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

Japan International
Cooperation Agency
(JICA)

No.

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

Phase II

CREATS

Cairo REgional Area Transportation Study

FINAL REPORT Vol. II

Strategic Corridors, Area Transport Management and Development Program

December 2003

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Pacific Consultants International (PCI)

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Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt Phase 2

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The following foreign exchange rates are applied in this study.
USD $1.00 = 6.0 Egyptian Pound (LE)

（As of September 2003）

PREFACE

In response to the request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct the Phase 2 Study for "Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt" and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched the study team headed by Dr. Katsuhide Nagayama of Pacific Consultants International to the Arab Republic of Egypt between February 2003 and October 2003. In addition, JICA set up an Advisory Committee headed by Professor Noboru Harata of Tokyo University between February 2003 and January 2004, which examined the Study from the specialist and technical point of view.

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

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

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

December 2003

Kazuhisa Matsuoka
Vice President
Japan International Cooperation Agency

December 2003

Mr. Kazuhisa Matsuoka
Vice President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the Final Report of the Phase 2 study for "Transportation Master Plan and Feasibility Study of Urban Transport Project in Greater Cairo Region in the Arab Republic of Egypt".

The Study was undertaken in the Arab Republic of Egypt from February 2003 through October 2003 by the Study Team organized by Pacific Consultants International under the contract with JICA.

This report compiles Feasibility Studies of five priority projects identified within the framework of the Transport Master Plan, which was built in Phase 1 study in order to contribute to the sustainable development in Greater Cairo Region.

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

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

Very truly yours,

Dr. Katsuhide Nagayama
Team Leader,
The Study Team for the Transportation Master Plan and Feasibility Study of Urban Transport Project in Greater Cairo Region in the Arab Republic of Egypt
Phase 2

CREATS Phase II : FINAL REPORT Vol. II
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A/C	Air Conditioned
AE	Acid Equivalent
ASG	Assignment Group (Code)
ATMs	Automatic Teller Machines
B/C	Benefit / Cost Ratio
BiH	Bosnia and Herzegovina
BOOT	Build-Own-Operate-Transfer
BOT	Build-Operate-Transfer
Br.	Bridge
C/C	Counterpart Committee
CAIP	Cairo Air Improvement Project
CAPMAS	Central Agency for Public Mobilization and Statistics
CBD	Central Business District
CCTV	Closed Circuit Television System
CDO	Central Development Organization
CDC	Cairo Demographic Center
CEHM	Cairo University Center for Environmental Hazard Mitigation
CIDA	Canadian International Development Agency
CH_4	Methane
CLS	Cordon Line Survey
CMO	Cairo Metro Organization
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Di-Oxide
CORPS	Corniche, Ramses and Port Said Streets
CREATS	Cairo Regional Area Transportation Study
CRR	Cairo Ring Road
CTA	Cairo Transport Authority
CTEB	Cairo Traffic Engineering Bureau
CTP	Common Transport Policy
CTS	Cargo Transport Survey
DRTPC	Development Research and Technological Planning Center of Cairo University
EAS	Environmental Awareness Survey
EC	European Community
EC	Executive Committee
ECMT	European Conference of Ministers of Transport
EEA	European Environment Agency
EEAA	Egyptian Environmental Affairs Agency
EEIS	Egyptian Environmental Information System
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Study
EIMP	Environmental Information and Monitoring Program

EMT	Environmental Management and Technology Fund
ENIT	Egyptian National Institute of Transport
ENL	Effective Number of Lanes
ENR	Egyptian National Railways
EQI	Environmental Quality International
ESCAP	Economic and Social Commission for Asia and Pacific
ESE	Egyptian Stock Exchange
EU	European Union
FLC	Fully Loaded Containers
FDI	Foreign Direct Investments
FIRR	Financial Internal Rage of Return
FRN	French Railway Network
FY	Fiscal Year
GAM	Goal Achievement Matrix
GC	Greater Cairo
GCBC	Greater Cairo Bus Company
GCR	Greater Cairo Region
GDP	Gross Domestic Product
GIS	Geographic Information System
GNP	Gross National Product
GOE	Government of Egypt
GOPP	General Organization for Physical Planning
HBE	Home Based Education
HBO	Home Based Other
HBW	Home Based Work
HC	Hydro-Carbons
HCM	Highway Capacity Manual
HDM	Highway Development and Management System
HIS	Home Interview Survey
HM	Heavy Metals
HOV	High Occupancy Vehicle (Lane)
HRT	Heavy Rail Transit
HSR	High Speed Rail
IAURIF	I'Insitut d'Aménagement et d'Urbanisme de la Region d'Ile-de-France
I/C	Interchange
ICM	Intermodal Concept and Management
ICT	International Cargo Transport
ID	Identification
IEE	Initial Environmental Examination
IHS	Internal Homogeneous Planning Sector
IIA	Independence of Irrelevant Alternative
IM	Inter-Modal
IMF	International Monetary Fund
IRF	International Road Federation
IRMS	Integrated Road Management System
ISO	International Organization for Standardization

ITS	Information Transfer Strategy
ITU	Intermodal Transport Unit
JICA	Japan International Cooperation Agency
JIT	Just In Time
KAP	Knowledge, Attitude and Practice
LAN	Local Area Network
LE	Egyptian Pound
LOS	Level of Service
LRT	Light Rail Transit
MAD	Mean Absolute Difference
M/M	Minutes of the Meetings
MCA	Multi-Criteria Analysis
MEA	Metropolitan Expressway Authority
MENA	Middle East and North African Nations
MHUUC	Ministry of Housing, Utilities and Urban Communities
MOE	Ministry of Environment
MOI	Ministry of Interior
MOO	Metro Operation Organization
MOP	Ministry of Planning
MOT	Ministry of Transport
MP	Master Plan
MRT	Mass Rapid Transit
MS	Mobile Station for Air Quality Monitoring
MSEA	Ministry of State for Environmental Affairs
Mμ	Micrometer
N.A.	Not Applicable/Available
NAT	National Authority for Tunnels
NGO	Non Governmental Organization
NH_4	Methane
NHB	Non Home Based
NMHC	Non Methane Hydro-Carbons
NNL	Nominal Number of Lanes
NO	Nitrogen Monoxide
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
NPV	Net Present Value
NRR	Net Reproduction Rate
NU	National Universities
O_3	Ozone
OD	Origin-Destination
OECD	Organization for Economic Co-operation and Development
O&M	Operation & Maintenance
PCI	Pacific Consultants International
PCI	Pavement Condition Index
PCU	Passenger Car Unit
PHR	Peak Hour Ratio (peak hour volume/daily volume)

PM_{10}	Particulate Matter (particles) less than 10 micro meter (μm)
$PM_{2.5}$	Particulate Matter (particles) less than 2.5 micro meter (μm)
PPP	Public-Private Partnership
PPP	Purchasing Power Parity
PRD	Paris Region Division
PRT	Public Road Transport
PT	Public Transport
PTB	Public Transport Bus
PTF	Public Transport Ferry
PTM	Public Transport Metro
PTSR	Public Transport Suburban Rail
PTST	Public Transport Super Tram
PTT	Public Transport Tram
PTXR	Public Transport Express Rail
RCPR	Regional Council of Paris Region
ROI	Return on Investment
RPS	Revealed Preference Survey
S/C	Steering Committee
SCF	Standard Conversion Factor
SE	Socio-economic
SEA	Strategic Environmental Assessment
SLS	Screen Line Survey
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxide
SPS	Stated Preference Survey
TAP	Transport Action Program
TDM	Transport Demand Management
TEN	Trans-European Networks
TEU	Twenty-feet Equivalent Unit
TNI	Traffic Noise Index
TOR	Terms of Reference
TP	Traffic Police
TPA	Transport Planning Authority
TSP	Total Suspended Particulate Matter
TSP	Traffic Safety Program
UAE	United Arab Emirates
UK	United Kingdom of Great Britain and Northern Ireland
USA	United States of America
USAID	United States Agency for International Development
UTPU	Urban Transport Planning Unit
V/C	Volume to Capacity Ratio (Volume divided by Capacity)
VOC	Vehicle Operating Cost
VOC	Volatile Organic Compounds
WB	World Bank (International Bank for Reconstruction and Development)
WHO	World Health Organization

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Executive Summary

INTRODUCTION AND APPROACH

The Japan International Cooperation Agency (JICA) and the Higher Committee for Greater Cairo Transport Planning, Ministry of Transport, are cooperating in the conduct of **CREATS - Cairo Regional Area Transportation Study** (Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt). Pacific Consultants International (PCI), headquartered in Tokyo, Japan, is the designated lead consultant for this study which addresses the multi-modal and integrated transport needs of Greater Cairo over the next 20 years. The Transport Master Plan, identified as CREATS Phase I, was completed during November, 2002.

CREATS Phase II was initiated during February, 2003 with the express purpose of conducting feasibility studies of five high priority projects identified within the framework of the Transport Master Plan. These are divided into Programs A and B, containing three and two components, respectively. **Program A focuses on public transport connections between Cairo and 10th of Ramadan City as well as 6th of October City (termed the East Wing and West Wing, respectively), as well as traffic management techniques along major roads in Cairo and Giza,** the subject of this report, contains three components with specific objectives: Program B: Cairo Transport Authority (CTA) Transport Improvement Project in East Sector of Cairo in Volume III.

- Component A-1: (Chapter 2 of main report)
  Conduct a feasibility study for development of a public transport system within the East-West Corridor composed of the East Wing, linking Ain Shams station with 10th of Ramadan City, including formulation of inter-modal facility development plans in Ain Shams (Area 1);
- Component A-2: (Chapter 3 of main report)
  Conduct a feasibility study for development of a public transport system within the West Wing, linking Giza and the 6th of October City, with investigative foci being the West Wing terminus point in the central area of Giza (Area 2); and
- Component A-3: (Chapter 4 of main report)
  Formulate a short-term traffic management and a bus priority plan along the corridor which, within the longer-term CREATS framework, contains the proposed Metro Line 4; and,

Further detail regarding project history, objectives and content is presented in Chapter 1 of the main report.

Program A shall be carried out within the East-West Corridor and the Metro Line 4 Corridor. The East Wing connects central Cairo with the 10th of Ramadan City, while the West Wing connects central Cairo with the 6th of October City. The Metro Line 4 Corridor is identical to the proposed alignment of Metro Line 4 identified during the Phase I Study (refer to Figure ES.1). Finding is summarized in each section in Executive Summary, complete detail is provided in following chapters of main report.

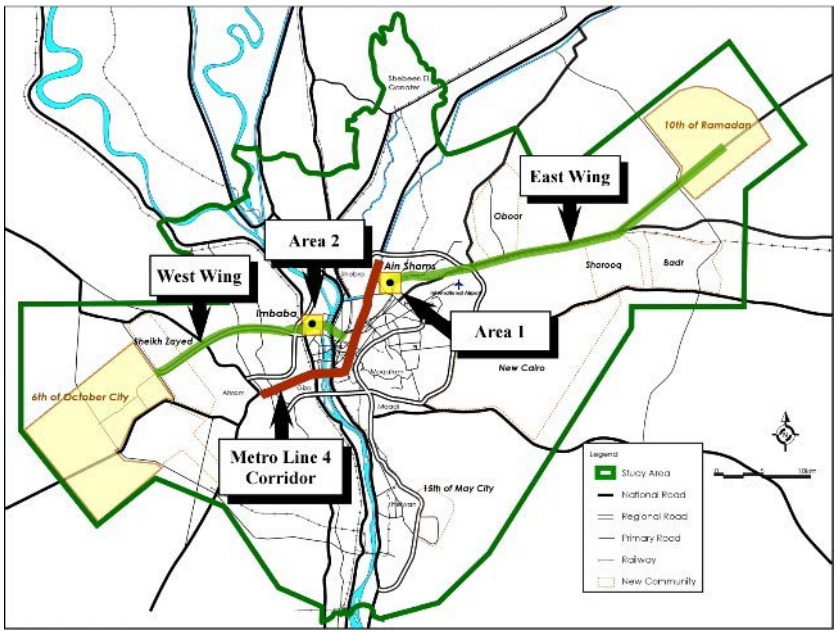


Figure ES.1 Stud Area Map

A-1 EAST WING PUBLIC TRANSPORT DEVELOPMENT

The development of new communities in the eastern part of the Greater Cairo will be a key to mitigate diseconomies due to the excessive concentration of socioeconomic activities in the central areas of Cairo, which has been recognized in the national policy. The CREATS Master Plan addresses the importance of these new communities' growth and proposes to provide a reliable public transport system in the East Wing Corridor, by upgrading the existing Suez Line as part of the suburban rail system. **Complete detail on this Project is presented in Chapter 2, Main Report Volume II.**

BASIC CONCEPT AND STRATEGIES

Along the **East Wing Corridor**, which was defined as a corridor between Ain Shams and 10th of Ramadan City in the East, several new community developments have been in progress as shown in Figure ES.2. The total length of the corridor is about 50 km long. Among those new communities, the 10th of Ramadan City has the biggest population and is expected to accommodate 576,000 residents in 2022. The Oboor and Shorooq new communities will have 300,000 populations, while the Badr new community will be with a 200,000 population.

Current and future population growth potential along the East Wing is very robust, and several suburban centers, which are located along the corridor, need a mass transit system development towards the future.

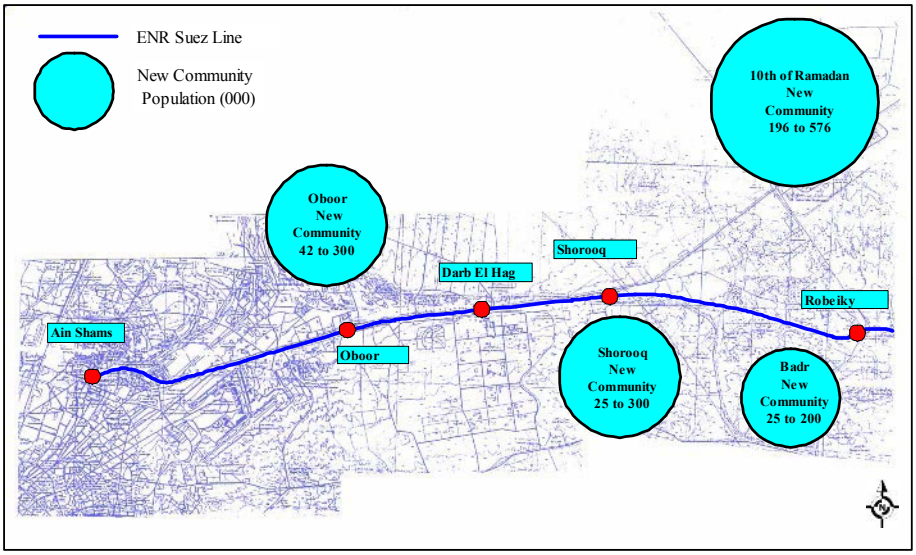


Figure ES.2 New Communities along the East Wing

Travel Characteristics of Residents in New Communities

According to the interview survey, which was conducted for residents of new communities, the following characteristics were revealed.

- 70% of the interviewed residents travel to Cairo at least one a week;
- More than 80% of the interviewee use public transport to go to Cairo;
- More than 60% of car users would use public transport if service is improved; and,
- Social trips for visiting friends and relatives and/or participating in social activities, share about one third of the total trips to Cairo. Thus, travel demands between the new communities and the Cairo CBD are not limited to commuting.

These survey results indicate that public transport development along the East Wing is indispensable and urgent to secure "**quality of life**" of the residents in the new communities. Given a good and reliable public transport mode, it could encourage people to move to the new communities, thereby leading to a success in the urban development policy.

Current Transport Service along the East Wing Corridor

The existing main road along the East Wing is Ismailia Desert Road. It connects all the new communities along the corridor except for the Badr new community where is linked with Badr by Suez Desert Road. Shared taxi offers a major road-based public transport service to connect the central areas of Cairo and the new communities along the corridor. Although no CTA bus service is provided between the 10th of Ramadan and the Cairo CBD area at present, a private bus company (East Delta Bus) serves to/from Ramses area. The service starts at 6 a.m. and ends at 10 p.m. at the city

terminal (the 10th of Ramadan). The headway of the service is every 20 minutes and its travel time to Cairo is approximately 90 minutes.

As for the railway, Egyptian National Railway (ENR) operates eight trains per day on the Suez Line, which connects Ain Shams and Suez via the East Wing Corridor. Travel time between Ain Shams Station and Robeiky Station is approximately 45 minutes. However, the number of passengers of the line is very limited, because of its long headway.

A RAILWAY SYSTEM FOR THE EAST WING

For the East Wing public transport development, the CREATS Master Plan proposed a railway link from the Cairo CBD to the 10th of Ramadan City, by rehabilitating the existing ENR Suez Line and constructing a new railway link extending to the new city directly.

In the process of the alternative route analysis, the Study Team examined a **busway connection** to/from the new city as a possible option of public transport for the East Wing, and compared priority of various railway route options with the busway option as well. Six alternative route plans, consisting of one busway and five alternative railway route plans were examined. As the conclusion, a railway option, which connects Ain Shams and the 10th or Ramdadan City at shortest distance, was selected as the best option based on preliminary economic evaluation. The busway option, which utilizes median of Ismailia Desert Road for exclusive busways, was not recommended, because such an option consequently causes severe traffic congestions on the road, thereby resulting in a comparatively low economic internal rate of return for the busway project.

Future Transport Demand Forecast

Future passenger demand was estimated for the selected option of the East Wing Railway, and its volume band chart by section is depicted as shown in Figure ES.3.

The estimated number of passengers in 2022 is approximately 390,000 per day for both directions at the most congested section between Ring Road Station and Oboor Station.

To meet such a great passenger demand in 2022, a double track and diesel car operation system will be needed as the basic planning concept of the East Wing Railway

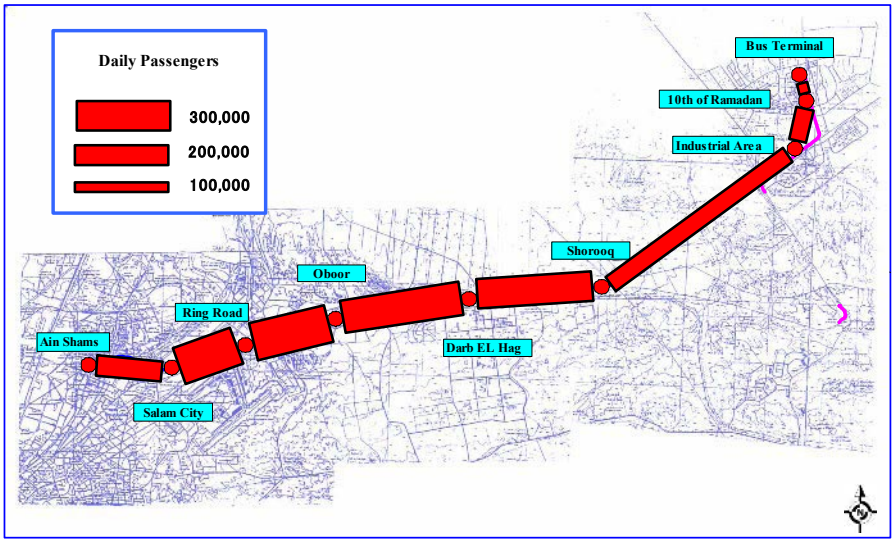


Figure ES.3 Passenger Flow of the East Wing in 2022

Development of New Stations

In addition to the existing four stations (Ain Shams, Oboor, Darb El Hag and Shorooq), five new stations are planned along the East Wing Corridor. These new stations are as below.

Salam City:	At grade station, where future connection to the planned Metro Line 3 is expected.
Ring Road:	At grade station, where an intermodal system is considered with road-based transport modes such as buses, minibuses, shared-taxies, taxies and private cars.
Industrial Area:	At grade station, where is expected to serve workers to/from industrial area of the 10th of Ramadan as well as passengers who travel toward the East further.
10th of Ramadan:	Elevated station, where is the center of the 10th of Ramadan City.
Bus Terminal:	Elevated station, where an Intermodal terminal with bus, shared taxi and even private cars for residents of the new city.

Track Layout

The East Wing railway starts from the ENR Ain Shams Station and the new station at Bus Terminal Station in the 10th of Ramadan City. The whole section shall be **double-tracked** to meet the anticipated demand in the future, 2022.

The existing ENR Suez Line shall be utilized between Ain Shams Station and Shorooq Station with necessary rehabilitation for the commuter train operation. From Shorooq Station, the line will be separated from the Suez Line and overpass the Ismailia Desert Road and reach the 10th of Ramadan City by passing new stations of Industrial Area, 10th of Ramadan and Bus Terminal Stations along the northern side of the road. The section between Shorooq and the Bus Terminal shall be newly constructed. The total route length is estimated to be **49 km**, out of which **30 km** for the rehabilitation of the existing Suez Line and **19 km** for the newly constructed line (Figure ES.4).

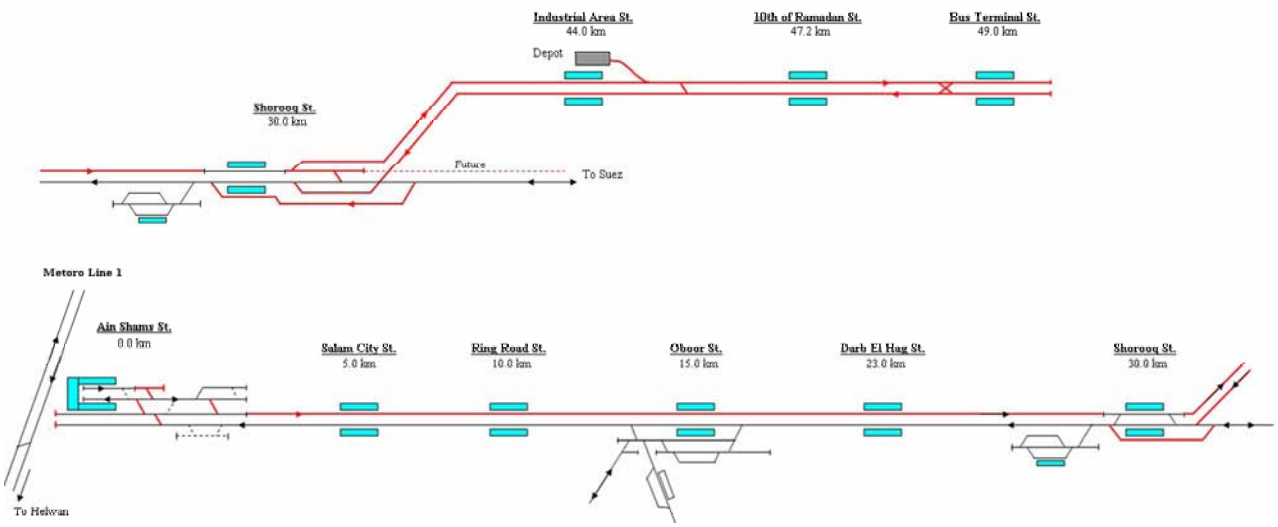


Figure ES.4 Track Layout of the East Wing

Rolling Stock

All cars of a train are planned as **diesel powered rolling stocks** for the East Wing Line. This type of decentralize power train has advantages of high acceleration, high operation frequency and transport capacity compared to locomotive hauling type of trains. Thus, the decentralized power train is attractive to passengers and has characteristics of high speed and comfortable service. However, the introduction of this type of train needs comparatively high investment as well as expensive maintenance facilities.

It is designed that one train consists of 3 cars in the beginning of operation of the East Wing Line. The 3 cars consist of 2 control cars and 1 intermediate car by considering transport demand and operation efficiency.

- Gauge: 1,435 mm
- Coupling Length: 20.0 m
- Body Length: 19.5 m
- Body Width: 2,950 mm
- Weight: Control car: 30.0 tons; and Intermediate car: 27.8 tons

Figure ES.5 A Typical Diesel Car Train

Train Operation

A train operation plan of the East Wing Line was built, according to the projected peak-hour passenger demand and the transport capacity of a train. Numbers of trains per hour were planned to be 4, 5 and 25 in 2007, 2012 and 2022, respectively. Necessary numbers of trains, based on future planned diagram, are 8 trains with a 3-car train formation in 2007 and 2012, and 24 trains with a 5-car train formation in 2022. The expected travel time between Ain Shams Station and Bus Terminal Station of the 10th of Ramadan is **43 minutes**. Average travel speed will be approximately **68 km/h**.

COST ESTIMATION

Construction Cost

Under the design concept of the East Wing Line, the construction cost was estimated, based on the following assumptions:

- Civil work includes embankments, cuttings, viaduct structures, realignment of streets and highways. Cost for relocations of utilities and sanitary services are taken into account in contingencies;
- Stations are to be simply designed and economical in function and design;
- The system and equipment include double track work, signalling, communication, and ticketing. The track work includes ballast, sub ballast and other track materials;
- The depot and workshop include capital cost of tracks and equipment cost for maintenance and repair;
- Land acquisition includes land for new line construction and the depot; and,
- The Rolling Stock includes costs for initial operation in the year 2007.

The estimated total construction cost for the initial investment accounts for approximately **2.4 billion LE**, as shown in Table ES.1. Detailed design work is considered to take one year, followed by construction works, which shall be two years. In the beginning of 2007, the East Wing Railway shall be operated. Besides this initial investment, additional rolling stocks shall be purchased to increase the transport capacity in 2013, 2017 and 2020. The total additional investment costs for such an capacity enhancement are estimated to be **722.7 million LE.**

Table ES.1 Initial Investment Cost of the East Wing Line

(Unit: LE Million at 2003 prices)

Investment Item	Total Investment	Local Amount	Foreign Amount
Running Track	**1,028.2**	**719.7**	**308.4**
Elevated	444.5	311.1	133.3
At-Grade (new line)	237.3	166.1	71.2
At-Grade (rehabilitation)	346.3	242.4	103.9
System Works	**629.9**	**220.5**	**409.5**
Track Work (new line)	168.1	58.8	109.3
Track Work (rehabilitation)	185.8	65.0	120.8
Signal & Communications	275.9	96.6	179.4
Station	**85.3**	**56.8**	**28.5**
Elevated	29.0	17.4	11.6
At-Grade	56.3	39.4	16.9
Depot & Workshop	**24.1**	**12.1**	**12.1**
Rolling Stock	**152.9**	**4.6**	**148.3**
Land Acquisition	**10.3**	**9.8**	**0.5**
Sub- total	**1,930.7**	**1,023.4**	**907.2**
Engineering and Construction Management	154.5	15.4	139.0
Local Administration and Contingency	314.7	210.0	104.6
Total	**2,399.8**	**1,249.0**	**1150.9**

Source: JICA Study Team

Operation and Maintenance Cost

The operation and maintenance cost of the East Wing Railway was estimated based on Japanese experiences on diesel car operation in consideration of Egyptian local conditions such as labor cost, fuel cost and labor productivity and/or efficiency.

Labor costs were estimated, based on a projection of the number of employees necessary for three functions to be held by the operating entity. The necessary numbers of employees were calculated, based on the estimated future **train-km** for the operating function, and **car-km**, for maintenance section. That for the administrative section was based on total number of employees of the operating and maintenance section. As a consequence, the employees will total 1,163 in 2022 for the operation of the East Wing Railway, the number of which is greater by 20% than that derived from an

international standard, considering local conditions. In 2022, when the East Wing Railway will be fully operated, the operation and maintenance cost, including material costs, will be required **219.3 million LE** per year.

INTERMODAL TERMINAL AT AIN SHAMS

Intermodal Terminals are planned to facilitate convenient intermodal transfer between public transport modes at four (4) major stations, namely, Ain Shams Station , Salam City Station, Ring Road Station and Industrial Area Station.

The East Wing Railway connects with Metro Line 1 at Ain Shams Station, and will connect with the fourth-coming Metro Line 3 at Salam City Station. The railway should have a functional connection at Ring Road Station with road-based transport modes.

Some physical development schemes, as a sample of intermodal facilities, are illustrated for Ain Shams Station, where Metro Line 1 and the East Wing railway meet, as shown in Figures ES.6 and ES.7. The two stations are planned to connect each other with a pedestrian deck to ensure convenient and safe transfer for passengers. Passengers can also overpass the East Wing railway track by using another pedestrian deck to access *safely* and *comfortably* to a newly designed intermodal terminal, which locates adjacent to the station, providing convenient transfer to/from buses, minibuses, shared-taxies, taxies and private cars.

Figure ES.6 Pedestrian Connection between the East Wing Rail and Metro Line1 at Ain Shams

Figure ES.7 The Intermodal Link with Bus and Rail at Ain Shams Station

The Traffic Management Program was also planned at the intermodal terminal and its vicinity areas, as illustrated on Figure ES.8. On-street parking facilities, traffic signals and bus priority lanes are introduced for safe and smooth traffic around the intermodal terminal area.

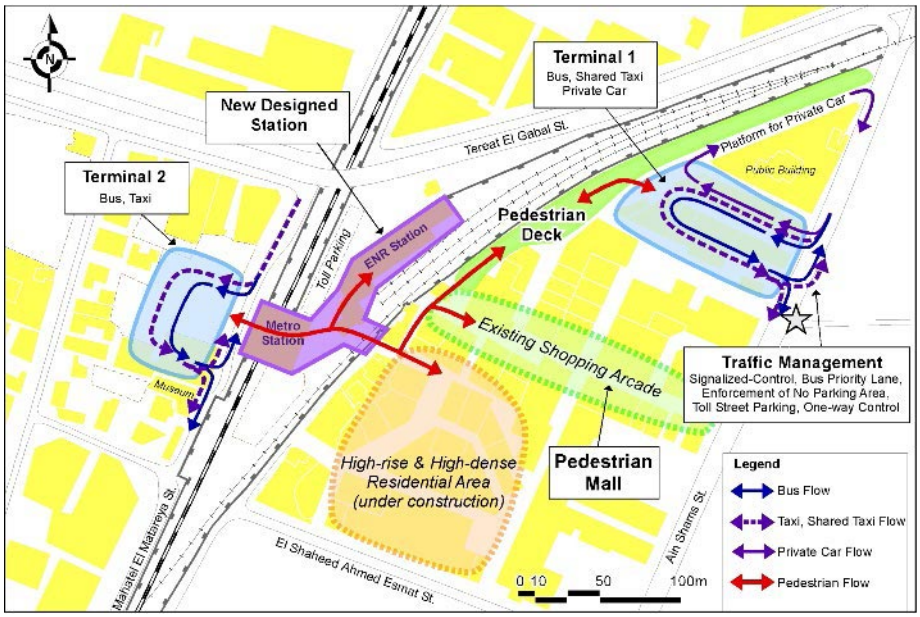


Figure ES.8 A Concept of Traffic Management System of the Intermodal Terminal at Ain Shams Station

ENVIRONMENTAL IMPACT ASSESSMENT

To ensure sustainability for the East Wing Rail Way Project, a **scoped Environmental Impact Assessment (EIA)** was carried out as part of the feasibility study according to the Egyptian, JICA and other international guidelines and regulations. The EIA indicates the negative as well as the positive environmental impacts that are expected from the East Wing Railway Project. Also mitigation measures, required to alleviate the identified adverse environmental impacts, are provided.

Environmental Surveys and Impacts

As a part of the Environmental Impact Assessment, **Air Quality** and **Noise Level Surveys** and a **Social Survey** (Social Impact Assessment) were carried out. Their results revealed the present environmental condition of the Project Area, as well as the opinion of residents related to the proposed Project.

Negative environmental impacts, which have been identified for the proposed Railway Project, are minor: split up of neighbourhoods by rail tracks; impact on aesthetics by three flyovers and two elevated stations at 10th of Ramadan City. Furthermore, trees have to be cut over a length of about 5 km at the median of the road (10th of Ramadan City). Most adverse environmental impacts will be temporary during the construction phase.

Mitigations measures are proposed to alleviate the identified impacts, that is, construction of pedestrian-friendly environment to be compensated by landscaping, planting of trees and parks. Additionally, a sound barrier is proposed over a length of 1 km near Ain Shams to improve the noise situation.

Major reasons for the fact that only minor environmental impacts are expected from the proposed Railway Project are:

- The proposed Railway Project is a public transport project; diesel locomotives consume less energy for the transportation of a certain number of passengers than cars.
- The Project concerns an activity partly in a city environment and partly in a desert like environment; there is no impact on fragile ecology.
- The right of way is mainly owned by the government and free of houses and other structures.
- The identified negative impacts can be mitigated.

Positive environmental impacts expected in the field of economics from the Railway Project are: improved mobility and access for the residents of Greater Cairo; reduced travel time and costs; improved conditions for economic development; enhanced development of tourism. These economic impacts will result in lessening the total environmental burden in Cairo Metropolitan Area. Direct environmental impacts are positively expected in the following aspects:

- A number of car users will start using the Railway *(less emission, less energy consumption).*
- There will be less air pollution compared to the situation of not carrying out the proposed Railway Project (Zero Option) (*less emission, less energy consumption).*There will be no significant increase of noise levels.
- Reduced number of accidents and increased safety for pedestrians.
- Possibilities for planting of trees / landscaping.For the global environmental impact, the total CO_2 emission of **42,152 tons/year** can be reduced by the introduction of the East Wing Project in 2022. It is generally said that as one litter of gasoline generates **2.30 kg** of CO_2, the CO2 reduction of about 42,000 tons is equivalent to the reduction of about **18.3 million litters/year of gasoline**, or 108,000 bbl./year.

Overall Evaluation

The conclusions of the scoped Environmental Impact Assessment for the East Wing Railway Project are:

- Major positive impacts are expected.
- Minor negative impacts are expected, which can be mitigated.
- The Rail Way Project is sustainable and environmentally feasible.

ECONOMIC EVALUATION

The economic evaluation was carried out from a view of whether or not the investment for the East Wing Railway project be feasible in terms of the national economy, based on basic premises such as: prices as of mid-2003; the exchange rate of 1 US$=6.0 LE; and project life of 27 years from 2004 through 2030.

With and Without the Project

Economic benefits are both calculated as differences between "With the Project" and "Without the Project". For the calculation of economic benefits, the situation of the "Without" case is defined identical to the "Do Nothing Scenario" as examined in the CREATS Master Plan. This scenario is not the same situation as the current condition, but depicts such a situation that all committed projects, including Metro Line 3, the capacity enhancement of Metro Line 1 and a number of flyover projects, have materialized in a planned time framework (see the CREATS Master Plan). ***Metro Line 3 is assumed to be operated in 2017. Thus, it should be noted that even the "Without the Project" case hold inclusion of the Metro Line 3 which is very influential to changes in the transport pattern.***

Economic Capital Costs

According to a planned construction schedule, the economic costs [1], converted from the estimated financial costs for the East Wing Project, are allocated in the phased manner. The economic cost of the initial investment totals 2,004 Million LE, and the total additional investment cost will be 625 million LE to strengthen the transport capacity in 2013, 2017 and 2020. The economic cost of 664 million LE is allocated for the reinvestment to improve the system in 2026. The residual value of the vested assets is appropriated as a negative cost in 2030.

Economic Benefits

Economic benefits are assumed to be two: savings in time cost and savings in vehicle operation cost (VOC), which are both derived from a difference between "with the Project" and "without the Project". In 2022, the annual time saving is projected to be about 730 million LE, and the annual operation cost VOC saving, 248 million LE. These savings are increasing along with the increasing passenger demand.

Cost-Benefit Analysis

Since the East Wing Project requires a massive amount of initial investments, the Project is inherently sensitive to the passenger demands. A more demand-responsive investment scheme needs to be explored. In this sense, two options in terms of timing of the operation are examined:

- **Option 1**: The Project be commenced from 2004 and the railway system be operated from 2007; and
- **Option 2**: The Project be commenced from 2007 and the railway system be operated from 2010.

The results of the cost-benefit analysis are summarized as shown in Table ES.2.

Table ES.2 Summary of Economic Evaluation Results for the East Wing Railway Project

Evaluation Indicators	Option 1	Option 2
Economic Internal Rate of Return (EIRR)	11.1%	13.1%
Net Present Value (NPV) at mid-2003 *	- 157.6 million LE	143 million LE prices
Benefit - Cost (B/C) Ratio *	0.92	1.09

*Notes: * at 12% discount rate*

Comparing the two options, it is evident that Option 2 indicates more favorable evaluation indicators than Option 1. Option 1 can hardly assure the economic feasibility, because the Economic Internal Rate of Return (EIRR) is 11.1%, less than the social discount rate of 12%. Therefore, the Net Present Value (NPV) yields negative value, so the Benefit/Cost ratio (B/C) ratio is less than 1.0.

[1] Conversion rates are assumed to be 81% for local currency items as well as 87% for foreign currency (or imported) items. taking into account the Egyptian taxation and labor market conditions.

On the other hand, the EIRR of Option 2 is computed at **13.1%**. This rate is higher than the Egyptian social discount rate of 12%, The NPV accounts for **143 million LE** at the mid-2003 prices and the B/C ratio is **1.09**, given a 12% discount rate. These indicators denote that the Project will bring a considerable amount of economic benefits to the national economy as a whole, therefore it can be evaluated that the Project is economically feasible, or worth being implemented from the national economy point of view.

FINANCIAL EVALUATION

The East Wing Railway Project is evaluated from the financial viewpoint. The following are a summary of the findings.

Assumptions

- For the sake of checking the financial viability of the Project, the investment schedule of "Option 1" is adopted. Hence, the estimated financial capital costs are allocated in such a way that the railway service will be operated in 2007 and will generate the operating revenues from 2007.
- The evaluation period is assumed to be the period between 2004 and 2030, and the depreciation of depreciable assets are appropriated with a straight line method under an assumed useful life by asset and the residual value of the invested capitals is considered in 2030 as a negative cost.
- For the operating revenue, a distance-based fare system (a base fare plus distance-based charge) is adopted as shown below.

Table ES.3 Assumed Fare Structure for the East Wing Railway Service

(at mid-2003 prices)

	2007	2012	2022
Base Fare (LE)	0.63	0.74	1.00
Distance-based (LE/km)	0.03	0.04	0.05
An Example Fare (LE) Ain Shams Station ~ 10th of Ramadan Bus Terminal Station (49km)	2.10	2.70	3.45

- Additional incomes accruing from ancillary sources related to the railway service operation, such as advertisement charges and commercial activities at stations, are considered to be 6% of the operating revenue, taking into account experiences being performed in other countries. Since this off-rail revenue rate is significant to the financial feasibility, a sensitivity test will examine the financial conditions with different rates in a range from 6% to 20%.

Summary Result of the Financial Analysis

The results of the financial analysis are summarized in Table ES.4. The Financial Internal Rate of Return (FIRR) for the East Wing Railway Project is computed at **3.3%**, which implies that the Project will hardly be viable from the financial point of view.

Although the FIRR seems hardly favorable, the Project will not be bankrupted. A positive operating profit will occur at an annual basis in the year 2014, or 7 years after the commencement of the operation; and in the next year, 2015, the net profit after reduction of the interest payment and depreciation will be positive. In the accumulated balance, the Project will recover all the investments in the year 2022, that is, the accumulated net profit will be positive 15 years after the commencement of the operation.

Table ES.4 A Summary of Financial Analysis for the East Wing Project

Evaluation Indices	Result
FIRR (Financial Internal Rate of Return)	3.31%
The First Year of Positive Operation Profit at Annual Basis	Year 2014
The First Year of Positive Net Profit at Annual Basis (after Interest and Depreciation)	Year 2015
The First Year of Positive Accumulated Net Profit	Year 2022

Source: JICA Study Team calculations

Sensitivity Tests

The Project would hardly be feasible in terms of the FIRR under the assumed conditions. Therefore, some financing measures to make the Project more viable need to be considered. The following results of "Sensitivity Tests" indicate useful implications for this purpose:

- Should only the depreciation of rolling stock be considered, the FIRR accounts for **21.2%**. This means that if the capital investments for the infrastructure, other than rolling stocks, could be financed by a government subsidy, the Project would be financially feasible.
- Given additional revenues from off-rail business activities equivalent to **20%** of the operation revenue, instead of 6%, the FIRR would be **4.5%**, which shows an improvement of its financial feasibility by 1.2 points.
- Given a 20% reduction in the initial investment cost, the FIRR is improved to **4.7%**.

Financial Evaluation: A Conclusion

Taking into account the above findings through the sensitivity tests, the East Wing Project could be financially feasible, given three key conditions to be assured:

- Positive involvement of the government sector;
- Diversification of revenue sources other than railway service revenues; and
- Establishment of an unique financing and operation mechanism.

AN ALTERNATIVE INVESTMENT SCHEME: A RAIL-BUS JOINT SYSTEM

A Concept of the Rail-Bus Joint System

Based on the proven facts that its economic feasibility is somewhat sensitive to the investment schedule, and that a demand-responsive investment scheme should be explored for the implementation of the East Wing Project, another alternative scheme was examined in terms of the economic and financial feasibilities, that is, the initial investment for the rail system is minimized, being supplemented by the improvement of a bus system to connect with the rail service. This scheme, named "***a rail-bus joint system***", consists of two project components to be integrated with each other:

1) Rehabilitation of the section of the between the Ain Shams Station and the Shorooq Station of the existing Suez Line for the urban railway service; and

2) Provision of a feeder service with **an exclusive busway system** between the Shorooq Station and new communities such as the 10th of Ramadan.

It is noted that the new rail line construction between Shorooq Station and 10th of Ramadan Bus Terminal Station is not initially considered in this scheme, but this section is to be served by an exclusive busway system which is equivalent to the railway service in terms of transport comfort and travel speed.

For such an exclusive busway system operation, the segregated structure be provided as planned in such a way that the busway can be easily replaced for the railway by layering a rail system on the structure in the time when the passenger demand will assure the feasibility of the railway system.

The basic premises and the methodology are the same as those employed for the previous economic evaluation analysis. It is assumed that the operation service will be available in the year 2007 and the economic benefits will be generated at the same year 2007.

Comparison of Investment Costs

A total of about 2.01 billion LE will be required for the initial investment for the rail-bus joint system. Compared to the original case, the total investment cost of this scheme can be saved by approximately 390 million LE, as shown in Table

ES.5. This alternative case can reduce the costs for system works and rolling stocks, but increase the costs for additional facilities such as a bus terminal & station plaza and the procurement of bus vehicles.

It should be noted that the cost for the running track is not different from the original case, because it is assumed that the exclusive busway be served with the segregated structure between Shorooq Station and 10th of Ramadan that is designed so as to be converted to a railway structure when it is necessary. However, the busway structure excludes the cost for the signaling and communication facilities which are needed for the railway system.

Table ES.5 Cost Comparison Between the Alternative Case and the Original Case

(LE million at mid-2003 prices)

Financial Cost	Alternative Case Rail +Bus	Original Case Option 1	Difference
	(a)	(b)	(a)-(b)
Running Track	1,028.2	1,028.2	0.0
System Works	354.8	630.0	-275.2
Stations	85.3	85.3	0.0
Bus Terminal & Station Plaza	9.3	0.0	9.3
Depot & Workshop (Rail)	24.1	24.1	0.0
Depot & Workshop (Bus)	6.2	0.0	6.2
Rolling Stock	76.4	152.9	-76.5
Articulated Bus Vehicle	16.2	0.0	16.2
Land	16.9	10.3	6.6
Engineering	129.4	154.4	-25.0
Local Adm.	80.9	96.6	-15.7
Contingency	182.8	218.2	-35.4
Total Cost	**2,010.5**	**2,400.0**	**-389.5**

Source: JICA Study Team

Results of Economic Analysis for the Rail-Bus Joint System

The economic analysis was carried out in accordance with the same methodology and theoretical properties, and the results are presented in Table ES.6 in comparison with the original cases, Options 1 and 2.

As seen in this summary table, the alternative investment scheme of a rail-bus joint system yields the sufficiently high rate of EIRR, **13.2 %**, which means that under this scheme, the East Wing Projects is economically feasible. The NPV accounts for **196.6million LE** at mid-2003 prices, and the B/C ratio is **1.16**, which means that the Project will bring a considerable amount of economic benefits to the national economy as a whole. It can be assessed that the Project is economically feasible, or worth being implemented from the national economic point of view.

Compared to the originally planned cases of Options 1 and 2, this alternative scheme resulted in the most favorable condition in terms of the economic indicators.

Table ES.6 A Summary of Economic Evaluation of the Alternative Scheme

Indicators	Alternative Scheme (A Rail + Bus System)	Original Cases	
		Option 1	Option 2
Economic Internal Rate of Return (EIRR)	**13.2%**	11.1%	13.1%
Net Present Value (NPV) : Million LE at mid-2003 prices*	**196.6**	-157.6	143.8
Benefit/Cost (B/C) Ratio *	**1.16**	0.92	1.09

*Notes: * at 12% discount rate.*
Source: JICA study team calculations

Economic Evaluation: A Conclusion

The economic evaluation result of the alternative investment scenario, which is to provide a rail-bus joint system for the East Wing corridor, presented economically justifiable indicators, even though the operation will start from the year 2007.

Based on these implications, it is recommended that the East Wing Project should commence with the rail-bus joint system in the initial stage in order to avoid a risk in the front-heavy investment, and then along with the increasing passenger demand, the feeder bus system should be shifted to a new railway system between the Shorooq Station and the 10th of Ramadan Bus Terminal Station, which is to be constructed after 2010.

Financial Analysis

Based on the same assumptions as the previous analysis in the original case, a financial evaluation was conducted. For the operating revenue, **an integrated fare system** with a distance-based fare system (a base fare plus distance-based charge) is adopted in such a way that passengers can use the service with one ticket for the bus and railway services.

The result of the financial analysis is summarized in Table ES.7 in a comparison with that of Option 1, because Option 1 stands on the same assumption that the service will be available in 2007. The FIRR of the rail-bus joint system was computed at **5.8%**, which is considerably higher that that of Option 1, **3.3%**. Moreover, the other financial indicators in terms of the years of profit generation, are all significantly improved by shortening the period of "negative balance". The first year when the accumulated net profit becomes positive will be 2017, or 10 years after the operation, being shortened by 5 years, compared to Option 1. Nevertheless, this financial evaluation still indicates a sensitive situation, which requires a thoughtful financial arrangement to assure the financial viability of this Project.

Table ES.7 A Summary of Financial Analysis for the East Wing Project

Evaluation Indices	Alternative Scheme (A Rail-Bus Joint System)	Original Case (Option 1)
FIRR (Financial Internal Rate of Return)	5.80%	3.31%
The First Year of Positive Operation Profit at Annual Basis	Year 2011	Year 2014
The First Year of Positive Net Profit at Annual Basis (after Interest and Depreciation)	Year 2013	Year 2015
The First Year of Positive Accumulated Net Profit	Year 2017	Year 2022

Source: JICA Study Team calculations

RECOMMENDED IMPLEMENTATION SCHEME

Three Alternative Scenarios for the Implementation

It is assessed that the East Wing Project is economically feasible but financially less feasible. This implies a need for a well deliberate design for the implementation mechanism. In general, three scenarios are conceivable as follows:

Alternative 1 (Government-Initiative): The government sector (ENR) shall take full responsibilities for the construction and the operation. This option is rational, because the Project itself is economically feasible. In this option, the government subsidy should be injected to some extent.

Alternative 2 (Privatization): The so-called BOT (Build, Operation and Transfer) mechanism is a possible option in this context under a well-planned concession scheme. However, a BOT scheme is not necessarily recommended for this Project, because of some reasons: (1) the private sector will hardly take a financial risk on such a huge amount of investments constantly required in the long-term; (2) the private sector will claim a sort of government guarantees on the revenue, or a constant subsidy to avoid a risk of ridership, which is dependant heavily on the progress of the development of new communities; (3) the private sector's fund raising capacity for the infrastructure construction is subject to economic fluctuation, therefore, the private sector can hardly guarantee a scheduled construction and operation; and (4) it will normally take long time to reach an agreement between both the government and private sectors, thereby loosing the otherwise-could-be-gained benefits.

Alternative 3 (Public-Private Partnership): A sort of Public-Private Partnership (PPP) mechanism shall be pursued. This option is flexible and applicable for the East Wing Project. The government sector (ENR) assumes a responsibility for the infrastructure development, and owns its property, while the private company or a joint venture company with the public and private sectors, shall assume a responsibility for the operation and maintenance including procurement of rolling stocks, leasing the infrastructure from the owner who is the government under a concession scheme. The government may recover the investment cost by the concession fee to be collected from the operator. As this mechanism reinforces both weakness, and integrates both strengths of the public and private sectors, this is suitable for such a project requiring a considerable amount of investment and sophisticated technologies for operation and management. Table ES.8 shows a basic concept of the recommended PPP scheme.

Table ES.8 A Proposed Framework of Public-Private Partnership Scheme

	THE INFRASTRUCTURE OWNER (The Government Sector)	THE OPERATOR (A Private or Joint Entity)
Investment	Provision of capital investments and construction of the infrastructures and the systems	Procurement of rolling stocks and related facilities and equipment
Tasks & Roles	• Issuing a Concessionaire for use of the Infrastructures • Issuing a business operation license with a definite set of rules and regulations • Monitoring the operation and the management	• Assuring a proper operation and services • Strengthening the human capacity • Generating operational revenues • Maintaining the Total System
Obligations	Recovering the investment by the levied Concession Fees in the long-term	Paying the Concession Fee at an agreed rate of the operation revenue.
Accountability	To the public	To the Infrastructure owner as well as the public
Access to Funds	• Government subsidy • International donor agencies	• International donor agencies • Local financing institutions and commercial banks

Source: JICA Study Team

A Business Model of the Public-Private Partnership Scheme

Under the framework of "Alternative 3", a business model was examined from the cash-flow analysis. For this purpose, two players are supposed in the playground of the Project, namely, the Government (the infrastructure owner) and the Operator (an operating company). Financial assumptions are as follows:

- The government sector, or the Egyptian National Railway (ENR), be the implementing body of the Project, and invests for the infrastructure facilities. Therefore, the infrastructures belong to the government sector.
- The cost of the foreign currency portion for the infrastructure shall be procured through an ODA soft loan scheme, while that for the local portion shall be raised internally as a government subsidy. Financial conditions of the ODA soft loan are assumed to be: 3% interest rate; 7 years grace period and 25 years repayment period.
- The operating company shall maintain all the infrastructure facilities and operate the rail service, with procuring the necessary rolling stock. The operating company should guarantee a good practice for the railway operation business and be capable of commercially managing the total system in a professionally proper manner.
- It is assumed that the equity, as the initial capital, of the operating company shall be raised at 20% of the initial investment, and that in order to raise the remaining funds, the operating company can have access to an international soft loan equivalent to the amount of the foreign currency portion necessary for the rolling stock procurement and a long-term loan at a commercial bank with a 10% interest rate for local procurement. An annual shortfall, if it occurs, be fulfilled with a short-term loan (one year) at a 13% interest rate at local commercial banks. Needless to say, the gearing ratio (the ratio of the equity against the total investment) is a crucial factor affecting the financial conditions of the company in the start-up period. The assumed rate of 20% seems rational as a rail business entity.
- It is assumed that the operating company is entitled to run off-rail commercial business such as advertisement and kiosks related to the railway service. Taking into account experiences in the other countries, the off-rail business revenue is assumed to be 6% of the operating revenue, as a possible level.

- The concession is a key for this business model of the Public-Private Partnership scheme. The government sector receives the concession fee from the operating company at a certain percentage of the operation revenue. The government sector should earmark the levied fees for recovering the initial investment cost in the long-term.
- The rate of the concession fee that the operator shall pay the infrastructure owner is assumed to be 5% of the operational revenue as a base case, then an appropriate rate is examined so that ***both parties' financial situations become favorable, or not worsened at least.***

Through a cash flow analysis based on the above assumptions, the most favourable condition was sought, as tabulated in Table ES.9. In the base case, given a 5% Concession Fee Rate, the Operator will yield 21.1% of FIRR and 47.2% of ROE (Return on Equity). On the other hand, the Infrastructure Owner (the Government) needs to provide a total of 2,916 million LE, and the accumulated net profit will be -1,846 million LE (negative) in 2030. Thus, this situation is too much favourable for the Operator. Therefore, another assumption on the Concession Fee Rate may be applied.

Should the Concession Fee Rate be **30%** of the operation revenue, the Operator can still enjoy a **12.3% FIRR** and a **26.6% ROE**, while the Infrastructure Owner will provide a total of 1,216 million LE, and can minimize the net loss at 146 million LE in 2030. In conclusion, a scheme with 30% of the Concession Fee Rate will enable both parties to manage the Project.

Table ES.9 A Summary of Cash Flow Analysis of Option 3

(at mid-2003 prices)

Condition	The Operation Company		The Infrastructure Owner (the Government)		
	FIRR (%)	ROE [2] (%)	Accumulated Subsidy (Million LE)	Average Annual Subsidy (Million LE)	Accumulated Net Profit **in 2030** (Million LE)
Base (CF [1] = 5%)	21.1	47.2	2,916	108	- 1,846
Case of CF=30%	12.3	26.6	1,216	45	- 146

Notes: 1. "CF" stands for the rate of Concession Fee to the operation revenue.
2. "ROE": Return on Equity

Recommendations

The result of the cash flow analysis revealed that the scheme with 30% Concession Fee Rate of the operating revenue will enable both parties to manage the Project in such a way that both parties will be able to satisfy their own objectives, that is, the operator will enjoy a sufficient level of profits, while the government will recover the vested subsidy in the long run, providing public transport services for the people. Therefore, it is recommended that this scheme should be further pursued to materialize the implementation in consideration of the following aspects as discussed in previous sections:

1) The external resource mobilization is essential for the Project, because the Project is financially sensitive. The assumed financial conditions for procuring the external funds are rational and plausible in general, but depending upon funding institutions of international aid organizations. Therefore, the analysis needs to be further clarified with concrete conditions to be offered by a possible agency.

2) Since the Project itself is evaluated economically feasible, the government subsidy for the Project can be justified in the long-term from the national economy point of view. However, the investment schedule should be carefully decided, responding to increasing demands along with the progress of the new communities development.

3) In this regard, there are two feasible options: one is that the East Wing Project be implemented targeting at that the full railway service shall start from 2010; and the other is the alternative solution, i.e., **the rail-bus joint system** that the exclusive busway system be developed initially, then shifted to a new railway system between the Shorooq Station and the 10th of Ramadan Bus Terminal Station, in the time when the railway investment would be financially feasible, maybe after 2010. As either solution will be economically and financially feasible, technical and operational considerations should be given priority for the decision.

4) The concept of **the rail-bus joint system** is technically rational but operationally complicated**,** needing a two step procedure: the intermodal facility development at Shorooq Station at the initial stage and replacement of the busway system for the rail system in the second stage. As a conclusion, it is recommended that the East

Wing Project be started with the concept of the rail-bus joint system, including rehabilitation of the existing Suez Line in the section between Ain Shams Satation and Shorooq Station and the new construction of the structure suitable for the railway system between Shorooq Station and 10th of Ramadan, but that it should be flexible to shift to the full railway system for the new construction section, depending upon the passenger demand in the new communities.

5) Under the proposed PPP scheme, some private sector's offers could be invited for the operating entity, through a biding process, as far as it is assured that the entity can be functionally organized with sufficiently trained staffs. However, the **Cairo Metro Organization (CMO)** is recommended to become the operating entity for the East Wing railway service, being restructured so as to accommodate such new suburban rail services, rather than establishing a new entity. CMO has experienced in running the railway business and has an advantage that the East Wing can be operated in conjunction with Metro Line 1 at Ain Shams Station. This integrated operation, in the future, will be vital when the ENR suburban rail is physically connected with the metro lines.

6) CMO may organize this East Wing Company, **as a Private Entity,** through an international bidding process, and the private sector will be given a chance to explore this rail service business as a concessionaire. Both international and local investors may offer their own proposals on how to manage the operating company, bringing their own management know-how and modernized technologies and systems for the operation. The organizational structure is proposed in the following section.

7) For such a privatization scheme, the government needs to deregulate the public transport service provision in such a way that the private sector can pursue the commercial operation though the market mechanism as well as promote off-rail business to fulfil an anticipated financial gap or averse financial risks on revenue generation.

ORGANIZATIONAL STRATEGY FOR EAST WING RAILWAY OPERATION

An organizational structure for the East Wing Railway operator is proposed to be applicable for either the private or public sector. It is planned according to the selected technical options and the anticipated passenger demands by the years 2007, 2012 and 2022. The recommended general organization for the operation and maintenance of the East Wing Railways is similar to the metro system organizations used in Cairo, and adjusted in accordance with worldwide experiences in sub-urban railways operation. The staffing of each department has been adjusted according to the selected technical and operational options. The labor productivity and work load are planned at the internationally level, but adjusted in consideration of local conditions.

Organizational Structure

The proposed East Wing Company is structured with five (5) departments under a general management unit as shown in Figure ES.9. The Board of Directors shall assume comprehensive management responsibilities. The Operation Department includes three divisions relevant to the practical operation. The Safety and Quality Assurance Department is vital in particular to assure the safe and punctual railway service.

Staff Requirements

Staff requirements for each department of the East Wing Railways Operation Company is estimated, based on the following assumptions:

- An efficiency-oriented commercial operation is the basic employment framework of the organization;
- Numbers of staffs responds to the planned operation schedule and service volume of the railway system, referring to the current operation of Cairo Metro Organization as well as the international levels of the similar system;
- Concerning the managers: one person per post, thus highly efficient managerial personnel are expected;
- Concerning the staff working conditions:
  - Equivalence of 1.5 rest day every 5.5 work day (7/5.5 factor);
  - 1.20 absenteeism factor (holidays, illness, refreshing training, etc.); and
  - For operating staff and post assured 24 hours per day; 3 shifts per day.

The number of staff required for each department is estimated by professional/skill category and by class/grade. The result is tabulated in Table ES.10. For the operation during the period between 2007 and 2012, or the initial stage, a total of 375 staffs need to be employed. This is the minimum number of staff to operate the railway service.

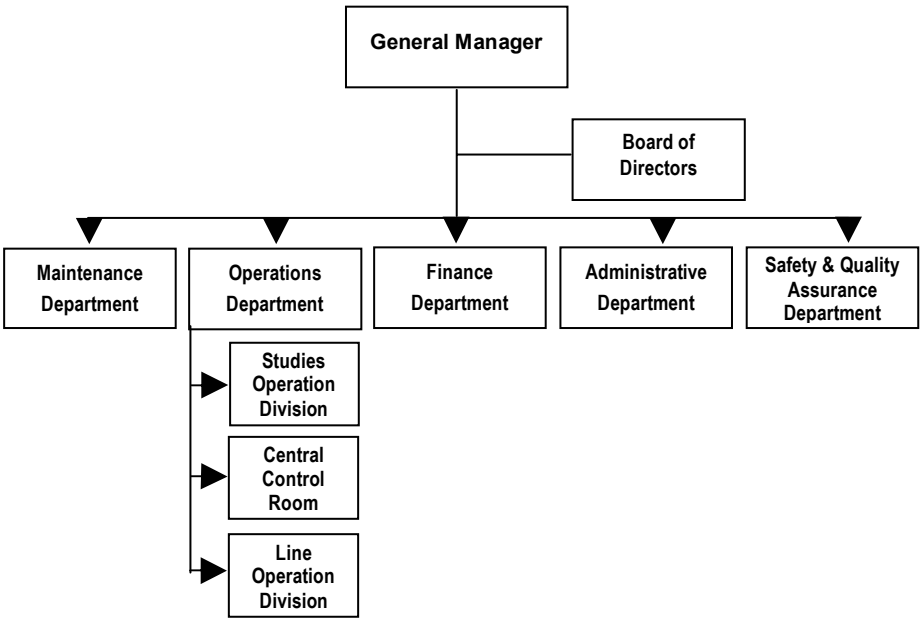


Figure ES.9 Organization of the East Wing Railway Operation Company

Along with the increasing passenger demands, the East Wing Railway Company should be strengthened in terms of its operation capability, while its organizational structure is kept being the same. In 2022 when the full operation of the railway system is required, the staff capacity will need to be significantly enhanced with approximately 900 employees at least. Great increases will be placed in Maintenance Department and Operation Department, while the management side is conservative in its number. It is noted that the proposed staff numbers of Maintenance Department and Operation Department are calculated at the international standard, so local conditions should be flexibly considered in practice.

Table ES.10 A Summary: East Wing Railways Staffing in 2007, 2012 and 2022

Department	Total	Number of Staff by Grade					
		Manager	Senior Engineer	Engineer	Senior Technician	Technician	Other Staff
Initial stage (2007-2012)							
Management	**6**	3	-	-	-	-	3
Safety/Quality	**6**	1	-	-	2	-	3
Maintenance	**184**	1	3	10	24	40	106
Operations	**135**	1	3	4	10	36	81
Finance	**15**	1	3	2	4	1	4
Administration	**30**	1	4	7	6	5	7
Total	**375**	**8**	**13**	**23**	**44**	**83**	**204**
For Operation in 2022							
Management	**8**	4	-	-	-	-	4
Safety/Quality	**7**	1	-	-	3	-	3
Maintenance	**461**	1	6	21	50	95	288
Operations	**331**	1	7	8	19	82	214
Finance	**32**	1	4	8	6	4	9
Administration	**63**	1	8	12	15	12	15
Total	**902**	9	25	49	93	193	533

Source: JICA Study Team

A-2 WEST WING PUBLIC TRANSPORT DEVELOPMENT

The development of new communities in the western part of the Greater Cairo will be also a key to mitigate diseconomies due to the excessive concentration of socioeconomic activities in the central areas of Cairo as well as Giza. The CREATS Master Plan addresses the importance of these new communities' growth and proposes to provide a reliable and comfortable public transport system in the West Wing Corridor, by introducing the trunk busway system. **Complete discussions on this West Wing Project is provided in Chapter 3, Main Report Volume II.**

BASIC CONCEPT AND STRATEGIES

The CREATS Master Plan proposes that the 6th of October Corridor should ultimately be served with a dual-track rail system connecting the 6th of October new community and Ramses Station in 2022 and beyond the year when the demand guarantees the feasibility of the investment for the railway project. In the short- and the medium-term, however, a more cost-effective solution should be pursued, that is, provision of **a trunk busway system** in the existing 26th of July Corridor in such a way that the engineering design may permit the introduction of a rail system within the same right of way. The introduction of a railway system needs to be warranted by a transport demand of more than 15,000 passengers/hour/direction, which will be realized after the year 2017 (Figures ES.10 and ES.11).

The 6th of October Busway System is visualized, consisting of two bus lanes with an exclusive alignment and high-order service, which is provided via over-sized, articulated buses operating at frequent headways, depending on transport demands. The buswasy system is flexible in operation and responsive to demands, thereby providing a cost-effective transport service.

Two types of bus services will be provided in the specified target years based on the passenger demand: a normal bus with air-condition and an articulated bus with a greater passenger capacity. In the first stage, the bus service by normal bus with air-condition will be operated during a few years as long as the passenger demand is still low. In the second stage after 2009, articulated buses can be introduced to meet the increased passenger demand. In the third stage after 2017, a two-lanes busway system or a railway connection as another option, be considered, when the demand will exceed 15,000 passengers/hour/direction.

Figure ES.10 A Busway System in Colombia

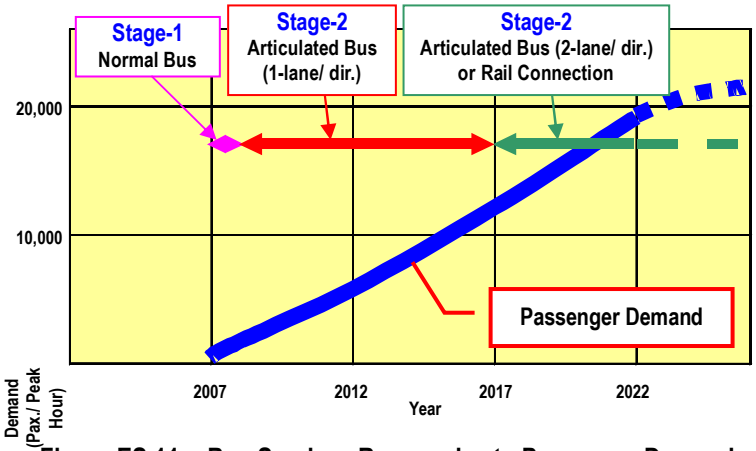


Figure ES.11 Bus Services Responsive to Passenger Demands

BUSWAY SYSTEM IN THE WEST WING

General Profile of the Busway

Since the West Wing Busway system is expected to be an integral part of the entire mass transit system in the Greater Cairo, it needs an intermodal connection with Metro Lines. The CREATS Master Plan proposes that the West Wing is to be directly linked with the planned Metro Line 3 in the future. However, in order to pursue an effective system in the short-term, the busway is studied to connect with the existing Metro Line 2 in the central area of Giza. In this context, **Cairo University Station** is the focal point as a strategic intermodal point.

Three different types of road structure for the busway system were designed between the bus terminal in the 6th of October City and Cairo University Station of Metro Line 2, namely:

(1) At-grade bus priority lane system on the central lane;
(2) At-grade median full segregated busway; and
(3) Elevated (viaduct) full segregated busway.

The at-grade bus priority lane system is introduced at the same level as that on the existing major streets within the 6th of October City. The at-grade median full segregated busway is suitable for the existing 26th of July Corridor. The viaduct type of full segregated busway needs to be constructed over the space of the 26th of July Road and the canal along ENR, where is located between the Ring Road interchange and Cairo University Station (refer to the road section drawings on Figure ES.12).

The total length accounts for 38.0km, within which five stations for the busway system are planned at strategic locations along the alignment. Out of them, three station plazas where feeder transport services need to be provided, are proposed to be built outside the 26th of July Corridor, as shown in Figure ES.12.

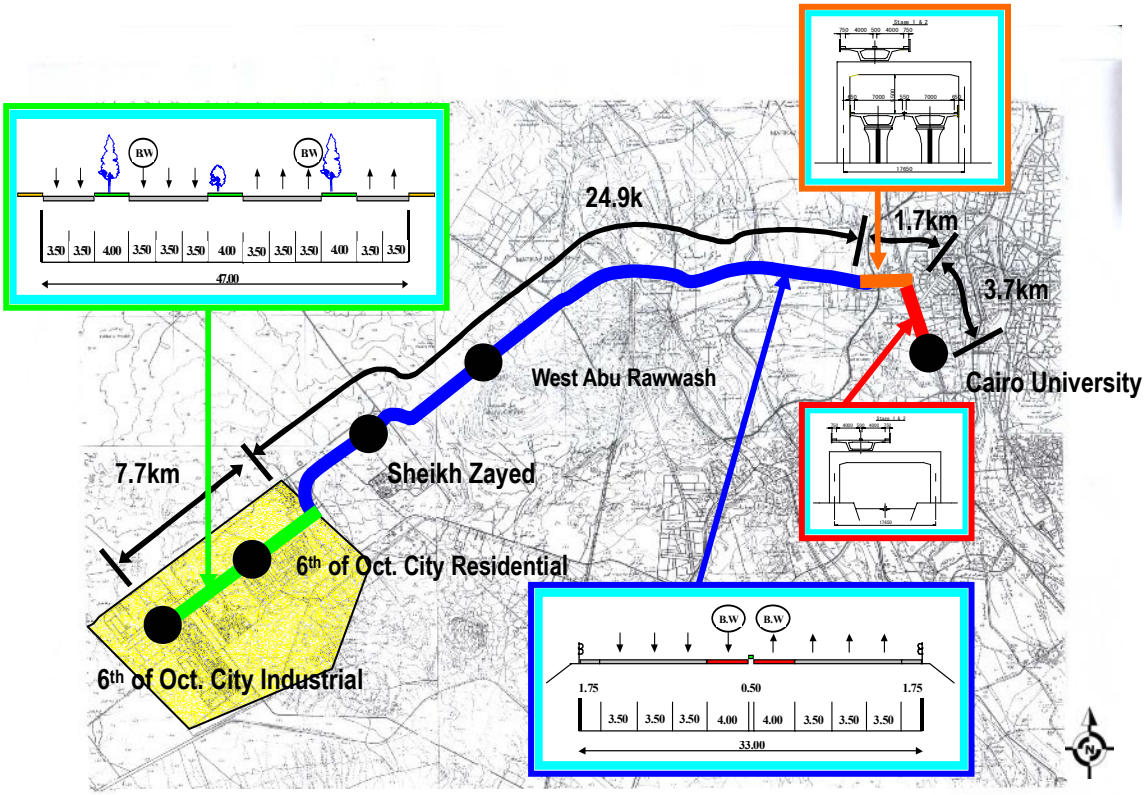


Figure ES.12 General Profile of the West Wing Busway System

Bus Stops and Station Facilities

Articulated buses will be operated on the bus priority lanes along median in the 6th of October City, and be operated on the full segregated busway on central 2-lanes along the median of the West Wing Corridor. Therefore, the bus stop stations are constructed in the median area of the road. Figure ES.13 shows a typical cross section of a bus stop on the 26th of July Corridor.

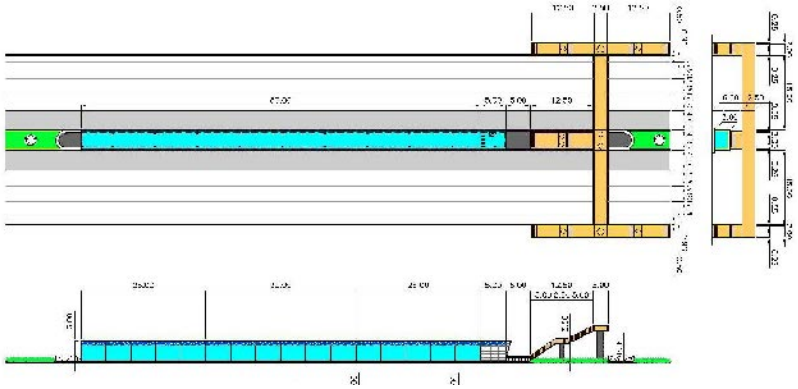


Figure ES.13 Typical Cross Section of Bus Stop Station

A pedestrian bridge needs to be installed for passengers to approach to the station. The station facility with an off-board and quick ticketing system should be placed on a traffic island.

Bus Terminals and Station Plazas

Station plazas are proposed to be developed near intermediate bus stops in the 26th of July Corridor. The station plaza is constructed, linking to the bus stop station of the trunk busway in order to ease passengers' transfer from the busway to feeder transport services. Three locations of station plazas are proposed: (1) 6th of October City Residential Station, (2) Sheikh Zayed Station, and (3) West Abu Rawwash Station.

Based on the estimate of passenger boarding demands in 2022, the total numbers of berths and land areas for these station plazas were computed as follows (refer to Figures ES.14 and ES.15):

- 6th of October City Residential Station 36 berths (900 m^2);
- Sheikh Zayed Station, 56 berths (10,020 m^2); and
- West Abu Rawwash Station 16 berths (6,050 m^2).

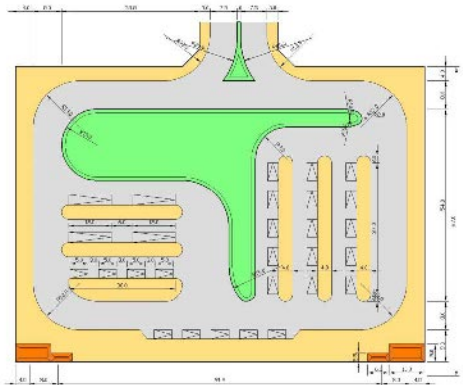


Figure ES.14 Station Plaza At Sheikh Zayed

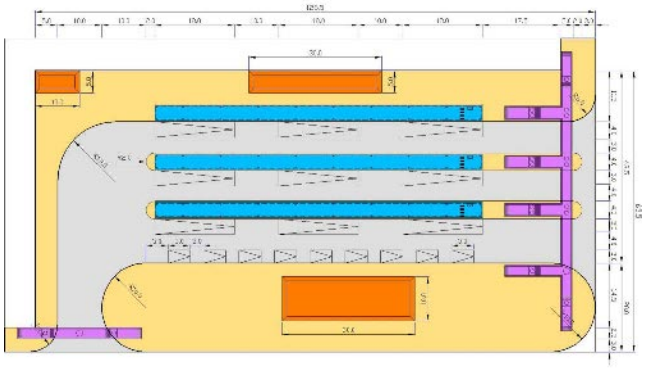


Figure ES.15 Bus Terminal at 6th of October City

Bus terminals, that shall be located at major intermodal points, have a terminal function to transfer from buses to the other public transport modes. Two locations of these bus terminals are proposed: (1) 6th of October City industrial, and (2) Cairo University Station at Metro Line 2 with the following terminal capacities required in 2022:

- 6th of October City Industrial 9 berths (5,220 m^2); and
- Cairo University Station 13 berths (8,030 m^2).

Bus Passenger Capacity

For a heavy passenger demand, a bus with a larger passenger capacity should be introduced on the busway on West Wing Corridor to offer both lower operation cost and higher service reliability. Although normal single-body buses with a capacity of 100 passengers may be used during the initial stage, articulated buses with a capacity of 200 passengers, as shown in Figure ES.16, be soon introduced in the second stage.

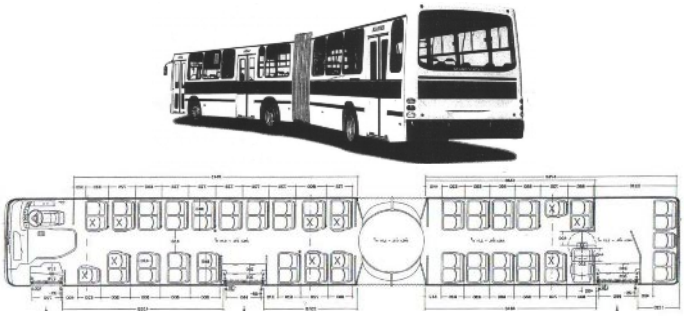


Figure ES.16 Layout of Articulated Bus

Bus Ticketing System

A main physical constraint to determine the transport capacity and average commercial bus speeds is the ticketing system to be applied. An efficient fare collection system on the busway needs to be introduced in order to reduce dwell time at bus stations. To ensure an efficient shuttle service system between the 6th of October City and the Central Giza area, an electronic fare cards system is recommended to reduce dwell times and optimize boarding and alighting procedures (Figure ES.17).

Tariff System

As the busway can provide a long-distance shuttle bus service, fares will be determined on a distance-base system under an off-board and quick ticketing system. The CREATS modal envisaged an elastic relationship between fare levels and passengers demands. An optimal fare level was verified through such a sensitivity analysis of revenues and passenger demand with respect to fare levels. **The optimal fare**, which is defined as the level that yields the maximum revenues, is:

- 0.94 LE base fare plus additional 0.04 LE per Km in year 2007;
- 1.11 LE base fare plus additional 0.06 LE per Km in 2012; and
- 1.50 LE base fare plus additional 0.08 LE per Km in 2022.

Figure ES.17 Electronic Fare Card

For instance, the optimal fare between both end-terminals with 38.0 km is computed about 2.5 LE, which is almost the same as that of the current air-conditioned bus.

Service Frequency

The scheduled service frequency was examined, taking into account the passenger demand and headway during peak hours. During the period between 2007-2009, the minimum operating headway for both normal buses and articulated buses is estimated at approximately 4.0 to 10.5 minutes. During the period 2012-2017, the minimum operating headway will be 2.0 minutes. In practice, the operation with less than 2 minutes headway is difficult to manage for the one lane per direction operation. Therefore, an operation system with two lanes busway per direction will be needed after 2018. Thus, a flexible busway system should be considered, depending on the development of new communities along the West Wing Corridor.

The average commercial speed during peak hours will be 40-50km/h. It can be foreseen that the total travel time is about **45-50 minutes** between the 6th of October City Industrial Station and Cairo University Station even during peak hours.

Necessary Bus Fleets

Based on key operation factors of: 1) commercial speed, 2) bus capacity, 3) minimum headway and 4) number of passengers, the numbers of necessary bus fleets to be allocated during peak hours can be estimated. In addition to these, taking into account 20% of the garage ratio for maintenance, the total number of bus fleets necessary to be procured are: 15 normal air-conditioned buses in the initial stage (2007-2008), and 36-140 articulated buses, for the second stage (2009-2017), and 210 articulated buses, for the third stage (2013-2017). These articulated buses are necessary to be newly procured.

COST ESTIMATION

Premises

The trunk busway system can be developed and enhanced in a phased manner, responding to passenger demands. In the initial stage (up to 2008), normal bus with air-condition may be operated with 1-lane per direction. After then, the busway system will be operated with articulated buses for 1-lane per direction during nine years between 2009 and 2017. Based on the increasing of passenger demand after 2018, given more than 12,000 passengers/hour/direction, a 2-lanes busway per direction will be needed. The construction period for the busway is assumed relatively short, or 1.5 years since the commencement of construction work up to the completion.

Project Cost

The project costs include all those for construction of the infrastructures and facilities , bus fleet procurement, land acquisition, administration for the project management and engineering service costs. These costs are estimated, based on unit cost by work item obtained from a "unit price analysis" in comparison with similar projects in Cairo. As summarized in Table ES.11, a total of about **506.7 million LE** is necessary to initiate this project and **78.3 million LE** will be additionally required to procure additional bus fleets after 2012. For Stages 1 and 2 (2007-2017), **586.3 million LE** will be needed, including road maintenance costs.

In order to respond to the increasing passenger demand after 2018, a total of **513.1 million LE** will be needed to expand the busway to the 2-lanes system.

Table ES.11 Estimated Project Cost of the West Wing Busway System

(Million LE at mid-2003 prices)

Project Cost	Stage 1 & Stage 2 (2007-2017)			Stage 3 (2018-2022)		
	Total Investment	Local Amount	Foreign Amount	**Total Investment**	Local Amount	Foreign Amount
1. Investment Cost	**506.72**	289.89	216.83	**513.07**	297.93	215.14
2. Maintenance Cost	**1.22**	1.22	0	**0.44**	0.44	0
3. Additional Investment	**78.31**	0	78.31	**0**	0	0
Total	**586.25**	291.11	295.14	**513.51**	298.37	215.14

Source: JICA Study Team

Operation Cost and Operation Revenue

Table ES.12 shows an anticipated annual balance between operation costs and operation revenues for the West Wing Busway operation. From the beginning of the operation, the balance will be positive, or a profit of 10.9 million LE will be yielded even in 2007.

Table ES.12 Operation Cost and Operation Revenue on Busway

(Million LE at mid-2003 prices)

Item (Mil. LE)	2007	2009	2012	2022
1. Annual Operation Cost	3.3	11.9	26.1	68.2
2. Annual Revenue	14.2	57.2	148.3	587.9
Balance (2 - 1)	**10.9**	**45.3**	**122.2**	**519.7**

Source: JICA Study Team

TRAFFIC MANAGEMENT PROGRAM AT CENTRAL GIZA

Development of the Intermodal Function at Cairo University Station

The terminus of the West Wing linking with Metro Line 2 at Cairo University Station could offer passengers to directly link to other parts of Cairo. From an intermodal point of view, it is required to develop intermodal facilities and provide with a station plaza for feeder transport services facilitate a more convenient and efficient public transport system. Given such a functional intermodal system, approximately 450 thousand passengers per day will directly benefit in 2022.

Figure ES.18 Proposed Intermodal Point of West Wing at Cairo University Station

The West Wing Busway service will benefit about 200 thousand commuters per day to/from the 6th of October City, and 85% of these passengers are expected to transfer to Metro Line 2 at Cairo University Station. **An elevated pedestrian deck system** linking both stations is necessary to assure safety and smooth transfers. Figure ES.18 illustrated a concept of the physical development of the intermodal facilities connecting with Cairo University Station (Metro Line 2) and the proposed terminal of the West Wing Busway.

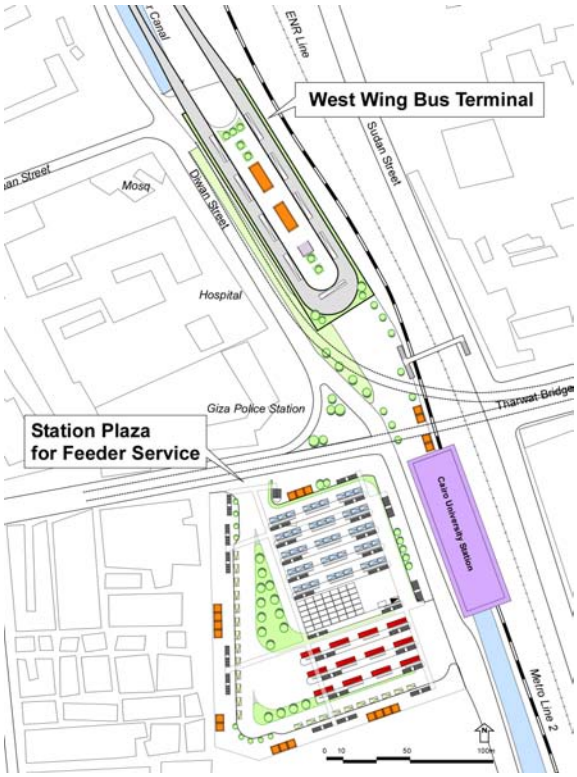


Figure ES.19 A Conceptual Layout of Intermodal Facilities at Cairo University Station Area in 2022

The existing traffic congestion in surrounding areas of Cairo University Station is caused mainly by blocking at middle of the streets by shared-taxis and taxis due to a lack of terminal facilities. The CREATS Model revealed that 48% of the passengers of Metro Line 2 will transfer to public transport modes such as bus, minibus, shared taxi and taxi at Cairo University Station in 2022. Development of an appropriate intermodal function, including berths of public transport as well as space for a kiss and ride system, is proposed on a long-term vision.

Figure ES.19 illustrated a planning concept to enhance the intermodal function, including the Cairo University Station Plaza as well as the West Wing Bus Terminal. In order to accommodate necessary numbers of berths and transfer facilities for feeder transport modes, a land area of 21,000 m^2 will be necessary to be redeveloped in the west side of Cairo University Station. At present, this area is densely occupied by residential and commercial buildings. Needless to say, it would be extremely difficult to execute such an urban redevelopment project in short-term, because of difficulties in relocation of more or less 100 households residing in this area. However, it is recommended that such a redevelopment vision be further explored in the context of an urban development policy in the long-term.

Traffic Management Program

As a short-term solution, a traffic management program is proposed to be introduced in and around the Cairo University Station Area. Since there is no available space for new road construction in the built-up area, it is necessary to increase road traffic capacity through the maximum use of the existing road facilities. The proposed traffic management system to mitigate current traffic congestions around this terminal area includes: 1) formulation of a traffic management plan for smooth traffic circulation ; 2) road widening of the station plaza; 3) a signalized-control system and an one-way circulation system for each street; 4) a on-street parking control system; and 5) installation of pedestrians safety facilities (refer to Figure ES.20).

The urban environment, where is amenable to **pedestrians**, should be created. This must be a basic planning concept for design of a traffic management program.

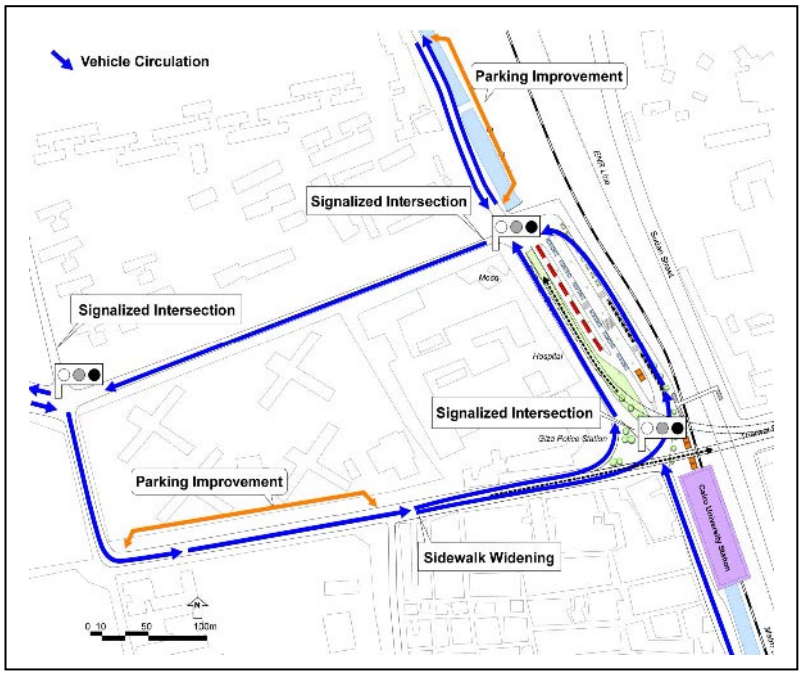


Figure ES.20 Traffic Management Programs around Cairo University Station Area

ENVIRONMENTAL IMPACT ASSESSMENT

To ensure sustainability for the West Wing Busway Project, a **scoped Environmental Impact Assessment (EIA)** was carried out in the course of the feasibility study according to the Egyptian, JICA and other international guidelines and regulations. The EIA indicates the negative as well as the positive environmental impacts that are expected from the Busway Project. Mitigation measures, required to alleviate the identified adverse environmental impacts, are proposed..

Environmental Survey and Impacts

As parts of the Environmental Impact Assessment, **Air Quality** and **Noise Level Surveys**, and a **Social Survey** (Social Impact Assessment), were carried out. Their results revealed the present environmental condition of the Project Area, as well as the opinion of the residents on the proposed Project.

Negative environmental impacts, which have been identified for the proposed Busway Project, are: split up of neighbourhoods by bus lanes; and impact on aesthetics by a viaduct and flyovers, blocking the views for residents. When development of the Cairo University Station Plaza is materialized, a social issue for compensations for those who would be enforced to move or relocate will take place.

Mitigations measures are proposed to alleviate the identified impacts: proper compensation and assistance for alternative housing and jobs; construction of bridges and underpasses for pedestrians; compensation by landscaping, planting of trees, parks; additionally, sound barriers are proposed were required to improve the situation.

Major reasons for the fact that only minor environmental impacts are expected from the proposed Busway Project are:

- The proposed Busway Project is a public transport project; busses consume less energy for the transportation of a certain number of passengers than cars.
- The Project concerns an activity in the city environment; there is no impact on fragile ecology.
- The right of way is mainly owned by the government and predominantly free of houses and other structures.
- The identified impacts can be mitigated.

Positive impacts expected in the urban economy from the Busway are: improved mobility and access for the residents of Greater Cairo; reduced travel time and costs; improved conditions for economic development; and enhanced development of tourism. These economic impacts will result in lessening the total environmental burden in Greater Cairo.

Positive environmental impacts expected from the Trunk Busway are as follows:

- A number of car users will start using the Trunk Busway *(less emission, less energy consumption).*
- There will be less air pollution compared to the situation of not carrying out the proposed Busway (Zero Option), especially when the busses are running on gas (*less emission, less energy consumption).*There will be no significant increase of noise levels.
- Reduced number of accidents and increased safety for pedestrians by the construction of pedestrian bridges are expected.
- There will be possibilities for planting of trees/ landscaping

For the global environmental impact, the total CO_2 emission of **631,700 tons/year** can be reduced by the introduction of this West Wing Project in 2022. It is generally said that as one litter of gasoline generates **2.30 kg** of CO_2, the CO_2 reduction of about **631,700** tons is equivalent to the reduction of about **274.7million litters/year of gasoline**, or 1.63 million bbl./year.

Overall Evaluation

The conclusions of the scoped Environmental Impact Assessment for the selected Busway Project (West Wing) are:

- Major positive impacts are expected.
- Minor negative impacts are expected, which can be mitigated.
- The West Wing Busway Project is sustainable and environmentally feasible.

ECONOMIC EVALUATION

The economic evaluation is carried out from a view of whether or not the investment for the West Wing Busway Project be feasible in terms of the national economy, based on basic premises such as: prices as of mid-2003; the exchange rate of 1 US$=6.0 LE; and project life of 27 years from 2004 through 2030.

With and Without the Project

Economic benefits are both calculated as differences between "With the Project" and "Without the Project". For the calculation of economic benefits, the situation of the "Without" case is defined identical to the "Do Nothing Scenario" as examined in the CREATS Master Plan. This scenario is not the same situation as the current condition, but depicts such a situation that all committed projects, including Metro Line 3, the capacity enhancement of Metro Line 1 and a number of flyover projects, have materialized in a planned time framework (see the CREATS Master Plan). ***Metro Line 3 is assumed to be operated in 2017. Thus, it should be noted that even the "Without the Project" case hold inclusion of the Metro Line 3 which is very influential to changes in the transport pattern.***

Economic Costs for the Investment

According to a planned construction schedule, the economic capital costs for the West Wing project, which are converted [2] from the estimated financial costs as shown in Table ES.1, are allocated in a phased manner. The total economic cost for the initial investment is 423.5 Million LE, appropriated in the initial phase between 2004 and 2006. Furthermore, the economic cost for the additional investment for the transport capacity enhancement to be allocated in 2012 and during the period between 2015 and 2017, accounts for 496.4 million LE. In addition, in order to maintain the system, a total of 284.2 million LE shall be allocated for the reinvestment for bus fleets procurement, responding to the increasing demand in the years 2016, 2022, 2026 and 2027.

Economic Benefits

Economic benefits are assumed to be two: savings in time cost and savings in vehicle operation cost (VOC), which are both derived from a difference between "with the Project" and "without the Project". In 2022, the annual time saving is projected to be about **2,420 million LE**, and the annual operation cost VOC saving, **666** million LE at mid-2003 prices. These savings are increasing along with the increasing passenger demand.

Cost-Benefit Analysis

The results of the cost-benefit analysis are summarized as tabulated in Table ES.13. The Economic Internal Rate of Return (EIRR) is computed at as high as **48.9%**. Since this rate is significantly higher than the Egyptian social discount rate of 12%, it is evaluated that the Project is economically feasible, or worth being implemented from the national economy point of view.

The Net Present Value (NPV) accounts for **5,243 million LE** at the mid-2003 prices, and the Benefit/Cost ratio is as high as **9.6**, given a 12% discount rate. This means that the West Wing Project will bring a considerable amount of economic benefits to the national economy as a whole.

Table ES.13 Summary of Economic Evaluation Results for the West Wing Busway Project

Evaluation Indicators	Value
Economic Internal Rate of Return (EIRR)	48.9%
Net Present Value (NPV), at 12% discount rate	5,243 million LE at mid-2003 prices
Benefit/Cost (B/C) Ratio	9.6

Source: JICA Study Team

[2] Conversion rates are assumed to be 81% for local currency items as well as 87% for foreign currency (or imported) items. taking into account the Egyptian taxation and labor market conditions.

FINANCIAL EVALUATION

The West Wing Busway Project was evaluated from the financial viewpoint. The following are a summary of the findings

Assumptions

- The costs and revenues are estimated at mid-2003 constant prices;
- The estimated financial capital costs are allocated in the scheduled time framework up to the year 2030;
- The planned bus service be operated in 2007 and generate operating revenues from 2007;
- The evaluation period is assumed to be the period between 2004 and 2030, and the residual value of invested capitals is considered in 2030;
- For the operating revenue, **a distance-based fare system** (a base fare plus distance-based charge) employed as planned below.

Table ES.14 Assumed Fare Level for the West Wing Busway Service

(at mid-2003 prices)

	2007	2012	2022
Base Fare (LE)	0.94	1.11	1.50
Distance-based (LE/km)	0.04	0.06	0.08
An Example Fare (LE): Cairo University Station ~ 6th of October Bus Station (38km)	2.46	3.39	4.54

Source: JICA Study Team

- Additional incomes accruing from ancillary sources related to the bus service operation, such as advertisement charges, are considered to be 6% of the operating revenue, taking into account experiences being performed in other countries.

Results of the Financial Analysis

The results of the financial analysis are summarized in Table ES.15. The FIRR for the West Wing Busway Project is computed at as high as **22.3%**, which implies that the Project will be very viable from the financial point of view, or that the Project is robust enough against any financial scheme.

Looking at the financial state in the long-term, a positive operating profit at an annual basis, even after reduction of the interest and depreciation, will occur in the year 2008, or in the second year after the operation. The accumulated net profit will be positive in the next year, 2009. Thus, the Project is expected to generate sufficient profits to recover the investment in a quite short-term.

Table ES.15 A Summary of Financial Analysis for the West Wing Project

Evaluation Indices	Result
FIRR (Financial Internal Rate of Return)	22.3%
The First Year of Positive Operation Profit at Annual Basis	Year 2008
The First Year of Positive Net Profit at Annual Basis (after Interest and Depreciation)	Year 2008
The First Year of Positive Accumulated Net Profit	Year 2009

Source: JICA Study Team

A RECOMMENDED IMPLEMENTATION SCHEME

Three Alternative Scenarios for the Implementation

Since it is assessed that the West Wing Project is both economically and financially feasible, a wide range of flexibility can be conceivable for the implementation of the Project. Three options are examined as follows:

Alternative 1: The government sector shall take full responsibilities for the construction and the operation. This option is rational, because the Project itself is economically feasible. Even under the currently serious resource constraint, the government investment will be soon recovered financially and yield a considerable amount of profits. A constraint, however, will take place in the operation and management of the bus services, because the government sector has no experiences in operating such modern technologies as required.

Alternative 2: Since a considerable high rate of financial returns can be expected through the Project, a private sector participation scheme may be one of the possible and realistic options. The so-called **BOT** (Build, Operation and Transfer) mechanism is a possible option in this context under a well-planned concession scheme. However, a BOT scheme is not necessarily the best policy to implement this Project, because of some reasons: (1) the private sector will hardly take a financial risk on the investments constantly required in the long-term; (2) the fund raising capacity for the infrastructure construction by the private sector is subject to economic fluctuation, therefore, the private sector can hardly guarantee a scheduled construction and operation; and (3) it will normally take long time to reach an agreement between both the government and private sectors, thereby loosing the otherwise-be-gained benefits.

Alternative 3: A sort of Public-Private Partnership (PPP) mechanism shall be pursued. This option is flexible and applicable for the West Wing Project as well. The government sector, or Ministry of Housing, Urban Utilities and New Communities, assumes a responsibility for the infrastructure development. On the other hand, the private company or a joint venture company with the public and private sectors, shall assume a responsibility for the operation and maintenance including procurement of bus fleets, leasing the infrastructure from the owner who is the government under a concessionaire agreement. The government may recover the investment cost by the concession fee from the operator. This mechanism reinforces both weakness, and integrates both strengths of the public and private sectors, and its conceptual scheme is the same as depicted in Table ES.8 for the East Wing Project in the preceding Chapter.

A Business Model of the Public-Private Partnership Scheme

Under the framework of "**Alternative 3**", a business model was examined from the cash-flow analysis. For this purpose, two organizations are supposed, namely, the Government and the Operator (an operating company). Financial assumptions are as follows:

- The Government, or Ministry of Housing, Urban Utilities and New Communities, is supposed to be the implementing body of the Project, and invests the infrastructure facilities. The cost of the foreign currency portion shall be procured through an ODA soft loan scheme, while that for the local portion shall be raised internally as a subsidy. Conditions of the ODA soft loan are assumed: 3% interest rate; 7 years grace period and 25 years repayment period.
- The Operator is supposed to be an private entity, and shall maintain the whole infrastructure facilities and operate the express bus service, procuring a necessary number of bus fleets. It is assumed that the Operator can access to an international soft loan equivalent to the amount of the foreign currency portion necessary for the procurement, and a long-term loan at commercial bank at a 10% interest rate and short-term loans (one year) at a 13% interest rate, if necessary to fulfil an annual shortfall. The equity (the initial capital) of the Operator is assumed to be 20% of the total initial investment.
- A rate of the **Concession Fee** that the Operator shall pay the Government is assumed to be 5% of the operation revenue as a base case, then an appropriate level is examined so that both parties' financial situations are not worsened.

Through a cash flow analysis based on the above assumptions, the most favourable condition was sought. The major evaluation indicators are tabulated in Table ES.16. In the base case, given a 5% concession fee level, the Operator will yield as high as 58% of FIRR and 115% of ROE (Return on Equity). On the other hand, the Government needs to provide a total of 656 million LE, but will be able to gain the accumulated net profit of 239 million LE in 2030. It is assessed that this situation is too much favourable for the Operator, therefore the concession fee rate may be raised.

Should the concession fee rate be even 50% of the operation revenue, the Operator can still enjoy a 37.6% FIRR and a 64.8% ROE, while the Infrastructure Owner will provide a total of 206 million LE, and can gain the net profit of as much as 4,616 million LE in 2030. In conclusion, a scheme with a 50% concession fee rate will be feasible for both parties to manage the Project.

Table ES.16 A Summary of Cash Flow Analysis for the West Wing Project

Condition	The Operation Company		The Government		
	FIRR (%)	ROE [2] (%)	Accumulated Subsidy (Million LE)	Average Annual Subsidy (Million LE)	Accumulated Net Profit **in 2030** (Million LE)
Base (CF [1] = 5%)	58.1	114.9	656	47	239
Case of CF=50%	37.6	64.8	206	15	4,616

Notes: 1. "CF" stands for the rate of Concession Fee to the operation revenue.
2. "ROE": Return on Equity
Source: JICA Study Team

Recommendations on the Implementation

From the business model analysis of the Public-Private Partnership, it was revealed that the scheme with a concession fee rate of **50%** of the operation revenue could enable both parties to manage the Project in such a way that both parties will be able to satisfy their own objectives: the Operator can enjoy a sufficient level of profits, while the Government can recover the vested subsidy in the long-term, providing public transport services for the people. Therefore, it is recommended that this scheme should materialize in consideration of the following aspects:

1) Ministry of Housing, Urban Utilities and New Community shall be responsible for the development of the West Wing Busway, then will transfer its ownership to the Giza Governorate. Thus, well coordination between the two governments as well as Ministry of Transport needs to be established to initiate the Project.

2) The external financial resource mobilization is not necessarily essential for the Project, because the Project is financially robust enough against even local funding schemes. However, as proven by the business model analysis, the use of some international donor resources will make this project more implementable and practical. Along with this context, technical resources are also expected to be introduced from some experienced institutions to properly manage such new technologies..

3) Based on this economic evaluation result, the government's definite decision for initiating the Project should be made in the line with the government policy to facilitate the new community development. Since some successful models of the similar project are already available in Bogota City (Colombia), it is recommended that relevant officials study such advanced examples for their prompt decision-making.

4) Under the recommended Public-Private Partnership, the capable operator, or the West Wing Busway Company, needs to be organized with a commercially rational institutional structure. For this purpose, the private sector can be invited to take part in this business area through a concessionaire bidding process. However, it is recommended as a possible and rational option that the Cairo Transport Authority (CTA) shall establish the operating company as a **CTA affiliated entity** under a restructuring scheme towards the commercialization process, as discussed in Program B-2, CTA Restructuring. This will provide with a practical opportunity to reform CTA itself. An organizational structure of the entity is proposed as presented in the following section.

ORGANIZATIONAL STRATEGY FOR WEST WING BUSWAY OPERATION

The organization of the West Wing busway operator is proposed, according to the selected technical options and the anticipated ridership for the period between 2007-2012 and year 2022. The principal management system is based on the following:

- The organization will not be in charge of the design, construction of the project, but functions as an operating entity of the West Wing Busway service;
- The staff organization will be in charge of the operation, the maintenance and the management of the system;
- The general operating principals will be a centralized control of all the different tasks, and

The recommended general organization for the operation and maintenance of the busway is similar to bus system organizations used throughout the world, regardless of its characteristics of a private or public entity. The staffing of each department has been adjusted, base on an optimal commercialized operation system. The labor efficiency, however, is considered for the local conditions to some extent in particular for the operation and maintenance work.

Organizational Structure

The proposed West Wing Company Organization is structured with five departments under a general management unit as shown in Figure ES.21. Board of Directors shall assume comprehensive management responsibilities. Operation Department, which shall play a core function of the operation, consists of three divisions: Studies Operation Division; Central Control Room Division; and Line Operational Division.

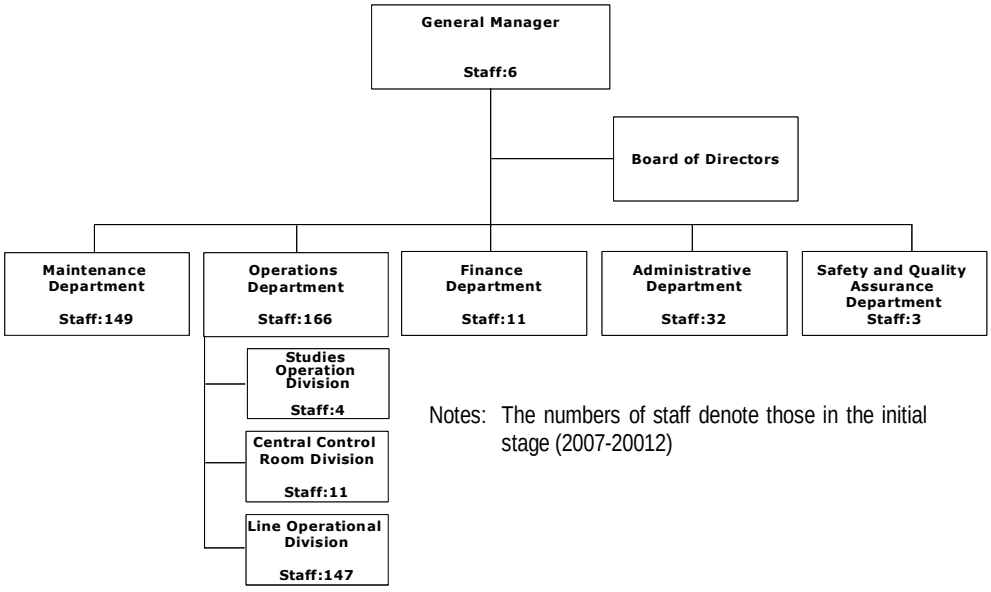


Figure ES.21 West Wing Company Organizational Structure

Staff Requirements

Staff requirements under the proposed organizational structure are estimated, based on the following assumptions:

- One manager is assigned per one post.
- The labor productiveness and efficiency are assumed as follows:
  - Equivalence of 1.5 rest day every 5.5 work day (7/5.5 factor);
  - 1.20 absenteeism factor (holidays, illness, refreshing training, etc.); and
  - For the operating staff and post assured 24 hours per day; 2 shifts per day.

The number of staff required for each department is estimated by professional/skill category and by class/grade. The result is presented in Table ES.17. For the operation during the initial period between 2007 and 2012, a total of 367 staffs will be employed. Towards the year 2022, in order to meet an increasing demand, the organization needs to be strengthened in term of staff capacity for service expansion, while keeping the same organizational structure. The management unit should be kept conservative in its expansion, however, Safety and Quality Assurance Department as well as Operation Department and Maintenance Department should be further staffed in accordance with the number of actively operating bus fleets in such a way that the work load and the labor efficiency be not worsened. Consequently, a total of 639 staffs will be organized for the operation in 2022.

Table ES.17 A Summary: West Wing Busway Company Staffing in 2007-2012 and 2022

Department	Total	Number of Staff by Grade					
		Manager	Senior Engineer	Engineer	Senior Technician	Technician	Other Staff
Initial stage (2007-2012)							
Management	**6**	3	-	-	-	-	3
Safety/Quality	**3**	1	-	-	1	-	1
Maintenance	**149**	1	2	5	12	28	101
Operations	**166**	1	3	4	12	93	53
Finance	**11**	1	3	3	1	-	3
Administration	**32**	1	4	6	6	5	10
Total	**367**	**8**	**12**	**18**	**32**	**126**	**171**
For Operation in 2022							
Management	**6**	3	-	-	-	-	3
Safety/Quality	**7**	1	-	-	3	-	3
Maintenance	**253**	1	3	8	22	50	169
Operations	**302**	1	3	7	35	107	149
Finance	**23**	1	3	3	5	5	6
Administration	**48**	1	4	7	10	11	15
Total	**639**	**8**	**13**	**25**	**76**	**173**	**345**

Source: JICA Study Team

A-3 TRAFFIC MANAGEMENT PROGRAM ALONG METRO 4 CORRIDOR

BASIC CONCEPT AND STRATEGY

Definition of the Metro Line 4 Corridor

Metro Line 4 is proposed as a core element of the entire urban mass transit network by the CREATS Master Plan. However, due to limited financial resources as well as a prior commitment of the construction of Metro Line 3, the implementation of Metro Line 4 is likely to be materialized in the second half of the planning horizon. Currently, the Metro Line 4, comprising of Ahram St. and Malek Feisal St. and Port Said St., is of the most heavily utilized transport corridors in the metropolitan area. Effective traffic improvement actions are urgently expected along Metro Line 4. **Complete detail is provided in Chapter 4, Main Report Volume II.**

Objectives, Approach and Strategy of Traffic Management Program

The objective of the Traffic Management Program along the Metro 4 Corridor is to formulate a short-term transport management program, enhancing the public transport capacity along the proposed Metro Line 4 Corridor with a view to achieving smooth traffic flow on the corridor. This program also aims to shift private car users to public transport modes, thereby mitigating traffic congestion at bottlenecks. The focus of entire efforts is placed on a low cost traffic management solution which are likely to catalyze high benefits in terms of enhanced traffic operations, capacity and safety. Traffic management strategies will also address an interim solution prior to realization of Metro Line 4. Introduction of bus priority facilities, in the form of median bus lanes, emerges as a particularly strong contender in this corridor.

The current traffic status on the Metro 4 Corridor, including identification of traffic congested sections/intersections and causes in the context of traffic engineering, was surveyed by various traffic investigations. It was found that major current traffic congestions are caused by inadequate road usage due to a lack of a well-developed traffic management and control system. Such major causes of traffic congestions along Metro 4 Corridor are: (a) Unsuitable traffic signal control system at intersection; (b) Conflicts of buses and shared-taxies near bus stops; (c) Conflicts at U-turn points; (d) Merging and diverging to/from side roads without signal control; and (e) High occupancy of on-street parking.

From the traffic management point of view, three basic planning strategies are employed: 1) to promote service level of bus transport system; 2) to mitigate traffic congestions; and 3) to create pedestrian-friendly environment.

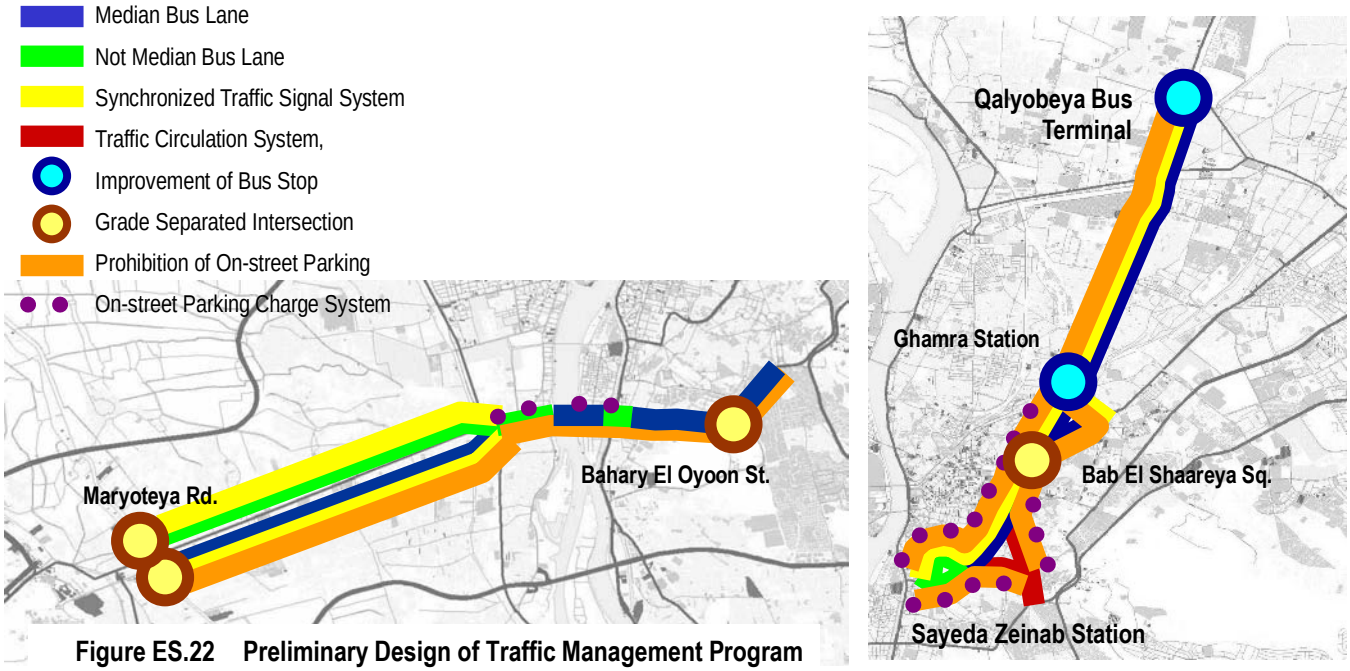


Figure ES.22 Preliminary Design of Traffic Management Program

TRAFFIC MANAGEMENT AND CONTROL MEASURES

The Traffic Management Program along the Metro 4 Corridor composes of several major components, namely, (1) Bus priority system (median bus lane system, bus priority signal light system; (2) Improvement of bus stop/terminal); (3) Improvement of traffic signal control system (synchronized system, improvement of traffic signal phase system, bus priority system, installation of signals); (4) Improvement of intersections (installation of signal light, traffic channelization); (5) Parking system (on-street parking prohibition; on-street parking charge system); (6) **Pedestrian friendly system** (signal phase for pedestrian crossing), and (7) traffic circulation system (one-way, bus lane system). Figure ES.22 shows a conceptual allocation plan of these traffic management projects along the Metro 4 Corridor.

Bus Priority System with Median Bus Lanes

The public transport requires road space for its facilities, so a priority of the public space usage must be given to the introduction of a new bus system. The purpose of introduction of a bus priority system is to realize punctual public transportation, improve convenience for bus users and promote car owners to use public bus transportation. The bus priority system is designed with three sub-systems: (1) the Median Bus Lane System; (2) the Bus Priority Signal System; and (3) Improvement of Bus Stops and Terminals. The average operating speed targets at 25km/h.

The median bus lane is generally planned both in the center of road (median) and alongsides (lateral), depending on the road width. The length of bus track running on the center of road is: Port Said St. (10.4km), Salah Salem St. (3.9km), and Ahram St. (6.0km). The one-way bus track system on Bab El Shaareya Sq. is proposed, although a two-way bus lane system can be considered as an alternative option. An average interval of bus stops is designed at 800-1,000 meter, taking into account pedestrians' walking distance limits. Numbers of bus stops are: Port Said St. (20 bus stops), Salah Salem St. (9 bus stops), and Ahram St. (12 bus stops).

Two types of bus stops are considered for the median bus lane system, based on conditions of road width and parking conditions. They are: bus stops by road marking or bus bay on roadside, and bus stops in the center of road (Figure ES.23).

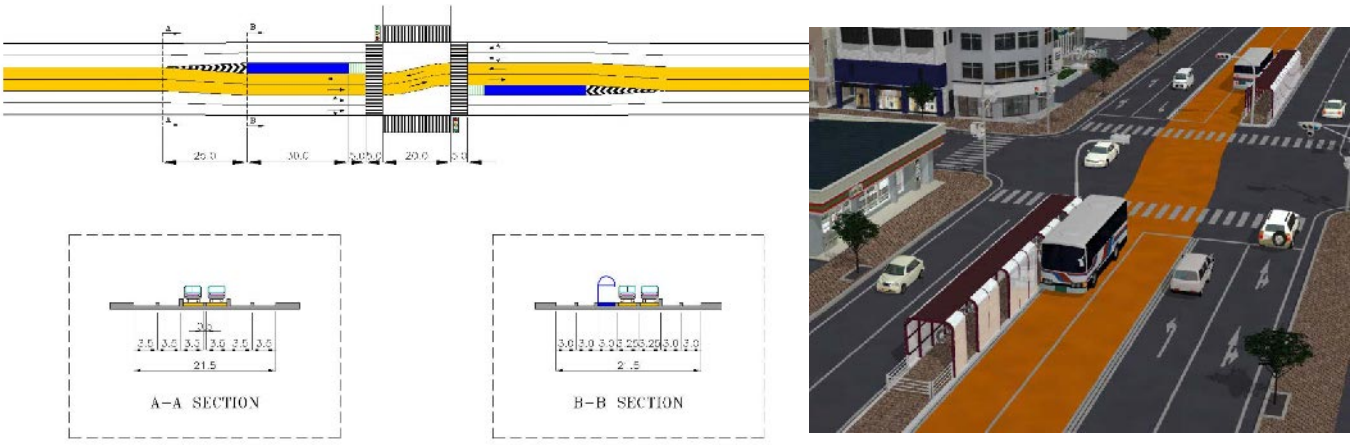


Figure ES.23 Typical Cross Section of Median Bus Lane System

Bus Priority Signal Control System

In order to ensuring a smooth bus operation, a bus priority signal light system should be introduced on the Metro 4 Corridor, in accordance with the plan of the median bus lane system. The bus priority signal control system shall realize punctual public transportation services, thereby improving convenience for bus users. As a low cost solution, introduction of a synchronized control system for bus priority in association with an independent traffic-actuated control system is proposed.

Traffic Signal Control System

The signal control system is effectively operated when the traffic shows an unstable fluctuation pattern. Some technical improvement of the signal control system at bottlenecks is necessary by introducing a Synchronized System, a Traffic Signal Phase System and a Bus Priority System of traffic signal light, instead of the manual operation by the traffic police. In addition, improvement of a traffic signal phase system (Figure ES.24) and installation of traffic signal lights should be employed in association with the technical improvement of the existing system (Figure ES.25).

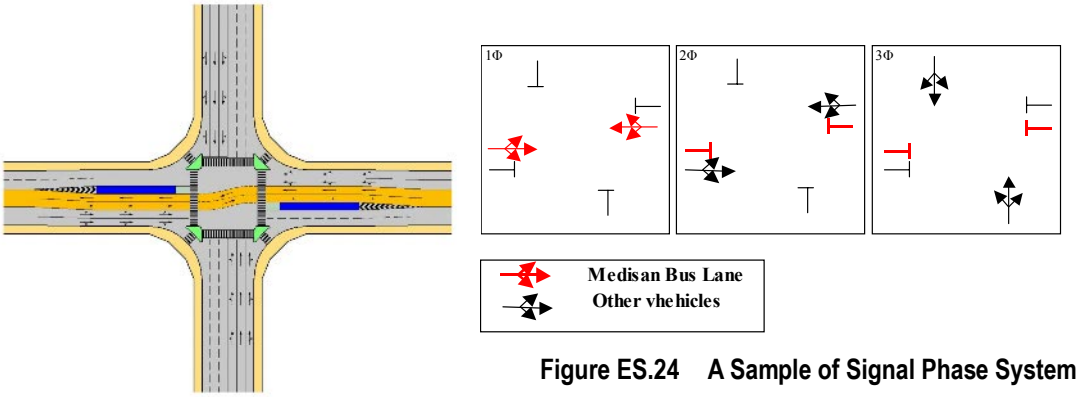


Figure ES.24 A Sample of Signal Phase System

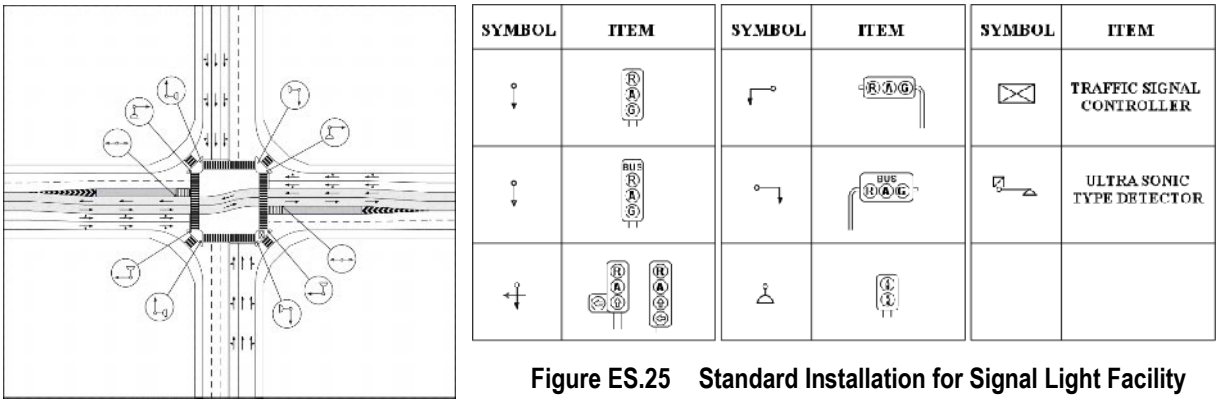


Figure ES.25 Standard Installation for Signal Light Facility

Improvement of Intersections

Along with the introduction of the bus priority system, improvement of the traffic signal control system and the pedestrian-friendly system, it is crucial to improve intersections that can enhance mutual effects of each system. The channelization plans were reviewed for intersection improvements, taking into account the following factors:

a. improvement of pavement markings where lane operation is to be altered;
b. addition of exclusive left-turn/right-turn lanes;
c. installation of pedestrian crossings;
d. improvement of channelizing islands;
e. improvement of median;
f. improvement of the median bus lane system; and
g. improvement of corner cut.

Serious bottlenecks appearing on this corridor will be greatly improved by introducing these traffic measures. As a sample, an improvement plan of the Port Said St.-Sawah St. intersection is illustrated on Figure ES.26. Currently, this intersection is one of the most serious bottlenecks with long traffic queue due to U-turn system, complex turning movement and long cycle time by manual control.

Parking System

The Metro 4 Corridor has a high parking demand, where the on-street parking occupancy exceeds 90% during peak hours. A rational parking system should be employed in order to enlarge the road capacity as designed. Such a system calls for two types of parking management, namely, one is "prohibition of on-street parking" during 8:00-20:00 and the other is "control of long time parking" by introducing a parking charge system. These two measures ought to be applied at the same time as one system.

Prohibition of on-street parking should be applied along sections with the median bus lane system. The sections of on-street parking prohibition are: Port Said St. (13.7km); Salah Salem St. (3.9km); and Ahram St. (7.2km).

On-street Parking Charge System is proposed in order to increase the parking capacity in the planned corridor. This is effective to increase the parking turnover rate. The parking charge system, employing a parking ticketing system, instead of parking charge machine, is recommended for local conditions. For parking on designated sections, a driver needs to buy a parking ticket from an officially assigned inspector, then has to put it on the dashboard so that it can be seen from outside. Inspectors shall be responsible for sales of parking tickets, patrolling to check for violators and issuing a traffic violation ticket for the offence. The on-street parking charge system is proposed to be designated in four areas along the Metro 4 Corridor: in Bab El Shaareya Sq. (2.1km); Sayeda Zeinab Sq. (5.9km); Giza Br. (1.0km); and Giza Sq. (0.8km). The parking ticketing system is classified into three kinds of tickets: one hour, two hours and three hours tickets. An example of a parking ticket is shown in Figure ES.27.

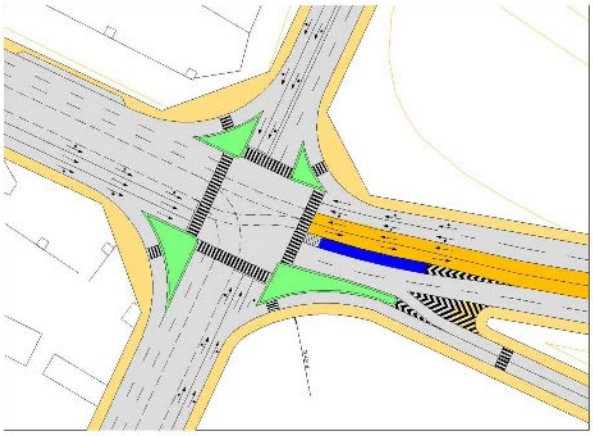


Figure ES.26 Improvement Plan at Sawah Intersection

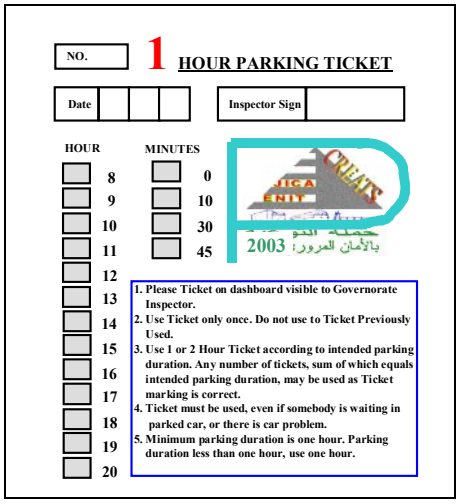


Figure ES.27 An Example of Parking Ticket

Pedestrian-Friendly System

It is observed that drivers generally pay little attention to pedestrians even when pedestrians are using pedestrian crossings at intersections. This drivers' attitude must be changed through enhancement of "**education**" and "**enforcement**" for a social norm of "**priority to pedestrian**". For this sake, "**engineering**" measures should be also considered to provide safe and convenient facilities. In order to ensure a safe pedestrian environment, an exclusive signal phase for pedestrian crossing needs to be prepared at signalized intersection (Figure ES.28).

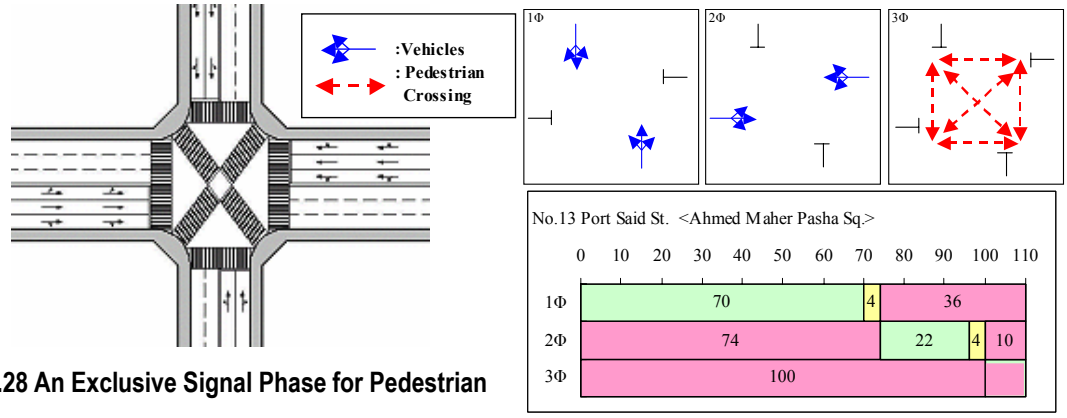


Figure ES.28 An Exclusive Signal Phase for Pedestrian

Traffic Circulation System

In the area between Sayeda Zeinab Sq. and Qalaa St. where are old, densely built-up areas with narrow streets, a considerable volume of traffic is concentrated, and heavy traffic congestions take place due to mixed traffic with big-size buses. Since it seems difficult to widen the existing streets, a traffic circulation plan is formulated, introducing a system of separate road functions and traffic restrictions. Two alternatives are proposed for one-way system with bus priority on side lane: (a) Sayeda Zeinab Sq.- Qalaa Sq (via Mohamed Qadry Pasha St.) - Ahmed Maher Pasha Sq, and/or (b) Port Said St. - Abdel Baqy St. - Sayeda Aisha St.- Qalaa St.

IMPACTS AND EFFECTIVENESS

The evaluation of the proposed traffic management program was carried out by utilizing the "**Dynamic Simulation Model**" that was developed by the Study Team. A comparative analysis between the "before" and "after" improvement cases was made in terms of two different quantitative indices, namely, *average vehicle speed* and *total vehicle hour*. The result envisages that a significant improvement will take place after the implementation of the program on the Metro 4 Corridor. Compared with the present case, the proposed program will increase the average travel speed on the total network, by 26% for buses and 13% for other vehicles, and will reduce the total vehicle hours by **21%** for buses and **11%** for other vehicles, as illustrated on Figure ES.29.

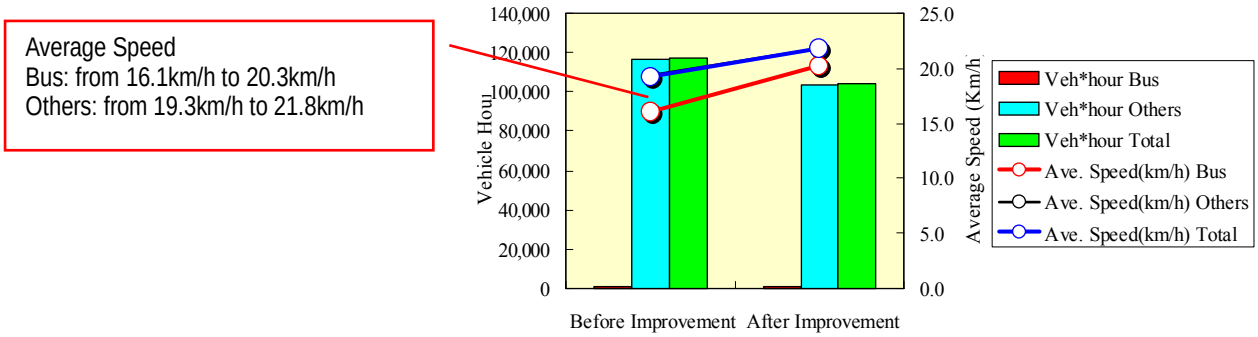


Figure ES.29 Impacts of Proposed Traffic Management Program (by a Dynamic Simulation Model)

PROJECT COST

The initial investment cost for the proposed Traffic Management Program, consisting of eight (8) project components, will total about **211.0 million LE** at 2003 constant prices, out of which 140.4 million LE, or 66.5%, is the cost of local amount and 70.7 million LE, that of foreign amount, as show in Table ES.18. The annual maintenance and operating cost are estimated as shown in Table ES.19.

Table ES.18 Summary of Initial Investment Cost for Traffic Management Program of Metro 4 Corridor

(Unit: at mid-2003 prices)

Program Component	Total Cost (million LE)	Local (million LE)	Foreign (million LE)
1 Signal Control for Vehicles	60.554	24.543	36.011
2 Bus Priority Signal Control for Median Bus Lane	1.590	0.734	0.856
3 Median Bus Lane System	61.178	47.204	13.973
4 Improvement of Intersections	2.257	1.519	0.739
5 Improvement of Bus Terminal and Bus Stops	4.802	4.335	0.467
6 On-street Parking Charge System	1.316	0.994	0.322
7 Traffic Circulation System on El Qalaa Str.	0.196	0.184	0.012
8 Flyovers Construction (4 intersections)	80.142	60.851	19.291
Total (%)	**211.035 (100.0%)**	**140.364 (66.5%)**	**70.671 (33.5%)**

Source: JICA Study Team

Table ES.19 Project Cost for the Traffic Management Program

(Million LE per Year)

	Total Investment	Local Amount	Foreign Amount
1. Maintenance Cost	1.24	0.72	0.52
2. Operating Cost	0.98	0.98	0.0

Source: JICA Study Team

A RECOMMENDED IMPLEMENTATION SCHEME

Funding for the Program Implementation

As discussed above, since it is proven that the proposed Traffic Management Program be significantly effective to mitigate current traffic congestions and increase the public transport capacity of bus services, the Cairo Governorate and the Giza Governorate are recommended to jointly implement the Program as soon as practical. The earlier the Program is initiated, the more economic benefits will take place for the people.

As the Program does not yield financial revenue, except for the On-street Parking Charge System, the private sector's participation in investing for the proposed improvement cannot be considered. Therefore, these local governments need to take full responsibilities for funding, construction, operation and management, based on a fact that the Program is economically feasible. These Governorates may request the international donor community to get technical and financial assistance.

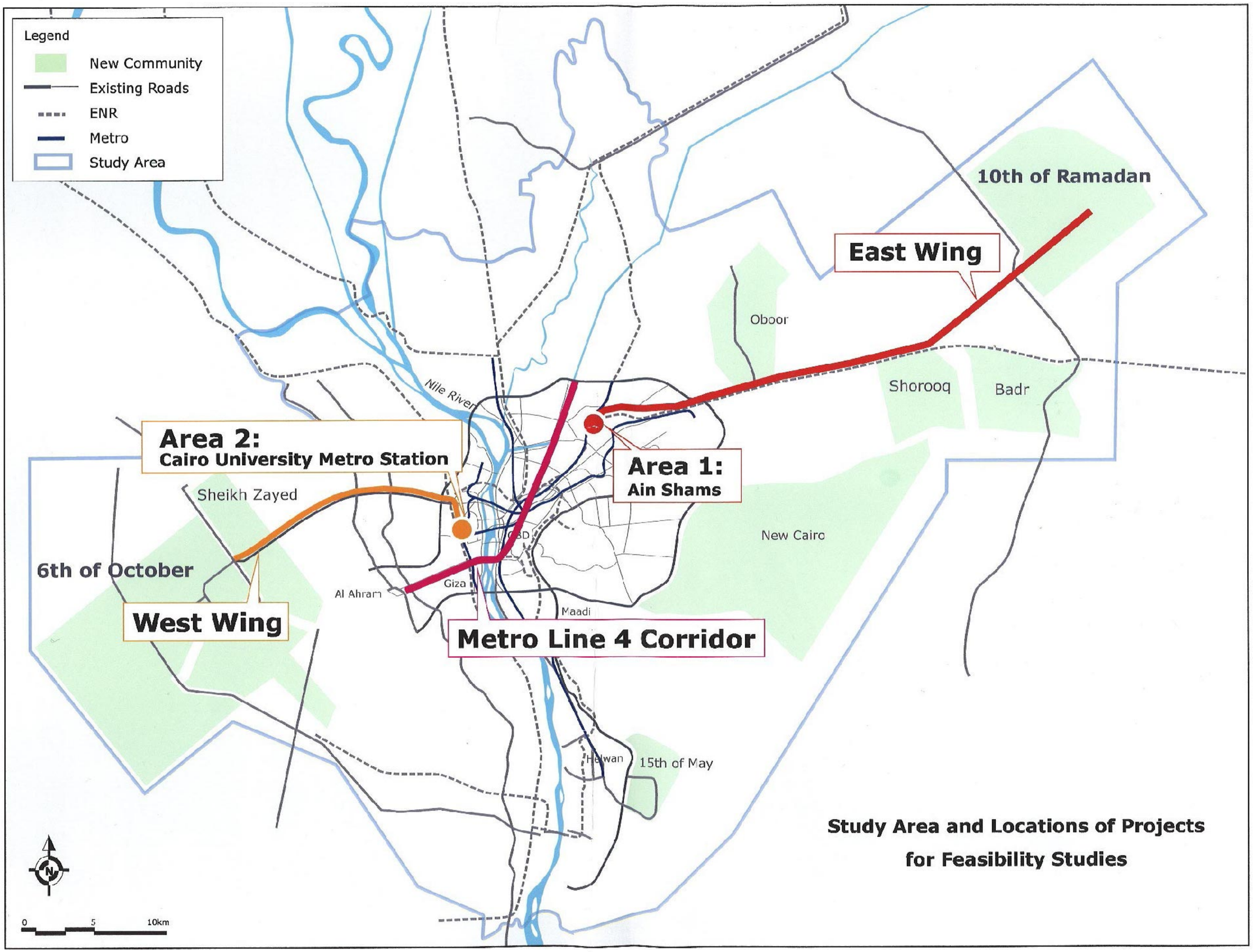
Warrants for the Sustainable and Successful Implementation

It is noted that a successful traffic management system, as widely recognized, requires three "Es", namely, ***Engineering***, ***Education*** and ***Enforcement***. The proposed measures in this Program are all related to the engineering aspects. The other two "Es" should be concomitant with this engineering improvement. In this sense, an educational campaign program for the general public as well as drivers with respect to traffic safety, as proposed in the CREATS Master Plan, should be facilitated, and at the same time, a capacity building program for traffic enforcers is needed to be enhanced along with introduction of the signaling systems at major intersections and the bus priority operation, otherwise, the capital investment for such measures would be useless for the local conditions. It is also stressed again that the ***pedestrian-friendly traffic environment*** is really necessary to be created in the Cairo Metropolis.

Proposed Implementing Mechanism

Planning and implementation of the Program should be conducted with the deliberate implementing procedure and staff organization. To this end, the following mechanism is recommended to be established:

- It is desirable that the Cairo Traffic Engineering Bureau (CTEB) be in charge of the implementation of the propose program as a whole, because CTEB is responsible for overall traffic management planning and policy implementation. With the same functions, the Giza Governarate should newly organize the Giza Traffic Engineering Bureau (GTEB).
- Regarding the operation of the parking ticket system, CTEB needs to be further strengthened in its staff capacity for planning, designing, operation and monitoring, recruiting more staffs, and GTEB should be sufficiently staffed for these tasks.
- The Traffic Police should be in charge of enforcement. Inspectors, who are officially assigned by the Traffic Police shall patrol once every hour to check if there are violators. The inspectors should be well educated through technical training courses.
- It is also recommended that, at the initial stage, this new system be introduced in the most important areas as "A Pilot Project", and its impacts should be carefully monitored. As people become gradually accustomed to the new system, it could be expanded to other areas, and any modifications necessary to make it more suitable for the Egyptian way of life should be implemented.
- Regarding the traffic signal control system, in order to respond to traffic flow conditions, the traffic control parameters of signal lights should be monitored and updated periodically.



Study Area and Locations of Projects for Feasibility Studies

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 STUDY SCOPE AND OBJECTIVES

The Japan International Cooperation Agency (JICA) and the Higher Committee for Greater Cairo Transport Planning are cooperating in the conduct of the *Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt* (CREATS – Cairo Regional Area Transportation Study), based upon agreements finalized during November, 2000[1]. Pacific Consultants International, headquartered in Tokyo, Japan, is the designated lead consultant for the study.

The CREATS is divided into two phases, with Phase I dedicated to formulating a master plan and Phase II to conducting feasibility studies for selected priority projects/programs identified within the master plan. The Phase I study was completed during November, 2002, and the resultant CREATS Master Plan officially submitted to the Government of Egypt during February, 2003. Phase II commenced during the same month with mobilization of the Study Team to Cairo.

1.1.1 Overview of Phase I Approach to Formulation of The Master Plan

A basic premise of all investigations is that the CREATS is comprehensive in nature, that is, adopt approaches designed to mitigate urban transport problems and contribute to the sustainable development of the Greater Cairo Region. Three key products form the foundation upon which investigative efforts were based:

- Formulation of an integrated, multi-modal transport master plan extending over a twenty year planning horizon (to year 2022), termed the Phase I analysis[2]. Technical efforts related to the Phase I Master Plan formulation were initiated during March, 2001 and completed by November, 2002;

[1] *Scope of Work - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, as mutually agreed upon between the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, November, 2000.

[2] Further detail regarding scope of work, Study Team composition and technical framework is contained in *Inception Report - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., April, 2001.

- Identification, within the Phase I master plan framework, of high-priority projects whose implementation is to be achieved in the near-term future, and whose merit is determined via more detailed follow-on feasibility studies, termed the Phase II analysis. Technical efforts related to the Phase II Feasibility Studies, the topic of the current study, were initiated during February, 2003; and,
- Implementation of an effective and productive technology transfer program with Egyptian counterparts during both phases of CREATS.

The transport strategy embedded in the Master Plan is designed to concurrently contribute to an efficient economic structure of the region, strengthen linkages with other parts of Egypt as well as neighboring countries, and provide a base for market-oriented transport activity. The components of the Master Plan further diversify beyond the traditional "hardware" concepts associated with infrastructure provision. Additional key elements of the process consist of:

- "software" aspects, that is, available technology, international standards, and multi-modal integration needs (cargo/passenger terminals, transfer points);
- "humanware" needs, or the cultivation of human resources via the designation of training and education programs as well as other requirements for developing expertise; and,
- "sustainability", that is, the notion that the planning process must allow Egyptian stakeholders to participate in visualizing and shaping their own future. This is of substantial importance in terms of ownership building if CREATS is to be adopted and used by the people and their elected officials both during, and following, the conduct of CREATS.

A participatory planning process is one of the most important elements of both CREATS Phases I and II so that the ownership of the plans should be ensured by the Egyptian people.

1.1.2 Priority Projects/Programs Identified in the Master Plan

The CREATS Master Plan proposes a total of 56 projects and programs, as tabulated in Table 1.1.1 to realize the five key strategies to achieve an integrated transport system. The necessary investments or initiatives for the implementation are conceptually allocated into three phases. Priority activities to be rendered in the short-tem are given to those that will initiate the proposed strategies to formulate an integrated transport system as follows:

1. Strengthening of an integrated public transport system featuring MRT, LRT, suburban rail and bus services to improve people's mobility;
2. Economic rationality of the investment;
3. Rehabilitation and revitalization of existing infrastructures;
4. Low-cost solutions with ease of implementation and quick impacts;
5. Essential initiatives to catalyze improvement of efficient, safe and comfortable transport; and

6. Institutional programs required as a prerequisite the implementation of the CREATS Master Plan.

Based on a prioritization process, CREATS identified the highest priority projects for infrastructure (Top 20) and the institutional and humanware programs (Top 10), as shown in Tables 1.1.2 and 1.1.3 respectively. Towards forming the integrated urban transport system, infrastructure projects should be implemented in association with institutional and human-related programs.

Viewing the infrastructure projects, MRT-related projects such as the improvement of MRT Line 1, the extension of MRT Line 2 and the new construction of MRT Line 3, are ranked at the highest places. These have been all committed, therefore, should be executed as scheduled. Metro Line 4, proposed by CREATS, is also at the highest rank, however, it is recommended that this project is commenced soon after the committed MRT projects are accomplished or get started along the right lines.

Other than the MRT projects, three projects are evaluated to be of the highest priority, namely,

- Supertram projects;
- Public bus fleet expansion/modernization project (to proceed hand in hand with commercialization of the CTA); and
- The 6th of October trunk busway project.

These are vital to structure an integrated mass-transit system, therefore, should be initiated at the early phase.

Regarding the institutional and human-based programs, all the programs ranked at the top 10 are equally crucial. Among them, the highest priority is given to the programs for:

- Improvement and restructuring public transport operators;
- Institutional component for "public fleet expansion and modernization", and
- Institutional strengthening for integrated policy.

Although all the programs listed in the top 10 are related to each other, these may be pursued individually. However, in order to make them successful, definite political decision-making for a comprehensive sector reform is needed. This should start with establishment of an organizational structure for integrated policy formulation, in particular, for CTA, as soon as practical.

It is noted again that the CREATS Master Plan has been formulated with a critical prerequisite that all committed projects, including MRT improvement projects, shall be accomplished in schedule, where MRT Line 3 has been given the top priority to implement.

Table 1.1.1 CREATS Proposed Projects/Programs by Strategy

Strategy 1: Improvement of People's Mobility

Proposed Measure and Project/Program	Short	Mid.	Long
Integrated Public Transport			
- Committed Projects	■	■	■
- Hierarchy of Modes	■	■	
- Improvement of Strategic Intermodal Points/Facilities	■	■	■
- Development of "Park and Ride System"	■	■	
- Complementary Routes Structure for PT	■	■	■
- Introduction of an Integrated Ticketing System	■	■	■
Traffic Demand Management			
- Introduction of measures and Policies	■	■	■
- Truck Traffic Control (Generalized Truck Ban)		■	■

Strategy 2: Optimal Infrastructure Development

Rail-based Public Transport			
- Committed Projects	■	■	■
- New Metro Line 4 (Pyramid Line) Development		■	■
- Heliopolis Metro and Tram Upgrading	■	■	
- Super Tram Introduction	■	■	■
- ENR Suburban Line Improvement	■	■	■
- East-West Wing Lines to New Communities		■	■
- Intermodal Facilities Development	■	■	■
Road-based Public Transport			
- Improvement of Public Bus Facilities	■	■	■
- Public Bus Fleet Improvement	■	■	■
- Priority Bus Facility Development	■	■	■
Roads and Highways			
- Committed Projects	■		
- Primary/ Secondary Roads Development	■	■	■
- Grade Separation Works		■	■
- Expressway Network		■	■
Cargo Transport			
- Truck Terminal Development (3 Locations)	■	■	■
- Expansion of Existing Rail and River Terminals	■	■	■
- Sector Restructuring	■	■	■

Strategy 3: Accessible Transport for All

All Citizens			
- Public Transport Route Structure	■	■	■
- Safe and Comfortable Amenities	■	■	
The Poor			
- Social Welfare Policy for Transport	■	■	■
- Targeted Subsidy	■	■	■
- Area-Specific par Transit Operation	■	■	■
Gender-Based			
- Provision of Clean and Safe Bus Service	■	■	■
- Establishment of a "Gender Auditing System"	■	■	■
Handicapped			
- Improvement of Barrier-Free Facilities at Stations	■	■	■

Strategy 4: Safe and Environment-friendly Transport

Proposed Measure and Project/Program	Short	Mid.	Long
Traffic Management			
- Improvement of Intersections/ Signal System	■		
- Policy Zoning System for Parking Management	■		
- Development of Parking Lots	■	■	■
- Improvement of Bus Safety Facilities	■	■	■
- Public Transport Information Dissemination	■	■	■
- Introduction of Traffic Information System	■	■	■
Human Resource Management			
- Establishment of Egyptian Traffic Safety Council	■		
- Traffic Safety Education & Information Program	■	■	■
- Coordinated Enforcement for Drivers' Licenses	■	■	■
Environmental Measures			
- Enhanced Environmental Monitoring System	■	■	■
- Increased Use of CNG and Unleaded Gasoline	■	■	■
- Enforced Transport Regulations & Operations	■	■	■
- Enhanced Vehicle Inspection System	■	■	
- Introduction of Alternative Fuels/ Hybrid Cars	■	■	■
- Environmental Awareness Campaigns	■	■	■

Strategy 5: Institutional and Financial Mechanism

Institutional Arrangement			
- Establishment of CMTB	■	■	■
Sustainable Financial Mechanism			
- Rationalization of Subsidy Policy and Revision of Public Transport Fare Structure	■	■	■
- Introduction of "User Pay System"	■	■	■
- Stepwise Privatization of Bus Public Transport	■	■	■
- Introduction of "Earmarked Taxation"		■	
Justifiable Investment Human Resource			
- Legalization of Public Private Partnership Scheme for Transport Investment	■	■	■
- Facilitation of Public Awareness of "Safety and Environment"	■	■	■
Improvement/ Restructuring of Operators			
- Capacity Building of Operators for "Good Practice"	■	■	■
- Restructuring of CTA	■	■	
- "Area Franchising System" for Shared Taxi	■	■	■
- Establishment of "Suburban Rail Service Corporation" and "Expressway Development Corporation"		■	

Notes:
1) Measures in "blue letters" represent "institutional, organizational and/or human-based program"; while those in black, physical and/or infrastructure projects.
2) The color gradation in phasing blocks stands for a relative magnitude of investment/ activity of the corresponding project/ program, that is, the darker, the more.

Table 1.1.2 Highest Priority Projects for Infrastructure Development (Top 20)

Project and Program	Rank	Points	Begin
MRT Line 1 Improvements	1	18	S
MRT Line 3	2	21	S
MRT Line 4	3	20	L
Public Bus Fleet Modernization	4	48	S/M
MRT Line 2 Extensions	5	51	S
Supertram Line 1	6	57	S
Supertram Line 3	7	74	M/L
West Wing - 6th of October Truck Busway (Phase 1)	8	75	S
Central Cairo Grade Separation Plan Package	9	82	S
East Wing - Railway (Phase 1)	10	86	S/M
Tram/ Heliopolis Metro Rehabilitation	11	93	S/M
East Wing - Railway (Phase 2)	12	93	L
River and Rail Container Terminals	13	98	M
Shobra El Kheima Grade Separation Plan Package	14	100	S
Supertram Line 2	15	113	M/L
West Wing – Railway (Phase 2)	16	114	L
North Cairo Grade Separation Plan Package	17	122	M/L
Giza Grade Separation Plan Package	18	133	S/M
Heliopolis/ Madinet Nasr Grade Separation Plan Package	19	148	M/L
Ring Road (on Maryoteya Road)	20	151	S

Note: ranking contains top twenty projects based on accumulated points achieved via testing and sensitivity analyses. "Begin" refers to initiation of project during short (to year 2007), medium (years 2008 to 2012) or long (after year 2012) terms. Refer in Chapter 11, Volume III, CREATS Master Plan for more precise sectorial scheduling.

Source: JICA Study Team

Table 1.1.3 Highest Priority Programs for Institutional Development (Top 10)

Project and Program	Rank	Points	Begin
Improvement/ Restructuring of Operators	1	39	S
Public Bus Fleet Modernization	2	48	S/M
Institutional Strengthening	3	52	S
Accessible Public Transport for All	4	78	S
Cargo Transport Sector Restructuring	5	90	M
Human Resources Development	6	97	S
Investment Decision Procedures	7	98	S
Targeted Support for the Poor	8	113	S
Traffic Demand Management	9	128	M/L
Traffic Management and Control	10	131	S/M

Note: ranking contains top twenty projects based on accumulated points achieved via testing and sensitivity analyses. "Begin" refers to initiation of project during short (to year 2007), medium (years 2008 to 2012) or long (after year 2012) terms. Refer in Chapter 11, Volume III, CREATS Master Plan for more precise sectorial scheduling.

Source: JICA Study Team

1.1.3 Objectives of Phase II: Feasibility Studies

Phase II efforts build upon the humanware, software and hardware conclusions of CREATS Phase I. That is, five priority projects, jointly selected in consultation with Egyptian specialists and members of the committees associated with CREATS, are subject to more detailed investigations. These five projects are arrayed into two core programs[3]:

Program A: ***Strategic Corridors, Areas Transport Management and Development Program,*** whose key objectives are:

- Conduct feasibility studies to develop public transport systems within the East-West Corridor composed of the East Wing, linking Ain Shams station with 10th of Ramadan City, and the West Wing, linking Giza with 6th of October City;
- Formulate a short-term traffic management and a bus priority plan along the corridor which, within the longer-term CREATS framework, contains the proposed Metro Line 4; and,
- Formulate short-term traffic management and inter-modal facility development plans in Ain Shams (Area 1) and Central Giza (Area 2). These plans are linked with East Wing and West Wing public transport strategies, with investigative foci being Ain Shams station area and the West Wing terminus point, respectively.

Program B: ***Cairo Transport Authority (CTA) Transport Improvement Project in East Sector of Cairo,*** whose principal objectives are:

- Conduct a feasibility study for improvement, upgrading and modernization of the Heliopolis Metro tram system, with a particular focus being Supertram Line 1 as proposed within CREATS;
- Conduct a feasibility study of CTA bus route restructuring for efficient inter-modal operations in the catchment area of Supertram Line 1; that is, those routes most likely to benefit either bus or Supertram operations and patronage in terms of providing enhanced intermodal efficiencies; and,
- Formulate an organizational and institutional reform plan for the CTA.

Both programs (depicted in Figures 1.1.1 and 1.1.2) also include technology transfer to Egyptian counterparts.

[3] Further detail regarding scope of work, Study Team composition and technical framework is contained in *Inception Report (2) - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., March, 2003.

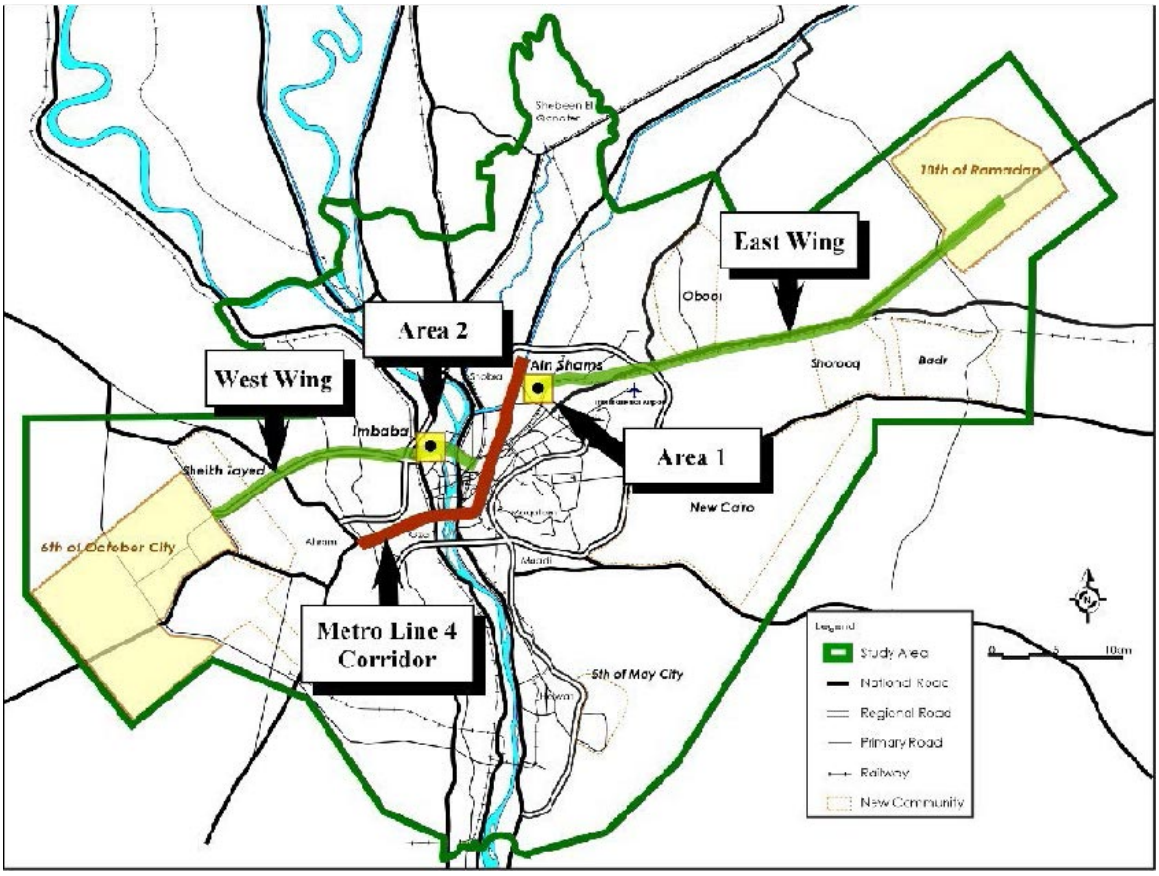


Figure 1.1.1 Program A Project Content

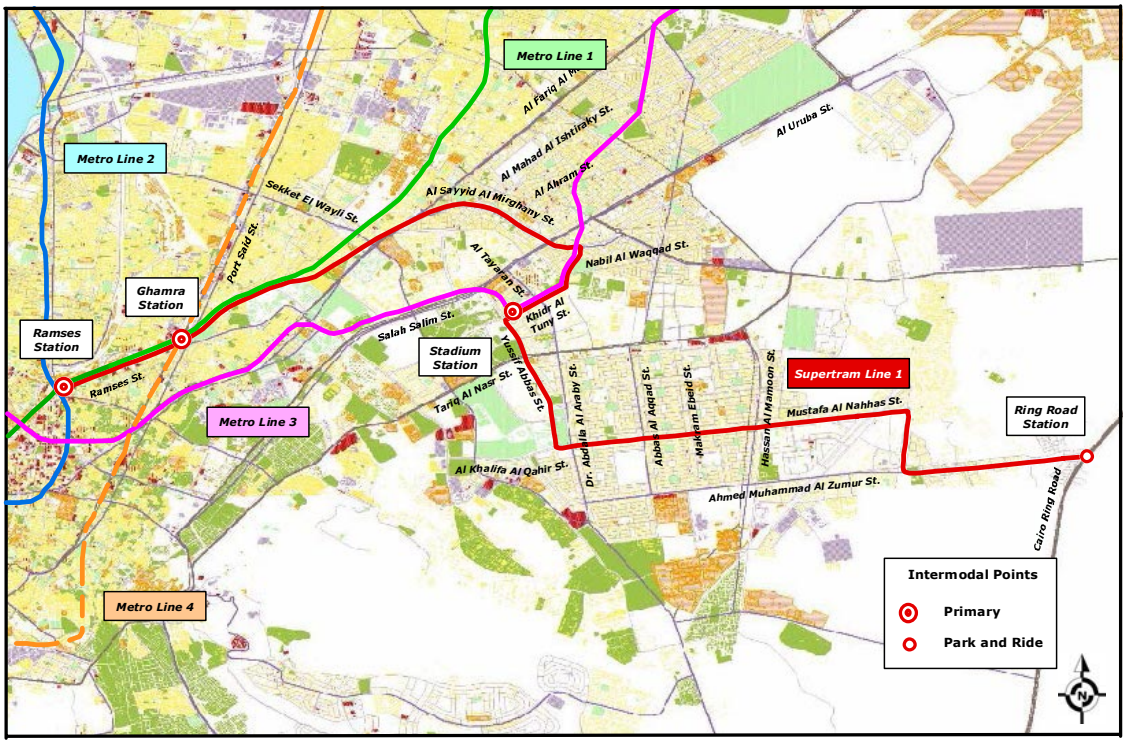


Figure 1.1.2 Program B: Supertram Line 1 in an Intermodal Context

1.2 APPROACH TO THE CONDUCT OF PHASE II

The final structure of CREATS Phases I and II, and the successful reception thereof, can only be achieved as a direct result of cooperative efforts and close liaison between the Study Team and local experts. Considerable efforts have, and are continuing to be, expended in gathering information, reviewing previous studies and holding numerous discussions to enhance knowledge of, and sensitivity to, local transport conditions, norms and practices.

The Study Team, housed in the offices of the Egyptian National Institute of Transport, is being strongly assisted by its designated Steering Committee and Higher Committee, as it was during Phase I. In addition, taking into account the necessity of extensive involvement of a wide variety of relevant authorities for Phase II, two Technical Counterpart Committees were established for respective Programs A and B. This in effect reorganized the Phase I Counterpart Committee. Thus, continuous and productive technical liaison is being maintained with a number of organizations including the Office of the Prime Minister; Ministry of Transport and various entities thereof (Egyptian National Institute of Transport, National Authority for Tunnels, Egypt National Railways, General Authority for Roads, Bridges and Land Transport, General Authority for Civil Aviation, Cairo Metro Organization, Transport Planning Authority); the Ministry of Housing, Utilities and Urban Communities; Ministry of Planning; State Ministry of Foreign Affairs, Sector of International Cooperation; Ministry for Environment Affairs; CAPMAS (Central Agency for Public Mobilization and Statistics); Ministry of Justice; as well as Cairo, Giza and Qalyobeya Governorates and various entities thereof (General Secretaries Offices, Cairo Transport Authority, Traffic Police Departments, Road and Transport Directorates, Traffic Engineering Bureaus). Close coordination has also been effected with Universities (University of Cairo, Ain Shams University, Azhar University) and various departments within those learned institutions.

Likewise, on-going and effective consultations are being carried out with various international agencies, funding institutions, donors, and consultant groups in order to obtain an overview of previous, current, and likely future activities and/or involvement in Egypt.

Wide-spread information dissemination methodologies are being employed in the study process. These include exchanges of information via periodic focused presentation and discussion programs with study committees and members thereof; conduct of public workshops with a primarily technical orientation with timing roughly in accordance with submission of intermediate milestone reports; conduct of public seminars with a primarily strategic focus with timing roughly in accordance with submission of draft versions of Phases I and II final reports; and, submittal of monthly progress reports to the committees associated with the study. Furthermore, focused pamphlets, press releases and similar task-specific items are prepared in association with conduct of data collection surveys.

1.3 REPORTING METHODOLOGY

A rigorous and systematic reporting approach has been adopted for CREATS.

1.3.1 Phase I: The Transport Master Plan

The Phase I reporting structure adopted by the Study Team incorporates both core reports (contractual obligations specified in the *Inception Report*), and, on an as-needed basis, a series of a supplementary technical reports. Each report is an independent and self-contained document. While a synopsis of the most relevant findings is transferred between reports, the interested reader is urged to consult the specific report in question for desired detailed information. Core reports issued in the Phase I process were:

- *Inception Report*, submitted during April, 2001, contains, as noted previously, detail regarding study methodologies, staffing plan and programmed study outputs. This document was finalized in close cooperation with JICA, committees associated with the study and other local experts.
- *Progress Report (1)*[4], submitted during July, 2001, details approaches and methodologies to be employed during the conduct of surveys. These include a home interview survey, cordon line survey; screen line survey; traffic count survey; interview survey for public transport passengers; travel speed survey; road condition survey; transport networks survey; parking survey; cargo transport survey; and, environmental survey.
- *Progress Report (2)*[5], submitted during May, 2002, quantifies and clarifies study progress to near conclusion of data collection and survey programs. The content of *Progress Report (2)* amplifies, as necessary, technical techniques and methodologies; quantifies findings as to existing conditions, documents results of surveys and highlights early opportunities as well as constraints.
- *Phase I Final Report,* submitted during November, 2002, documents the Master Plan and details sector plans. *The Final Report* consists of four separate volumes:
  - *Volume I: Executive Summary*, contains highlights of recommended strategies, projects and programs;
  - *Volume II: Urban Transport Policy and Strategy,* summarizes the essence of the transport master plan and those policies upon which core plan elements of hardware (infrastructure), software (technology and institution) and humanware (human aspect) rest;

[4] *Progress Report (1) - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., July, 2001.

[5] *Progress Report (2) - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, *Volume I (Current Urban Transport Status) and Volume II (Results of Transport and Traffic Surveys)*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., May, 2002

- *Volume III: Transport Master Plan* presents detailed sector-specific technical analyses and procedural approaches used in the derivation of the Master Plan and its essential elements; and,
- *Volume IV: CREATS Urban Transport Database*, contains the extensive numeric database collected and generated as part of CREATS technical procedures, as well as explanatory documentation regarding its content.

In addition to core reports, the Study Team has, on an as-needed basis, published a series of:

- *Technical Reports*[6], which summarize key technical issues, or milestone events, which are seen as being of particular relevance and which may be of interest to project participants outside of guidelines imposed by the *Inception, Progress* and *Final Reports*.

1.3.2 Phase II: Feasibility Studies

Three core reports are published during Phase II. These are:

- *Inception Report (2)*, submitted during March 2003, contains, as noted previously, detail regarding study methodologies, staffing plan and programmed study outputs. This document was finalized in close cooperation with JICA, committees associated with the study and other local experts.
- *Progress Report (3)*[7] quantifies and clarifies study progress to approximately May/June, 2003. Methodologies, findings, analyses and preliminary conclusions appropriate to that time frame are presented. It is emphasized that the intent of this report is as the name implies; a statement of progress at a particular point in time. The ultimate disposition of any topic addressed in *Progress Report (3)* is presented in the *Phase II Final Report*.
- *Phase II Final Report* which documents findings of the *Phase II Feasibility Studies* and provides detail for the two programs, and projects therein, in terms of approaches and methodologies; investigative efforts; evaluation of alternative solutions; conduct of economic, financial and environmental investigations; and, formulation of implementation strategies[8]. *The Final Report* consists of four separate volumes:

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[6] Refer *Technical Report (1)*, July 2001; *Technical Report (2): Framework of the Transport Model*, January, 2002; *Technical Report (3): Urban Public Transport Perspectives*, May, 2002; and, *Technical Report (4): Traffic Safety and Environmental Programs*, September, 2002; all under *Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al.

[7] *Progress Report (3) - Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., June, 2003.

[8] The draft version of the *Phase II Final Report* was submitted during October, 2003. Following receipt and incorporation of comments from the Egyptian and Japanese sides, the final version of the *Phase II Final Report* was submitted during early 2004 via the diplomatic channel.

- *Volume I: Summary*, containing highlights of recommended strategies for the projects and programs contained within Program A and Program B;
- *Volume II: Program A Feasibility Studies,* **the current report,** detailing feasibility studies for those projects contained within the Program A framework; that is, the East Wing, the West Wing, Ain Shams and Giza areas intermodal analyses, as well as transportation system management in the Metro Line 4 corridor;
- *Volume III: Program B Feasibility Studies,* detailing feasibility studies for those projects contained within the Program B framework.; that is, detailing of Supertram Line 1, public transport improvements in the East Sector of Cairo and an organizational restructuring program for the CTA; and,
- *Volume IV: Technical Appendix*, containing four separate attachments featuring elements common to both Volumes II and III. These describe three aspects: the nature of the CREATS transport model and its refinement during Phase II (Chapter 1); intermodal theory and background (Chapter 2); and, a discussion of potential financing mechanisms within the Egyptian context (Chapter 3).

The Study Team also continued its Phase I approach to issuing *Technical Reports*[9], which summarize key technical issues, or milestone events, seen as being of particular relevance and which may be of interest to project participants outside of guidelines imposed by the *Inception, Progress* and *Final Reports*.

1.4 STRUCTURE OF THIS VOLUME II OF THE FINAL REPORT

The structure of the *Phase II Final Report* is consistent with essential formats and tenets voiced in *Inception Report (2)*, as well as guidance received from the studies committees. This Volume II of the *Phase II Final Report* consists of three chapters, in addition to this *Introduction*, which describe Program A techniques, methodologies, findings and conclusions:

- *Chapter 2: Feasibility Study of the East Wing and Traffic Management Program at Ain Shams (Area 1)* defines results of planning work and feasibility study of the East Wing public transport development and area development program in Ain Shams as a terminus of the East Wing.
- *Chapter 3: Feasibility Study of the West Wing and Traffic Management Program at Central Giza (Area 2)* defines results of planning work and feasibility study of the West Wing public transport development and area development program in Central Giza as a terminus of the West Wing.
- *Chapter 4: Traffic Management Program along Metro 4 Corridor* focuses on low cost traffic management solution with rapid implementation potential for

[9] *Technical Report (5): CREATS Transport Model User Manual*, under *Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Higher Committee for Greater Cairo Transportation Planning, by Pacific Consultants International, et. al., July 2003.

Metro 4 Corridor as the most heavily utilized transport corridor in the metropolitan area.

The Study Team, and members of the committees associated with CREATS, stand ready to discuss technical content of this report in additional detail at any mutually convenient time.

CHAPTER 2

FEASIBILITY STUDY OF THE EAST WING AND TRAFFIC MANAGEMENT PROGRAM AT AIN SHAMS (AREA 1)

CHAPTER 2: FEASIBILITY STUDY OF THE EAST WING AND TRAFFIC MANAGEMENT PROGRAM AT AIN SHAMS (AREA1)

2.1 INTRODUCTION

2.1.1 Objectives

The objectives of the feasibility study of the Component A-1: Feasibility Study of the East Wing and Traffic Management Program at Ain Shams (Area 1) are:

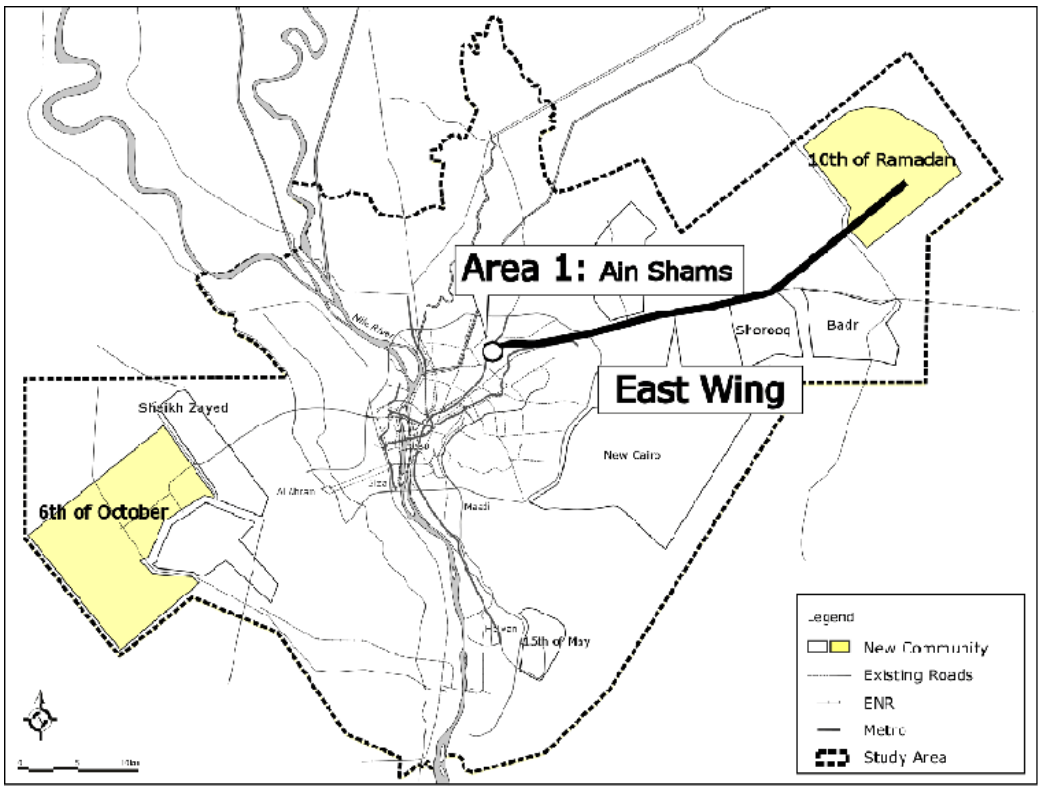
- To conduct a feasibility study to develop public transport system within the East Wing Corridor, linking central Cairo with 10th of Ramadan City, and
- To formulate short-term traffic management and inter-modal facility development plans in Ain Shams (Area 1), which are linked with the East Wing public transport strategies.

2.1.2 Study Area

The study area of Program A-1, which is the Feasibility Study of the East Wing public transport development and Traffic Management Program at Ain Shams (Area 1), is defined as the East Wing corridor between Ain Shams and 10th of Ramadan City as shown in Figure 2.1.1.

The Feasibility Study focuses on the East Wing corridor area, however, since the Project will affect the entire transport pattern in the Greater Cairo Region, this study shall consider a change in travel activities, covering the Greater Cairo Region as a whole. This insight is employed for an analysis of the economic and financial benefits in particular.

Therefore, the Study area is the same as the CREATS Master Plan, although planning work regarding the public transport system is focused mainly between Ain Shams and 10th of Ramadan City, along the East Wing.



Source: JICA Study Team

Figure 2.1.1 Study Area

2.1.3 Contents of the Chapter

In this chapter, the Study Team described the results of planning work and the feasibility study of the East Wing public transport development.

In the first place, the existing and future socio-economic situation of the East Wing corridor is examined. The current and future population distribution along the corridor is reviewed in reference to the CREATS Master Plan.

Next, current transport network and services along the corridor are studied. Major roads, road based transport services and ENR railway service are examined.

Based on the examination of the socio-economic situation and the stages of public transport development along the corridor, possible development options to meet the objectives of the study are investigated. Initial engineering studies are carried out for the possible option. The future transport demand forecast from the Master Plan was utilized at this stage.

One option among the possible options is selected based on a screening procedure, which evaluated the options in terms of qualitative and quantitative aspects, including an economic analysis.

An engineering study follows for the selected option for the East Wing public transport development. A detailed future transport demand forecast, specifically conducted for the East Wing corridor, is a base for the engineering study.

The evaluation of the development plan of the selected option considers environmental, economic and financial aspects as the next step.

The necessary measures to realize the option are very carefully researched, including funding sources, appropriate organizational and institutional frameworks, and a mechanism to secure the sustainable operation of the selected option.

Finally, recommendations, by taking due consideration of all aspects examined, are presented by the CREATS Study Team for the development of the selected option.

In addition to the recommendations, the Study Team analyzed an extra case, which is a combination of railway and busway option, which was proposed by the Egyptian Steering Committee of the Study.

2.2 EXISTING SITUATION OF THE EAST WING CORRIDOR AND AIN SHAMS

2.2.1 East Wing Corridor

(1) Existing and Future Socio-economic Situation

The existing and future socio-economic situation, given in the Master Plan Study, and the existing situation of new communities in the Study Area was examined in detail. The Study Team members visited concerned authorities, as well as offices of the new communities, to collect proper information of the communities.

In the Master Plan, population of the Study Area and the New Communities were projected based on possible future economic growth scenario, because the economic growth was considered as a key factor for new community development. Resulting future population estimates are given in Table 2.2.1 (refer to Section 2.4.3, *Chapter 2: URBANIZATION STRUCTURE AND SOCIO-ECONOMIC FRAMEWORK*, Volume III, Transportation Master Plan and Feasibility Study of Urban Transport Projects in the Greater Cairo Region in the Arab Republic of Egypt, Phase I Final Report, November 2002 by JICA).

According to the Master Plan, the total population of the new communities, including 10th of Ramadan, Oboor, Shorooq and Badr, along the East Wing will grow from 288,000 in 2001 to 1,376,000 in 2022, as shown in Table 2.2.1 and Figure 2.2.1. Of those, the 10th of Ramadan City is the biggest new community along the corridor. In this city, employment at the work place was estimated to increase from 155,000 to 322,000, the number of students with education places was also estimated to increase from 62,000 to 132,000, in 2001 and 2022

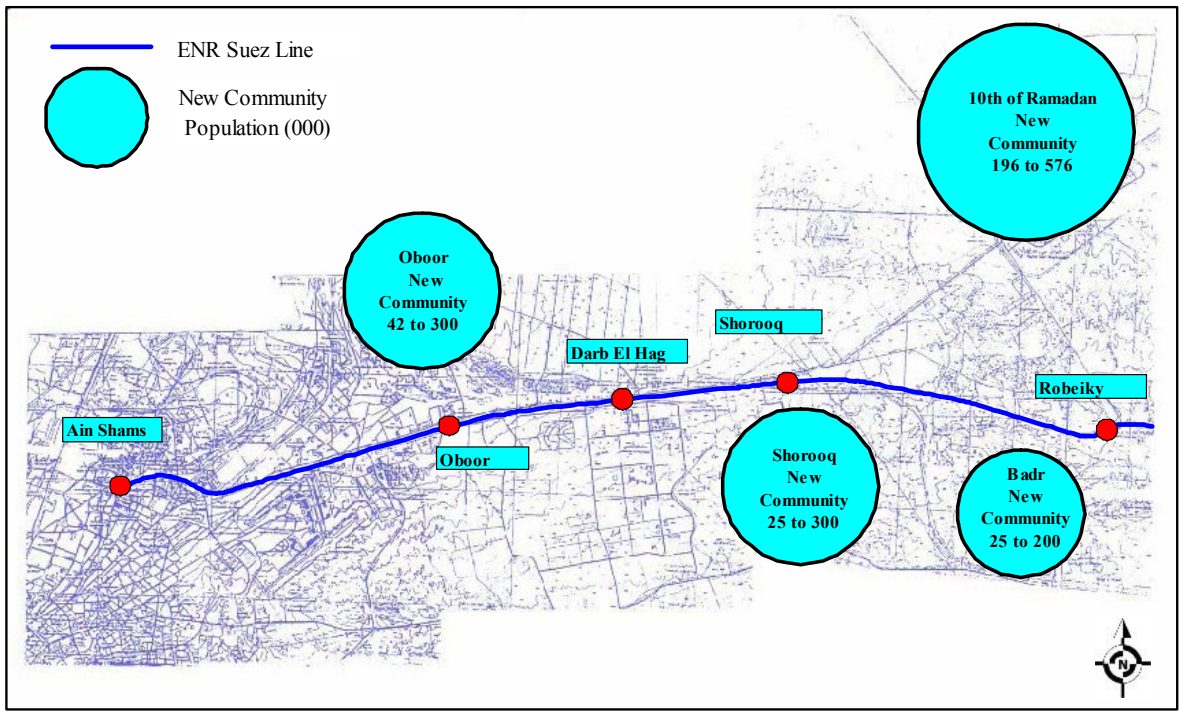
respectively. Therefore, it can be said that the current and future population growth potential along the East Wing is very strong. In addition to this, continuous urban cores, which lie along the corridor, also are characteristics of the East Wing. These characteristics, generally speaking, meet a need for mass transit system development.

Table 2.2.1 Population Distribution of New Communities

(Unit: thousand)

	2001	2007	2012	2022
New Communities in the East Wing Corridor	**288**	**416**	**685**	**1,376**
Oboor	42	50	112	300
Shorouq	25	50	112	300
Badr	25	38	88	200
10th Ramadan	196	278	373	576
New Communities in the West Wing Corridor	**200**	**332**	**513**	**1,165**
6th October	200	302	426	865
Sheik Zayed		30	87	300
New Cairo	**120**	**165**	**272**	**699**
Total of New Communities	**488**	**914**	**1,469**	**3,241**
Rest of the Study Area:	13,904	15,184	16,180	17,480
The Study Area	**14,392**	**16,098**	**17,649**	**20,721**

Source: JICA study team, based on the GOPP data.



Source: JICA Study Team

Figure 2.2.1 Population of New Communities along East Wing (2001 to 2022)

(2) Transport Demand

Person trips related to the 10th of Ramadan City Sector, which are the number of trips made by residents of the City as well as visitors to the City in 2001 were estimated at 329,532 per day including both intra-zonal and inter-zonal trips, based on the Home Interview Survey, which was conducted for the Master Plan. These person trips are estimated to increase to 973,587 in 2022, or about 3 times as many as those in 2001 (refer to Table 2.2.2).

Figure 2.2.2 shows major trip destinations/origins in terms of the CREATS 18 sector divisions (refer to Figure 2.3.1, Transportation Master Plan and Feasibility Study of Urban Transport Projects in the Greater Cairo Region in the Arab Republic of Egypt, PHASE I Final Report, Volume III, November 2002). It is apparent that the eastern sectors of the Study area have strong relationships with the 10th of Ramadan City sector. Of those, the Nasr city sector was the biggest sector in terms of trip-relations with 38,000 trips per day, followed by the Salam city sector with 32,000 trips per day in 2001.

In 2022, the CREATS model has forecasted that the Nasr city sector will be the biggest, as it was in 2001, with 196,000 trips per day, followed by aggregated sectors of the CBD area with 61,000 trips per day and the Masr El Gadeeda sector with 47,000 trips per day. The CBD sectors include the Khaleefa, CBD and Shobra sectors.

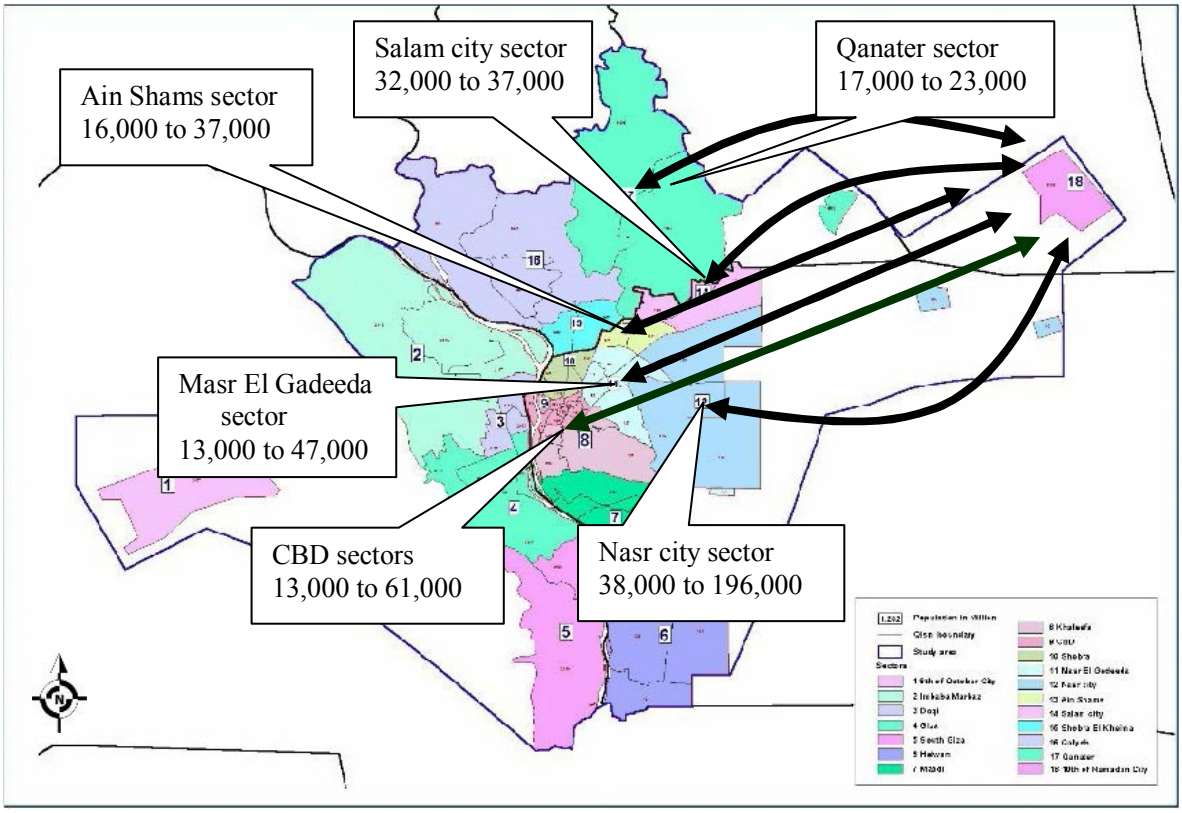
Thus, the forecast results showed that although the Nasr city sector would be the biggest origin/destination for 10th of Ramadan City, the distant CBD area would also have close connections with the City in the future. This implies that transport demand would become bigger and that travel distances would become longer in 2022.

Table 2.2.2 Forecast Person Trips and Population of the 10th of Ramadan City Sector

	2001	2022
Intra-zonal trips	165,026	468,932
Inter-zonal trips	164,506	504,655
Total trips	329532	973,587
Population	196,085	576,225

Source: JICA Study Team

Notes: The numbers of trips in 2001 are based on the Home Interview Survey for the CREATS Mater Plan, and those in 2022 are the results of the future demand analysis using the CREAS Model.



Source: JICA Study Team

Figure 2.2.2 Changes in Numbers of Person Trips from 2001 to 2022

The future transport demand for the East Wing public transport mode was estimated in the Master Plan to be 430,000 passengers per day, and it was projected that passengers at the maximum congested section during peak hours in 2022 will account for 15,300 passengers per hour per direction, which represents a sectional traffic volume of the public transport mode. It should be noted that this traffic demand in terms of the number of passengers is different from person trips which are shown in Table 2.2.2 and Figure 2.2.2.

Such an intensity of this traffic volume of 15,300 passengers per hour per direction implies some optimal public transport modes to be introduced in the East Wing corridor in the long-term. A high capacity transport mode such as railway will be needed over the two decades, in 2022.

From a standpoint of demand-responsive solutions, however, the railway system might not necessarily be justifiable from a short-term perspective. An exclusive busway system with two-lanes may provide a transport capacity of more or less 10,000 passengers per hour per direction (refer to details in Section 3.3, Chapter 3 in this volume). Thus, a busway system may be suitable for the short-term solution. The Team elaborates this aspect in the screening process, covering almost all conceivable options, including a busway option, which is explained in Section 2.5 Planning and Selection of Options.

The Study Team viewed several options for the rational solution, using the existing assets in both short- and long-term perspectives, and these options are

evaluated from the economic justification point of view. It can be said that even though buswasy will be introduced in the early years of the planning horizon, a railway system needs to be considered to cope with the high volume of the future demand.

(3) Travel Characteristics of Residents in New Communities

The Stated Preference Survey (SPS), which aims to collect information for a disaggregate modal choice analysis, was conducted as one of many surveys in the Master Plan (refer to Chapter 2: Household Interview Survey, Progress Report (2): Volume II of CREATS). The survey was conducted by using a home interview survey method for residents at the new communities of Cairo by asking mainly about trip activities to Cairo CBD. The survey results were utilized for the model analyses in the Master Plan. However, the results showed the interesting trip characteristics of the residents to Cairo CBD.

The characteristics of the interviewed residents can be summarized by stating that males are dominant i.e. more than 80 %, that car ownership is as low as approximately 17 %, and that the income of almost 60 % of interviewees is LE500 or less. The number of samples in the survey was 1,375.

Table 2.2.3 shows some interesting results of the survey as summarized below:

- Only 30% of the interviewees do not make trips to Cairo in a week. Most residents visit Cairo at least once per week.
- More than 80% of the interviewees use public transport. Most residents have no choice of transport modes but must use public transport to go to Cairo CBD.
- More than 60% of car users would use public transport if the service was improved. If public transport was improved then this would have the effect of reducing car trips to Cairo.
- Looking into trip purposes of going to Cairo CBD, social trips have a share of about one third of the total trips per day.

Social trips are very important, as well as work trips for residents. Visiting friends and relatives and/or participating in activities in Cairo CBD are indispensable human activities for the residents of the new communities.

These survey results indicate that public transport development along the East Wing is indispensable and urgent to improve “quality of life” for the residents in the new communities. This also means that transport development is indispensable to Cairo residents who have opportunities for visiting the new communities.

Table 2.2.3 Some Results of SPS from the Master Plan

How many times regular trips do you make to Cairo per week?

	Frequency	%	Valid %
0	422	30.7	30.7
1	316	23.0	23.0
2	118	8.6	8.6
3	84	6.1	6.1
4	47	3.4	3.4
5	75	5.5	5.5
6	263	19.1	19.1
7	43	3.1	3.1
8	1	0.1	0.1
12	2	0.1	0.1
14	2	0.1	0.1
15	2	0.1	0.1
Total	1375	100.0	100.0
No answer	0	0.0	-
Grand Total	1375	100.0	-

Would you use public tranport if service were to be impro
(Car Users)

	Frequency	%	Valid %
0		0.0	0.0
1. Never	14	14.9	15.4
2. Highly unlikely	8	8.5	8.8
3. Unlikely	12	12.8	13.2
4. Likely	57	60.6	62.6
Total	91	96.8	100.0
No answer	3	3.2	-
Grand Total	94	100.0	-

Transport mode to Cairo?

	Frequency	%	Valid %
1. Private Car	94	6.8	9.9
2. Public transport	792	57.6	83.1
3. Other	67	4.9	7.0
9. No trips to Cairo	422	30.7	-
Total	1375	100.0	100.0
No answer	0	0.0	-
Grand Total	1375	100.0	-

Trip purpose

	Frequency	%	Valid %
1. Work	320	23.3	33.6
2. Education	128	9.3	13.4
3. Home	11	0.8	1.2
4. Selling/delivering	1	0.1	0.1
5. Meeting/Buiness	37	2.7	3.9
6. Return work place	0	0.0	0.0
7. Shopping/eating	70	5.1	7.3
8. Sending/fetching	2	0.1	0.2
9. Recreation	27	2.0	2.8
10. Medical	11	0.8	1.2
11. Social	323	23.5	33.9
12. Other	23	1.7	2.4
Total	953	69.3	100.0
No answer	422	30.7	-
Grand Total	1375	100.0	-

Source: "2.3 Stated Preference Survey (SPS)", Progress Report (2) Vol. II: Results of Transport and Traffic Surveys, CREATS

The characteristics of the East Wing corridor can be summarized as below in terms of socio-economic and transport demand aspects;

- Large scale new communities locate continuously along the corridor;
- A considerable volume of public transport passenger demands will be emerging along with the growth of new communities in the corridor;
- Trips to Cairo CBD area constitute basic needs for the residents in the new communities;
- 70% of the interviewed new communities' residents travel to Cairo CBD at least once a week, and the average frequency of those residents is 3.5 times a week. Thus, transport relationship between CBD and New Communities is/will be strong through commuting and social activities, although the new communities have been planned to be self-sustainable; and
- Eighty percent of the interviewed new community residents travel to Cairo CBD by public transport modes.

Thus, the result of the Stated Preference Survey (SPS) provides several planning implications on the public transport service to be introduced for the East Wing corridor. Main objective of the Project must be to provide a more comfortable, reliable and modernized transport system for residents in new communities within the economically justifiable investment. Given such a new system, more than 60% of private car users in the new communities would use or diverted to the public transport system, according to the result of SPS.

2.2.2 Ain Shams Area

(1) Land Use

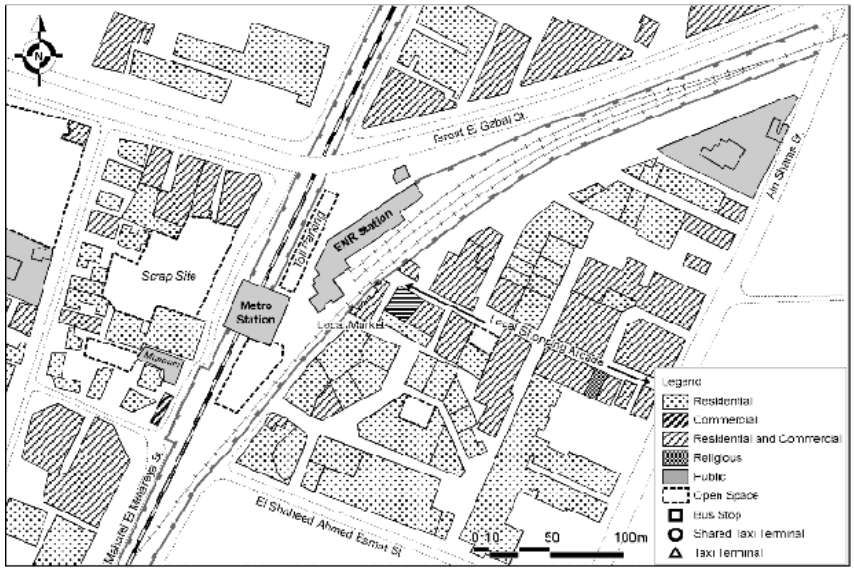
The Ain Shams Station area is designated as Area 1 of Component A-1 for the area traffic management program, which is expected to be one of the most important stations of the East Wing in future. The surrounding area of Ain Shams Station will attract a large number of passengers after completion of the East Wing public transport development. The station is located 10 km to the northwest of Cairo CBD. The station is situated in the center of a high-density residential area. Population within a 800m radius area of the station was 455,000 and its population density was about 2,300 person/ha in 2001. The estimated population is 584,000, in 2022, according to the Master Plan.

The current land use pattern around Ain Shams Station is shown in Figures 2.2.3 and 2.2.4. The major characteristics of land use patterns are residential and combined residential/commercial use, such as grocery stores and other shopping stores. A bus stop, a taxi terminal and a shared taxi terminal are in dispersed locations due to the lack of an integrated transport terminal.

The western part of the station area is a high-density residential area. Most residences are within mid-rise residential buildings. However, high-rise residential buildings have been constructed in recent years due to a moderation of building coverage regulations. There is a local market on the east side of ENR Ain Shams Station and a local shopping arcade along a road from the market to Ain Shams Street. An informal transfer terminal exists with illegally converted shared taxis on many alleyways in this area.

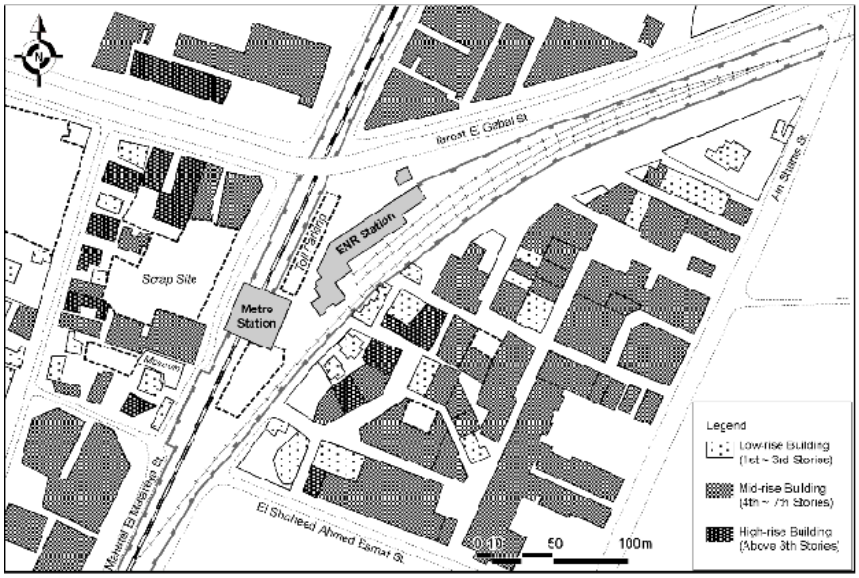
The eastern part of the area is also a residential area with mid to high-rise residential buildings. An inefficient land use pattern is observed in this area, as there are vacant lands only used for scrap sites and an old derelict building is located near to the station. Meanwhile, Mahatel El Matareya Street, which is located in front of the metro station, is always crowded with waiting taxis and through traffic, as well as various kiosks.

The northern part of the station is a narrow area surrounded by Metro Line 1, the ENR railway and a flyover at Tareat El Gabal Street. In this narrow area, there is one bus stop serving passengers to/from Ramses station under the flyover, as well as a toll parking area for private cars between Metro Line 1 station and ENR station.



Source: JICA Study Team

Figure 2.2.3 Land Use Pattern in the Vicinity of Ain Shams Station



Source: JICA Study Team

Figure 2.2.4. Distribution of Building Heights in the Vicinity of Ain Shams Station

(2) Traffic Management

1) Traffic Management Facilities

Currently, the number of signalized intersections is insufficient in the station area of Ain Shams. It is important that modern signal lights at intersections should be installed in order to control both motor vehicles and pedestrian traffic. In addition, traffic safety facilities such as pedestrian bridges and pedestrian crossings with signal lights are also insufficient in terms of numbers. Existing traffic congestion is caused by inadequate road capacity, including a lack of a well-developed traffic management plan. An appropriate and systematic traffic

management plan is essential for safe and smooth traffic flow for the increasing vehicle traffic on the roads.

2) Current Traffic Condition

A vehicle traffic count survey, a pedestrian traffic survey and an on-street parking survey were conducted to obtain information on intermodal facility planning for the East Wing. Methodologies for the traffic surveys are described in Chapter 4 Component A-3: Traffic Management Program Along Metro 4 Corridor. The vehicle traffic counts survey, for 3 types of vehicles, and the pedestrian traffic survey during peak periods were carried out at Ain Shams Station intersection. The on-street parking survey was conducted at a section between Ain Shams St.–Abdel Aziz Gomaa St. on Fayrooz St. The current traffic condition, based on the results of the traffic surveys, is described below:

a. Vehicle Traffic Counts Survey

Table 2.2.4 shows that the two-way hourly traffic volumes at the Ain Shams Station intersection are in a range of 444 and 2,911 in terms of passenger car units (PCU). The highest volume of 2,911 was observed at the southern section of the Ain Shams St.

Table 2.2.4 Traffic Volume at the East Wing

Location	Street	Section	Maximum Two-Direction Hourly Traffic Volume (PCU*)
Ain Shams Station	Ain Shams St.	Northern	1,920
		Southern	2,911
	El Mashroaa St.	Western	2,063
		Eastern	444

Source: JICA Study Team

*Note: * PCU (Passenger Car Unit) is as follows: The types of vehicles for the counting are classified into 3 types: 1) Buses/trucks: Large buses (Public buses, Private buses), Large trucks (3 Axles truck, Heavy truck), Big military: PCU at 2.5. 2) Shared taxies (urban and intercity): PCU at 1.7. 3) Others: Passenger cars and Taxi (urban taxi and intercity taxi), Minibuses, Small trucks (Light commodity vehicle, 2 Axles truck), others (small military, small police, ambulance and etc.): PCU at 1.0.*

b. Pedestrian Traffic Survey

Table 2.2.5 shows both-direction hourly pedestrian volumes, which cross Ain Shams Station intersection. Pedestrian traffic volume crossing the intersection at the Ain Shams St. was in a range of 199 and 1,105 pedestrians. The highest volume was observed on El Mashroaa St., to the west of Ain Shams St. intersection.

Table 2.2.5 Pedestrian Traffic Volume at the East Wing

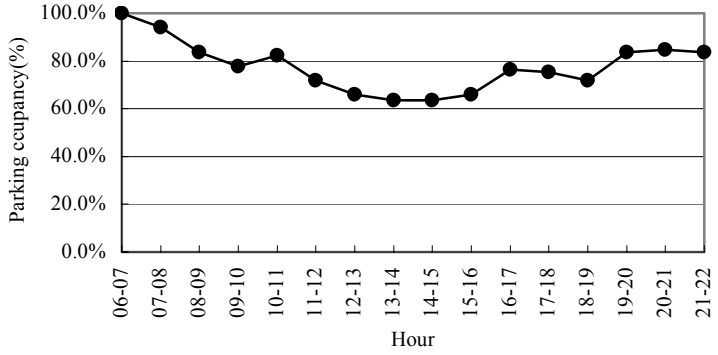
Location	Street	Section	Maximum Two-Direction Hourly Pedestrian Traffic Volume (Pax.)
Ain Shams Station	Ain Shams St.	Northern	222
		Southern	199
	El Mashroaa St.	Western	1,105
		Eastern	786

Source: JICA Study Team

c. On-street Parking Survey

Parking Occupancy

Figure 2.2.5 shows the ratio of on-street parked vehicles against legally allowed on-street parking capacity (referred to as parking occupancy) on Fayrooz St., at the Ain Shams intermodal point. Parking occupancy fluctuates between 60% and 100%. This indicates that the lowest occupancy rate is observed during business hours.

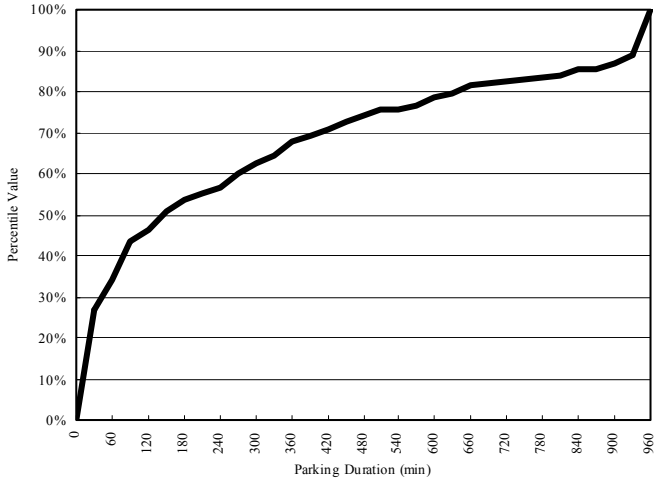


Source: JICA Study Team

Figure 2.2.5 Fluctuation of Hourly On-Street Parking Occupancy

Parking Duration

Parking duration at a section of Ain Shams St.-Abdel Aziz Gomaa St. on Fayrooz St. is shown in Figure 2.2.6 and Table 2.2.6. Average parking duration time was 5.32 hours according to the survey. It also appeared that 34.0% of all on-street parking cars parked for less than 1 hour, 12.4% for 1-2 hours, 7.2% for 2-3 hours, and 46.4% parked for more than 3 hours. Cars parking for longer durations of more than 8 hours was 24.2 %.



Source: JICA Study Team

Figure 2.2.6 Cumulative Parking Duration Distribution

Table 2.2.6 Share of Parked Vehicles by Parking Duration

Parking Duration	Less than 0.5 Hr	Less than 1.0 Hr	Less than 1.5 Hrs	Less than 2.0 Hrs	Less than 2.5 Hrs	Less than 3.0 Hrs	Less than 3.5 Hrs	Less than 4.0 Hrs	Less than 4.5 Hrs	Less than 5.0 Hrs	More than 5.0Hrs
Share of Parked Vehicles (%)	26.94	7.25	9.33	3.11	4.15	3.11	1.55	1.55	3.11	2.07	37.82

Source: JICA Study Team

Turnover Rate

Table 2.2.7 shows an average parking turnover rate of cars on Fayrooz St. The turnover rate was as low as 2.28 times at the section between Ain Shams St.-Abdel Aziz Gomaa St.

Table 2.2.7 On-Street Parking Duration at the East Wing

East Wing : Fayrooz St.	Parked Vehicles* (Vehicles)	Parking Capacity (PCU)	Ave. Parking Duration (hour)	Ave. Parking Turn-over Rate
Ain Shams St.-Abdel Aziz Gomaa St.	194	85	5.32	2.28

Source: JICA Study Team

Note: The survey period for parked vehicles is during 16 hours from 6:00 to 22:00 hrs.*

2.3 EXISTING TRANSPORT SERVICE

2.3.1 Road and Bus Services

The existing road along the East Wing is represented by the Ismailia Desert Road. It connects all the new communities along the corridor except for the Badr City. Major road link to Badr e.g. the Suez Desert Road.

Shared taxi is a major road based public transport service connecting Cairo and the new communities along the corridor. According to an interview survey at a central shared taxi terminal in the 10th of Ramadan city, the travel time to Cairo is 1 hour with a fare of LE3.00.

Although no CTA bus service is provided between 10th of Ramadan and Cairo CBD area at present, a private bus company (East Delta Bus) operates between the Ramses area and the city. The service starts at 6 a.m. and ends at 10 p.m. at the city terminal (10th of Ramadan). The headway of the service is every 20 minutes. Travel time to Cairo is 1 hour and 30 minutes with a fare of LE3.00 and LE2.50 for air-conditioned and normal bus services, respectively.

2.3.2 Egyptian National Railway (ENR) Services

(1) Current Railway Passengers

According to recent ENR information, the average number of passengers per day by station along the East Wing is 3,500, 1,725, 1,850, 825 and 500 at Ain Shams, Oboor, Darb El Hag, Shorooq and Robeiky stations, respectively. Fare levels from Ain Shams are 40 pt to Darb El Hag, 50 pt to Shorooq and 60 pt to Robeiky stations in the case of the Class III coach.

(2) ENR Suburban Railway Service

ENR operates 7 suburban railway lines in the Greater Cairo Region as shown in Table 2.3.1.

The Suez line, which closely relates with this study because it connects Ain Shams and Robeiky station along the East Wing, is Line 5 in the table. This railway section is illustrated in Figure 2.3.1.

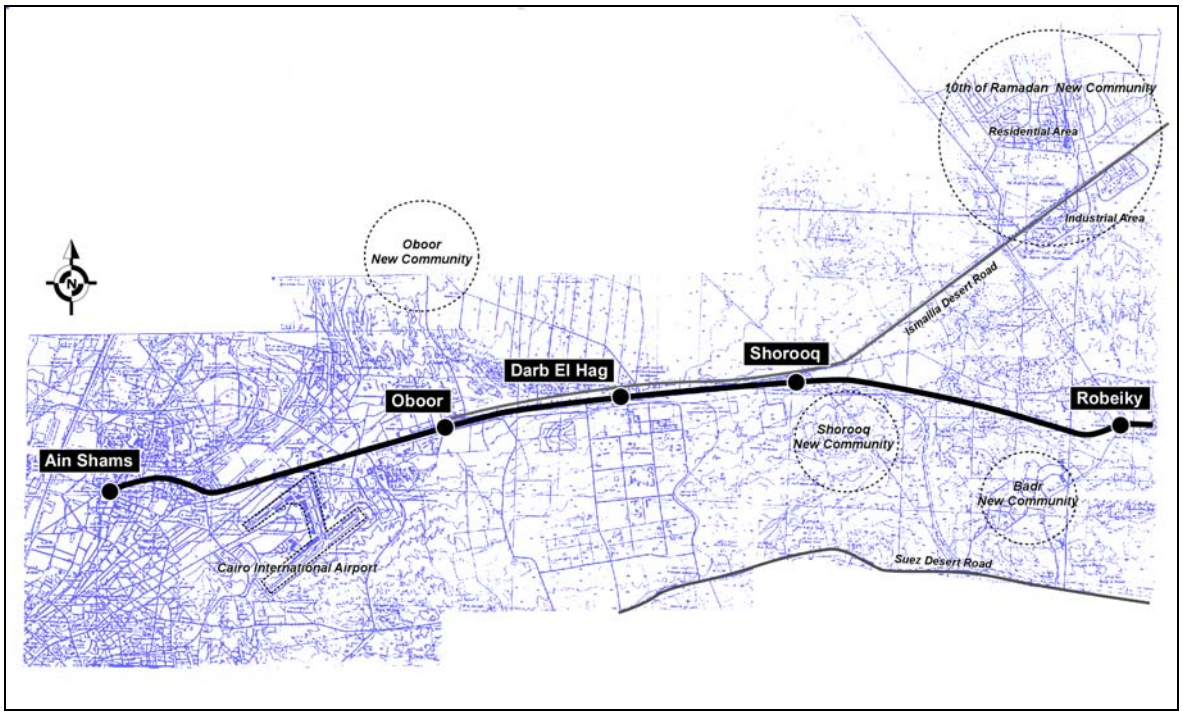
The Ain Shams and Robeiky section of the Suez line is single track with a distance of 45 km, while the total length of the Suez line is 127 km. The first section of the Suez line was constructed in 1935. The design speed of the line is 90 km/h except in the station yards, where train speed is limited to less than 20 km/h.

Table 2.3.1 Current ENR Suburban Railway Service

Number of Line		Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7
1. Power Supply System								
	Acor DC and Voltage	-	-	-	-	-	-	-
	Diesel engine	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
2. Operation System								
	Ordinary train	Ordinary	Ordinary	Ordinary	Ordinary	Ordinary	Ordinary	Ordinary
	Ordinary express train	Ordi. Exp.	Ordi. Exp.	Ordi. Exp.		Ordi. Exp.	Ordi. Exp.	Ordi. Exp.
	Express train	-	-	-	-	-	-	Express
3. Gauge (mm)		1,435	1,435	1,435	1,435	1,435	1,435	1,435
4. Train load: Axle load (ton)		12.5	12.5	12.5	12.5	12.5	12.5	12.5
5. Track structure								
	Rail weight (kg/m)	54.0	54.0	54.0	54.0	54.0	54.0	54.0
	Sleeper type	Wood	Wood	Wood	Steel	W/S	PC	PC
6. Train composition		9	7	7	6	7	5	9
7. Commercial speed (km/h)		40.0	40.0	40.0	40.0	40.0	40.0	40.0
8. Number of passenger/train		450	700	900	600	350	540	980
9. Average distance between station (km)		7	4.6	3	2	5	3	3.5
10. Signal system		Auto	A/S	A/S	Staff	Staff	Auto	Auto
11. Ticketing system		Nominal only	Nominal only	Nominal Only	Nominal	Nominal	Nominal	Nominal

Note: Line 1 : Cairo – Qalyoob *Line 2 : Cairo - Qalyoob – Shebeen El Qanater*
Line 3 : Cairo - Qalyoob - Shebeen El Qanater *Line 4 : Marg - Shebeen El Qanater*
Line 5 : Ain Shams – Robeiky *Line 6 : Cairo - Imbaba – Manashy*
Line 7 : Cairo – Marazeeq
A/S : Auto / Staff

Source: ENR



Source: JICA Study Team

Figure 2.3.1 Route Map of Existing Suez Line

(3) Stations

Between Ain Shams and Robeiky, there are three stations and the distances between stations are shown in Table 2.3.2.

Table 2.3.2 Distances from Ain Shams Station

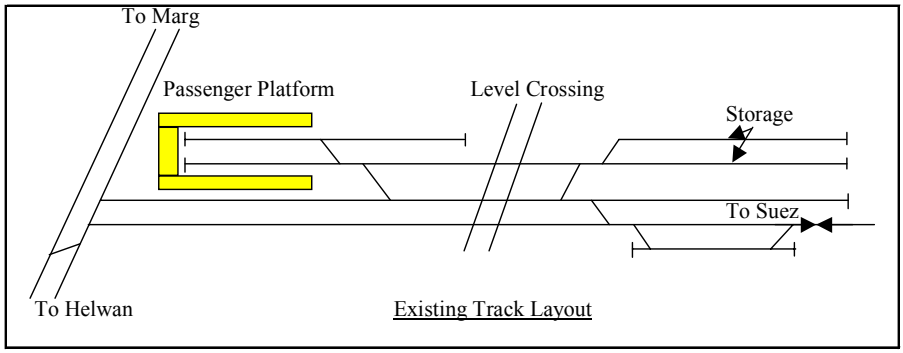
Station	Distance (Km)
Ain Shams	0.0
Oboor	15.0
Darb El Hag	23.0
Shorooq	30.0
Robeiky	45.0

Source: ENR

Following are brief descriptions of existing major ENR stations along the line.

Ain Shams Station

This station is a terminal station of the Suez line of the ENR. Ain Shams station of Metro line no.1 is adjacent to the ENR station. Passengers heading to Cairo should transfer from ENR to Metro line no.1 at this station. Ain Shams station has 2 platforms and three trains can stop at the station at the same time. Station facilities are very basic with one ticket office, which also serves as a general office for the railway. Trains are operated as scheduled. There are few current passenger numbers. The track layout of the station is shown in Figure 2.3.2.

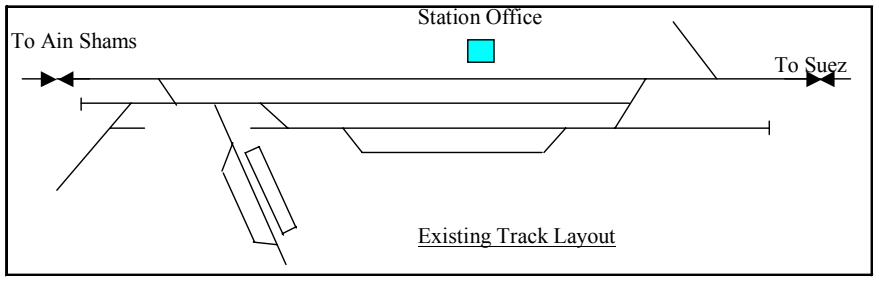


Source: ENR

Figure 2.3.2 Track Layout of Ain Shams Station

Oboor Station

This station has no platform and no station facilities except for a small station office. However, a huge Oboor Market is located on the opposite side of the adjacent Ismailia desert road. In addition to this, Oboor New Community is now being developed. Therefore, the station has a big potential to become one of major stations of the East Wing. The track layout of Oboor station is shown in Figure 2.3.3.

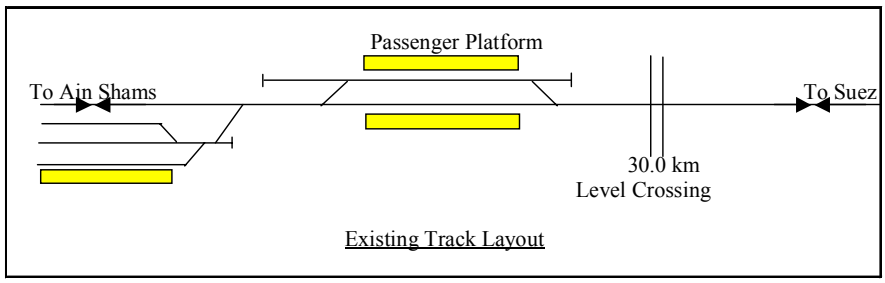


Source: ENR

Figure 2.3.3 Track Layout of Oboor Station

Shorooq Station

This station is located in the currently developing Shorooq New Community area. A new station building and new platforms have recently been constructed. The number of passengers is expected to increase after the completion of the new community, although there are not many passengers at the moment. Figure 2.3.4 illustrates the track layout of the station.

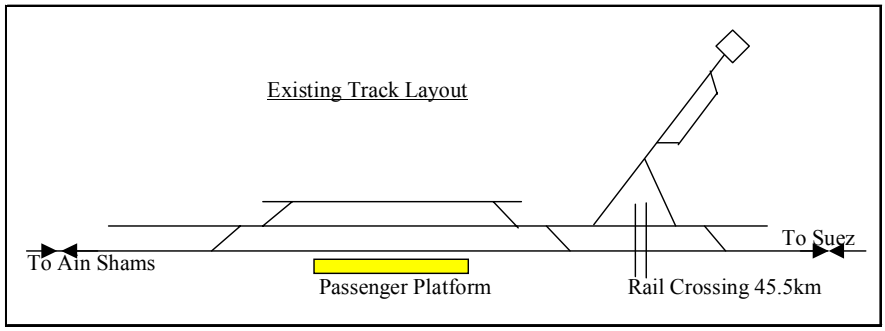


Source: ENR

Figure 2.3.4 Track Layout of Shorooq Station

Robeiky Station

There are no buildings around this station. The station is located in the desert. This station has sidings for the single track train operation of the Suez line. A small station office exists near to a platform. However, development of the Badr New Community is in progress. After the completion of the new community, this station might be bigger. Figure 2.3.5 illustrates the track layout of the station.



Source: ENR

Figure 2.3.5 Track Layout of Robeiky Station

(4) Rolling Stock

Trains operated on the Suez line have been used for more than 30 years. Different sizes of coaches are adopted as shown in Table 2.3.3. Therefore, it would not be possible to use the existing trains for a railway service for commuters, because the level of service, such as transport capacity, high speed, comfort and punctuality, of these old trains would not attract passengers.

It is expected that the East Wing public transport system will transport massive volumes of commuters to/from Cairo. Modern trains would be necessary for a high speed, comfortable commuter transport system.

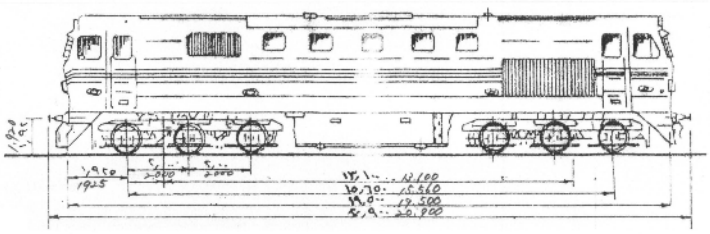
Table 2.3.3 Existing Passenger Coaches of the Suez Line

No.	Class	Seats	Standing	Wheel distance (mm)	Weight (ton)	Date of joining the service	Product
1	2nd class ordinary	88	-	1,000		1973	
2	3rd class ordinary	80	-	990		1963	Japan (Hitachi)
3	3rd class ordinary	102	-	1,000	42	1979	Romania
4	Sub-urban Coach with Driving Cabin	72	220	1,000	42	1980	

Source: ENR

Following are drawings of existing diesel locomotive and passenger cars.

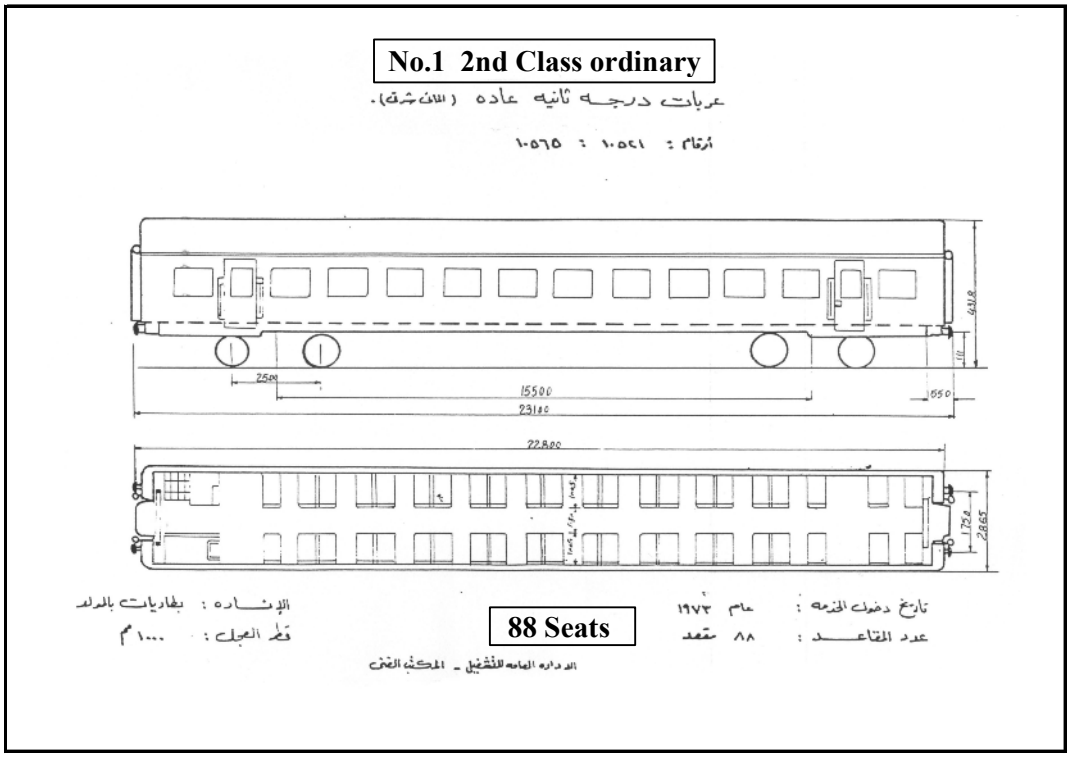
Deisel Locomotive

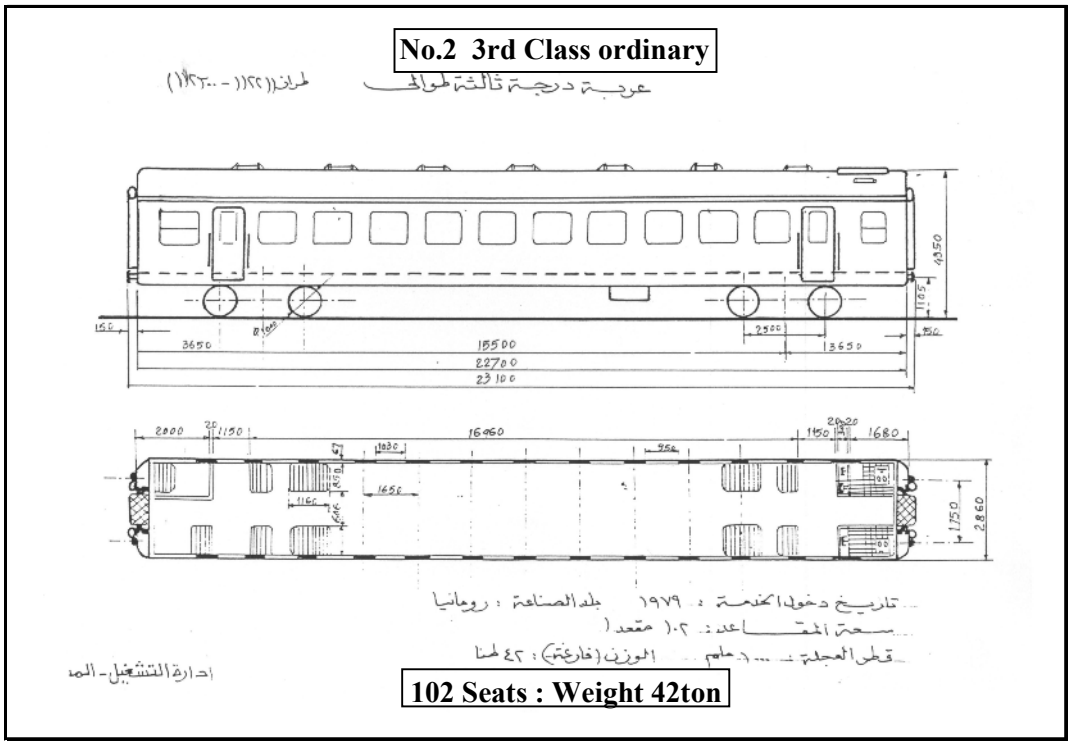


Item	Specification
Type of dragging engine	D-77
Net weight	111.05 tons
Axial load	20.33 ton
Locomotive type	Automatic from (3016 - 3063), Normal, Spiral
Capacity of Fuel tank	11,500 liter
Engine type	Electric Diesel : 12-645 E3
Manufactured Company	Western Germany - Type: AA2T
Date of joining the Service	1977
Max. Speed	120 km/h
Type of the Main generator	(AR10F) - D14

Source: ENR

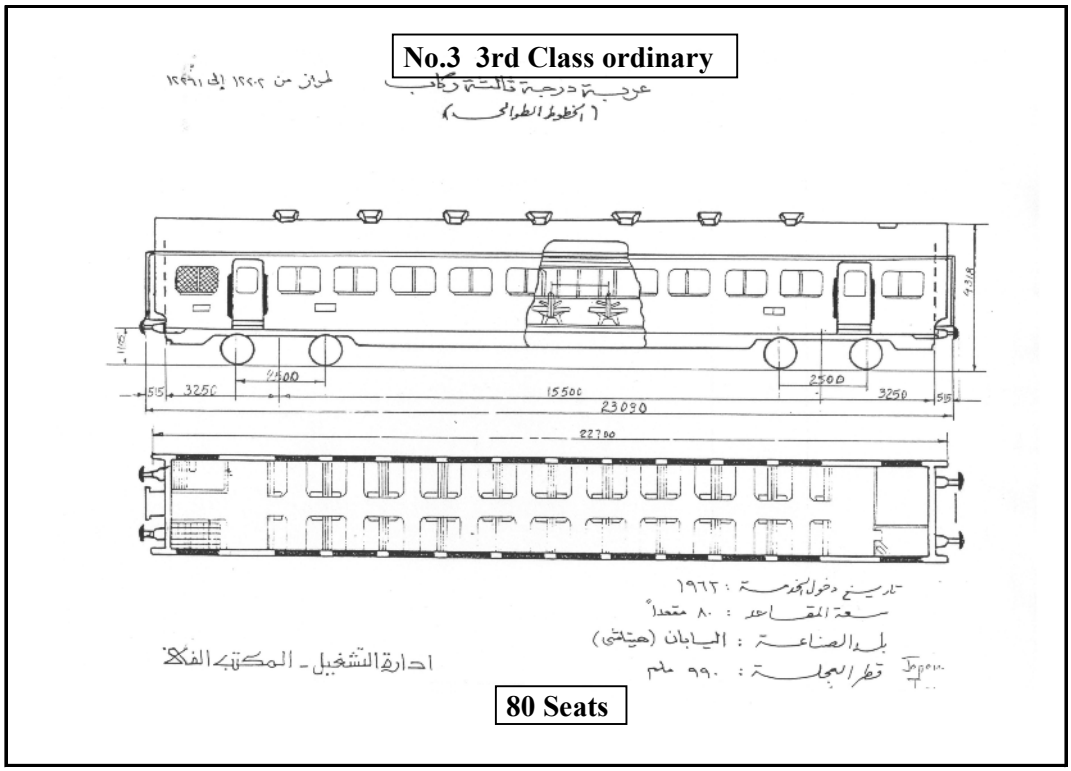
Figure 2.3.6 Typical Diesel Locomotive of the Suez Line

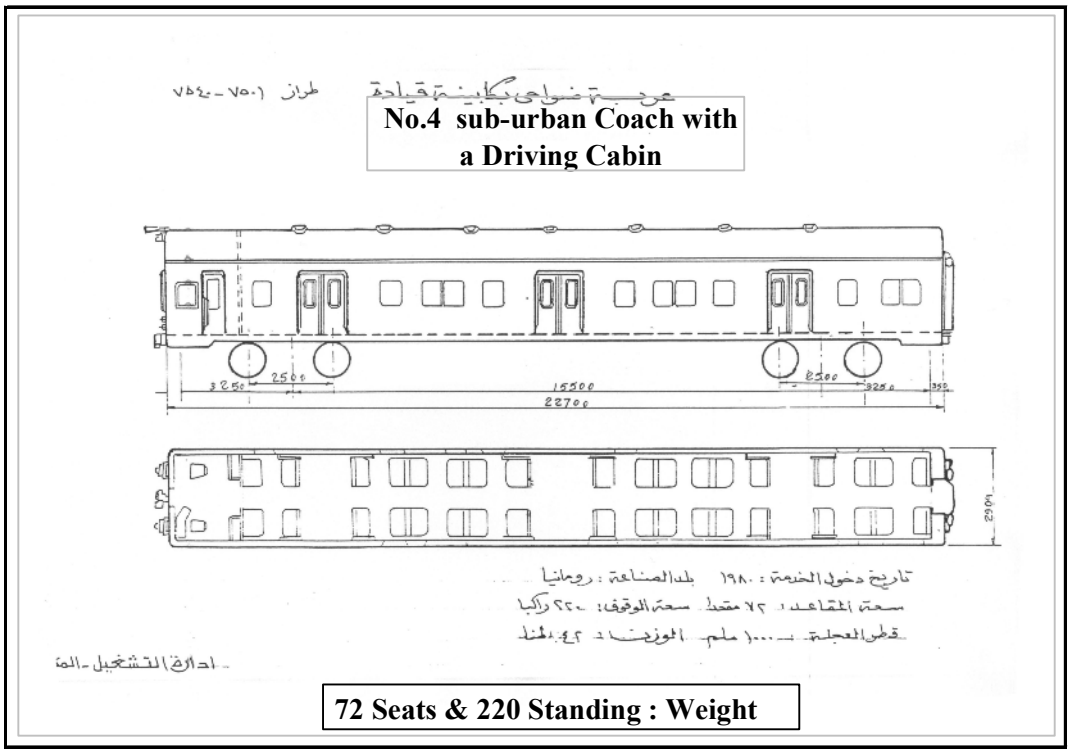




Source: ENR

Figure 2.3.7 Passenger Coaches of the Suez Line (1)





Source: ENR

Figure 2.3.8 Passenger Coaches of the Suez Line (2)

(5) Train Operation

Diesel trains are currently operated on the Suez line. The number of trains per day is 8. One of the 8 trains is for military service. According to a train operation diagram, the travel time between Ain Shams and Robeiky station (45 km length) is 45 to 47 minutes. The operating speed of the line is estimated to be around 60 km/h. However, the train speed at a section between Darb El Hag – Robeiky (22.0 km length) is more than 80 km/h.

(6) Signal System

Trains are operated by an automatic signal system. However, train drivers slow train speed and confirm operation safety near at grade intersections with roads, because automatic gates are not installed along the line.

2.3.3 Intermodality at Ain Shams

The ENR Ain Shams station presently interconnects the following public transport services:

- Metro Line 1 into Cairo
- Small bus terminal with one bus line to Ramses
- Shared taxi service near the terminal.

Metro Line 1 could be described as a good operating station, given it is elevated and efficiently structured. The metro is, at present, the most efficient type of public transport and should therefore be considered as a strategic link to the future East Wing connection.

The present railway station is of poor quality and should be completely replaced to be capable of functioning as a terminal station for the future East Wing. The new design will be particularly important for efficient ticketing services and a throughput of high levels of passengers during peak hours.

Shared taxis will also require total restructuring. At present, the service is limited to illegal taxis operating in the small streets behind the railway line. Accessibility from both the railway and metro stations is through illegal passes over the railway line. It is said that many of the shared taxis are not registered and that they are in a very poor condition. In some cases, drivers have no license and, in more than one instance, it was noted that these vehicles were operated by children. Offering an efficient shared taxi services in these streets is impossible, given that the streets are small and very crowded, creating an unacceptably dangerous situation[1].

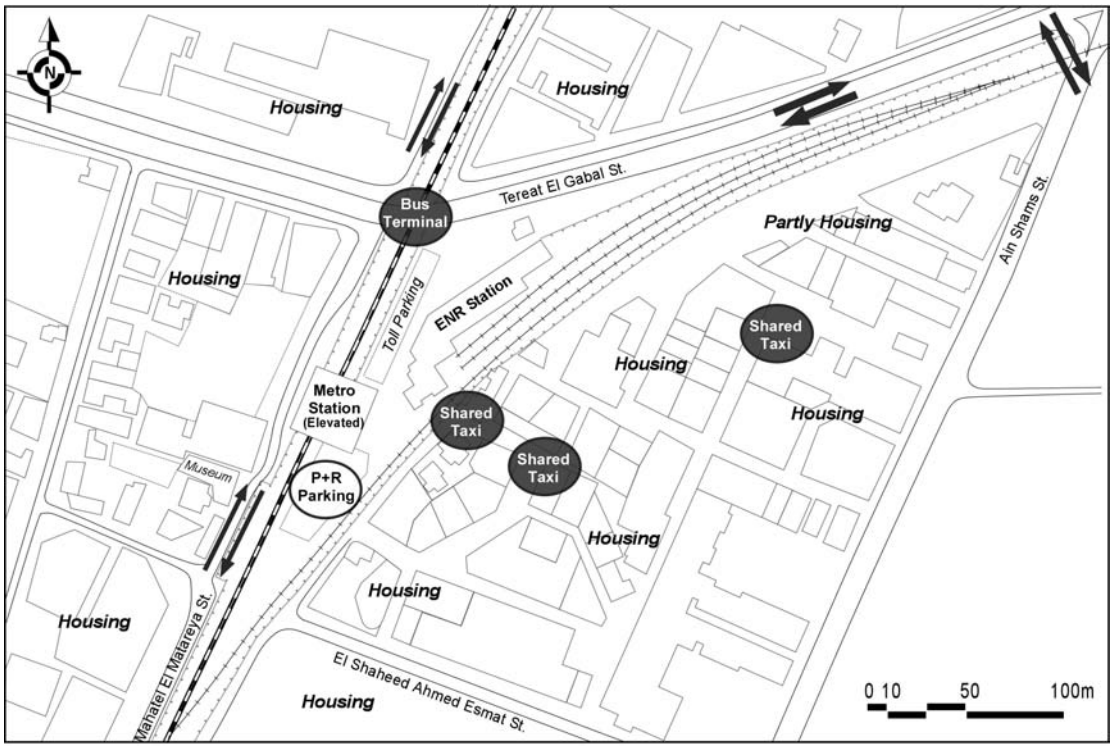
Finally, a small P&R parking place is located between the railway and metro station. The parking is difficult to access and many people randomly park their cars in the surrounding narrow streets. The new terminal will need to foresee an

[1] *There is a public market just outside the (illegal) entrance to the terminal, attracting many people, in particular children, women and older people.*

efficient P&R facility to accommodate increasing numbers of persons making use of the P&R facility.

Although several public transport modes are available at that location, intermodal transport is non-existent because the integration of services is completely absent.

However, this integration is complicated by a number of constraints as will be briefly discussed hereafter. The present situation at Ain Shams station is shown in the next figure, Figure 2.3.9.



Source: JICA Study Team

Figure 2.3.9 Ain Shams Station - Present Situation

2.4 BASIC PLANNING POLICY AND STRATEGIES

2.4.1 Past Transport Development Studies

The Study Team obtained information on transport development related to the East Wing Corridor from three studies which were previously conducted by different bodies, as described below. All the studies discussed needs of a public transport mode, or mass rapid transit system to link with the new communities. No studies, however, present a scientifically rational forecast of future transport demands to rationalize the development.

ENR Study

HTA Transport Consultants in Holland submitted a report to Egyptian National Railway, entitled "Preliminary Report – Light Railway Link between Ain Shams

and 10th of Ramadan – Traffic Research and Feasibility Concept", in February 2001. The report recommended introducing a light rail transit system between Ain Shams and 10th of Ramadan. Estimated total cost was LE 3.3 billion in year 2001 prices. However, the report assumed a LE 1.0 billion contribution by some government agency to make the project financially feasible. No economic evaluation of the project was done in the report.

GOPP Study

Another study, entitled "Technical Studies for Developing Entrances of East Greater Cairo, Final Technical Report, Project of Developing Greater Cairo Entrances (East Cairo Entrances)" was completed by the General Organization for Physical Planning (GOPP), Ministry of Housing, Utilities and New Communities in 2000.

The study examined future traffic demand along corridors in the East of Cairo, such as Cairo – Ismailia desert road, Cairo – Suez desert road, Cairo – Belbeis desert road and Qattameya – Ain El Sokhna road. The Cairo- Ismailia desert road was identified as the most congested road among them. Daily traffic volume on the Cairo- Ismailia desert road was estimated to reach about 77,000. The report recommended constructing a railway link between Cairo and 10th of Ramadan City during 2003 – 2007 as one of conclusions.

Ministry of Housing, Utilities and New Communities' Study

This study was entitled "A Feasibility Study of the Project for Linking Greater Cairo Region with 10th of Ramadan, 6th of October and Badr Cities by an Electric and Fast Mass Transit – Draft No. 3 for Discussion", by the Economic Consultancy Center, without date.

Based on the future socio-economic growth of the new communities, and current and future transport demand forecasts, the study proposed that three links, which connect the new communities and Cairo, should be constructed to ease traffic congestion, to encourage people to settle in these cities and to facilitate employment in these areas. The proposed lines are electric mass transit systems connecting Ain Shams – 10th of Ramadan, Mohandeseen – 6th of October and Almaza in Cairo – Badr city.

2.4.2 Basic Planning Policy and Strategies

(1) Basic Planning Policy

The basic planning policies of the Study are as follows:

- Public transport system integration;
- Efficient and realistic alternative plan setting;
- Detailed transport demand forecast;
- Realistic financing plan; and,
- Sustainable operation.

These are closely related with five core strategies in the Master Plan. These are: 1) improvement of people's mobility, 2) optimal infrastructure development and management, 3) accessible transport for all, 4) safe and environmentally friendly transport, and 5) establishment of a sustainable institutional and financial mechanism.

With regard to the East Wing public transport development, these would be applied in the following manner:

1) Public Transport System Integration

The East Wing public transport could be a road-based or rail-based system. However, in any case, the new mass transit system will have high transport capacity compared to traditional bus transport. Therefore, inter-modal facilities shall be duly planned as a part of facility development to assure the integration of diverse services.

Intermodality was also considered not only with public transport, but also with private transport in terms of park-and-ride facilities, as planned in the Master Plan. Formation of a functional inter-modal connection with the metro system is a vital planning issue for the East Wing Project. In this context, Metro Line 1 offers a major and important intermodal point at Ain Shams Station. Metro Line 3, which has been evaluated as the highest priority project in the Master Plan to structure a robust public transport network in Cairo Metropolis, should be integrated with the East Wing system, developing a strategic intermodal point at Salam City Station. Such an intermodal concept should be fully designed in both projects of Metro Line 3 and the East Wing project.

2) Efficient and Realistic Alternative Plan Setting

The East Wing mass transit was planned as a modern railway service utilizing the existing ENR Suez line, as mentioned in the Master Plan. This is considered as efficient and realistic.

In this feasibility study, however, a busway option is also examined for study as another efficient alternative compared to the railway upgrading plan, by utilizing Ismailia Desert Road, which connects Cairo CBD and 10th of Ramadan City.

In addition to the modal selection for the service, route alternatives and system alternatives were examined as much as possible. The East Wing has various route alternatives with regard to new sections to 10th of Ramadan City. System alternatives, such as single or double track, diesel locomotive/train and electrification, were examined based on future transport demand forecast for alternative routes.

3) Detailed Transport Demand Forecast

In the Master Plan, traffic zones were organized at the Shiakha level of detail, which is a minimum administrative unit in the region. However, it was

considered insufficient to conduct a feasibility study to identify viability of the East Wing development. Therefore, the Study Team subdivided the Master Plan traffic zones.

With regard to links, which denote transport services for road, railway, bus etc., the Study Team has taken into consideration of not only trunk traffic links but also feeder links in order to be able to forecast appropriate transport demand as well as to examine the intended effect of various transport planning possibilities as much as possible.

4) Realistic Financing Plan

The Master Plan has already examined various funding sources and financing plans. In the East Wing development, the Study Team has examined not only external but also internal funding sources to realize the development.

5) Sustainable Operation

As in Inception Report 2, "It is not a rare instance that operation of a new transport system cannot continue successfully after implementation, despite huge capital investment." Government subsidy might be necessary not only for capital investment but also for operation of the transport service and/or the fare level might be revised. Organizational/institutional changes might be necessary for sustainable operation.

(2) Strategies for the East Wing

As reviewed in the previous sections, the East Wing corridor is identified as a high transport demand corridor. Several substantial scale of new communities are being developed, future transport demand for public modes will be indispensable and a high speed service will be a critical condition of the service because the new communities are located far from Cairo CBD.

Recognizing the above issues, the Study Team decided the following strategies for the East Wing public transport development.

- Route options are prepared between the Ain Shams Station to the 10th of Ramadan City to compare priority order of the options based on preliminary plans of the options.
- Modal options are busway and railway, which are included in the route option.
- Other options such as single/double-track operation and/or electrification are discussed after the screening of the options in the case of railway
- Intermodality is investigated carefully at Ain Shams station, together with traffic management planning around the area.
- Screening of the options is basically determined by economic analysis, though other preliminary evaluations are taken into consideration.

- The Study Team planned the East Wing public transport, based on the selected option, by forecasting detailed future transport demand for the Wing.
- An environmental impact analysis and an economic/financial evaluation of the project were also conducted for the selected option.
- A financing plan and sustainable operation were investigated for the selected option.
- An environmental impact analysis and an economic/financial evaluation of the project were also conducted for the selected option.
- A financing plan and sustainable operation were investigated for the selected option.

2.5 PLANNING AND SELECTION OF OPTIONS

2.5.1 Route and Mode Options

For the East Wing public transport development, the master plan proposed a railway link from Cairo CBD to 10th of Ramadan City, by utilizing the existing ENR Suez line. The Suez line passes very near to the 10th of Ramadan City, although the line does not directly extend to the city at the moment

The Study Team prepared five railway route plans and one busway connection to the city to compare mode of transport and route options. Although mode selection should come earlier than route selection, the Study Team intended to compare the priority of various railway route options with the busway option. Therefore, six alternative route plans were examined consisting of one busway and five railway route plans.

As discussed in the previous section, other options such as electrification, single track operation and double tracking are examined in a later part of this section, because these relates to a magnitude of future transport demand and construction costs.

Constraints such as a committed project area, protected areas, natural and social environmental aspects, construction costs and public utility facilities were taken into consideration to plan the alternative route. On the other hand, accessibility, both existing and future transport demand, level of service of the new public transport mode and coverage area of the service depend on the route options.

After the examination of the six route options, only one route option was selected for the East Wing feasibility study, which was then focused on in detail.

(1) Busway Option

The busway option has several advantages compared to the railway options. These include:

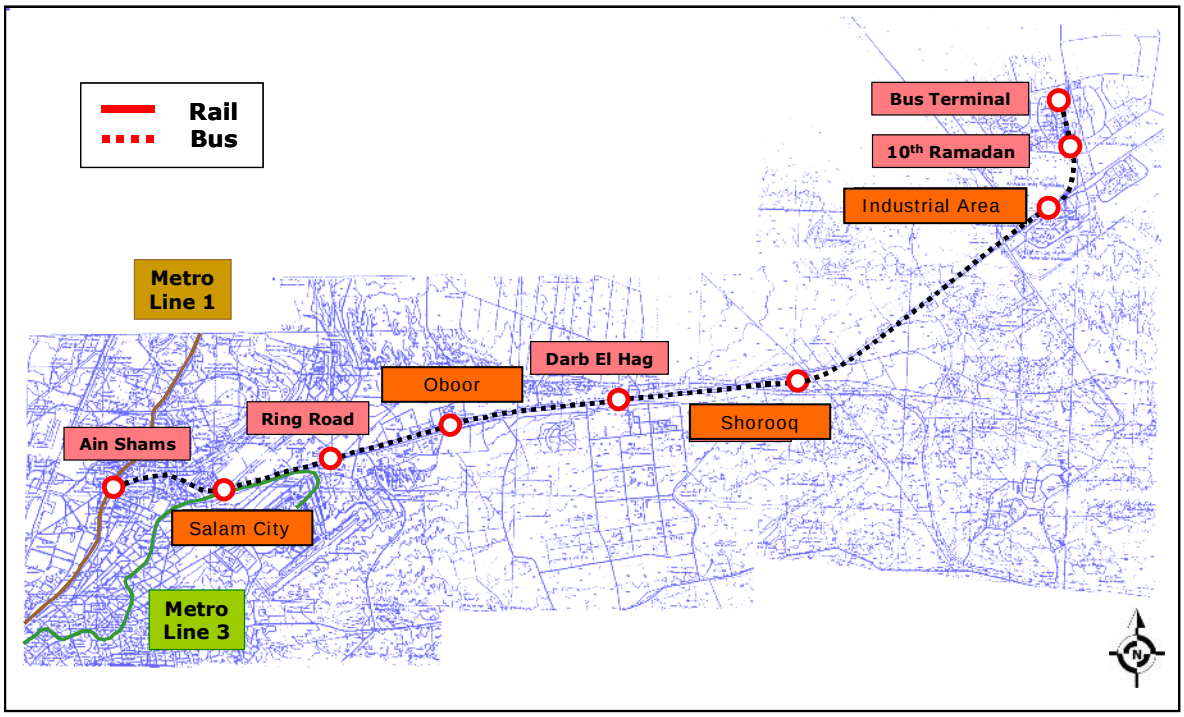
- Low construction cost and
- Flexible route settings.

However, the busway option has several disadvantages to the railway as shown below:

- Limited transport capacity;
- Reducing the road transport capacity of the Ismailia Desert road;
- Less travel speed and less punctuality compared to railway;
- Construction cost would become expensive, when the bus-way saturates in a short period after construction; and,

- Users' inconvenience during the construction period if the busway is converted to railway system on the same route.

This busway option aims at a low cost solution for the East Wing mass transit development. The busway starts from existing Ain Shams station of ENR/Metro line no. 1 and terminates at the Bus Terminal in the 10th of Ramadan City, stopping at the bus stations of Salam City, Ring Road, Oboor, Shorooq, Industrial Area, 10th of Ramadan as shown in Figure 2.5.1. After completion of Metro no.3, Salam City station would be a major intemodal terminal.



Source: Study Team

Figure 2.5.1 Busway Option

(2) Railway Option 1

Railway options have advantages of disadvantages of a busway system and disadvantages of advantages of a busway system.

The railway option 1 aims at connecting Ain Shams and 10th of Ramadan City by shortest route. So, accessibility of the city to Cairo CBD will be minimized.

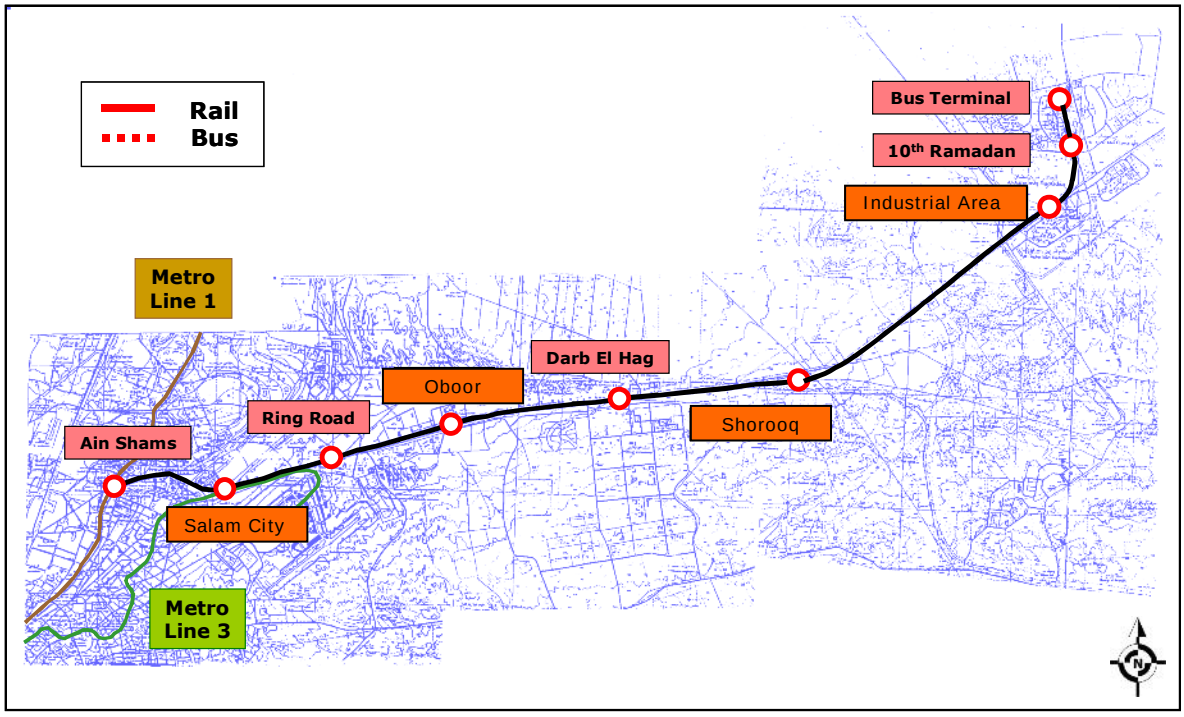
As shown in Figure 2.5.2, railway option 1 connects Ain Shams station and Bus Terminal station in the 10th of Ramadan City by passing Shorooq and Industrial stations, with about 49 km in terms of route distance.

The track layouts at the existing Ain Shams station are improved for a new terminal station in railway option 1. Intermodality with bus, shared-taxi and taxi service are conveniently planned as well for Metro line no. 1.

Adjacent to an interchange with the Ring Road, a new station is planned to provide convenient transfer to/from bus services.

Shorooq station, which was built recently, is planned as a diverging point to the 10th of Ramadan. A new line is constructed along Ismailia Desert road to the industrial Area station and is terminated at an existing bus terminal in the 10th of Ramadan City.

After completion of Metro line no.3, Salam City will be one of the major intermodal points.



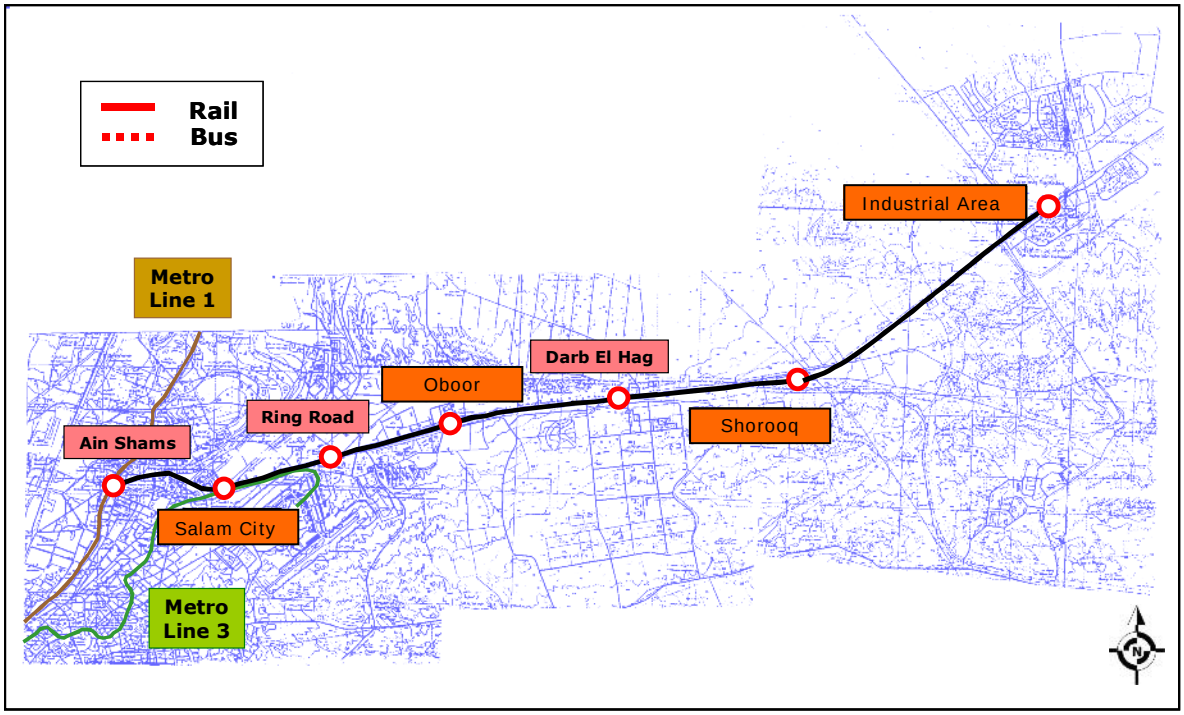
Source: Study Team

Figure 2.5.2 Railway Option 1

(3) Railway Option 2

Railway option 2 is a variation of option 1 as illustrated in Figure 2.5.3. The terminal station of 10th of Ramadan is at the Industrial Area station, which is located at the entrance of the city. The total length of this option is around 44 km. From the terminal Industrial Area station, passengers will transfer to existing bus and/or shared-taxi services to reach central areas of the 10th of Ramadan City or to other areas of the north-eastern part of Cairo. New transport modes, such as a tram system, might be constructed for residents/visitors to the city.

This option emphasizes environmental considerations for residents who reside within the 10th of Ramadan City, because option 1 is planned to extend into the center of the city. Although the planned route of option 1 is along a reserved area for a mass transit system and the planned route is located between busy wide roads, the Study Team adopted this option for examination.



Source: Study Team

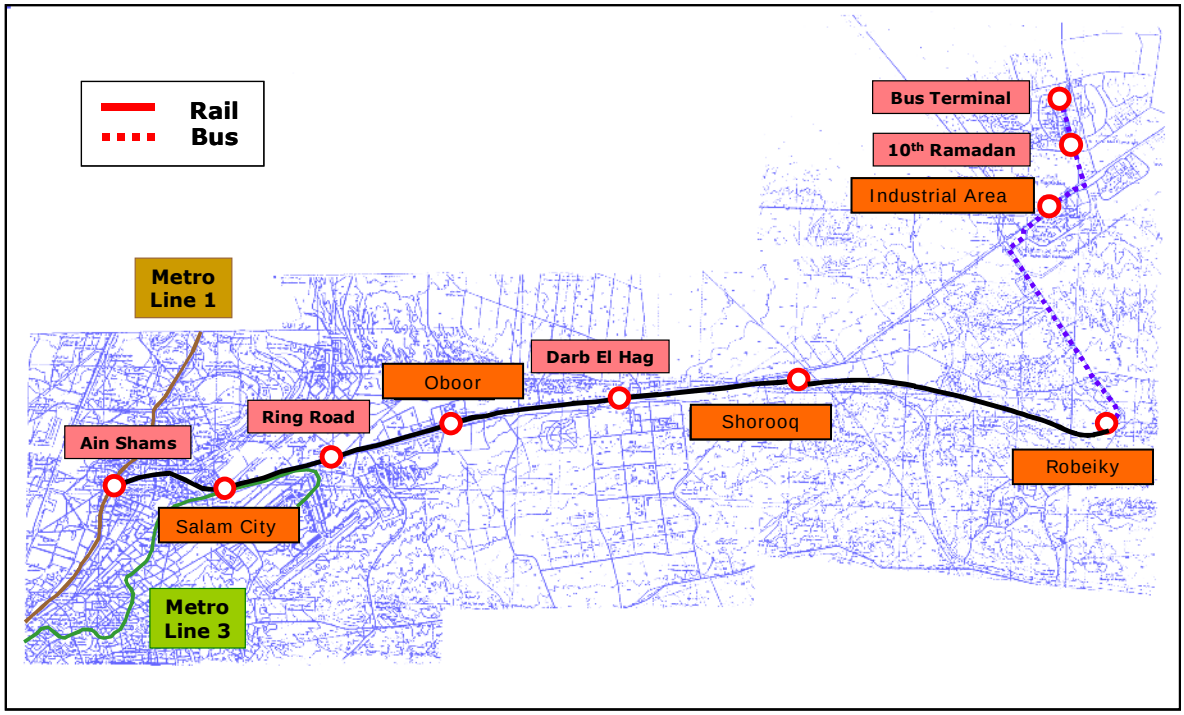
Figure 2.5.3 Railway Option 2

(4) Railway Option 3

Railway option 3 connects Ain Shams station, with Robeiky station as a terminus station. A new railway commuter service completely shares railway tracks with the existing long distance Suez line service. From Robeiky station, a shuttle bus service is provided for passengers to reach the bus terminal of the 10th of Ramadan City via the Industrial Area, as shown in Figure 2.5.4.

Station plans between Ain Shams and Shorooq are the same as railway option 1.

This option aims for a cheap solution by making the most use of the existing ENR Suez line. The capital investment is expected to be small. The transport service for this option covers residents near Robeiky station, such as Badr New Communities. However, residents in the 10th of Ramadan City have to transfer from the railway to the shuttle bus to reach to their homes, in addition to a longer travel time compared to the option 1.



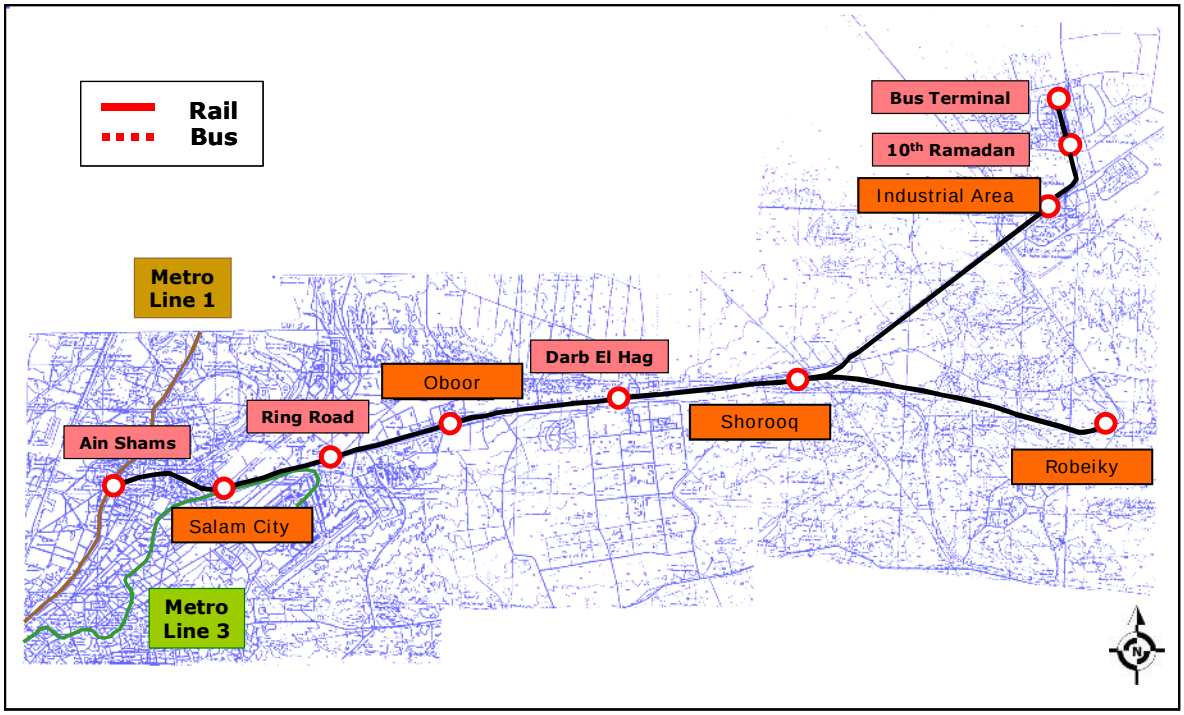
Source: Study Team

Figure 2.5.4 Railway Option 3

(5) Railway Option 4

This option is a combination of option 1 and 3 and connects the Bus Terminal station of the 10th of Ramadan City and Robeiky station at the same time, as shown in Figure 3.4.5. Therefore, there will be no inconvenience for 10th of Ramadan residents. Service coverage for the residents around Robeiky station is also secured.

However, the construction cost inevitably becomes bigger compared to other options. This option is not realistic when lower cost solutions are taken account of.



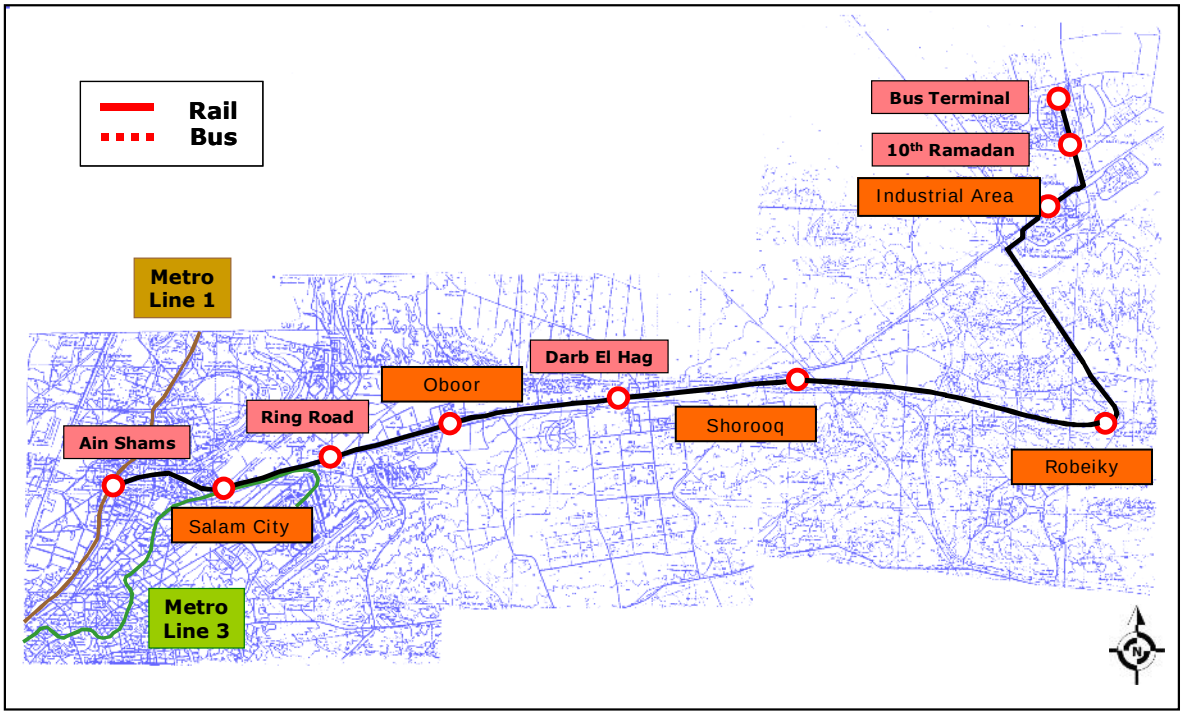
Source: Study Team

Figure 2.5.5 Railway Option 4

(6) Railway Option 5

This option aims at connecting the new communities as much as possible along the corridor by constructing new lines from Robeiky station to the Bus Terminal station of 10th of Ramadan City via the Industrial Area station, as shown in Figure 2.5.6.

This option reduces transfer inconvenience for 10th of Ramadan residents by providing through train operation to the terminus. However, this is a detour route to the 10th of Ramadan. Travel time from Cairo CBD to the city is longer than option 1.



Source: Study Team

Figure 2.5.6 Railway Option 5

2.5.2 Transport Demand Forecast by Option

(1) Assumptions of Transport Demand Forecast

Preliminary future transport demand forecast was carried out to screen the six options. Capacity constraints were not considered in the forecast. Assumptions were made to determine a preliminary demand forecast, which is basically common for all options.

Travel speed (or average commercial operation speed) of buses on the busway was assumed to be 40 km/h except for a section between 10th of Ramadan and Bus Terminal stations, where the speed was assumed to be 30 km/h. The frequency of the service was assumed to be every 6 minutes, for all forecast years.

The fare system was assumed to be a distance-based. An optimal fare level was searched, based on an analysis on the relationship between fare levels and traffic demands. The optimal point was defined as the level gaining the maximum revenue. As the result, the following are an assumed level (at 2001 constant prices):

- LE0.63 + LE0.03/km in 2007;
- LE0.74 + LE0.04/km in 2012; and
- LE1.00 + LE0.05/km in 2022.

As for the railway service, the travel speed (or average commercial operation speed) was assumed to be 60 km/h between Ain Shams and Oboor and between

the Industrial Area and Bus terminal, and 80 km/h between Obor and the Industrial Area. With regard to sections of the Shorooq – Robeiky – Industrial Area, the travel speed was assumed to be 90 km/h. The frequency of railway service was assumed to every 6 minutes, the same as the busway service.

The fare system for railway options was assumed to be the same as that of the busway option, because the fare impedance needs to be common among all options for a screening purpose.

(2) Preliminary Transport Demand Forecast by Option

A preliminary transport demand forecast was conducted for a purpose of screening the options. It should be noted that the demand forecast in this section shows preliminary values only for screening purposes, based on preliminary assumptions as mentioned above. Therefore, the results of passenger demands discussed in this Section is not necessarily the same as those of the future transport demand analysis discussed in Table 2.6.2, the following section 2.6, which was based on finalized data and different assumptions to examine the selected option in detail.

Table 2.5.1 shows the results of the preliminary transport demand forecast by option and by year. The peak ratio of the demand was assumed to be 10% of daily traffic volume, which was derived from peak ratios of the Metro in operation.

As shown in this table, the increase of transport demands will accelerate from 2012 through 2022 in all the options, of which the average growth rates in numbers of passengers between 2012 and 2022 are 9~14% p.a., despite that the population growth in the East Wing Corridors (including 4 new communities) between the same period is 7.2% p.a. This means that the public transport demands are likely to be more elastic to the population growth, affected by economic factors such as income and car ownership. The more serious the road congestion becomes along with the car ownership growth, the more significantly the public transport demand will increase.

According to the results in Table 2.5.1, Options R1 and R2 showed the biggest flows in terms of maximum passenger flow. The passenger flow in Option R4 is less than the busway option in 2012 and 2022.

In terms of daily passengers, Option R1, R2 and R5 attract more passengers compared to other options. Option R4 appeared to attract the least number of passengers among all options, although this option has two branches, 10th of Ramadan and Badr. The reason is that the frequency of Option R4 is half that of other railway options because of branch line operations. Option R3 has least number of passengers apart from Option R4. The reason seems to be that this option does not have direct access to the 10th of Ramadan.

With regard to the busway option, transport demand exceeds transport capacity in some future year after 2012.

Table 2.5.1 Preliminary Future Transport Demand by Option for Screening

		Busway	R1	R2	R3	R4	R5
Maximum Pax. Flow (per hour/directin)	**2007**	4,200	4,800	4,800	3,900	4,700	4,800
	2012	6,500	5,900	5,800	5,500	6,100	5,900
	2022	17,900	22,000	22,000	20,000	17,000	19,000
Average Growth Rate	*2007-2012*	*9.1%*	*4.2%*	*3.9%*	*7.1%*	*5.4%*	*4.2%*
	2012-2022	*10.7%*	*14.1%*	*14.3%*	*13.8%*	*10.8%*	*12.4%*
Number of Passengers per Day ('000/day)	**2007**	90	150	120	90	140	140
	2012	101	160	140	120	150	170
	2022	440	500	500	430	360	510
Average Growth Rate	*2007-2012*	*2.3%*	*1.3%*	*3.1%*	*5.9%*	*1.4%*	*4.0%*
	2012-2022	*15.9%*	*12.1%*	*13.6%*	*13.6%*	*9.1%*	*11.6%*

Source: JICA Study Team

2.5.3 Screening of the Options

In selecting of the options for detailed planning, evaluation criteria should be prepared. Among the criteria, economic evaluation is of the most importance. The Study Team conducted a preliminary economic evaluation based on planning data for the options described above.

Table 2.5.2 shows an overall comparison of the 6 options for the East Wing public transport development plans.

Railway options are planned as double-track, diesel train (3 cars) operations. The investment cost includes infrastructure, rolling stocks, depot, detail design, insurance, utility relocation, construction supervision and contingency. With regard to the busway option, it was assumed that the same number of vehicles is used as the West Wing. The investment cost includes the same components as the railway options.

As seen in Table 2.5.2, there exists a great difference in the investment costs among the options. Compared to the cost of the Busway option which will cost 641 million LE, those of the other options are 1,702 million LE (R3) ~ 3.506 million LE (R4), which are 2.7 ~ 5.5 times of the cost of the Busway option. However, the lowest cost option is not necessarily a justifiable option in terms of the national economy. The economic benefit should be considered, compared with the investment costs. Thus, the economic sustainability and feasibility are examined based on the cost-benefit analysis in a 25 years time framework.

Table 2.5.2 Comparison of East Wing Public Transport Development Options

Option	Busway	R1	R2	R3	R4	R5
Route Plan	Ain Shams-Bus Terminal	Ain Shams-Bus Terminal	Ain Shams-Industrial Area	Ain Shams-Robeiky-Bus Terminal	Ain Shams-Shorooq-Bus Terminal & Robeiky	Ain Shams-Robeiky-Bus Terminal
Route Distance						
Busway	49.4 km					
Existing ENR	-	30.0 km	30.0 km	45.0 km	45.0 km	45.0 km
New Railway	-	19.0 km	14.0 km	-	19.0 km	17.0 km
Access (By Bus)	-	-	-	17.0 km	-	-
Total	**49.4 km**	**49.0 km**	**44.0 km**	**62.0 km**	**64.0 km**	**62.0 km**
Number of Station	8 bus stops	9 Stations	7 Stations	7 Stations	10 Station	10 Station
Scheduled Time						
Railway	-	43min.	37min.	49min.	43min & 36min	53min
Bus	74 min.	-	15+10=25min.	26+10=36min.	-	-
Total	**74 min.**	**43min.**	**62min.**	**85min.**	**43min & 36min**	**53min**
Investment Cost (Million)	**641**	**3,043**	**2,652**	**1,702**	**3,506**	**2,919**

Note: Cost for access bus service is not included.

Source: JICA Study Team

Regarding transport capacity, this is considered critical although it was not tabulated in the table. In the case of busway, the transport capacity is estimated to be less than 10,000 passengers per hour and per direction as shown in Section 3.3.2, Chapter 3. In this context, the newly constructed busway should be converted to railway in some year when allows to make the investment viable, according to the preliminary transport demand forecast in Table 2.5.1. If the busway has a short life, in terms of transport capacity, the cost to society is huge even though the investment cost is the smallest.

The preliminary economic analysis was carried out in the same manner as the Master Plan. Costs of the options were converted from financial costs to economic costs. Time saving and cost saving benefit were calculated based on the demand forecast outputs. However, additional investment costs were not included in this analyses. The analyses aimed at comparing relative priorities among the options.

In this screening of options, a financial evaluation was not conducted, because financing of the East Wing largely depends on the Government transport policy. For example, a government subsidy to infrastructure investments and operating cost varies over a very wide range. A government fare policy is also critical for the financial viability of the East Wing public transport operator. So, financial matters are studied on one selected option in the later section, which should be consistent with sustainable operation, organizational and institutional issues.

The result of the preliminary economic analysis of all the options was summarized in Table 2.5.3, showing a comparison in the Economic Internal Rate of Return (EIRR) among them. As seen in this table, the railway option 1 (R1) represents the highest economic viability with a 26.5 % of the EIRR. The EIRRs of other railway options were less than 20 %.

Looking into the transport demand in 2012, even Option R1 presents the maximum flow at only 5,900 passengers per hour per direction, which might seem difficult to make such a costly railway project viable. However, a transport infrastructure project cannot be evaluated in the short-term or in a single year, but needs a longer-term evaluation period, because the transport infrastructure is usually utilized for more than 20 to 30 years. The EIRR of each option was computed with a long-term time horizon, or the 25 years project life.

Regarding the busway option, its EIRR was negative because of increased road congestion along the Ismailia Desert Road, of which two lanes were used for the busway. In order to further clarify the EIRR of the busway option, the Study Team conducted another economic evaluation under an alternative assumption that no extra investment costs are given to provide the busway service on Ismailia Desert Road without any reduction of the number of lanes. This assumption yielded a more favorable EIRR, more or less 20%, however, which is not higher than the EIRR of the railway option, R1.

Based on the above examinations of the options of the East Wing public transport, the Study Team decided to select railway option 1 as the option to be planned further in this feasibility study. Planning works and evaluation tasks are conducted for the selected option 1, hereafter.

Table 2.5.3 Preliminary Economic Analyses of the Options

(LE million, year 2001 price)

Option	EIRR	NPV	B/C
R1	26.5%	6,549.0	4.4
R2	15.0%	557.8	1.3
R3	12.5%	66.0	1.1
R4	15.2%	845.6	1.4
R5	15.9%	762.8	1.4
Busway	Negative	Negative	Negative

Source: JICA Study Team
Note: Social discount rate was assumed as 12 % per annum.

2.5.4 Other Technical Considerations

As a conclusion of the screening process, the railway option 1 (R1) is selected as the comparatively viable option of the East Wing public transport development in terms of mode and routing. Based on this option, other technical alternative aspects for the railway development were examined.

Firstly, the options of single track or double track should be examined. According to the future transport demand for Option R1, which is shown in Table 2.5.1, the peak-hour traffic volume per direction will reach 22,000 in 2022, although in the early years of the operation, the demand will stays at a range between 5,000 and 6,000.

The Study Team examined the possibility of a single track operation in the early years in 2007 and 2012. However, it was concluded that double track operation is appropriate, because sidings are necessary at some points along the line, other than station areas, even in the early years in order to cope with 5,000-6,000 passengers per hour and per direction. Therefore, double track operation is selected.

With regard to the possibility of its electrification, the Study Team examined the necessary cost for electrification. The construction cost for the electrified railway system approximately doubles the non-electrified railway system. Furthermore, modern diesel cars have as high specifications for efficiency and maximum speed as the electrified railway. Therefore, the Study Team selected a diesel car operation system for the East Wing public transport development. In the long-term, however, the East Wing should be electrified, by which a through-train operation with Metro Line 1 could be realized, thereby enhancing the intermodal connection with the metro system and the sub-urban transport services.