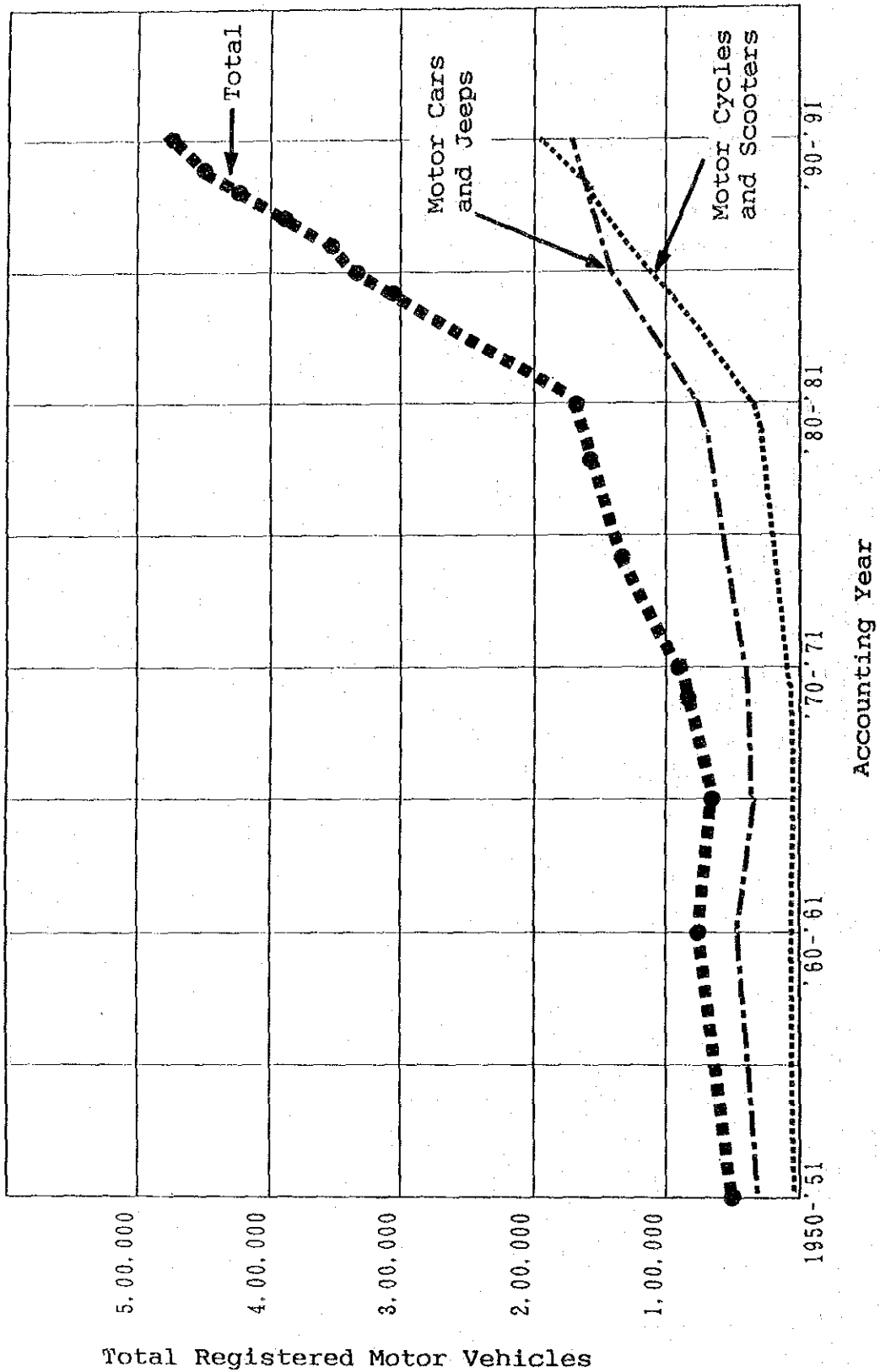


Figure 2.2.1 Motor Vehicle Ownership

2.3 Land Use

2.3.1 Development Patterns

Over centuries the river Hooghly has deposited large quantities of alluvial silt along its banks, forming a natural levee of high land suitable for human settlement. Within a very short distance (about 3 km) from either bank, the higher levels slope down gradually to marshy, low lying areas. The low lying land has presented great difficulties for urban development on any large scale since it is either perennial marsh and swamp or liable to annual inundation during the monsoon. In the early growth of Calcutta physical expansion to the east and west was prevented by the marshy, low lying areas and urban development was limited to a narrow zone of high land along the river bank.

Subsequently, as National and State Capital, Calcutta has experienced further rapid growth. The availability of mineral resources in the north-west and south-west also encouraged the development of engineering industries on the West bank. On the east bank jute industries were developed as a result of the ready supply of jute from East Bengal (now Bangladesh).

In the last 20 or 30 years growth and development have been influenced by the partitioning of Bengal and also by the post independence industrialization. Heavy migration resulted and further spreading of the developed areas took place, particularly to the east of the railway lines on the east bank, and to the west of the railway lines on the west bank. The existing settlements were intensified giving rise to the development pattern which Calcutta has today.

More recently it has become apparent that there is a tendency to break away from the old linear pattern of development and there have been more developments in the areas to the east and west, corresponding more to a radial pattern of development. This is likely to continue as Calcutta expands its role as a strong focal point to the hinterland areas. The strong development of radial corridors along Jessore Road, Orissa Trunk Road, NH No.2, NH No.6, Diamond Harbour Road and Kulpi Road or towards Tollygunge Behala area are further evidence of this trend.

In Calcutta City itself the maximum concentration of commercial (including administrative and office) areas are in the Burbazar, B.B.D. Bag and Esplanade areas which form the Central Business District (CBD) and are characterized by increased intensity. During the last two decades the CBD has been extending towards the south-east beyond Park Street area and reaching A.J.C. Bose Road. Another noteworthy feature has been the rise of secondary commercial areas over the last few decades in the north at Shyambazar-Hatibagan and in the south at Hazra-Rashbehari-Gariahat.

The largest open space is at Maidan, located adjacent to CBD and flanked by the Strand and the river on the west, with Eden Garden the main focal point for recreational activities.

Educational facilities are concentrated in a few locations of central and south Calcutta such as College Square, Golfpark, Ballygunge Circular Road etc. Although medical facilities of a local nature are distributed within the residential and commercial area, major hospital facilities are only available at four locations, one each at the north, central, east and south of Calcutta.

2.3.2 Land Use Composition

Table 2.3.1 shows the land use composition within the CMD in 1961 and 1981, the former being surveyed by CMPO. The land use in 1981 is shown in Figure 2.3.1 (source: Plan for Metropolitan Development 1990-2015). There are certain trends in land use patterns which have emerged in the metropolitan district over the two decades. Changes in residential land use are most apparent and usage increased from 15.5% in 1961 to 32.10% in 1981. Other important land uses such as Industrial, Commercial and Recreational increased only slightly. Transportation categories occupied 5.1% and 6.36% of CMD land in 1961 and 1981 respectively; both values are low compared to other major cities. The remaining area of land within CMD recorded under non-urban use and consisting of arable, forest and wasteland including water bodies and marshes still represents more than half of CMD but showed a marked decrease, falling from 72.3% to 52.5% during the period under consideration.

Table 2.3.1 Land Use Composition of CMD

Land Use Category	1961		1981	
	Area(sq.km)	%	Area(sq.km)	%
Residential	203.80	15.50	420.89	32.01
Industrial	55.22	4.20	62.19	4.73
Commercial	9.20	0.70	9.34	0.71
Recreational	9.20	0.70	10.52	0.80
Transportation	67.06	5.10	83.63	6.36
Institutional	19.72	1.50	38.26	2.91
Sub-Total	364.20	27.70	624.83	47.52
Vacant	950.66	72.30	690.03	52.48
Total	1,314.86	100.00	1,314.86	100.00

source: A Perspective Plan for Calcutta:2011

CALCUTTA METROPOLITAN STANDARD URBAN AREA

Existing Landuse

LEGEND

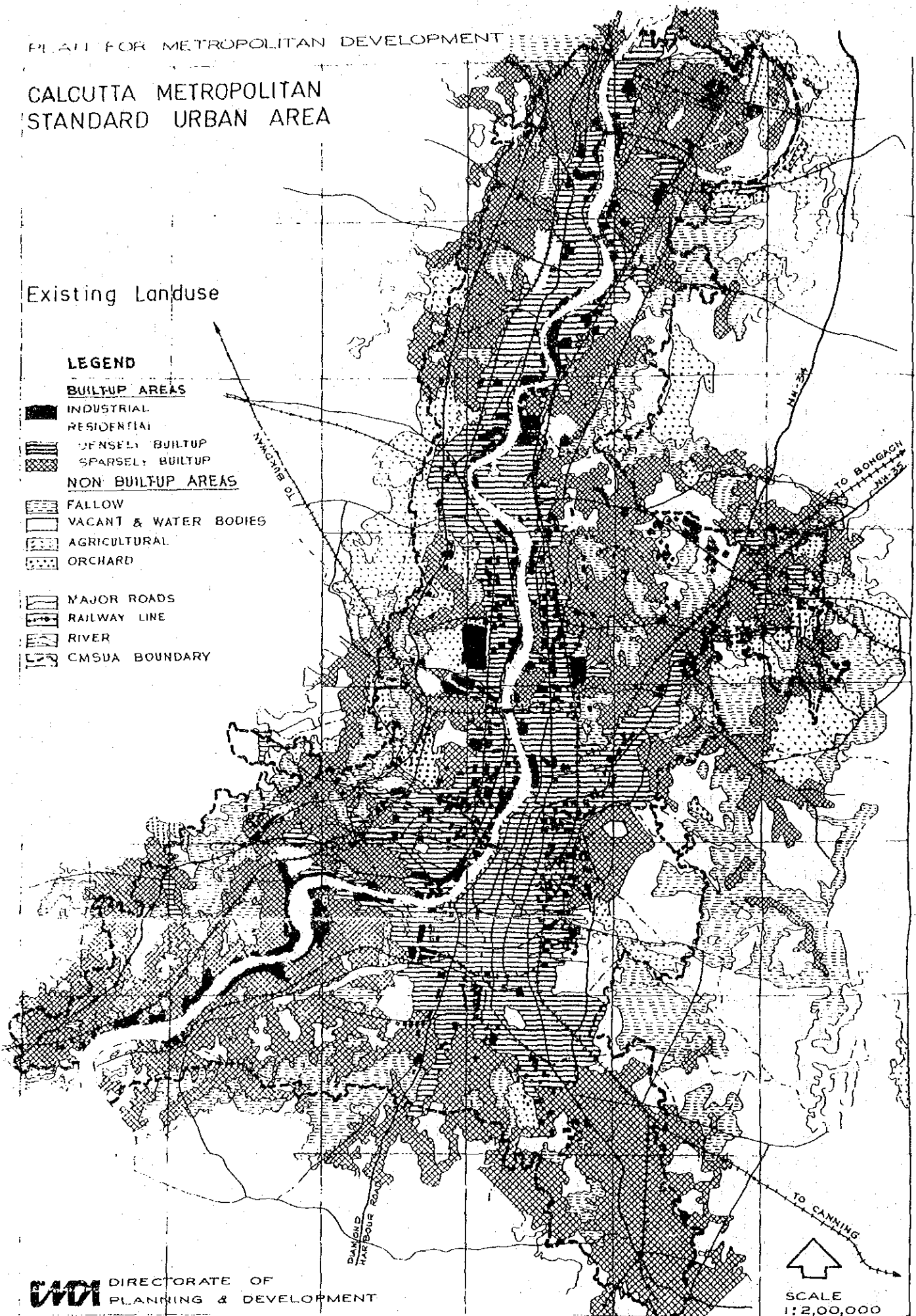
BUILTUP AREAS

- INDUSTRIAL
- RESIDENTIAL
- DENSELY BUILTUP
- SPARSELY BUILTUP

NON BUILTUP AREAS

- FALLOW
- VACANT & WATER BODIES
- AGRICULTURAL
- ORCHARD

- MAJOR ROADS
- RAILWAY LINE
- RIVER
- CMSUA BOUNDARY



WDI DIRECTORATE OF
PLANNING & DEVELOPMENT



SCALE
1:2,00,000

Figure 2.3.1 Existing Land Use in CMD

2.4 Mass Transportation Systems

Public Transport systems in Calcutta are of vital importance in Calcutta because there are relatively few private vehicles. In 1989, around 10 million passengers per day were carried by public transport.

The transit modes under the control of the Transport Department, ie. public and private buses, trams and ferries carried about 7.47 million passengers per day as shown in Table 2.4.1.

Table 2.4.1 Transit Data for Calcutta and Howrah in 1989

Mode	No of fleet daily on road	No. of Passengers per day (millions)	% of total
CSTC Buses	621	.733	9.82
Private Buses	2726	4.871	65.22
Mini-buses	1541	.896	11.99
Chartered Buses	600	.240	3.20
Trams	310	.550	7.37
Ferry Services		.180	2.40
total		7.470	100.00

source: A Handbook On Transport

In addition to the number of passengers in the above Table, 2.3 million passengers per day were carried by the suburban rail system and Metro Rail is predicted to carry 1 million passengers per day when the section now under construction is opened. The main features of each transit mode are described below.

2.4.1 Railway

The railways have a major role in the transportation system of CMD and the railways networks on both banks of the river Hooghly have contributed significantly to the development of the present linear pattern of the urban structure.

There are a total of 10 railways, with about 230 km of long distance passenger services, suburban passenger services and goods transportation lines. There are 105 stations within CMD at an average spacing of 2 to 2.5 km. Suburban services are shown in Fig. 2.4.1 (source: A Handbook on Transport, 1989) and extend to;

- a) Burdwan, Katwa, Krishnagar and Bangaon to the north,
- b) Diamond Harbour, Budge Budge and Port Canning to the south,
- c) Tarakeswar to the west, and
- d) Kharagpur to the south-west.

The most important passenger terminals within CMD are the Sealdah and Howrah Stations. A large volume of suburban commuter traffic is channeled through these two stations. The number of suburban trains operating from Howrah Station on an average week day in 1987 was 362. From Sealdah Station about 488 suburban passenger trains were operated on an average week day in the same year. The number of passengers using these two stations on an average weekday was found to have increased by a factor of more than three since 1965 as shown in Table 2.4.2.

Table 2.4.2 Number of Passengers (in thousands)

	1965	1981	1988
Howrah Station	221	624	722
Sealdah Station	314	730	934
Total	535	1,354	1,656

source: A Handbook on Transport

The railway network also accommodates goods wagons traveling to the railway goods sheds or goods yards. Most of the railway goods terminals are equipped with warehouses. Major goods terminals within the metro core area are at Sealdah, Chitpur, Howrah, Shalimar, Cossipore and Khidirpur Dock.

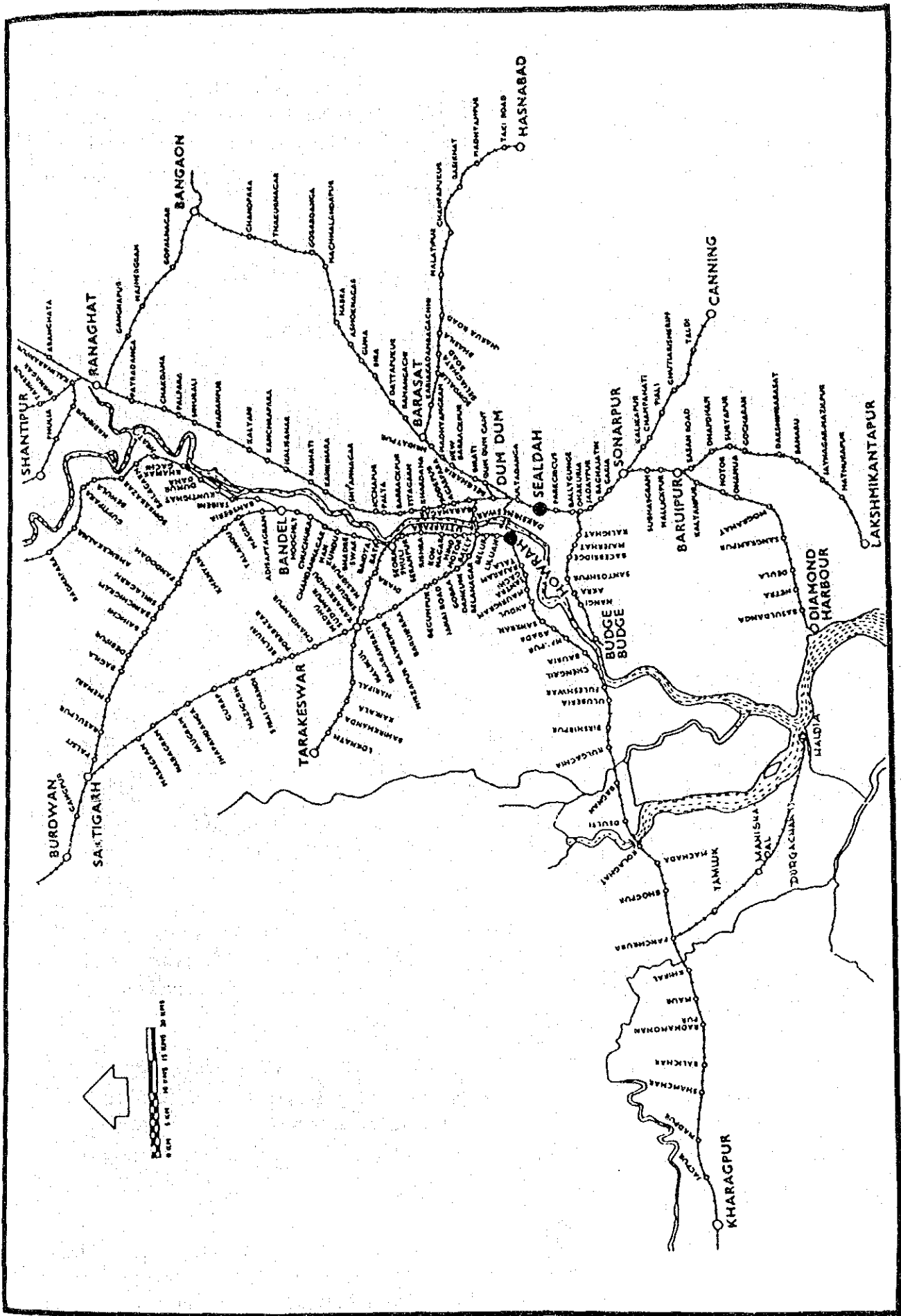


Figure 2.4.1 Suburban Railway System

2.4.2 Metro

A Metro Railway comprising north - south and east - west lines was proposed in the "Traffic And Transportation Plan 1966-1986". Construction of the 16.5 km long north - south Metro Railway from Dum Dum to Tollygunge commenced in 1972 along one of the major road corridors. The route is shown in Figure 2.4.2.

The cut and cover method with diaphragm walls and piles was adopted. At the northern section crossing Circular Canal the driven shield tunneling method was adopted.

The southern section of the line from Esplanade to Bhowanipur (3.42 km) and from Bhowanipur to Tollygunge (4.24 km) began operation on 24 October 1984 and 28 April 1986 respectively. The northern section from Dum Dum to Belgachia (2.15 km) was opened on 12 November 1984. The remainder of the section is expected to be completed within the next three (3) years.

2.4.3 Trams

The tram is one of the oldest modes of passenger transport in Calcutta, and is operated by Calcutta Tramways Company (CTC). The tram service operates on 36 routes within the metro core area on a route length of 70.42km, 24.85km of which is on reserved track. The system has ten (10) terminal and seven (7) depots located at Belgachia, Rajabazar, Park Circus, Gariahat, Kalighat, Tollygunge and Kidderpore as shown in Figure 2.4.3.

A total number of 310 tram cars carried 550,000 passengers in 1989. The average operating speed can be as low as 6 km/h, but on the reserved sections it is higher, reaching 32 to 40 km/h.

The tramways have been criticized in the past as inefficient and not a very effective use of public funds but the trams nevertheless carry a substantial number of passengers and are an important component in the public transport system.

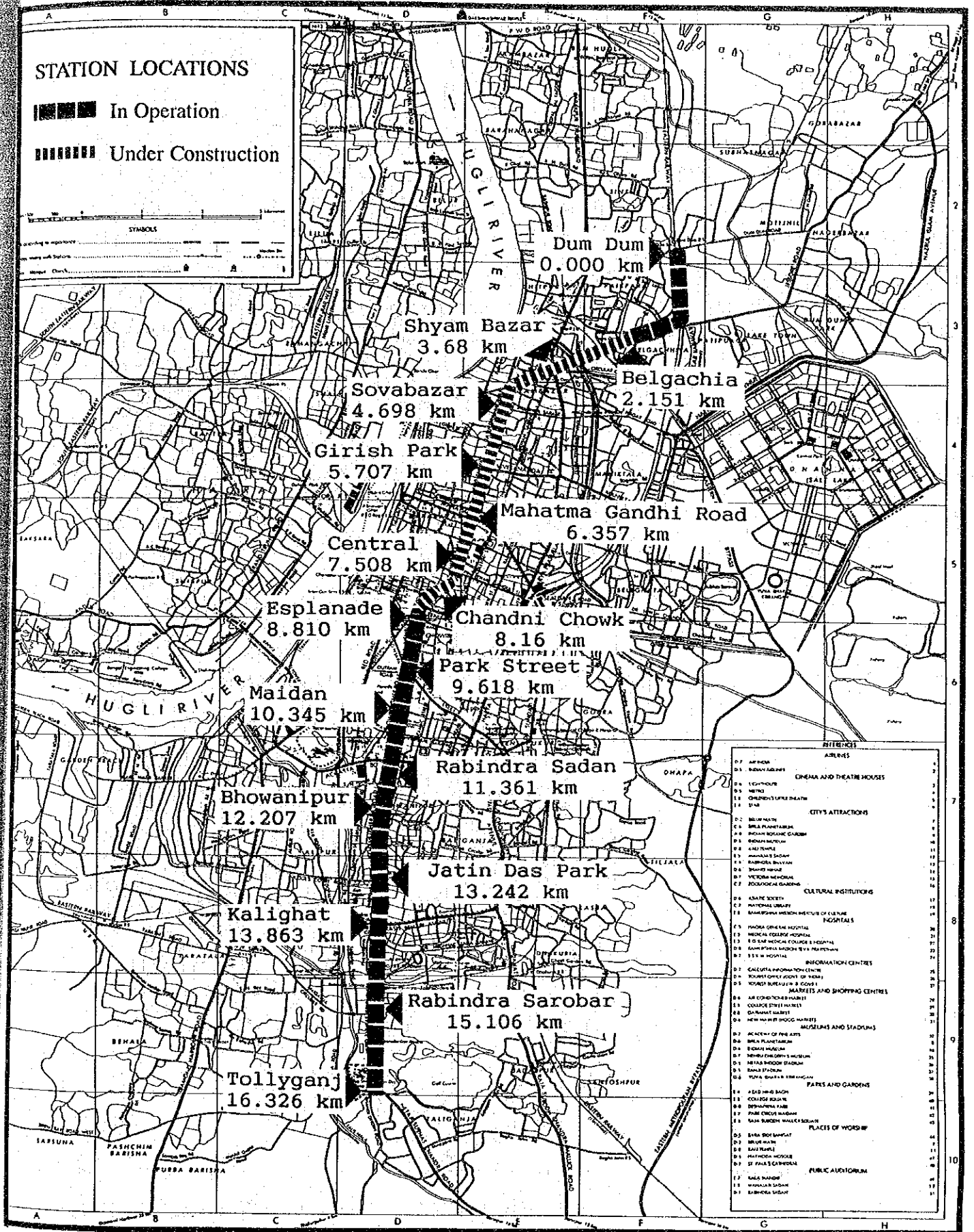


Figure 2.4.2 Calcutta Metro System

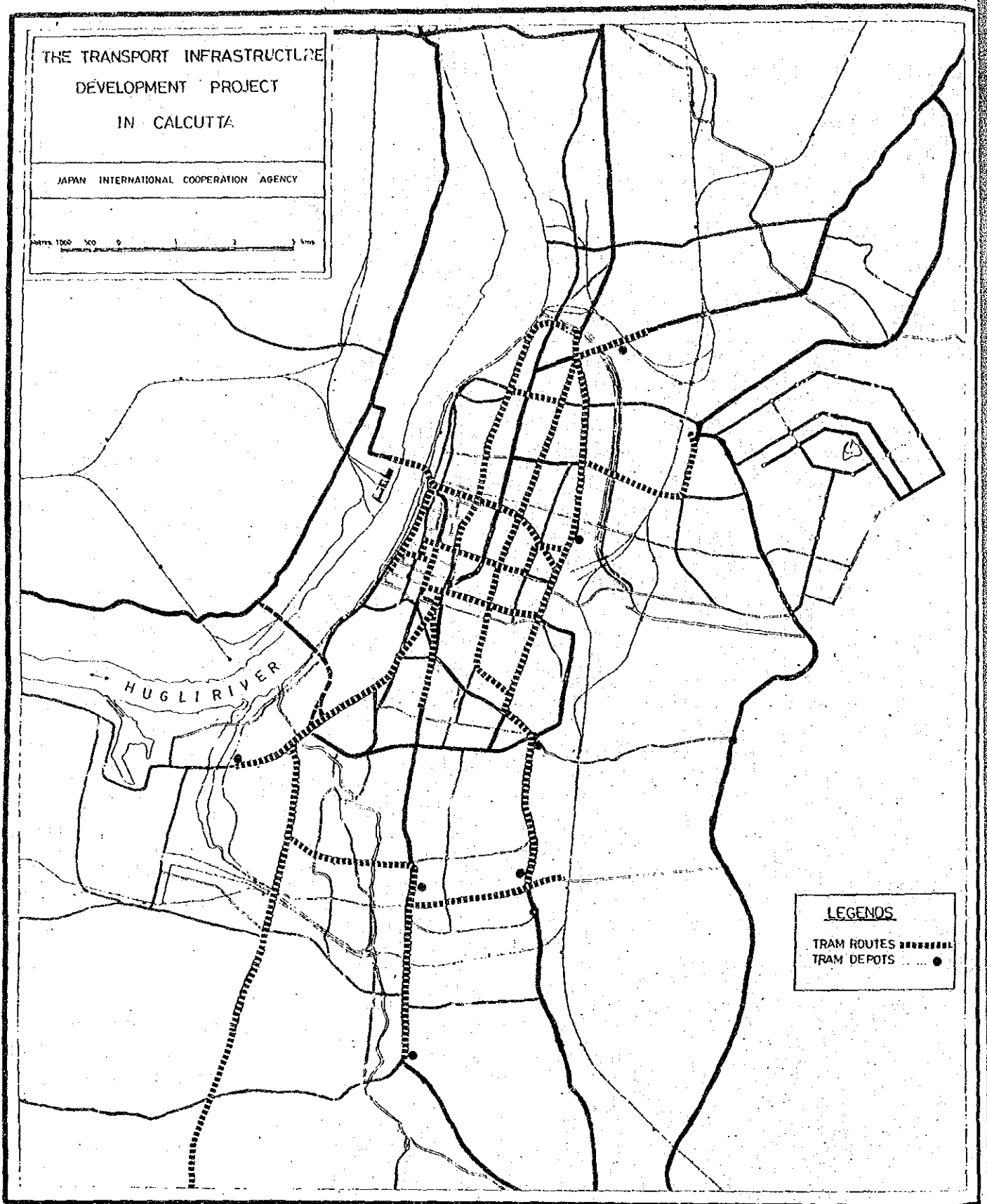


Figure 2.4.3 Tram Routes and Depots

2.4.4 Buses

The bus services are mainly operated by Calcutta State Transit Corporation (CSTC) and privately owned bus companies. The bus services operate on a road length of about 500 km within CMD. Bus services within the metrocore area are shown in Fig. 2.4.4. There are seventy nine (79) intra city routes and sixty-four (64) long distance routes to and from the metropolis.

Mini-buses as a mode of mass transit were introduced to the area in 1972. They were originally intended to provide a comfortable all seated service to the passengers at a relatively high fare rate, but due to the excessive passenger load and other socioeconomic reasons the mini-buses are no longer a comfortable mode of travel. Mini-bus routes are also shown in Fig. 2.4.4.

2.4.5 Ferry Services

Ferry services have been a very popular mode of transport for crossing the river Hooghly. As per the survey conducted by the CMDA in 1976-77, there were 31 ferry crossing points in the metropolis of which only 7 ferry crossing points were operated within the city area viz. the Howrah station, Fairlie Place, Pricep Ghat, etc.

Motorized launches have now also been put in service by the Transport Department in collaboration with the Hooghly Nadi Jalapath Paribaha Samabay Samity. The ferry services in the metropolis carry about 200,000 passengers per day.

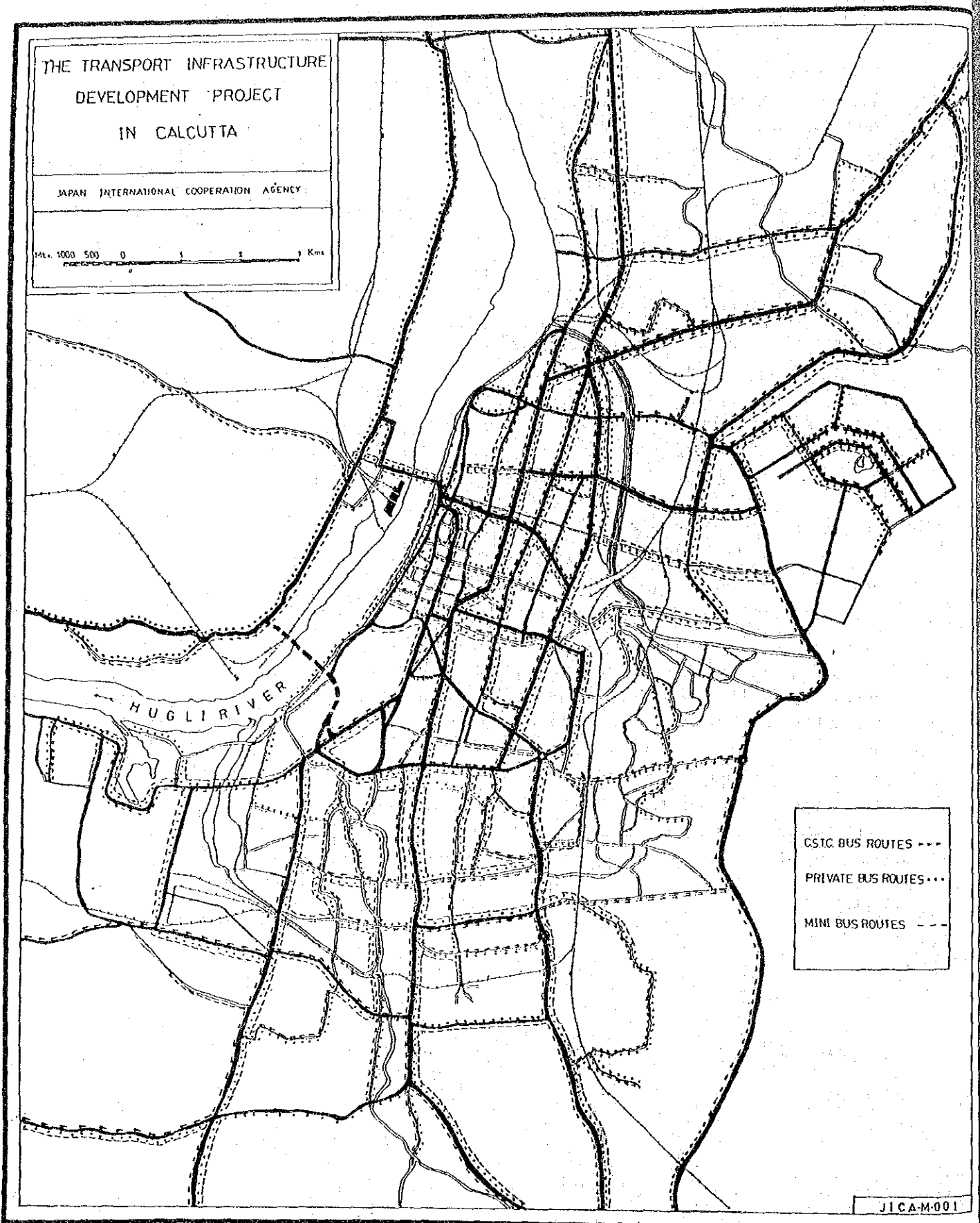


Figure 2.4.4 Bus Routes

2.5 Highway and Street Network

The most important factor that has influenced the configuration of the major highway and road system is the topography. The CMD is divided into two halves by the Hooghly River, and the difficulty and expense in providing adequate river crossings have led to the development of independent road systems on either side of the river.

Furthermore, substantial portions of the area are prone to flooding so that development has been concentrated in a strip along the higher ground along each side of the river. This strip type development coupled with the limited number of river crossing facilities is the main reason behind the north-south oriented street and highway pattern.

The major road categories in India follow the classifications established in 1943 (refer to footnote below). Using these categories, the alignments of major roads in CMD are shown in Figure 2.5.1 (source: Plan for Metropolitan Development 1990-2015) and are described in more detail in Sections 2.5.1 and 2.5.2 below. The metropolitan road system is described separately in Section 2.5.3, although some of the highways and district roads also function as metropolitan roads and serve local traffic as well as through traffic.

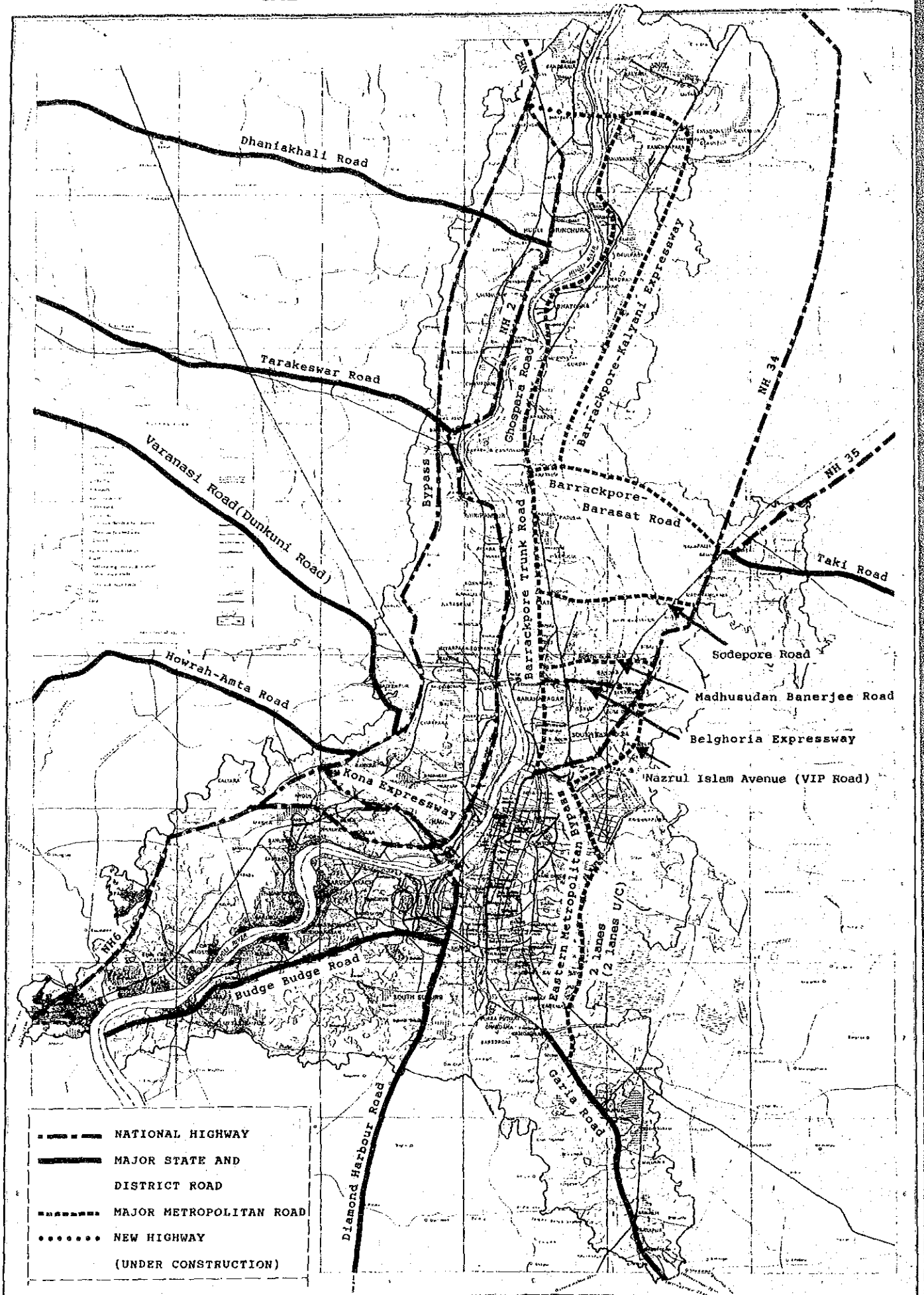
Footnote - Road Classifications

Roads classifications in India were prescribed in 1943 by a Road Development Plan known as the "Nagpur Plan" and are as follows;

- National Highways (NH)
- State Highways (SH)
- Major District Roads (MDR)
- Other District Roads (ODR)
- Village Roads (VR)

Thirty-nine (39) routes for National Highways were identified by the "National Highway Act 1956".

Figure 2.5.1 EXISTING REGIONAL HIGHWAY LINKAGES OF CALCUTTA METROPOLITAN DISTRICT



- NATIONAL HIGHWAY
- MAJOR STATE AND DISTRICT ROAD
- · - · - · MAJOR METROPOLITAN ROAD
- NEW HIGHWAY (UNDER CONSTRUCTION)

2.5.1 National Highways

National highways, along with state highways and district roads, form the regional road system serving CMD. The national highways are the principal roadway connections between CMD and the rest of the Indian sub-continent. National highways extend for 1,631 km in CMD and include the following;

NH 2 known as the Grand Trunk Road, is the longest and one of the oldest road alignments in India, extending from Calcutta to Kashmir, and provides a connection between Calcutta and northern India including New Delhi. It connects CMD and the Durgapur-Asansol industrial complex about 200 km north-west of Calcutta at the regional level. The section extending through the western portion of CMD was narrow and very congested and was relocated to an alignment west of the urbanized area as a high grade bypass.

NH 6 extends west from Calcutta to the west coast of India, and provides a connection between Calcutta and central and western India including Nagpur and Bombay. The route of NH 6 has considerable regional importance as an access to the developing new port facility at Haldia near the Runpnarayan River Bridge.

NH 34 extends north from Calcutta to Siliguri in northern West Bengal. The Siliguri area is an access point for roads connecting to Assam and the North-East Frontier.

NH 35 known as Jessore Road, extends north-east from Calcutta to Bongaon, on the border of Bangladesh, and then on to Jessore in Bangladesh. It serves as an important road connection between the two countries. At the CMD level it provides access to the Calcutta International Airport.

2.5.2 State and District Roads

State highways and district roads provide regional roadway connections between Calcutta and its immediate hinterland within the State of West Bengal. There are 3,455 km of State Highway, 2,784 km of Major District Roads and 3,819 km of Other District Roads in West Bengal.

The most important roads in this category are as follows;

Diamond Harbour Road extends about 40 km south of Calcutta to Diamond Harbour, a town on the east bank of the Hooghly River opposite the Haldia port development.

Taki Road extends from Barasat on NH34 to Basirhat which is about 40 km to the east, near the boundary of Bangladesh.

Garia Road is the southern extension of Raja Subodho Mullick Road and connects Calcutta with Baruipur, Canning and Raidinghi.

Howrah - Amta Road connects Howrah and Amta about 24 km west of CMD.

Varanasi Road connects west from Howrah to Bankura, about 60 km west of CMDA

Tarakeswar Road connects Baidyabati and the towns of Tarakeswar, Champadanga and Kalikapur.

Dhaniakhali Road extends about 40 km west from Chinsrah to Dhaniakhali

Budge Budge Road connects Budge Budge to Diamond Harbour Road at Taratala.

2.5.3 Metropolitan Road System

(1) Major Roads

There are several metropolitan roads within the CMD area not classified as state highways or district roads since their main function is to serve the metropolitan area. The major metropolitan roads existing or under construction are shown in Fig. 2.5.1. The current metropolitan road system consists of the national and state highways listed above, plus regional or metropolitan roads.

The major metropolitan roads within CMD are;

- a) Madhusudan Banerjee Road
- b) Sodepore Road
- c) Barrackpore-Barasat Road
- d) Barrackpore Trunk Road - Ghoshpara Road
- e) Eastern Metropolitan Bypass
- f) Barrackpore-Kalyani Expressway

The northern section of the Eastern Metropolitan Bypass is currently being widened from 2 lanes to 4 lanes. The Barrackpore Expressway is completed with the exception of the final section connecting to National Highway No. 2.

Two new highways are now under construction;

- a) Belghoria Expressway
- b) Kona Expressway - 2nd Hooghly Bridge to NH6

The main roads which function as the major arteries within the study area are shown in Fig. 2.5.2. The main arterials, especially in and near the CBD were not intended to carry the high volumes of traffic which now exist and this is the root of the transportation problem in Calcutta.

In the study area the north-south arterial streets are also the main corridors and have influenced the linear development pattern in CMD and the east-west streets connecting them. The basic pattern is almost the same as it was 200 years ago when the configuration of the built up areas was established - A.J.C. Bose Road was called the Circular Road and delineated the built up area from rural areas.

THE TRANSPORT INFRASTRUCTURE
DEVELOPMENT PROJECT
IN CALCUTTA

JAPAN INTERNATIONAL COOPERATION AGENCY

Scale 1000 500 0 1 2 3 kms



Figure 2.5.2 Existing Roads in Metrocore Area

In CMD the attraction of Calcutta City is very strong, reflected in higher traffic volumes on the north-south corridors nearer to Calcutta City. Suburban residential area developments in recent years have generated further traffic demands resulting in traffic congestion along the corridors.

As the CBD has developed, the congested area has moved towards the east, making A.J.C. Bose Road more important. However, A.J.C. Bose Road is not fully developed over its entire length. A flyover was constructed in front of Sealdah station in the 1980's by CMDA with the intention of segregating vehicular traffic from pedestrian streams and slow vehicles. The 3 leg intersection with Mahatma Gandhi Road is now located on the elevated structure.

The Eastern Metropolitan Bypass was recently constructed to alleviate the congestion along the north - south corridors but the connection with the existing road network needs further improvement.

(2) Bridges across the Hooghly River

The only Hooghly River bridge in the study area is the Howrah Bridge which was completed in 1943. This bridge has tram tracks in the median and a 3 lane roadway on either side. Traffic volume was 61,000 vehicles per day, the highest in the study area. Some 8 km to the north is Vivekananda bridge which has a railway in the center and a 2 lane roadway on either side. Further north is Kalyani bridge, opened to traffic in 1989. It will eventually link the Barrackpore-Kalyani expressway with NH2 but the connection to NH2 is not yet complete and the traffic volume using the bridge is still very low.

The regional cross river traffic at Howrah bridge is mixed with CBD traffic, since the Howrah bridge is located in the north of the CBD. Directing regional traffic through the CBD worsens the traffic congestion in the CBD.

The Second Hooghly Bridge is under construction and is planned to be opened in 1992. The approaches to the bridge on the eastern side include an interchange, as shown in Figure 2.5.3, which is designed to disperse traffic into

three directions by connecting to three different routes. A.J.C. Bose road will play an important role as a bridge feeder road.

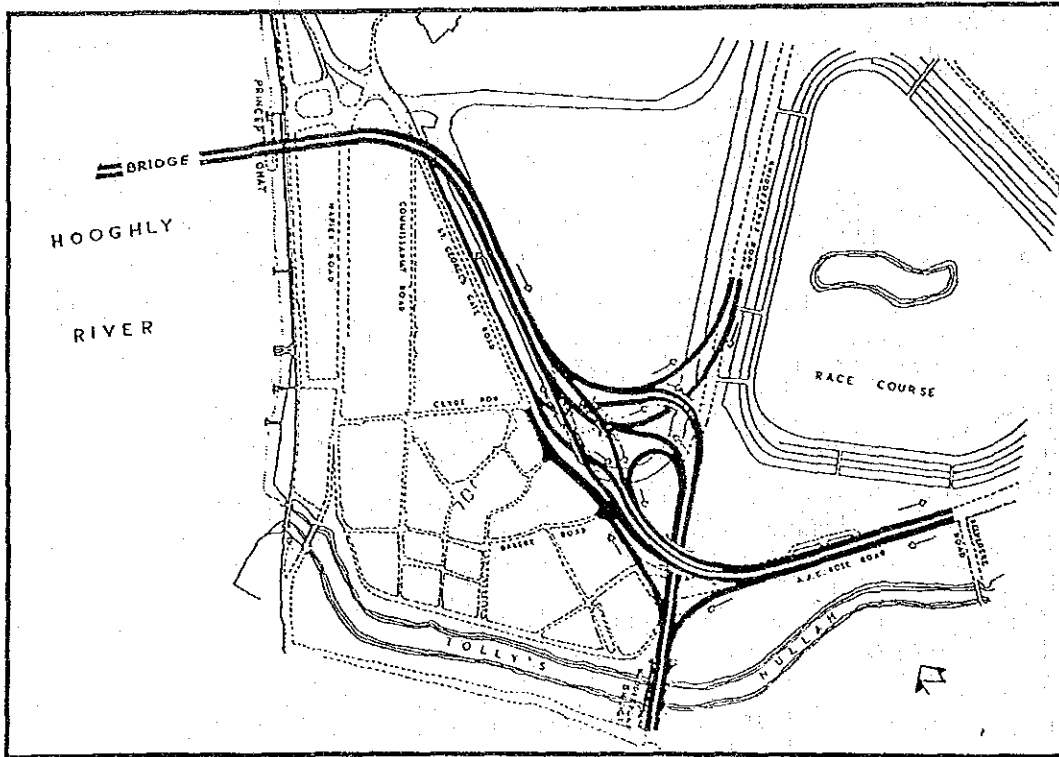
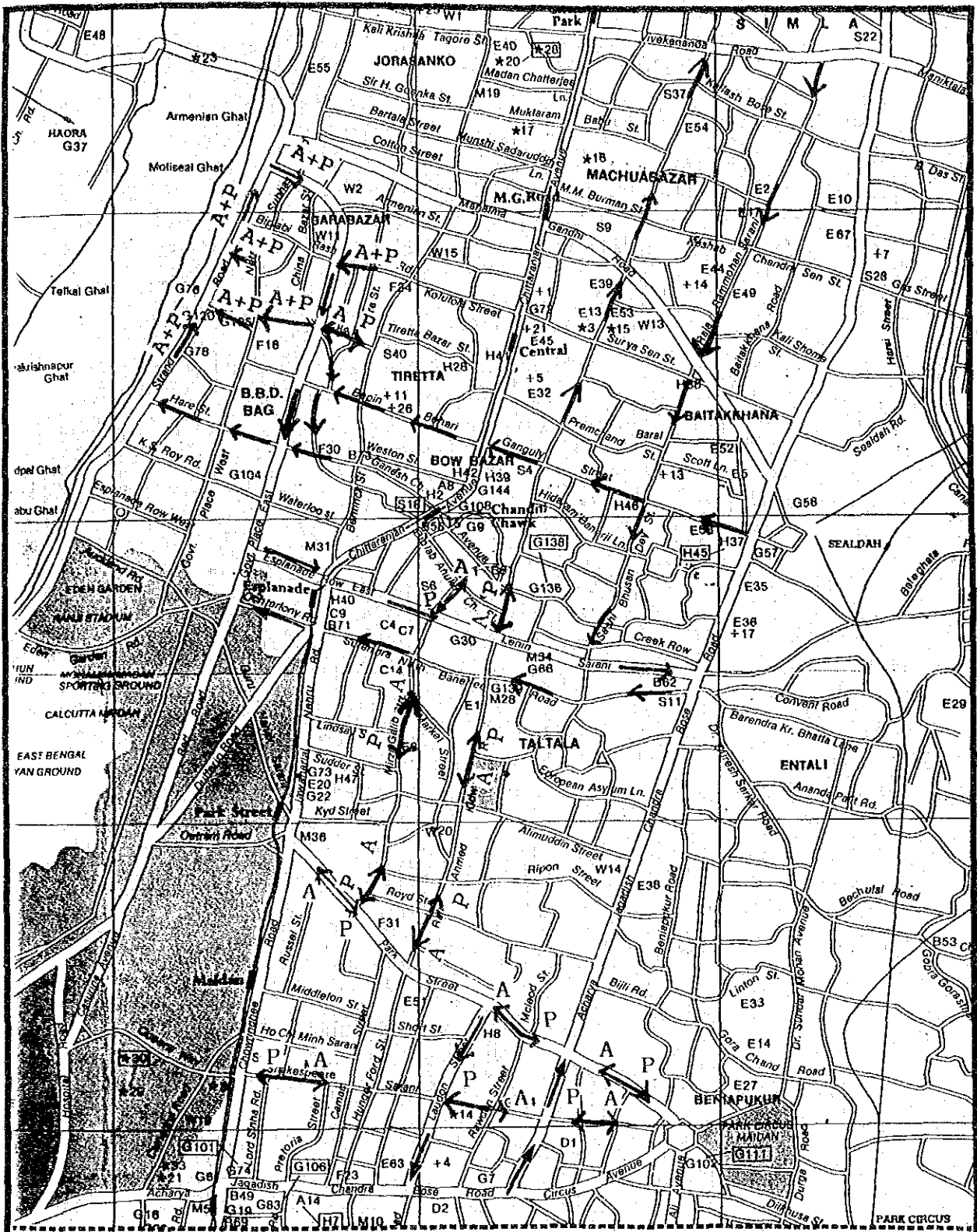


Figure 2.5.3 Approach Interchange on Calcutta Side

(3) One-Way Traffic Operation

In an attempt to reduce the traffic congestion within the study area a number of roads are one-way only. In several cases the direction of one-way flow changes according to the time of day and two-way flow is permitted at night. The current system is shown in Figure 2.5.4.



Legend

- ↑ Full time one-way operation
- ↕ Reversible one-way operation
 - A ↑ A = Morning direction of flow
 - ↓ P = Evening direction of flow
- ↔ (Otherwise two-way operation)

Figure 2.5.4 Existing One-Way Road System