JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

GENERAL AUTHORITY FOR ROADS,
BRIDGES AND LAND TRANSPORT (GARBLT),
MINISTRY OF TRANSPORT,
ARAB REPUBLIC OF EGYPT

FEASIBILITY STUDY ON HIGH PRIORITY URBAN TOLL EXPRESSWAYS IN CAIRO IN ARAB REPUBLIC OF EGYPT

FINAL REPORT

VOLUME I

MAIN TEXT

JANUARY 2009

KATAHIRA & ENGINEERS INTERNATIONAL
PwC ADVISORY

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PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct the “Feasibility Study on High Priority Urban Toll Expressways in Cairo” and entrusted it to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a Study Team headed by Dr. Hani Abdel-HALIM, who later was replaced by Mr. Masakazu ISHIGURO, of Katahira & Engineers International from August 2007 to September 2008.

The Team held discussions with the officials of the Ministry of Transport represented by GARBLT as well as other officials concerned, and conducted field surveys by assistance of local consultants, data analysis and engineering drawings for the Study routes. Upon returning to Japan, the Team prepared this Final Report to summarize the results of the study.

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

January 2009,

Eiji HASHIMOTO,
Vice President
Japan International Cooperation Agency

Mr. Eiji HASHIMOTO,
Vice President
Japan International Cooperation Agency

January 2009

Dear Sir,

Letter of Transmittal

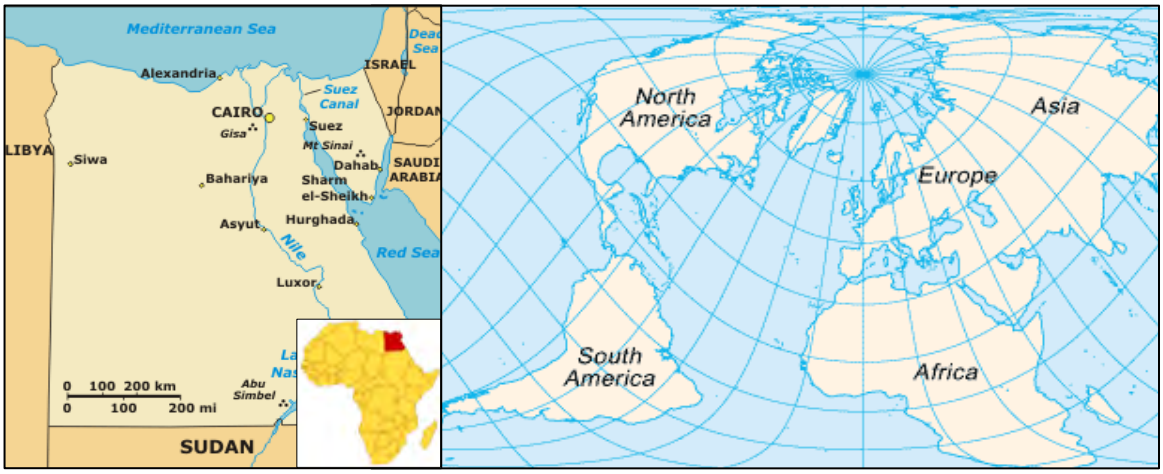
We are pleased to submit herewith the Final Report of the "Feasibility Study on High Priority Urban Toll Expressways in Cairo". The report compiles the results of the Study and includes the advices and suggestions of the authorities concerned of the Government of Japan and your agency as well as the comments made by the Ministry of Transport and other authorities concerned in the Arab Republic of Egypt.

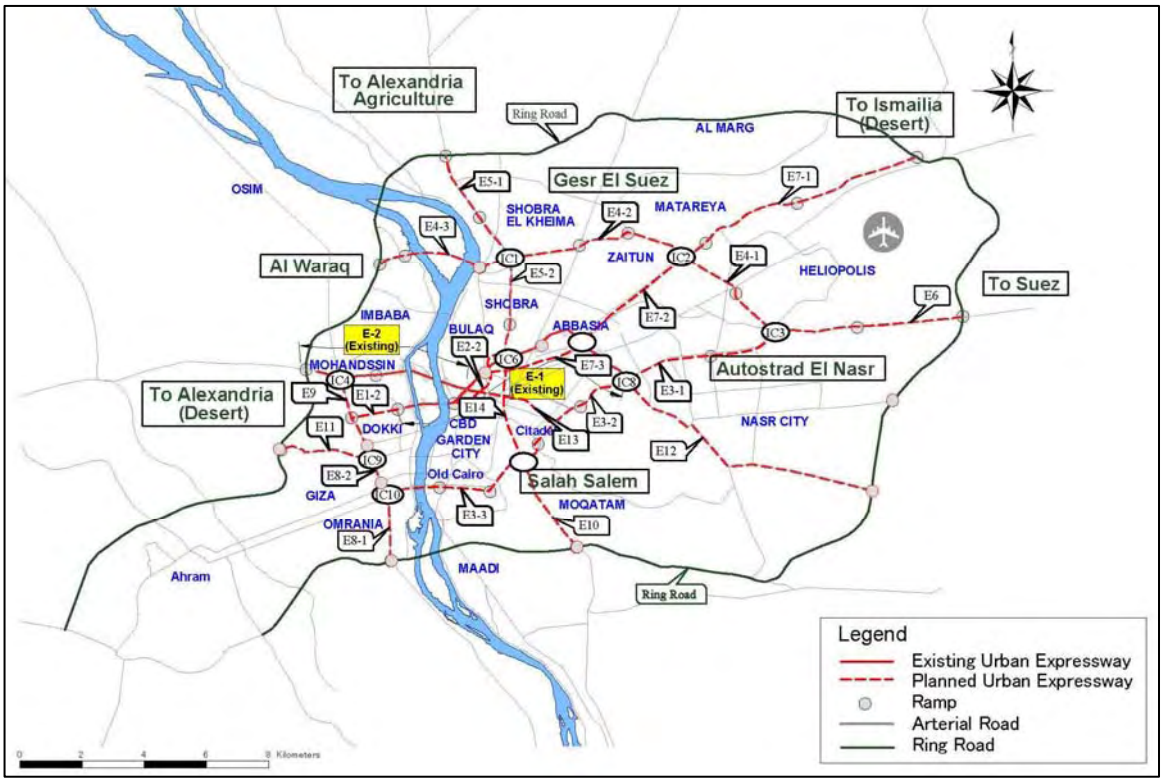
This report defines the high priority urban toll expressways in Greater Cairo Region, presents the results of traffic forecast and based on traffic analysis, the review and updating of previous PPP Study is offered. The report shows also the results of existing conditions surveys. Alignment/configuration of high priority routes is described. The preliminary geometric and structural design is presented. The toll expressway operation and maintenance systems are illustrated. Expressway legislation, environmental and social impacts are investigated. For economical and financial assessment, construction cost estimation is revealed. Finally, the report presented the project implementation program and the PPP implementation plan.

Wish to take this opportunity to express our sincere gratitude to your agency and the Ministry of Foreign Affairs. We also wish to express our deep gratitude to the Ministry of Transport and especially GARBLT as well as other Governmental Agencies concerned in the Arab Republic of Egypt for the close cooperation and assistance extended to the JICA Study Team during the course of the Study. We hope this report will contribute to the development of the Arab Republic of Egypt.

Very truly yours,

Mr. Masakazu ISHIGURO
Team Leader,
Feasibility Study on High Priority Urban Toll Expressways in Cairo





Route	Location	Length (Km)
E1-1	6th October Elevated Road	11.0
E1-2	6th October Extension	4.3
E1-3	6th October Bypass	1.6
E1-4	6th October Bypass	1.5
E2-1	15th May Elevated Road	6.4
E2-2	15th May Extension	1.8
E3-1	Autostrad El Nasr Street in Nasr City	6.5
E3-2	Autostrad from Nasr City to Citadel	5.6
E3-3	Salah Salem from Citadel to Giza Sq.	6.6
E4-1	Abu Bakr El-Sedeeq	4.7
E4-2	Ibn El hakam – El Matariyah	7.1
E4-3	Tereat Ismailia – Al Warraq	5.2
E5-1	Cairo-Alexandria Agriculture Road	5.3
E5-2	Ahmad Helmi Street	4.7

Route	Location	Length (Km)
E6	Cairo-Suez Road	7.5
E7-1	Gesr El Suez (Ismailia Desert)	10.5
E7-2	El Gheish Street	5.4
E7-3	El Khalefa El Mamon Street	2.8
E8-1	Tereat El-Zumur South of King Faisal	2.9
E8-2	Tereat El-Zumur North of King Faisal	1.9
E9	Tereat El-Zumur in Bolaq el Dakroor	4.0
E10	Salah Salem from Citadel to Ring Road	4.0
E11	From Tereat El-Zumur to Ring Road	4.0
E12	El Tiaran Street	10.8
E13	Az Har Tunnel Extension	5.3
E14	El Qalaa Street	4.6
	TOTAL	136.0

CAIRO URBAN TOLL EXPRESSWAY NETWORK

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ABBREVIATIONS

1. Organization Abbreviations

AASHTO	: American Association of State Highway and Transportation Officials
CAPMAS	: Central Agency for Public Mobilization and Statistics
CBE	: Central Bank of Egypt
CGR	: Cairo Greater Region
CMTB	: Cairo Metropolitan Transport Bureau
CPT	: Counterpart Team
CTEB	: Cairo Traffic Engineering Bureau
EEAA	: Egyptian Environment Affairs Agency
ENIT	: Egyptian National Institute of Transport
ENR	: Egyptian National Railways
EOJ	: Embassy of Japan
GAFI	: General Authority for Investment and Free Zones
GARBLT	: General Authority for Roads, Bridges and Land Transport
GCR	: Greater Cairo Region
GOE	: Government of Egypt
GOJ	: Government of Japan
GOPP	: General Organization for Physical Planning
JBIC	: Japan Bank of International Cooperation
JICA	: Japan International Cooperation Agency
MEA	: Metropolitan Expressway Authority
MHUUD	: Ministry of Housing, Utilities and Urban Development
MLIT	: Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MOC	: Ministry of Cloture
MOD	: Ministry of Defense
MOE	: Ministry of Environment
MOF	: Ministry of Finance
MOI	: Ministry of Interior
MOT	: Ministry of Transport
NAT	: National Authority for Tunnels
NGO	: Non Governmental Organization
NRI	: Nile Research Institute
NUC	: New Urban Community
ODA	: Official Development Assistance
TPA	: Transport Planning Authority

2. Technical Abbreviations

ADT	: Average Daily Traffic
ATP	: Affordability-to-Pay
BH	: Bore Hole
B/D	: Basic Design
BOOT	: Build, Operate, Own and Transfer
BOT	: Build, Operate and Transfer
CCTV	: Closed Circuit Television
CO	: Carbon Monoxide
CO_2	: Carbon Dioxide
CREATS	: Cairo Regional Area Transportation Study
D	: Directional Distribution
DBFO	: Design-Build-Finance-Operate
DBO	: Design, Build and Operate
DBOT	: Design-Build-Own-Transfer
D/D	: Detail Design
EFC	: Electronic Fee Collection
EIA	: Environmental Impact Assessment
EIRR	: Economic Internal Rate of Return
ETC	: Electronic Toll Collection
FIRR	: Financial Internal Rate of Return
F/S	: Feasibility Study
GC	: Greater Cairo
GDP	: Gross Domestic Products
GPS	: Global Positioning Systems
HCM	: Highway Capacity Manual
HPE	: High Priority Expressway
IC	: Interchange
IEE	: Initial Environmental Examination
ITS	: Intelligent Transportation System
JCT	: Junction
JICA STRADA	: JICA System for Traffic Demand Analysis
LE	: Egyptian Pound
LOS	: Level of Service
LL	: Liquid Limit
M/M	: Minutes of Meeting
M/P	: Master Plan
NGOs	: Non-Governmental Organizations
NOx	: Nitrogen Oxide

NPV	: Net Present Value
OBU	: On Board Unit
OD	: Origin-Destination
PAP	: Project Affected People
PCE	: Passenger Car Equivalents
PCU	: Passenger Car Unit
PFI	: Private Finance Initiative
PHF	: Peak Hour Factor
PHV	: Peak Hour Volume
PL	: Plastic Limit
PPPs	: Public Private Partnership
R/D	: Record of Discussion
ROW	: Right-Of-Way
RR	: Ring Road
SC	: Steering Committee
SH	: Stakeholder
STEP	: Special Terms for Economic Partnership
S/W	: Scope of Work
TIS	: Traffic Information System
TOR	: Terms of Reference
TP	: Traffic Police
TTC	: Travel Time Cost
V/C	: Volume Capacity
VCR	: Volume Capacity Ratio
veh	: Vehicle
VFM	: Value for Money
VMS	: Variable Message Signs
VOC	: Vehicle Operating Cost
vpd	: Vehicle per Day
WTP	: Willingness-to-Pay

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Greater Cairo Region (GCR), with a population of more than 15 million inhabitants at present, is estimated to accommodate a population of 24 million in 2027 which puts growing pressure on all infrastructure systems, including the road network system. At present, the urban transport situation, in general, is characterized by traffic congestions, constrained resources for public transport and deterioration of air quality. Congestion in GCR is caused by its excessive traffic demand and insufficient road capacity with inefficient traffic flow and ineffective traffic management. Results of previous JICA studies show that everyday there are about half a million pcu's (passenger-car units) entering and exiting GCR and one million pcus crossing the Nile River mainly between the two Governorates of Cairo and Giza.

Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of the technical cooperation of the Government of Japan, formulated the "Master Plan of Urban Transport Project in Greater Cairo Region" (Phase 1, hereinafter referred to as "Master Plan") in which a master plan was formulated in 2002, with the target year of 2022, as the outcome of this study. Under Master Plan, the construction of the urban toll expressway network with about 78 km in length of new expressways was proposed as one of the priority projects.

The implementation of the proposed urban toll expressway network requires huge financial resources for construction, operation and maintenance. Conventionally, road projects have been financed out of the general revenues of the government. These sources, however, are not sufficient for the implementation of the urban expressway projects, new and stable sources of fund are required. This financial gap is expected to be filled by the private sector that is capable of improving the quality of transport infrastructure services. The development of private sector involvement in the provision of public services can be achieved through ensuring their benefits. The benefits of private sector participation will be promoted more if the government clarifies the responsibilities of involved governmental agencies and develops supporting polices on competition and regulation.

In this regard, the JICA study on "Public-Private Partnership "PPP" Program for Cairo Urban Toll Expressway Network Development" (hereinafter referred to as "PPP Study") was started in 2005 and completed in 2006. PPP Study formulated a financing plan for commercialization and support of PPP system structure with a strategy for introducing Public-Private Partnership

(PPP) and applying toll road system on the expressway network. In addition, a new organization, called the Metropolitan Expressway Authority (MEA), was planned to handle all the tasks related to the expressway network.

To promote the construction of the expressway network by the target year of 2022, results of the PPP Study showed the necessity of the immediate constructions of high priority routes that are composed of the extensions of existing elevated Route No.1 and Route No.2 (E1-2 and E2-2), and the new Route No.3 (E3). These routes are proposed to be financed by utilizing concessional loans, such as Official Development Assistance (ODA) finance, after the implementation of a feasibility study as well as institutional building, reinforcement of PPP strategy and introducing an appropriate toll road system.

In response to the request of the Government of Egypt (hereinafter referred to as "GOE"), the Government of Japan (hereinafter referred to as "GOJ") has decided to conduct Feasibility Study on High Priority Urban Toll Expressways in Cairo (hereinafter referred to as "the Study"), within the framework of the Agreement on Technical Cooperation Between GOJ and GOE signed on June 15, 1983 (hereinafter referred to as "the Agreement").

Accordingly, JICA organized and dispatched a Study Team, from Katahira & Engineers International (KEI) and PwC Advisory Co. Ltd. (PwC), a member firm of PricewaterhouseCoopers, to Egypt to commence the Study on August 2007. The Inception Report that was submitted on August 2007 sets forth the objectives and methodologies of the Study which will proceed for about one year. The Interim Report was submitted on March 2008 and the Final Report is scheduled to be submitted to the GOE by the end of January 2009.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Study are:

1) To implement Feasibility Study on high priority expressways proposed in Master Plan and PPP Study.
2) To assist the Ministry of Transport (hereinafter referred to as "MOT") to strengthen the functions of MEA.
3) To assist MOT and MEA to smoothly introduce toll road system and PPP scheme for the construction of the proposed high priority expressways.

1.3 THE STUDY ROUTES

The Study will cover high priority routes as presented below (please refer to the Location Map) with the major tasks to be carried out:

1) E1-2, E2-2 and E3-1: To carry out Feasibility Study
2) E1-1 and E2-1: To analyze methods of applying toll and to evaluate the impact of both existing and newly operated sections when extensions and/or new route are opened.
3) E3-2 and E3-3: To carry out Pre-Feasibility Study in order to analyze the feasibility of E3 as a whole, as well as the network after implementing and operating E1, E2, and E3.

1.4 SCOPE OF THE STUDY

The Study includes the following tasks:

1.4.1 Review of PPP Study and Existing Condition

- Review of Socioeconomic Framework
- Review of Existing Traffic Data
- Review of Study Route Alignment
- Setting of Study Route Alignment
- Review of Initial Environmental Examination (IEE) and Identification of related Environmental Information
- Review of the Progress in MEA Establishment

1.4.2 Feasibility Study

- Conduct of Supplementary Traffic Survey and Affordability Survey
- Conduct of Road Inventory Survey
- Conduct of Natural Condition Survey
- Conduct of Environment and Social Survey
- Forecast of Future Traffic Demand
- Setting of Design Standards
- Survey of Availability and Cost of Construction Materials
- Identification of Optimum Location of On/Off Ramps
- Establishment and Comparison of Alternatives
- Preparation of the Preliminary Design of Expressway
- Design of Road Facilities
- Assessment of Environmental and Social Impact
- Preparation of Project Implementation Program
- Planning of Operation and Maintenance System
- Estimation of Construction, Operation and Maintenance Cost
- Setting of Toll Level

- Economic and Financial Analysis
- Support for Public Involvement
- Securing of Feasibility and Sustainability

1.4.3 Implementation Planning of PPP

- Confirming the Status of PPP/MEA
- Capacity Development and Improving the Institutional Framework for the Establishment of MEA
- Technical Support for the Implementation of PPP

1.4.4 Overall Evaluation and Recommendations

- Conclusions
- Recommendations

1.5 ORGANIZATION OF THE STUDY

The Steering Committee, which is composed of concerned governmental authorities in Greater Cairo, is assembled for the implementation of the Study. The Egyptian side agreed that the Chairman of General Authority for Roads, Bridges and Land Transport (hereinafter will be referred to as GARBLT), will chair the Steering Committee.

Eng. Tarek El-Attar	Chairman of the Steering Committee Chairman, General Authority of Roads, Bridges and Land Transport (GARBLT), Ministry of Transport
General Mohamed Mansour	Director, Central Traffic Directorate, Ministry of Interior
Eng. Bahy Yusif Basily	Ministry of Economic Development
Dr. Sherif Oteifa	Advisor to the Minister, Ministry of Investment
Prof. Dr. Laila Salah Radwan	Ministry of Culture, Professor of Highway Engineering, Cairo University
Eng. Ahmed Abou El-Seoud	Head of Central Department for Air Quality and Noise, Ministry of Environment
General Eng. Ahmed B. Mahrous	Director, Roads and Transport Directorate, Cairo Governorate
Mr. Mousa Mahmoud Hussein	Assistant General Secretary, Giza Governorate
Eng. Samy Abozeid	Head, Infrastructure Central Department General Organization of Physical Planning (GOPP), Ministry of Housing

Eng. Atta El Sherbiny	Chairman, National Authority for Tunnels (NAT) Ministry of Transport
Eng. Hassan Ahmed Selim	Vice Chairman, Transport Planning Authority (TPA), Ministry of Transport
Prof. Dr. Abdallah Wahdan	Director, Egypt National Institute Transport (ENIT), Ministry of Transport
Eng. Mohamed Gamal Nada	Advisor to the Minister, Head of PPP Unit, Ministry of Transport
Prof. Dr. Mohamed R. EL Mitainy	Professor of Highway and Traffic Engineering, Faculty of Engineering, Cairo University
Eng. Magdy El-Dahan	Director of Investment Roads Directorate, GARBLT, Ministry of Transport
Dr. Hisham Mahmoud Fouad	Technical Advisor to GARBLT Chairman, Committee Secretariat

The Study is conducted in the manner of joint work of both the Egyptian and Japanese sides. In this context, the Ministry of Transport has allocated the necessary number of counterpart personnel from GARBLT and other related entities, as follows:

Eng. Hosam Badrawy	GARBLT, Ministry of Transport
General Salah Abdel Wahab	Central Traffic Directorate, Ministry of Interior
Eng. Ahdab Gamal Gaafar	GARBLT, Ministry of Transport
Eng. Diaa Eldein Mustafa	GARBLT, Ministry of Transport
Eng. Ahmed Shehab	GARBLT, Ministry of Transport
Eng. Ehab Ismail	GARBLT, Ministry of Transport
Dr. Maram Mahmoud Saudi	GARBLT, Ministry of Transport
Eng. Mona Samy Khafagi	GARBLT, Ministry of Transport
Accountant Mona Abdel-Rahman	GARBLT, Ministry of Transport
Prof. Hussam Fahmy	Director, Nile Research Institute
Eng. El-Said Metwaly	GARBLT, Ministry of Transport

The Study is carried out by JICA Study Team which is composed of the following experts:

Dr. HANI Abdel Halim	Team Leader / Transport Plan, up to Sept. 3rd, 2008
Mr. ISHIGURO Masakazu	Team Leader / Transport Plan, from Sept. 4th, 2008
Mr. ISOMOTO Kenji	Deputy Team Leader / Road Plan
Mr. ONO Masazumi	Traffic Survey / Demand Forecast
Dr. Ahmed El-HAKIM	Natural Condition Survey / Operational Coordination
Mr. Anthony GOURLEY	Structure Design

Mr. MIZUISHI Mitsunori	Road / Facility Design
Mr. SHOJI Takeo	Environmental and Social Assessment
Dr. Faten A. SAYED	Social Environment
Mr. MATSUKAWA Kazufumi	Construction Plan / Cost Estimate
Ms. OGAWA Mariko	Economic and Financial Analysis
Ms. IKEDA Kaori	Financial Plan
Mr. TAKEDA Hiroo	Toll Road Legislation / Organization
Mr. FURUSAWA Yasuhisa	PPP Structure / Implementation Plan (1)
Mr. Alaa ELSOUENI	PPP Structure / Implementation Plan (2), up to March 31st, 2008
Mrs. Gada EL FEKKI	PPP Structure / Implementation Plan (2), from April 1st, 2008
Mr. SAKURAI Tatsuyuki	Toll Expressway Policy Advisor

1.6 STEERING COMMITTEE MEETINGS

Two Steering Committee meetings were held during the course of the Study. The first meeting presented and discussed the Inception Report of the Study, while the second meeting had the objective of presenting the progress of the Study. The main discussions in each meeting are presented in the following sections.

1.6.1 1st Steering Committee Meeting

The meeting was opened on 11:00hrs of September 10, 2007 by the Chairman of the Steering Committee, Eng. Tarek El-Attar. He welcomed the representatives of Japanese Embassy, JICA Egypt Office, Study Team Members and the Steering Committee Members. The Chairman summarized the background of the Study from 2002 Master Plan till now and clarified the outline of the Study and its necessity. (Attached). Then, Dr. Hani Abdel-Halim, representing JICA Study Team, presented a summary for the Inception Report (Attached) including:

1. Objectives of the Study
2. Organization of the Study
3. Description of the routes under the Feasibility Study, known as high priority expressways (E1, E2 and E3), and critical locations that may affect the proposed alignment of routes and planning of interchanges.
4. Methodology and tasks of the Study, as included in the TOR agreed upon between the Egyptian and Japanese sides, which include:

- Review of the previous studies to meet the present situation
- Carrying out feasibility studies on sections of the 3 routes (E1-2, E2-2 and E3-1), and pre-feasibility studies on other sections (E3-2 and E3-3) that include the identification of

applied design standards, preliminary design, cost estimate, project impact on surrounding environment, etc.

- Proposing engineering solutions to problems expected at locations of high traffic volumes (15th of May), complicated interchanges (E1 / E3 interchange) or related to urban planning of Cairo and Giza.
- Implementing supplemental studies on the affordability-to-pay toll on expressways through field interview surveys.
- Assisting in the establishment of the proposed MEA including required capacity development and improvements in its institutional framework.

5. Mr. Shoji of the JICA Study Team summarized the requirements of the Environmental Impact Assessment "EIA" (Attached). He expressed the need to start in the EIA process as early as possible and that JICA Study Team will assist GARBLT in this process.
6. A DVD presentation was done on the activities of Tokyo Metropolitan Expressway to develop the expressway network in Tokyo.

During the presentation of Dr. Hani Abdel-Halim, there were several discussions on the following points:

- Dr. Wahdan (ENIT): The Study should include both alternatives of 2-lane and 3-lane per direction to cope with congestion problems in case of car-engine troubles or accidents.

  Dr. Hani explained that the study will look for the optimum engineering solutions considering the project cost and the distance between the expressway and buildings. The Study will cover also required facilities such as emergency parking as well as optimum locations of on/off ramps to not interrupt at-grade traffic.
- Eng. Abou El-Seoud (Ministry of Environment): The Study should consider the sensitive issue of applying toll on existing non-toll sections. He expressed that it is better to apply toll on newly constructed sections and keeping the existing sections as non-toll.

  Dr. Hani explained that the Study includes interview surveys on the affordability -to-pay to supplement the previously conducted surveys of the willingness-to-pay. He also expressed that less traffic volumes are expected on the non-toll alternatives of the at-grade network after implementing the expressway network.

  Eng. El-Attar asked the Steering Committee to review the survey sheets to assure the accuracy of the survey.
- General Mansour (Ministry of Interior): The Study should consider the impact of introducing the expressway network on traffic, as it may attract more activities to Cairo which has a long-term target of relocating trip attraction points to outside of Cairo.

  Dr. Hakim (JICA Study Team) explained that there is another ongoing JICA Study, under the Ministry of Housing, that deals with land use activities. He assured that there will be coordination between both studies and their results will be fully considered.
- General Eng. Mahrous (Cairo Governorate): The Study should consider the underground

utilities along the proposed routes as the cost of reallocating such utilities is very high.

Dr. Hani explained that cost estimate of the expressways includes utility reallocation cost and coordination will be done with the Utilities Centres of Cairo and Giza Governorates.

- Eng. El-Attar (GARBLT): The Study should include updating of previous studies especially after implementing new road projects by the Ministry of Transport, such as Shobra-Banha and the regional ring road, which will affect the traffic circulation in Greater Cairo.

  Dr. Hani explained that the Study includes review and updating tasks that will cover newly implemented projects by MOT and MOH as well such as Al-Azhar Tunnel and E11 of the expressway network which is being implemented before its proposed schedule.

- Eng. Basily (Minstry of Economic Development) asked on how to attract the private sector to invest in the expressway projects.

  Eng. Nada (MOT-PPP Unit) explained that applying toll on expressways as well as other advertisements and value added services will attract the private sector. He mentioned the great interest by other international financing institutions to invest in the transport and road sectors under PPP schemes.

  Eng. El-Attar (GARBLT) explained that there are many examples in foreign countries that utilize private sector in infrastructure projects, also the socioeconomic conditions of road users are considered and applying a shadow toll can be one option.

- Prof. Mitainy (Cairo University): The study should coordinate with ministries and agencies that are implementing major road plans and projects, such as Ministry of Housing (E11: Saft El-Laban Corridor – Rod El-Farag Corridor), Ministry of Culture (Realignment of Ramses Square) and Giza Governorate (Giza Square Development). Such important projects were not previously considered in JICA Studies.

  Eng. El-Attar (GARBLT) asked the Counterpart Team to facilitate such coordination and to assist JICA Study Team to start contacts with related ministries and agencies as soon as possible.

- Dr. Wahdan (ENIT): The Study should coordinate with the ongoing Ring Road Development Study as there are several connecting points with the expressway network, especially the issues of toll collection systems and applied tolls to avoid congestion at connecting points.

  Eng. El-Attar (GARBLT) invited JICA Study Team to attend the Workshop on the Ring Road Development Study on Sep. 12 and asked for regular meetings between both study teams.

- Dr. Wahdan (ENIT): asked to increase the number of boring survey points when compared with route length and to add more traffic survey points, if possible, for more data accuracy.

  Dr. Hani explained that this survey is basically for new construction sections, while data of existing sections are requested from Cairo and Giza Governorates through GARBLT.

- Eng. Hassan Selim (TPA): The Study should update growth in traffic volumes and toll

setting related surveys as they will affect the economic viability of the project.

Dr. Hani explained that such tasks are included and interview survey sheets will be sent for review by the Steering Committee.

- Eng. Hassan Selim (TPA): The Study should examine administrative and management alternatives if MEA can not be established in due time, as the government is directed to avoid the increase in organizations.

  Eng. El-Attar (GARBLT) asked the JICA Study Team to provide their recommendations, and the Steering Committee will review such recommendations based on governmental policies.
- Eng. El-Attar (GARBLT): The Study should propose the most suitable toll collection system that can be applied in Cairo. He proposed that two collection systems (manual and electronic) can be applied at first until road users got more familiarity with the best collection system.
- Eng. Abou El-Seoud (Ministry of Environment): Environment Law No. 4 of Egypt identifies items to be studied as both Physical Impacts and Socioeconomic Impacts. The Ministry has long experience in reviewing Environmental Impact Studies of several large-scale projects including Ameriya Airport (JBIC) and Terminal 3 of Cairo International Airport (World Bank).
- Mr. Tanaka Kenshiro (JICA Assistant Resident Representative), in his greeting words, expressed that cooperation with all related ministries and agencies is important for successful implementation of the Study. He also stressed on the necessity to establish MEA to efficiently handle all the activities to implement and operate Cairo Urban Expressway Network.

  Dr. Hani explained that several field surveys will be carried out including topographical survey during Ramadan, and traffic police permissions will be required.
- General Mansour expressed that the Central Traffic Directorate will assist in providing required permissions.
- The Steering Committee requested the JICA Study Team to provide an English Executive Summary not only in Arabic as mentioned in Chapter 3 of the Inception Report. The Study Team will convey this request to JICA Headquarters in Tokyo.

The meeting ended at 13:00hrs and the Chairman thanked all participants from both sides.

1.6.2 2nd Steering Committee Meeting

The meeting was opened on 13:00hrs of Nov. 27, 2007 by the Chairman of the Steering Committee, Eng. Tarek El-Attar. He welcomed the representatives of JICA Tokyo Headquarters and Egypt Office, Study Team Members and the members of the Steering Committee. The Chairman referred to the Prime Minister Decree No. 1128 of the year 2000 in which a Higher Committee was established for the formulation of an integrated plan for

Greater Cairo Transport. For optimum results, the Chairman also assured the need for a full cooperation with the JICA Study Team by all concerned ministries and agencies in the planning and implementation of the Study routes composing i) E1-2, E2-2, and E3-1, ii) E1-1 and E2-1, and iii) E3-2 and E3-3.

Then, the Chairman expressed the gratitude of GARBLT to JICA for their continuous support during the course of the Study. He also stressed on the need for more support by JICA for some additional tasks that are in urgent need to be carried out based on the preliminary results of the Study. Such tasks are:

- As a full EIA is urgently required to proceed in implementing the project, the Steering Committee is kindly requesting JICA to revise the scope to include a full EIA on the Feasibility Study Routes (E1-2, E2-2 and E3-1).
- Due to the high priority of the Route E8, as presented in the Study results, the Steering Committee is kindly requesting JICA to revise the Scope of the Study to include the Route E8 under the Feasibility Study.
- With the urgent need to start the implementation of the expressway project as early as possible and the intention to request Japan's ODA financial support, the Steering Committee is kindly requesting JICA to provide technical assistance for the detailed design of the feasibility study sections.

Next, Dr. Hani Abdel-Halim, Leader of JICA Study Team, presented the progress of the Study regarding the following tasks:

1. Review of PPP Study
   - Expressway network components
   - Assigned traffic volumes
   - Route Prioritization
   - Toll application schemes and affordability survey results
2. Alignment alternatives and constraints for each alternative
3. Structural alternatives
4. Environmental surveys and considerations
5. Photos introducing Nagoya Urban Expressways

During these presentations, there were discussions on the following main points by members of the Steering Committee.

- There are several schemes regarding imposing toll on existing elevated sections that show different levels of revenue, and it is the decision of the Egyptian side to select the most acceptable scheme. The Steering Committee will assess the proposed alternatives at the

end of the Study.

- A lane width of 3.30m for standard urban expressway sections is accepted to be applied in the Study as it will greatly reduce the construction cost of the whole structures of the expressway network compared with the width of 3.60m applied on intercity highways.
- Coordination should be done with the on-going study on the upgrading of Cairo Ring Road under GARBLT.
- Comprehensive and detailed coordination with the Ministry of Housing is required regarding their plans of several underpasses along a proposed alignment of E1-2. The Ministry of Housing is requesting to include E8 under this JICA F/S in order to maximize the benefits gained by implementing E1-2, E3 and E11. The Study Team will convey this request to JICA Headquarters in Tokyo.
- Basically, extending E1-2 as a shield tunnel to the west under the land of the Ministry of Agriculture and other areas to meet E11 is a favourite alternative. However, more technical information and data should be collected to carry out a comprehensive comparative analysis with the basic alternative in order to select the optimum one.
- Ventilation issues should be addressed for long depressed sections of E3-1 in order to cope with air pollution of heavy traffic volumes expected to use this section.
- The expressway level should not be higher than other existing roads in the vicinity of the Citadel as well as the height of the Aqueduct to avoid any negative impact on these historical locations. Utilizing the space over or beneath the railway line at these locations is accepted to provide acceptable height for the expressway.
- The Ministry of Housing will provide plans for relocating a section of Salah Salem Avenue to the east of the Aqueduct which can be used for the expressway alignment. The Ministry is planning also on relocating the section of E1-1 in front of Cairo Central Railway station to the back side of the station. For future network connects, 8 lanes are required for this section instead of the planned 6 lanes.
- It is very important to coordinate with the National Authority for Tunnels regarding the alignment of new Metro lines No. 3 and No. 4, especially on the design of Maspiro Station of Line 3.
- Social and environmental studies and assessment should be done in accordance with Egyptian Environmental Laws and other international standards as well.
- The experience of the private sector in operating and maintaining the expressway network should be utilized at early stages instead of traditional procedures in order to get optimum benefits of this large-scale and important project. Based on the Study results, financial resources and schemes for private sector participation will be thoroughly investigated.

Chairman Tarek El-Attar re-stressed on the importance of quick coordination with different agencies and that the Government is putting high priority on road projects that provide higher level of services. The meeting ended at 16:00hrs and the Chairman thanked all participants from both sides.

1.6.3 3rd Steering Committee Meeting

The meeting was opened on 13:00hrs by the Chairman of the Steering Committee, Eng. Tarek El-Attar. He welcomed the representatives of JICA Egypt Office, Study Team members and the members of the Steering Committee. The Chairman referred to the Prime Minister Decree No. 1128 of the year 2000 in which a Higher Committee was established for the formulation of an Integrated Master Plan for Greater Cairo Transport. Next, Steering Committees were established to supervise transport studies related to the Master Plan, including the present Feasibility Study on High Priority Expressways.

The Chairman also pointed to the 1st Stakeholders meeting that was conducted by GARBLT on March 13, 2008 and attended by representatives of concerned ministries and agencies, such as the Ministries of Transport, Interior, Housing, Economic Development, Investment, Environmental Affairs and Irrigation, as well as National Authority for Tunnels (NAT), Egypt National Railway (ENR) and representatives of Cairo and Giza Governorates. In addition, the meeting was attended by representatives of holding and private companies of the road sector, consultants, academic professors and NGOs working in environmental issues and socio-economic development.

The Chairman stressed on the importance of such meetings in providing information and results of the on-going study to all concerned agencies and stakeholders. It is also important to discuss such results and listen to different opinions from attendants for the benefit of the Study. The Stakeholders meeting will be followed by another two meeting, tentatively in June and August 2008.

In his greetings words, Mr. Tanaka Osamu, the Assistant Resident Representative for JICA in Egypt mentioned that JICA, for years, is carrying out different studies and projects to develop the transport sector in Egypt. He expressed his gratitude for the cooperation of all parties in promoting the on-going study, looking forward to the implementation of the Study results to alleviate the present traffic and transport problems in Cairo.

Next, Dr. Hani Abdel-Halim, Leader of JICA Study Team, summarized the contents of the Interim Report of the Study that was submitted during the meeting. He asked the Steering Committee members to submit all comments and inquiries in a period of 4 weeks till April 10, 2008 (Thursday).

Dr. Hani Abdel-Halim explained also the updatings in the alignment of expressway sections under the Study with expected problems for each section and the estimated preliminary costs. During the presentation, the discussions with the Steering Committee members on several issues can be summarized as follows:

1) Dr. Abdallah Wahdan (ENIT): expressed the need to utilize results of other related and on-going transport and urban development studies in addition to the coordination with other study teams in order to assure harmony between all the results.

   The JICA Study Team explained that the present Study is considering the results of other studies and there is a continuous coordination with other study teams.

2) Mr. Bahy Basily (MoED): requested the need to consider future growth in population and transport demand to assure that proposed projects, with huge investments, will meet not only short-term demand but also long-term requirements.

   Dr. Hani Abdel-Halim answered that the on-going study is based on a long-term plan with a target year of 2027 for the growth in both population and transport demand. This target year is also the same for the urban development study under the Ministry of Housing.

3) General Mohamed Mansour (MoI): stressed the importance of careful selection of the locations of on- and off-ramps in regard to the at-grade network, otherwise traffic congestions may occur which is against project objectives.

   Dr. Hani Abdel-Halim also stressed the importance of this issue which is still under study. Next stage of the Study will finalize the location of ramps taking into consideration the at-grade traffic congestions and the proposed toll collection system.

4) General Ahmed Badr Mahrous (CG): stressed the need for coordination with the Ministry of Culture regarding any plans at Ramses Square. The Ministry currently announced for an international tender to develop the square. In addition, there is another important issue which is the relocation of utilities that may greatly increase the project costs.

   Coordination with the Ministry of Culture will continue as mentioned by Dr. Hani Abdel-Halim. The Study is considering that the 6th of October corridor, which is a link in the Expressway Network passing in front of Ramses Station, will be in its existing location. Relocating the corridor to the rear of the Station, based on the requirements of Ramses Square development project, will not affect the transport studies but the preliminary design should be revised. As for data on utilities, coordination is being done with the Utility Information Centre of Cairo Governorate.

5) Dr. Laila Salah Radwan (MoC): mentioned that coordination with the Ministry of Culture should extend not only for the development plans of Ramses Square but also for the expressway proposed near the Citadel to preserve the historical image of this area

   In this regard, it was explained that the Study Team had very comprehensive contacts and meetings with the Ministry of Defence (MoD) and Egypt National Railway (ENR) to look for the possibility of utilizing the space over the Doeka Railway near the Citadel for the expressway alignment. Such alignment will keep the expressway level lower than the existing Salah Salem Road. The Study Team is waiting for the approval of MoD.

6) Eng. Atta El Sherbiny (NAT): expressed the need to study required ventilation, lighting, control and emergency facilities for the shield tunnels proposed for the section E1-2. He mentioned that the cost of one kilometer of the metro line, including electrical and mechanical works as well as the rolling stocks, is about million 600 LE that can be used as a reference for the Study Team.

   Dr. Hani Abdel-Halim mentioned that such facilities will be considered in the Study. As for the estimated cost by the Study of about million 700 LE, it includes the recent rapid increase in the unit cost of construction materials.

7) Eng. Atta El Sherbiny (NAT): advised the Study Team to consider the Super-Tram Line that may pass beneath the Nasr Road along Yusif Abas Street. He promised to provide available information to the Study Team.

   The Study Team expressed the need to obtain such important information in the earliest possible chance.

8) Eng. Fifi Abdel-Ghani (Cairo Governorate): requested the Study Team to consider El-Fangary underpass that will cross Al-Nasr Road, as it will be presented to the Cabinet shortly.

   Dr. Hani Abdel-Halim clarified that per the request of MoD, the expressway along Al-Nasr Road should be as a tunnel not elevated to protect the nature of area in front of the Unknown Soldier Monument. To connect this tunnel with ramps of 6th October elevated road (E1-1), Al-Fangary Underpass should be beneath the expressway tunnel otherwise expressway connections can’t be geometrically done.

9) Eng. Tarek El-Attar (GARBLT): assured that many difficulties are expected during project implementation, so the optimum engineering solutions should be adopted to provide an efficient expressway network. For example, the tunnel of E3-1 should be 3 lanes in each direction to meet long-term demand and to avoid bottlenecks in case of malfunction car in a 2 lane section.

   The members of the Steering Committee agreed on this proposal to provide 6 lanes for new expressways.

10) Eng. Fifi Abdel-Ghani (Cairo Governorate): requested that traffic flow should be kept during construction, and coordination should be done with the Ministry of Housing (MoH) in regard to developing plans of area surrounding El-Sayedab Aisha Mousque especially at the cemeteries.

    For traffic detours during construction, plans will be submitted to Cairo Governorate and the Traffic Police Department as explained by the Team. In addition, coordination with MoH is going-on regarding the proposed new alignment of Salah Salem Road at that area.

11) Eng. Hassan Selim (TPA): asked on the planned connections of E3-3 with Giza Square after crossing the Nile River, as this area is suffering severe traffic problems at present.

    The Study Team didn’t finalize these connections and ramp location yet, but their concept is to completely separate the expressway traffic with existing at-grade or

flyover traffic.

12) Eng. Ahmad Abou El-Seoud (Ministry of Environment): expressed his support to the project by detailed review of proposed alignments and clarified that it is important to launch a comprehensive awareness campaign to the public for their understanding in regard to the new three expressways. He noticed also that under this stage of the Study, only three expressways are covered, out of the required eleven expressways to alleviate traffic congestion, so what will be the next stage of the Study?

    The Study Team actually started in the awareness process by holing the 1st Stakeholders Meeting on Thursday March 13, 2008 that was attended by a large number of representatives of ministries and governmental agencies, holding companies in the road sector and private sector companies working in road construction and maintenance fields. It was attended also by professors, NGOs and representatives of both governorates of Cairo and Giza. Two more Stakeholders meetings are scheduled for June and August 2008. As for the next stage of the Study, Dr. Hani Abdel-Halim explained study tasks that are not completed yet stressing that accuracy of the Study results depends mainly on the urgent providing of data and information requested from different agencies, taking into consideration the limited remaining period to complete the Study.

13) Eng. Sami Gorge (NAT): clarified that it is important to identify “hard points” for each expressway alignment for aspects such as geometric design, traffic flow, utilities or historical areas. He assured that NAT is ready for full cooperation with the Study Team either in providing available data and information or through NAT experience in implementation activities such as monitoring systems to avoid any possible damage due to excavation works.

At the end of the meeting, Chairman Tarek El-Attar requested all members, as representatives of their ministries and agencies, to provide requested data and information so the Study Team can complete the Study in the most perfect way and results can be used in solving the traffic and transport problems in Greater Cairo Region. The members of the Steering Committee kindly promised to comply with this request. The meeting ended at 16:00hrs and the Chairman thanked all participants from both sides.

1.7 STAKEHOLDERS MEETINGS

Three stakeholders meetings during the course of the Study are the minimum requirement for a full EIA. The first meeting has the objective of sharing the initial plan for the project and benefit from the experiences, expertise and knowledge of participating stakeholders. Participants in the first meeting were mainly relevant government officials in addition to some members of civil society and representatives from private construction companies. The second and third scheduled stakeholders meetings had more balanced list of invitations between

government, civil society and private sector. The minutes of meetings of the three meetings are presented in the following sections.

1.7.1 1st Stakeholders Meeting

The meeting was opened on 10:00hrs of March 13, 2008 by the GARBLT Chairman Eng. Tarek El-Attar. He welcomed the representatives of Japanese Embassy, JICA Egypt Office, Study Team Members and the participants. The workshop was divided into 3 sessions in order to present a full picture on the different aspects of the project. The sessions were as follows:

- Cairo Urban Toll Expressway Network: Presentation on the need for an expressway network and the mechanism for implementation and operation suggested by the project.
- High Priority sections under Feasibility Study: Presentation on the results of the feasibility study conducted in terms of infrastructure and alternative configurations for highways.
- Environmental Impact and Countermeasures: Presentation on the possible environmental impact of the project and suggested solutions.

Upon completion of the presentation, participants raised different issues, concerns and recommendations to be taken into consideration during the planning process, following are the main points discussed by participants of the stakeholders:

- Prof. Mostafa Sabry (Ain Shams University): GOE has worked on building highways and bridges to relief the pressure off congested areas in the country; however, not all projects managed to successfully fulfill such objective. Simultaneously, it was pointed out that the studies in the presentation portray the projected image in 2022 based on a per day unit of measurement, which is efficient in assessing the number of lanes needed as opposed to the capacity of the bridge.
- Mr. Salah Abdel Wahab: exit and entry ramps of expressways may increase the traffic in the surrounding areas. The team has been urged to carefully study these points as not to add pressure on these areas in terms of traffic congestion.
- Eng. Sayed Ali Khalil: Expressways may result in increased visual pollution due to the garbage dumps created underneath and solving such problem could be very costly.
  In response to the above comments, the Study Team explained that the toll expressway is based on a comprehensive urban transport study conducted in 2002. The concept of the Study is to provide 2 new east-west corridors south and north of 6th of October Bridge and 15th May Bridge. Such concept intends to divide traffic between the south and the north relieving pressure from Down Town area. The ongoing study will incorporate the existing level of congestion in all entry and exit points and will assess the feasible and viable solutions of minimizing their impact. As for the possibility of increasing visual

pollution, the space underneath the new bridges will be used for economic activities, as to avoid wasting resources on cleaning these areas and simultaneously generate employment opportunities. The Team stressed on the fact that the toll expressway will have a different management system to work on increasing demand for the highway and attracting cars while simultaneously minimizing possible negative impact.

- Prof. Abdallah Wahdan (Enit Director): There was a concern about Egypt following blindly the Japanese model without incorporating differences in existing infrastructure and behavioral attitudes of the people.
- Mr. Abdel Kader Lashine (Chairman of Technical Consultations Bureau), The Japanese public enjoys higher standards of living and thus they can afford to pay the tolls imposed in order to compensate the private sector investment. Egypt will not be able to impose high tolls to recover the costs incurred.

  The Study Team assured the participants that the research includes 'Egyptizing' Japan's experience and that the toll expressway will not be an identical replica due to the different traffic situation. Japan's experience will be of a benefit to Egypt in terms of sharing new ideas, know-how, and lessons learnt. As for the funding, the government will subsidize the difference between the toll collected and the cost incurred. The project expects private sector engagement at a later stage after the public sector has supported the project in taking-off.
- Mr. Ahmed Bas. (GARBLT), Dr. Karima Attia (Nile Research Institute) and Eng. Tarek Khalil (Hassan Allam), Concerns were raised with regards to the duplication of efforts and work done by the many governmental and non-governmental institutions working on transport issues.
  - The Study Team confirmed that they are in contact with other bodies working in transport. In addition, they are reviewing existing projects as to benefit from other efforts previously started to address the issue of traffic congestion.
- Eng. Sayed Ali Khalil: Several participants were concerned with the 20 year life of the project implementation. The situation with the traffic in Egypt is a pressing issue as it is perpetuating and negatively affecting the socio-economic development of the country. Therefore, Egypt might not be able to afford waiting another 20 years to experience results. The project should include short-term objectives that would hinder the expansion of the problem and long-term ones.

  In response, the Study Team explained that the project is divided into phases, 5 year periods, as to work on shorter term solutions. However, the project extends to long-term planning, which is reflected by the overall life of the initiative.
- Eng. Yehia El Sayed (Samcrete Egypt) and Mr. Samy George (NAT): Participants expressed their confusion with regards to the role of the public vis-à-vis the private sector. In addition, they stressed on the importance of creating incentives to encourage the engagement of private sector firms, for example the government can provide land at the end of the highway for the private sector to invest in and establish entertainment centers.

In response the Study Team explained that to involve the private sector, the project needs the full-pledged support of the public sector. The latter will be responsible for the first phase in terms of funding and implementation. Accordingly, the public sector should successfully trigger the start of the project in order to facilitate private sector involvement. Initially, the latter will be involved with the maintenance, operation, and rehabilitation of the network until a comfortable working environment has been created for both sectors. At a later stage, the private sector can get involved with the management and construction of the network. As for the toll system, the government will need to subsidize the private sector, as the total burden of the cost cannot be levied on the people in the form of toll fees.

- Mr. Safwat Kamal (Consultant): The issue of the project timeline and the exact implementation date has been raised as a repeated concern. In addition, the traffic situation during implementation should be carefully planned as to avoid further congestion. The construction of the expressway will require the closing down of main roads that will increase the burden of traffic on the functioning roads.
- Mr. Samy George (NAT): As to minimize the chances of impeding factors to the project during implementation, it has been recommended that the Study Team should work on identifying hard-points in areas of construction throughout the planning stage, for example underground sewage systems. The occurrence of such factors during implementation will require costly solutions that might exceed the project budget.

  The Study Team explained that the F/S phase will be completed in October 2008 will be followed by the design stage leading to actual implementation of the project. The team is still working on conducting the feasibility study for the initiative, planning for the situation of the existing roads during construction will definitely be considered at a later stage. As for the prioritization of projects, this initiative was on the top of the transport projects and those ranking higher already started work; however, the Team cannot wait upon completion of others to start working as it is time consuming. The traffic situation is a pressing problem that needs coordinated efforts dedicated from different projects in order to address the issue
- Eng. Mahmoud Marwan (Egyptian Environmental Affairs Agency): There was a repeated concern for the environment with regards to the emission of benzene and carbon monoxide and asked for the establishment of detectors that would limit the amount of emits released by cars using the expressway. In addition, to compensate for the rapid increase in number of vehicles in the streets, participants suggested resorting to electronic toll systems as not to increase the traffic at toll stations. Other types of pollution, both visual and noise, must be addressed as there is a high possibility of their occurrence during and after construction. Participants suggested well-managing areas under the expressway and using them for valuable purposes, such as economic activities.

  The Study Team explained that although they did not plan for installing detectors, studies demonstrate that the expressway should reduce poisonous gas emissions due to the

reduced traffic jams and the fact that fast expressways do not allow for stops. The current traffic situation allows for more air pollution and increased amount of carbon monoxide emissions. Electronic toll systems are definitely being considered in the feasibility study and should be implemented at a later stage. As for visual pollution, the team is planning to effectively use the area under the bridges for economic purposes.

The Study Team is planning to advertise the 5-year plan on the website as to have all necessary information easily accessible for the people and the private sector. In addition, they are planning to conduct consultation sessions to non-users to explain the positive and negative impacts of the project and listen to their concerns. As for Egypt's master plan, a study will be conducted to start the process.

In addition to the above discussion participants added some other projects and suggestions relevant to the issue of environmental impact which are summarized in the following:

- To include civil society and non-governmental organizations in the planning stage as to benefit from their knowledge and expertise.
- To expand the project to reach other governorates outside the greater Cairo Region.
- To work on increasing underground transportation as opposed to double bridges to minimize the negative environmental impact.
- To include the already existing infrastructure in the environmental studies as to have a complete vision.
- Establish a governmental body / department specifically for the general planning of such projects
- The Ministry of State for the Environment Affairs is currently implementing a project aimed at replacing old taxis with newer cars that work with natural gas, as to minimize environmental degradation.
- Consider the possibility of having smaller bridges over the River Nile, as it is a short-term solution with more positive impact.
- Levy taxes on new cities, such as 6th of October, as they will use the expressway instead of applying the toll system.
- Create bus exclusive lanes in the new expressway to make public transportation more efficient and reliable.
- Dr. Hany Abdel-Halim (Leader of JICA Study Team), Concerning the latter, the team explained that such suggestion was part of the original plan; however, the relevant government body refused to cover its costs as it was not part of their current budget and would result in an increase in the ticket price for the people. The toll expressway is supposed to reduce the traffic burden from the existing infrastructure; therefore, traffic for public transportation would be smoother and more reliable.

Recommendations:

- ✓ Participants raised the issue of careful planning and the need to share plans with the public. In order to successfully attract the private sector, the project should become more transparent.
- ✓ The project needs to inform and consult with non-users of the expressway as they will experience certain negative impacts as a result of the project. This initiative should be part of a greater social master plan for the transportation situation for all of Egypt.
- ✓ After this, two times of stakeholder meeting are scheduled. In those meetings, it is proposed to invite not only people who are in the position to promote the project and involve with contracts, but also those who will be benefited (toll users) and local residents surrounding the project site.

The meeting ended at 14:00hrs and the Chairman thanked all participants from both sides.

1.7.2 2nd Stakeholders Meeting

The meeting was opened on 10:00hrs of June 23, 2007 by GARBLT Chairman; Eng. Tarek El-Attar. He welcomed the representatives of JICA Egypt Office, Study Team members and the members of the Steering Committee. The Chairman pointed also to the 1st Stakeholders meeting that was conducted by GARBLT on March 13, 2008 and attended by representatives of concerned ministries and agencies, such as the Ministries of Transport, Interior, Housing, Economic Development, Investment, Environmental Affairs and Irrigation, as well as NAT, ENR and representatives of Cairo and Giza Governorates. In addition, the meeting was attended by representatives of holding and private companies of the road sector, consultants, academic professors and NGOs working in environmental issues and socioeconomic development. The meeting was divided into 3 sessions which were as follows:

- **First session:** "Outline of Cairo Urban Toll Expressway Network": Presentation on the necessity of establishing Urban Expressway network, financial resources and supervisor management of the project.
- **Second session:** "Results of 1st Stakeholders Meeting (March 17, 2008) and Progress in the Physical Environmental Impact Assessment (EIA)": Presentation on the Results of first Stakeholders Meeting, evaluation the impact of the project on Physical and Social Environment during construction and operation ,efforts done to minimize this impact.
- **Third session:** "Major Issues of Social Environment"; Presentation of the survey to determine the positive and negative impact that might face the project, investigate the willingness of people to pay for the toll and to vacate their residences particularly in case of relocation and the willingness of non- governmental, organization and civil society to support the project.

Upon completion of the presentation, participants expressed their concern with the negative impact of the project on the physical and social environment and stressed the importance of taking environment into account throughout the life of a development project, starting from the initial concept through the detailed design, construction and reuse of the land, Other concerns include the importance of fully comply the project with Egyptian Environmental laws. Finally, participants suggest solution to minimize the negative impact on people and preserve the environment.

- Eng. Eman Ziad, The main objective of expressway is to solve traffic problem in Cairo region but it is considered to be one of the investment solution as there were other applicable methods, with low cost to solve this problem used in developed countries including Japan like specialized day for moving of odd and other for even number vehicles, paid parking area, full use of the road supply.
  In response, The Study Team explained that low cost solutions are short-term, but we are planning for long- term solutions of traffic problem Project of expressway that will extend to 50-100 years. This suggestion was part of the original plan.
- Dr. Abdel Kader Lashine (Consultant), The situation with the traffic in Egypt pressing issues as it is perpetuating and negatively affecting the socio-economic development of the country. Therefore Egypt might not be able to afford waiting another 20 years to experience results. The feasibility study of establishing express ways must not take so longtime and should begin actual implementation of the project as soon as possible, while the project should include short- term solutions.
- Eng. Rashad El-Mitainy (Professor): The importance of establishing a government body is recommended to develop and supervise the new urban toll expressways and to be responsible for setting transport plans in Cairo region. This organization establish under Ministry of Transport.
- Eng. Tarek El- Attar (GARBLT Chairman): There is co-operation, duplication of effort between related ministries, civil society, non-governmental organization for setting plans to solve traffic problem. Development of an Urban Toll Express Network is proposed in the master plan, in parallel with the development of all other components in the transport sector to solve traffic problem extending over a twenty year planning horizon to the year 2022. As for funding the project the government will subsidy the difference between the collected toll and the cost incurred for the project.
- Dr Mahmoud Marwan (V.E.D), There was a repeated concern for the environment with regards to the emission of benzene and carbon monoxide from cars using the expressway as the study depends in measuring air pollution on participate matters PM10 and ignores mobile source PM2.5 which emits from vehicles, it is a colorless poison gas that has harmful effect on the body and these gases need to be measured by using air pollution monitoring station of the Ministry of Environment.
- In addition, participants concern over visual pollution as there is a high possibility of its

occurrence after construction of expressway. They suggest utilizing tunnels instead of bridges as underground transportation network decreases visual pollution.

- Other concern raised with regard to negative impact of the project during construction and operation on the building are air, noise and visual pollution. Effort must be done to minimize this impact.
- Vibrations must be monitored and evaluated although it is not yet specified in Egyptian Environmental Law.
- ***Dr Mansour (CONSULTANT),*** In response, all the measures of pollution used has ISO1966 the study team measures the impact of the project on physical and social environment during operation and construction daily every 10 minutes. There is the importance of taking environment into account throughout the life of a development project, starting from the initial concept through the detailed design, construction and reuse of the land. It was the first time in Egypt to study the effect of vibration during construction and operation of the project which is not included in Egyptian Environmental laws. Also the study gives due care to visual pollution but for establishing underground network to avoid air, noise, visual pollution needs no huge investment.

Recommendations:

- ✓ Before the implementation of the project, individuals should be aware of the new traffic routes and the time allotted for the construction.
- ✓ Raising awareness through various media and NGOs about the project should involve disclosing the project details and ensure the community acceptance of the toll levels.
- ✓ All details of relocation should be disclosed transparently.
- ✓ Lots to be relocated should be in an appropriate area and in good condition.

Conclusions:

- ✓ Traffic congestion is a so serious problem in Cairo region that cooperation and consolidated efforts between civil society, governmental and non-governmental organizations in the planning stage need utilizing their knowledge and expertise.
- ✓ Stakeholders and participants discuss the positive and negative impacts of the project on physical and social environment, financial resource, etc.
- ✓ Stakeholders and participants present the opinion of the local people in the project especially who residence surrounding the project site.
- ✓ Most of the toll users and public people were in favor of the project as it has positive environmental, health, economic, and social impacts and strongly proposed the earlier implementation of the project.

Lessons learned are:

- ✓ Although advertising of meeting was published in national newspaper (Al-Ahram, El-Akbar), and web-site, and invitation were sent directly to social interviews/group discussion groups, many attendants were government staff and private company related to road construction and there was no attendance from toll users and local residents surrounding the project site. It became clear that the participation of common public to such a formal and large scale meeting looks very difficult although the study team invited them. So, other way of inviting public participation and getting their opinions for project and environmental impacts may be necessary.
- ✓ Absence of mass-media, only one journalism attend from Transport journal there must be methods to announce for the project to be more transparent so can attack private sector and to share the plan with public.

The meeting ended at 14:00hrs and the Chairman thanked all participants.

1.7.3 3rd Stakeholders Meeting

After the first and second stakeholders meetings held on March17and June 23, 2008, the stakeholder meeting held 10:00-13:00 hours in GARBLT on September 4, 2008 is the third and final of a series of stakeholders meeting to present the results of EIA studies and get comments from stakeholders as the final procedure to get an environmental approval to the project from the Government of Egypt.

Attendants of the meeting from official and private sectors were as follow: GARBLT, JICA, Technical Consultation Bureau, Egyptian Environmental Affaires Agency, Ministry of cooperation, Ministry of Transport, Samcrete Egypt, El Soaada Company, El-Nasr Company, Al Azhar University, Nile Company for Construction and Pavement, Ein Shams University, Orascom Construction Industries, Cairo University, Nile company for Construction and Pavement, Transport Planning Authority, and Ministry of Investment.

The meeting is divided into 3 sessions in order to present the participants full picture on the different aspects of the project. The sessions were as follows:

- **First Session:** "Feasibility study on high priority urban toll expressways in Cairo": Need for expressway network and objective of the study were presented..
- **-Second Session:** "Environmental Impact Assessment: Evaluation of the impact of the project on physical environment during construction and operation, and measures to minimize its impact were presented.

- **Third Session:** "Social Impact Assessment": Possible social impacts of the project, its solution, details of relocation and policy of compensation were presented.

After the presentation, attendants are requested to express their concerns, suggestion and recommendation for each issue. Following opinions were raised:

- Eng. Abdallah (Egypt Cairo Traffic Bureau CTEB) urged comprehensive development of all components in the traffic sector including electronic toll collection system.as it is the effective solution to solve traffic congestion
- Eng. Nabela Ahmed (RF Structure Department) expressed his concerns about possible increase in fuel consumption, pollutants emitted from the vehicles and visual impact caused by the project
- Dr. Mansour (Presentator for Study Team, MB CONSULTANT) mentioned, in response, the impact of the project on physical and social environment during construction and operation was thoroughly studied to minimize it.
- Mohamed A. Sabour (Senior Transportation Economist) worried that surrounding shops in such districts as Manial will be emigrated and noise pollution will affect people's privacy during the construction of the project,.
- Dr. Faten Abdel Fattah (Study Team Member and One of the Presantator) replied that most shopkeepers in Manial District are in favor of the Project as they can keep selling to customers and the noise and privacy invasion can be minimized by the construction of barrier..

Recommendation:

- ✓ The project should be implemented as soon as possible.
- ✓ All suggestions should be examined carefully and taken into consideration in the implementation of the project.

Conclusion:

- ✓ In the third stakeholders meeting, participant discussed the results and the mitigation measures of expected impact of the project on social and physical environment during construction and operation stage.
- ✓ Most of the participants supported the project and thus strongly proposed its early implementation.

Lesson Learnt:

- ✓ None of private toll users and local residents surrounding the project site attended to the

meeting, though the study team had offered them to provide transportation fee for their attendance. Interviews of 2,000 samples, 50 group discussions, 5 open houses and web-site, however, will be enough for collecting their opinions to reflect them in the project.

1.8 COUNTERPART TEAM ACTIVITIES

The General Authority of Roads, Bridges and Land Transport (GARBLT) assigned to the Study a Counterpart Team composed of nine (9) members having a wide spectrum of expertise. The Counterpart Team includes representatives from the divisions of: Investment Roads, Roadway Maintenance, Roadway Safety, Project Control and Procurement. Representation of each of these divisions included a senior member for expert advice on the specialty of interest, and a junior member providing a continuous interface with the Study Team. The main activities of the Counterpart Team can be summarized as follows:

- Assist in providing the Study Team with information pertaining to the laws and legislation governing GARBLT in the construction, operation and maintenance of its roadway network. The Counterpart Team has also provided wide-ranging information that is important to the Study Team's general understanding of the roadway sector in Egypt and GARBLT's role in developing it. This included; organizational structures, budgetary plans, fiscal responsibilities, procurement methodologies and raw material cost trends.
- Assist in providing the Study Team with the standards and specifications used by the local market in the design and construction of roads and bridges. Also, familiarize the Study Team with quality control and quality assurance practices currently utilized in GARBLT projects.
- Provide links to Study Team's engaged by other international entities and donors who are providing studies for further GARBLT projects. This is necessary in order to coordinate efforts and mitigate duplications, etc.
- Accompany the Study Team for site visits to provide technical accounts of project sites.
- Coordinate trips to local construction sites for the Study Team to gauge the capabilities and technological development of local contractors and their adaptability to utilize proposed engineering solutions.
- Organize and manage study-related meetings with officials from pertinent ministries including the ministries of Defense, Interior, Housing, Economical Development, Investment, Finance, Culture and Environmental Affairs. Also, officials from the Cairo and Giza Governorates, not to mention officials from the Ministry of Transport, including; the Egyptian National Railway Authority (ENR), the National Authority for Tunnels (NAT), the Egyptian National Institute for Transportation (ENIT) and the Transportation Planning Authority (TPA). These meetings were critical for acquiring technical information, policy directions, prospective engineering solutions and

overcoming planning conflicts.

On the other hand, interacting with the Study Team on a daily basis provided the Counterpart Team members with a deep understanding of the Study methodology, procedures as well as field and office work efforts. This direct interaction was instrumental in achieving a promising level of technology transfer believed to have built the capacity of the Counterpart Team members in the areas of the Study.

In addition, technical biweekly meetings were held on the progress of the Study in different technical aspects related to the planning and design of the components of expressway sections. Also, a PPP Seminar was conducted for the Counterpart Team under a capacity building task and as a technical support for the implementation of PPP.

CHAPTER 2

HIGH PRIORITY EXPRESSWAYS

CHAPTER 2

BACKGROUND OF THE HIGH PRIORITY EXPRESSWAYS

This feasibility study deals with high priority expressways that were concluded in PPP Study. PPP Study, which is based on Master Plan, included analyses on the present and future conditions and demand of transport in the GCR. It presented the overall plan established for the sustainable development of the urban toll expressway network, including the required institutional setup, toll setting mechanism, as well as maintenance and operation system. For the network development, a comprehensive program and strategy for introduction of the PPP scheme was formulated with the required cash flow analysis and contractual arrangements. The following sections summarize the main findings of PPP Study.

2.1 CAIRO URBAN TOLL EXPRESSWAY NETWORK DEVELOPMENT

2.1.1 Necessity of Expressway Network

With the rapid increase in traffic volume and the limited capacity of streets in urban areas without the possibility of widening existing roads or constructing new ones, the historical concept of providing elevated roads and expressways started to be the most realistic solution to the traffic and transport problems. For decades, traffic problem in the Cairo Region has imposed itself as a negative impact, not only on the daily lives of people and the environment, but on the socio-economic development on the country.

Master Plan established an urban expressway network parallel with the development of all components in the transport sector with the following objectives:

- To reduce economic losses by reducing vehicle operating costs and time cost
- To promote socio-economic development by improving the road transport sector as a basic infrastructure for encouraging foreign and local investments
- To provide smoother and safe traffic flow by reducing congestion
- To reduce congestion by increasing expressway capacity by 2 to 3 times over the ordinary road
- To improve air quality by decreasing traffic congestion, vehicle-hours and vehicle-kilometers as well as vehicular idling during stoppage at congestion

In addition to the objectives above, the expressway network is expected to provide the following benefits to road-users:

- Time value: savings in time as well as vehicles which can be used for other purposes
- VOC value: savings in vehicle operating costs, including gasoline, tires, repairs and maintenance, which should be higher than the toll rate
- Comfort: reduction in fatigue to both drivers and passengers
- Efficient public transport: easier movement of buses with less traffic on at-grade streets due to diversified traffic to expressways

It should be noted that success in the implementation of the proposed urban toll expressway network is based on public acceptance, political commitment and government support.

2.1.2 Necessity for Toll Collection

Although the basic principle is that the use of a public road should be free-of-charge, the urgency of the necessity and insufficiency in funds for road network development necessitates the governments to adopt toll road systems. Historically, though, public roads were not always free-of-charge, as in the medieval ages, federal lords collected money from those who came into their territories.

To construct elevated expressways in urban areas, huge investment is required. Hence, toll collection is justified by the beneficiary-pay principle for the new service provided by expressways as long as free alternatives of the at-grade street network exist.

2.1.3 Necessity for PPP

PPP is a useful scheme for financing urban toll expressway network projects. As the project is economically feasible, though not very financially viable, government subsidy is required. Applying the PPP will produce the followings:

- Reduce burden on the government and support the national budget;
- Deliver better but cheaper services;
- Contribute to the development of private sector capabilities through better use of private entities.

2.1.4 Optimum Network under the PPP Study

The urban expressway network proposed in Master Plan consists of new construction of seven lines with a total length of 78.3km, in addition to the existing ones. As a result of the PPP Study and based on Master Plan, the concluded optimum Cairo Urban Toll Expressway Network for the year 2022 is shown in Figure 2.1-1.

Figure 2.1-1 Optimum Expressway Network – 2022 (PPP Study)

2.2 TOLL NETWORK ALTERNATIVE SCENARIOS

Applying toll on the expressway network was investigated based on a comparative analysis for four different alternative scenarios as presented in Table 2.2-1 and Figure 2.2-1.

Table 2.2-1 Toll Alternative Scenarios

Scenarios	Applying Toll on Existing Elevated Roads E1 and E2	Applying Toll on Cairo Ring Road	Applying Toll on New Expressways
Scenario 1	No	No	Yes
Scenario 2	Yes	No	Yes
Scenario 3	No	Yes	Yes
Scenario 4	Yes	Yes	Yes

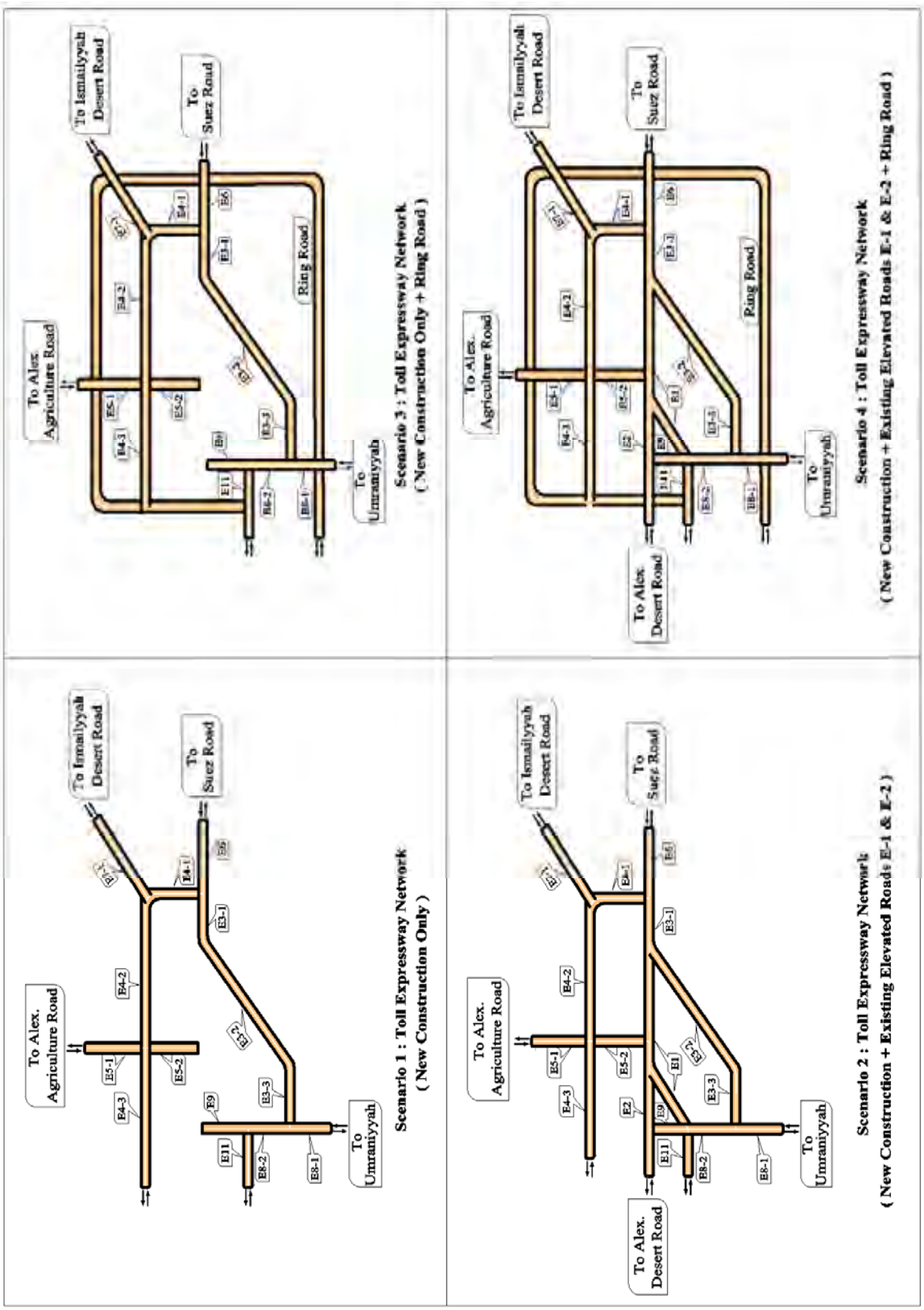


Figure 2.2-1 Scenarios of Toll Expressway Network

A comparative analysis was conducted on the four scenarios regarding network efficiency and traffic efficiency indicators as well as the economic and financial analysis. Results of the analysis showed that Scenario 4, in which toll is applied on an integrated urban road network system composed of the existing elevated roads, Cairo Ring Road and the newly constructed expressways, gives the most feasible traffic, environment, economic and financial indicators as shown in Table 2.2-2.

Table 2.2-2 Evaluation Results of Scenarios

Scenario	Ex'ways veh/day ('000)	Network PCU-km ('000)	Network PCU-hr ('000)	NPV (LE m)	B/C	EIRR %	FIRR %	Reduction in CO_2 (ton/day)
1	337	147,727	11,536	4,940	2.33	26.67	6.30	6.90
2	444	147,635	11,593	4,329	2.08	24.14	7.70	7.10
3	912	147,291	11,242	7,356	2.97	36.28	16.30	7.80
4	1,713	147,122	11,157	7,846	2.96	38.78	17.20	8.20

2.3 INSTITUTIONAL SETUP

CREATS recommended the establishment of a *Ministerial Committee for Greater Cairo Region Transport* (MCGCRT) and the *Cairo Metropolitan Transport Bureau* (CMTB). It is interpreted that the basic functions of the MCGCRT and CMTB do not include direct planning or implementation of practical construction or operation of the transport facilities. As for the Cairo Urban Toll Expressway Network, CREATS recommended the establishment of a new organization, hypothetically named as the *Metropolitan Expressway Authority* (MEA) to develop and supervise the new urban toll expressway network in Greater Cairo.

2.3.1 Necessity of New Organization

Cairo Expressway Network is a new and high level-of-service national infrastructure project which needs highly specialized professional expertise. The design, construction, maintenance, operation and control of the new transport infrastructure facility need to be based on original ideas not influenced by the precedent cases of old concepts.

An authorized and efficient such organization should be in charge. The "Metropolitan Expressway Authority" (MEA) is proposed to be established under the Ministry of Transport to vigorously promote this national Project. This organization will assist the Government of Egypt to plan PPP packages, evaluate proposals, negotiate with proponents and monitor the implementation and other tasks including management of the expressway.

2.3.2 Governing Mechanism of the MEA

It is assumed that the MEA will be exclusively and solely responsible for implementation of the planned expressway network. Therefore, all urban expressway related PPP projects will be supervised by MEA. The entity may be allowed to directly construct, maintain and operate any section of the planned expressways. Other governing options include:

- For MEA to be under the supervision of the Minister of Transport and with advice by the MEA Council consisting of three governorates and representatives of all the concerned agencies (recommended option)
- For MEA to be under the supervision of the Prime Minister or a minister especially appointed by the President (very strong political power)
- For the stakeholders to participate in governing MEA as members of the General Assembly and/or members of the Board, as stipulated in the Public Business Sector Companies Law (weak political power)

The power and functions of MEA may include:

- To enter into loans or borrowings to come up with funds needed for network construction, maintenance and operation
- To use toll revenues to maintain and operate the network
- To amortize loans used to fund construction of expressways
- To evaluate proposals of PPP schemes for any section or line of expressways
- To regulate traffic or stop the passage of vehicles in case of emergency

2.4 HIGH PRIORITY EXPRESSWAYS

Based on results of the prioritization criteria developed under the PPP Study, the high priority expressways that should be urgently constructed in the first stage of the implementation program are presented in Table 2.4-1. It should be noted that the presented cost is estimated basically for viaducts with two lanes in each direction.

Results of the economic evaluation for the high priority expressways, presented in Table 2.4-2, show high economic viability, especially for E1+E2, with low construction cost (only for extensions), while E3 includes a relatively high cost due to the bridge over the Nile River. Table 2.4-3 shows improvement in the air quality from the daily reduction in air pollution.

The implementation staging, as concluded in the PPP Study, of the high priority sections E1, E2, E3-1, E3-2 and E3-3, followed by E4, are shown in Figure 2.4-1a, b, and c, based on the established implementation schedule in order to complete construction of these expressways

by the years 2011, 2013 and 2016.

Table 2.4-1 High Priority Expressways (PPP Study)

Section	Location	Length (km)	Cost (mLE)	Remarks
E1-2	6th of October Extension	2.1	354	El-Tahrir Street
E2-2	15th of May Extension	1.2	98	Boulaq 1-way Section
E3-1	Autostrad El Nasr – Nasr City	6.8	690	Underpass (1,400m)
E3-2	Autostrad from Nasr City to Citadel	5.8	563	Elevated Viaduct
E3-3	Salah Salem from Citadel to Giza	6.9	802	Nile Bridge (600m)
Total		**22.8**	**2,507**	

Table 2.4-2 Economic Parameters of High Priority Expressways

Expressway	NPV (mLE)	B/C	EIRR %
E1 + E2	4,945	9.84	48.7
E3	3,331	2.85	20.4

Table 2.4-3 Daily Reduction in Air Pollution (kg in Year 2022)

Expressway	Veh/day	HC	CO	NOx
E1 + E2	222,217	31.2	258.0	30.5
E3	149,172	23.1	190.6	22.5

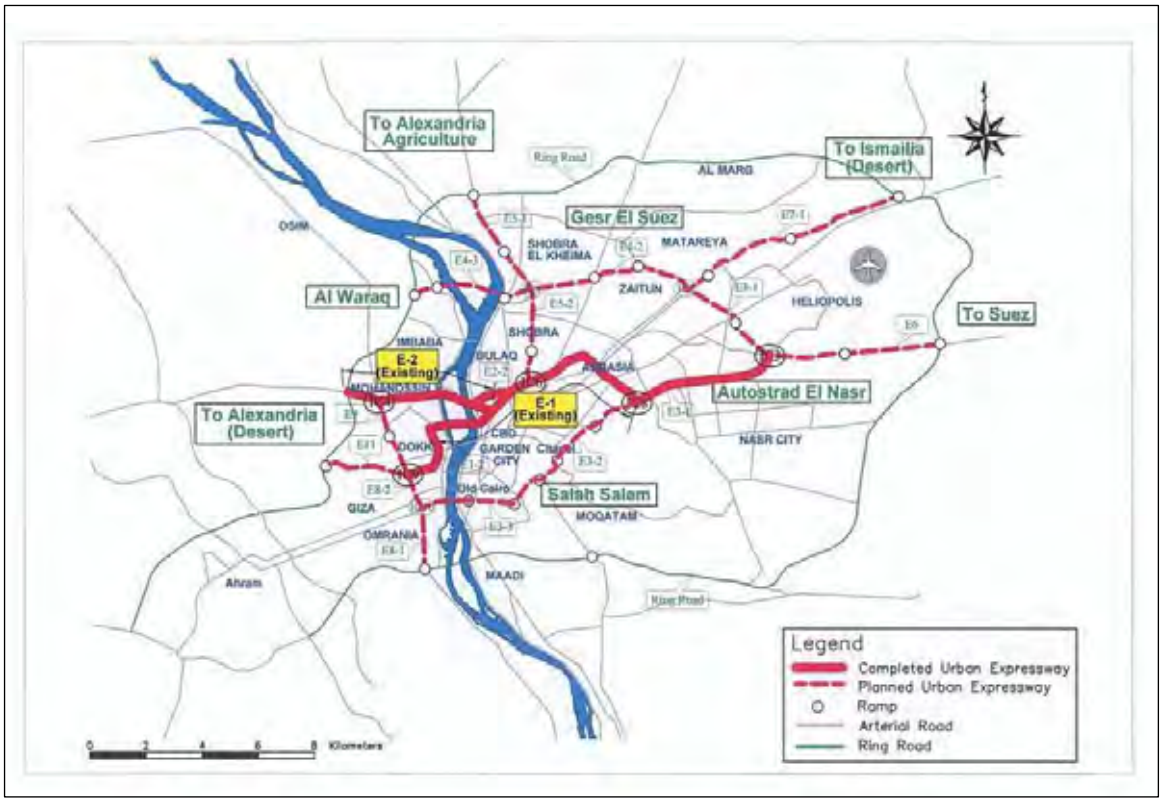


Figure 2.4-1a Staging of High Priority Expressways – Year 2011

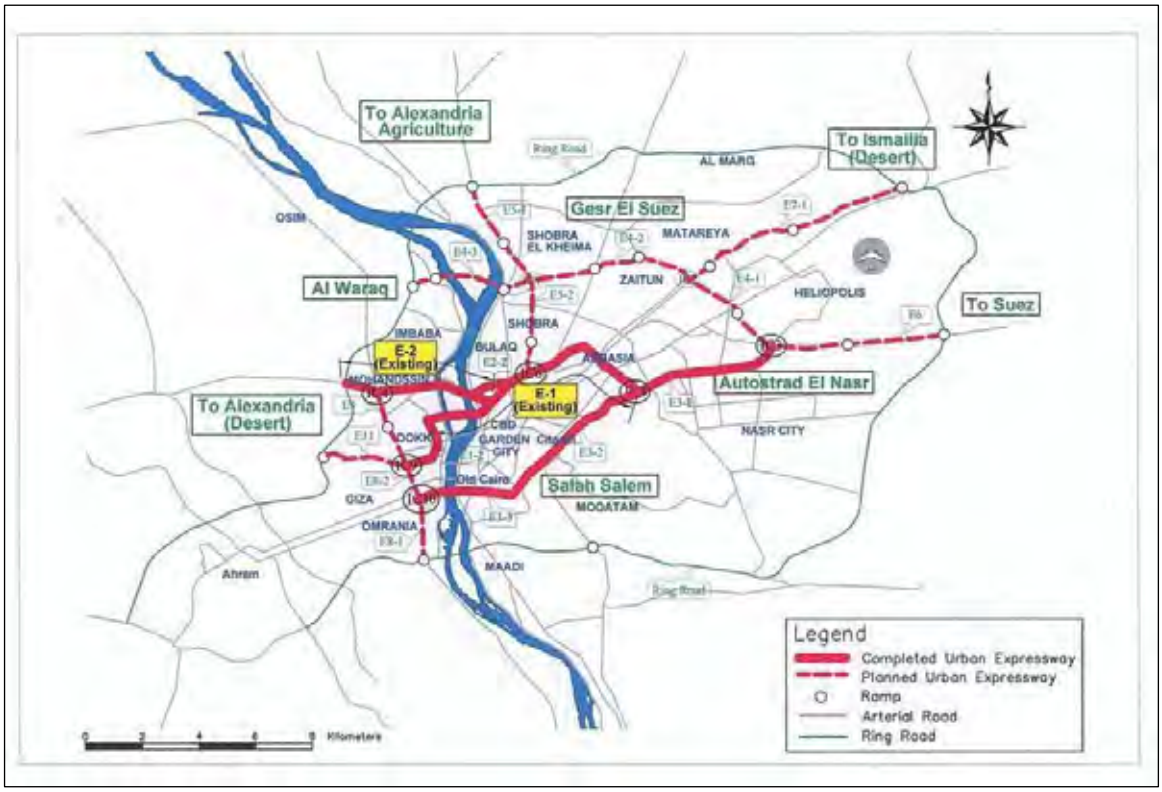


Figure 2.4-1b Staging of High Priority Expressways – Year 2013

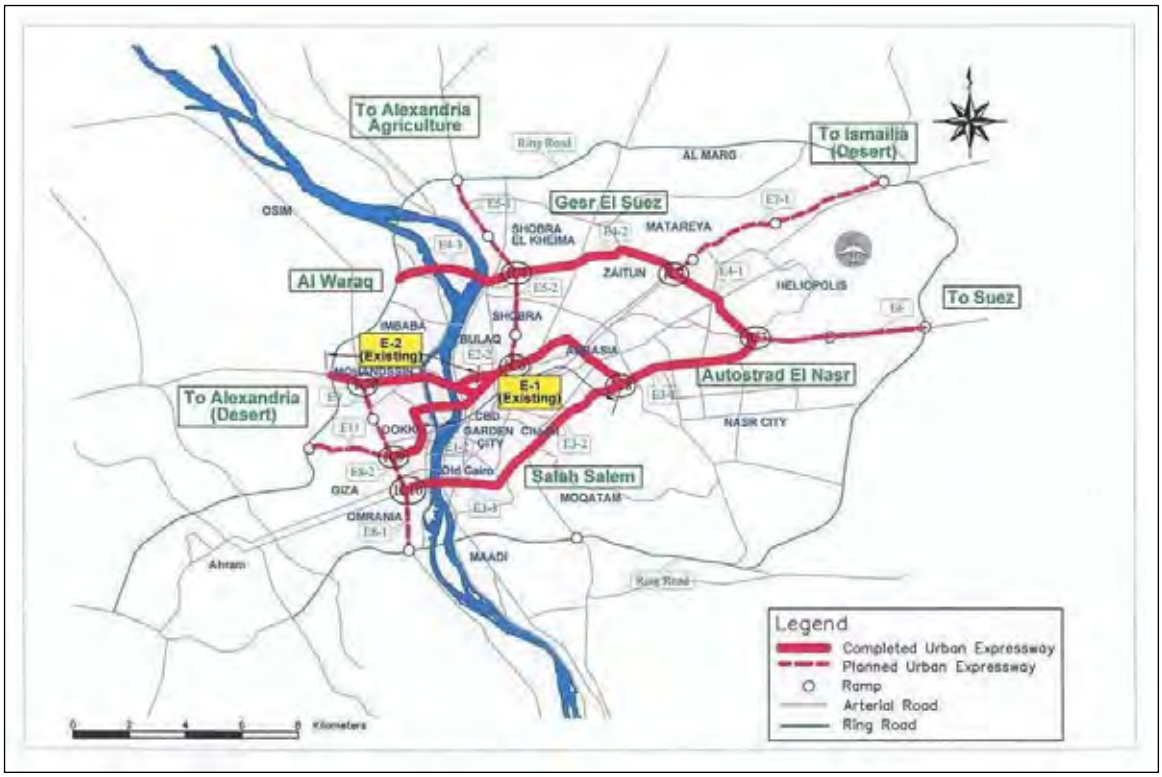


Figure 2.4-1c Staging of High Priority Expressways – Year 2016

For the early implementation of high priority routes, an action plan for the different required tasks was developed, as shown in Table 2.4-4. Under this plan, the detailed design stage is considered for the two financing options; i.e. through local fund/grant or through ODA loans.

Table 2.4-4 Implementation Action Plan for High Priority Expressways (PPP Study, May 2006)

Major Tasks	2005	2006	2007	2008	2009	2010	Agency In-charge
Cairo PPP Study							JICA ST – ENIT
Route Prioritization - HPE							JICA ST
MEA Secretariat							MOT
Feasibility Study on HPE							MOT/ENIT/ODA
EIA on HPE							ENIT/GOPP/MOE
MOT Approval							MOT
MEA Organization Set-up							MOT
MOP / MOF Approval							MOP/MOF
Parliament Committee							MOT
Cabinet Approval							MOT
D/D Loan Preparation							MEA
D/D Loan Agreement							MEA
Consultant Selection							MEA
Detailed Design of HPE			Grant		Loan		ODA/MEA
Construction Loan							MEA
Tendering							MEA
Construction of HPE							MEA/ODA
F/S on Next Routes							MEA

HPE: High Priority Expressways
JICA ST: Study Team
D/D: Detailed Design
F/S: Feasibility Study
EIA: Environmental Impact Study
MEA: Metropolitan Expressway Authority
CG: Cairo Governorate

MOT: Ministry of Transport
MOP: Ministry of Planning
MOF: Ministry of Finance
MOE: Ministry of Environment
ENIT: Egypt National Institute of Transport
GOPP: General Organization for Physical Planning
ODA: Official Development Assistance

2.5 PUBLIC-PRIVATE PARTNERSHIP (PPP) STRATEGY

2.5.1 Approach for Private Sector Participation

The primary goal of GOE is to implement the whole network of urban expressways on time and efficiently utilizing private sector's expertise and capacity. In order to implement the expressway network to achieve the above goal, the approach presented in three phases in Figure 2.5-1 is proposed as follows:

- Phase I: Establishing implementation framework and building capacity
- Phase II: Promoting PPP
- Phase III: Increasing private participation, such as privatizing MEA

In the first phase, the government will build and strengthen its basic structure for project implementation, such as establishing a new organization which promotes Cairo Urban Expressway, introducing toll systems, and adopting necessary legislation. Private participation will be promoted but limited to outsourcing of toll collection and operation and maintenance functions under performance based contracts in this phase.

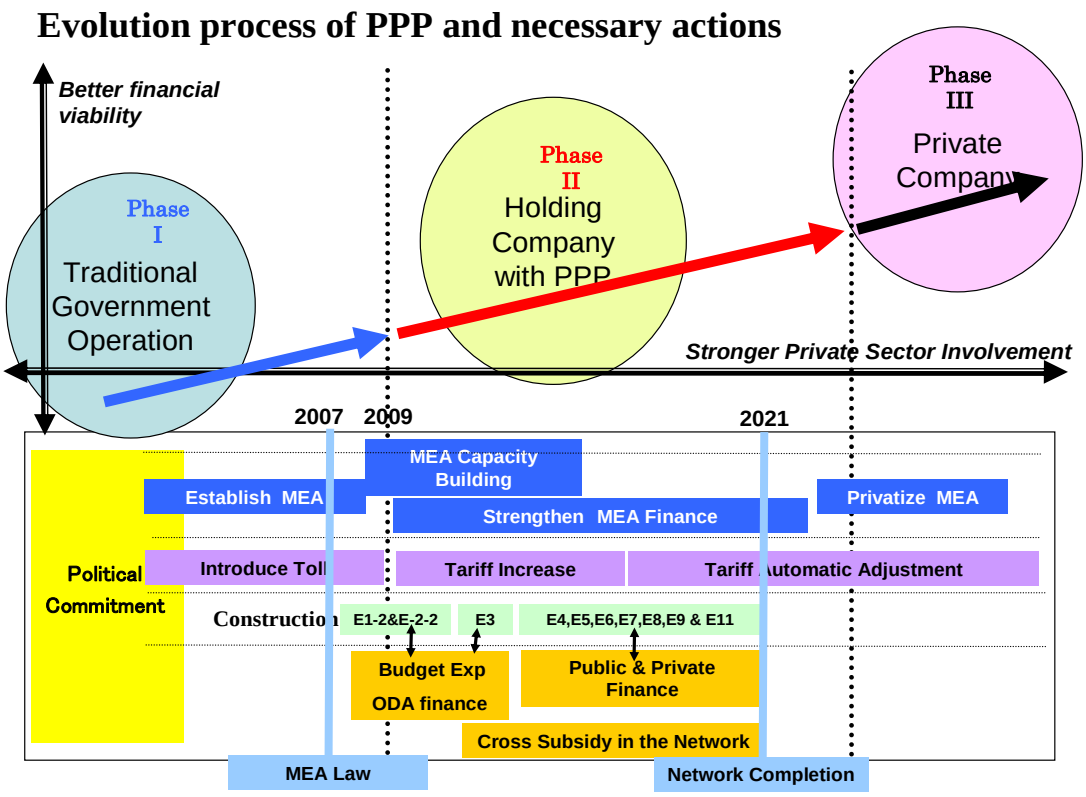


Figure 2.5-1 Evolution Process of PPP

In the second phase, the private sector participation will include from the design to operate under DBO scheme. Depending on project viability, it will finance a part of the expressway network under DBFO scheme where government may subsidize the cost of the portion that toll fee cannot cover. Subsidized amount will be decided based on the project profitability of the expressway concerned and the income generating capacity of private sector who operate it. In the third phase, the Government will have an option to plan privatization of a self-sustaining MEA.

2.5.2 Key Conditions for Private Sector Participation

A strong political commitment and continuous government support is imperative towards achieving a self-sustaining network system and gaining confidence of the private sector. In addition, the establishment of an independent and financially sound executing entity which shall have the power and function for network implementation is also necessary.

Other conditions include a holistic approach and best utilization of toll revenues from the network for future expansion and upgrading. Moreover, setting an appropriate counterpart for PPP from the public sector side to promote better coordination and dialogue between the public sector and the private sector is also an important factor.

Depending on the project economics under each phase, the possible PPP structure will vary as indicated in Figure 2.5-2 below. The gradual increase of private sector participation is recommended.

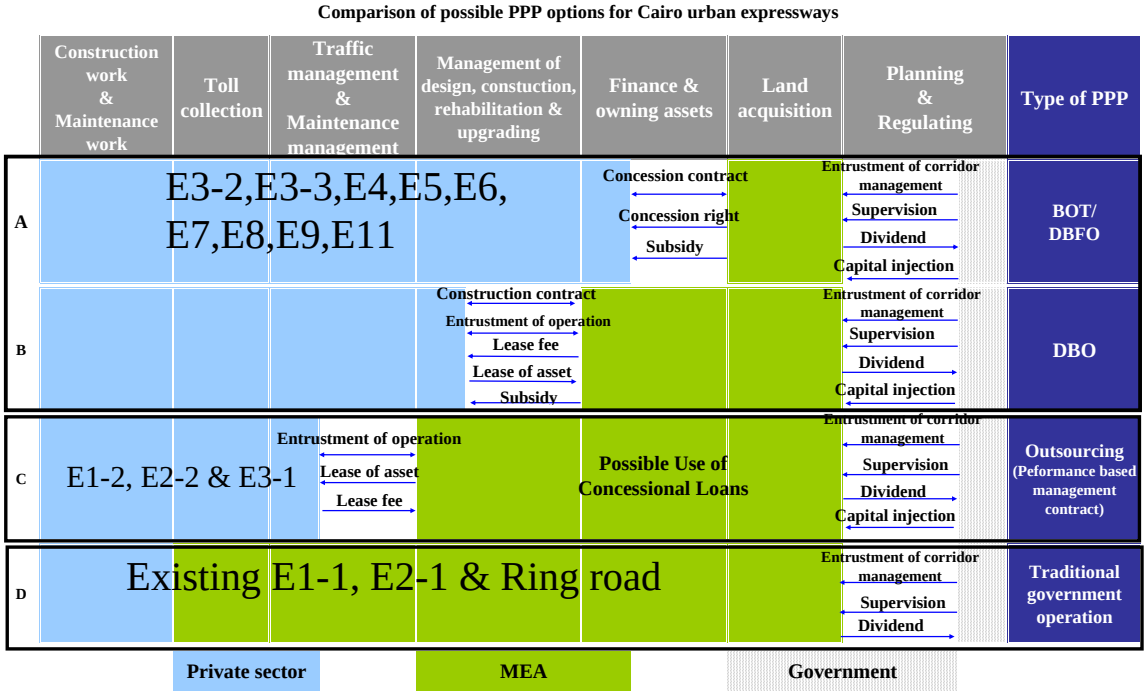


Figure 2.5-2 PPP Options for Cairo Urban Expressways

2.6 FINANCING PLAN

2.6.1 Financial Market in Egypt

The financial market in Egypt shows that since the early 90s, the Egyptian financial system with its three main sectors, the banking, equity market, and capital market, has been undergoing ambitious legislative reforms to enhance performance and encourage competition especially among the private sectors. Credit markets are constituted of credit agreements between lender and borrower. Credit agreements are not normally traded, even on secondary market. There are three categories of credit agreement: loans, credit lines and project financing. Credit markets are major financing source in Egypt. As Egypt is also over banked, based on PPP Study, the state owned banks control over 56% of banking assets and Egypt has one of the lowest levels of private sector control share.

Lending to large companies including future MEA and project financing for BOT projects are dominated by four state owned banks. Equity market in Egypt is seen still as underdeveloped and immature.

2.6.2 Government Budget for the Transport Sector

The total amount of investments during the last five years is about 8.8 LE billion and its growth rate of the investments is about 9% per annum. The share of transportation investment has been slightly decreasing, partly because the Government has shifted investments for the transport sector to BOT projects.

2.6.3 Financing Plan

Toll revenues will be a major funding source of the capital and operating costs of the network. However, even under the scenario of maximizing toll revenues, all costs will not be recovered by toll revenues only. The gap between toll revenues and required funds must be recovered by capital and operating subsidies from the Government cross subsidy from other roads, and/or other business revenues.

In order to lower financial costs, concessional loans such as ODA finances, loans from state owned banks, and government guarantee for MEA borrowing will be effective.

The financing for the expressway project will be comprised of (a) senior debt from banks, (b) subordinated debt-capital, and (c) equity. Senior debt from banks has first call on the available cash flows and subordinated debt-capital has second call. Equity is fully at risk.

Government equity injection will be necessary especially for the priority route. Next,

concessional loans will be on-lent by the government or directly provided to MEA. Loans from state owned banks will be considered. Available amount, maturity, interest rates are depending on the project economics and credit enhancement structure. Loans from commercial banks will be available for short and medium term.

When the private sector provides finances for the network, a PPP company will be established with sponsor's equity. Commercial loans will be mobilized and toll revenues and/or payments from the public sector will secure repayments of loans.

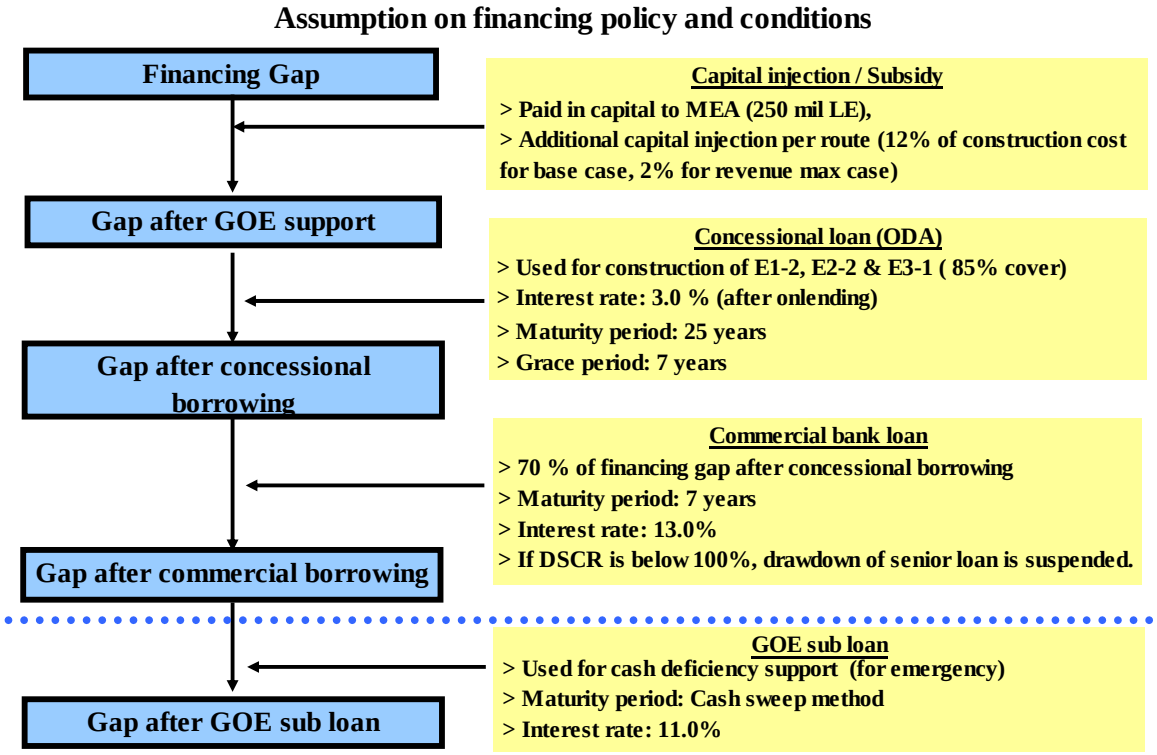


Figure 2.6-1 Financing Policy and Conditions

CHAPTER 3

TRAFFIC FORECAST AND ANALYSIS

CHAPTER 3

TRAFFIC FORECAST AND ANALYSIS

3.1 CONDUCT OF SUPPLEMENTARY TRAFFIC SURVEYS

3.1.1 Intersection Traffic Counting

(1) Survey Location

A total number of 20 intersections along the proposed alignment of expressway routes at crossings with specified streets had been selected for the traffic counting survey. The counting locations are indicated in Table 3.1-1 and Figure 3.1-1.

Table 3.1-1 List of Intersections for Traffic Counting

Code	Intersection Name
E1-01	AL NAHDA (6th October Bridge / El Batal Ahmed Abdel Aziz / Wazaret Al Zerra)
E1-02	Doqqi Square / Flyover (El Tahrir / Dokki Street)
E1-03	Cairo University (Sarwat / Gamiat El Qahira / Dokki Street)
E1-04	Abd Al Salam Arif /Sudan Street / Flyover
E2-01	E1 Highway (Exits/Entrances/Main Way) at North Tahrir /Galaa Street / Ramses Street
E2-02	15th of May Bridge East (26th of July Street / Corinch El Nile)
E3-01	El Nasr / Cairo Suez Road / Flyover
E3-02	El Nasr Road / Abbas El Aqqad / Nozha
E3-03	El Nasr Road / El Tayaran
E3-04	Nair Road / Yousof Abbas
E3-05	Fangray / El Nair Road
E3-06	Imtedad Ramsis / El Nasr Road / Flyover
E3-07	El Nasr Road / Ahmed Said / Al Amir Qaraqush
E3-08	Salah Salem / El Nasr Road / El Mokattm Road
E3-09	Salah Salem / El Nasr Road next to E3-08
E3-10	Sayyidah Ashah Square
E3-11	Magra El Ayoun / Salah Salem / Ain Al Sira
E3-12	Salah Salem / Corniche El Nil / Flyover
E3-13	Giza Bridge (Gamal Abd El Naser)
E3-14	Giza Square / Flyover

Figure 3.1-1 Traffic Counting Location Map

(2) Survey Date and Time

The traffic counting was carried out during a weekday (Monday through Wednesday), when traffic volume variations were relatively small, and data was collected by direction of movements at every one hour. The traffic counting survey continued for 18 hours, i.e., between 6:00 hrs and 24:00 hrs.

(3) Vehicle Types

Vehicle classification for the traffic counting consists of seven categories (sedan/wagon, taxi, minibus, bus, light cargo vehicle, heavy cargo vehicle and motorcycle) as shown in Table 3.1-2 below.

Table 3.1-2 Vehicle Categories

Vehicle Category	Description
1. Sedan/Wagon	Private Cars
2. Taxi	Taxis (Cairo taxis and intercity taxis)
3. Mini Bus	Shared Taxis, Public Minibuses, Private Minibuses
4. Bus	Public Buses (CTA, GCBC, governorate and intercity) Private Buses (school, company and tourist buses)
5. Light Cargo Vehicle	2-axle Trucks, Pickups and Vans
6. Heavy Cargo Vehicle	3-axle Trucks, Over 3-axle, Trailers and Semi-trailers
7. Motorcycle	2-wheeler, Others

3.1.2 Affordability to Pay (ATP) Interview Survey

(1) Objective

Affordability survey to probe drivers' capability to pay for toll expressways was carried out using the stated preference survey (SP Survey) method. The survey was done at petrol stations where drivers are frequently stopped over by interviewers. 526 samples were collected and, to avoid biased data, the survey was made at five separate locations.

(2) ATP Interview Form

The questionnaire forms are shown in Figure 3.1-2a and 2b.

Katahira & Engineers International
PwC Adisory
NAMAT Engineering Consultant

General Authority for Roads, Bridges and Land Transport (GARBLT) , Ministry of Transport, Egypt

Japan International Cooperation Agency (JICA)

FEASIBILITY STUDY ON HIGH PRIORITY URBAN TOLL EXPRESSWAYS IN CAIRO

SURVEY ON AFFORDABILITY-TO-PAY ATTITUDE OF CAR USERS

for study purpose only

General Info.

A Sample ID ☐☐☐☐ **C Date (month/day)** ☐☐☐☐

B Location ☐ **D Time (hour/min)** ☐☐☐☐ *hour* *min*

E Vehicle ☐
1-Passenger car 2-Taxi 3-Bus 4-Light Truck 5-Heavey Truck

Trip Information

1 Trip OD
Where did you start this trip? _____
Landmark, Road Name _____ ☐☐☐ (Zone Code)

Where do you go this trip? _____
Landmark, Road Name _____ ☐☐☐ (Zone Code)

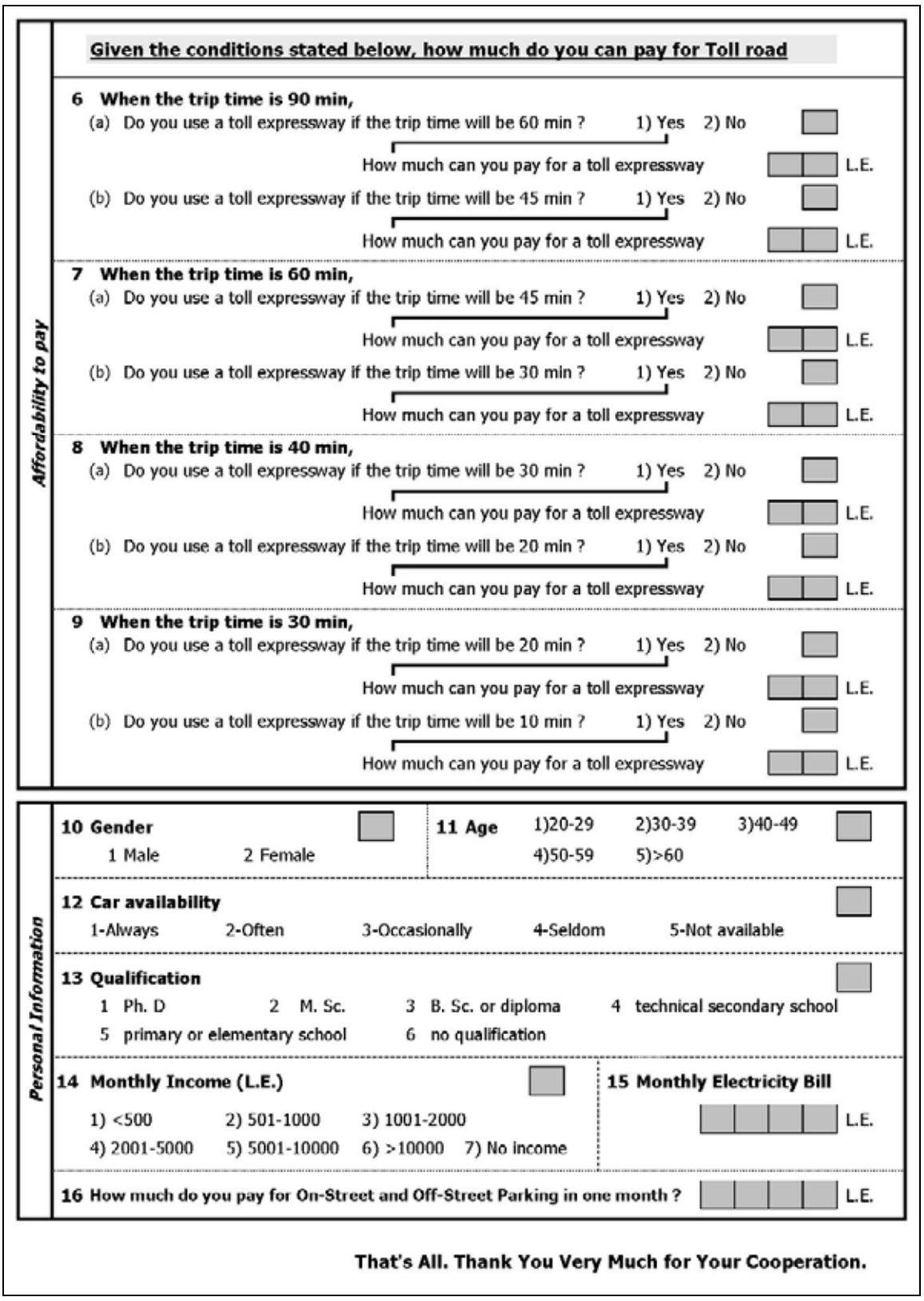
2 Travel Time How long does it take? ☐☐☐ Min.

3 Frequency How often do you use a car for this trip purpose and OD ? ☐
1 Daily (7 days) 2 work days only 3 2-3 days
4 once a week 5 rarely 6 just this time

4 Trip purpose ☐
1 Home 2 Job 3 Study 4 business
5 Shopping 6 Freight Delivery 7 Social 8 Medical
9 Recreational 10 Others

5 How much would you pay for travel time reduction of today's trip by Toll Expressway ?
(a) By 10% of travel time of this trip ☐☐ L.E.
(b) By 25% of travel time of this trip ☐☐ L.E.
(c) By 50% of travel time of this trip ☐☐ L.E.
(d) By 75% of travel time of this trip ☐☐ L.E.

Figure 3.1-2a Questionnaire Form on Affordability to Pay (1/2)



Affordability to pay

Given the conditions stated below, how much do you can pay for Toll road

6 When the trip time is 90 min,

(a) Do you use a toll expressway if the trip time will be 60 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

(b) Do you use a toll expressway if the trip time will be 45 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

7 When the trip time is 60 min,

(a) Do you use a toll expressway if the trip time will be 45 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

(b) Do you use a toll expressway if the trip time will be 30 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

8 When the trip time is 40 min,

(a) Do you use a toll expressway if the trip time will be 30 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

(b) Do you use a toll expressway if the trip time will be 20 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

9 When the trip time is 30 min,

(a) Do you use a toll expressway if the trip time will be 20 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

(b) Do you use a toll expressway if the trip time will be 10 min ? 1) Yes 2) No ☐

How much can you pay for a toll expressway ☐☐ L.E.

Personal Information

10 Gender ☐
1 Male 2 Female

11 Age ☐
1)20-29 2)30-39 3)40-49 4)50-59 5)>60

12 Car availability ☐
1-Always 2-Often 3-Occasionally 4-Seldom 5-Not available

13 Qualification ☐
1 Ph. D 2 M. Sc. 3 B. Sc. or diploma 4 technical secondary school
5 primary or elementary school 6 no qualification

14 Monthly Income (L.E.) ☐
1) <500 2) 501-1000 3) 1001-2000
4) 2001-5000 5) 5001-10000 6) >10000 7) No income

15 Monthly Electricity Bill
☐☐☐☐ L.E.

16 How much do you pay for On-Street and Off-Street Parking in one month ? ☐☐☐☐ L.E.

That's All. Thank You Very Much for Your Cooperation.

Figure 3.1-2b Questionnaire Form on Affordability to Pay (2/2)

(3) Interview Locations

The petrol stations selected for interview locations are indicated in Table 3.1-3 and Figure 3.1-3.

Table 3.1-3 Interview Locations

No.	Location Name
1	Gas Station at the intersection of Autostrad and Abbas El-Aqqad
2	Gas Station near the intersection of Autostrad and Ahmad Saeed Street
3	Gas Station at the intersection of Salah Salem and Fostat Street
4	Gas Station at the intersection of Ramsis Street and Ahmad Saeed Street
5	Gas Station at the intersection of Ramsis and Emad-El-Deen Steert

Figure 3.1-3 Interview Locations Map

3.1.3 Ramp Traffic Counting on Existing E1 and E2

(1) Survey Location

Survey stations were at all ramps on the existing E1 and E2 routes, excluding the stations already carried out with 18 hours traffic counting by recent traffic studies. To study daily expanding factor (24-hr vs 18-hr), traffic flows by direction at four cross-sections were counted for 24 hours. The survey locations are indicated in Figure 3.1-4.

Table 3.1-4 Number of Survey Points

Route	Ramp	Carriageway	Total
E1	28	4	32
E2	22	4	26
Total	**50**	**8**	**58**

(2) Survey Date and Time

The traffic counting were carried out during a weekday (Monday through Wednesday) after the Ramadan, when traffic volume variations are relatively small. The survey was conducted on a pair of ramps (on and off) in the same day.

- Ramps: One typical working day, from 6:00 hrs to 22:00 hrs (Monday through Wednesday)
- Carriageways: One typical working day, starting 6:00 hrs to 6:00 hrs of the next day.

(3) Vehicle Types

Seven vehicle types, same as the classification used in the intersection traffic counting, were also counted separately on the ramp traffic counting as shown in Table 3.1-5.

Table 3.1-5 Vehicle Categories

Vehicle Category	Description
1. Sedan/Wagon	Private Cars
2. Taxi	Taxis (Cairo taxis and intercity taxis)
3. Mini Bus	Shared Taxis, Public Minibuses, Private Minibuses
4. Bus	Public Buses (CTA, GCBC, governorate and intercity) Private Buses (school, company and tourist buses)
5. Light Cargo Vehicle	2-axle Trucks, Pickups and Vans
6. Heavy Cargo Vehicle	3-axle Trucks, Over 3-axle, Trailers and Semi-trailers
7. Motorcycle	2-wheeler, Others

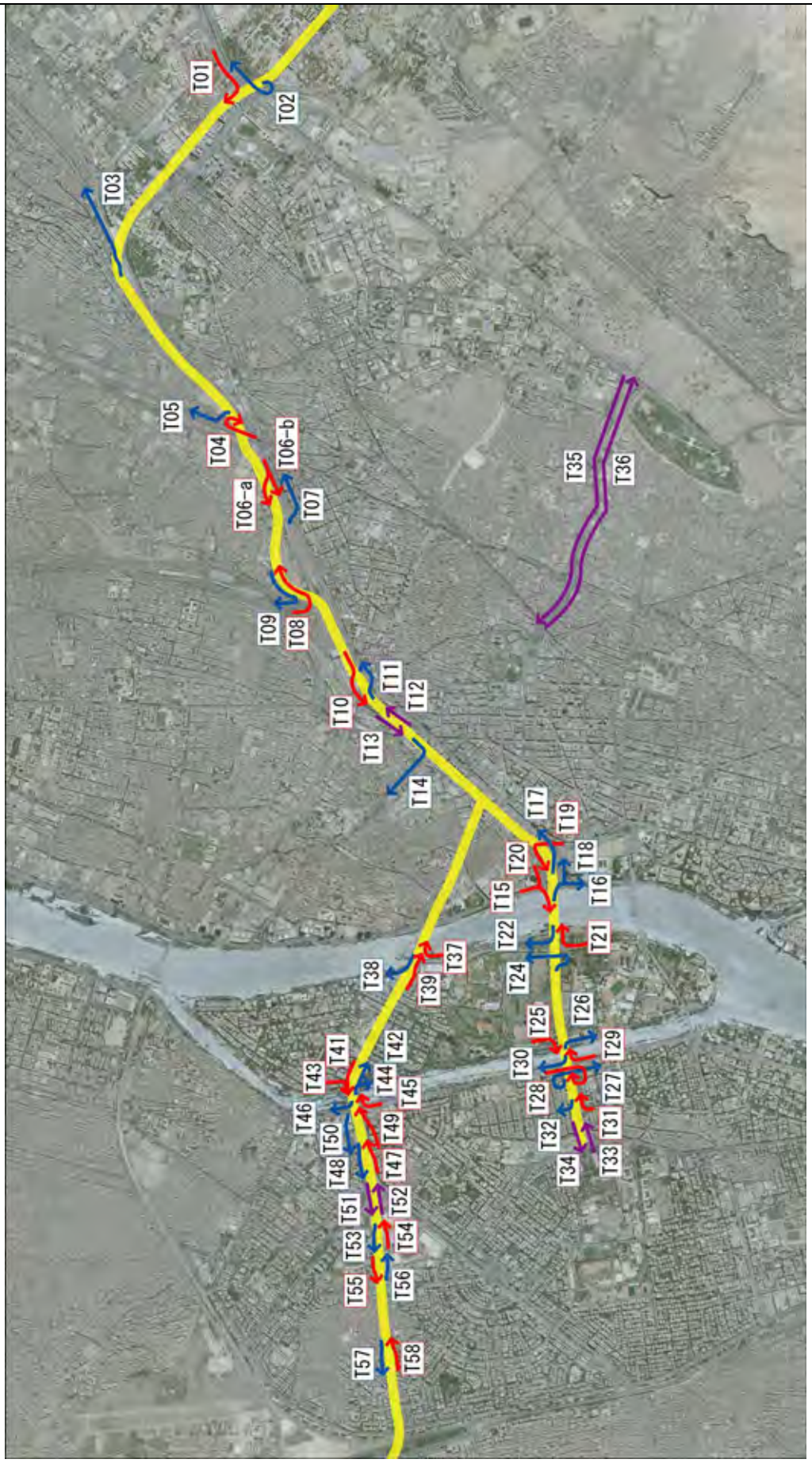


Figure 3.1-4 Location of Ramp Traffic Counting

3.2 ANALYSIS OF SUPPLEMENTARY TRAFFIC SURVEY

3.2.1 Analysis of Intersection Traffic Counting

(1) Total of In-flow Traffic Volume to Intersections

In the initial survey schedule, the traffic counting at each location should be carried out on the days before Ramadan (13 September 2007) and after Ramadan, respectively. However, due to delayed receipt of permission from the traffic police, the traffic counting on 15 locations had been carried out for two days after Ramadan.

Based on the summary of the traffic counting results shown in Table 3.2-1, significant trends such as increase or decrease of traffic volume between "before Ramadan" and "after Ramadan" could not be found. The difference in total volume at the same location is assumed to be from the traffic condition in the survey date, traffic accident, and/or broken vehicle on the road and so on.

Table 3.2-1 Total of In-flow Traffic Volume to Intersections

No.	Intersection Name	Total of In-flow Volume		
		Day 1	Day 2	Day 3
E1-01	AL NAHDA (6th of October Bridge / El Batal Ahmed Abdel Aziz / Wazaret Al Zerra)	168,443	144,880	
E1-02	Doqqi Square / Flyover (El Tahrir / Dokki Street)		148,107	148,034
E1-03	Cairo University (Sarwat / Gamiat El Qahira / Dokki Street)		180,636	182,309
E1-04	Abd Al Salam Arif / Sudan Street / Flyover		113,806	109,982
E2-01	E1 Highway (Exits/Entrances/Main Way) at North Tahrir / Galaa Street / Ramses Street		126,385	113,037
E2-02	15th of May Bridge East (26th of July Street / Corinch El Nile)		207,054	204,678
E3-01	El Nasr / Cairo Suez Road / Flyover	159,575	186,990	
E3-02	El Nasr Road / Abbas El Aqqad / Nozha		123,634	135,903
E3-03	El Nasr Road / El Tayaran		140,748	150,322
E3-04	Nair Road / Yousof Abbas		133,795	166,494
E3-05	Fangray / El Nair Road		139,787	171,322
E3-06	Imtedad Ramsis / El Nasr Road / Flyover	202,871	203,404	
E3-07	El Nasr Road / Ahmed Said / Al Amir Qaraqush		80,239	101,513
E3-08	Salah Salem / El Nasr Road / El Mokattm Road	236,375	241,806	
E3-09	Salah Salem / El Nasr Road next to E3-08	129,151	132,319	
E3-10	Sayyidah Ashah Square		158,669	160,097
E3-11	Magra El Ayoun / Salah Salem / Ain Al Sira		162,045	116,808
E3-12	Salah Salem / Corniche El Nil / Flyover		150,186	143,603
E3-13	Giza Bridge (Gamal Abd El Naser)		164,025	172,021
E3-14	Giza Square / Flyover		252,909	230,989

Note: Day 1 - Before Ramadan; Day 2 & Day 3 - After Ramadan

(2) Result of Intersection Turn Movements by Location

In Appendix 3, the results of the intersection turn movements by location and survey date are summarized in the corresponding tables and figures.

3.2.2 Analysis of Affordability to Pay Interview Surveys

(1) Number of Samples Accomplished

A total of 526 samples were interviewed, as indicated in Table 3.2-2.

Table 3.2-2 Number of Samples Accomplished for the Affordability to Pay Interview Surveys

No.	Location Name	No. of Samples	%
1	Autostrad and Abbas El-Aqqad	148	28.10
2	Autostrad and Ahmad Saeed Street	106	20.20
3	Salah Salem and Fostat Street	49	9.30
4	Ramsis Street and Ahmad Saeed Street	79	15.00
5	Ramsis and Emad-El-Deen Street	144	27.40
	Total	**526**	**100.00**

(2) Characteristics of Drivers Interviewed

Vehicle Type

The actual number of each vehicle type sampled is presented in Table 3.2-3. Passenger cars represents majority of the sample (75%), followed by taxis (14%) and heavy trucks (9%).

Table 3.2-3 Number of Samples of ATS by Vehicle Type

Vehicle Type	No. of Samples	% in Sample
Passenger car	396	75.30
Taxi	74	14.10
Bus	10	1.90
Light truck	1	0.20
Heavy truck	45	8.60

Travel Time Fluctuation

Table 3.2-4 shows the distribution of travel time within the sampled drivers. About 30% of them had a travel time of more than 60 minutes, followed by about 27% for travel time between 20 and 40 minutes. In general, about half of them had less than 40 minutes travel time while the other half had more than 40 minutes.

Table 3.2-4 Number of Samples of ATS by Travel Time

Travel Time Distribution	No. of Samples	% in Sample
1-20 (min)	123	23.40
21-39 (min)	144	27.40
40-59 (min)	86	16.40
60 over (min)	161	30.60

Trip Frequency

Trip frequency is a measurement unit for how frequent road users make a relevant trip in a week, which might affect the regularity of traffic demand on the proposed urban expressway network. Table 3.2-5 presents the distribution of trip frequency made by interviewees. Majority of the respondents make their trips on working days only (35%), followed by daily (26%).

Table 3.2-5 Number of Samples of ATS by Trip Frequency

Frequency	No. of Samples	% in Sample
Daily (7 days)	138	26.20
Work days only	186	35.40
2-3 days	88	16.70
Once a week - rarely - just this time	114	21.70

Trip Purpose

Table 3.2-6 shows the distribution of different trip purposes among the total interviewed sample. The “job (work trips)” represents the highest share (60%), while the “home” represents a rather lower value (12%), which may be biased due to the time of the day when the interviews were made.

Table 3.2-6 Number of Samples of ATS by Trip Purpose

Trip Purpose	No. of Samples	% in Sample
Home	61	11.60
Job	318	60.50
Study	17	3.20
Business	52	9.90
Shopping	14	2.70
Freight Delivery	4	0.80
Social	19	3.60
Medical	3	0.60
Recreational	3	0.60
Others	35	6.70

Gender

The total number of males interviewed is 491, representing about 93% of the total sample size. On the other hand, the total number of females interviewed is 35, accounting for only 7% of the total sample size.

Table 3.2-7 Number of Samples of ATS by Gender

Gender	No. of Samples	% in Sample
Male	491	93.30
Female	35	6.70

Age

Ages of the persons interviewed ranged between 20-year-olds to over 60-year-olds. Table 3.2-8 shows the distribution of the ages among the interviewed samples. Almost one-third of them are in the 30 to 39 years old range, followed by the 20 to 29 years old range with 28%, 40 to 49 years old with 24%, 50 to 59 years old with 12%, and over 60 years old with 3%.

Table 3.2-8 Number of Samples of ATS by Age Group

Age Group	No. of Samples	% in Sample
20 ~ 29	148	28.10
30 ~ 39	171	32.50
40 ~ 49	128	24.30
50 ~ 59	64	12.30
> 60	15	2.90

Car Availability

The availability of car for the persons interviewed was categorized into the following five categories, namely, “Always”, “Often”, “Occasionally”, “Seldom” and “Not Available”. Table 3.2-9 shows the distribution of car availability in the sample. The maximum sampled percentage is observed in “Always”, with 76%, while the minimum sampled percentage is found in “Not Answer”, with less than 1%.

Table 3.2-9 Number of Samples of ATS by Car Availability

Car Availability	No. of Samples	% in Sample
Always	399	75.90
Often	91	17.30
Occasionally	29	5.50
Seldom	5	1.00
Not Answer	2	0.40

Driver Qualifications

Table 3.2-10 shows the distribution of academic qualifications among the interviewees. More than a half of them have a bachelor or diploma degree, followed by "Technical or Secondary School" certificate with 27%, and "No Qualification" with 10%. Others are "Primary or Elementary School" with about 5%, and "Doctor" and "Master" degrees with less than 3% each, respectively.

Table 3.2-10 Number of Samples of ATS by Academic Qualifications

Qualification	No of Sample	% in Sample
Doctor	13	2.50
Master	12	2.30
Bachelor or Diploma	281	53.40
Technical or Secondary School	140	26.60
Primary or Elementary School	28	5.30
No Qualification	52	9.90

Monthly Income

Table 3.2-11 illustrates the distribution of different income classes among the interviewed samples. It is expected that most of the respondents would refuse to report their real income class, which is not an uncommon response even in developed countries. In fact, majority of the respondents refused to disclose their income. Some have no income at all, such as students and jobless persons, and the total number of interviewees who refused to answer accounts for 42%.

On the other hand, based on the remaining distribution of the monthly income level with six classes emphasizes a logical distribution of income levels among the interviewed sample, in which income level of "501-1,000 LE" and "1,001-2,000 LE" represents 29% (50%) and 15% (26%), respectively. The poor "Less than 500 LE" and the rich "More than 10,000 LE" represented 6% (10%) and less than 1%, respectively.

Table 3.2-11 Number of Samples of ATS by Monthly Income

Monthly Income (LE)	No. of Samples	% in Sample
<500	32	6.10 (10.40)
501 ~ 1,000	154	29.30 (50.20)
1,001~ 2,000	80	15.20 (26.10)
2,001~ 5,000	31	5.90 (10.10)
5,001~ 10,000	8	1.50 (2.60)
>10,000	2	0.40 (0.70)
No Income and Refused to Answer	219	41.60

Note: (%) percentage means excluding "No Income and Refused to Answer

Electricity Bill

Some proxy variables have to be selected to substitute the expected lack of income data. The monthly electricity bill is one of the reliable indicators for such kind of proxies based on previous experience of home interview survey for CREATS. Table 3.2-12 shows the distribution of monthly electricity bill value among the persons interviewed. Much less percentage (10%) of the interviewed persons refused to provide information compared with 41% for who refused to report their income class. It is obvious that 40 % of interviewed sample are still paid only or less than 40 LE per month.

Table 3.2-12 Number of Samples of ATS by Electricity Bill

Monthly Electricity Bill (LE)	No. of Samples	% in Sample
10 ~ 20	59	11.20
21 ~ 40	157	29.90
41 ~ 60	90	17.10
61 ~ 80	78	14.80
81 ~ 100	50	9.50
101 ~ 1000	92	17.50

Parking Fee per Month

To determine the suitable toll fare, parking cost per month was surveyed. Table 3.2-13 shows the distribution of monthly parking cost among the respondents. About 70% of the drivers did not pay parking fees, but the average cost among those who pay is about 70 LE per month.

Table 3.2-13 Number of Samples of ATS by Parking Fee

Monthly Parking Fee (LE)	No. of Samples	% in Sample
No Pay	364	69.20
1 ~ 20	17	3.20
21 ~ 40	32	6.10
41 ~ 60	53	10.10
61 ~ 80	13	2.50
81 ~ 100	23	4.40
> 101	24	4.60

Affordability to Pay by Reduction Rate of Travel Time

The analyses, shown in Table 3.2-14, are the answers to “How much would you pay for reduction in travel time of today's trip by toll expressway?”, expressing the affordability to pay for the toll expressway.

In the situation of lesser travel reduction by toll expressway, such as 10% and 25%, two-thirds of drivers refused to use the toll expressway. On the other hand, according to the increase in reduction of travel time, such as 50% and 75%, the percentage of drivers who refused to drive

on a toll expressway, declined to one-third.

Amounts of affordability to pay in the each case were 1.19 LE for 10% time reduction, 1.75 LE for 25%, 2.23 LE for 50%, and 3.01 LE in 75%, respectively.

Table 3.2-14 Affordability to Pay by Reduction Rate of Travel Time

Time Reduction Rate	No.	1 LE	2 LE	3 LE	4 LE	5 LE	> 5 LE	Average
10 %	69.20	24.70	3.20	1.50	0.20	1.00	0.20	1.19
25 %	62.20	25.10	7.00	1.90	1.10	1.90	0.08	1.75
50 %	39.90	28.70	16.70	5.50	3.20	2.90	3.00	2.23
75 %	36.30	19.80	19.40	10.10	2.10	7.80	4.60	3.01

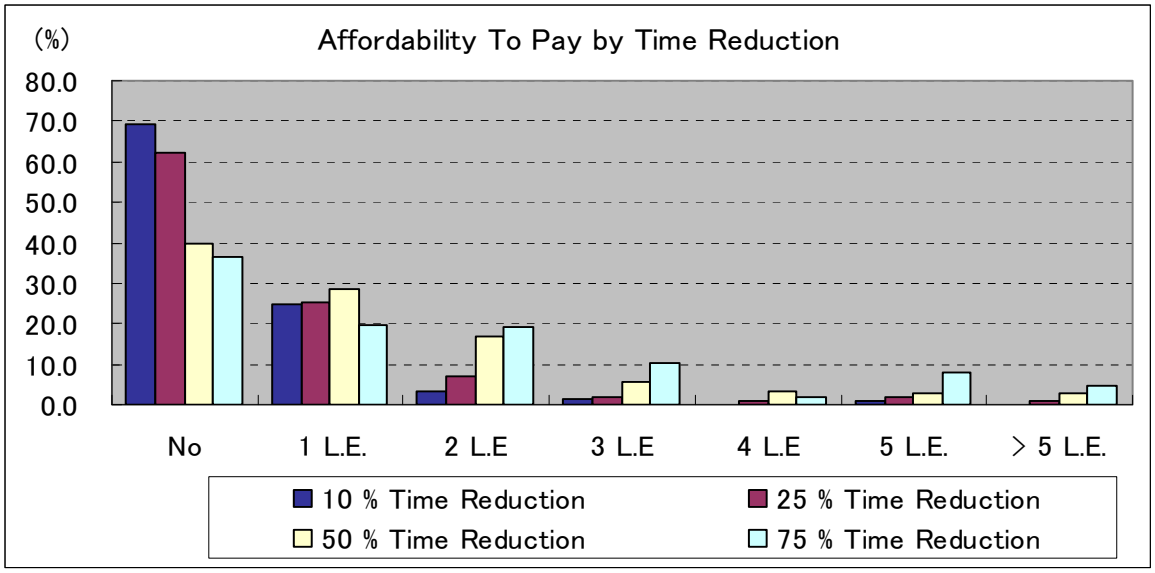


Figure 3.2-1 Affordability to Pay by Reduction Rate of Travel Time

Affordability-to-Pay for 25% Reduction on Travel Time

The most obvious outcome of this survey is that majority of the sample (62%) refused to pay any amount of money regardless of the expected benefits of introducing a better level of service, as shown in Figure 3.2-2. This observation can be expected and inferred as a logical result for road users who are not familiar with this kind of service, in addition to their resistance to pay additional cost for their trips. Consequently, it might be fair to say that this outcome is underestimated. On the other hand 25% and 7% of the total samples interviewed indicate that they would pay 1 LE and 2 LE, respectively, for a 25% reduction in their travel time.

Affordability-to-Pay for 50% Reduction in Travel Time

Similar to the response for 25% savings on travel time saving, Figure 3.2-3 indicates that about 40% of the interviewed samples have no intention to pay even for a 50% reduction in travel time, but reduced about point 20 from 25% time reduction case. On the other hand, about 29% and 17% of the total interviewed samples indicate that they would pay 1 LE and 2 LE, respectively, for a reduction of 50% in their travel time.

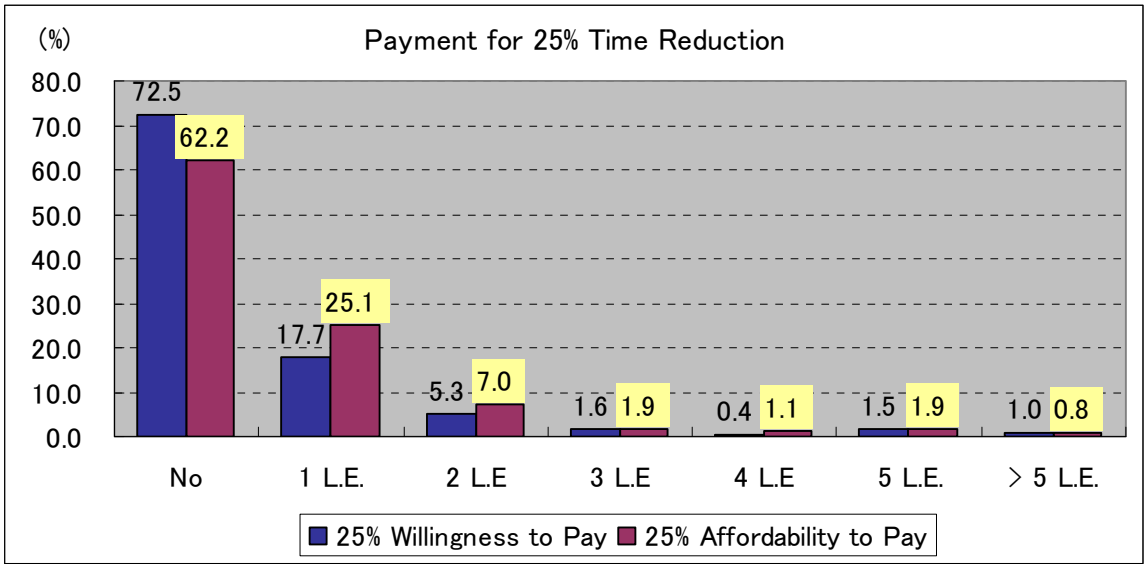


Figure 3.2-2 Comparison of Affordability to Pay and Willingness to Pay, Case 25%

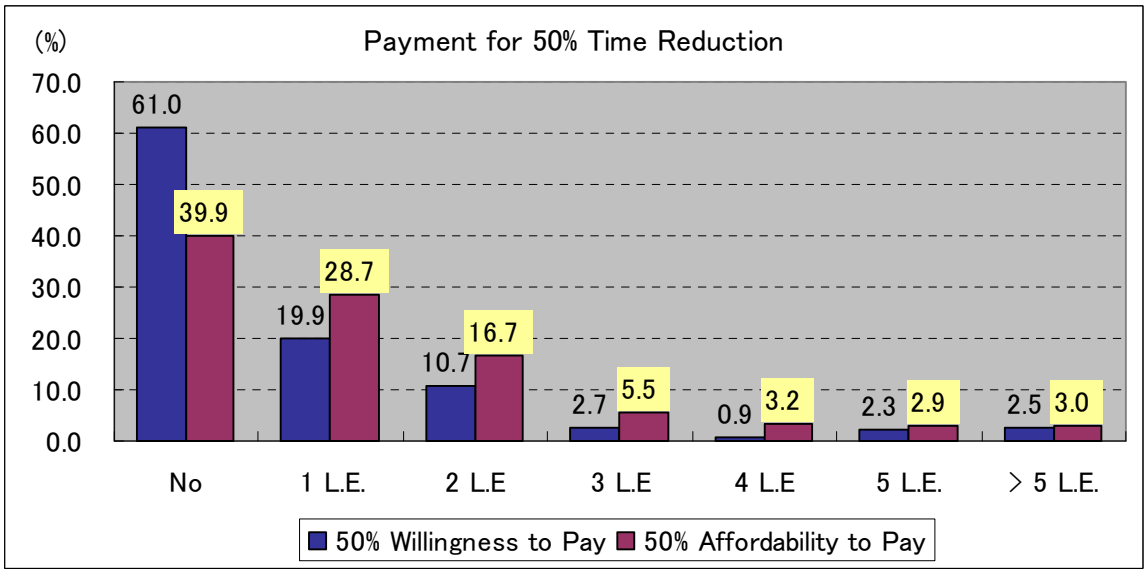


Figure 3.2-3 Comparison of Affordability to Pay and Willingness to Pay, Case 50%

Comparison of Affordability-to-Pay and Willingness-to-Pay

Table 3.2-15 shows the comparison between affordability and willingness to pay. The willingness to pay survey was carried out under the PPP study in 2005. The difference between affordability and willingness to pay surveys is that how to make a question. In ATP, with 25% or 50% time reduction, the person refused to pay is 62% and 40%, respectively, against 73% and 61% in case of WTP.

This supposed to be caused by the different definition among the affordability and willingness and also by the surveyed year. And if this is caused by the surveyed year, which may mean people in Egypt are becoming to get use to pay the toll for roads gradually, and which is also supported by percentage increases by who is intending to pay some amount of toll in almost all categories as shown in Table 3.2-15 as well as previous Figure 3.2-2 and Figure 3.2-3.

Table 3.2-15 Comparison between Affordability to Pay and Willingness to Pay (unit; %)

Time Reduction	Survey Name	No	1 LE	2 LE	3 LE	4 LE	5 LE	> 5 LE
25%	Willingness to Pay	72.50	17.70	5.30	1.60	0.40	1.50	1.00
	Affordability to Pay	62.20	25.10	7.00	1.90	1.10	1.90	0.80
50%	Willingness to Pay	61.00	19.90	10.70	2.70	0.90	2.30	2.50
	Affordability to Pay	39.90	28.70	16.70	5.50	3.20	2.90	3.00

Affordability to Pay by Stated Condition

One random case out of five different cases was introduced to each interviewee to determine his tendency to pay for pre-specified amounts of toll for six different alternatives of travel time savings. These cases are presented in Table 3.2-16.

Table 3.2-16 Affordability to Pay by Stated Condition

Case Name	Case 1A	Case 1B	Case 2A	Case 2B	Case 3A	Case 3B
Title	90 to 60	90 to 45	60 to 45	60 to 30	30 to 20	30 to 10
Travel Time by At-grade Road (min)	90.00	90.00	60.00	60.00	30.00	30.00
Travel Time by Toll Road (min)	60.00	45.00	45.00	30.00	20.00	10.00
Reduced Travel Time (min)	30.00	45.00	15.00	30.00	10.00	20.00
Reduced Travel Time (%)	33.30	50.00	25.00	50.00	33.30	66.70
No Use Toll Road (%)	21.10	20.00	33.50	25.90	37.60	30.00
Toll 1 LE (%)	17.70	8.40	17.10	10.80	26.00	16.70
Toll 2 LE (%)	20.30	16.30	19.80	18.80	19.20	21.10
Toll 3 LE (%)	13.10	12.50	12.00	12.70	7.00	11.60
Toll 4 LE (%)	8.00	10.30	5.50	9.90	2.70	4.90
Toll 5 LE (%)	14.60	15.20	8.00	10.80	4.80	8.20
Toll <5 LE (%)	5.10	17.30	4.20	11.00	2.70	7.40
Total	100.00	100.00	100.00	100.00	100.00	100.00
Average Toll (LE)	3.150	4.360	2.850	3.82	2.24	3.14

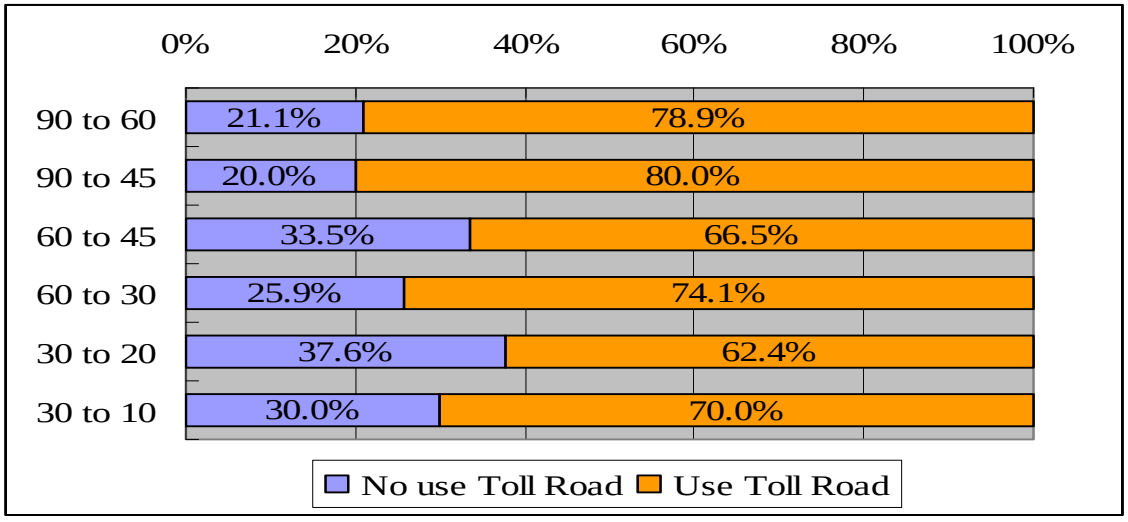


Figure 3.2-4 Affordability to Pay by Stated Condition (refuse or not)

The results drawn from the tables can be summarized as follows:

- The analysis indicates that 20% to 40% of the interviewed persons will not pay toll at any level of travel time reduction.
- This result shows the lower percentage for answering “No Use Toll Road” compared with the previous question which gives only the time reduction rate.
- By being given the stated condition, the interviewee could reply different choice. In other words, the drivers have the high affordability to pay for toll road by getting the image of the precise road condition.
- Reduction of travel time will have a great influence on increasing people's affordability to pay.

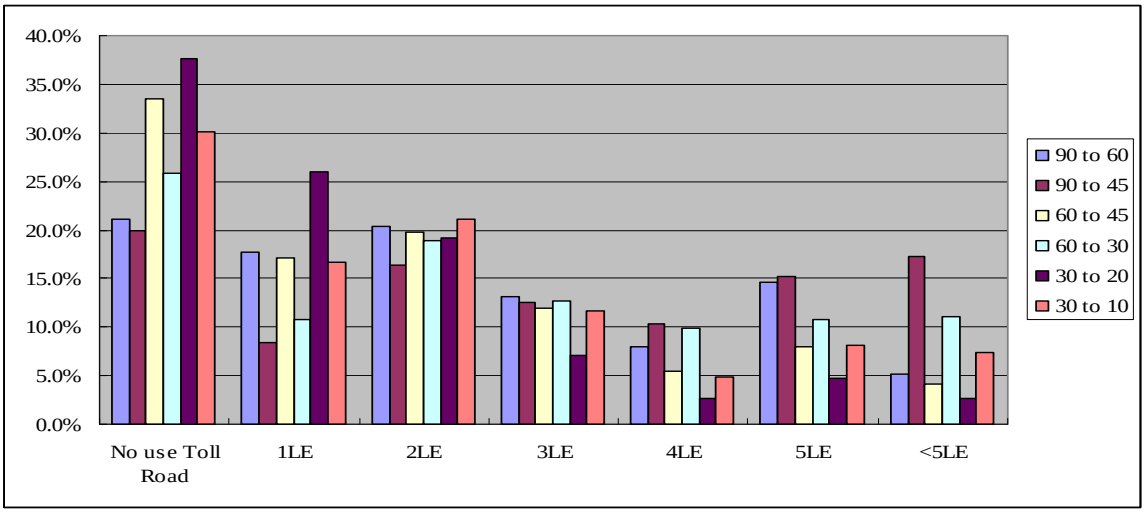


Figure 3.2-5 Affordability to Pay by Stated Condition (Distribution by Toll Fee)

3.2.3 Analysis of Ramp Traffic Counting

(1) Hourly Distribution

Details of traffic counting at the ramps and cross sections on expressways are included in Appendix 3. Data are presented in terms of hourly counting and histograms showing traffic patterns along the counting hours. As previously explained in the Methodology section, traffic counings were carried out for 18 hours (6:00 hrs to 24:00 hrs) at ramps and for 24 hours at cross sections on the expressways (5th of May Bridge, 6th of October Bridge and 26th of July Bridge).

Table 3.2-17 Hourly Distribution of Traffic Counting at Cross Sections

Cross Section	5th of May Bridge (Ramsis SQ)	6th of October Bridge (Doqi)	26th of July Bridge	Total	
06:00-07:00	3,255	2,370	1,618	7,243	2.0%
07:00-08:00	7,547	4,469	3,746	15,762	4.4%
08:00-09:00	12,347	7,200	4,245	23,792	6.7%
09:00-10:00	11,391	7,558	4,173	23,122	6.5%
10:00-11:00	10,049	7,564	3,491	21,104	6.0%
11:00-12:00	9,523	5,792	4,658	19,973	5.6%
12:00-13:00	9,337	5,169	4,760	19,266	5.4%
13:00-14:00	9,255	5,614	4,196	19,065	5.4%
14:00-15:00	11,000	4,250	3,902	19,152	5.4%
15:00-16:00	10,124	4,972	4,167	19,263	5.4%
16:00-17:00	10,103	5,202	3,920	19,225	5.4%
17:00-18:00	10,434	4,940	4,388	19,762	5.6%
18:00-19:00	8,799	5,007	3,516	17,322	4.9%
19:00-20:00	9,831	4,981	3,869	18,681	5.3%
20:00-21:00	9,305	4,890	3,684	17,879	5.0%
21:00-22:00	8,280	4,325	3,753	16,358	4.6%
22:00-23:00	8,383	4,775	3,498	16,656	4.7%
23:00-24:00	7,060	4,488	2,951	14,499	4.1%
00:00-01:00	5,692	2,920	1,521	10,133	2.9%
01:00-02:00	3,951	3,172	1,104	8,227	2.3%
02:00-03:00	1,993	1,802	684	4,479	1.3%
03:00-04:00	1,343	1,230	483	3,056	0.9%
04:00-05:00	980	741	297	2,018	0.6%
05:00-06:00	957	802	362	2,121	0.6%
Total	**180,939**	**103,056**	**70,281**	**354,276**	**100.0%**
24-hr / 18-hr	**1.090**	**1.114**	**1.065**	**1.092**	

Table 3.2-17 illustrates the traffic counting fluctuations at the three cross sections where traffic counting were continuously recorded for 24 hours. The 24-hour traffic at cross sections will be utilized to compute the ratio of 24-hour counting against 18-hour (6:00 hrs to 24:00 hrs) counting at intersections. The ratio will be the expansion factor for extrapolation of the other interchanges to calculate the daily volumes.

The overall average expansion factor of the entire 24-hr against 18-hr traffic counting becomes 1.092, which means the 24-hour counting is 9.2% more than the 18-hour counting.

A morning peak hour is observed between 8:00 and 9:00 with 6.7%, and an evening peak is observed between 17:00 and 18:00 with 5.6% peak hour ratio against daily traffic volume on those existing elevated expressways.

(2) Vehicle Type Composition

Vehicle types of the three cross sections at the expressways are represented in Figure 3.2-6 with vehicle base unit and PCU base unit. Table 3.2-18 summarizes the number of vehicles by vehicle type at the cross sections on existing expressways. The overall proportions of the different vehicle types are 77% passenger cars, 13% taxis, 5% microbuses / shared taxi, 0.8% standard bus, and 3% light trucks in vehicle base unit. The composition of heavy trucks is 0% because these are prohibited to drive on existing expressways.

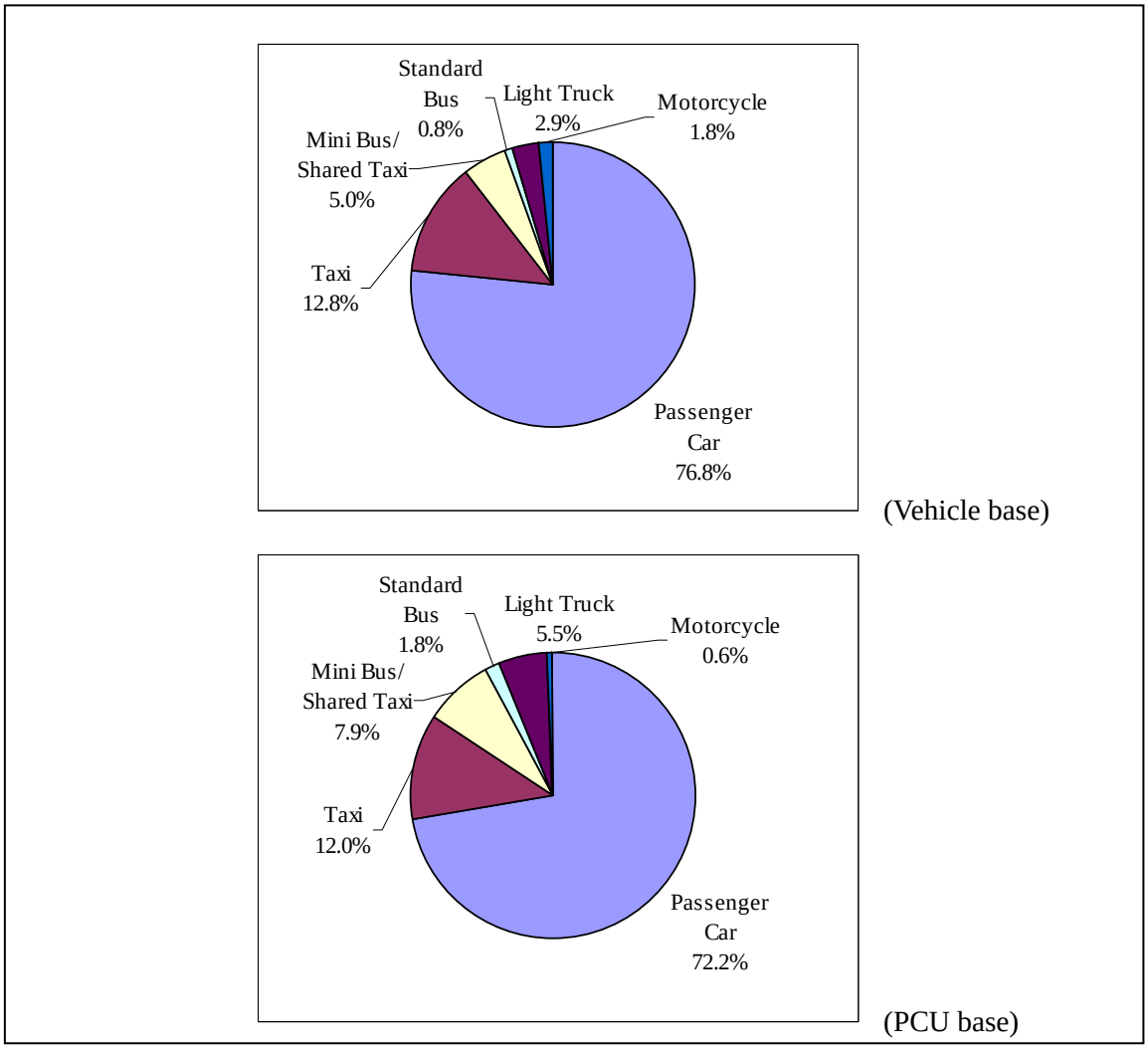


Figure 3.2-6 Vehicle Type Composition at Cross Sections of Existing Expressways

Table 3.2-18 Vehicle Type Composition at Cross Sections of Existing Expressways

Site	Direction	Number of Vehicles							
		Passen-ger Cars	Taxis	Mini Bus / Shared Taxi	Std. Bus	Light Trucks	Heavy Trucks	Motor-cycles	Total
5th of May Bridge (Ramsis SQ)	To Airport	70,733	7,644	2,854	619	2,230	0	1,381	85,461
	To Tahrer SQ	74,198	13,424	2,725	709	2,971	0	1,451	95,478
6th of October Bridge (Doqi)	To Tahrer SQ	36,697	7,993	1,299	390	1,147	0	889	48,415
	To Giza	40,349	8,505	3,066	325	1,661	0	1,092	54,998
26th of July Bridge (Mohandeseen)	To Lebanon SQ	30,225	5,245	4,103	283	1,753	0	998	42,607
	To Zamalek	22,187	2,782	3,695	379	752	0	584	30,379
Total	No. of Vehicles	274,389	45,593	17,742	2,705	10,514	0	6,395	357,338
Total	PCU	274,389	45,593	30,161	6,762	21,028	0	2,110	380,044
PCU Equivalent		1.0	1.0	1.7	2.5	2.0	2.5	0.3	-

(3) Traffic Volume at each Ramp of Existing Expressways

Table 3.2-19 and Figure 3.2-7 show the results of ramp traffic volume in each ramp. Turn No B1 to E1 are from the intersection traffic counting data.

Table 3.2-19 Traffic Flow of Expressway Ramps in January and February 2008

ID No.	Direction		Volume / 16 hrs	ID No.	Direction		Volume / 16 hrs
	To West	To East			To West	To East	
1	flow in		12,061	34	through		49,925
2		flow out	19,829	35	through		36,710
3		flow out	9,575	36		through	23,263
4	flow in		5,114	37		flow in	2,059
5		flow out	6,026	38	flow out		12,546
6-a	flow in		23,514	39		flow in	8,475
6-b	flow in		30,352	41	flow in		14,955
7		flow out	22,892	42		flow out	19,835
8		flow in	31,689	43	flow in		7,971
9	flow out		15,236	44		flow out	17,792
10	flow in		26,325	45		flow in	5,963
11		flow out	9,867	46	flow out		9,327
12		through	78,845	47		flow in	10,726
13	through		87,178	48	flow out		20,248
14	flow out		4,524	49		flow in	28,620
15	flow in		5,944	50	flow out		5,581
16		flow out	10,778	51	through		39,902
17		flow out	33,803	52		through	28,633
18		flow out	10,052	53	flow out		6,503
19	flow in		27,849	54		flow in	4,040
20	flow in		20,022	55	flow in		15,542
21		flow in	10,275	56		flow out	19,213
22	flow out		10,591	57	flow out		14,982
24		flow out	9,737	58		flow in	10,592
25	flow in		16,554				
26		flow out	5,545				
27		flow in	17,386				
28	flow out		18,125				
29		flow in	19,566				
30	flow out		11,880				
31		flow in	7,984				
32	flow out		7,789				
33		through	43,641				

Note: Flow In - Traffic entering Expressway, Flow Out - Traffic exiting Expressway; Through - Traffic on Expressway at Cross Section

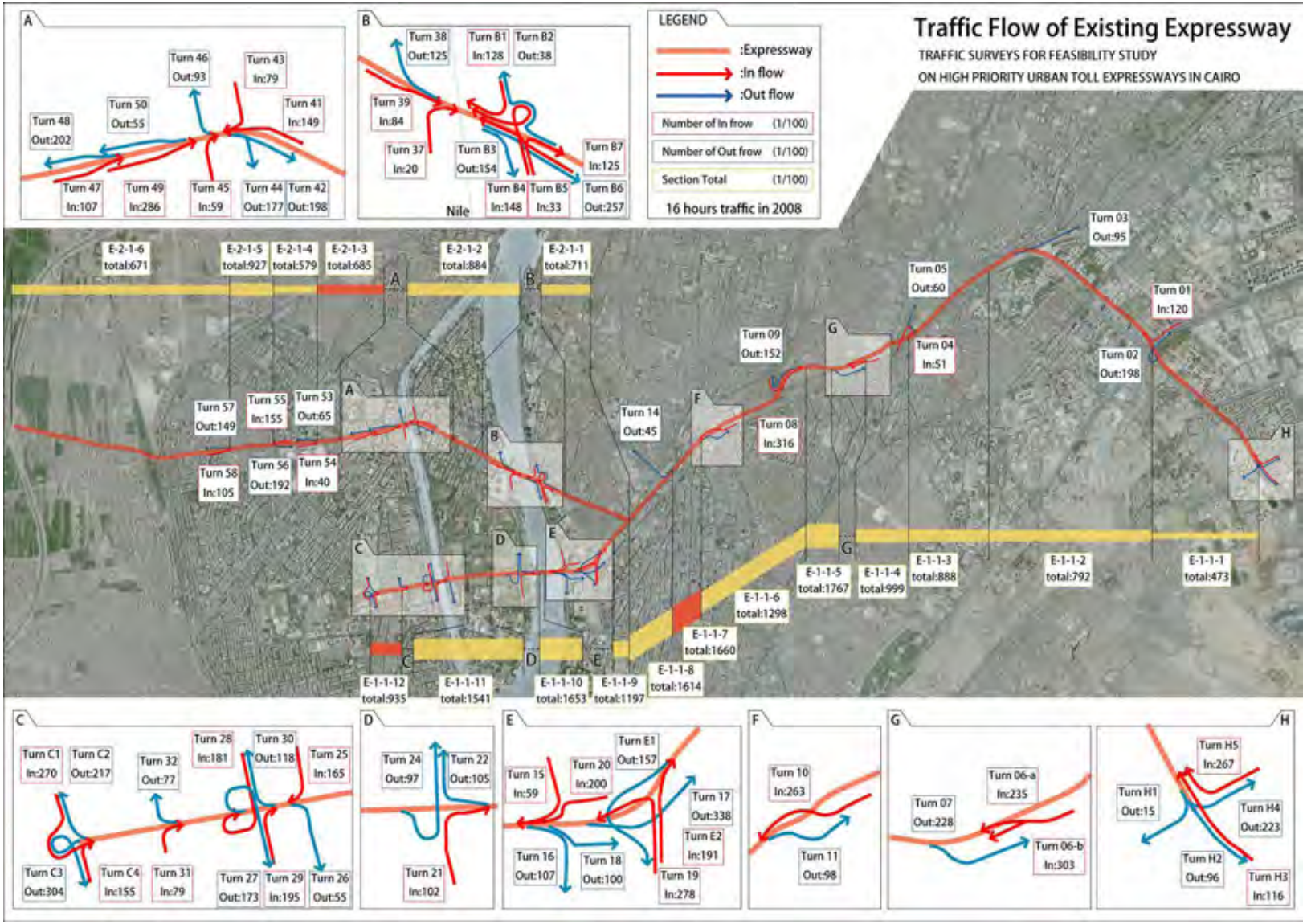


Figure 3.2-7 Traffic Flow of Ramp Traffic Counting

Note; Turn No from Alphabet + No, like, Turn C1 is from the results of Intersection Traffic Counting

3.3 FUTURE TRAFFIC DEMAND

3.3.1 Methodology and Assumption of Traffic Demand Forecasting

(1) Methodology

To estimate the traffic volume on the planned expressway network, traffic counting and affordability-to-pay interview surveys in the GCR area was fully utilized. Traffic counting data are used to analyze the present traffic characteristics and to revise present OD tables by vehicle category. Affordability-to-pay interview data are used to decide the parameter of traffic assignment model on the expressways. Then, the forecasted person trips based on CREATS and SDMP are converted to the future OD tables for target years 2012, 2017, 2022 and 2027, respectively by vehicle category.

Traffic volumes are assigned first on the existing, on-going and committed road networks without the F/S expressway network, which is the case of "Base-Case". Next, traffic volume which will be handled in the future on the high priority expressway network are determined, which is the case of "With Project Case"

(2) Traffic Demand Model Structure

CREATS forecasted the traffic demand based on the transport model framework shown inFigure 3.3-1, using a predicted future socio-economic framework. The transport model framework employs a conventional 4-step approach which has been well-tried and found to be effective in many cities around the world. The current SDMP study also follows the same procedure as CREATS, and estimates the future traffic demand by using the same models as CREATS. This study basically follows the same model structures as the CREATS and SDMP Models.

The 4-step approach consists of a series of nested and cascading sub-modals:

- Trip End Models (Trip Generation and Attraction Model): Estimating the "amount" of travel and where it begins and finishes;
- Trip Distribution Model: Linking the trip ends together to form trips between the origins and destinations;
- Modal Split Model: Accessing the modal shares of the available travel modes; and,
- Assignment Model: Assigning traffic volume of each segment on the highway and road networks.

The main thrust of the model is targeted at representing the travel demand of the residents of the Greater Cairo Region and their usage of private and public transports. Goods vehicles

and the travel crossing the boundary of the study area (external travel) are “added-in” prior to the traffic assignment.

Estimates of goods vehicle travel were derived from the CREATS survey data, adjusted to reflect the observed travel patterns obtained from the traffic counting undertaken at many locations throughout the city. Forecasts of future goods vehicle traffic have been based on general growth and the assumed employment distribution.

External travel is derived in the base year from the cordon roadside interview stations which were located adjacent to the Study Area boundary. In the current study, cordon survey data obtained from CREATS were adjusted for economic growth until 2007 and used as input data.

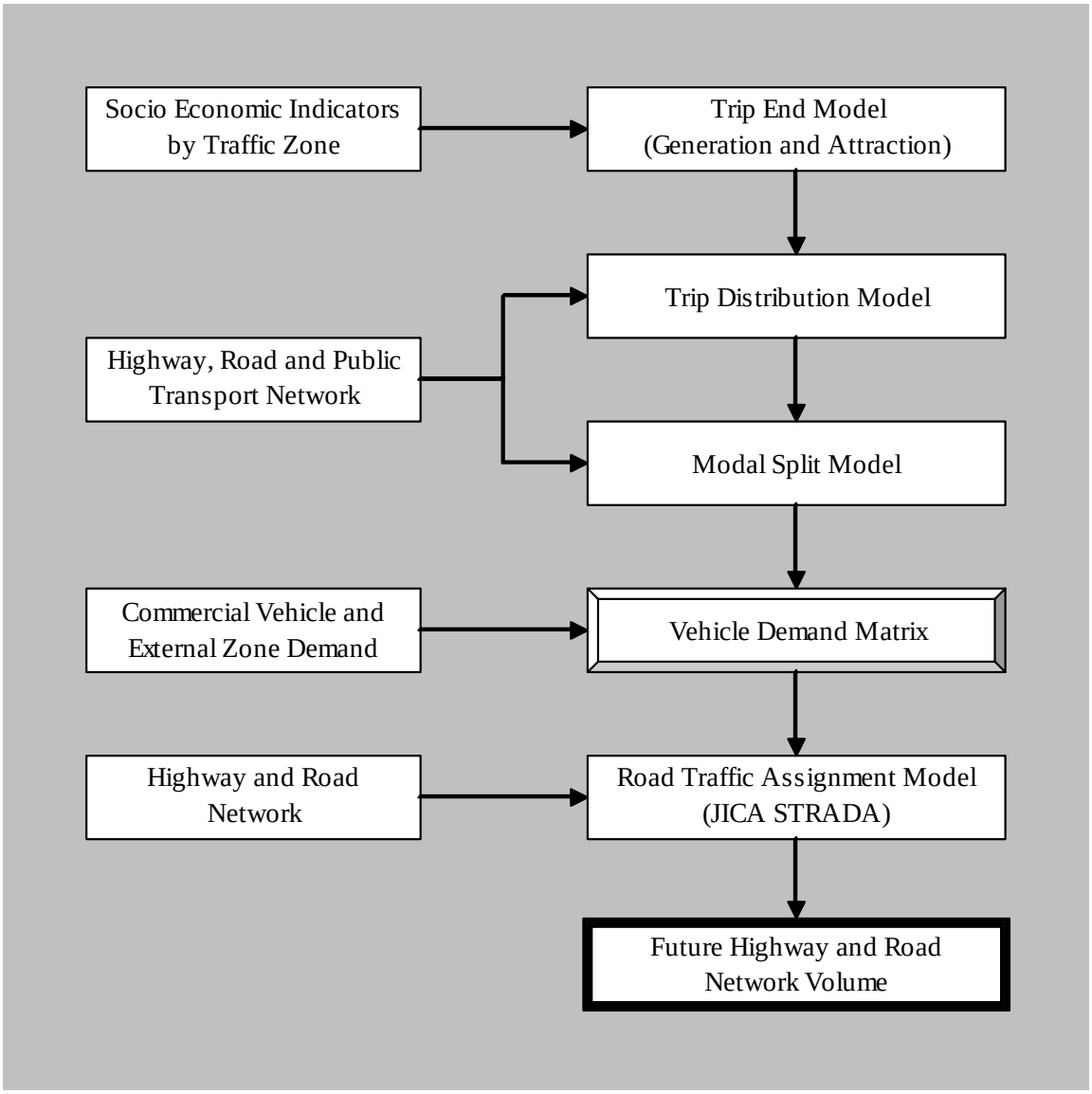


Figure 3.3-1 Transport Model Framework

(3) Planning Framework for the Whole Study Area

Vehicle Ownership

Vehicle ownership by household income is tabulated from the Household Interview Survey (HIS) database in CREATS, shown in Table 3.3-1. Household income obtained from the HIS is obviously smaller than actual. So, hereafter, the HIS household income is considered only as an income indicator. The high rise in car ownership for households above the LE 400 household income indicator shows that LE 400 is the threshold for private car ownership.

Table 3.3-1 Monthly Income Indicator and Car Ownership

Monthly Income Indicator (LE)	Car Ownership		
	Own	Not Own	Ownership
< 200	683	10,826	0.06
201 - 300	1,630	9,268	0.15
301 - 400	2,115	4,274	0.33
401 - 500	1,340	868	0.61
501 - 1,000	492	154	0.76

Table 3.3-2 represents the various indices to estimate car ownership rate in 2007, which was done as follows:

- It was assumed that increase in total number of cars is predictable from the sum of increases in population, household income indicators, and due to “other reasons”.
- In other developing countries and/or regions, car ownership rate sometimes increased drastically, more than the sum of population growth and GRDP growth, especially when such country and/or region has crossed above mentioned threshold income level or experienced newly introduced cheaper way to own cars.
- The number of registered private cars in the GCR was 843,820 in 2000 and 1,011,293 in 2005. It increased by 19.8% in five years and annual growth rate became 3.7%.
- During the same period, population in the GCR was 14,254,126 in 2000 and 14,961,971 in 2005. It increased by 4.97% in five years and annual growth rate became 0.97%.
- In addition, Household Income Indicator (HHII) representing the growth of GRDP of the three Governorates during the same period was LE 185 in 2000 and LE 241 in 2005. It was 30.3% increase in 5 years and growth rate became 5.4% in annual basis.
- If first assumption was correct, growth rate of number of cars should be more than sum of growth rates of population and household income indicator, however 3.7% is less than 6.4% which obtained from 1.0% plus 5.4%.
- The number of registered cars per one thousand population (net car ownership rate) in the GCR was 59.2 in 2000 and 67.6 in 2005, respectively. It was 14.2% increase in 5 years and growth rate became 2.7% in annual basis.
- This net car owner ship growth rate of 2.7% was just a half of above HHII growth rate

of 5.4%.

- From those indicators, we have concluded that GCR was facing some kind of difficulties to encourage owning cars due to other reason such as chaotic traffic jams in GCR.
- Instead of working for increasing net car ownership rate, "other reasons" in GCR was working for decreasing net car ownership rate as following way;
- 1.0 (Population Factor) + 5.4 (Income Factor) – 2.7 (Discourage Factor) = 3.7

Table 3.3-2 Yearly Change of Car Ownership related Indicators

Items	2000	2005	Note
Number of Registered Private Cars	843,820	1,011,293	Three Governorates
Growth Index (Cars)	1.000	1.198	2005/2000
Annual Growth Rate (Cars)	3.7%		2000 - 2005
Population ('000)	14,254	14,962	Three Governorates
Growth Index (Population)	1.000	1.050	2005/2000
Annual Growth Rate (Population)	0.97%		2000 - 2005
HH Income Indicator (HHII)	185	241	Estimated from GRDP
Growth Index (HHII)	1.000	1.303	2005/2000
Annual Growth Rate (HHII)	5.4%		2000 - 2005
Net Car Ownership Rate	59.2	67.6	Unit / '000 Population
Growth Index (Ownership)	1.000	1.142	2005/2000
Annual Growth Rate (Ownership)	2.7%		2000 - 2005

- On the other hand, recent trend of number of registered private cars in GCR indicated that such discouragement is no longer effective, despite the same or worse condition of traffic jams or recent oil crisis, owing to continuous active economic growth and recent introduction of private loan system in Egypt.
- Increases of car usage due to HHII growth and population growth are built-in to the trip generation function. Only the increases or decreases due to "other reasons" must be considered as the parameter adjusting net car ownership.
- Once above-mentioned "Discourage Factor" is cleared, at least net car ownership growth will reach the same level as HHDI growth. In this case, "Discourage Factor" is assumed to be "zero" (nil). The "Encourage Factor" should be applied based on the recent statistical data, and further research.

Total Population

Planning framework for the study area was formulated in terms of population, economy, and social development as follows:

- Population: Total population in the study area will be 24.2 million in 2027 with the incremental population of 8.1 million for the period 2007-2027. According to the

population structure proposed by CDC, the share to the total of the population who are15 years or older will increase from 71% in 2006 to 78% in 2027.

- GRDP and GRDP per capita: the GRDP will increase with the annual growth rate of 8% in the period of 2006~2012 as proposed in the Sixth Five Year Plan. Following the proposed growth rate in the Long-term Vision, the high growth rate will remain and slow down to 6% in 2022~2027. This strong growth will contribute to increase the GRDP per capita to an average growth rate at 5% per year.
- Employment: Unemployment rate will be improved from 7% in 2006 to 5% in 2027. This improvement will provide more than seven million workers in 2027.
- Education Enrolment: An attendance rate for primary education will continue at 100% in 2027, while that of preparatory and secondary education will improve to 100% as proposed in the Sixth Five Year Plan. The enrolment rate for the universities will be improved to 50%. As a result, the total number of students in the study area will be 5.8 million in 2027.

The planning framework for the study area until 2027 is summarized in Table 3.3-3.

Table 3.3-3 Planning Framework of the Study Area until 2027

Indicator			Unit	2006	2007	2012	2017	2027
Population	Total 1)		1,000	16,101	16,464	18,411	20,369	24,192
	Annual Growth Rate		%	2.22 (96-06)	2.25 (06-07)	2.26 (07-12)	2.04 (12-17)	1.61 (22-27)
	Age Structure (<5 / 5-14 / 14<)		%	10/19/71	10/18/72	9/17/74	8/16/76	7/15/78
Economy	GRDP		Million LE	164,372	177,521	260,837	365,837	670,757
	Annual Growth Rate		%	-	8 (06-07)	8 (07-12)	7 (12-17)	6 (22-27)
	GRDP per Capita		LE per capita	10,209	10,782	14,167	17,960	27,726
	Labor Force 4)		1,000	4,613	4,777	5,506	6,316	7,761
	Unemployment		%	7	6	6	5	5
	No. of Workers	Primary	1,000	260	266	306	349	427
		Secondary	1,000	1,667	1,741	2,014	2,311	2,824
		Tertiary	1,000	2,384	2,467	2,876	3,323	4,126
		Total	1,000	4,310	4,475	5,196	5,982	7,378
Education	Enrolment Rate (Pri/Prep/Sec/Univ)		%	100/50/ 58/37	100/52/ 59/37	100/63/ 61/40	100/71/ 71/44	100/100/ 100/50
	No. of Students	Primary	1000	1,827	1,828	1,963	2,075	2,333
		Preparatory	1000	479	501	675	847	1,281
		Secondary	1000	593	612	709	914	1,334
		University	1000	504	519	565	646	877

Source: SDMP

Population Distribution

Based on the selected future growth pattern, the population distribution by "Shiakha", like a community zone unit, was estimated for the target year of 2027 together with the intermediate years of 2007, 2012, 2017, and 2022. The method for determining the population distribution is summarized hereunder.

- The growth curves for each "Shiakha" were set up from two starting points (1996 and 2006) up to the maximum population capacity for each "Shiakha".
- The maximum capacity was set to the highest density of existing built-up areas for all "Shiakha" in the main agglomeration and to the highest density of existing built-up areas for the other areas (new urban communities and villages and small towns).

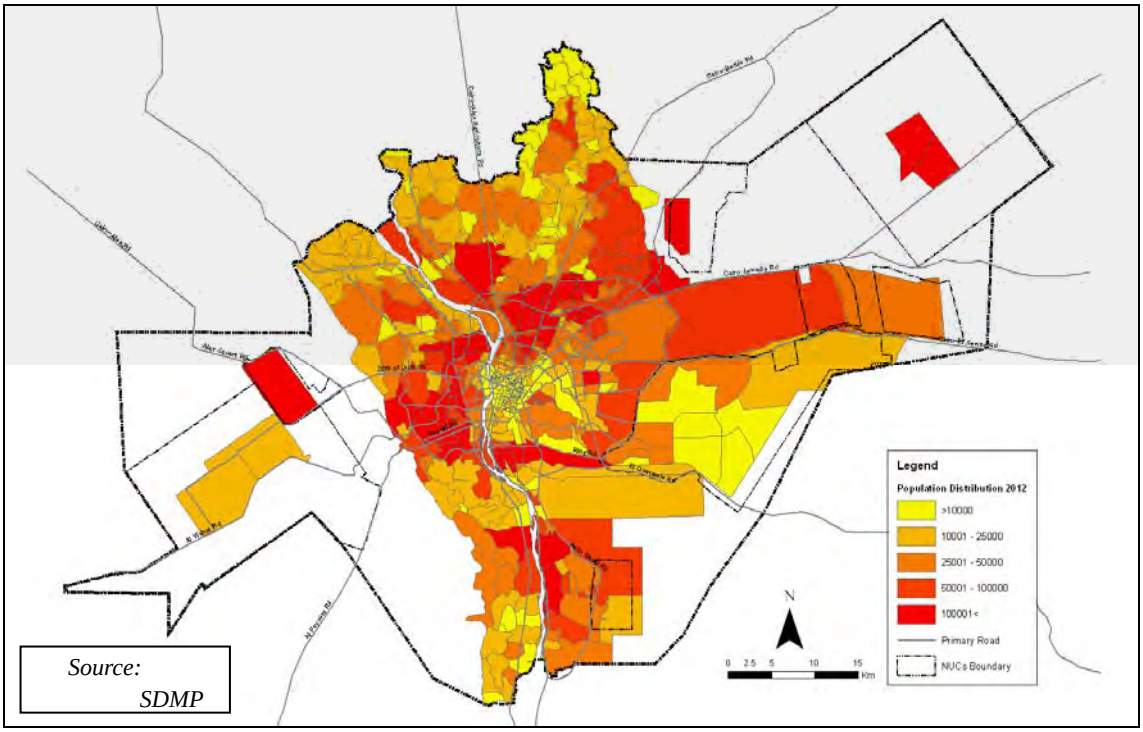


Figure 3.3-2 Population Distribution by Shiakha in 2012

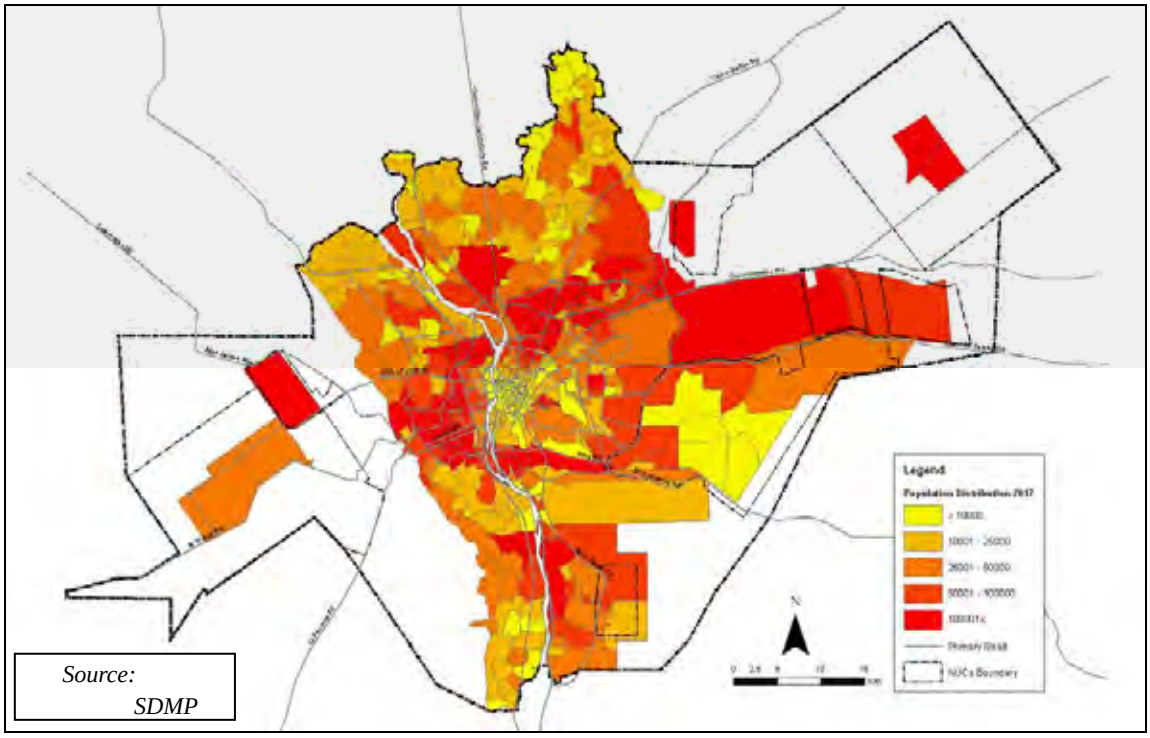


Figure 3.3-3 Population Distribution by Shiakha in 2017

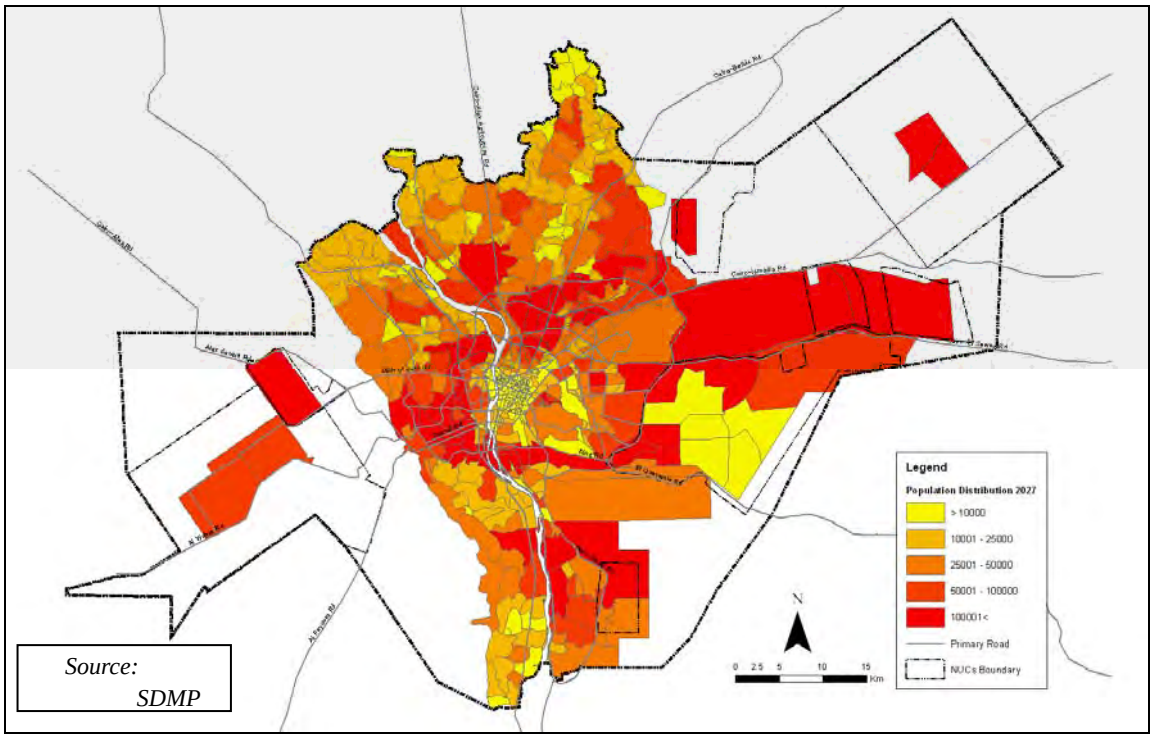


Figure 3.3-4 Population Distribution by Shiakha in 2027

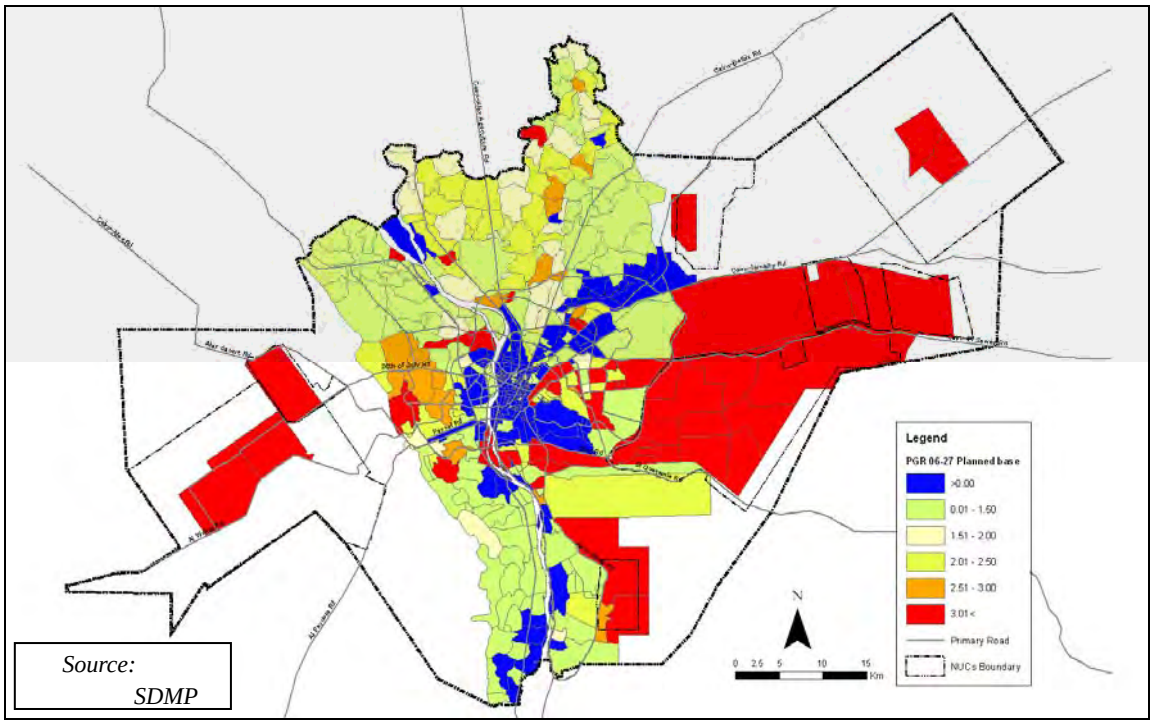


Figure 3.3-5 Average Population Growth Rate by Shiakha in 1996~2027

Employment Distribution

The estimated number of workers employed in primary industry in the Study Area was distributed according to the area of agricultural land by "Shiakha". Secondary industry workers were classified into two categories: (1) the industrial workers on the local job level, which was considered to be proportional to the population and (2) the workers at factories. In this Study, the former is defined as "non-manufacturing" and the latter as "manufacturing". Workers in the tertiary industry were also classified into two categories: (1) the "local job level" and (2) "others", in a similar way to that used for the secondary industry.

Student Distribution

The number of students in primary, preparatory, and secondary education was presumed to follow the population distribution in the Study Area. High educational facilities, such as university, are concentrated in Cairo and Giza, and some of universities are shifting to areas outside the main agglomeration in the New Urban Communities (NUCs). To mitigate the further concentration in the main agglomeration, the new universities will be encouraged to locate in NUCs, such as New Cairo and 6th of October City.

(4) Population Distribution by Sector Zone

Population Distribution discussed above are summarized on a large zone basis (Sector Zone), as shown in Table 3.3-4 to Table 3.3-9.

Table 3.3-4 Projected Population of Greater Cairo (Over 6 Years of Age) for 2007~ 2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	212,574	441,470	751,699	1,120,364	1,449,364
2	Imbaba Markaz	1,660,231	2,057,377	2,341,873	2,539,466	2,684,164
3	Dokki	1,345,855	1,375,369	1,392,886	1,409,739	1,429,463
4	Giza	1,532,983	1,641,374	1,733,653	1,844,470	1,974,991
5	South Giza	525,737	548,502	562,591	574,496	590,495
6	Helwan	806,093	855,146	896,085	937,043	995,041
7	Maadi	1,038,498	1,216,145	1,394,566	1,524,869	1,655,522
8	Khaleafa	850,018	889,611	927,466	937,678	951,550
9	CBD	407,156	402,299	399,583	389,553	384,529
10	Shobra	1,029,514	1,038,096	1,050,047	1,040,147	1,041,766
11	Masr El Gedeeda	879,293	891,072	911,527	947,948	976,786
12	Nasr City	1,019,609	1,245,899	1,517,150	1,944,114	2,355,577
13	Ain Sham	1,017,588	1,145,003	1,266,927	1,338,631	1,401,467
14	Sadam City	844,972	806,700	780,886	746,741	725,064
15	Shobra El Kheima	1,042,303	1,153,583	1,245,672	1,333,275	1,406,107
16	Qalyob	874,049	998,681	1,104,810	1,199,685	1,270,396
17	Qanater	1,241,229	1,493,999	1,778,883	2,064,134	2,313,704
18	10th of Ramadan	136,538	210,288	312,719	441,503	586,024
	Total	**16,464,242**	**18,410,613**	**20,369,022**	**22,333,857**	**24,192,009**

Source: SDMP

Table 3.3-5 Projected Number of Employed Primary Industry Workers for 2007~2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	2,318	2,581	2,876	3,208	3,424
2	Imbaba Markaz	62,742	69,846	77,826	86,811	92,682
3	Dokki	470	523	583	650	694
4	Giza	29,292	32,608	36,334	40,529	43,269
5	South Giza	27,170	30,246	33,702	37,593	40,135
6	Helwan	5,846	6,791	7,804	8,811	9,526
7	Maadi	12,882	14,967	17,198	19,418	20,992
8	Khaleafa	47	55	63	71	77
9	CBD	0	0	0	0	0
10	Shobra	3	3	3	4	4
11	Masr El Gedeeda	21,130	24,549	28,209	31,850	34,432
12	Nasr City	1,101	1,280	1,470	1,660	1,795
13	Ain Sham	2	3	3	3	4
14	Sadam City	956	1,110	1,276	1,440	1,557
15	Shobra El Kheima	10,916	12,916	15,060	17,211	18,985
16	Qalyob	36,585	43,286	50,472	57,681	63,628
17	Qanater	54,908	64,964	75,749	86,569	95,495
18	10th of Ramadan	91	105	120	135	146
	Total	**266,457**	**305,831**	**348,746**	**393,643**	**426,845**

Source: SDMP

Table 3.3-6 Projected Number of Employed Secondary Industry Workers for 2007~2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	99,374	123,309	161,980	216,238	253,079
2	Imbaba Markaz	76,133	94,828	108,013	115,496	118,213
3	Dokki	85,947	85,258	84,869	83,945	81,921
4	Giza	112,923	116,168	117,107	116,550	117,809
5	South Giza	34,862	36,378	36,468	35,361	35,437
6	Helwan	201,608	211,346	217,272	218,634	219,008
7	Maadi	109,655	134,539	159,984	182,488	202,035
8	Khaleafa	70,383	84,949	99,060	109,620	116,325
9	CBD	40,472	45,998	51,236	54,797	56,633
10	Shobra	82,365	96,833	110,574	120,742	127,244
11	Masr El Gedeeda	91,253	104,770	118,209	132,775	142,005
12	Nasr City	146,091	178,575	216,804	270,138	313,546
13	Ain Sham	66,541	90,177	114,943	135,422	149,705
14	Sadam City	59,264	66,273	72,490	76,524	78,603
15	Shobra El Kheima	98,684	111,009	122,362	133,241	137,063
16	Qalyob	65,921	79,821	93,261	106,188	112,184
17	Qanater	130,018	158,069	191,567	226,344	251,238
18	10th of Ramadan	169,617	195,889	234,745	281,154	312,416
	Total	**1,741,114**	**2,014,189**	**2,310,943**	**2,615,658**	**2,824,464**

Source: SDMP

Table 3.3-7 Projected Number of Employed Tertiary Industry Workers for 2007~2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	22,966	49,274	79,199	119,219	148,995
2	Imbaba Markaz	149,677	195,891	230,141	260,690	277,289
3	Dokki	259,433	256,473	261,978	268,097	270,822
4	Giza	207,846	214,020	227,989	245,471	258,674
5	South Giza	39,401	41,237	44,786	48,880	51,174
6	Helwan	92,751	119,090	144,859	167,624	185,382
7	Maadi	114,565	154,870	198,270	231,984	257,160
8	Khaleafa	141,339	164,549	186,483	199,303	208,012
9	CBD	314,017	314,065	314,139	299,293	291,417
10	Shobra	130,143	153,691	176,739	190,206	198,199
11	Masr El Gedeeda	236,522	262,000	288,031	328,446	351,503
12	Nasr City	225,160	284,465	362,749	493,023	599,532
13	Ain Sham	113,286	149,810	187,416	214,379	232,024
14	Sadam City	88,923	103,786	118,244	126,425	130,360
15	Shobra El Kheima	136,346	143,973	157,751	171,645	180,329
16	Qalyob	78,691	91,556	105,770	119,390	127,948
17	Qanater	107,596	146,272	181,760	217,955	248,348
18	10th of Ramadan	8,660	31,027	56,361	83,855	109,247
	Total	**2,467,324**	**2,876,050**	**3,322,666**	**3,785,884**	**4,126,414**

Source: SDMP

Table 3.3-8 Projected Number of School Students (Secondary and Technical School) for 2007~2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	4,273	13,006	31,346	57,814	90,664
2	Imbaba Markaz	29,185	56,299	94,297	129,419	167,907
3	Dokki	32,286	44,023	60,316	73,712	89,419
4	Giza	33,518	49,928	73,023	95,273	123,545
5	South Giza	13,535	18,642	25,354	30,635	36,938
6	Helwan	38,550	38,258	41,776	43,352	47,096
7	Maadi	37,845	43,843	56,281	65,773	78,357
8	Khaleafa	39,140	37,100	40,544	41,807	45,037
9	CBD	32,482	26,598	24,408	20,770	18,200
10	Shobra	38,504	38,647	43,443	45,426	49,307
11	Masr El Gedeeda	52,332	46,844	47,247	46,337	46,232
12	Nasr City	40,963	45,746	60,662	82,220	111,491
13	Ain Sham	47,677	51,250	60,171	63,220	66,332
14	Sadam City	26,779	27,163	30,588	31,884	34,318
15	Shobra El Kheima	50,325	55,442	66,445	74,560	83,615
16	Qalyob	39,108	44,936	56,334	65,651	75,545
17	Qanater	50,865	63,555	87,232	110,699	137,586
18	10th of Ramadan	5,054	8,212	14,280	22,115	32,722
	Total	**612,422**	**709,490**	**913,748**	**1,100,667**	**1,334,313**

Source: SDMP

Table 3.3-9 Projected Number of University Students for 2007~2027

	Sector	2007	2012	2017	2022	2027
1	6th of October	19,785	27,367	27,750	55,420	101,384
2	Imbaba Markaz	0	1,945	8,596	12,324	12,673
3	Dokki	0	2,705	10,266	13,629	13,525
4	Giza	242,577	245,382	253,753	258,288	259,158
5	South Giza	0	50	181	231	222
6	Helwan	0	1,682	6,605	9,059	9,415
7	Maadi	0	2,392	10,279	14,742	15,664
8	Khaleafa	0	1,750	6,836	9,065	9,003
9	CBD	4,006	4,797	6,951	7,772	7,644
10	Shobra	4,389	6,431	12,129	14,445	14,246
11	Masr El Gedeeda	247,990	250,041	254,853	258,422	261,070
12	Nasr City	0	8,865	13,462	42,331	86,335
13	Ain Sham	0	2,252	9,338	12,941	13,260
14	Sadam City	0	1,586	5,756	7,219	6,860
15	Shobra El Kheima	0	2,269	9,181	12,889	13,304
16	Qalyob	0	375	1,647	2,441	2,597
17	Qanater	0	4,374	6,573	21,554	44,813
18	10th of Ramadan	0	414	2,305	4,268	5,545
	Total	**518,746**	**564,676**	**646,460**	**757,040**	**876,720**

Source: SDMP

(5) Road Traffic Assignment Model

Road Traffic Assignment Procedure

Various assignment techniques are usually used ranging from manual methods for small tribulations to complex iterative procedures by computer programs. In this study, the capacity restraint assignment model which is the most straightforward for use in network models, and the most efficient particularly where the number of zones in the trip matrix is large, is employed. This assignment technique is based on the speed – flow relationship, and the flow chart of the applied methodology is shown in Figure 3.3-6.

In this assignment technique, and by calculating the required travel time for each link according to its travel speed and road conditions, the program determines the fastest routes between each origin and destination by evaluating the consuming time on links, and assigns the trips between the given origin and destination to these routes starting at the destination and working back to the origins. As congestion increases till a certain level, alternative routes are introduced to handle the unassigned traffic. Zone-to-zone routing is built, which is the fastest path from each zone to any other, and all trips are assigned to these optimum routes.

Since the link-travel time varies with the traffic volume of vehicles using that link, which can be explained as a degree of link congestion, the OD tables are divided to apply an iteration procedure on five stages. At each iteration, and depending upon the current link loadings, the flows are divided between all the shortest routes generated and a new travel time is computed for the average assigned link flow at each pass. The iteration continues to re-estimate the speed on that links considering the assigned traffic on links, and to produce alternative routes so that more accurate allocation can be achieved. The accumulated assigned traffic volume from each OD pair on the links composes the total assigned traffic volumes per direction for the network.

To do above-described tasks, the traffic simulation software created by JICA in association with engineering consulting firms called JICA-STRADA is used to estimate future traffic volumes in GCR for not only along existing at-grade and/or elevated road networks, but also newly proposed urban toll expressway networks as well as Ring Road and outer links.

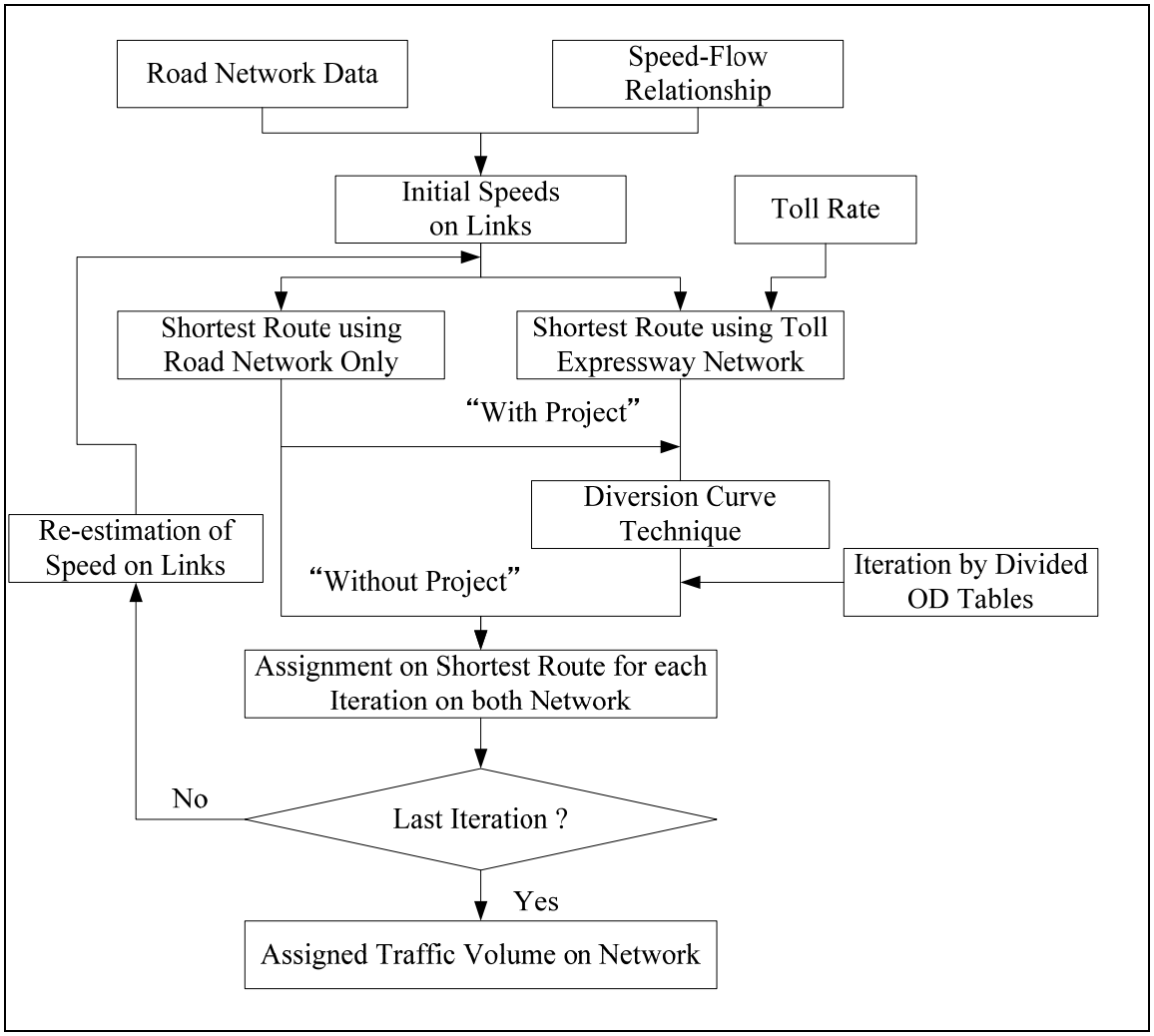


Figure 3.3-6 Traffic Assignment for Cairo Metropolitan Road Network

Passenger Car Units (PCUs)

Vehicle demand/capacity is expressed in terms of passenger car units (PCUs). In this study, the assumption of the CREATS for PCUs was applied without amendment, as shown in Table 3.3-10.

Table 3.3-10 Passenger Car Units (PCUs)

Vehicle Type	Motorcycle	Light Vehicle (1)	Small Truck(2)	Medium Truck (3)
PCU	0.33	1.00	2.00	2.50
Vehicle Type	Large Truck (4)	Micro Bus (5)	Mini Bus	Standard Bus
PCU	3.00	1.50	2.00	2.50

Note: (1) Light Vehicle: Cars, Pick-ups, Taxis, Vans; (2) Small Trucks: Two-axle Trucks; (3) Medium Trucks: Three-axle Trucks; (4) Large Trucks: More than Three Axles; (5) Micro Bus: Shared Taxis

Source: CREATS Final Report Vol. 2, 2003

Road Capacity

Mid-block road capacity with interrupted flow conditions was adopted in traffic assignment simulations. Table 3.3-11 shows the capacity of each road class under the different circumstances and conditions used in this study, quoting from the CREATS.

Table 3.3-11 Road Capacity Assumptions

Facility Type (1)	Road Condition (2)	Curb Parking	Capacity (PCU/hour/direction) (3)			
			Core	Urban	Suburban	Rural
Two-way, 2 lanes	Wide	No	770	870	880	950
		Yes	540	650	700	*(4)
	Standard	No	600	680	690	740
		Yes	420	510	550	*
	Narrow	No	450	510	520	560
		Yes	320	380	410	*
One-way, 2 lanes	Standard	No	1,690	2,090	2,310	*
		Yes	1,440	1,830	2,080	*
One-way, 4 lanes	Standard	No	3,580	4,320	4,720	*
		Yes	3,220	3,970	4,430	*
Two-way, 4 lanes	Undivided	No	1,580	1,970	2,190	2,280
		Yes	1,340	1,720	1,970	*
	Divided	No	1,780	2,200	2,430	2,540
		Yes	1,510	1,930	2,190	*
Two-way, 6 lanes	Undivided	No	2,500	3,050	3,350	3,420
		Yes	2,250	2,800	3,150	*
	Divided	No	2,820	3,410	3,730	3,800
		Yes	2,540	3,140	3,500	*
Expressway	Four lanes	No	2,990	2,990	2,990	2,990
	Six lanes	No	4,490	4,490	4,490	4,490

Source: CREATS Final Report Vol. 2, 2003

Free Flow Speed

Free-flow speeds of roads vary depending on facility type and urban environment, ranging from under 30 kph for two-lane CBD roads to some 80 kph for multi-lane roads situated in rural or outlying areas. Urban expressways, whose design criteria remain consistent, are shown as possessing free-flow speed profiles of up to 100 kph. Free-flow speeds assumed in this study are summarized in Table 3.3-12.

Table 3.3-12 Link Free-flow Speed

Road Operation (1)	Free-flow Speed by Environment (kph) (2)			
	Core	Urban	Suburban	Rural
Two-way, 2 lanes	25-30	30-40	40-50	50-60
Two-way, 4 lanes	35-45	45-60	60-70	70-80
Two-way, more than 4 lanes	45-55	55-65	65-75	75-85
Expressway	80-90	80-90	90-100	90-100

Notes: (1) For the entire carriageway. For example, two-way and six lanes represent two-way flow with three lanes in each direction; (2) Range in speed based on reasonable variation in lane width.

Source: CREATS Final Report Vol. 2, 2003

Speed–Flow Relationship

The speed–flow relationship used in the traffic assignment procedure is shown in Figure 3.3-7. This approximate relationship is based on the CREATS data and used in PPP Study as well.

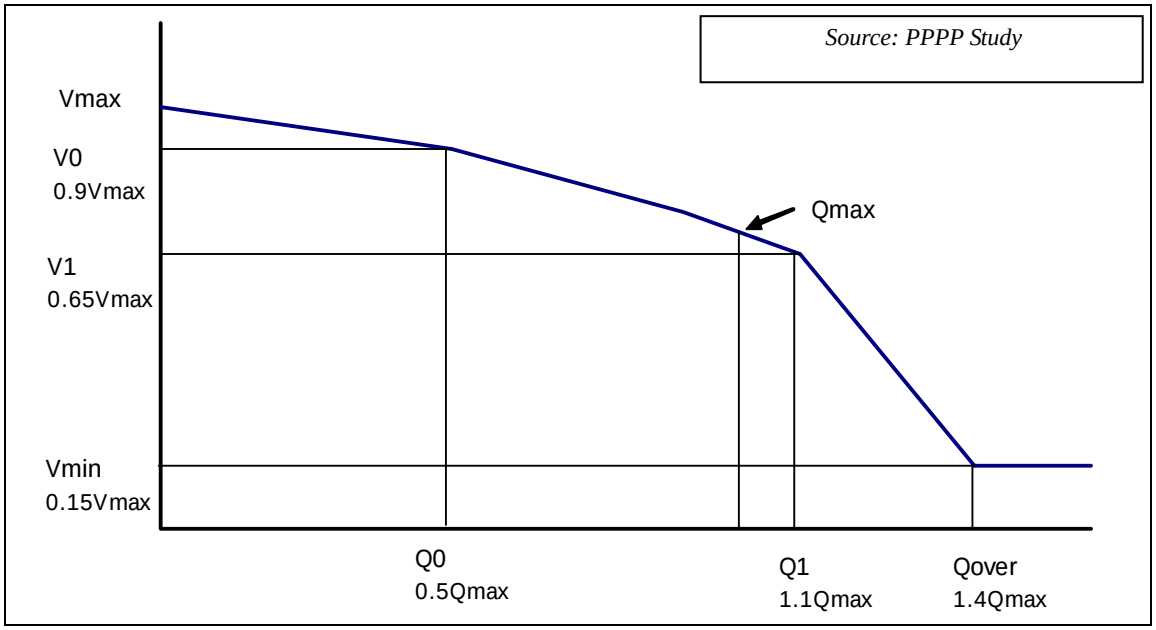


Figure 3.3-7 Speed–Flow Relationship

Diversion Curve Model

The diversion curve model was used in the study to estimate the proportion of traffic volumes diverted from the future road network to the new toll expressway network. The factors having the greatest influence on the routes taken by drivers are the comparative travel time and distance.

The diversion curve model used in AASHTO is chosen for the study. The model is used also in Tokyo Metropolitan Expressway Public Corporation (MEX) and for other toll urban expressways in Japan. This formula is based on the AASHTO one, which is widely used for freeways in the United States.

The JICA Study Team adjusted this formula for the Cairo Metropolitan Expressway based on the result of the affordability-to-pay and willingness-to-pay survey in PPP Study. Parameter γ is settled by the growth of economy (see Table 3.3-13). The model structure revised for Cairo Metropolitan Expressway is as follows:

$$p = \left(\frac{1}{1+\alpha X^{\beta}}\right)\gamma$$

where:

p	:	Diversion Rate
X	:	Time Difference (TH / TG)
TH	:	Inter-zonal time distance using toll road in minutes (including fare resistance calculated by time evaluation time)
TG	:	Inter-zonal time distance using ordinary road in minutes
α, β, γ	:	Parameters, which have the following values

Table 3.3-13 Parameters of Diversion Curve for Cairo Expressway

Year	α	β	γ	Time Value (LE/hrs)
2005	3.0	6.0	0.57	6.50
2007			0.60	7.00
2012			0.75	8.60
2017			0.88	10.00
2022			1.00	11.50
2027			1.10	12.50

Peak Hour Factors

Time distributions based on the traffic counting data on existing highways (E1 and E2) is re-shown in Table 3.3-14 (as same as in previous Table 3.2-17). The peak hour (8:00 hrs to 9:00 hrs) rate is 6.7%.

Table 3.3-14 Peak Hour Traffic Volumes and Times of Peak Hour

Cross Section	5th of May Bridge (Ramsis SQ)	6th of October Bridge (Doqi)	26th of July Bridge	Total	
06:00-07:00	3,255	2,370	1,618	7,243	2.0%
07:00-08:00	7,547	4,469	3,746	15,762	4.4%
08:00-09:00	12,347	7,200	4,245	23,792	6.7%
09:00-10:00	11,391	7,558	4,173	23,122	6.5%
10:00-11:00	10,049	7,564	3,491	21,104	6.0%
11:00-12:00	9,523	5,792	4,658	19,973	5.6%
12:00-13:00	9,337	5,169	4,760	19,266	5.4%
13:00-14:00	9,255	5,614	4,196	19,065	5.4%
14:00-15:00	11,000	4,250	3,902	19,152	5.4%
15:00-16:00	10,124	4,972	4,167	19,263	5.4%
16:00-17:00	10,103	5,202	3,920	19,225	5.4%
17:00-18:00	10,434	4,940	4,388	19,762	5.6%
18:00-19:00	8,799	5,007	3,516	17,322	4.9%
19:00-20:00	9,831	4,981	3,869	18,681	5.3%
20:00-21:00	9,305	4,890	3,684	17,879	5.0%
21:00-22:00	8,280	4,325	3,753	16,358	4.6%
22:00-23:00	8,383	4,775	3,498	16,656	4.7%
23:00-24:00	7,060	4,488	2,951	14,499	4.1%
00:00-01:00	5,692	2,920	1,521	10,133	2.9%
01:00-02:00	3,951	3,172	1,104	8,227	2.3%
02:00-03:00	1,993	1,802	684	4,479	1.3%
03:00-04:00	1,343	1,230	483	3,056	0.9%
04:00-05:00	980	741	297	2,018	0.6%
05:00-06:00	957	802	362	2,121	0.6%
Total	**180,939**	**103,056**	**70,281**	**354,276**	**100.0%**
24-hr / 18-hr	**1.090**	**1.114**	**1.065**	**1.092**	

Source: JICA Study Team (surveyed in January and February 2008)

3.3.2 Future Vehicle Traffic Demand

(1) Vehicle Trip Generation

For the evaluation of road capacity, the number of vehicles is used (i.e., the number of vehicles making trips). The generated numbers of vehicle trips are shown in PCU base. In comparison with CREATS, the new estimate under this study is 6,833 thousand trips against 6,328 thousand trips of CREATS in 2022 with about 8% increase.

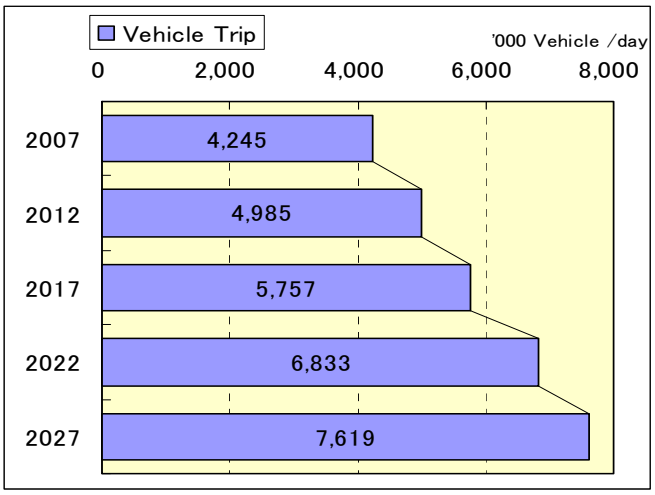


Figure 3.3-8 Trend of Vehicle Trip Generation from GCR

Figure 3.3-9 and Table 3.3-15 show vehicle trip generation by sector zone and its break downs are shown in Table 3.3-16~Table 3.3-20, respectively.

According to those data, Giza, Doqi and Masr El Gedeeda are generating relatively large volume, Again 10th of Ramadan, 6th of October, Nasr City and New Cairo are generating remarkable volume because of their growth rate. However, Masr El Gedeeda exceeds Doqi by volume and Nasr City and New Cairo draw close to 6th of October in growth rate.

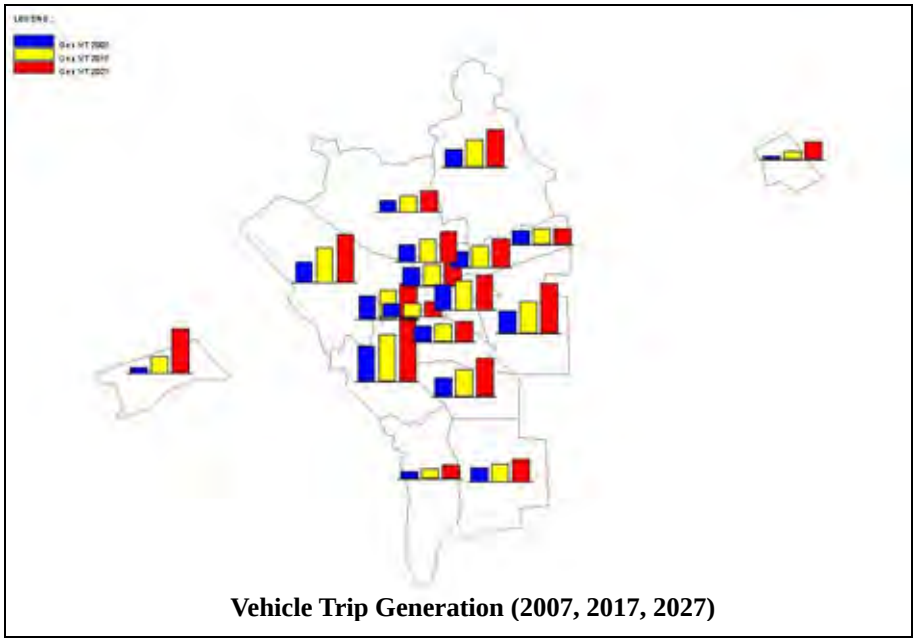


Figure 3.3-9 Trip Generation by Sector Zone Based on Vehicle Trip

Table 3.3-15 Trip Generation by Sector Zone Based on Vehicle Trip

(Unit: PCU)

No.	Name	2007	2012	2017	2022	2027
1	6th of October City	76,042	141,735	229,893	412,466	573,188
2	Imbaba Markaz	281,597	370,571	456,770	554,566	632,146
3	Doqi	308,593	349,155	389,724	434,638	476,427
4	Giza	464,444	534,950	607,626	697,743	786,705
5	South Giza	111,035	127,647	145,290	162,910	180,362
6	Helwan	197,349	223,608	246,905	276,122	306,983
7	Maadi	250,055	300,960	358,521	431,676	501,810
8	Khaleefa	204,802	215,983	234,719	254,237	272,850
9	CBD	185,536	175,606	186,794	196,715	208,277
10	Shobra	243,676	262,880	284,694	306,484	326,385
11	Masr El Gedeeda	338,238	361,447	385,673	427,708	458,666
12	Nasr City & New Cairo	298,785	351,738	416,727	548,872	650,578
13	Ain Shams	216,242	250,761	290,026	335,684	374,335
14	Salam City	183,587	198,395	201,371	202,805	207,803
15	Shobra El Kheima	229,565	270,003	306,849	354,961	392,634
16	Qalyob	164,292	194,436	220,735	256,106	284,240
17	Qanater	239,400	301,009	355,569	433,497	494,133
18	10th of Ramadan City	53,622	88,675	122,989	178,719	238,389
	Total	**4,046,860**	**4,719,559**	**5,440,875**	**6,465,909**	**7,365,911**

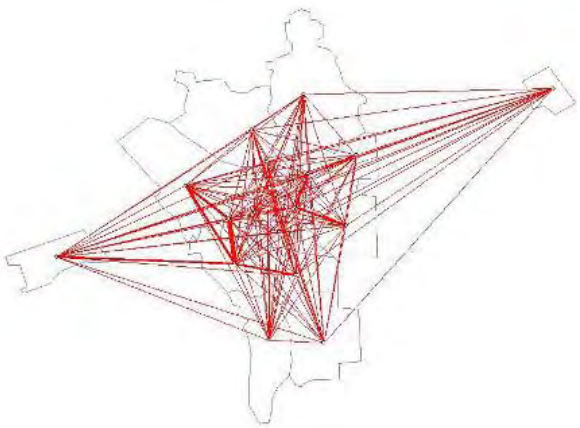
Vehicle Trip Distribution

The desire line of vehicle trips is shown in Figure 3.3-10. In order to see the change, the patterns of 2007, 2012, 2017, 2022 and 2027 are compared.

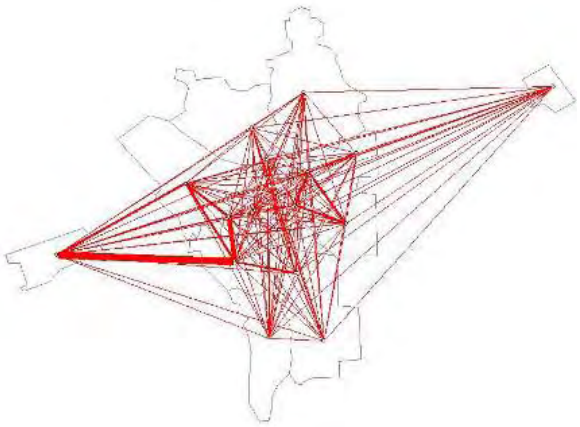
- The trip distribution pattern in 2007 shows that the main movement of traffic is in a south-north direction. Traffic forms the Giza block (line structured by Imbaba, Doqi and Giza Zones) and the West block (line structured by Shobra, Masr El Gedeeda and Nasr City-New Cairo Zones). Both lines meet at CBD and Shobra and flow to Shobra El Kheima and Qalyob.
- In 20 years (from 2007 to 2027), the main movement of traffic will shift to a west-east direction. The Giza block grows to the triangle including 6th of October. The West block also grows by merging the 2007 West block and Qanater and 10th of Ramadan.
- When looking into the traffic distribution, the new concept of a trunk road connecting 10th of Ramadan and 6 of October through CBD and Giza may be studied.

Year 2007

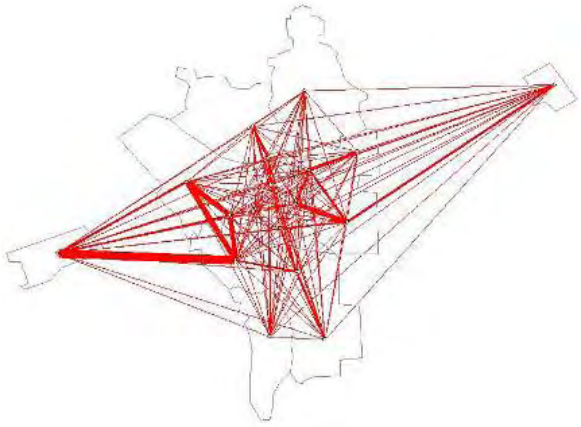
Year 2012



Year 2017



Year 2022



Year 2027

Figure 3.3-10 Desire Line

Table 3.3-16 Vehicle Trip OD Table in 2007

VT OD 2007

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
		6th of Octorber City	Imbaba Markaz	Doqi	Giza	South Giza	Helwan	Maadi	Khaleefa	CBD	Shobra	Masr El Gedeeda	Nasr City & New Cairo	Ain Shams	Salam City	Shobra El Kheima	Qalyob	Qanater	10th of Ramadan City	External Zone	
1	6th of Octorber City	19,397	6,058	4,650	18,173	2,287	1,297	2,967	2,617	2,725	2,215	1,753	1,670	975	1,073	1,005	848	576	352	5,404	76,042
2	Imbaba Markaz	6,060	135,059	34,739	32,571	2,225	2,638	5,788	5,999	8,028	7,797	7,778	5,283	3,482	2,734	4,951	4,870	2,253	1,039	8,303	281,597
3	Doqi	4,651	34,735	67,154	54,059	4,973	6,909	13,660	13,939	16,277	15,857	16,845	9,616	7,596	4,779	11,490	7,632	5,762	698	11,961	308,593
4	Giza	18,175	32,566	54,056	157,176	19,579	12,615	27,445	24,501	18,691	15,348	16,739	12,557	7,293	5,175	11,061	6,885	5,288	732	18,562	464,444
5	South Giza	2,287	2,224	4,972	19,570	49,204	6,855	3,859	3,703	2,094	1,594	2,345	3,098	826	570	1,107	606	584	319	5,218	111,035
6	Helwan	1,297	2,633	6,898	12,596	6,845	90,296	23,457	7,561	5,923	4,211	6,649	6,245	3,255	2,419	3,064	1,851	1,888	869	9,392	197,349
7	Maadi	2,967	5,788	13,650	27,436	3,855	23,476	72,441	22,853	12,975	8,623	15,017	12,130	5,571	3,926	4,745	3,350	3,145	802	7,305	250,055
8	Khaleefa	2,618	5,998	13,938	24,495	3,704	7,572	22,857	31,005	12,088	10,088	17,307	20,665	7,995	5,130	5,684	2,107	3,152	718	7,681	204,802
9	CBD	2,726	8,027	16,277	18,690	2,092	5,927	12,977	12,087	16,600	16,423	16,458	11,054	8,441	5,860	10,206	5,080	4,833	818	10,960	185,536
10	Shobra	2,215	7,798	15,856	15,350	1,594	4,213	8,627	10,089	16,423	47,821	25,658	14,020	12,799	8,930	17,072	9,902	8,617	1,442	15,250	243,676
11	Masr El Gedeeda	1,751	7,793	16,840	16,735	2,345	6,649	15,016	17,316	16,451	25,653	61,154	42,911	30,858	21,730	15,876	8,381	15,700	2,163	12,916	338,238
12	Nasr City & New Cairo	1,663	5,251	9,610	12,533	3,077	6,098	12,079	20,635	11,052	14,013	42,881	75,745	21,693	16,836	11,297	4,941	9,569	5,929	13,883	298,785
13	Ain Shams	975	3,480	7,596	7,292	826	3,257	5,569	7,996	8,444	12,798	30,859	21,713	39,080	21,834	11,942	5,877	13,020	3,239	10,445	216,242
14	Salam City	1,073	2,734	4,778	5,175	572	2,421	3,927	5,131	5,859	8,930	21,731	16,853	21,832	38,117	8,527	6,434	17,704	2,912	8,877	183,587
15	Shobra El Kheima	1,005	4,947	11,486	11,060	1,108	3,065	4,745	5,684	10,202	17,067	15,869	11,367	11,938	8,526	66,522	18,965	14,815	1,547	9,647	229,565
16	Qalyob	848	4,872	7,632	6,883	606	1,857	3,353	2,108	5,077	9,901	8,382	4,950	5,877	6,435	18,969	52,685	12,676	724	10,457	164,292
17	Qanater	577	2,252	5,762	5,292	585	1,893	3,145	3,153	4,833	8,617	15,698	9,577	13,022	17,703	14,825	12,678	105,155	1,616	13,017	239,400
18	10th of Ramadan City	352	1,037	696	732	319	871	802	718	818	1,442	2,164	5,938	3,238	2,913	1,548	725	1,616	17,359	10,334	53,622
19	External Zone	5,402	8,299	11,955	18,556	5,221	9,399	7,307	7,680	10,955	15,247	12,914	13,953	10,441	8,873	9,647	10,453	13,016	10,335	8,658	198,311
Total		76,039	281,551	308,545	464,374	111,017	197,308	250,021	204,775	185,515	243,645	338,201	299,345	216,212	183,563	229,538	164,270	239,369	53,613	198,270	4,245,171

Table 3.3-17 Vehicle Trip OD Table in 2012

VT OD 2012

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
		6th of Octorber City	Imbaba Markaz	Doqi	Giza	South Giza	Helwan	Maadi	Khaleefa	CBD	Shobra	Masr El Gedeeda	Nasr City & New Cairo	Ain Shams	Salam City	Shobra El Kheima	Qalyob	Qanater	10th of Ramadan City	External Zone	
1	6th of Octorber City	43,624	11,319	7,851	31,189	4,069	2,110	5,535	4,033	3,771	3,505	2,789	2,847	1,651	1,810	1,689	1,435	1,094	789	10,625	141,735
2	Imbaba Markaz	11,322	181,952	43,327	40,226	2,870	3,311	7,737	7,111	8,649	9,726	9,799	7,019	4,663	3,290	6,603	6,492	3,785	1,935	10,754	370,571
3	Doqi	7,852	43,335	74,671	59,944	5,635	7,659	16,179	14,439	15,310	16,521	17,721	10,672	8,462	5,042	12,998	8,731	6,843	1,077	16,064	349,155
4	Giza	31,195	40,216	59,935	178,324	22,027	13,791	32,732	24,884	17,552	16,267	17,930	13,847	8,306	5,551	12,646	7,972	6,499	1,161	24,115	534,950
5	South Giza	4,065	2,864	5,629	21,996	55,211	7,317	4,668	3,992	1,980	1,738	2,686	3,558	972	625	1,294	737	849	541	6,925	127,647
6	Helwan	2,100	3,302	7,629	13,734	7,275	102,707	26,955	7,731	5,477	4,461	7,367	7,756	3,685	2,570	3,518	2,217	2,526	1,390	11,208	223,608
7	Maadi	5,527	7,724	16,149	32,689	4,667	27,008	89,946	25,658	13,142	9,862	17,580	14,965	6,780	4,442	5,752	4,181	4,288	1,365	9,235	300,960
8	Khaleefa	4,031	7,107	14,431	24,884	4,000	7,758	25,673	30,750	10,479	10,048	17,685	22,323	8,788	5,310	6,183	2,288	3,921	1,110	9,214	215,983
9	CBD	3,772	8,648	15,303	17,549	1,979	5,494	13,150	10,479	13,184	14,705	14,858	10,530	8,132	5,201	9,847	4,863	5,013	1,028	11,871	175,606
10	Shobra	3,506	9,726	16,521	16,271	1,738	4,476	9,870	10,053	14,709	50,332	26,040	15,149	14,103	9,209	18,645	10,900	10,028	2,166	19,438	262,880
11	Masr El Gedeeda	2,783	9,820	17,702	17,913	2,682	7,368	17,562	17,685	14,851	26,031	61,689	46,327	33,536	21,876	17,452	9,190	17,862	3,104	16,014	361,447
12	Nasr City & New Cairo	2,814	6,883	10,645	13,775	3,476	7,287	14,785	22,252	10,521	15,133	46,139	94,701	25,243	18,171	13,108	5,771	12,606	10,216	18,212	351,738
13	Ain Shams	1,652	4,660	8,459	8,303	974	3,697	6,788	8,787	8,133	14,101	33,537	25,322	46,437	23,983	13,958	7,002	15,950	5,256	13,762	250,761
14	Salam City	1,811	3,290	5,038	5,550	626	2,579	4,448	5,306	5,199	9,205	21,874	18,235	23,985	38,726	9,338	7,144	20,594	4,379	11,068	198,395
15	Shobra El Kheima	1,689	6,601	12,981	12,635	1,295	3,527	5,756	6,179	9,842	18,622	17,435	13,354	13,939	9,330	80,591	22,464	18,114	2,492	13,157	270,003
16	Qalyob	1,435	6,502	8,732	7,969	738	2,223	4,184	2,290	4,863	10,900	9,197	5,800	7,002	7,148	22,483	62,116	15,442	1,273	14,139	194,436
17	Qanater	1,094	3,784	6,841	6,507	850	2,532	4,291	3,921	5,013	10,023	17,868	12,655	15,956	20,595	18,133	15,448	132,640	3,163	19,695	301,009
18	10th of Ramadan City	790	1,934	1,077	1,161	542	1,397	1,366	1,110	1,028	2,163	3,106	10,266	5,253	4,375	2,492	1,273	3,161	29,876	16,305	88,675
19	External Zone	10,603	10,741	16,045	24,094	6,926	11,244	9,238	9,214	11,853	19,422	16,006	18,493	13,741	11,055	13,144	14,129	19,677	16,312	13,870	265,807
Total		141,665	370,408	348,966	534,713	127,580	223,485	300,863	215,874	175,556	262,765	361,306	353,819	250,634	198,309	269,874	194,353	300,892	88,633	265,671	4,985,366

Table 3.3-18 Vehicle Trip OD Table in 2017

VT OD 2017

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
		6th of Octorber City	Imbaba Markaz	Doqi	Giza	South Giza	Helwan	Maadi	Khaleefa	CBD	Shobra	Masr El Gedeeda	Nasr City & New Cairo	Ain Shams	Salam City	Shobra El Kheima	Qalyob	Qanater	10th of Ramadan City	External Zone	
1	6th of Octorber City	82,141	17,675	11,708	46,581	6,117	3,063	8,934	5,759	5,242	5,065	4,016	4,281	2,581	2,588	2,524	2,172	1,724	1,355	16,367	229,893
2	Imbaba Markaz	17,648	226,449	51,447	47,079	3,491	3,933	9,907	8,263	9,850	11,625	11,516	8,713	6,003	3,809	8,097	7,812	5,170	2,687	13,271	456,770
3	Doqi	11,670	51,440	82,789	64,802	6,239	8,235	19,116	15,248	15,749	17,560	18,612	11,896	9,556	5,249	14,281	9,726	7,675	1,380	18,501	389,724
4	Giza	46,386	47,012	64,767	200,129	24,730	14,697	38,514	26,132	18,139	17,382	19,069	15,602	9,539	5,852	13,914	8,892	7,428	1,498	27,944	607,626
5	South Giza	6,094	3,485	6,239	24,733	61,903	7,956	5,572	4,399	2,067	1,898	2,928	4,056	1,150	668	1,460	831	1,061	686	8,104	145,290
6	Helwan	3,068	3,928	8,272	14,751	7,956	111,634	31,331	8,245	5,609	4,748	7,846	8,699	4,212	2,702	3,872	2,484	3,011	1,774	12,763	246,905
7	Maadi	8,703	9,698	18,773	37,815	5,484	30,611	111,601	29,237	14,489	11,233	19,830	18,000	8,289	4,945	6,706	4,957	5,273	1,858	11,019	358,521
8	Khaleefa	5,713	8,221	15,124	25,972	4,376	8,149	29,657	32,475	10,513	10,503	18,346	24,807	10,059	5,532	6,736	2,466	4,498	1,388	10,184	234,719
9	CBD	5,266	9,889	15,803	18,256	2,075	5,626	14,877	10,770	13,126	15,066	15,005	11,367	9,015	5,204	10,480	5,210	5,476	1,267	13,016	186,794
10	Shobra	5,014	11,547	17,424	17,284	1,885	4,693	11,356	10,464	14,850	54,135	26,718	16,581	15,850	9,469	20,144	11,924	11,169	2,708	21,479	284,694
11	Masr El Gedeeda	3,990	11,497	18,529	18,983	2,912	7,777	20,156	18,526	14,830	26,946	62,935	49,776	37,023	21,928	18,775	9,981	19,448	3,858	17,803	385,673
12	Nasr City & New Cairo	4,246	8,555	11,896	15,537	3,958	8,130	18,195	25,067	11,272	16,846	49,872	119,436	29,872	19,649	14,840	6,608	15,687	15,686	21,375	416,727
13	Ain Shams	2,508	5,902	9,434	9,376	1,128	4,115	8,348	9,998	8,804	15,858	36,704	29,362	56,241	26,227	16,005	8,230	18,738	7,011	16,037	290,026
14	Salam City	2,424	3,562	5,003	5,573	638	2,539	4,793	5,354	4,921	9,150	21,093	18,718	25,572	37,178	9,478	7,326	21,396	5,076	11,577	201,371
15	Shobra El Kheima	2,512	8,083	14,242	13,892	1,455	3,856	6,815	6,771	10,375	20,268	18,787	15,023	16,164	9,947	93,925	25,627	20,755	3,260	15,092	306,849
16	Qalyob	2,167	7,842	9,726	8,895	834	2,475	5,048	2,489	5,167	12,012	10,020	6,618	8,327	7,786	25,684	69,681	17,915	1,696	16,353	220,735
17	Qanater	1,721	5,205	7,647	7,439	1,066	3,004	5,415	4,602	5,427	11,278	19,502	15,710	19,005	22,499	20,754	17,874	158,412	4,411	24,598	355,569
18	10th of Ramadan City	1,367	2,719	1,397	1,525	693	1,782	1,929	1,442	1,277	2,774	3,950	15,893	7,245	5,440	3,326	1,729	4,471	44,419	19,611	122,989
19	External Zone	16,522	13,420	18,681	28,305	8,217	12,902	11,343	10,407	13,062	21,875	18,096	21,827	16,534	12,367	15,262	16,546	24,807	19,626	16,853	316,652
Total		229,160	456,129	388,901	606,927	145,157	245,177	362,907	235,648	184,769	286,222	384,845	416,365	292,237	209,039	306,263	220,076	354,114	121,644	311,947	5,757,527

Table 3.3-19 Vehicle Trip OD Table in 2022

VT OD 2022

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
		6th of Octorber City	Imbaba Markaz	Doqi	Giza	South Giza	Helwan	Maadi	Khaleefa	CBD	Shobra	Masr El Gedeeda	Nasr City & New Cairo	Ain Shams	Salam City	Shobra El Kheima	Qalyob	Qanater	10th of Ramadan City	External Zone	
1	6th of Octorber City	175,064	29,149	18,549	73,989	9,734	4,797	15,550	8,794	7,686	7,840	6,528	7,130	4,314	3,930	4,118	3,597	2,985	2,589	26,123	412,466
2	Imbaba Markaz	29,123	274,764	59,799	54,485	4,117	4,548	12,435	9,299	10,750	13,414	13,532	11,014	7,495	4,253	9,838	9,448	7,001	3,828	15,423	554,566
3	Doqi	18,484	59,814	91,004	70,116	6,748	8,778	22,278	15,770	15,829	18,357	19,914	13,959	10,701	5,330	15,800	10,995	8,748	1,819	20,194	434,638
4	Giza	73,587	54,372	70,040	223,099	27,320	15,748	45,577	27,183	18,441	18,445	20,908	18,439	10,892	6,145	15,550	10,109	8,606	1,987	31,295	697,743
5	South Giza	9,703	4,117	6,753	27,342	67,333	8,390	6,550	4,709	2,080	2,028	3,353	4,642	1,327	704	1,630	946	1,336	907	9,060	162,910
6	Helwan	4,841	4,577	8,880	15,899	8,437	123,784	36,644	8,757	5,674	4,993	8,857	9,869	4,787	2,811	4,305	2,854	3,733	2,387	14,033	276,122
7	Maadi	14,931	12,032	21,616	44,244	6,369	35,162	138,368	32,852	15,669	12,639	23,594	22,837	10,043	5,407	7,917	5,948	6,624	2,643	12,781	431,676
8	Khaleefa	8,679	9,224	15,547	26,896	4,661	8,547	33,577	33,142	10,255	10,699	19,618	28,764	11,242	5,593	7,322	2,672	5,177	1,781	10,841	254,237
9	CBD	7,772	10,843	15,967	18,689	2,086	5,692	16,426	10,716	12,731	15,001	15,224	12,967	9,754	5,029	11,095	5,525	5,957	1,587	13,654	196,715
10	Shobra	7,718	13,252	18,089	18,222	1,992	4,875	12,835	10,636	14,558	57,062	27,481	19,182	17,515	9,489	21,795	13,131	12,462	3,513	22,677	306,484
11	Masr El Gedeeda	6,468	13,463	19,767	20,753	3,325	8,697	24,246	19,995	14,890	27,946	67,305	59,702	40,923	21,856	20,640	11,030	21,636	5,137	19,929	427,708
12	Nasr City & New Cairo	7,123	10,846	13,966	18,393	4,540	9,273	23,515	29,351	12,755	19,730	59,959	185,335	36,774	21,830	17,552	8,031	20,769	24,695	24,435	548,872
13	Ain Shams	4,106	7,297	10,450	10,601	1,292	4,584	10,166	11,109	9,303	17,552	40,306	35,614	66,937	28,062	18,508	9,765	22,273	9,682	18,077	335,684
14	Salam City	3,475	3,734	4,868	5,592	646	2,493	5,073	5,253	4,512	8,884	20,296	19,863	26,687	34,482	9,590	7,543	22,242	6,051	11,521	202,805
15	Shobra El Kheima	4,089	9,828	15,745	15,518	1,628	4,258	8,131	7,399	10,894	22,070	20,682	17,650	18,839	10,524	111,903	30,068	24,360	4,492	16,883	354,961
16	Qalyob	3,591	9,488	10,988	10,112	948	2,821	6,123	2,699	5,438	13,320	11,090	8,015	9,977	8,461	30,160	80,683	21,317	2,412	18,463	256,106
17	Qanater	2,973	7,076	8,680	8,612	1,351	3,687	6,922	5,416	5,868	12,679	21,728	20,761	22,844	24,499	24,352	21,240	198,276	6,473	30,060	433,497
18	10th of Ramadan City	2,627	3,884	1,838	2,035	917	2,372	2,800	1,887	1,582	3,643	5,311	25,065	10,196	6,850	4,619	2,478	6,592	70,534	23,489	178,719
19	External Zone	26,679	15,741	20,533	32,026	9,268	14,259	13,422	11,254	13,720	23,450	20,529	25,032	19,066	13,031	17,226	18,868	30,571	23,573	19,175	367,423
Total		411,033	553,501	433,079	696,623	162,712	272,765	440,638	256,221	192,635	309,752	426,215	545,840	340,313	218,286	353,920	254,931	430,665	176,090	358,113	6,833,332

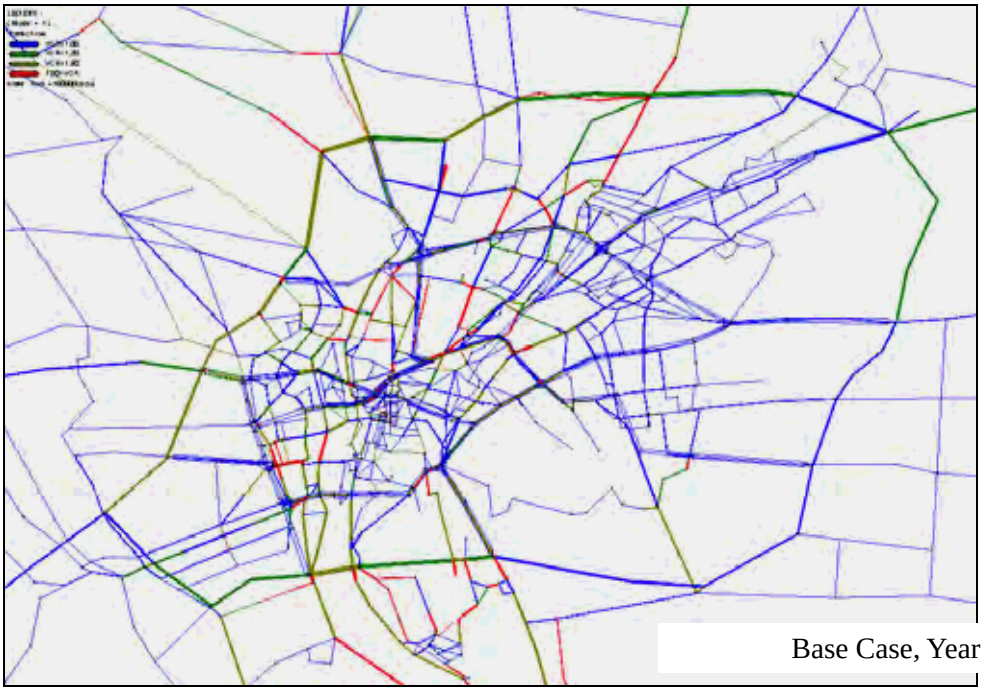
Table 3.3-20 Vehicle Trip OD Table in 2027

VT OD 2027

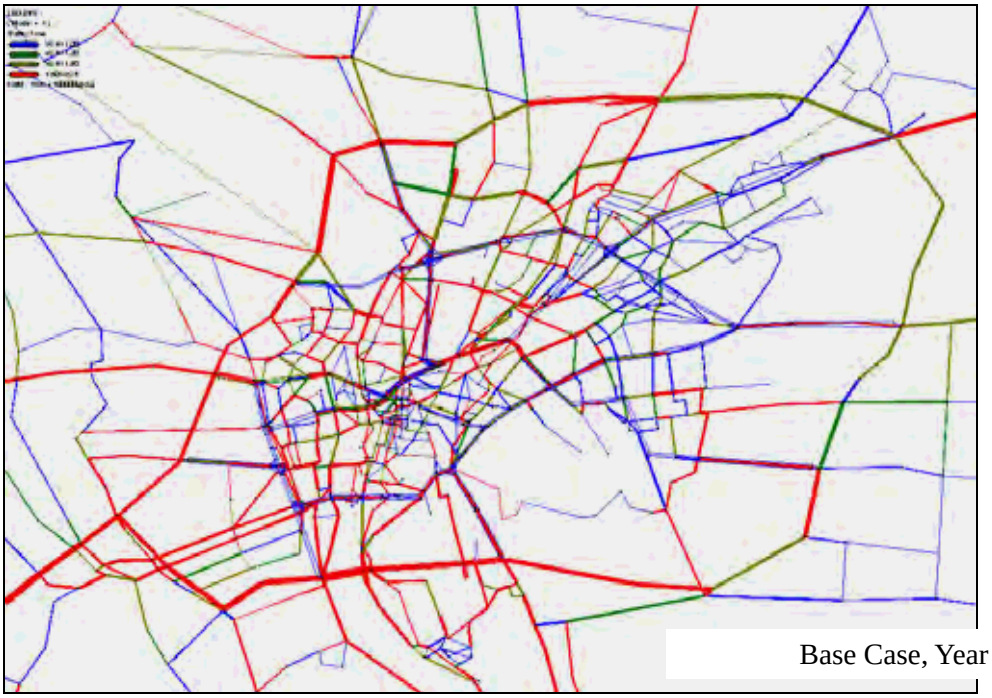
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
		6th of Octorber City	Imbaba Markaz	Doqi	Giza	South Giza	Helwan	Maadi	Khaleefa	CBD	Shobra	Masr El Gedeeda	Nasr City & New Cairo	Ain Shams	Salam City	Shobra El Kheima	Qalyob	Qanater	10th of Ramadan City	External Zone	
1	6th of Octorber City	266,577	40,177	24,949	99,253	13,163	6,427	22,056	11,474	10,013	10,364	8,763	9,763	5,913	5,058	5,541	4,935	4,191	4,162	20,409	573,188
2	Imbaba Markaz	40,163	312,958	67,356	61,738	4,721	5,153	14,676	10,133	11,642	15,004	14,983	12,769	8,756	4,627	11,309	10,895	8,530	5,608	11,125	632,146
3	Doqi	24,871	67,386	100,275	77,054	7,461	9,595	25,460	16,818	16,703	19,737	21,325	15,792	11,903	5,534	17,409	12,319	9,780	2,492	14,513	476,427
4	Giza	98,759	61,590	76,948	253,479	30,743	17,408	52,962	29,175	19,685	20,225	23,000	21,295	12,346	6,612	17,416	11,477	9,882	2,752	20,951	786,705
5	South Giza	13,134	4,720	7,470	30,782	74,368	9,385	7,566	5,132	2,213	2,216	3,740	5,248	1,513	756	1,840	1,080	1,617	1,268	6,314	180,362
6	Helwan	6,507	5,196	9,713	17,609	9,455	140,061	42,392	9,495	6,065	5,381	9,871	11,142	5,429	2,993	4,796	3,248	4,455	3,418	9,757	306,983
7	Maadi	21,195	14,208	24,677	51,345	7,351	40,579	164,754	36,573	17,210	14,226	27,123	27,210	11,802	5,911	9,166	6,942	7,911	3,854	9,773	501,810
8	Khaleefa	11,351	10,052	16,558	28,833	5,086	9,243	37,372	34,441	10,589	11,290	20,974	32,150	12,496	5,753	7,942	2,899	5,824	2,463	7,534	272,850
9	CBD	10,148	11,763	16,860	20,002	2,229	6,092	18,078	11,130	13,221	15,687	15,839	14,404	10,672	5,117	11,927	6,004	6,500	2,127	10,477	208,277
10	Shobra	10,197	14,805	19,438	19,954	2,175	5,250	14,448	11,213	15,197	61,449	29,066	21,679	19,545	9,839	23,946	14,667	13,990	4,839	14,688	326,385
11	Masr El Gedeeda	8,696	14,909	21,151	22,843	3,698	9,659	27,896	21,405	15,451	29,585	71,304	67,008	44,484	22,124	22,349	12,061	23,407	6,857	13,779	458,666
12	Nasr City & New Cairo	9,782	12,602	15,802	21,243	5,141	10,511	28,085	32,874	14,128	22,348	67,323	234,440	42,858	23,743	20,017	9,415	25,616	37,365	17,285	650,578
13	Ain Shams	5,623	8,505	11,606	11,981	1,462	5,168	11,918	12,325	10,143	19,583	43,772	41,354	77,114	30,070	20,950	11,293	25,509	13,575	12,384	374,335
14	Salam City	4,406	4,002	4,988	5,925	677	2,614	5,467	5,350	4,523	9,112	20,315	21,358	28,359	33,783	9,981	8,021	23,405	7,831	7,686	207,803
15	Shobra El Kheima	5,502	11,299	17,345	17,396	1,841	4,742	9,415	8,024	11,684	24,291	22,392	20,094	21,354	11,096	126,736	34,174	27,359	6,179	11,711	392,634
16	Qalyob	4,924	10,942	12,297	11,472	1,084	3,217	7,143	2,937	5,901	14,864	12,134	9,394	11,545	9,160	34,270	92,867	24,501	3,551	12,037	284,240
17	Qanater	4,187	8,615	9,692	9,884	1,632	4,396	8,281	6,141	6,397	14,247	23,506	25,619	26,222	26,140	27,334	24,401	237,605	9,387	20,447	494,133
18	10th of Ramadan City	4,206	5,655	2,510	2,794	1,278	3,371	4,063	2,604	2,109	5,000	7,075	37,792	14,247	8,950	6,322	3,631	9,510	105,127	12,145	238,389
19	External Zone	21,276	11,497	14,953	21,812	6,568	10,136	10,413	7,970	10,627	15,524	14,447	18,112	13,345	8,925	12,169	12,521	21,262	12,404	9,403	253,364
Total		571,504	630,881	474,588	785,399	180,133	303,007	512,445	275,214	203,501	330,133	456,952	646,623	379,903	226,191	391,420	282,850	490,854	235,259	242,418	7,619,275

(2) Vehicle Trip Assignment (Base Case)

Present and future OD tables are correspondingly assigned on the existing road network for the present and future cases after adding future plans of CREATS, PPP and SDMP in the year 2027 composing future road networks without taking into consideration the expressway networks as “Base Case”, as shown in Figure 3.3-11.



Base Case, Year 2007



Base Case, Year 2027

Figure 3.3-11 Traffic Assignment Results in Base Case

Vehicle Assignment Results in Base Case

Table 3.3-21 gives the result of assigned traffic volumes per day in years 2007, 2012, 2017, 2022 and 2027 for "Base Case".

Table 3.3-21 Traffic Indicators on Base Case

Year		2007	2012	2017	2022	2027
No. of Vehicle Trips ('000 PCU)		4,245	4,985	5,757	6,833	7,619
'000 PCU-km		68,719	85,841	103,582	129,292	143,815
'000 PCU-hrs		2,874	4,087	5,546	8,512	10,494
Ave. Speed (km/hrs)	Whole Network	23.90	21.00	18.70	15.20	13.70
	Expressway	38.90	29.80	25.40	20.50	19.60
VCR	Whole Network	0.54	0.68	0.82	1.02	1.14
	Expressway	1.00	1.16	1.27	1.47	1.59
No. of Users	E1, E2	305,893	349,319	368,197	438,795	488,672
	Ring Road	1,064,290	1,254,966	1,421,667	1,684,522	1,835,838
	Total	1,370,183	1,604,285	1,789,864	2,123,317	2,324,510

Note: Expressway consists of the Ring Road and the viaduct sections of 6th of October Bridge and 26th of July Bridge.

Vehicle Trips, PCU-km and PCU-hrs

Total traffic indicators of vehicular trips are evaluated from the viewpoints of changes in number of vehicular trips, PCU-hr and PCU-km. The vehicular trips are forecasted to increase from 4.3 million trips in 2007 to 7.6 million trips in 2027 with about 1.8 times growth. In addition, PCU-hr will be increased from 2.87 million to 10.49 million with about 3.65 times while PCU-km will be increased from 68.7 million to 143.8 million with about 2.1 times in same period.

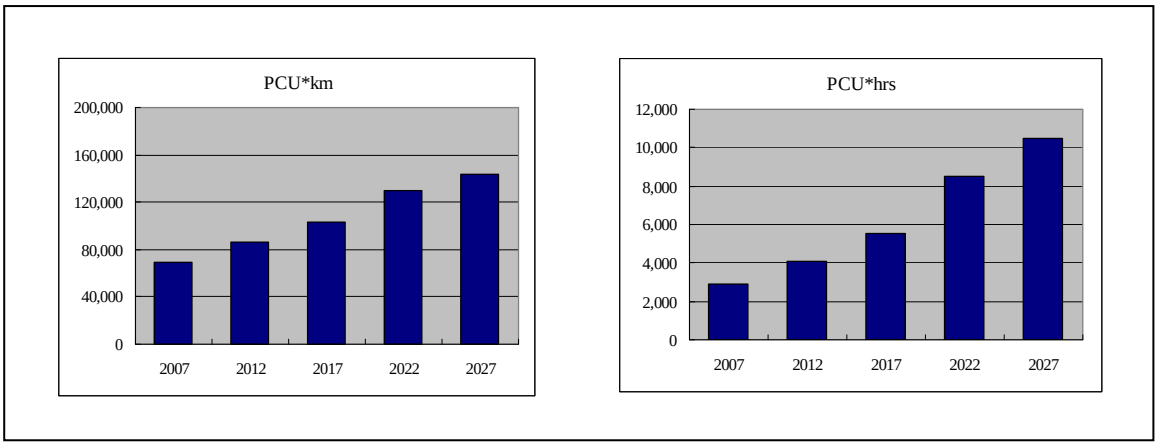


Figure 3.3-12 Trend of PCU-km and PCU-hrs

Traffic Congestion

Results of the volume to capacity ratio (VCR) were analyzed to investigate the road congestion. As shown in Figure 3.3-13, it gives a desirable ratio of 0.54 on the whole network and 1.00 on existing expressways and Ring Road Network in 2007. However, it shows unacceptable level of traffic congestion with an average value of 1.14 on the whole network and 1.59 on the existing expressway and Ring Road network in 2027 in case of "Base Case"

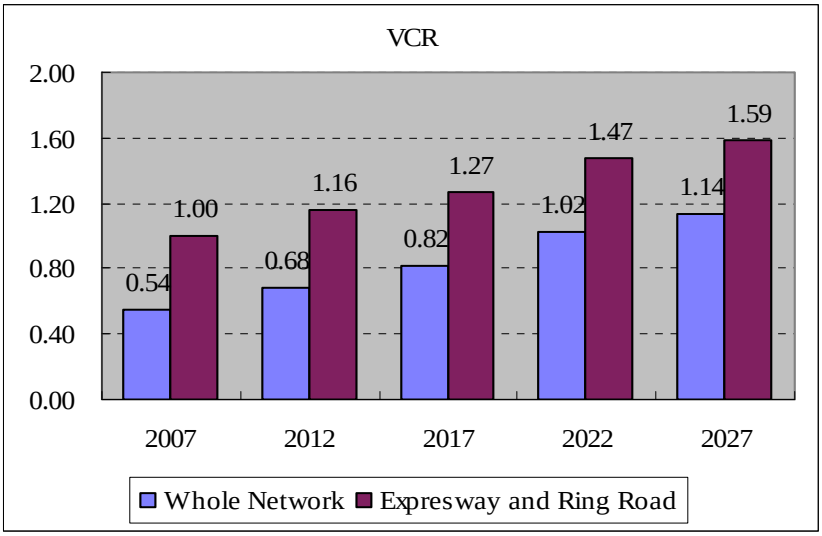


Figure 3.3-13 Trend of VCR

Average Travel Speed

As shown in Figure 3.3-14, the average travel speed will be decreased from 23.9 kph in 2007 to 13.7 kph in 2027 over the whole network, which means that the level of service on the road network will face a severe situation in terms of traffic, economic and environmental points of view.

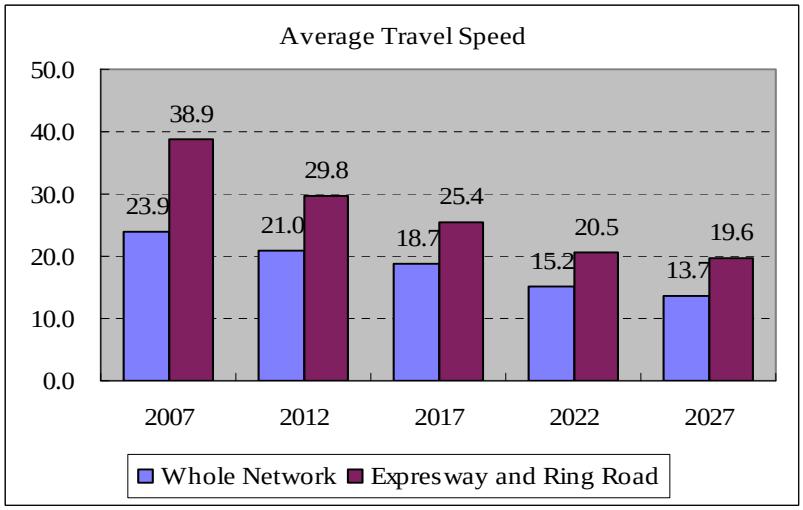


Figure 3.3-14 Trend of Average Speed

3.3.3 Future Traffic Demand in With Project Case

(1) Setting up Future Express Network (With Project Case)

Traffic assignments for the future expressway network based on the CREATS, PPP Study and SDMP Plan are carried out as "With Project Case" case. In this case, traffic is assigned on both future road network and expressway network together for year 2012 and 2027. Other assignments in year 2017 and 2022 will be done in later stage for section priority, toll system, environment assessments, economic and financial analysis. Expressway networks in 2012 and 2027 are set up as shown in Figure 3.3-15 and Figure 3.3-16 after reviewing the previous studies and the discussion with the counterpart team.

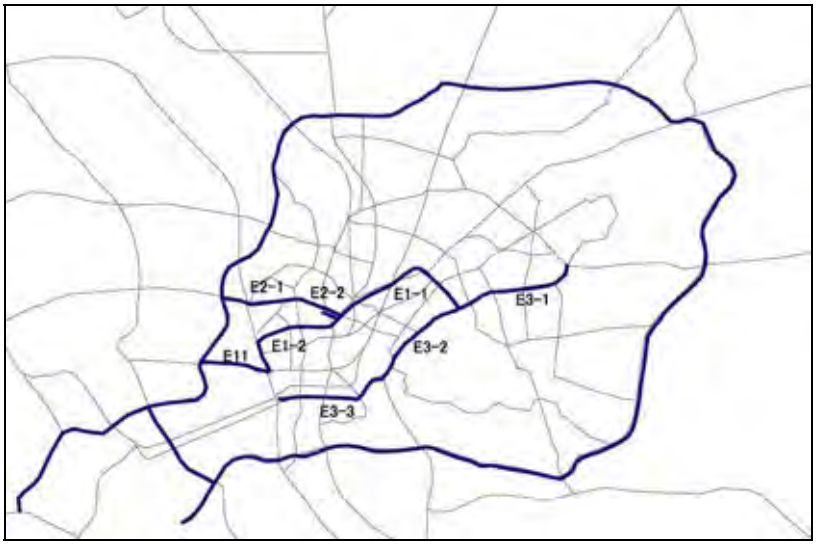


Figure 3.3-15 Expressway Network in 2012

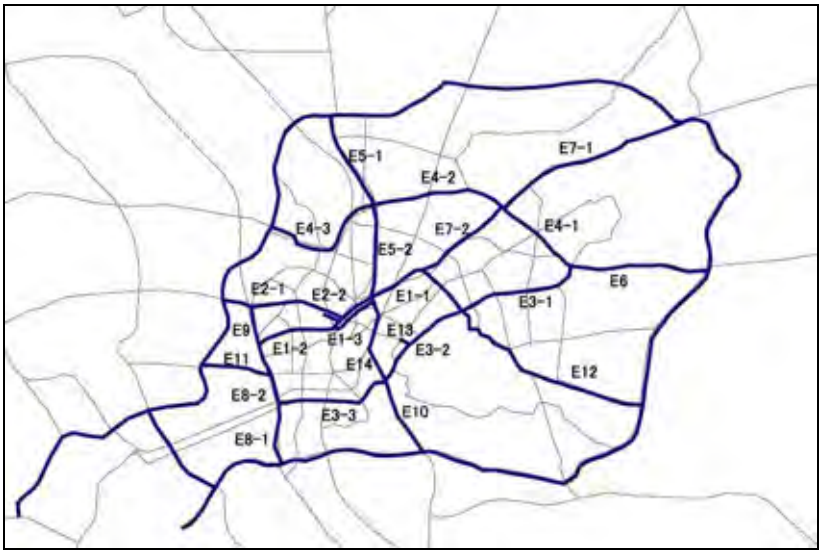


Figure 3.3-16 Expressway Network in 2027

(2) Assumption of Traffic Assignment Simulation

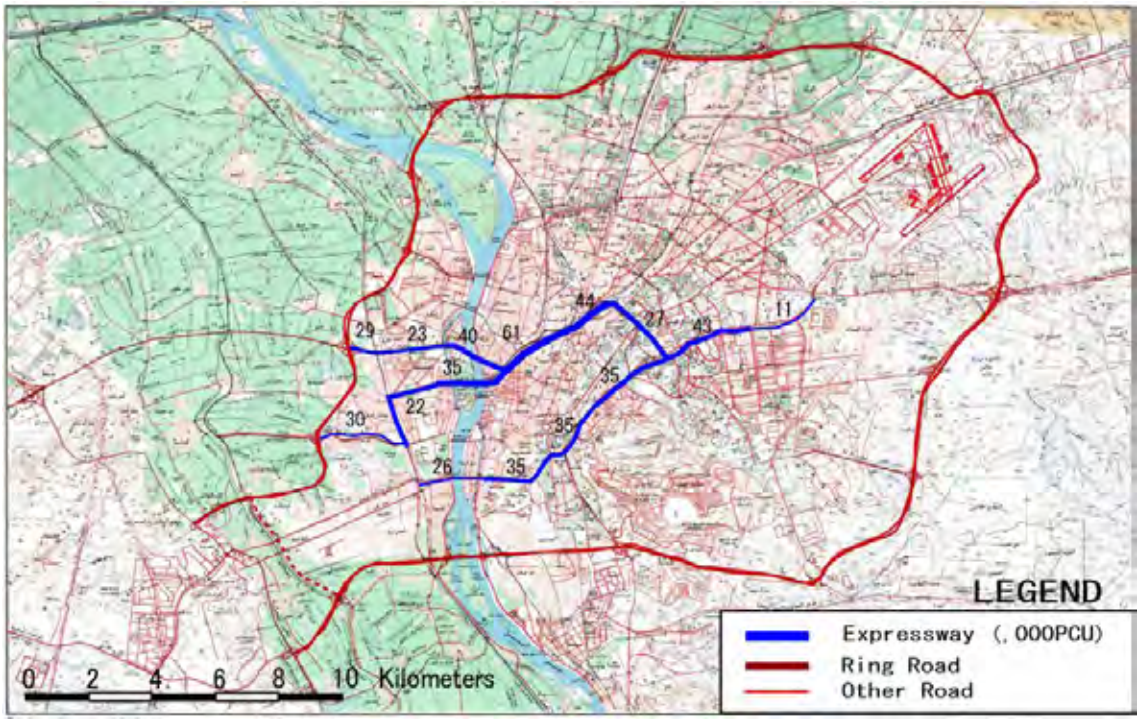
Network and toll system assumptions are determined as shown in Table 3.3-22 following the PPP and SDMP studies. As to the number of lanes, all sections, except E11, E3 and E1-3, are assumed to be 4 lanes. Toll level is 4 LE per time in 2012 and 8 LE in 2027, and closed system is introduced.

Table 3.3-22 Assumption of Traffic Assignment Simulation for With Project Case

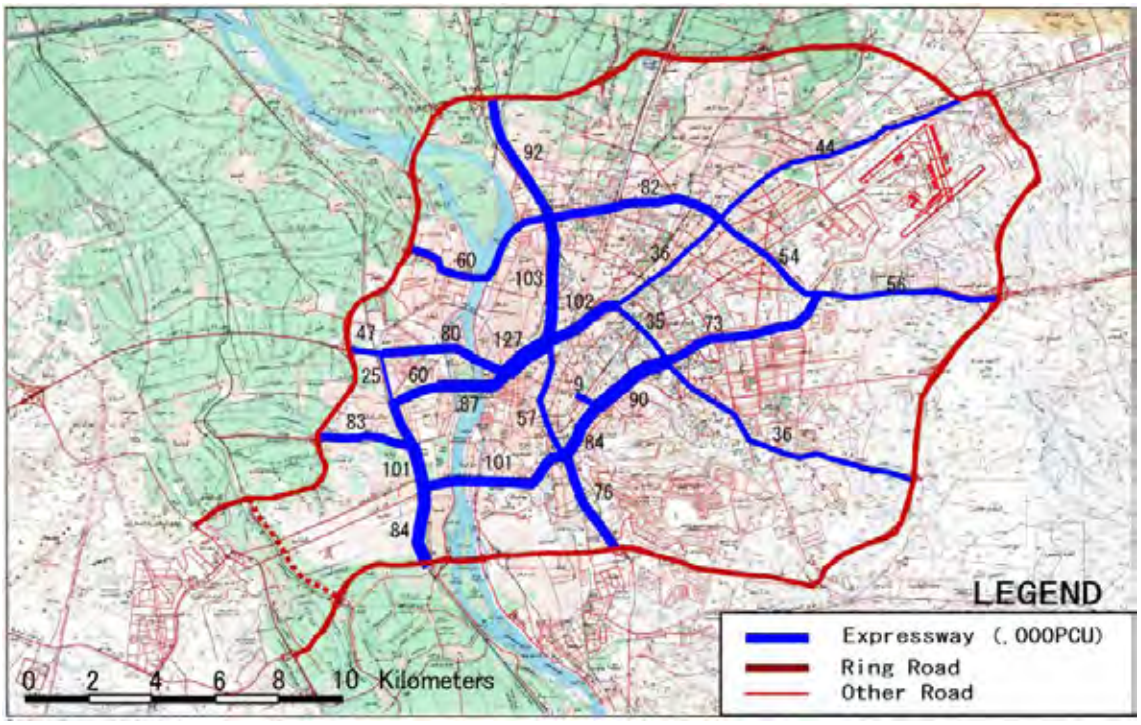
Case Name	Toll Road Network	No. of Lanes	Toll Level	Demand Matrix
Case 2012	E1-1/2, E2-1/2	4	4 LE	2012
	E11, E3-1/2/3	6		
Case 2027	E1-1/2, E2-1/2, E4, E5, E6, E7, E8, E9, E10, E12, E13(Long Ramp), E14	4	8 LE	2027
	E11, E3-1/2/3	6		
	E1-3 (Ramsis to Tahrir)	8		

(3) Future Traffic Volume in Year 2012 and 2027

Figure 3.3-17 and Figure 3.3-18 show the simulation results of traffic volume for the “With Project Case” in 2012 and 2027.



Year 2012 (unit; thousand PCUs per day)



Year 2027 (unit; thousand PCUs per day)

Figure 3.3-17 Traffic Volume of Toll Roads in 2012 and 2027

(4) Overall Traffic Situation in With Project Case

The traffic indicators expressing the traffic condition under simulation are given in Table 3.3-23, compared with Base Case.

Table 3.3-23 Traffic Indicators on With (E1-E14) and Base Case

Case		**Base Case**			
Year		**2012**	**2017**	**2022**	**2027**
No. of Vehicle Trips ('000 PCU)		4,985	5,757	6,833	7,619
'000 PCU-km		85,841	103,582	129,292	143,815
'000 PCU-hrs		4,087	5,546	8,512	10,494
Ave. Speed (km/hrs)	Whole Network	21.0	18.7	15.2	13.7
	Expressway and Ring Road	29.8	25.4	20.5	19.6
VCR	Whole Network	0.68	0.82	1.02	1.14
	Expressway and Ring Road	1.16	1.27	1.47	1.59
No. of Users ('000 PCU)	E1 - E14	349	368	439	489
	Ring Road	1,255	1,422	1,685	1,836
	Total	1,604	1,790	2,123	2,325
Case		**With Project Case**			
Year		**2012**	**2017**	**2022**	**2027**
No. of Vehicle Trips ('000 PCU)		4,985	5,757	6,833	7,619
'000 PCU-km		85,984	103,501	129,153	143,498
'000 PCU-hrs		4,013	5,333	7,791	9,496
Ave. Speed (km/hrs)	Whole Network	21.4	19.4	16.6	15.1
	Expressway and Ring Road	32.8	30.5	25.2	23.9
VCR	Whole Network	0.67	0.79	0.98	1.06
	Expressway and Ring Road	0.98	1.00	1.17	1.19
No. of Users ('000 PCU)	E1 - E14	220	403	695	940
	Ring Road	1,176	1,255	1,462	1,492
	Total	1,396	1,657	2,156	2,432
Case		**With Project Case – Base Case**			
Year		**2012**	**2017**	**2022**	**2027**
'000 PCU-km		142	-81	-138	-317
'000 PCU-hrs		-74	-213	-721	-998
Ave. Speed (km/hrs)	Whole Network	0.44	0.73	1.39	1.41
	Expressway and Ring Road	2.99	5.14	4.71	4.35
VCR	Whole Network	-0.01	-0.03	-0.05	-0.08
	Expressway and Ring Road	-0.17	-0.27	-0.30	-0.40
No. of Users ('000 PCU)	E1- E14 Expressway	-129	34	256	451
	Ring Road	-79	-167	-223	-344
	Total	-208	-133	33	107

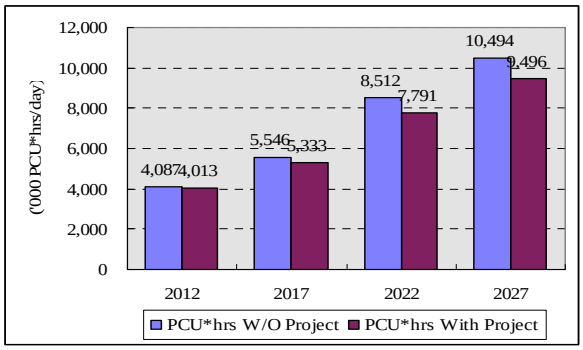
From above tables, the following points are noted:

Figure 3.3-1818 shows differences of PCU* hours, average speed and VCR over whole road network (including the expressways and ordinary streets) in each milestone years, for With Project Case and Base Case. The differences between With Project Case and Base Case are not so large, since these indices are calculated over entire road network.

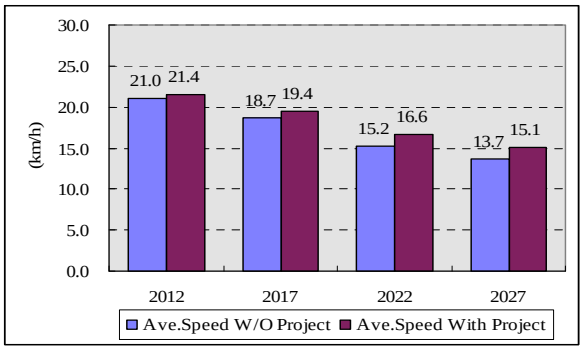
The vehicle*km in 2012 is increased by the effect of installation of toll system on the existing free expressway, but the savings travel time by the Project is about 74,000 PCU*hours in 2012, which in 2027 reaches 998,000 PCU*hours 2027 with more than 10 times.

According to reclining the total travel time, the average speed in With Project is bigger then that of Base Case with 0.44 km/h in 2012 and 1.41 km/h in 2027. VCR is also improved by implementing the Project with 0.01 in 2012 and 0.08 in 2027.

(PCU*hours/day)



(Average Speed)



(VCR)

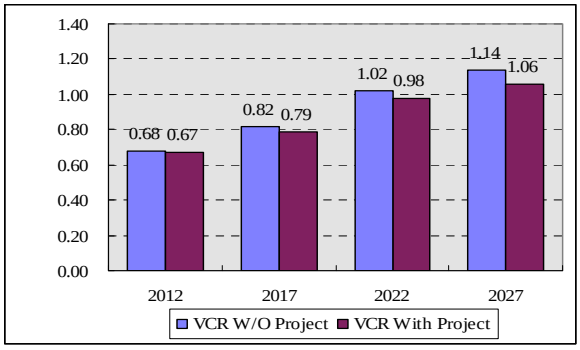


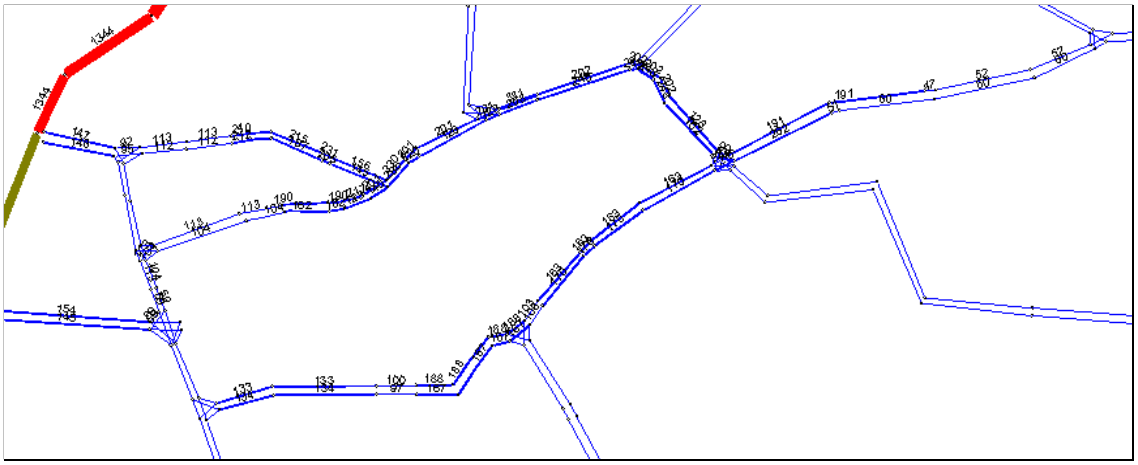
Figure 3.3-18 Traffic Indicators on With and Base Case

3.4 TRAFFIC EFFICIENCY IN F/S AND PRE-F/S ROUTES

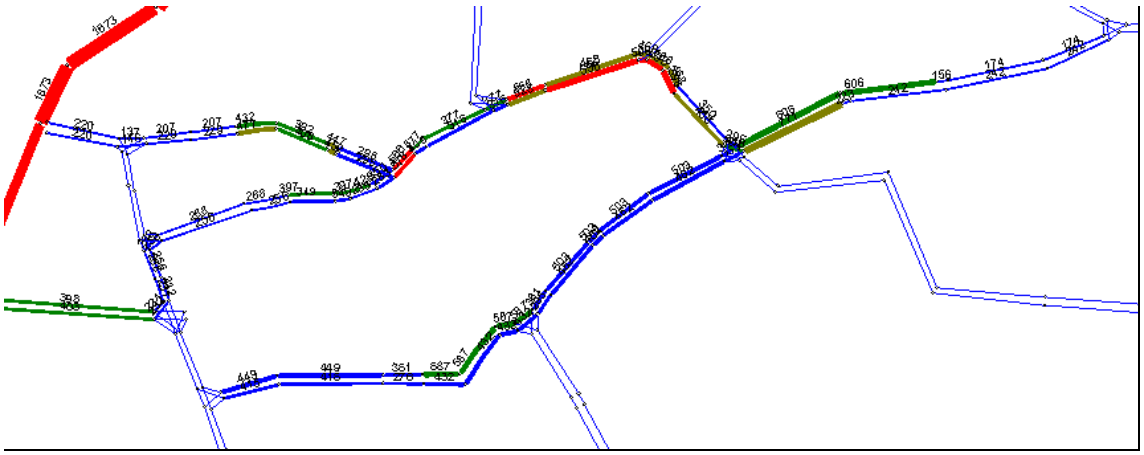
In this section, the traffic demand with and without F/S + Pre-F/S routes as well as the impact on traffic efficiency and improvement from the various points of view are studied.

3.4.1 Future Traffic Volume on F/S and Pre-F/S Routes

To measure the impact by implementation of the F/S + Pre-F/S routes, the future traffic demand of expressways and at-grade roads in the GCR was forecasted, as shown in Figure 3.4-1.



Year 2012, With F/S + Pre-F/S Case (unit; 00 PCU/day)



Year 2027, With F/S + Pre-F/S Case (unit; 00 PCU/day)

Figure 3.4-1 Future Traffic Demand with F/S and Pre-F/S Routes

3.4.2 Impact Analysis on Traffic Performance

The basic traffic indicators expressing traffic system performance of the F/S and Pre-F/S routes are assessed as shown in Table 3.4-1.

Table 3.4-1 Traffic Performance Indicators of "With F/S + Pre-F/S Project" and "Base Case"

Case	Indicators	Unit	2012	2017	2022	2027
With F/S + Pre F/S – Base Case	PCU-hrs	PCU-hrs/day	-54,124 (-1.3%)	-71,077 (-1.3%)	-305,427 (-3.8%)	-357,020 (-3.4%)
	PCU-km	PCU-km/day	116,407 (+0.1%)	239,930 (+0.2%)	391,837 (+0.3%)	577,798 (+0.4%)
	Ave. Speed	kph	0.33	0.29	0.61	0.54
	VCR	-	-0.011	-0.014	-0.016	-0.017
Base Case	PCU-hrs	PCU-hrs/day	4,086,955	5,545,751	8,511,679	10,494,008
	PCU-km	PCU-km/day	85,841,455	103,581,887	129,291,564	143,814,768
	Ave. Speed	kph	21.00	18.68	15.19	13.70
	VCR	-	0.679	0.819	1.023	1.138
With F/S + Pre-F/S	PCU-hrs	PCU-hrs/day	4,032,831	5,474,674	8,206,252	10,136,987
	PCU-km	PCU-km/day	85,957,861	103,821,818	129,683,401	144,392,566
	Ave. Speed	kph	21.34	18.96	15.80	14.24
	VCR	-	0.668	0.806	1.006	1.121

(1) PCU-hours, Travel Speed and Volume Capacity Rate (VCR)

With F/S and Pre-F/S routes, the savings in time will be about 54,000 PCU-hours, which represents 1.3% decrease in 2012, and 357,000 PCU-hours which represents a 3.4% decrease in 2027, while PCU-km increase will remain as low as 0.1% to 0.4% against "Base Case.

On the other hand, average speed will gradually decline by about two-thirds level, while VCR will gradually worsen and bring about forced flow conditions even With F/S and Pre-F/S routes, although it will be better than Base Case.

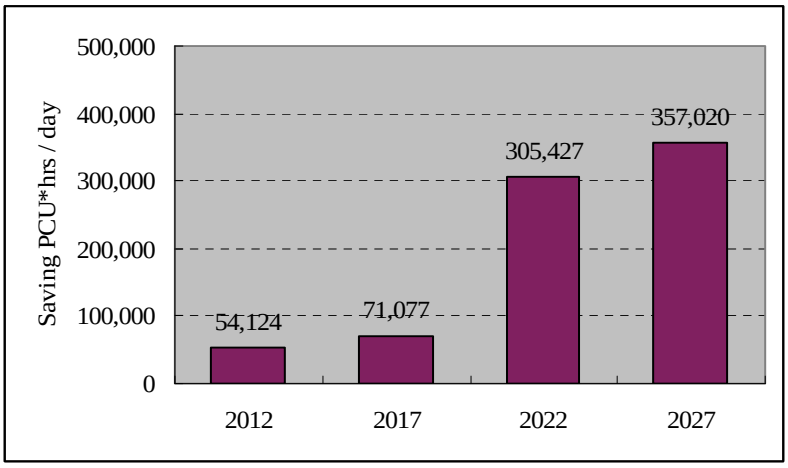


Figure 3.4-2 Trend of Saving PCU-hours per Day

(2) PCU-km and Vehicle Operating Cost (VOC)

The detour will be compelled by introduction of new expressway network, because the drivers usually want to avoid crowded road. This natural behaviour causes the increase of total PCU-km. However, the composition of low speed road will be decreased and then that of high speed road will be increased, as shown in Figure 3.4-3.

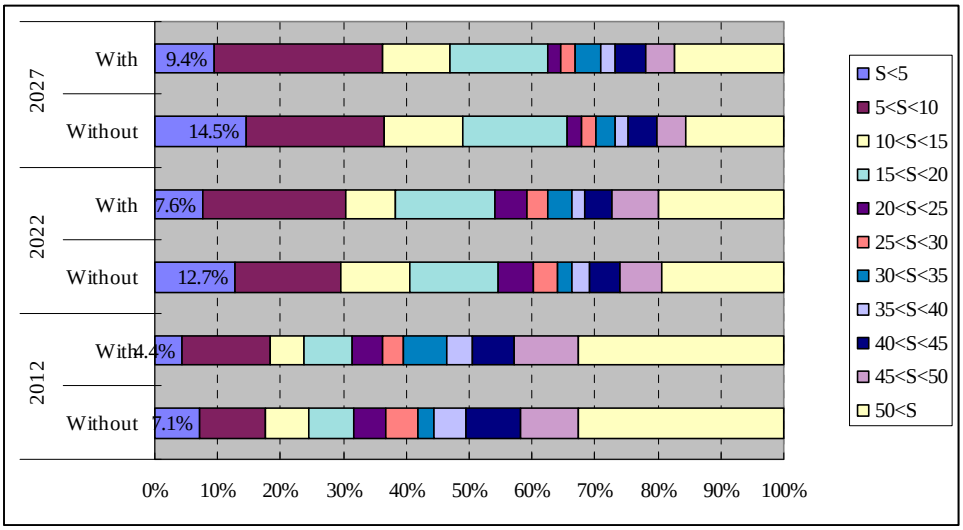


Figure 3.4-3 PCU-km by Travel Speed

Based on the change of speed distribution, Vehicle Operating Cost (VOC) is estimated by applying the unit cost by travel speed. Table 3.4-2 explains the VOC in With F/S + Pre-F/S and Base Case. The VOC savings is estimated at about 0.22 million LE per day in 2012 and about 1.43 million LE per day in 2027. Detailed analysis of the VOC is made under the chapter that discusses the economic analysis.

Table 3.4-2 VOC Savings from Implementation of F/S and Pre-F/S Sections

Case	Indicators	Unit	2012	2017	2022	2027
With F/S + Pre-F/S – Base Case	PCU-km	PCU-km/day	116,407	239,930	391,837	577,798
	VOC	LE/day	-222,706	-297,097	-784,601	-1,427,220
Base Case	PCU-km	PCU-km/day	85,841,455	103,581,887	129,291,564	143,814,768
	VOC	LE/day	61,088,336	76,242,311	100,924,751	116,254,799
With F/S + Pre-F/S	PCU-km	PCU-km/day	85,957,861	103,821,818	129,683,401	144,392,566
	VOC	LE/day	60,865,630	75,945,213	100,140,149	114,827,579

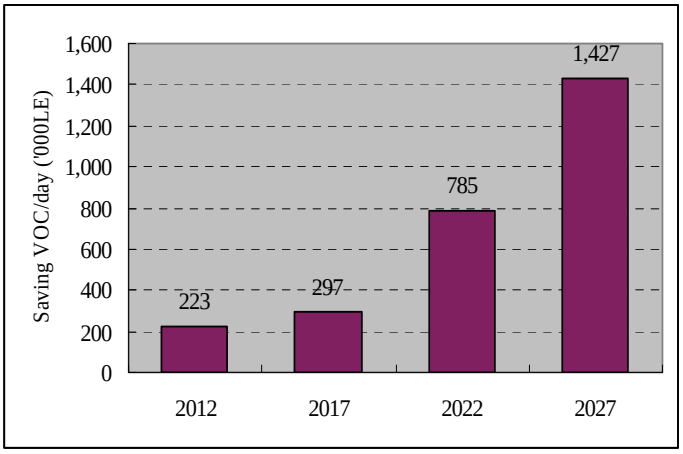


Figure 3.4-4 Trend of Saving VOC per Day

3.4.3 Impact Analysis on Environment

Among the various environmental impacts, air pollution has been taken into account for "With F/S + Pre-F/S" and "Base Case" analysis. By implementing the F/S and Pre-F/S routes, the impact of travel speed of moving vehicles on emissions and air quality will be improved, especially with the reduction of low speed vehicles (under 10kph). The air pollution components of CO_2, NOx and SPM produced by With F/S + Pre-F/S Case and Base Cases are estimated as follows:

(1) Emission Rate by Travel Speed

The emission unit by travel speed is set up based on the standards unit as of 2007 in Japan, as shown in Table 3.4-3. The Study Team tried to apply the emission units in Egypt, however, it is impossible to set an Egyptian standard due to the lack of essential data and information.

Table 3.4-3 Emission Unit of CO_2, NOx, SPM

Speed (kph)	CO_2 (g/PCU-km)	NOx (g/PCU-km)	SPM (g/PCU-km)
S<5	0.547	1.162	0.105
5<S<10	0.342	0.671	0.052
10<S<15	0.269	0.498	0.046
15<S<20	0.229	0.407	0.037
20<S<25	0.204	0.374	0.034
25<S<30	0.186	0.336	0.031
30<S<35	0.172	0.299	0.028
35<S<40	0.161	0.266	0.025
40<S<45	0.152	0.238	0.023
45<S<50	0.146	0.217	0.021
50<S	0.141	0.203	0.019

Source: Act Collection of Road Policy Evaluation, Japan Road Announcing Center, 2007

(2) Impact on Air Pollution

Table 3.4-4 indicates the forecasting results of air pollution in With F/S + Pre-F/S Case and Base Case. All the emissions have strong ties with PCU-km with low speed road, so that a big impact on emission will be expected. The reduction of CO2, NOx, and SPM will be about 430 tons, 1.04 tons, and 0.12 ton per day in 2012 and 1,840 tons, 4.41 tons, and 0.46 ton in 2027, respectively.

Table 3.4-4 Forecasting Results of Air Pollution in With F/S + Pre-F/S and Base Cases

Case	Indicators	Unit	2012	2017	2022	2027
With F/S + Pre-F/S – Base Case	PCU-km	PCU-km/day	116,407	239,930	391,837	577,798
	CO_2	ton/day	-431	-772	-1,383	-1,837
	NOx	kg/day	-1,035	-1,869	-3,362	-4,409
	SPM	kg/day	-120	-203	-372	-456
Base Case	PCU-km	PCU-km/day	85,841,455	103,581,887	129,291,564	143,814,768
	CO_2	ton/day	18,421	23,998	33,649	40,149
	NOx	kg/day	32,637	43,495	62,843	76,078
	SPM	kg/day	2,929	3,889	5,557	6,668
With F/S + Pre-F/S	PCU-km	PCU-km/day	85,957,861	103,821,818	129,683,401	144,392,566
	CO_2	ton/day	17,990	23,225	32,265	38,311
	NOx	kg/day	31,603	41,627	59,481	71,669
	SPM	kg/day	2,809	3,686	5,184	6,212

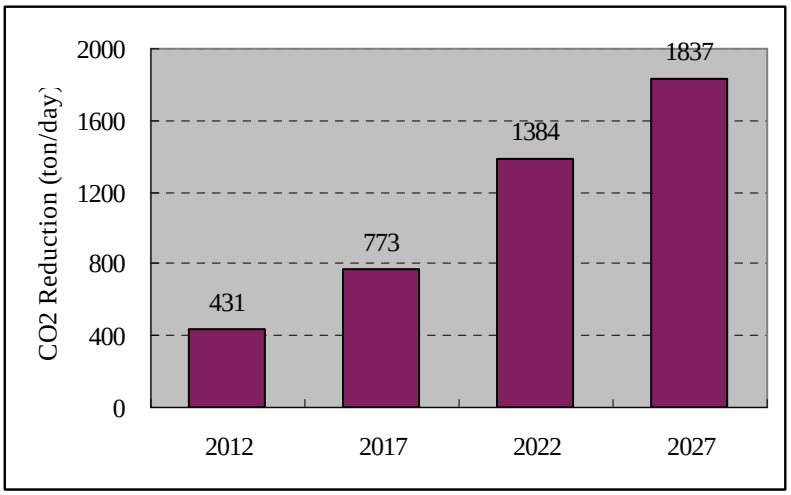


Figure 3.4-5 Trend of CO_2 Reduction by F/S and Pre-F/S Routes

CHAPTER 4

REVIEW AND UPDATING OF PPP STUDY

CHAPTER 4

REVIEW AND UPDATING OF PPP STUDY

Under this Chapter, the previous PPP Study is reviewed in regard to the planning aspects of the expressway network. The purpose of this review is to take into consideration new conditions that did not exist during the course of that previous study. Such new conditions include the relocation plans of ministerial buildings outside the central business district to the eastern of Cairo and the early construction of E11 under the expressway network by the Ministry of Housing. In addition, the characteristics and results of the newly developed urban development plan of "The Strategic Urban Development Master Plan Study for Sustainable Development of the Greater Cairo Region in the Arab Republic of Egypt" to be completed under JICA in August 2008, are considered and applied. This urban development plan has the target year of 2027 that is also utilized in this study rather the previous target year of 2022.

4.1 NETWORK COMPONENTS

As a result of PPP Study and based on Master Plan, the concluded Cairo Urban Toll Expressway Network for the year 2022 is shown in Figure 4.1-1 while Table 4.1-1 gives the major components of the network. Under the planning process of this network, there are two links that were studied and proposed to be implemented in later years after 2022 in order to improve the efficiency and functions of the network. The 2 links, which are called E7-2 and E10, were found to have low traffic volumes by the year 2022 in PPP Study and Master Plan.

Utilizing the developed socioeconomic framework and applying newly introduced development and on-going projects and parameters of the urban development plan with the target year of 2027; a more comprehensive network is developed with more links as shown in Figure 4.1-2. In addition to all the links of the network developed under PPP Study, the newly introduced links that will compose the urban toll expressway network for the year 2027 are as follows:

E7-2: Qubri El-Kobbah Corridor

This link will directly connect Ismailia road with central areas in Cairo.

E10: Cairo South Corridor

This link is getting higher priority than before due to new developments south of Cairo.

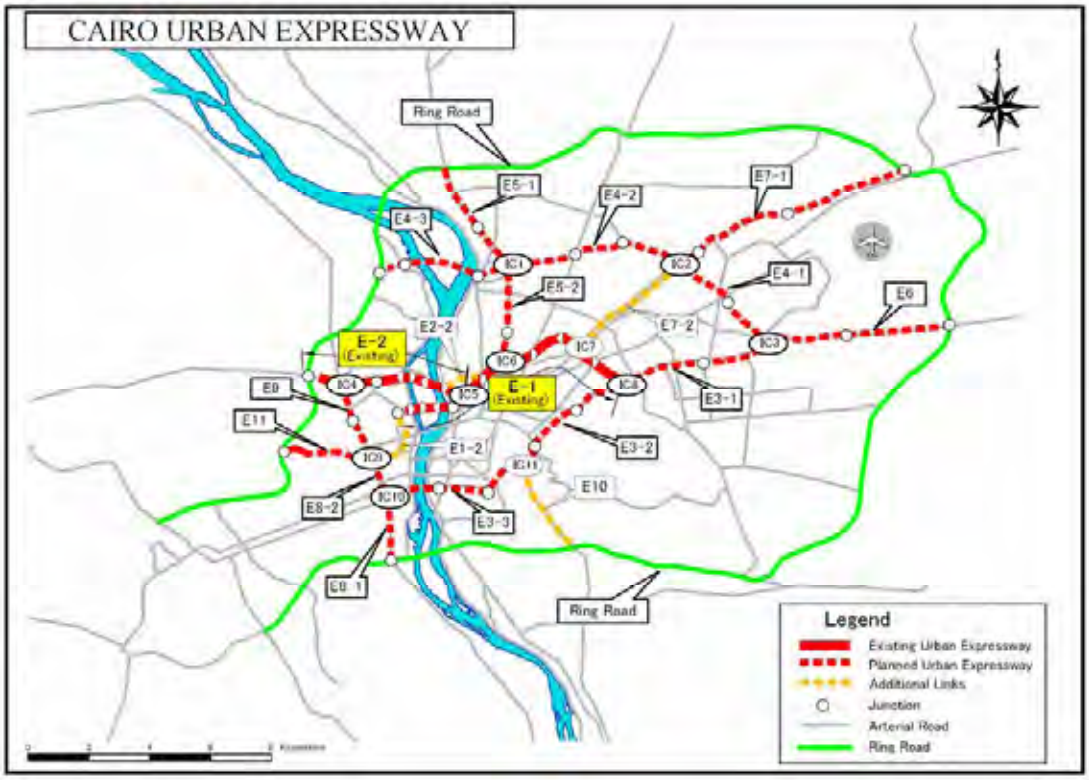


Figure 4.1-1 Cairo Urban Toll Expressway Network – 2022 (PPP Study)

Table 4.1-1 Components of Optimum Expressway Network – 2022 (PPP Study)

Route	Length (km)	Location	Remarks
E1-1	13.1	6th of October	Existing
E1-2	2.1	6th of October Extension	Newly Planned
E2-1	4.5	15th of May	Existing
E2-2	1.2	15th of May Extension	Newly Planned
E3-1	6.8	Autostrad El Nasr Street in Nasr City	CREATS Plan
E3-2	5.8	Autostrad from Nasr City to Citadel	CREATS Plan
E3-3	6.9	Salah Salem from Citadel to Giza Sq.	CREATS Plan
E4-1	4.7	Abu Bakr El-Sedeeq	CREATS Plan
E4-2	7.5	Ibn El hakam – El Matariyah	CREATS Plan
E4-3	5.3	Tereat Ismailia – Al Warraq	CREATS Plan
E5-1	5.7	Cairo-Alexandria Agriculture Road	CREATS Plan
E5-2	5.3	Ahmad Helmi Street	CREATS Plan
E6	7.5	Cairo-Suez Road	CREATS Plan
E7-1	11.0	Gesr El Suez (Ismailia Desert)	CREATS Plan
E8-1	3.0	Ter'at El-Zumur South of King Faisal	CREATS Plan
E8-2	1.7	Ter'at El-Zumur North of King Faisal	CREATS Plan
E9	4.0	Tereat El-Zumur in Bolaq el Dakroor	CREATS Plan
E11	3.1	From Tereat El-Zumur to Ring Road	CREATS Plan
Sub Total	99.2		Up to the year 2022
E7-2	5.3	Qubri El-Kobbah	Postponed to after 2022
E10	4.0	Cairo South Corridor	Postponed to after 2022
Total	108.5		

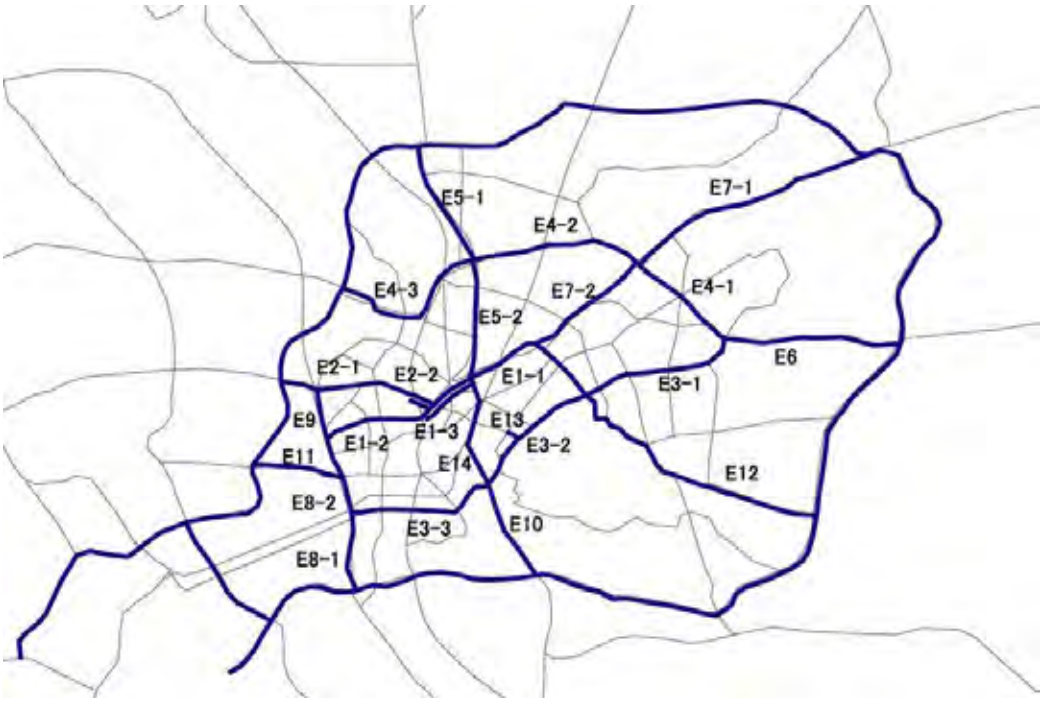


Figure 4.1-2 Proposed Cairo Urban Toll Expressway Network – 2027

E12: New Cairo Corridor

This newly developed section is to directly connect the area proposed for the relocation of governmental ministries and agencies with the urban expressway network of Cairo. This section has a total length of 22.0 kilometers.

E13: Extension of Al-Azhar Tunnel (as a long ramp of E3-2)

This section is to include Al-Azhar Tunnel in the urban expressway network. Under this plan, it is recommended to extend the tunnel from Salah Salem side to the Autostrade (E3-2) in order to use it as a long ramp for accessibility from the city center to eastern and western areas of Cairo through E3. This tunnel section has a length of 4.0 kilometers that passes under the cemetery. In future, the tunnel may be extended from the city center side and connected through a viaduct to E2-1 and E2-2 to provide a long corridor from east to west of Cairo. Until 2027, results show no urgent need to carry out this second extension work.

E14: Providing North-South Link in Cairo Side

The planning concept of the urban toll expressway network in CREATS Master Plan (JICA, 2002) is to provide mini-ring roads inside Cairo Ring Road. On the west side of the River Nile, with a narrow urbanized built-up area in Giza Governorate, a north-south link E8 and E9) is provided in the network. Similarly, a new North-South link on the east side of the River Nile was proposed to be included in the network. The most optimum location of this link is found to be the connection between E5-2 and E10.

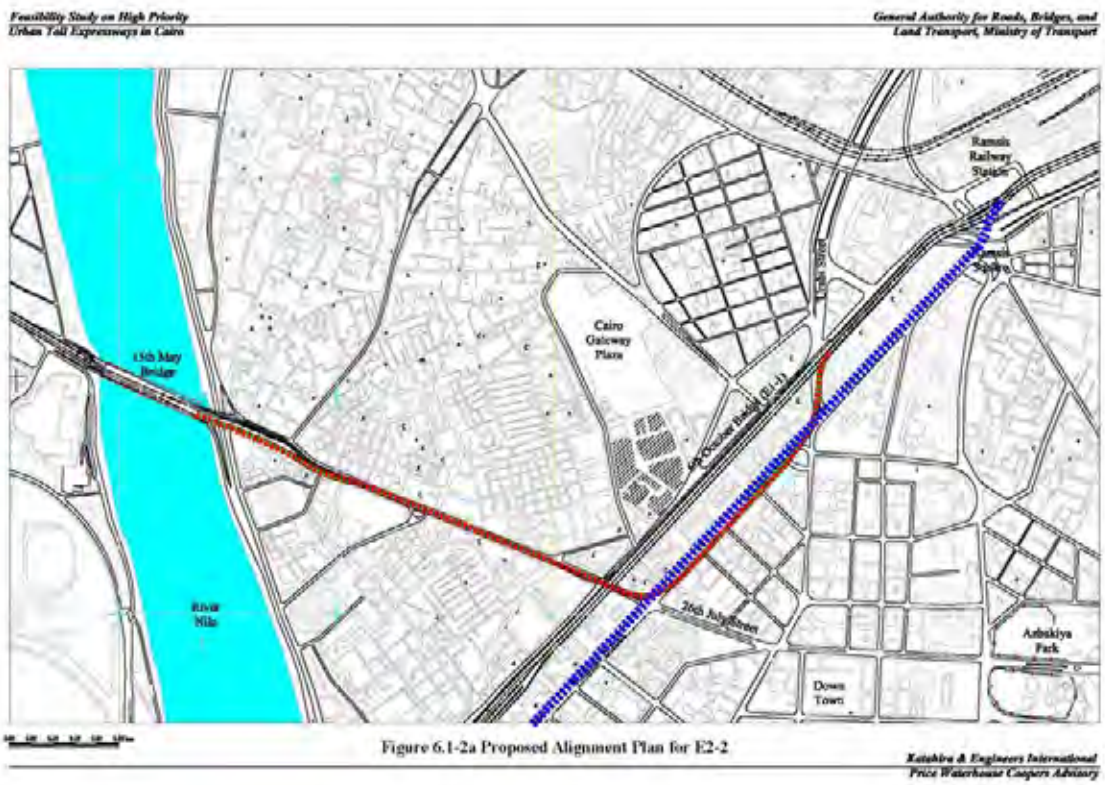


Figure 4.1-3 Proposed E2-2 with Ramses Street Viaduct

In addition, to connect E2-2 with E1-1 a new viaduct parallel to 6th of October elevated road is required over Ramses Street to allow a connection with E1-1 based on the applied design standard. This viaduct is required on a short section on Ramses Street between the two intersections of 26th of July Street and Orabi Street. In future, it may be necessary to extend it (that is called E1-3) between the River Nile to the east till Ghamra Metro Station to handle heavy traffic from E5, as shown in .

4.2 TRAFFIC VOLUMES

Chapter 3 provides the analysis and results of traffic surveys as well as the procedure of the traffic demand forecast. Here the traffic volume issue is discussed in relation to the required number of lanes on the study routes and the future requirements for bridges crossing the River Nile.

4.2.1 Number of Lanes

With the year 2027 as a target year, traffic assignment results presented in Chapter 3 give 3-lane requirements in each direction for most of the sections of E3 which is under this study. The other 2 sections of E1-2 and E2-2 require only 2 lanes in each direction to accommodate the assigned traffic volumes. It should be noted that the PPP Study proposed only 2 lanes for

each direction for the whole network based on the target year 2022. Providing 3 lanes in each direction is expected to increase the construction cost. In addition, there is the political understanding that 3 lanes per direction will be required in later years, even after 2027, as the life span of this project is expected to extend for more than 50 years. The bad experience of future widening after implementing 2 lanes of 6th of October elevated road gives the 3 lane option more practicality.

Figure 4.2-1 shows the traffic volumes assigned on the whole urban toll expressway for the target year 2027 when applying a fixed toll of LE 5 per trip. Section E3-2 shows high traffic volumes of 90,000 pcu, which can be adjusted by means of traffic management and control to give acceptable congestion ration of V/C. Figure 4.2-2 gives the traffic volumes assigned on only the study routes in 2027.

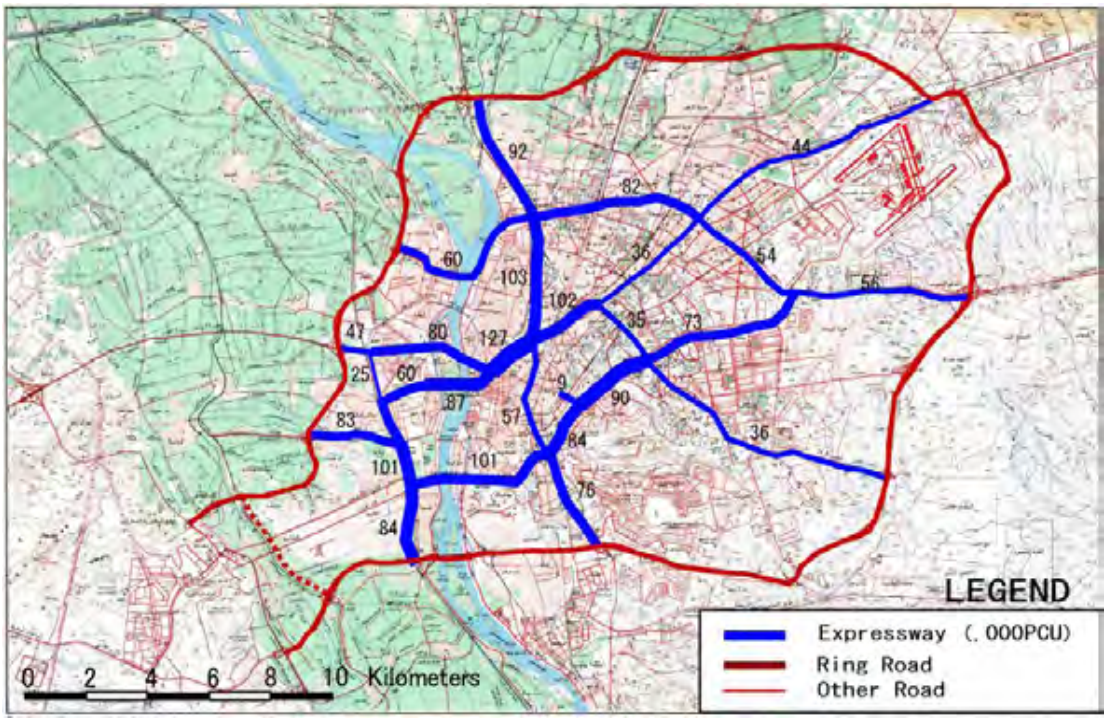


Figure 4.2-1 Assigned Traffic Volumes on Expressway Network - 2027

4.2.2 River Nile Bridges

An analysis is done here to investigate the required number of lanes for bridges over the River Nile in future for both the toll expressways and other ordinary non-toll roads. In addition, results will clarify the impact of transferring the existing E1 (6th of October) and E2 (15th of May) into toll expressways as well as the construction of a new bridge for the section E4-3 in future or to use the existing Rod El-Farag Bridge for the toll expressway. Table 4.2-1 presents the summary results of the analysis in which a maximum capacity of 12,000 pcu/day is applied for ordinary lanes and 18,000 pcu for expressway lanes.

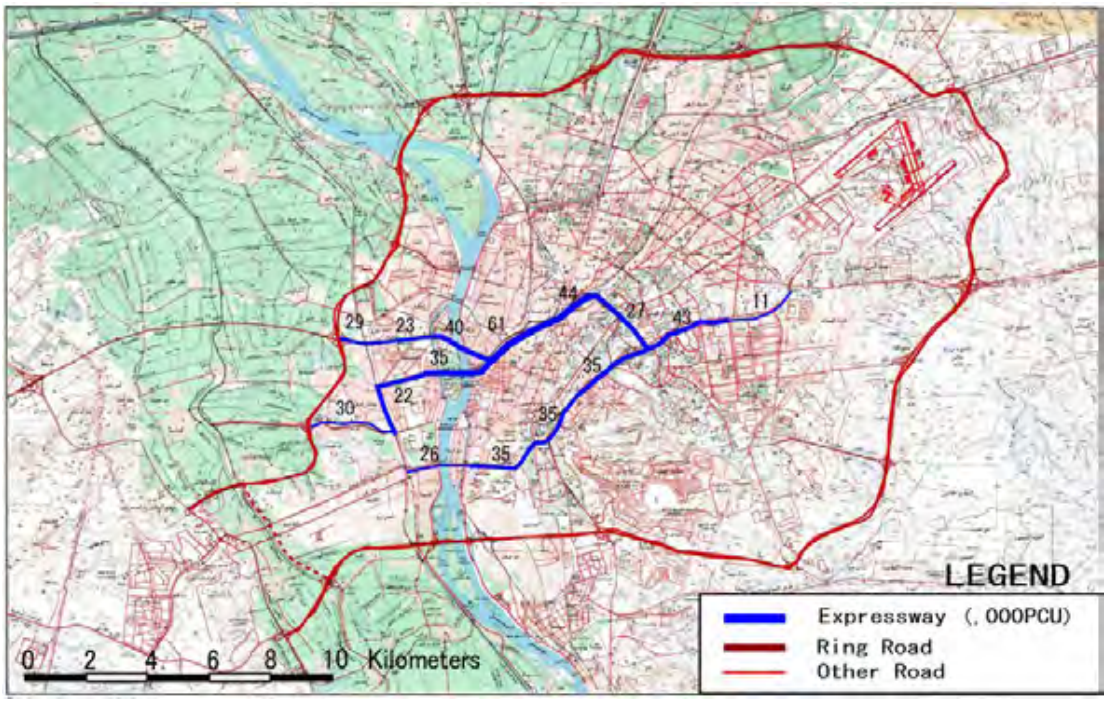


Figure 4.2-2 Assigned Traffic Volumes on Study Expressways Only - 2027

At present, there are 70 traffic lanes on the existing bridges over the Nile River including the Greater Cairo Ring Road bridges north and south of Cairo and all bridges in between. In the year 2012, the case of utilizing 8 existing lanes as toll expressway, providing that 2 new lanes can be added to the width of 6th of October Bridge, is compared with the case of keeping existing bridges as non-toll. After the year 2017, assessment is done to explore the necessity of a new bridge on the section E4-3 of the expressway network.

Based on the results in the table, it is clear that applying toll on the inner 4 lanes of the existing 6th of October and 15th of May will improve the total average V/C from 1.332 to 1.238 in the year 2012. In addition, providing a new bridge for the expressway at the section E4-3 is also necessary to keep an average V/C at the level of 1.5, which is considerably high. Without this new bridge the average V/C on all crossings over the Nile will reach 1.665 in 2027. By the year 2017, this new expressway bridge should be constructed.

Table 4.2-1 Traffic Volumes over River Nile Bridges

Year	Type	Lanes	Capacity	Volume	V/C	Remarks
2007	Bridges	70	840,000	1,123,899	1.338	Existing Bridges including RR
2012	Bridges	64	768,000			70-8+2 Lanes
	Expressway	14	252,000			E1: 4L / E2:4L / E3:6L
	Total (1)		1,020,000	1,263,045	1.238	
	Bridges	70	840,000			Existing
	Expressway	6	108,000			E3: 6L / E1 and E2 non-toll
	Total (2)		948,000	1,263,045	1.332	
2017	Bridges	64	768,000			
	Expressway	14	252,000			
	Total (1)		1,020,000	1,431,861	1.404	Without E4-3
	Bridges	64	768,000			
	Expressway	20	360,000			
	Total (2)		1,128,000	1,431,861	1.269	With E4-3
	Bridges	70	840,000			Existing
	Expressway	6	108,000			
	Total (1)		948,000	1,431,861	1.510	Without E4-3
	Bridges	70	840,000			
	Expressway	12	216,000			
	Total (2)		1,056,000	1,431,861	1.356	With E4-3
2022	Bridges	64	768,000			
	Expressway	14	252,000			
	Total (1)		1,020,000	1,667,020	1.634	Without E4-3
	Bridges	64	768,000			
	Expressway	20	360,000			
	Total (2)		1,128,000	1,667,020	1.478	With E4-3
2027	Bridges	64	768,000			
	Expressway	14	252,000			
	Total (1)		1,020,000	1,698,722	1.665	Without E4-3
	Bridges	64	768,000			
	Expressway	20	360,000			
	Total (2)		1,128,000	1,698,722	1.506	With E4-3

4.2.3 Assessment of Proposed E14

As this link will be implemented in the most congested central areas of Cairo, implemented as a shield tunnel is the only option. Other structures such as a viaduct or open-cut tunnel will be unpractical to implement. Rough cost estimation was carried out and the cost is estimated to be about LE 5.0 billion.

Table 4.2-2 presents changes in the traffic characteristics in the 2 cases of “with E14” and “without E14” as well as the expected increase in revenue as explained in the following sections.

(1) Traffic Volume Estimation in 2027

- ADT 68,528 pcu/day
- Passing through traffic 56,032 pcu/day
- in/out CBD traffic 12,496 pcu/day

(2) With and Without Analysis in 2027

- Induced demand for toll road by implementation of E14 is about 6,400 puc / day
- Incremental revenue per year is about LE 15 million. On the other hand, the construction cost of E14 is approximately LE 5.0 billion.

Table 4.2-2 Traffic Characteristics and Cost of E14

	Unit	With E14 (2027)	Without E14 (2027)	With E14 – W/O E14
Additional Length	km	5.3	0	5.3
Total Number of Toll Road Users (E1 - E14)	puc/day	978,402	972,015	6,387
Revenue (Toll Rate = 8.0 LE)	LE / day	7,827,216	7,776,120	51,096
Revenue per year	million LE	2,348.2	2,332.8	15.3
Average Travel Speed in CBD Area	km/ hour	12.19	12.04	0.15
Vol / Capacity in CBD Area		1.1063	1.1111	-0.0048
E14 Additional Construction Cost	Billion LE	5.0	0	5.0

(3) Assigned Traffic in With and Without Case in 2027

(a) and (b) show the assigned traffic volumes for the 2 cases of “with E14” and “without E14”.

(4) Assignment Result of E14 With and Without Case in 2027

Table 4.2-3 presents the assignment results in regard to the traffic characteristics on both the expressway network and at-grade road network. A little impact and low revenue are resulted in spite of its high investment.

(a) With E14 in 2027

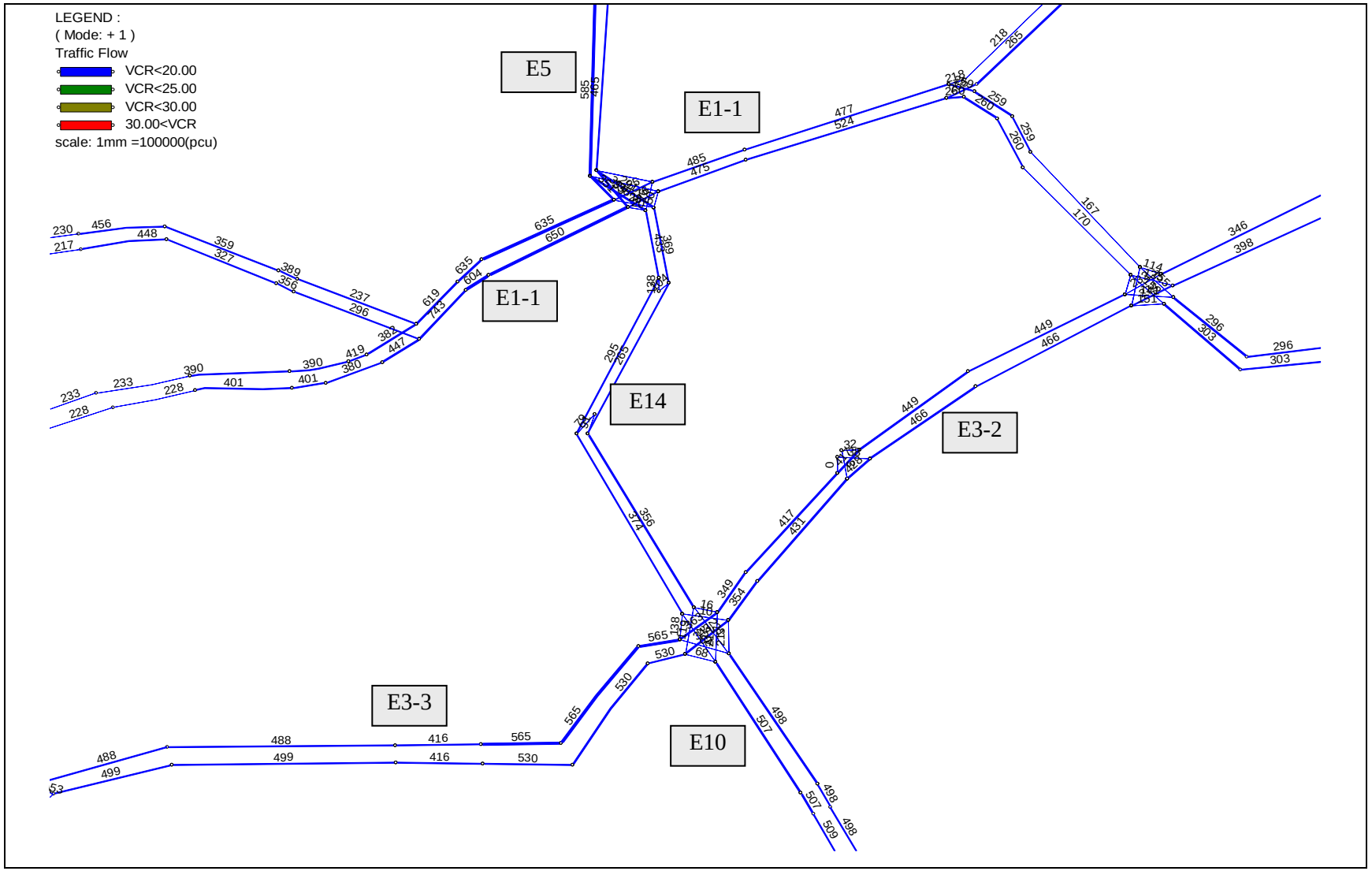


Figure 4.2-3a Assigned Traffic Volumes (With E14 Case in 2027)

(b) Without E14 in 2027

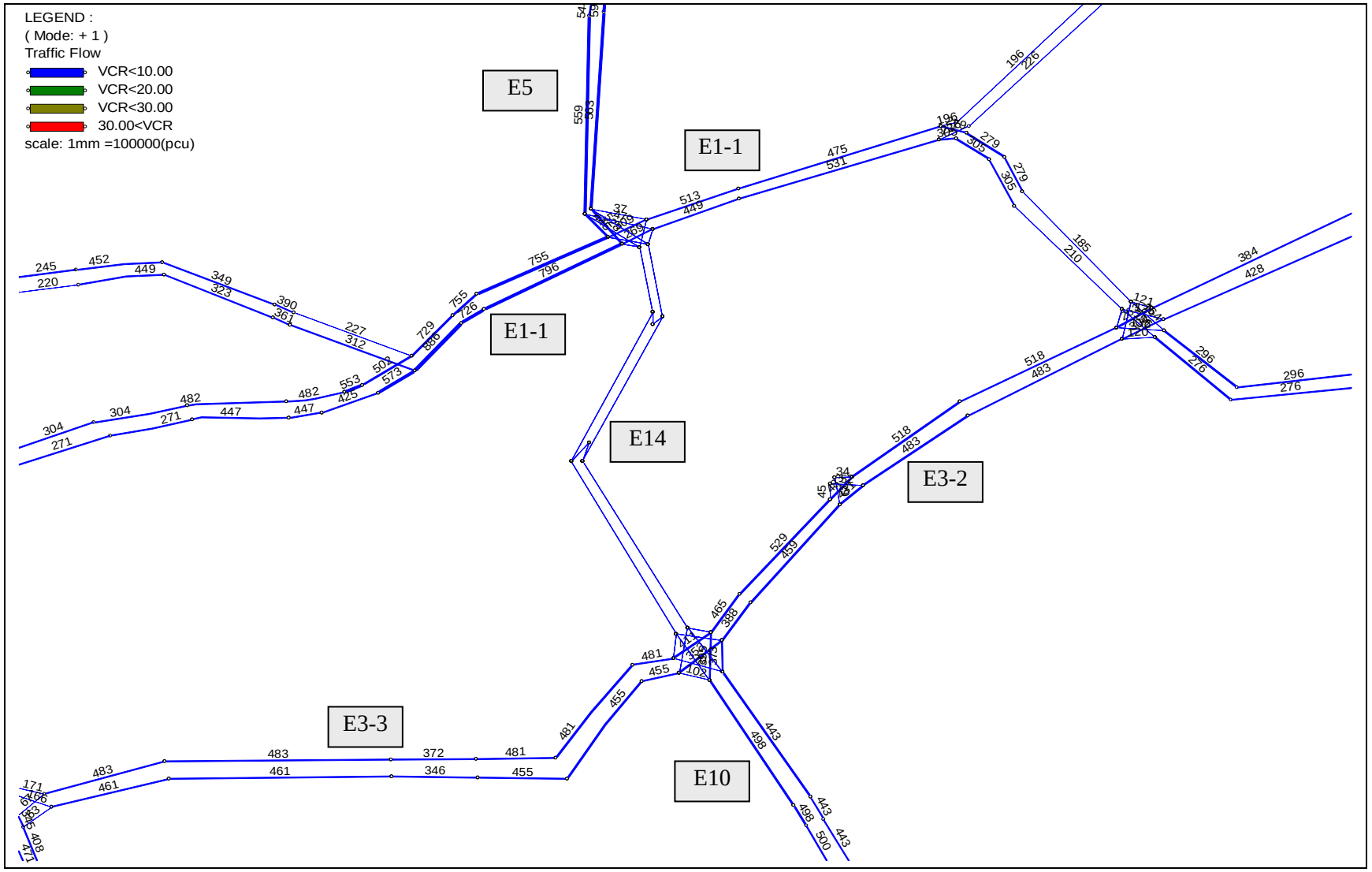


Figure 4.2-3b Assigned Traffic Volumes (Without E14 Case in 2027)

Table 4.2-3 Assignment Result of E14 for With and Without Cases in 2027

ADT	68,528	pcu / day	Passing through	56,032	in/out CBD	12,496

With E14

		Total Vol	km	Capa*km	AveSpeed	PeakSpeed	Vol*km	Vol*hrs(Ave)	Vol*hrs(Peak)	LOC
Ordinary Road Inside Ring Road			764.3	39,619,025	35.5	12.2	43,832,119	1,236,285	3,596,505	1.11
Ordinary Road Outside Ring Road			1,309.6	73,872,837	46.2	15.8	74,514,191	1,612,470	4,712,917	1.01
At Grade Road Total			2,073.9	113,491,862	41.5	14.2	118,346,310	2,848,756	8,309,422	1.04
	Toll Road(E1-E14)		144.1	11,990,821	58.7	28.4	9,885,201	168,423	347,806	0.82
	Ring Road		88.3	10,377,905	72.2	22.2	15,980,177	221,440	718,662	1.54
Toll Road and Ring Road			232.4	22,368,726	66.3	24.3	25,865,378	389,863	1,066,468	1.16
Total			2,306.3	135,860,588	44.5	15.4	144,211,688	3,238,619	9,375,890	1.06
No of Users Toll and RR	Toll Road(E1-E14)	978,402		Fare		Revenue	7,827,216	LE per day		
	Ramp Ringroad	1,878,959		8.0		million LE per year	2,348	million LE per year		
	Ramp Total	2,857,361		Conv. to year		300				

Without E14

		Total Vol	km	Capa*km	AveSpeed	PeakSpeed	Vol*km	Vol*hrs(Ave)	Vol*hrs(Peak)	LOC
Ordinary Road Inside Ring Road			764.3	39,619,025	35.4	12.0	44,021,355	1,244,082	3,656,530	1.11
Ordinary Road Outside Ring Road			1,309.6	73,872,837	46.5	15.9	74,488,693	1,601,278	4,673,565	1.01
At Grade Road Total			2,073.9	113,491,862	41.7	14.2	118,510,049	2,845,361	8,330,094	1.04
	Toll Road(E1-E14)		137.3	11,479,621	58.7	27.3	9,642,637	164,196	353,170	0.84
	Ring Road		88.3	10,377,905	71.6	22.2	16,204,692	226,434	728,890	1.56
Toll Road and Ring Road			225.6	21,857,526	66.2	23.9	25,847,329	390,630	1,082,060	1.18
Total			2,299.5	135,349,388	44.6	15.3	144,357,378	3,235,991	9,412,154	1.07
No of Users Toll and RR	Toll Road(E1-E14)	972,015		Fare		Renenue per day	7,776,120	LE per day		
	Ramp Ringroad	1,880,272		8.0		Revenue per year	2,333	million LE per year		
	Ramp Total	2,852,287		Conv. to year		300				

With - Without (E14)

		Total Vol	km	Capa*km	AveSpeed	PeakSpeed	Vol*km	Vol*hrs(Ave)	Vol*hrs(Peak)	LOC
Ordinary Road Inside Ring Road		0	0.0	0	0.1	0.1	-189,236	-7,797	-60,024	-0.005
Ordinary Road Outside Ring Road		0	0.0	0	-0.3	-0.1	25,498	11,192	39,352	0.000
At Grade Road Total		0	0.0	0	-0.1	0.0	-163,738	3,395	-20,672	-0.001
	Toll Road(E1-E14)	0	6.8	511,200	0.0	1.1	242,563	4,227	-5,364	-0.016
	Ring Road	0	0.0	0	0.6	0.0	-224,514	-4,994	-10,228	-0.022
Toll Road and Ring Road		0	6.8	511,200	0.2	0.4	18,049	-767	-15,592	-0.026
Total		0	6.8	511,200	-0.1	0.0	-145,689	2,628	-36,264	-0.005
No of Users Toll and RR	Toll Road(E1-E14)	6,387		Fare		Renenue per day	51,096	Le per Day		
	Ramp Ringroad	-1,313		8.0		Revenue per year	15	million LE per year		
	Ramp Total	5,074		Conv. to year		300				

4.3 ROUTE PRIORITIZATION

It was necessary to review the prioritization of the different links of the expressway network under the newly introduced conditions taking into consideration the objectives of the urban toll expressway development plan, which are:

- To reduce traffic congestion and to increase traffic efficiency on the road network in the Greater Cairo Region (GCR)
- To provide alternative high-grade service of expressway network to the road users
- To contribute to the provision of preferable social and urban environmental conditions
- To contribute to the national and regional economic development
- To promote the planned urban development and new communities.

4.3.1 Prioritization Procedure

The applied procedure for prioritization of the expressway sections is basically based on the procedure developed under the PPP Study with some minor modifications to meet the present status of the study. Under this procedure, the indicators of each factor were established and given scores based on importance of each factor. Indicators for each individual section are measured and scored following the procedure which is illustrated in Figure 4.3-1. The future traffic volumes of the new target year of 2027 are applied rather than those of the year 2022 of the PPP Study.

Table 4.3-1 gives the criteria and factors applied in the prioritization procedure. The prioritization factors from transportation aspects are set up in line with the objectives of Urban Toll Expressways Assessments. All the factors are considered with the length of toll road developed, so economical and financial aspects could be assessed assuming that the unit construction cost is the same for all sections.

Table 4.3-1 Prioritization Criteria

Criteria	Remarks
Magnitude of Traffic Volume (Density)	PCU/km in 2027
Growth Rate of Traffic Volume	AAGR (%) from 2017 to 2027
Volume Capacity Ratio in At-Grade Road	V/C/km, in 2027
Travel Speed in At-Grade Road	km/h / km, in 2027 inside Ring Road
PCU*hours in At-Grade Road	PCU*hours / km, in 2027 inside Ring Road
PCU*hours in All Road Network	PCU*hours / km, in 2027 inside Ring Road
Environmental Aspect	HC, CO and NOx
Land Acquisition	Interview to GARBLT
Urban Development, Urgency and Maturity	Information from and Interview to GARBLT and GOPP

Table 4.3-2 presents the scoring system for the applied prioritization criteria which is similar to the system applied in the PPP Study, while Table 4.3-3 presents the cases of simulation that are utilized to assess the established criteria for each expressway.

Table 4.3-2 Scoring System of Prioritization Criteria

Criteria	Score	Indicator
Magnitude of Traffic Volume (Density) PCU/km in 2027 (Change from Base Case)	5	PCU/km > 10,000
	4	10,000 > PCU/km > 7,500
	3	7500> PCU/km > 5,000
	2	5,000> PCU/km > 2,500
	1	2,500> PCU/km
Growth Rate of Traffic Volume AAGR (%) from 2017 to 2027 (Change from Base Case)	5	AAGR > 10%
	4	10% > AAGR > 8.0%
	3	8% > AAGR > 6%
	2	6% > AAGR > 5%
	1	5% > AAGR
Volume Capacity Ratio in At-Grade Road VCR / km, in 2027 (Change from Base Case)	5	VCR/km*1000 < -2.0
	4	-2.0 < VCR/km*1000 < -1.5
	3	-1.5 < VCR/km*1000 < -1.0
	2	-1.0 < VCR/km*1000 < -0.5
	1	-0.5 < VCR/km*1000
Travel Speed in At-Grade Road kph / km, in 2027 inside Ring Road (Change from Base Case)	5	km/h /km*100 > 3.0
	4	3.0 > kph/km*100 > 2.0
	3	2.0 > kph/km*100 > 1.0
	2	1.0 > kph/km*100 > 0.5
	1	0.5 > kph/km*100
PCU-hours in At-Grade Road PCU-hours / km, in 2027 inside Ring Road (Change from Base Case)	5	PCU-hrs/km < -4,000
	4	-4,000 < PCU-hrs/km < -3,000
	3	-3,000 < PCU-hrs/km < -2,000
	2	-2,000 < PCU-hrs/km < -1,000
	1	-1,000 < PCU-hrs/km
PCU-hours in All Road Network PCU-hours / km, in 2027 inside Ring Road (Change from Base Case)	5	PCU-hrs/km < -2,000
	4	-2,000 < PCU-hrs/km < -1,000
	3	-1,000 < PCU-hrs/km < -500
	2	-500 < PCU-hrs/km < -250
	1	-250 < PCU-hrs/km

The simulation cases for prioritization analysis started with the base case in which the on-going E11 and the 3 routes under this study are under operation with a toll rate of LE 5.00 for the two target years of 2017 and 2022. This basic is followed by other cases in which each individual expressway is added as shown in Table 4.3-3.

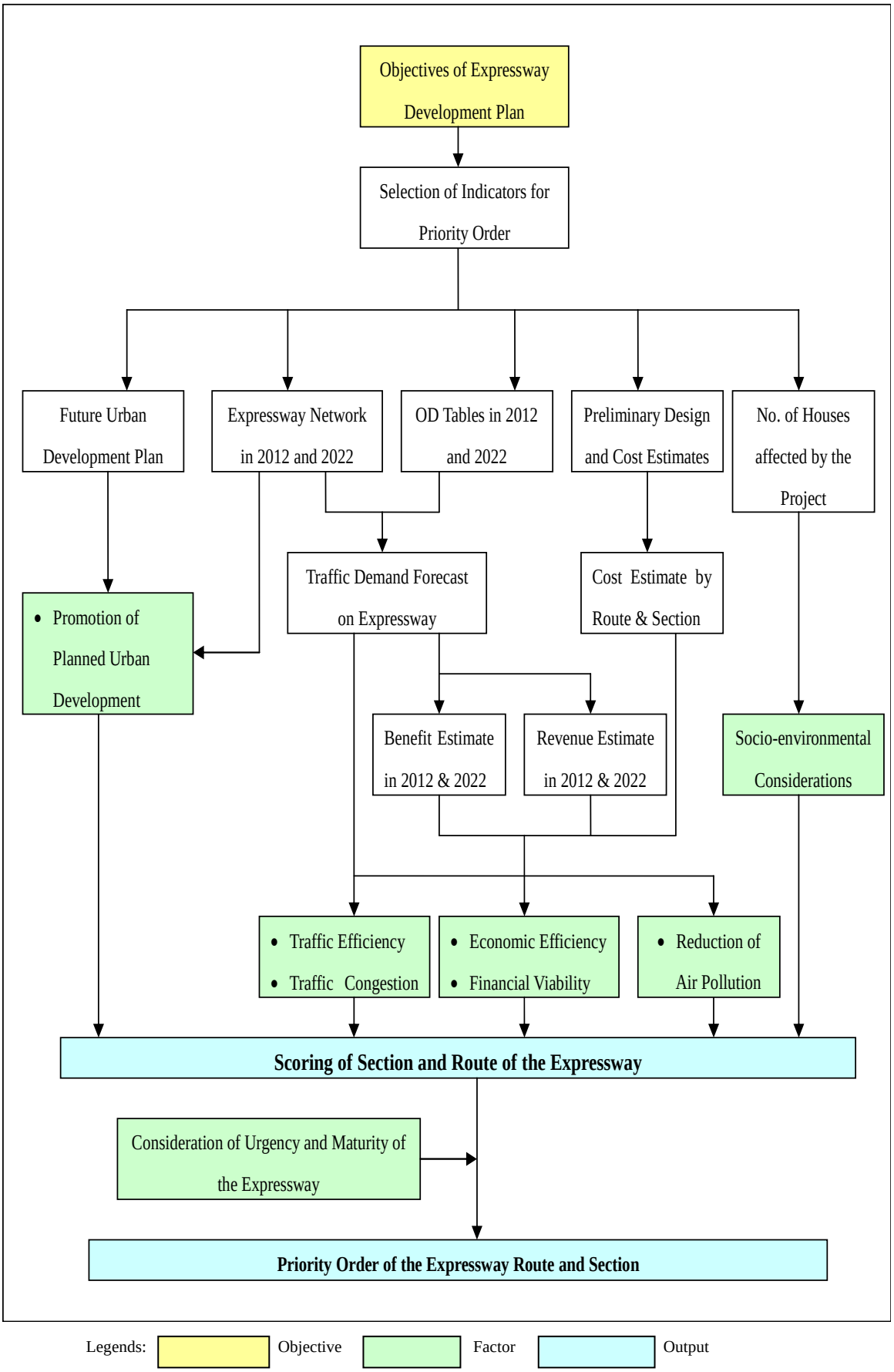


Figure 4.3-1 Prioritization Procedure (*Source: PPP Study*)

4.3.2 Results of Prioritization Analysis

Figure 4.3-2 shows a summary of the analysis results by applying the different criteria on each individual expressway. With the implementation the whole length of the expressway of E3 and E1-2 to the Zumur Canal and the railway line in Giza, the expressway E8, which connects both expressways and provides a link that closes Cairo Ring Road, is getting the highest priority compared with all other routes. Major functions of E8 can be summarized as follows:

Table 4.3-3 Simulation Cases for Prioritization Analysis

Toll Road Network	Toll Level	Target years
Base Case: E1+E2+E3+E11	5 L. E.	2017, 2027
Base Case + E4	5 L. E.	2017, 2027
Base Case + E5	5 L. E.	2017, 2027
Base Case + E6	5 L. E.	2017, 2027
Base Case + E7	5 L. E.	2017, 2027
Base Case + E8	5 L. E.	2017, 2027
Base Case + E9	5 L. E.	2017, 2027
Base Case + E10	5 L. E.	2017, 2027
Base Case + E12	5 L. E.	2017, 2027
Base Case + E13	5 L. E.	2017, 2027
Base Case + E14	5 L. E.	2017, 2027

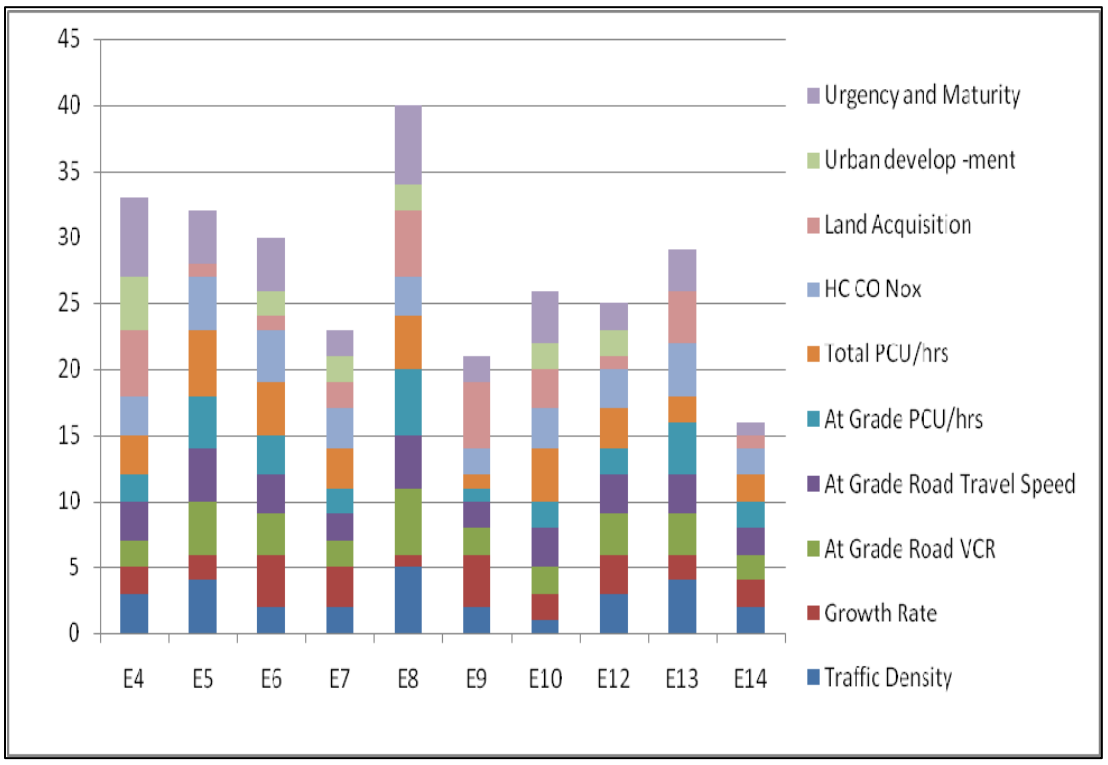


Figure 4.3-2 Prioritization Results

- To connect the Study Routes E1 and E3 and with E11 which is under construction.
- To optimize the benefits of implementing E1-2 and E3.
- To provide an Inner Ring Road with E1, E3 and with southern section of Cairo Ring Road as the basic concept of CREATS.
- To provide a missing link closing Cairo Ring Road.
- To provide a North-South link west of the Nile at Giza city.

Figure 4.3-3 presents a location map for the high priority route of E8 with its connections to other expressways in the network.

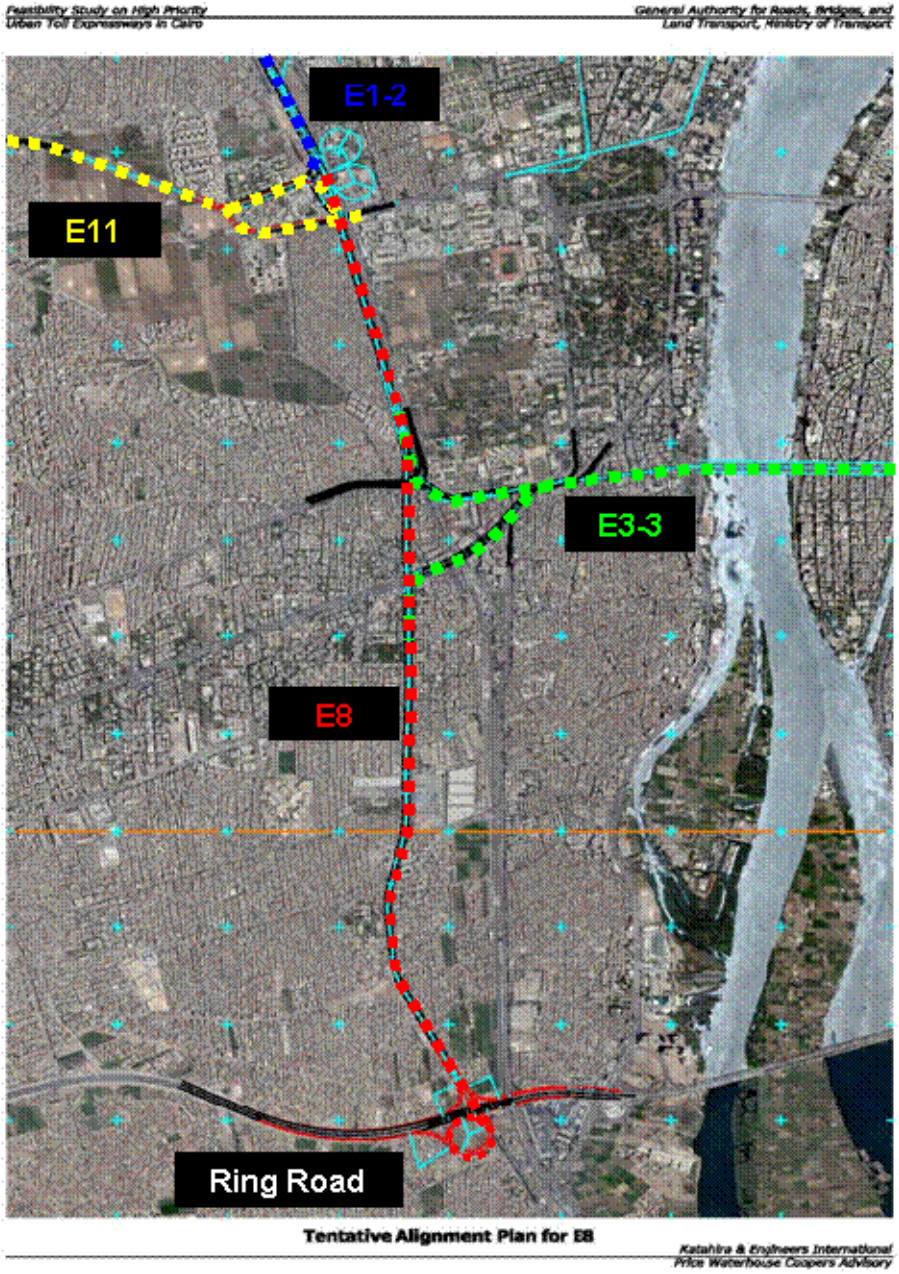


Figure 4.3-3 Location of E8

Table 4.3-4 shows a tentative implementation schedule based on the prioritization analysis. Results show that E4 and E5 with E13 are the following candidates. It is recommended that this prioritization analysis should be updated every 5 years in order to take into consideration any newly introduced developments that are not considered at present and may affect the optimum operational efficiency of the network.

In addition, this tentative implementation schedule will be greatly affected by the available financial resources, construction capabilities and availability of special construction materials such as fabricated steel components.

4.3.3 HPE Revised Implementation Action Plan

The Action Plan developed in the PPP Study is revised here, as presented in Table 4.3-5, for the early implementation of high priority expressways (HPE) based on the current conditions and financing possibilities. Under this plan, it is assumed that the detailed engineering design will start just after completing this study. It will take about one year to complete the detailed design tasks. During this period, financing aspects and official approvals can be secured.

Table 4.3-4 Tentative Expressway Implementation Plan

Section	Priority	Length (km)	Cost (1000 LE)	Year																					
				2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
E1-1	Toll Plaza	11.0	2,074					D	C															
E1-2	FS	4.3	2,648			D	C	C	C	C	C													
E2-1	Toll Plaza	12.8	1,206					D	C															
E2-2	FS	1.8	317			D	C	C	C															
E3-1	FS	6.5	2,306			D	C	C	C	C														
E3-2	Pre FS	5.6	1,529				D	C	C	C	C													
E3-3	Pre FS	6.6	1,853				D	C	C	C	C													
E4-1	1st	4.7	886							D	C	C	C											
E4-2	1st	7.1	1,778							D	C	C	C											
E4-3	1st	5.2	980							D	C	C	C											
E5-1	2nd	5.3	999										D	C	C	C								
E5-2	2nd	4.7	1,177												D	C	C	C						
E6	2nd	7.5	1,414										D	C	C	C								
E7-1	2nd	10.5	1,979											D	C	C	C							
E7-2	4th	5.4	1,018															D	C	C	C			
E8-1	1st	2.9	726				D	C	C	C														
E8-2	1st	1.9	476				D	C	C	C	C													
E9	4th	4.0	754																		C	C	C	C
E10	3rd	4.0	1,001												D	C	C	C						
E11	On Ggoing	4.0	1,001	C	C																			
E12	3rd	10.8	2,035												D	C	C	C						
E13	2nd	5.3	999						D	C	C	C												
E14	5th	5.3	1,000																					D
I. C. (Full)			2,564							D	C	C	C		D	C	C	C		D	C	C	C	
I. C. (Half)			1,442							D	C	C	C		D	C	C	C		D	C	C	C	

D Design
C Construction

Table 4.3-5 Revised Implementation Action Plan for High Priority Expressways

Major Tasks	2005	2006	2007	2008	2009	2010	2011	Agency In-Charge
Cairo PPP Study								JICA ST - ENIT
Route Prioritization – HPE								JICA ST - ENIT
MEA Secretariat								MOT
F/S on HPE (E1-2/E2-2/E3-1)								JICA ST - GARBLT
EIA on HPE								GOPP/MOE
MOT Approval								MOT
MEA Organization Set-up								MOT
MOP / MOF Approval								MOP/MOF
Parliament Committee Approval								MOT
Cabinet Approval								MOT
Consultant Selection								JICA
Detailed Design of HPE								ODA/MEA
Construction Loan								GARBLT/MEA
Tendering								GARBLT/MEA
Construction of HPE								GARBLT/MEA/ODA
F/S on Next Routes (E3-2/E3-3/E8)								JICA/GARBLT/MEA

HPE: High Priority Expressways
JICA ST: Study Team
D/D: Detailed Design
F/S: Feasibility Study
EIA: Environmental Impact Study
MEA: Metropolitan Expressway Authority
CG: Cairo Governorate

MOT: Ministry of Transport
MOP: Ministry of Planning
MOF: Ministry of Finance
MOE: Ministry of Environment
ENIT: Egypt National Institute of Transport
GOPP: General Organization for Physical Planning
ODA: Official Development Assistance