Higher Committee for
Greater Cairo Transportation Planning
Government of the Arab Republic of Egypt

Japan International Cooperation Agency
(JICA)

Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt

PHASE I FINAL REPORT

Volume II: Urban Transport Policy and Strategy

November 2002

Pacific Consultants International (PCI)

The following foreign exchange rates are applied in this study.
USD $1.00 = 4.58 Egyptian Pound (LE)

（As of August 2002）

PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct the Study for the Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Dr. Katsuhide Nagayama of Pacific Consultants International to the Arab Republic of Egypt between March 2001 and September 2002. In addition, JICA set up an Advisory Committee headed by Professor Noboru Harata of Tokyo University between March 2001 and October 2002, which examined the Study from Specialist and technical point of view.

The Study Team held discussions with the officials concerned of the Government of the Arab Republic of Egypt and conducted field surveys at the study area. Upon returning to Japan, the Study Team conducted further studies and prepared this report.

I hope that this report will contribute to development in the Arab Republic of Egypt, and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Arab Republic of Egypt for their close cooperation extended to the Study Team.

November 2002

Takao Kawakami
President
Japan International Cooperation Agency

November 2002

Mr. Takao Kawakami
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to formally submit herewith the Final Report of "Transportation Master Plan and Feasibility Study of Urban Transport Project in Greater Cairo Region in the Arab Republic of Egypt."

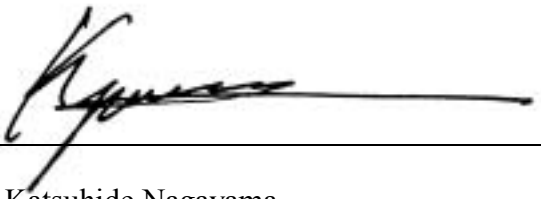
This report compiles the results of the Study which was undertaken in the Arab Republic of Egypt from March 2001 through September 2002 by the Study Team organized by Pacific Consultants International under the contract with the JICA.

This report compiles Transport Master Plan based upon identification of present condition in order to contribute to the sustainable development in Greater Cairo Region.

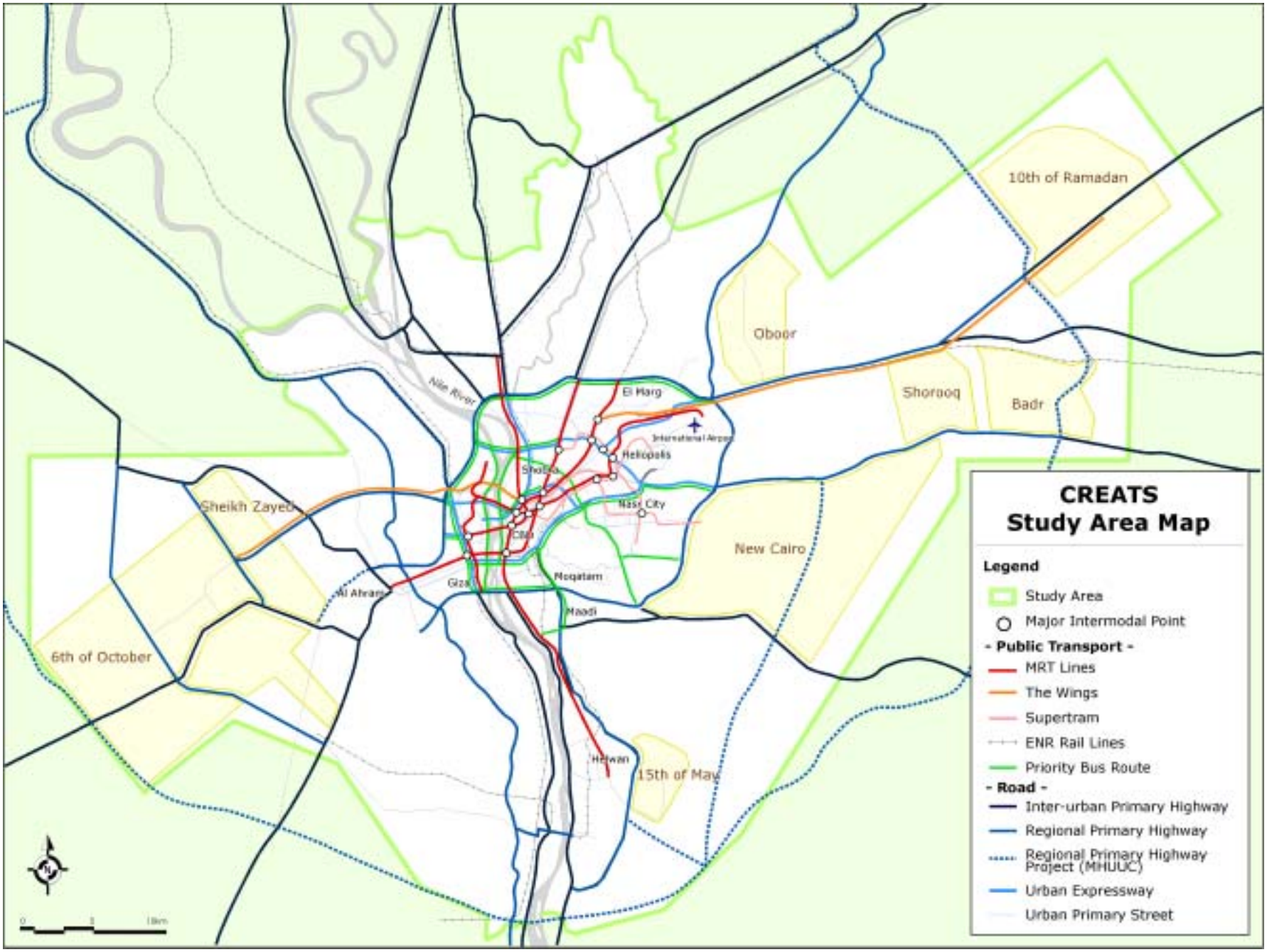
We would like to express our sincere gratitude and appreciation to all the officials of your agency and the JICA advisory Committee. We also would like to send our great appreciation to all those extended their kind assistance and cooperation to the Study Team, in particular, Ministry of Transport and Egyptian National Institute of Egypt as the counterpart agency. We beg to acknowledge our sincere gratitude to Dr. Ibrahim El Dimeery, the ex-Minister of Transport, for his devoted initiation of the Study as well as H.E. Eng. Hamdy Al Shayeb, the Minister of Transport, for his strong support to our activities.

We hope that the report will be able to contribute significantly to development in the Arab Republic of Egypt.

Very truly yours,



Dr. Katsuhide Nagayama
Team Leader,
The Study Team for the Transportation Master Plan and Feasibility Study of Urban Transport Project in Greater Cairo Region in the Arab Republic of Egypt


10th of Ramadan
Oboor
Shorouq
Badr
Nile River
El Marg
International Airport
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CREATS
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The Wings
Supertram
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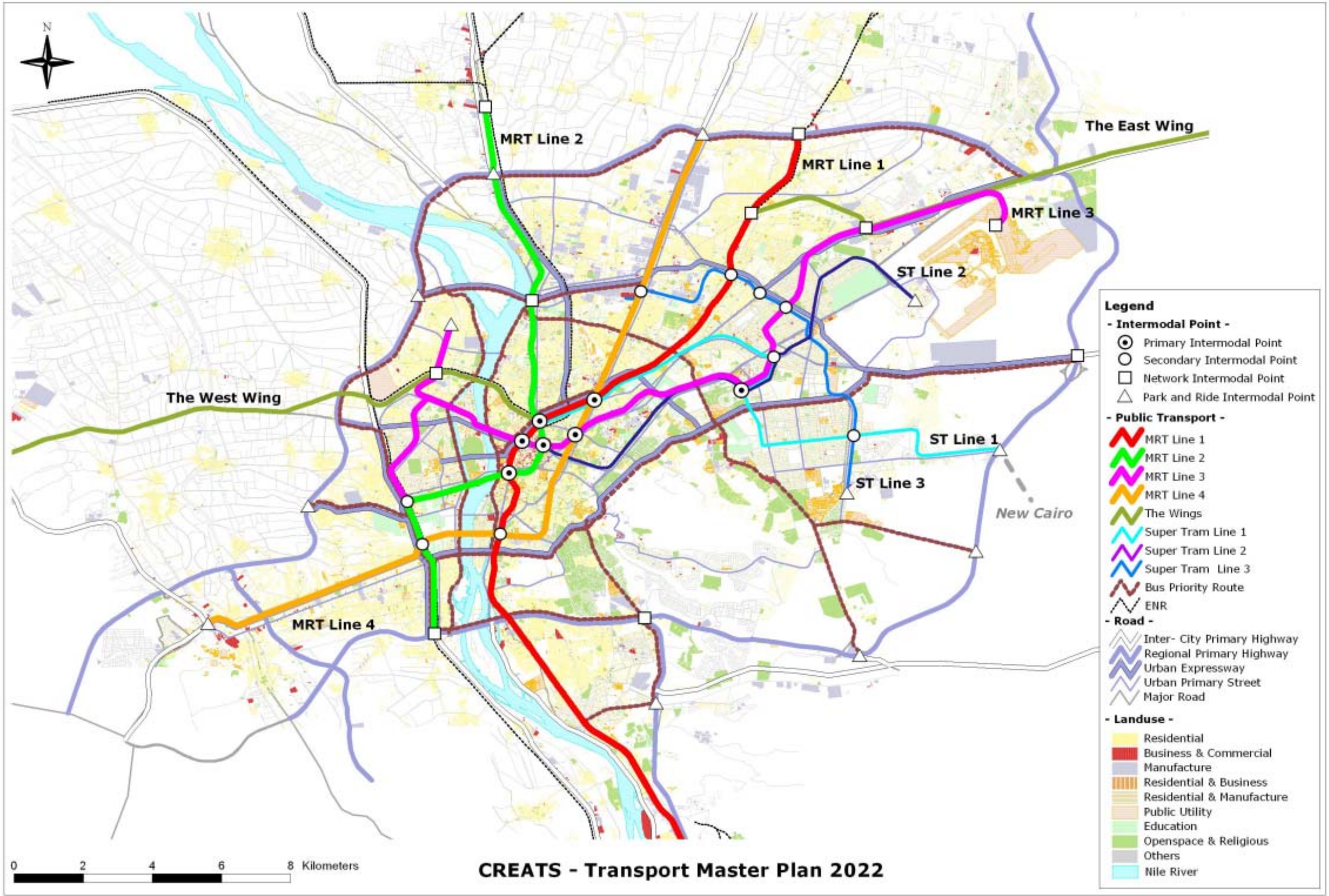
Inter-urban Primary Highway
Regional Primary Highway
Regional Primary Highway Project (MHUUC)
Urban Expressway
Urban Primary Street


N
MRT Line 2
MRT Line 1
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Regional Primary Highway
Urban Expressway
Urban Primary Street
Major Road
- Landuse -
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Manufacture
Residential & Business
Residential & Manufacture
Public Utility
Education
Openspace & Religious
Others
Nile River
0 2 4 6 8 Kilometers
CREATS - Transport Master Plan 2022

LIST OF ABBREVIATIONS

A/C	Air Conditioned
ACLM	American Council of Logistics Management
AE	Acid Equivalent
ASG	Assignment Group (Code)
AfDB	African Development Bank
ATMs	Automatic Teller Machines
BC Ratio	Benefit-Cost Ratio
B/C	Benefit / Cost Ratio
BiH	Bosnia and Herzegovina
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
Br.	Bridge
C/C	Counterpart Committee
CAIP	Cairo Air Improvement Project
CAPMAS	Central Agency for Public Mobilization and Statistics
CBD	Central Business District
CCTV	Closed Circuit Television System
CDO	Central Development Organization
CDC	Cairo Demographic Center
CEDARE	Center for Environment and Development for Arab Region and Europe
CEHM	Cairo University Center for Environmental Hazard Mitigation
CFC's	Chloro-Fluoro-Carbons
CIDA	Canadian International Development Agency
CH4	Methane
CLS	Cordon Line Survey
CMO	Cairo Metro Organization
CMTB	Cairo Metropolitan Transport Bureau
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO2	Carbon Di-Oxide
CORPS	Corniche, Ramses and Port Said Streets
CREATS	Cairo Regional Area Transportation Study
CRR	Cairo Ring Road
CTA	Cairo Transport Authority
CTEB	Cairo Traffic Engineering Bureau
CTP	Common Transport Policy
CTS	Cargo Transport Survey
DANIDA	Danish Agency for Development Assistance
DRTPC	Development Research and Technological Planning Center of Cairo University
DfID	Department for International Development (UK)
EAS	Environmental Awareness Survey
EBRD	European Bank for Reconstruction and Development
EC	European Community
EC	Executive Committee
ECMT	European Conference of Ministers of Transport
EEA	European Environment Agency
EEAA	Egyptian Environmental Affairs Agency
EEIF	Egyptian Environmental Initiative Fund

EEIS	Egyptian Environmental Information System
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Study
EIMP	Environmental Information and Monitoring Program
EMT	Environmental Management and Technology Fund
ENIT	Egyptian National Institute of Transport
ENL	Effective Number of Lanes
ENR	Egyptian National Railways
EQI	Environmental Quality International
ESCAP	Economic and Social Commission for Asia and Pacific
ESCPR	Economic and Social Counsel of Paris Region
ESE	Egyptian Stock Exchange
EU	European Union
FLC	Fully Loaded Containers
FDI	Foreign Direct Investments
FIRR	Financial Internal Rage of Return
FRN	French Railway Network
FY	Fiscal Year
GAM	Goal Achievement Matrix
GARBLT	General Authority for Roads, Bridges and Land Transport
GC	Greater Cairo
GCBC	Greater Cairo Bus Company
GCMA	Greater Cairo Metropolitan Area
GCMP	Greater Cairo Master Plan
GCR	Greater Cairo Region
GDP	Gross Domestic Product
GIS	Geographic Information System
GNP	Gross National Product
GOE	Government of Egypt
GOPP	General Organization for Physical Planning
GOV.	Governorate
GRDP	Gross Regional Domestic Product
GSLTD	General Syndicate for Land Transport Drivers
HBE	Home Based Education
HBO	Home Based Other
HBW	Home Based Work
HC	Hydro-Carbons
H.C.	Higher Committee
HCM	Highway Capacity Manual
HDM	Highway Development and Management System
HIS	Home Interview Survey
HM	Heavy Metals
HOV	High Occupancy Vehicle (Lane)
HRT	Heavy Rail Transit
HSR	High Speed Rail
IAURIF	l'Insitut d'Aménagement et d'Urbanisme de la Region d'Ile-de-France
I/C	Interchange
ICM	Intermodal Concept and Management
ICT	International Cargo Transport

ID	Identification
IEE	Initial Environmental Examination
IHCM	Indonesian Highway Capacity Manual
IHS	Internal Homogeneous Planning Sector
IIA	Independence of Irrelevant Alternative
IM	Inter-Modal
IMF	International Monetary Fund
IRF	International Road Federation
IRMS	Integrated Road Management System
ISESCO	Islamic Educational, Scientific and Cultural Organization
ISO	International Organization for Standardization
ITS	Information Transfer Strategy
ITU	Intermodal Transport Unit
JICA	Japan International Cooperation Agency
JIT	Just In Time
KAP	Knowledge, Attitude and Practice
LAN	Local Area Network
LE	Egyptian Pound
LOS	Level of Service
LRT	Light Rail Transit
MAD	Mean Absolute Difference
M/M	Minutes of the Meetings
MCA	Multi-Criteria Analysis
MEA	Metropolitan Expressway Authority
MENA	Middle East and North African Nations
MHUUC	Ministry of Housing, Utilities and Urban Communities
MINUTP	Mini Urban Transport Planning Program
MOE	Ministry of Environment
MOI	Ministry of Interior
MOIC	Ministry of International Cooperation
MOO	Metro Operation Organization
MOP	Ministry of Planning
MOT	Ministry of Transport
MP	Master Plan
MRT	Mass Rapid Transit
MS	Mobile Station for Air Quality Monitoring
MSEA	Ministry of State for Environmental Affairs
MTBE	Methyl Tertiary Butyl Ether
Mμ	Micrometer
N.A.	Not Applicable/Available
NAT	National Authority for Tunnels
NCPDM	National Council of Physical Distribution Management
NEAP	National Environmental Action Plan
NGO	Non Governmental Organization
NH_4	Methane
NHB	Non Home Based
NMHC	Non Methane Hydro-Carbons
NMVOC's	Non-Methane Volatile Organic Compounds
NNL	Nominal Number of Lanes
NO	Nitrogen Monoxide

NO2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPDCR	National Project for the Development of Cairo Region
NPV	Net Present Value
NRR	Net Reproduction Rate
NU	National Universities
O_3	Ozone
OD	Origin-Destination
OECD	Organization for Economic Co-operation and Development
O&M	Operation & Maintenance
PCI	Pacific Consultants International
PCI	Pavement Condition Index
PCU	Passenger Car Unit
PHR	Peak Hour Ratio (peak hour volume/daily volume)
PM10	Particulate Matter (particles) less than 10 micro meter (µm)
PM2.5	Particulate Matter (particles) less than 2.5 micro meter (µm)
PPP	Public-Private Partnership
PPP	Purchasing Power Parity
PRD	Paris Region Division
PR/PI	Public Relations and Public Involvement
PRT	Public Road Transport
PRTC	Parisian Region Transport Company
PT	Public Transport
PTB	Public Transport Bus
PTF	Public Transport Ferry
PTM	Public Transport Metro
PTSR	Public Transport Suburban Rail
PTST	Public Transport Super Tram
PTT	Public Transport Tram
PTXR	Public Transport Express Rail
RCPR	Regional Council of Paris Region
ROI	Return on Investment
RPS	Revealed Preference Survey
S/C	Steering Committee
SCF	Standard Conversion Factor
SE	Socio-economic
SEA	Strategic Environmental Assessment
SLS	Screen Line Survey
SO2	Sulphur Dioxide
SO_x	Sulphur Oxide
SPS	Stated Preference Survey
TAP	Transport Action Program
TCB/AET	Technical Consultation Bureau & Applied Engineering Technologies
TDM	Transport Demand Management
TEN	Trans-European Networks
TEU	Twenty-feet Equivalent Unit
TNI	Traffic Noise Index
TOR	Terms of Reference
TP	Traffic Police
TPA	Transport Planning Authority

TRASAC	Traffic Safety Council
TRASEC	Traffic Safety Education Center
TRASIC	Traffic Safety Information Center
TRASOs	Traffic Safety Organizations
TSP	Total Suspended Particulate Matter
TSP	Traffic Safety Program
TransCAD	Transportation Computer Assisted Design Program
UAE	United Arab Emirates
UK	United Kingdom of Great Britain and Northern Ireland
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
USAID	United States Agency for International Development
UTPU	Urban Transport Planning Unit
V/C	Volume to Capacity Ratio (Volume divided by Capacity)
VOC	Vehicle Operating Cost
VOC	Volatile Organic Compounds
WB	World Bank (International Bank for Reconstruction and Development)
WHO	World Health Organization
ZTEB	Zone Traffic Engineering Bureau

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The Transport and Traffic Consultations Unit (TTCU), Ain Shams University	

Group 2	
Technical Consultations Bureau & Applied Engineering Technologies (TCB/AET)	<u>Surveys</u> • Household Interview Survey (HIS) • Revealed Preference Survey (RPS) • Stated Preference Survey (SPS) • Environmental Awareness Survey (EAS) • Cordon Line Survey • Cargo Transport Survey • Public Transport Passengers Survey
	<u>Practical Demonstration</u> • Demonstration of A Traffic Safety Education Program and Campaign
Group 3	
Sound and Vibration Lab, Faculty of Engineering, Ain Shams University	<u>Surveys</u> • Environmental Survey

TABLE OF CONTENTS

1 INTRODUCTION

BACKGROUND

Japan International Cooperation Agency (JICA) and the Higher Committee for Greater Cairo Transport Planning, Ministry of Transport, are cooperating in the Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt (**CREATS** – Cairo Regional Area Transportation Study), based upon the bilateral agreements finalized during November, 2000.

Pacific Consultants International, headquartered in Tokyo, Japan, is designated to be the lead consultant for the study, and organized the Study Team, head by Dr. Katsuhide Nagayama, comprising of a total of 17 experts. Technical efforts in Egypt were initiated during March 2001.

OBJECTIVES

CREATS is comprehensive in nature, that is, adopt approaches designed to mitigate urban transport problems and contribute to the sustainable development of the Greater Cairo Region. Three key objectives form the foundation of planning efforts:

- To formulate a master plan for the urban transport network in the Study Area to the year 2022;
- To conduct a feasibility study for the priority project(s) identified under the master plan (however, this object shall be undertaken as a follow-up effort to the master plan study); and
- To carry out technology transfer to the Egyptian counter personnel in the course of the study

The transport strategy embedded in the Master Plan must concurrently contribute to an efficient economic structure of the region, strengthen linkages with other parts of Egypt as well as neighboring countries, and provide a base for market-oriented transport activity. The foci of future planning efforts must gradually shift from alleviation of present deficiencies to realization of a transport system founded upon sustainable evolution and integrated, mutually supportive transport solutions.

THE STUDY AREA

The Study Area is defined as consisting of the entire Greater Cairo where is a massive conurbation whose year 2000 population is estimated at some 14 million, including new communities of 10th of Ramadan, and 6th of October, as shown in the Study Area Map. Administratively, the Study Area is encompassed with Cairo Governorate, Giza Governorate and part of Qalubia and Sharqia Governorates.

The Study Area includes the Republic's capital city and serves as Egypt's focal point for commercial, cultural, religious and economic activities. The urbanization is still progressive, and its entire transport system has worsen, despite that the government of Egypt has striven massive efforts to tackle with transport issues such as road traffic congestions and environmental deterioration, introducing a metro-system and bus network. Yet, an intermodal system has not been structured to lead to a substantial solution.

SCOPE OF THE STUDY

The Study includes a full set of transport and traffic surveys with eleven kinds including a person trip-based home interview survey for about 57,000 sample households for identification of present conditions as well as building a reliable transport models.

The components of the Master Plan diversify beyond the traditional "***Hardware***" concepts associated with transport infrastructure provision. Additional key elements of the process consist of "***Software***" aspects, that is: technology and equipment, international standards, and multi-modal integration needs (cargo/passenger terminals, transfer points); and **"*Humanware***" needs, or the cultivation of human resources via the designation of training and education programs as well as integration of those components, problem/issue identification and other requirements for developing expertise. The "***Sustainability***" of the future transport system shall be assured with the notion that the planning process must allow Egyptian stakeholders to participate in shaping their own future.

RELEVANCE TO PREVIOUS TRANSPORT STUDIES

There exist three transport master plan studies for Cairo so far. The first effort was made in 1973 by the French support under Transport Planning Authority (PTA), MOT, focusing on Metro Line Development. The second one was made in 1989, with technical support of JICA under Cairo Governorate, and the third one is "Public Transport Study" by the French support in 1999 under NAT. All efforts are appreciable and some recommendations are reasonable. However, as these studies had different objectives for different study areas (Fig. 1.1), all are not necessarily comparative on the same ground. CREATS is the first attempt to delineate a comprehensive transport master plan, covering the entire metropolitan areas of Greater Cairo Region. CREATS reviewed all the previous transport studies and kept relevance to these previous efforts as well as Five Years Plans of both National and relevant Governorates.

INFORMATION DISSEMINATION

Efforts were made until November 2002 when the final Master Plan was completed. Wide-spread information dissemination methodologies were, during that period, employed through holding a number of workshops, and seminars as well as distributing periodic "***CREATS Newsletter***" to the stakeholders. The ***CREATS Web-site*** was created for all those who are interested in the publications issued in the planning process.

STUDY MANAGEMENT AND COLLABORATION

CREATS is a result of close collaboration with well-organized Higher Committee, chaired by H. E. Eng. Hamdy Al Shayeb, Minister of Transport, Steering Committee, chaired by Prof. Dr. Ali S. Huzayyin, and Counterpart Committee chaired by Dr. Ali S. Heikal. The Study was supported by capacities of local resources from relevant ministries and authorities, academic institutions, the business sector as well as local consultants. The Study Team was also advised by the JICA Advisory Committee, chaired by Prof. Dr. Noboru Harata.

During the study period, efforts were made for technical transfer to the counterpart personnel through daily collaborative work and special workshops for modeling technique.

REPORTING STRUCTURE

The CREATS Master Plan (the outcomes from Phase I Study) is composed of four (4) separate volumes of reports:

Volume I: Executive Summary
Volume II: Urban Transport Policy and Strategy
Volume III: Transport Master Plan
Volume IV: CREATS Urban Transport Database

Volume I complies essences of the CREATS Master Plan and summarizes recommendations derived from the Study. Volume II presents essential policies and strategies for improvement and development of the Greater Cairo transport system in the long-term, based on technical and analytical findings. Volume III discusses full-range of technical outcomes by sub-sector, including analytical findings, planning issues, approaches and methodologies, planning thoughts, projects and programs and recommendations for the implementation.

Meanwhile, Volume IV complies all supporting information and data collected/surveyed through the Study as well as the basic framework of the ***CREATS Model*** developed by the Study Team for simulation analyses. All those who are interested in technical and analytical methodologies in urban transport planning, and who are obliged to review the Master Plan periodically may refer to Volume IV.

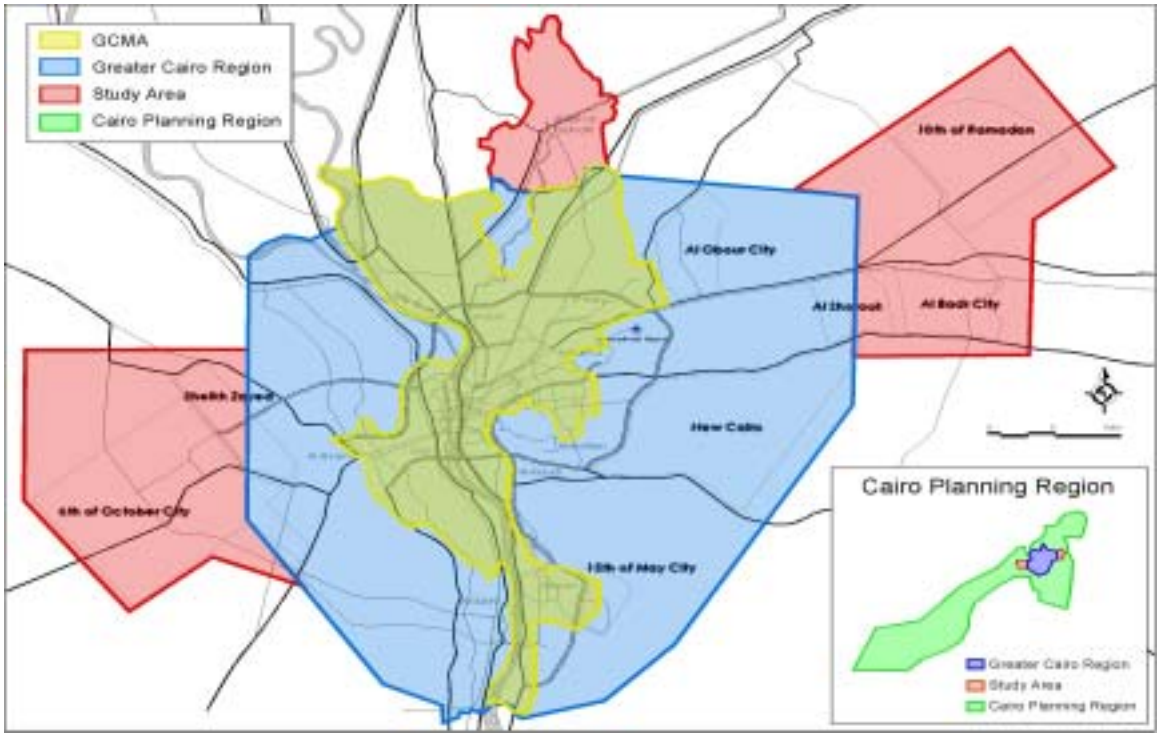

Fig. 1.1 CREATS Study Area and Administrative Planning

2 CHALLENGE FOR INNOVATIVE CAIRO TRANSPORT

OVERALL ISSUES

Cairo, the premier city of Egypt and one of the cultural as well as historical beacons of the Arab World, has reached a cross-roads; her population has swelled to more than 14 million persons and will reach 20 million in 2022, thus placing growing stress on a variety of infrastructure systems. The increasingly difficult urban transport situation, characterized by a high degree of traffic congestion, constrained resources for public transport services and deteriorating air quality, lies in the forefront of such concerns. Concurrently, the political, spatial and economic roles of Greater Cairo are changing; the on-going implementation of the new communities program, anchored by the potentially massive 6th October and 10th Ramadan cities, require unique solutions which are capable of addressing both the functional integration of the region, as well as the needs of inner city development.

No single remedy can be expected to comprehensively address such concerns, instead, a more holistic approach is needed. Herein lies the challenge for CREATS; innovative solutions are needed whose practicality can be viewed through the prism of existing realities. The transport strategy embedded in the Master Plan must not only address cornerstone issues such as infrastructure, policies and human resources, but concurrently contribute to an efficient economic structure of the region, strengthen linkages with other parts of Egypt as well as neighboring countries, and provide a base for market-oriented transport activity.

Economic expansion within Egypt is well underway; continuing improvements in productivity and well-being are expected. As economic growth continues, changes in transport activities and behavior will follow suit. Thus, the foci of transport planning must gradually shift from alleviation of present deficiencies to realization of a transport system founded upon sustainable evolution and integrated, mutually supportive transport solutions. This strategy is particularly valid in the 20-year planning horizon.

If history holds any lessons, it is that future growth in income will inevitably catalyze an increase in trip making, as well as changes in the types of modes used to accomplish such trips. It is likely that private modes of transport, such as passenger cars, will continue to become increasingly popular with Cairo people. The key issue is therefore how to manage growth in transport demand by developing transport systems that ultimately enhance economic productivity, increase personal mobility, improve the urban environment and ensure financial viability. A key consideration in this regard is that ultimately the need to move people must take precedence over the need to move vehicles.

A need for capital-intensive improvement projects has been confirmed as part of investigative efforts. This, in turn, will require careful thought regarding investment decisions. Domestic funds will likely be limited for the foreseeable future, thus, international funding in the form of aid, grants and other monetary mechanisms is expected to evolve as an important source of finance, including the participation of the private sector.

A series of extensive surveys conducted by CREATS revealed a number of notable findings and planning implications on the current transport situation in the Greater Cairo Metropolis. Based on those, it is clear that new additional infrastructure construction cannot, in isolation, provide a comprehensive solution. Other mutually supportive

strategies are required including strengthening of institutional and humanware components.

PLANNING OBJECTIVES OF CREATS

GOAL AND VISIONS

CREATS aims at a social goal to ultimately achieve three visions, each of which is the vital factor to improve the Egyptian people's quality of lives:

Vision 1: To Achieve a Sustainable Social and Economic Growth

Cairo, the premier city of Egypt, should be a robust engine to drive the Egyptian economy towards keeping its position as the economic and cultural center in the Arab world as well as Egypt in the future. A sustainable growth, in terms of people's quality of lives as well as the urban economy, needs to be assured.

Vision 2: To Assure Social Equity

Benefits of the development should not be concentrated on selected groups, but should be equitably prevailed for all the people. Getting one happy must not worsen another.

Vision 3: To Improve Urban Environment

Being free from any fear of environmental risks is an essential human right for all urban habitants to enjoy sustainable urban life and economic activities. The healthy city must be a pride of all the Cairo citizens.

MISSIONS OF TRANSPORT

The transport sector shall play a significant role to materialize the above three social visions. In the line with them, the Cairo urban transport should be developed to satisfy the following three missions:

- ***Economically Effective Urban Transport Systems***

Since a transport cost is part of diseconomies against the economic efficiency, the transport cost needs to be minimized to realize a sustainable social and economic growth in Greater Cairo Region (Vision 1). An economically effective urban transport system should be re-structured in such ways that travel time and costs spent for all urban activities can be minimized and that capital investments for construction of the system and recurrent expenditures for the operation and maintenance of the system can be economically feasible.

- ***Equitable People's Mobility***

The transport sector is greatly responsible for assuring social equity (Vision 2), providing all people with equitable accessibility to places for their employments, educations, medical cares, social services and other daily activities. To this end, all people's mobility should be guaranteed by the public sector.

- ***Safe and Environment-friendly Transport System***

Any mechanized transport means generates more or less environmental pollutions as far as fossil fuels are used for the energy source; and it is likely to incur risks of accidents. Making best use of appropriate technologies and human intelligence, a safe and environment-friendly transport system should be realized to improve urban environment (Vision 3).

KEY STRATEGIES

In response to the three missions of transport, extensive and intensive efforts should be made to build a robust and sustainable system to respond to future transport demands, while solving current problems and constraints. To this end, **five (5) key strategies** are proposed towards making Cairo Transport innovative over the next two decades time-horizon (Fig. 1). As each strategy needs some institutional and managerial reform as well as a considerable amount of public investments, the implementation of the five strategies requires challenging and innovative efforts by all government parties concerned.

Strategy 1: Improvement of People's Mobility

Urban economies are supported by smooth and uneventful travel activities of an individual from one place to another with a purpose, which can be achieved by an optimal transport mode, not necessarily with a private vehicle. The most important is that people's mobility should be improved in such a way that every travel can be made by the optimal cost, time and mode. Alleviation of road congestion is one of vital issues to be tackled, however, this shall contribute to improve the people's mobility not only for vehicle's mobility. To support the megalopolis with a 20 million population in this sense, development of a well-functioning public transport system is a must.

Strategy 2: Optimal Infrastructure Development and Management

Viewing future changes in social and economic activities as well as people's travel behaviors, economically justifiable investments should be explored in order to fulfill a gap between demands and supplies. Over-investments to provide a supply capacity eventually shoulder a negative burden on the society, and under-investments will cause economical losses in the society. The keyword must be "***optimal***" in terms of the budgetary and economic affordability of capital investments and costs for the operation and maintenance. At the same time, the optimally developed infrastructures should be properly and efficiently managed with well-organized operational systems. Hence, the management is crucial part of the infrastructure development strategy.

Strategy 3: Safe and Environmental-friendly Transport

Safe transport is not only a basic requisite for the human right but also a critical factor to alleviate social and economic losses. A social norm that ***pedestrians*** shall take priority in traffic operations should be fostered among all people. The environmentally risky society should be ameliorated to realize sustainable prosperity of people.

Strategy 4: Accessible Transport for All

Public transport services should be equally provided for all the poor, handicapped and the weak in the society. The social welfare sector needs to address effective measures even in the transport sector based on a definite policy that any ***social exclusion*** shall not be accepted referring to the constitution.

Strategy 5: Establishment of a Sustainable Institutional and Financial Mechanism

An integrated policy implementation, a strong leadership for appropriate and timely decision-making and a sustainable mechanism to meet financial demands need to be established in order to make the Cairo Transport more functional and rational. In this regard, a number of institutional reforms should be taking into action with a firmed will by the elected people.

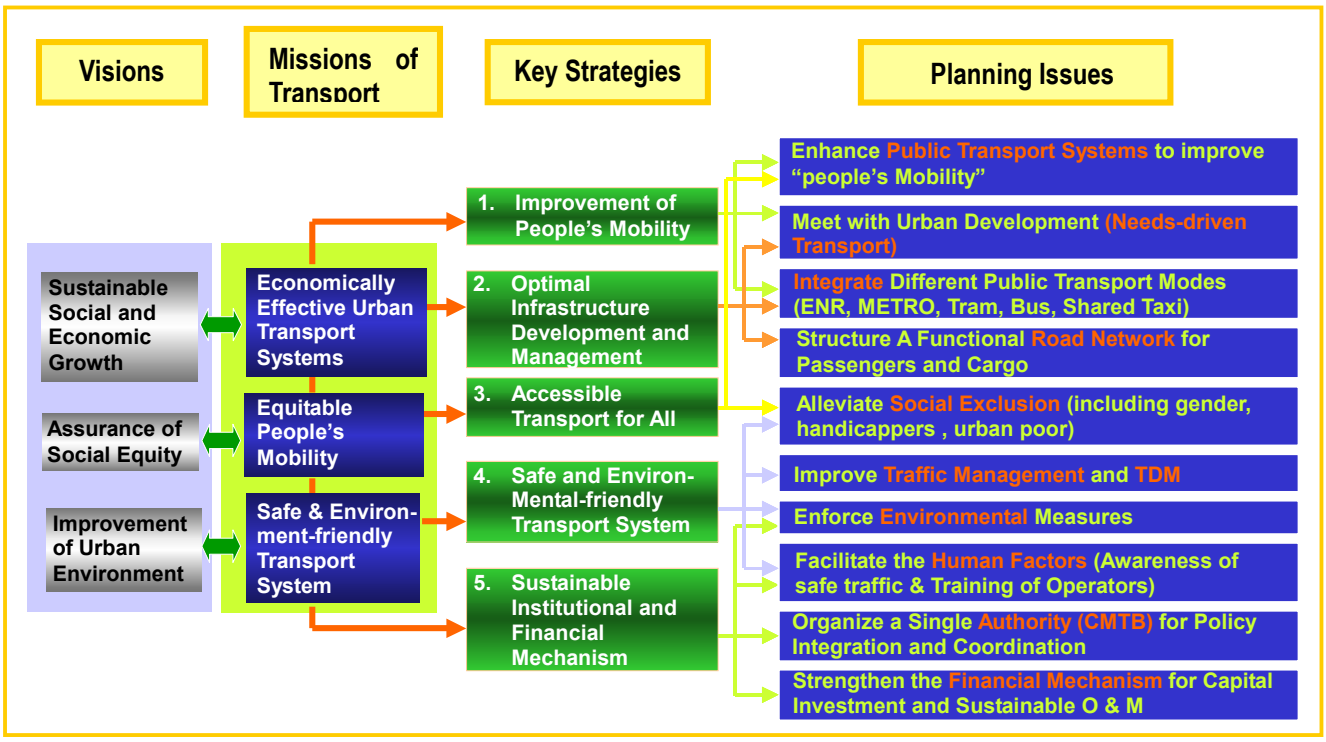

Fig. 2.1 Planning Concept of the CREATS Master Plan

3 PERSPECTIVES OF GREATER CAIRO IN 2022

PERSPECTIVES OF SOCIOECONOMIC EVOLUTION

POPULATION

The Study Area, encompassing the Greater Cairo Region and new communities, has a population of 14.4 million as of 2001, which will increase to be 20.7 million in 2022 at the average growth rate of 1.7 percent per annum. The number of households is 3.5 million as of 2001, and will increase to be 5.1 million in 2022 at the average growth rate of 1.77 percent per annum.

ECONOMIC GROWTH

Three scenarios of the economic growth in GCR until 2022 can be envisaged in terms of GRDP. The highest growth scenario will attain a 6.1% p.a. growth over two decades; the medium, a 4.6% growth, and the lowest, a 3.7% growth. It is assessed that the GCR economy is endowed with a potential to achieve the medium growth scenario. The per capita GRDP, therefore, will increase at about **2.9%** p.a. during the period between 2001 and 2022, which implies that the per capita income of Cairo people will be **1.86** times as much as the present level.

The number of employments accounts for about 3.97 million in total in 2001, of which 2.44 million (62%) are provided by the tertiary sector, and 1.38 million (35%) by the secondary sector. Those who are engaged in the primary sector are marginal. Employment opportunities will increase along with the economic growth, and account for 6.94 million in total in 2022. The tertiary sector will slightly increase its share: 4.36 million (63%), while the secondary sector will be 2.41 million (35%).

HOUSEHOLD INCOME DISTRIBUTION

No statistical data for household income is available. Based on the CREATS Household Interview Survey, an implicative distribution pattern of household income levels was derived, and that in 2022 was projected. The household income is grouped into 5 levels: Level 1 (less than 300 LE/month); Level 2 (300~500 LE/m); Level 3 (500~1,000 LE/m); Level 4 (1,000~2,000 LE/m); and Level 5 (more than 2,000 LE/m). The present distribution pattern of household income groups is as shown in Fig. 3.1.

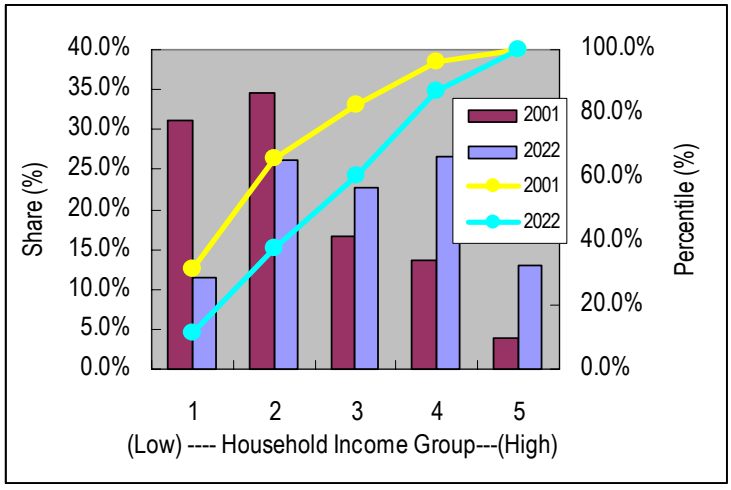

Fig. 3.1 Household Income Distribution: 2001-2022

It is noted that the percentile share of the households with below Level 3 occupies 83% of the total. The affluent households, Level 5 (more than 2,000 LE/month), share only 4% of the total. The average household income is expected to increase by 2.7% per annum, and this pattern will be changed towards being more equitable in the future. The percentile share of households with less than 1,000 LE/month will be decreasing to be 60%, while the rich group will increase to be a 13% share.

MOTORIZATION

Along with the expected income increase, motorization will undoubtedly progress at a higher rate than the income growth. The total number of "cars" registered in GCR is estimated at about 1.05 million as of 2001, and the number in 2022 is projected to be about 2.5 million, an average annual growth rate of **4.2** percent.

The CREATS survey reveals that only 30 percent of the households have access to a vehicle at present. Naturally, the higher income households feature higher accessibility. The Study Team correspondingly projected vehicle accessibility with respect to household income (Table 3.1).

It is noted that even given such a rapid motorization process, the households without car access will still be the majority, sharing 55% of the total.

Table 3.1 Households with Access to a Vehicle: Years 2001 and 2022

(Unit: million)

Household Economic Activity Class (Indicative Household Income)	2001	2022
Low (less than 500 LE/month)	0.27	0.25
Medium (500 ~1,000 LE/month)	0.23	0.43
High (more than 1,000 LE/month)	0.56	1.83
Total	**1.06**	**2.51**
Average Vehicle Accessibility per Household	0.30	0.49

Source: JICA Study Team

Not only the number of households with access to a vehicle increases but the number of motorized trips generated by these households will increase as well. This double impact is likely to increase the number of trips by more than 4 percent per annum over the next twenty years even with a substantial investment in public transport.

PERSPECTIVES OF TRIP GENERATION AND DEMANDS

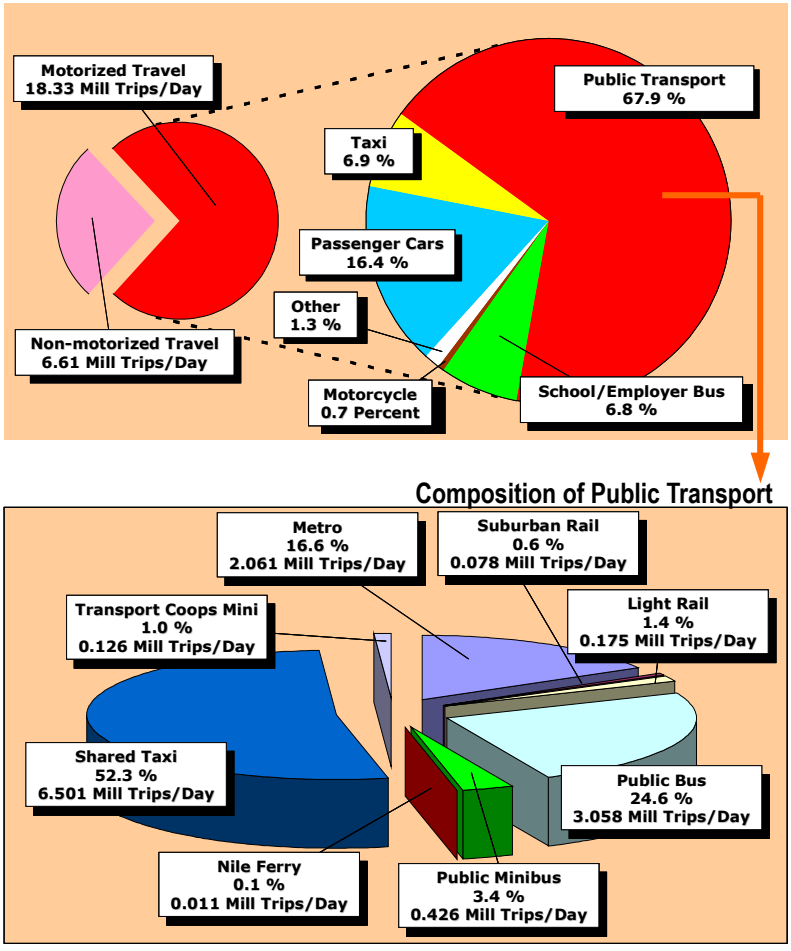

Fig. 3.2 Trip Generation Pattern (2001)

MODAL PATTERN

About 24.9 million trips (referring to "*unlinked trip*") are made daily at present in GCR. Of that portion defined as trips longer than 500 meters, some 18.3 million are made via motorized modes; that is, using vehicles propelled by an engine or motor. The proportion of trip making on foot is **27%**, but this increases to nearly half of all the trips in the lowest income level (Fig. 3.2).

Of the motorized trips, about 68% are made by public transport, followed by passenger cars (16.4%). Looking into the composition of the public transport, some 6.5 million trips are made by "***Shared Taxi***" which occupies a 52% share of the public transport trips, followed by "***Public Bus***" (3.1 million trips; 25%) and "***Metro***" (2.1 million trips; 17%). These three major modes share 83% of the total trips made by public transport.

Trips by "***Public Minibus***" are 0.4 million, sharing 3.4% only. Alike, "***Light Rails***" such as the Heliopolis Metro and CAT tram serve 0.18 million trips a day, sharing a minor portion, 1.4%. "***Nile Ferry***" trips are marginal (0.1%) in the whole trips in GCR.

TRIP GENERATION RATES

Overall the trip generation rate is **1.45 trips per person** (or 4.1 trips per household) at present, referring to "*linked trip*". For person over 6 years of age, the trip rate is **1.64**. As shown in Table 3.2, the number of trips is related to levels of household economic activity. There is also a high proportion of people, some 36% of people, that do not make any trips during a normal day.

It is noted that women over the age of 6 years make 1.2 trips per person per day, compared with 2.1 trips made by men. Such a relatively low trip rate of the female group is attributed to the Egyptian tradition and customs, however, the absence of safe and clean public transport tends to somewhat discourage females to go out of home.

Table 3.2 Trip Rates in 2001 for Persons over 6 Years Age

Household Economic Activity Class (Indicative household Income)	Trips per Person
Low (less than 500 LE/month)	1.5
Medium (500 ~1,000)	1.8
High (more than 1,000)	2.1
Total	**1.64**

Source: JICA Study Team

Overlooking at the ***motorized trips*** in the future, it is a critical factor to figure out the future infrastructure requirements. In twenty years the motorized mobility of people will increase with the number of trips per person rising from 1.0 to 1.2 for the medium economic growth scenario. The total number of motorized trips will increase from 14.4 to 25.1 million, or double at a 2.7% p.a. growth rate over the next twenty years. The growth rate of the high income groups will be predominant, growing at 5.5% p.a., as shown in Table 3.3.

This growth in the number of trips is directly related to the anticipated growth in household economic activity. As a result of this growth in trips there will be a higher tendency towards the private vehicle.

Table 3.3 Motorized Daily Trips in 2001 and 2022

(Unit: million)

Household Economic Activity Class	**2001**	**2022**	Growth (% p.a.)
Low (less than 500 LE/month)	7.7	6.6	- 0.1
Medium (500 ~1,000)	2.9	5.8	3.4
High (more than 1,000)	3.8	12.7	5.9
Total	**14.4**	**25.1**	**2.7**

Source: JICA Study Team

PERSPECTIVES OF URBANIZATION

URBANIZATION STRUCTURE

The Greater Cairo Region (GCR) has been still expanding its urbanization momentum towards the east-west desert areas whose spatial extent is encompassed with a 50-60km radius from the center of Cairo. The pressure of population increase slightly relaxed at 2.1% p.a. during the past decade (1986-1996), however, the urban population will continuously increase at 1.7% p.a. over the next two decades.

The Egyptian Government has taken an innovative strategy to develop new housing areas in desert regions to cope with increasing housing demand and to protect the agricultural arable land in the Nile Delta from habitants' encroachment. The Ministry of Housing, Utilities and Urban Communities officially launched the New Community Programs in 1979, after which a regional development policy was initiated in 1982, based

on the Physical Planning Law No. 3. Nowadays, five large urban agglomerations, comprised of eight new towns shape the Cairo metropolitan structure. These new suburban communities were originally designed to accommodate about 3.9 million population in total, with about 1,000 sq. km land area. This target was revised to be 4.2 million. It is generally recognized that in the new community structure, two urban agglomerations with a 2 million population are to be located in the east and west side of the GCR, namely the 10th of Ramadan and the 6th of October. Another 1.5 million inhabitants are to be located in three major new communities which are the Obour, the New Cairo and the 15th of May towns. **In terms of urban land capacity, it is assessed that these new communities can spatially and physically accommodate the increasing housing demand for the next two decades, given even a 2% population growth in the GCR.**

Towards the future, GCR faces two crucial urban planning issues. The first is how to redevelop or restructure the inner city areas with an extremely high population density (about 21,700 persons/sq. km on the average) to alleviate economic losses due to the congestions.

The second issue is how to functionally integrate the growing new communities physically spreading over more than 50km distant from the metropolitan center. Eventually, such an extensive megalopolis structure requires substantially huge capital investments to build new infrastructures, utilities and the transport system. In order not to hinder expected economic growth, the establishment of a functionally integrated transport network system, must be a key issue for the GCR.

EXPECTED GROWTH OF NEW COMMUNITIES

The development of the new suburban communities depends greatly upon four key factors: 1) Economic performance in general; 2) State investment for housing and utilities; 3) Private capital for housing, facilities and employment; and 4) Transport links. Taking into account these factors, it was projected what degree of the achievement can be predicted in the CREATS target year 2022, in other words, how many people will reside there.

Under the medium economic growth scenario, a total of **2.94 million** people will live in the new communities, which stands for the **70%** achievement of the planning target. Since the total population will be 20.7 million, the new communities will accommodate 14.2% of the total residents in 2022.

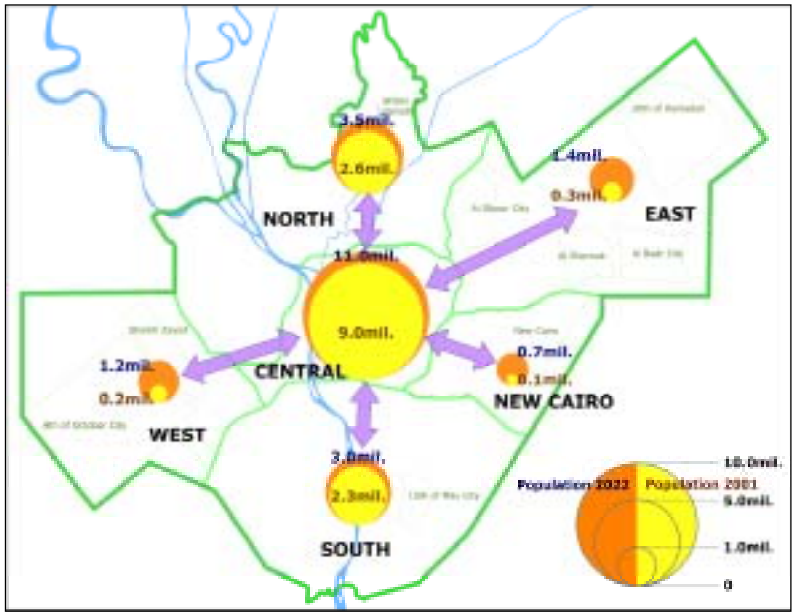

Fig. 3.3 Population Distribution: 2001 and 2022

A future geographical pattern of population distribution was projected, taking into account accommodation capacity which is defined by land use, urban planning regulations, and potentials of economic activities. Fig. 3.3 shows a distribution patter of comparative population magnitudes by zone and its change between 2001 and 2022. The north-south axis zones (the North, Central and South Zones) will continuously grow, accommodating an additional increase of 3.6 million, while the east-west wing (the East, West and New Cairo Zones) will increase the population by 2.7 million.

Based on this population distribution pattern, it can be easily imagined that the dominant traffic corridor is the north-south bond currently, and that another predominant traffic demand corridor will appear in the east-west bond in the future.

4 ALTERNATIVE SCENARIOS AND OPTIMAL TRANSPORT NETWORK (MODEL ANALYSES)

WHAT WILL HAPPEN WITHOUT INTEGRATED TRANSPORT?

A HYPOTHETICAL SCENARIO: COMMITTED NETWORK

Given only currently committed projects in the road and public transport sectors and given nothing more than the committed efforts, the traffic situation of GCR in 2022 will be chaotic. This was envisaged by ***the CREATS model*** (see Box in the next page). It is assumed that the committed public transport projects include ***Metro Line 3***, extension of Metro Line 2 and minor enhancements of the Heliopolis metro/CTA tram in the public transport system, while a number of on-going road improvement projects and those included in the Five Year Plan (2002-2007) are considered in the road sub-sector as tabulated below:

Table 4.1 Components of "Scenario A: Committed Network"

Modes	Projects Components
Road Network	Projects under construction; Projects included in the Five Year Plan
Public Transport	
MRT	Moneeb Extension of Metro Line 2 Metro Line 3
LRT	Existing Heliopolis Metro and CTA Trams
Bus/Shared Taxi	Existing route structure

The CREATS model reveals that under such a transport condition only with the committed projects, the ***trip speed*** on the average of all modes will be as low as **11.6 km/h** in 2022, compared to the current trip speed of **19.0 km/h**. This means that the major roads will be fully congested all day, that is, the volume/capacity (V/C) rate on the daily average will reach **1.5,** which means a saturated condition, compared to **0.8** at present.

Another indicator shows that a home-based work trip (or a commuting trip) takes about **37 minutes** by car on the average at present, while it will take more than **100 minutes** by car in 2022 under the condition without any additional efforts other than the committed project. This means that given such a condition in the future, car commuters shall suffer from enormous time and economic losses.

ALTERNATIVE SCENARIO SETTING TO SEEK FOR AN OPTIMAL TRANSPORT NETWORK

CREATS initially developed alternative infrastructure projects and/or programs by sub-sector which are assessed to be improved and newly developed, based on analyses and examinations about the current and future transport issues. These sub-sector improvement plans are integrated into several scenarios for an Integrated Master Plan, and were tested in terms of the economic efficiency, the complementary effects and the projected future transport demands.

ALTERNATIVE TRANSPORT NETWORK SCENARIOS

Four (4) scenarios (Scenarios A, B, C and D) are composed of different project components as shown below. The structural concept of the scenario setting is as illustrated on Fig. 4.1. The scenarios were evaluated by using indices of the effects to the three basic visions, i.e. 1) Economically efficient urban transport system; 2) Equitable people's mobility; and 3) Alleviation of environmental problems.

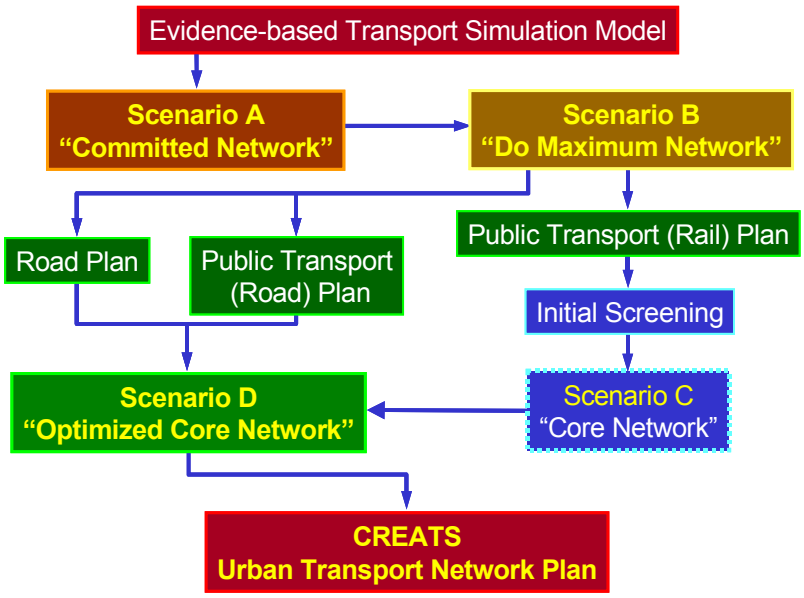

Fig. 4.1 Structural Concept of Scenario Setting

Scenario A: This scenario is assumed to network with only committed projects in the road and public transport sectors, as discussed in the preceding section. This scenario represents a minimum investment scenario and implies "***Do-Nothing***" other than presently committed projects. The project components are summarized in Table 4.1.

Since it cannot be conceivable in practice that no additional transport projects will be implemented over the next two decades, this scenario is regarded as ***a hypothetical worst scenario***. This also provides with a comparative evaluation standard to measure how much the other scenarios are effective to improve the worst situation.

Scenario B: This scenario is assumed to be the most ambitious transport network with all metro lines that were proposed by the *Greater Cairo Public Transport Master Plan* (1998, Systra), plus several projects which are proposed by CREATS such as improvement of the Heliopolis Metro (Supertram), Satellites City Connections called "the East and West Wings", priority bus service systems in association with re-structured shared-taxi service system for the public transport network.

THE CREATS MODEL FOR TRANSPORT SIMULATION

*The CREATS Study Team developed a state-of-the-art transport demand forecast model, named the **CREATS Model** and the GIS database. The CREATS model was built, based on a series of surveys conducted in the Study. Major surveys utilized for the model development were a Home Interview Survey (HIS), which covered the whole study area with about 57,000 households interviewed, and traffic count surveys at cordon lines and screen lines. The **CREATS Database**, compiling all the transport and traffic data sets, is the most sophisticated, comprehensive and reliable, compared to the others previously made.*

The model structure is with a conventional four-step procedure, consisting of trip generation/attraction; trip distribution; modal split; and trip assignment. The trip generation model was developed by using category analyses by adopting four-trip purpose categories (Home Based Work, Home Based Education, Home Based Others and Non Home Based) and by five household income level categories. The gravity model was selected as the trip distribution model. Regarding the modal split, a binary logit model was selected to split private and public transport usage. The trip assignment consists of two parts: one is for vehicle trips and the other is for public transport passenger trips. The vehicle trips were assigned to the road network according to equilibrium assignment, while the public transport passenger trips were assigned by minimum generalized cost procedure.

The CREATS model whose validity has been proven, is capable enough to make simulation analyses of traffic demand forecasts. The developed simulation model can demonstrate its full capacities for problem identification, examination of effects of proposed plans, generation of evaluation indices for Master Plan scenarios, calculation of necessary information for economic and financial analyses.

While, the road network includes a propose Urban Expressway Network with 92 km long in addition to the committed road improvement projects. These components are as tabulated in Table 4.2. This scenario represents a "***Do-Maximum***" scenario, eventually requiring a maximum amount of capital investments to materialize.

Table 4.2 Scenario B: "Do-Maximum" Network

Modes	Projects Components
Road Network	Committed Network + Improvements Urban Expressway Network (92 km)
Public Transport	
MRT	Committed Network (Scenario A); Metro Lines 4, 5 and 6 as proposed by the 1998 Greater Cairo Public Transport Master Plan (Systra); and Satellite City Corridors (The East and West Wings)
LRT	Improved Heliopolis Metro (Supertram System)
Bus/Shared Taxi	Optimized bus and shared taxi route structure coordinated with MRT/LRT

Notes: 1) Metro Lines 4,5 and 6 are identical to metro line alignments proposed by the 1998 Public Transport Master Plan (Systra)

2) Satellite city corridors (the East and West Wings) include both regional rail and priority bus strategies, with modal evolution dependant on actual demand.

Scenario C: This scenario is assumed to be a dummy scenario derived in the optimization process of the rail systems. Scenario B (Do-Maximum) is given no considerations of financial constraints and capacity limits of the project implementation that must, in reality, be critical factors. Therefore, some project components in the rail system public transport, which require a huge amount of capitals, are scaled-down, altered and/or cancelled depending upon estimated demands, while the road network is kept the same as Scenario B.

Scenario D: This scenario is an optimal amendment of Scenarios B and C, derived from a result of the optimization process, assessing demand volumes simulated by a model analysis of Scenarios B and C, in consideration of practical difficulties in and financial constrains against the implementation during the next two decades. Thus, this scenario is recognized as an Optimized Scenario, consisting of several proposals such as: 1) Metro Line 4; 2) Line 2 extension; 3) Satellite Cities Connections (the Wings); 4) Supertram Systems which are to be upgraded the existing Heliopolis Metro; and 5) Optimized bus route network with operational and intermodal coordination with Shared-taxi and the Metro System; and 6) Urban Expressway Network, as tabulated Table 4.3. It should be noted that a newly proposed MRT line is newly named "***Metro Line 4***", of which the alignment is different form that of Line 4 proposed by the 1998 Public Transport Master Plan (Systra). For the road network, the Urban Expressway Network System has a total length of 78 km, instead of 92 km in Scenario B, being altered based on an assessment of the simulated traffic volumes.

Table 4.3 Components of "Scenario D: Optimized Core Network"

Modes	Projects Components
Road Network	Committed Network + Proposed Improvements Urban Expressway Network (78 km)
Public Transport	
MRT	Committed Net, Metro Line 4, Line 2 Extension Satellite Cities Corridors (The Wings)
LRT	Supertram System+ network improvements
Bus/Shared Taxi	Optimized Route Structure Coordination with MRT / LRT Network

In Scenario D, the rail-based public transport system, the road-based public transport system and the urban expressway network are proposed as shown in Figures 4.2 through 4.4 respectively.

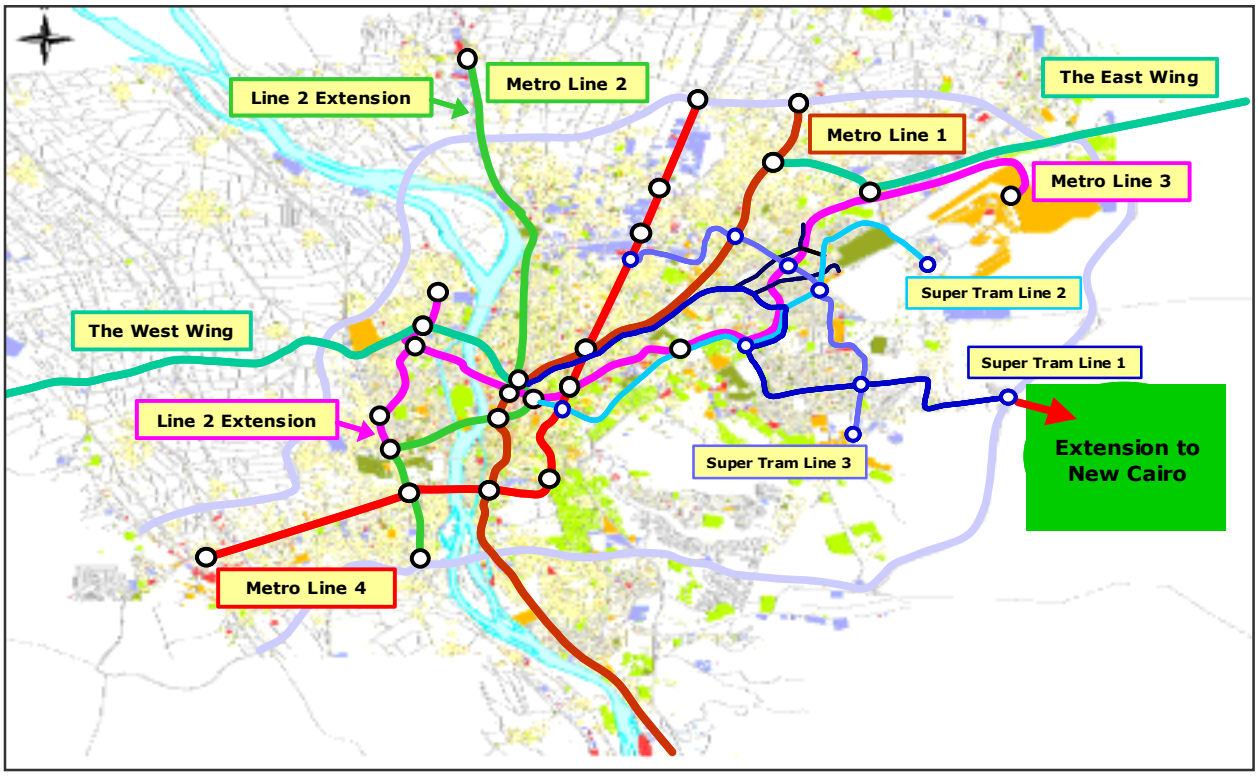

Fig. 4.2 Scenario D: Rail-based Public Transport

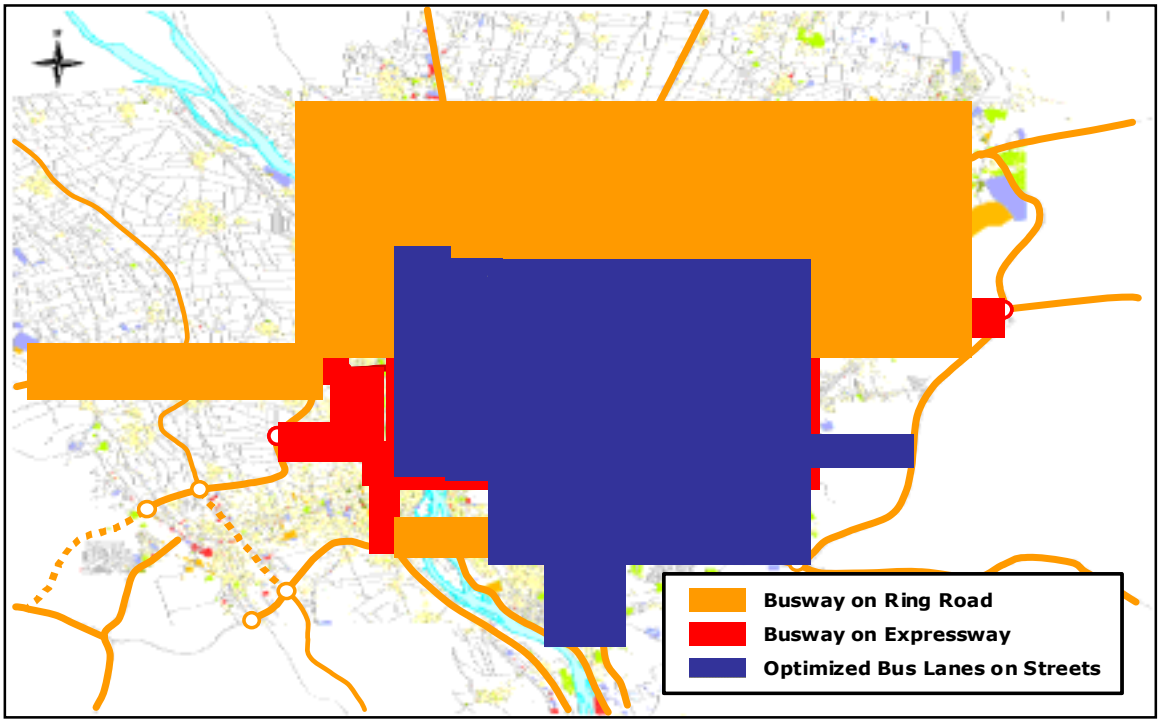

Fig. 4.3 Scenario D: Road-based Priority Public Transport

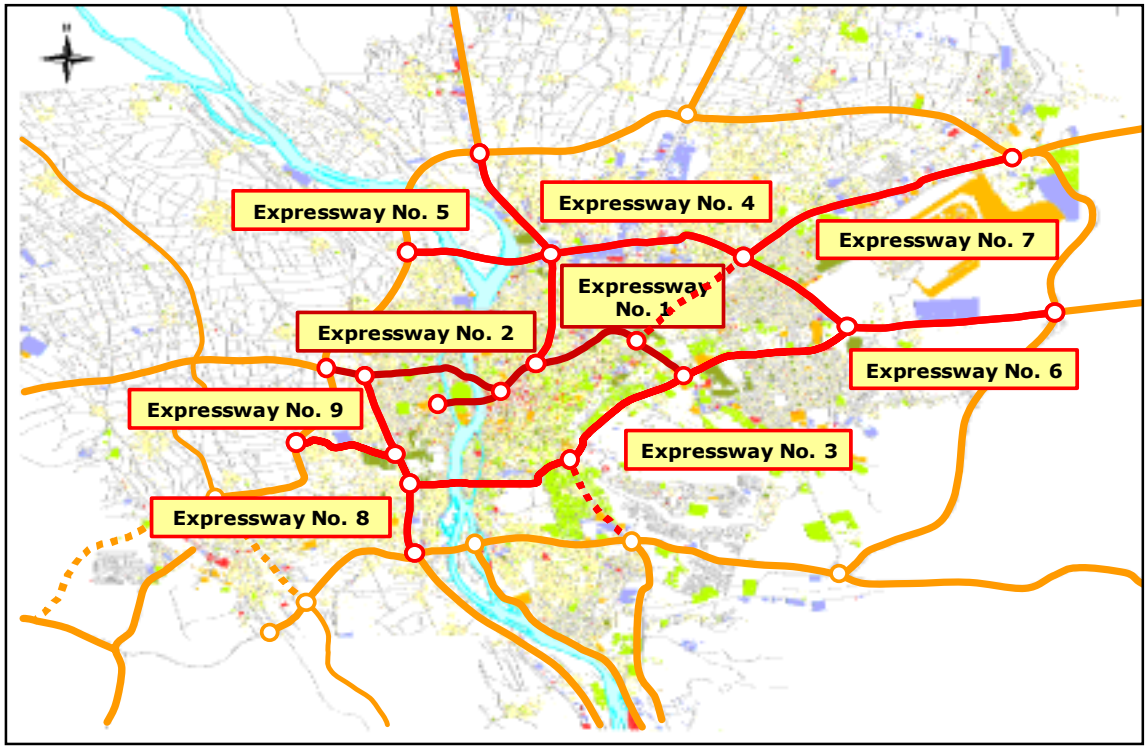

Fig. 4.4 Scenario D: Urban Expressway Network

OVERALL EVALUATION OF ALTERNATIVE SCENARIOS AND THE OPTIMAL TRANSPORT NETWORK

In the evaluation process, ***Scenario A***, as repeatedly mentioned earlier, is treated as a hypothetical case to get insight into what would take place in traffic conditions without any additional investments on transport infrastructures other than presently committed ones. ***Scenario B*** "Do Maximum" was firstly examined. This scenario includes all potential project ideas discussed in previous studies, but ignores any constraints like budgetary availability and affordability. ***Scenario C*** was formulated as an intermediate scenario to fine-tune the public transport network from Scenario B. Based on the results of testing Scenario C, ***Scenario D*** was finally envisaged as ***the optimal network scenario***, considering critical constraints such as budgetary affordability, the implementability of projects, and the environmental impacts.

The Scenario D is called the "**CREATS Network**" which is functionally incorporated in the stem transport structure of the CREATS Master Plan proposed for the GCR in 2022.

It is noted that in the optimization process, nonphysical factors such as a budgetary constraint and Implementability of projects were taken into account over the next 20 years time horizon. However, impacts/effectiveness of some measures for **Traffic Demand Management (TDM)**, which shall undoubtedly be a significant policy tool, were examined as a sensitivity analysis under the proposed optimized network system.

EVALUATION CRITERIA

A series of analyses to evaluate the alternative scenarios by using the CREATS models were made. A number of "***evaluation criteria***" are set forth with respect to three missions of transport of the Master Plan, as described in Chapter 2. The ***optimality*** of a transport network should be guaranteed by several evaluation factors that are implied by the missions of transport. Those are:

1. Economic efficiency in terms of improvement of people's mobility, cost/benefit effectiveness, financial affordability and less congestion;
2. Equitable transport service for all; and
3. Less environmental impact.

Under these three, some evaluation criteria to be represented by numerical indicators are considered as summarized in Table 4.4.

Table 4.4 Evaluation Criteria for the Optimal Network

Criteria	Evaluation (Conditions of Optimality)
1. Economically Efficient Urban Transport System	
Cost (LE billion)	Affordable and implemental
Economy (B/C)	Greater than 1.0
Trip Speed (km/h)	Not worsen the present status
No. of Pax of Public Transport (Million)	More users of Public Transport
Road Congestion (V/C)	Less than 1.0
Modal Share of Public Transport (%)	More shift to Public Transport
Daily Vehicle-km (10^6pcu-km)	As a reference indicator for the load of road transport
2. Equitable People's Mobility	
Population within 800m along Major PT (Million)	Majority of population, or more than 50%
Employment within 800m along Major PT (Million)	Significantly Greater than the present
Student within 800m along Major PT (Million)	Significantly Greater than the present
Low Income Population within 800m along Major PT (No. of HH)	More than 50% of the poor households
3. Alleviation of Environmental Pollution	
CO_2 Emission (10^6 ton)	Less than the present

EVALUATION OF ALTERNATIVE SCENARIOS

The Simulation results are summarized in Table 4.5. Major findings, noting a comparison among Scenarios A, B and D, are described as follows:

Economically Efficient Urban Transport:

Firstly, the required cost for Scenario A is estimated at LE 18.2 billion (at 2002 prices) and that of Scenario D is LE 59.8 billion, more than 3 times as much as Scenario A. The most expensive Scenario B will require LE 71.7 billion, 20% greater than Scenario D.

A question may be raised: are the investments economically feasible? The answer is clear, that is, in terms of B/C ratios, Scenario D accounts for **1.77**, higher than 1.41 of Scenario B. Thus, the overall economic evaluation says that the more investment is not necessarily more feasible, but an optimal investment scenario can yield the most feasible condition.

Secondly, as an overall evaluation in terms of "People's Mobility", it should be noted that with the proposed CREATS network (Scenario D), the ***trip speed*** will be recovered to be **18.0 km/h** even with a doubled traffic demand in 2022, compared to 19.0 km/h at present as of 2001. This means that under the CREATS Network, the overall traffic situation in 2022 will not be worsen than the current situation, otherwise the situation would be chaotically devastated in 2022, or as low as 11.6 km/h under the Committed Network (Scenario A). Even by Scenario B (Do Maximum), the average trip speed may increase to be 18.2 km/h, which means that the incremental improvement from Scenarios D to B is only 0.2 km/h.

Looking into numbers of pubic transport passengers, Scenario D accounts for 20.3 million/day in 2022, compared to 18.2 million in Scenario A. Scenario B, although this includes a more extensive MRT network than Scenario D, accounts for 21.1 million, a little difference from that of Scenario D.

The road congestion in terms of V/C (Volume-Capacity Ratio) will be lessened to be **1.0** in Scenario D which stands for keeping a balance between supplies (capacity) and demands (traffic volume). Even given more investments like Scenario B, the V/C ratio is 0.96, therefore, it cannot significantly improve the situation.

Equitable People's Mobility:

Assuming that a 800 meter buffer zone is an easily accessible service area to any public transport mean on foot, the population accessible to major public transport modes will be 8.2 million in Scenario D, which is significantly greater than Scenario A, 3.09 million.

More importantly, under Scenario D, the number of poor households served by major public transport will be much greater than that in Scenario A, that is, 188.3 thousands in Scenario D, compared to 68.4 thousands in Scenario A. Currently, only 46.3 thousands of poor household are accessible to major public transport. Thus, the great improvement in people's mobility, for the poor in particular, can be materialized by Scenario D, that is, increasing 4 times as many as the present. It should be noted that Scenario D provides the public transport service for more poor people than Scenario B, yet, 40% of the total poor households can be covered, not achieving the ideal target of 50%.

Alleviation of Environmental Problems:

The CREATS model computed comparative levels of CO_2 emission. Since no proven data of the Egyptian vehicle emission factors is available, the Japanese data was applied for a reference. Therefore, the absolute numbers of the computed volumes are meaningless, but a comparison can be made. With Scenario D, the CO_2 emission will be less by 15% than Scenario A. Scenario D is better than even Scenario B.

Table 4.5 Scenario Evaluation Summary

Scenario	Base Year 2001	Scenario A 2022 com.	Scenario B 2022 Do Max	Scenario D 2022 Opt. Core
Economically Efficient Urban Transport System				
Cost (LE billion)	--	18.2	71.7	59.8
Economy (B/C)	--	--	1.41	1.77
Trip Speed (km/h)	19.0 km/h	11.6 km/h	18.2 km/h	18.0 km/h
Modal Share of Public Transport (%)	70.9 %	61.7%	58.0 %	57.9%
No. of Pax of Public Transport (Million)	13.3	18.2	21.1	20.3
Daily Vehicle-km (10^6pcu-km)	62.8	127.3	144.0	139.7
Congestion (V/C)	0.67	1.11	0.96	1.00
Equitable People's Mobility				
Population within 800m along Major PT (Million)	2.04	3.09	9.10	8.20
Employment within 800m along Major PT (Million)	1.11	1.70	3.80	4.20
Student within 800m along Major PT (Million)	0.74	1.08	2.70	2.70
Low Income Population within 800m along Major PT (No. of HH)	46,300	68,400	179,500	188,400
Alleviation of Environmental Pollution				
CO_2 Emission (10^6 ton)	12.2	15.9	13.8	13.6

TRAFFIC DEMAND FORECAST UNDER "SCENARIO D"

The traffic demand is inevitably increasing along with the socioeconomic growth to almost double in 2022 growing at 2.7% p.a. It is impossible under the financial resource constraint to provide the transport capacity sufficiently enough to meet such a rapidly increasing traffic demand. A "more roads solution" alone cannot keep up with the demand, and more to integrate public transport systems serious road congestion will take place everywhere without another optimal solution which is implied by Scenario D.

The CREATS model forecasts the future traffic demands on all transport facilities proposed by Scenario D, which is assessed "Optimal". Under Scenario D, the volume bands of major rail-based public transport systems in 2022 are depicted as shown in Fig. 4.5. Alike, the volume bands scheme of major roads and expressways in 2022 is as illustrated on Fig. 4.6.

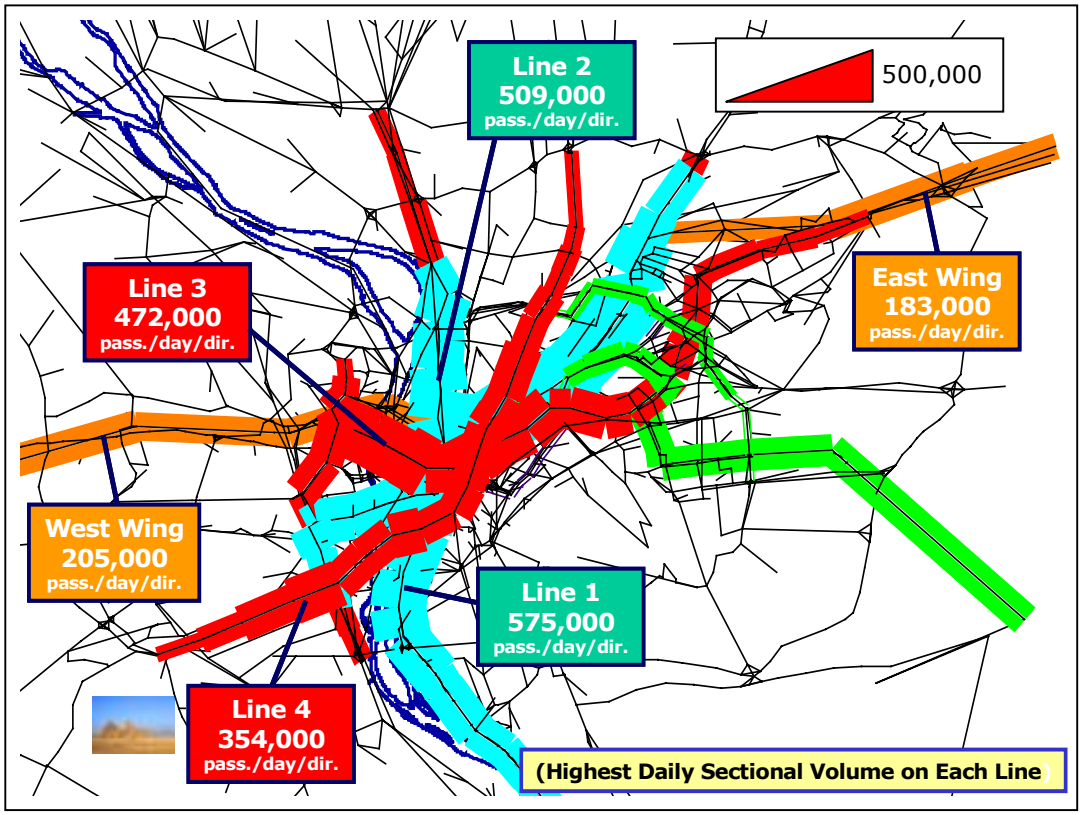

Fig. 4.5 Traffic Demands of Major Public Transport Systems in 2022 (Scenario D)

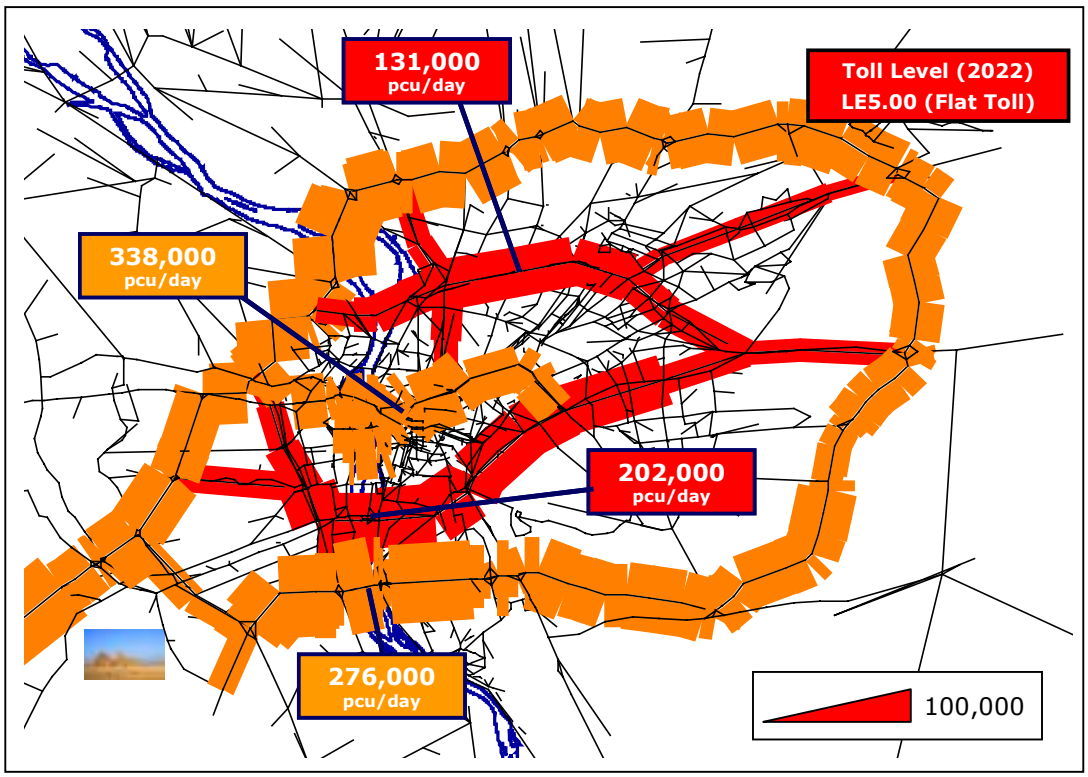

Fig. 4.6 Traffic Demand Estimates of Major Roads/Highways in 2022 (Scenario D)

5 STRATEGY 1: IMPROVEMENT OF PEOPLE'S MOBILITY

FURTHER ENHANCED POLICY TO IMPROVE PEOPLE'S MOBILITY

Resources available for development of the transport sector in GCR need to be strategically allocated towards improvement of "***People's Mobility***" rather than vehicles' mobility. Such a definite policy is required to efficiently manage transport activities in such a huge megalopolis with a 20 million population encompassing spatially more than 50 Km radius areas. Improvement of ***public transport systems***, needs to be further enhanced in the transport policy.

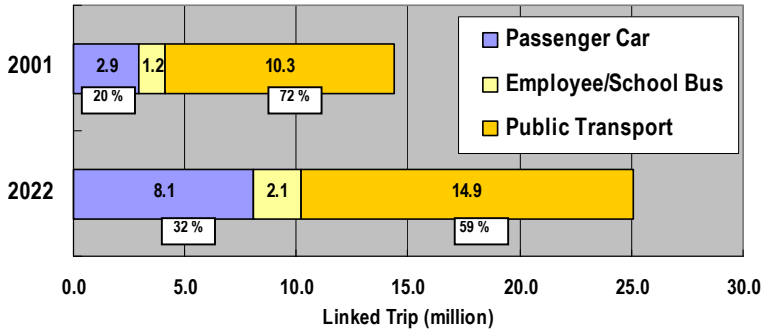

Fig. 5.1 Motorized trip Generation: 2001 and 2022

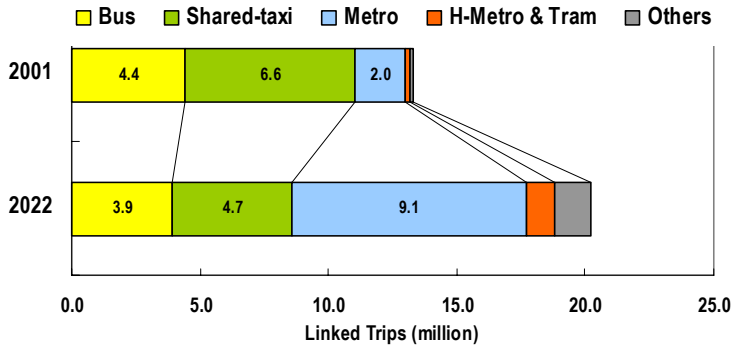

Fig. 5.2 Public Transport Trips: 2001 and 2022

At present, people in GCR are predominantly using public transport mode, that is, **72%** of the total motorized trips are made by public transport modes , referring to "*linked trip*" (Fig. 5.1). Along with the economic progress, the demand of motorized trips will undoubtedly increase to be almost double, i.e., 14.4 million trips in 2001 and 25.1 million in 2022. In the future, however, such a public transport-driven pattern will/should be kept in consideration of the increasing demand of public transport trips at **3% p.a**., based on the simulated analysis of the proposed CREATS network (Fig. 5.2).

The planning target must be to improve, or at least not worsen the current situation. As discussed in Chapter 4, the "***Trip Speed***" was employed as a numerical indicator to measure the people's mobility level. This indicator, different from vehicle speed on roads, represents the average velocity of people's travels in and around GCR, including all transport modes.

The CREATS model shows that the current trip speed is **19.0 km/h** on the average of all modes. In the future, if no substantial improvements other than the committed projects take place, the trip speed will be as low as 11.6 km/h in 2022. While, under the proposed CREATS transport network, the trip speed will slightly drop down to be **18.0 km/h** in 2022, but not significantly worsen the current condition. Hence, it may be said that the planning target will be almost achieved. It is noted that this achievement could be made only with an optimal integrated public transport system.

USER-ORIENTED PUBLIC TRANSPORT

The improvement of "People's Mobility" will be materialized by enlargement of the public transport capacity in GCR as a whole. In this regard, the committed projects, in particular, enhancement of the existing Metro Lines 1 and 2, and development of Metro Line 3, are very vital. These need to be deliberately implemented or initiated in the short-term.

On the other hand, policy integration and modal integration for the structural evolution for the "***User-oriented Public Transport System***" are a more important issue. This calls for both some, not capital intensive, infrastructure developments and system improvements as follows:

1) Formulating of a modal hierarchy with a complementary route structure for public transport services;
2) Improvement of Strategic Intermodal Points/Facilities;
3) Introduction of an Integrated Ticketing System; and
4) Development of Park & Ride Systems.

INTRODUCTION OF TRAFFIC DEMAND MANAGEMENT (TDM)

Motorization will surely progress in future at a higher growth rate (4.2% p.a.) than that of household income (2.9% p.a.). This will eventually demand more capital funds for the expansion of the road traffic capacity, thereby resulting in a "***vicious cycle***", that is, the more vehicles, the more roads, vice versa. In order to address this problem, some effective policy tools are available for traffic demand management (TDM) to control vehicle traffic demands through encouraging car owners to use more efficient public transport modes.

The impacts and effects of some TDM policies were examined, by using the CREATS Model (refer to Chapter 10). The analyses imply that the effects of TDM policies on the modal shift are not marginal, but significant, therefore, a few are recommended for the government to pursue their introduction in practice: 1) polices of petroleum and parking charge system levies; 2) a common ticketing system, and 3) development of sub-urban centers along the major public transport corridors to form ***a multi-polar urban structure***. This policy is further addressed in Chapter 10.