

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)**

**COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION (CDR)  
REPUBLIC OF LEBANON**

**THE STUDY  
OF  
ENVIRONMENTAL FRIENDLY INTEGRATED  
TRANSPORTATION PLAN  
FOR  
GREATER TRIPOLI**

**FINAL REPORT**

**MAIN REPORT - 1**

**INTEGRATED TRANSPORT PLAN**

**DECEMBER 2001**

**KATAHIRA & ENGINEERS INTERNATIONAL**

## PREFACE

In response to a request from the Government of Republic of Lebanon, the Government of Japan decided to conduct "The Study of Environmental Friendly Integrated Transportation Plan for Greater Tripoli in the Republic of Lebanon" and entrusted the Study to the Japan International Cooperation Agency (JICA).

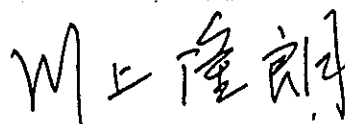
JICA selected and dispatched a Study Team headed by Mr. Tsuneo BEKKI, Katahira & Engineers International to Lebanon, at three different times between October 2000 and December 2001. In addition, JICA set up an Advisory Committee Headed by Dr. Hirohito KUSE, Tokyo University of Mercantile Marine, which examined the Study from technical points of view.

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

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

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

December 2001,



---

Takao KAWAKAMI  
President  
Japan International Cooperation Agency

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

December 2001

Dear Mr. Kawakami,

Letter of Transmittal

We are pleased to submit to you the report of "The Study of Environmental Friendly Integrated Transportation Plan for Greater Tripoli in the Republic of Lebanon". The report includes the advises and suggestions of the authorities concerned of the Government of Japan and your agency as well as the comments made by the Council for Development and Reconstruction and other authorities concerned in the Republic of Lebanon.

The report analyses the present and future conditions and demand of transport in Greater Tripoli. It comprehensively covers the transport sectors of road, public transport, transport management as well as the issues institution, legislation, financing and environment. The report presents the established Integrated Transport Plan to the year 2020, and the Short-term Improvement Plan for urgent projects to be implemented in the years 2001 - 2005. The output of the Study concludes that the plans are technically, environmentally, economically and socially viable, and will contribute to the development of transportation in Greater Tripoli. In view of the urgency of developing the transport facilities in Greater Tripoli, we recommend that the Government of Lebanon implement the projects with top priority.

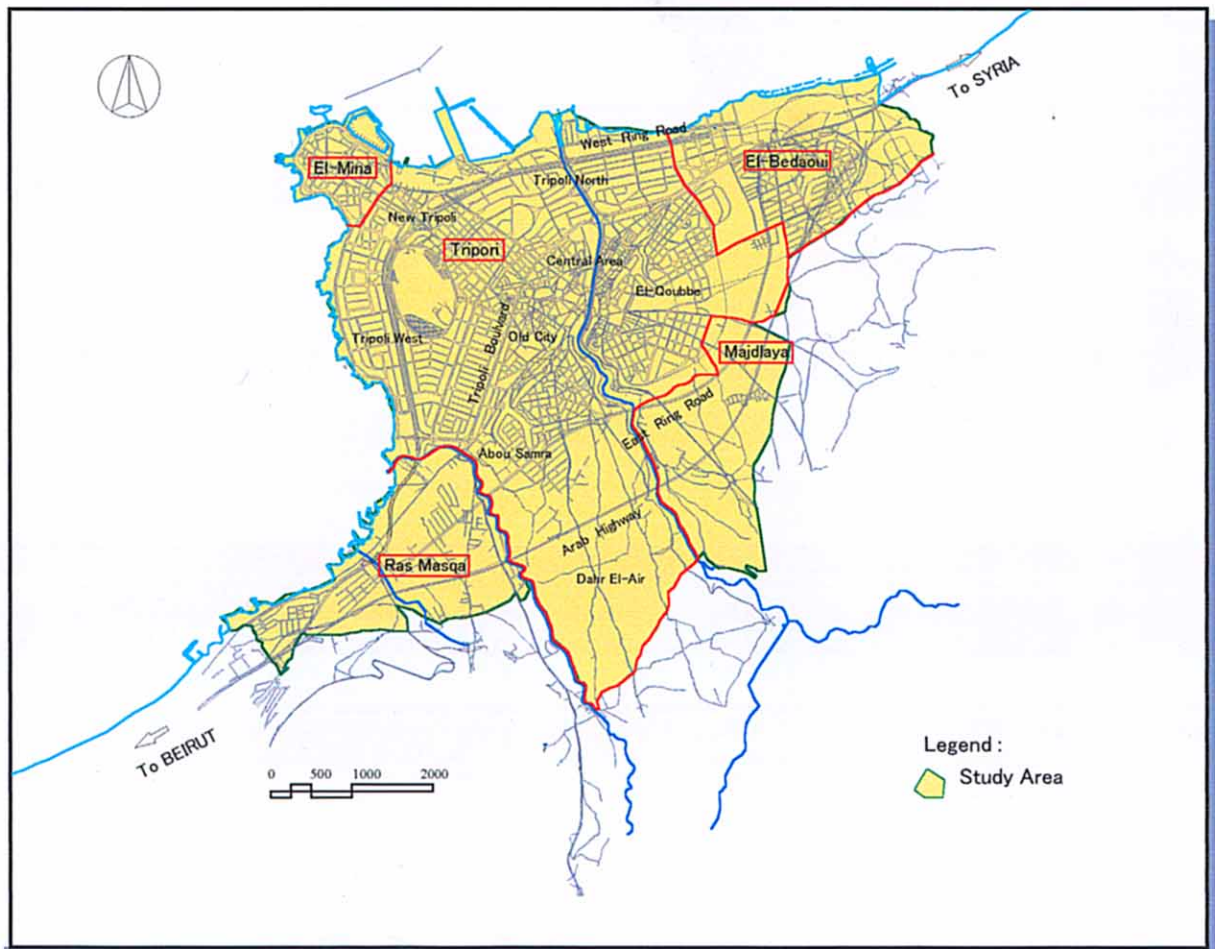
We wish to take this opportunity to express our sincere gratitude to your agency, the Ministry of Foreign Affairs and the Ministry of Land, Infrastructure and Transport. We also wish to express our deep gratitude to the Governmental Agencies concerned in the Republic of Lebanon for the close cooperation and assistance extended to us during the Study. We hope this report will contribute to the development of Greater Tripoli.

Very truly yours,



---

Mr. Tsuneo BEKKI  
Team Leader  
of the Study of Environmental Friendly  
Integrated Transportation Plan for Greater Tripoli  
in the Republic of Lebanon



LOCATION MAP

## **REPORT COMPOSITION**

The Final Report of the Study is structured to meet the requirements of each user-group. It contains an executive summary, two main reports and six technical reports as follows:

EXECUTIVE SUMMARY: is designed to address the decision-makers as ministers and politicians who do not need deep information in technical and engineering aspects. It contains brief information on all the aspects of the Study and concentrates on the input and output of each aspect. It has also a more concentrated summary for the main conclusions in two pages.

MAIN REPORT – 1 “Integrated Transport Plan”: is designed for planners and directors of CDR and concerned ministries and authorities, who need more technical information on the Master Plan formulation. It contains applied planning policies, development and evaluation of alternatives, main information on the plan of each sector, evaluation results of the Master Plan and the overall implementation plan.

MAIN REPORT - 2 “Short-term Improvement Plan”: integrates more detailed studies and information on the urgent projects included under the Short-term Improvement Plan. The report gives the necessity, objectives, preliminary design, cost estimate and project evaluation on the technical, environmental and economic viability of each project.

TECHNICAL REPORT - 1 “Traffic Analysis and Forecast”: is basically prepared for technology transfer purposes. It addresses transport planners and contains the forecast procedures of forecasting future transport demand. The procedure starts with traffic surveys and analysis, socioeconomic framework, trip generation and attraction and the future transport demand.

TECHNICAL REPORT - 2 “Road Network Plan”: is for the specialists in the road planning and network development. It includes the present road network pattern as well as the planning concept and strategies, which are the basis of the proposed network pattern. Projects of the developed plan are prioritized for implementation under each of the planning periods.

TECHNICAL REPORT - 3 “Public Transport Plan”: is for the specialists in the public transport sector and schemes planned under the Master Plan. It includes the estimated future demand, proposed routes, required number of buses and cost estimation in addition to the implementation plan. It includes also plans and measures for taxi service and school buses.

TECHNICAL REPORT - 4 “Traffic Management”: is for the specialists in the traffic management sector and projects included under the Master Plan. It demonstrates the problems under existing conditions and the formulated plan that includes different procedures and measures for traffic signalization, parking control as well as safety and education measures.

TECHNICAL REPORT - 5 “Environmental Assessment”: gives the environmental conditions and initial environmental examination for the Study Area. Through an environmental impact study, it highlights the environmental issue in establishing the urban transport plan in order to emphasize the importance of preserving and improving the environment.

TECHNICAL REPORT - 6 “Project Management and Financing”: is addressing the administrative issues that will affect the successful implementation of the planned projects. It includes the present legislation, organization and funding system of agencies that will implement the projects under the Study. For the successful implementation of the projects as scheduled, management and financing plans are presented.

### APPENDIX

**MAIN REPORT - 1**  
**Table of Contents**

	<u>Page</u>
<b>CHAPTER 1 INTRODUCTION.....</b>	1-1
1.1 BACKGROUND OF THE STUDY .....	1-1
1.2 STUDY OBJECTIVES.....	1-1
1.3 STUDY AREA.....	1-1
1.4 STUDY FRAMEWORK.....	1-2
1.5 MAJOR ACTIVITIES AND TECHNOLOGY TRANSFER.....	1-2
1.6 STUDY ORGANIZATION.....	1-2
1.7 ORGANIZATION OF FINAL REPORT .....	1-4
 <b>CHAPTER 2 RELEVANT DEVELOPMENT PLANS AND STUDIES .....</b>	 2-5
2.1 LIST OF PLANS AND PROPOSED TRANSPORT PROJECTS .....	2-5
2.2 URBAN DEVELOPMENT PLANS.....	2-6
2.3 PROPOSED TRANSPORT PROJECTS.....	2-8
2.4 OTHER STUDIES .....	2-10
 <b>CHAPTER 3 URBAN TRANSPORT PLANNING POLICY .....</b>	 3-14
3.1 PROCEDURE OF URBAN TRANSPORTATION MASTER PLAN FORMULATION .....	3-14
3.2 PRESENT TRANSPORT ISSUES AND POSSIBLE SOLUTIONS.....	3-14
3.3 TRANSPORT DEMAND FORECAST.....	3-16
3.3.1 Socioeconomic Profile .....	3-16
3.3.2 Policy of Urban Development and Reform.....	3-18
3.3.3 Alternative Urban Development Scenarios .....	3-18
3.3.4 Future Land Use – Year 2020 .....	3-19
3.3.5 Socioeconomic Framework.....	3-20
3.3.6 Present Transport Pattern.....	3-20
3.3.7 Traffic Demand Forecast.....	3-23
3.3.8 Assigned Traffic Volume.....	3-24
3.4 MASTER PLAN PLANNING POLICY .....	3-28
3.4.1 Urban Development Policy .....	3-28
3.5 PRECONDITIONS OF MASTER PLAN FORMULATION.....	3-33
3.6 MASTER PLAN OBJECTIVES AND COMPONENTS.....	3-33
3.7 TARGETS OF THE PLAN.....	3-35
3.8 TRANSPORT PLAN CHARACTERISTICS .....	3-35
3.8.1 Environmental Friendly Plan.....	3-35
3.8.2 Integrated Plan.....	3-36
 <b>CHAPTER 4 ALTERNATIVES DEVELOPMENT AND EVALUATION .....</b>	 4-38
4.1 SECTORIAL POLICY AND ALTERNATIVES .....	4-38
4.2 MASTER PLAN ALTERNATIVES .....	4-38
4.3 COMPARATIVE ANALYSIS OF ALTERNATIVES .....	4-39
4.3.1 Traffic Demand by Alternative Plans .....	4-40
4.3.2 Traffic Assignment by Alternative Plans.....	4-41
4.3.3 Air Pollution by Alternative Plans .....	4-41
4.4 ECONOMIC EVALUATION.....	4-42

4.4.1	Procedure.....	4-42
4.4.2	Economic Cost.....	4-42
4.4.3	Economic Benefit.....	4-43
4.4.4	Economic Parameters.....	4-44
4.5	SELECTION OF OPTIMUM PLAN .....	4-44
<b>CHAPTER 5 TRANSPORT SECTORIAL PLAN .....</b>		<b>5-45</b>
5.1	ROAD NETWORK PLAN.....	5-45
5.1.1	Road Network Planning Concept.....	5-45
5.1.2	Road Network Development Concept.....	5-45
5.1.3	Road Network Development Projects.....	5-47
5.1.4	Intersection Improvement Project.....	5-49
5.1.5	Preliminary Cost Estimation .....	5-49
5.1.6	Prioritization of Road Projects .....	5-50
5.2	PUBLIC TRANSPORT PLAN.....	5-52
5.2.1	Plan Concept .....	5-52
5.2.2	Planning Alternatives .....	5-52
5.2.3	City Bus .....	5-52
5.2.4	Intercity Bus .....	5-55
5.2.5	City and Intercity Taxi .....	5-55
5.2.6	School Transport .....	5-56
5.2.7	Implementation Schedule .....	5-57
5.3	TRAFFIC MANAGEMENT PLAN .....	5-58
5.3.1	Plan Concept .....	5-58
5.3.2	Education and Public Awareness .....	5-58
5.3.3	Enforcement.....	5-58
5.3.4	Traffic Signalization.....	5-58
5.3.5	Pedestrian Facilities.....	5-59
5.3.6	Traffic Control Facilities.....	5-59
5.3.7	Parking Control.....	5-60
5.3.8	Traffic Safety Facilities.....	5-64
5.3.9	Implementation Schedule .....	5-65
5.4	INITIAL ENVIRONMENTAL EXAMINATION.....	5-65
5.4.1	Environmental Legislation .....	5-65
5.4.2	Environment Related Agencies.....	5-65
5.4.3	Initial Environmental Examination .....	5-66
5.4.4	Screening and Scoping.....	5-66
5.4.5	Items for EIA Study .....	5-68
5.4.6	Pollution Assessment .....	5-69
5.4.7	Evaluation and Mitigating Measures.....	5-70
5.4.8	Master Plan Impact on Air Quality .....	5-70
5.5	PROJECT MANAGEMENT AND FINANCING.....	5-72
5.5.1	Legislation .....	5-72
5.5.2	System and Organization.....	5-73
5.5.3	Financing .....	5-75
5.5.4	Estimation of Available Fund for Master Plan.....	5-79
<b>CHAPTER 6 MASTER PLAN EVALUATION .....</b>		<b>6-80</b>
6.1	OPTIMUM TRANSPORT PLAN.....	6-80
6.1.1	Integration in Selection Plan.....	6-80
6.1.2	Planning Tasks .....	6-80

6.1.3	Major Projects .....	6-81
6.2	TRANSPORT MASTER PLAN EVALUATION .....	6-85
6.2.1	Environmental Friendly Plan.....	6-85
6.2.2	Plan Integration.....	6-85
6.2.3	Fundamental Aspects.....	6-85
6.3	TRAFFIC ANALYSIS .....	6-85
6.3.1	Traffic Demand Forecast.....	6-85
6.3.2	Traffic Parameters .....	6-89
6.3.3	Network Efficiency .....	6-89
6.4	ECONOMIC ANALYSIS RESULTS.....	6-89
6.4.1	Economic Parameters.....	6-89
6.4.2	Sensitivity Analysis .....	6-90
6.5	MASTER PLAN EFFECTS.....	6-91
6.5.1	Target Realization.....	6-91
6.5.2	Indirect Benefits.....	6-91
 <b>CHAPTER 7 OVERALL IMPLEMENTATION PLAN.....</b>		<b>7-93</b>
7.1	IMPLEMENTATION FRAMEWORK .....	7-93
7.2	IMPLEMENTATION SCHEDULE.....	7-94
 <b>CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS.....</b>		<b>8-96</b>
8.1	INTEGRATED TRANSPORT PLAN .....	8-96
8.2	RECOMMENDATIONS.....	8-97
8.3	TECHNOLOGY TRANSFER.....	8-98



## List of Tables

		<u>Page</u>
Table 3.2-1	Present Transport Issues and Possible Solutions .....	3-15
Table 3.3-1	Income and Vehicle Ownership .....	3-17
Table 3.3-2	Future Socioeconomic Parameters for Study Area.....	3-20
Table 3.3-3	Vehicle Age .....	3-22
Table 3.3-4	Present and Future Vehicular Trips .....	3-24
Table 3.3-5	Person Trips by Trip Purpose and Mode.....	3-24
Table 3.3-6	Traffic Assignment Results .....	3-25
Table 3.3-7	Road Lengths by Traffic Congestion Degree.....	3-25
Table 3.4-1	Proposed Development Area.....	3-30
Table 4.2-1	Master Plan Alternatives.....	4-39
Table 4.3-1	Traffic Demand Forecast - 2020.....	4-40
Table 4.3-2	Traffic Indicators by Alternative Plan - 2020 .....	4-41
Table 4.3-3	Road Length by Traffic Congestion Degree 2020 .....	4-41
Table 4.3-4	Population by Accessibility Time and Alternative Plans – 2000 and 2020 .....	4-41
Table 4.3-5	Air Pollution by Alternative Plan.....	4-42
Table 4.4-1	Economic Cost for Master Plan Projects.....	4-42
Table 4.4-2	Vehicle Cost.....	4-43
Table 4.4-3	Fuel Cost.....	4-43
Table 4.4-4	Tire Cost.....	4-43
Table 4.4-5	Depreciation Cost.....	4-44
Table 4.4-6	Unit Traffic Cost by Vehicle Type.....	4-44
Table 4.4-7	Economic Parameters of Alternative Plans.....	4-44
Table 4.5-1	Scoring of Optimum Plan.....	4-44
Table 5.1-1	Road Length and Density.....	5-47
Table 5.1-2	Road Projects .....	5-48
Table 5.1-3	Estimated Preliminary Cost of Road Projects .....	5-51
Table 5.1-4	Prioritization of Road Projects .....	5-51
Table 5.2-1	Target Ratios of Public Transport .....	5-52
Table 5.2-2	City Bus Demand.....	5-54
Table 5.2-3	City Bus Operation Length.....	5-54
Table 5.2-4	City Bus Central Terminal.....	5-54
Table 5.2-5	Intercity Terminal Stalls .....	5-55
Table 5.2-6	City Taxi Demand .....	5-55
Table 5.2-7	Capacity of City Taxi Terminals.....	5-55
Table 5.2-8	Capacity of Intercity Taxi Terminals .....	5-56
Table 5.2-9	School Bus Demand.....	5-57
Table 5.2-10	Implementation Plan.....	5-57
Table 5.3-1	Garage and Parking Demand in the Central Area .....	5-61
Table 5.3-2	Parking and Garage Demands in the Central Area.....	5-61
Table 5.3-3	Parking Demand in the Central Area .....	5-61
Table 5.3-4	Parking Stalls required at the Central Area.....	5-62
Table 5.3-5	Implementation Plan.....	5-64
Table 5.4-1	Environment Related Agencies.....	5-65
Table 5.4-2	Screening of Master Plan Projects.....	5-67
Table 5.4-3	Scoping of Master Plan.....	5-68
Table 5.4-4	Items Required for EIA .....	5-69
Table 5.4-5	Environment Survey Stations .....	5-69
Table 5.5-1	Laws and Regulations Relating to Transport in Lebanon.....	5-73
Table 5.5-2	Summary of Fiscal Performance (1996 to 2001) .....	5-76
Table 5.5-3	Public Debts .....	5-76
Table 5.5-4	Financial Resource for the Five Year Development Plan (2000-2004).....	5-77
Table 5.5-5	National, MOPWT and Tripoli Municipality Budget.....	5-78
Table 5.5-6	Financial Resources for the Master Plan Projects.....	5-79

Table 5.5-7	Required and Available Fund .....	5-79
Table 6.1-1	Summary of Major Projects .....	6-81
Table 6.3-1	Traffic Parameters .....	6-89
Table 6.3-2	Speed and Congestion.....	6-89
Table 6.3-3	Accessibility Coverage of Population .....	6-89
Table 6.4-1	Economic Cash Flow of Master Plan.....	6-90
Table 6.4-2	Sensitivity Analysis .....	6-91
Table 7.1-1	Estimated Budget for Transport Sector in Greater Tripoli.....	7-94
Table 7.1-2	Overall Implementation Schedule .....	7-95

## List of Figures

		<u>Page</u>
Figure 1.4-1	Study Flow Diagram.....	1-3
Figure 1.6-1	Organization of the Study.....	1-4
Figure 2.2-1	Proposed Locations of Land Readjustment Schemes .....	2-7
Figure 2.2-2	Locations of Proposed Intersections for Signalization .....	2-11
Figure 3.1-1	Procedure of Urban Transportation Master Plan Formation.....	3-14
Figure 3.3-1	Urban Structure and Topography.....	3-16
Figure 3.3-2	Present Land-use .....	3-16
Figure 3.3-3	Present Population Distribution.....	3-17
Figure 3.3-4	Basic Floor Area Ratio .....	3-18
Figure 3.3-5	Population Distribution (Scenario – 3) .....	3-19
Figure 3.3-6	Future land Use Plan – 2020.....	3-20
Figure 3.3-7 (1)	Person Trip Rate by Gender.....	3-21
Figure 3.3-7 (2)	Person Trip Rate by Age Group .....	3-21
Figure 3.3-8 (1)	Generated Trips by Time and Mode .....	3-21
Figure 3.3-8 (2)	Generated Trips by Time and Purpose .....	3-21
Figure 3.3-9 (1)	Person Trip Composition by Transport Mode .....	3-21
Figure 3.3-9 (2)	Person Trip Generation by Trip Purpose.....	3-21
Figure 3.3-10	Person Trip Length Distribution .....	3-22
Figure 3.3-11	Person Desire Line Chart .....	3-22
Figure 3.3-12	Present and Future Generated and Attracted Trips.....	3-23
Figure 3.3-13	Future Desire Line Chart – 2020.....	3-23
Figure 3.3-14	Present and Future Assigned Traffic .....	3-26
Figure 3.3-15	Present and Future Assigned Traffic (Travel Speed) .....	3-27
Figure 3.4-1	Regional Setting of Greater Tripoli.....	3-29
Figure 3.4-2	Freight Transport and Logistics Strategy .....	3-30
Figure 3.4-3	Spatial Distribution of Population and Urban Activity.....	3-31
Figure 3.4-4	Conceptual Plan of Transport System .....	3-32
Figure 3.6-1	Development Policy and Plan Components.....	3-34
Figure 4.1-1	Selection of Optimum Plan.....	4-39
Figure 4.2-1	Schematic Master Plan Alternatives .....	4-40
Figure 5.1-1	Present and Proposed Schematic Road Network.....	5-46
Figure 5.1-2	Road Network Projects .....	5-49
Figure 5.2-1	Public Transport Scheme .....	5-53
Figure 5.2-2	City Bus Routes .....	5-54
Figure 5.2-3	Terminal and Taxi Stands .....	5-56
Figure 5.3-1	Traffic Signals and Control Facilities .....	5-59
Figure 5.3-2	Location of On-Street Parking Meters .....	5-62
Figure 5.3-3	Intersection Approach Capacities .....	5-63
Figure 5.3-4	Off-Street Supply & Prohibited On-Street Locations.....	5-63
Figure 5.4-1 (1)	Average Concentrations of CO (ppm).....	5-70
Figure 5.4-1 (2)	Average Concentrations of SO <sub>2</sub> (ppm).....	5-70
Figure 5.4-1 (3)	Average Concentrations of NO <sub>2</sub> (ppm) .....	5-70
Figure 5.4-1 (4)	Average Concentrations of TSP .....	5-70
Figure 5.4-2	CO Emission Reduction of Master Plan.....	5-71
Figure 5.4-3	CO Emission Reduction of Public Transport.....	5-71
Figure 5.5-1	Financial Resources for Five-Year Development Plan (2000-2004) .....	5-77
Figure 6.1-1	Master Plan Projects – 2005 (1/3).....	6-82

Figure 6.1-1	Master Plan Projects – 2010 (2/3) .....	6-83
Figure 6.1-1	Master Plan Projects – 2020 (3/3) .....	6-84
Figure 6.3-1	Traffic Assignment Comparison (1/3).....	6-86
Figure 6.3-1	Traffic Assignment Comparison (2/3).....	6-87
Figure 6.3-1	Traffic Assignment Comparison (3/3).....	6-88

## LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
B/C	Benefit-Cost Ratio
BOT	Built, Operate and Transfer
CAS	Central Administration of Statistics
CBD	Central Business District
CDR	Council for Development and Reconstruction
CEGP	Council Executive des Grand's Projects
CNG	Compressed Natural Gas
CO	Carbon Monoxide
COM	Council of Ministers
DGHB	Directorate General of Highways and Buildings
DOR	Directorate of Road
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ERM	Environmental Resource Management
EU	European Union
FAR	Floor Area Ratio
FHWA	Federal Highway Administration
FYDP	Five Year Development Plan
GDP	Gross Domestic Products
GNP	Gross National Products
GOJ	Government of Japan
GOL	Government of Lebanon
HC	Hydrocarbon
HCM	Highway Capacity Manual
IBRD	International Bank for Reconstruction and Development
IEE	Initial Environmental Examination
ISF	Internal Security Force
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
LL	Lebanon Lira, Lebanon Pound
LOS	Level of Service
LRT	Light Railway Track
MEA	Middle East Airlines
M/P	Master Plan
MOE	Ministry of Environment
MOF	Ministry of Foreign Affairs
MOMRA	Ministry of Municipal and Ruler Affairs
MOI	Minister of Interior
MOPWT	Ministry of Public Works and Transport

MPWT	Ministry of Public Works and Transportation
NAC	Noise Abatement Criteria
NERP	National Emergency Reconstruction Program
NGOs	National Governmental Organizations
NO	Nitrogen Dioxide
NPV	Net Present Value
OD	Origin-Distention
ODA	Official Development Assistance
O & M	Operation and Management
ORRPT	Office of Rail Road & Public Transport
PCE	Passenger Car Equivalent
PCU	Passenger Car Unit
PDR	Plan Dimension Ratio
PIU	Project Implementation Unit
PMT	Project Management Team
RC	Reinforced Concrete
RER	Real Estate Registry
ROW	Right of Way
STRADA	JICA System for Traffic Demand Analysis
TCC	Technical Coordination Committee
TSP	Total Suspended Particulate
TTC	Travel Time Cost
UNICEF	United Nation Children's Fund
USEPA	United State Environmental Protection Agency
V/C	Volume-Capacity Ratio
VOC	Vehicle Operating Cost
WHO	World Health Organization
WTW	Water Treatment Works

# **CHAPTER 1**

## **INTRODUCTION**

# CHAPTER 1

## INTRODUCTION

### 1.1 BACKGROUND OF THE STUDY

Since the end of the civil war in early 90s, the Government of Lebanon has focused its activities on the reconstruction and development throughout the country. In 1994, “Horizon 2000” was established with the approval of the cabinet as the core policy of the development program, through some reviews and alterations of previous development plans. The target year of the present program, that covers all the development sectors, is the year 2007. The program emphasizes on the need to improve the road transport sector as one of the basic infrastructures. In addition, the national policy is calling for the decentralization of the Government, which gives Tripoli higher future role as the capital of the north.

Tripoli is the second largest city in Lebanon and the capital of the northern region. The development of Greater Tripoli Area through carrying out various infrastructure projects will encourage private investments and improve the economical base of the city so it can assume its future role. Linked with international routes that go across the border of Syria, Tripoli is the core city of land transportation in the area since long years ago due to the merit of its location facing the Mediterranean. In addition to a non-operated airport, Tripoli has the port that handles the second largest volume of cargo in Lebanon. Tripoli has a high potential in development, as it is an important tourism center in the country with many touristic and historical, and moreover being the center of financial services.

The transportation system of Greater Tripoli is lacking many facilities as it depends comprehensively on private cars, and shared-taxi is the most dominant mode for public transportation. With the rapid growth in population, urbanization and motorization, the problem of traffic congestion has imposed itself to be a major issue for concerned authorities. They decided that in order to solve the transport problems in the city, a comprehensive master plan covers the areas of road network improvement; public transport and traffic management should be developed with a time horizon of 2020.

In response to the request of the Government of Lebanon, the Government of Japan has decided to conduct “The Study on Environmental Friendly Integrated Transportation Plan For Greater Tripoli” (hereinafter referred to as “the Study”), in accordance with the relevant laws and regulations in force in Japan. The Government of Japan has entrusted the Study to the Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical assistance programs of the Government of Japan, to undertake it in close cooperation with the authorities in Lebanon.

JICA has organized and dispatched a Study Team to Lebanon consisting of experts from Katahira & Engineers International to commence the study in October 2000. The Study proceeded for about fourteen months in Lebanon and Japan, and its Final Report was submitted to the Government of Lebanon in December 2001.

### 1.2 STUDY OBJECTIVES

The objectives of the Study are set up as follows:

1. To formulate an Urban Transportation Master Plan (M/P) for the Greater Tripoli Area to the year 2020, in order to alleviate present traffic congestion and to ensure safe mobility;
2. To formulate a 5-year plan composed of priority projects identified under the M/P; and
3. To pursue technology transfer to the Lebanese counterpart personnel in the course of the Study.

### 1.3 STUDY AREA

The M/P covers the Municipalities of Tripoli, El-Mina, El-Bedaoui, Mejdlaya and Ras-Maska, while the 5-year plan shall cover the Municipalities of Tripoli, El-Mina and El-Bedaoui. In Principal, the



Study Area includes the areas west of the Northern Motorway and its corridor in the five municipalities of Tripoli, El-Mina, El-Bedaoui, Mejdlaya and Ras-Maska. The location map is shown next to the covering title page of this report.

#### 1.4 STUDY FRAMEWORK

The Study is basically composed of two main phases. The first phase is to carry out field surveys and to formulate an urban transport plan for Greater Tripoli. The second phase is to formulate a Short-term Improvement Plan, including further studies on high priority. Figure 1.4-1 shows the framework and tasks' flow of the Study.

#### 1.5 MAJOR ACTIVITIES AND TECHNOLOGY TRANSFER

The Study Team arrived at Lebanon on the beginning of October 2000, and the presentation of the Inception Report to the Steering Committee chaired by the CDR on October 4, 2000 commenced the Study. On October 26, 2000 a Workshop on the Study was conducted in Beirut with the participation of the Minister of Public Works and Transport in Lebanon, JICA Advisory Committee and members of the Steering Committee, Counterpart Team and Study Team.

During the course of the Study, technology transfer was conducted through continuous participation of counterpart members in all tasks of the Study. Counterpart members also facilitated the coordination with officials of related agencies in Tripoli and Beirut for the smooth implementation of the Study.

#### 1.6 STUDY ORGANIZATION

The organization chart of the Study, which clarifies the interrelationship between different agencies, committees and teams involved in the Study, is presented in Figure 1.6-1. The following experts compose the Study Team organized by JICA to carry out the Study:

Mr. BEKKI Tsuneo	Team Leader / Transport Planner
Dr. HANI Abdel-Halim	Deputy Team Leader / Road Planner
Mr. KURAUCHI Katsumi	Urban Planner
Mr. KIUCHI Mitsuo	Traffic Survey / Forecast Expert
Mr. NISHIDA Takashi	Institution / Organization Expert
Dr. Ahmed EL-HAKIM	Traffic Management Planner
Mr. KIMURA Toshio	Traffic Management Planner
Mr. YUMITA Kazuo	Transport Economist
Mr. Sudad RAAD	Natural / Social Environmentalist
Mr. YASHIRO Shuichi	Traffic Survey / Forecast Expert

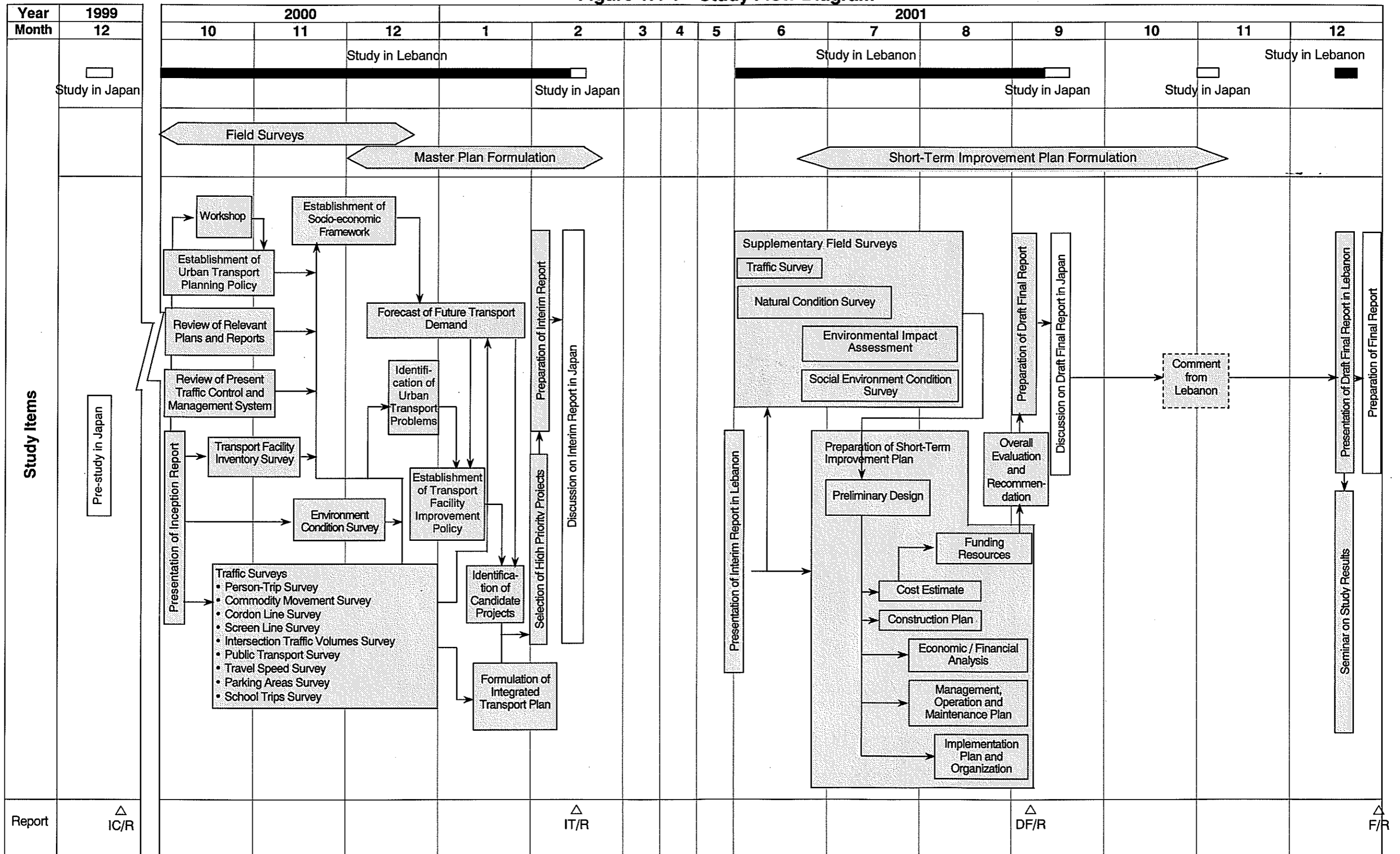
The guidance for the Study was realized through JICA Advisory Committee, which consisted of the following Japanese Government Officials:

Prof. Dr. KUSE Hirohito	Chairman	Tokyo University of Mercantile Marine
Mr. MORI Hideki	Member	Planning Division, Yokohama City
Mr. YOSHIDA Nobuhiro	Member	Ministry of Land, Infrastructure and Transport
Mr. OBATA Akihiro	Member	Ministry of Land, Infrastructure and Transport

The Study was conducted under the supervision of the First Development Study Division, Social Development Study Department, JICA Headquarter, Tokyo

Mr. HIRAI Toshio	Director
Mr. KAIBARA Takao	Ex Director
Mr. UMENAGA Satoshi	Deputy Director
Ms. HONDA Eri	Ex Deputy Director
Mr. KONYA Kenichi	
Mr. KOIZUMI Yukihiro	

Figure 1.4-1 Study Flow Diagram



▨ : Study in Lebanon

□ : Study in Japan

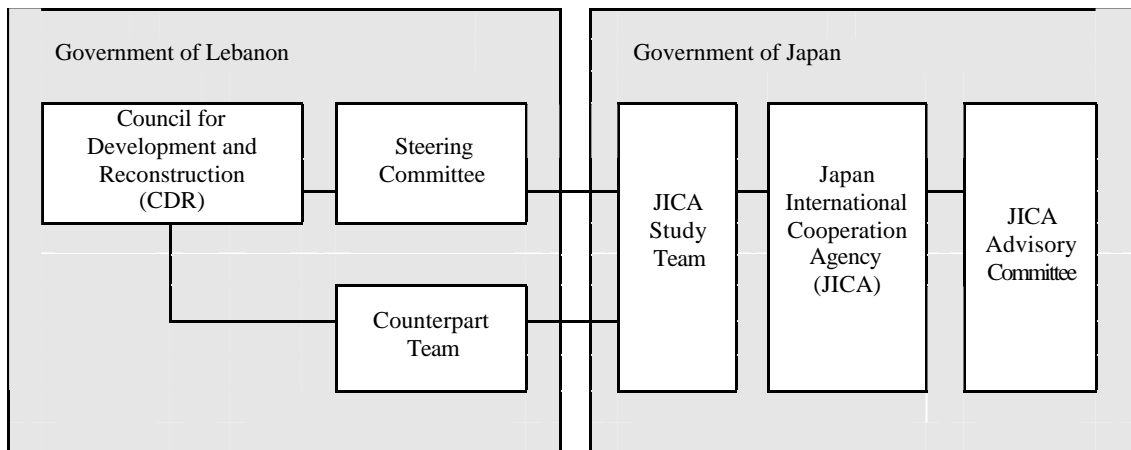


Figure 1.6-1 Organization of the Study

The Government of Lebanon established a Steering Committee consisting of the following members to discuss major policies on the Study with the Study Team:

Mr. Elias Helou	Project Coordinator / Transport and Traffic, CDR
Ms. Nada Mufarej	JICA Liaison/Grant Coordinator, CDR
Dr. Wafa Charafeddine	Environmental and Regional Development, CDR
Ms. Nathalie Rayes	Transportation Economist, CDR
Mr. Jawdat Abou Jaoude	Urban Planning, CDR
Mr. Abboud Khayr	Regional Director, Ministry of Public Works and Transport
Dr. Nabil Harb	Technical Advisor, Ministry of Public Works and Transport
Mr. Mikael Kareh	Mayor, Ras-Maska Municipality
Mr. Abdallah Abdul-Wahab	Head of Engineering Dept., Union of Al-Fayhaa Municipalities
Mr. Nazih Raad	Head of Engineering Section, Municipality of Tripoli
Mr. Jalal Abs	President of Urban Planning Committee, Municipality of Tripoli
Mr. Ghassan Chmeiseh	President of Planning Committee, Municipality of Tripoli
Mr. Said Lebien	Civil Engineer, Union of Coastal Municipalities, Representative of Mejdlaya Municipality

For the smooth implementation of the Study and to assure optimum technology transfer, the Lebanese side assigned CDR Counterpart Team covering the following fields:

Mr. Elias Helou	Project Coordinator / Transport and Traffic
Dr. Wafa Charafeddine	Environmental and Regional Development
Ms. Nathalie Rayes	Transportation Economy
Mr. Jawdat Abou Jaoude	Urban Planning

## 1.7 ORGANIZATION OF FINAL REPORT

The Final Report consists of 10 Volumes, as follows:

1. Executive Summary
2. Main Report 1: Integrated Transportation Plan
3. Main Report 2: Short-Term Improvement Plan
4. Technical Report 1: Traffic Analysis and Forecast
5. Technical Report 2: Road Network Plan
6. Technical Report 3: Public Transport Plan
7. Technical Report 4: Traffic Management Plan
8. Technical Report 5: Environmental Assessment
9. Technical Report 6: Project Management and Financing
10. Appendix

## **CHAPTER 2**

# **RELEVANT DEVELOPMENT PLANS AND STUDIES**

## CHAPTER 2

### RELEVANT DEVELOPMENT PLANS AND STUDIES

The city of Tripoli has a long and distinguished history for its two main parts of the Old City and the port area of El-Mina. Since independence in 1946 Tripoli becomes the administrative capital of northern Lebanon. It suffered some damage during the civil war but not nearly as much as the south of the country. Today it is concentrating on rebuilding its industry and business sectors and is looking to tourism as a source of future income. The expansion in the urbanized area around the city resulted in increasing the transport demand for people and goods that give an urgent importance to the development of the transport infrastructure network based on a sustained urban structure.

The first urban development plan for Tripoli was established in the late 1930s in which different areas between Tripoli and El-Mina was developed on readjustment scheme basis. A zoning system was established in 1971 for the urban planning and coding system of the city. After the Civil war, readjustment plans were formulated and implemented in some areas in which 25% of the land is acquired for the construction of infrastructure facilities.

In the process of planning and implementing major transport and other infrastructure projects during the last few years, studies and plans were established. The following sections present summarized information on the available relevant plans and studies.

#### 2.1 LIST OF PLANS AND PROPOSED TRANSPORT PROJECTS

Urban development plans and proposed transport projects are listed below:

Name of Study/Plan	Agency	Status
<u>Urban Development Plans:</u>		
1) Tripoli West Land Readjustment Plan	MPWT	• Infrastructure completed. Building permits are being issued.
2) Tripoli North Land Readjustment Plan	CDR	• The plan was legally approved.
3) Land Readjustment Plan along East Ring Road	MPWT	• The plan was legally approved. Infrastructure is being developed in accordance with this plan.
4) Tripoli Urban Planning Study	MPWT	• The study is ongoing and scheduled to be completed in year 2002.
<u>Proposed Transport Projects:</u>		
1) East Ring Road	CDR	• Road ROW is reserved by 3) above. A short section is under construction. Financed by the Islamic Development Bank.
2) West Ring Road (Tripoli North Exit Expressway)	CDR	• Road ROW is reserved by 2) above. F/S is being proposed to be carried out.
3) Arab Highway (Coastal Motorway Study)	CDR	• F/S was completed.
4) Traffic Signalization Project	CDR	• Financed by the Government of Saudi Arabia.
5) Public Transport Study in Tripoli and North Lebanon	MPWT	• A French Team undertook the study. MPWT is planning to implement city bus operation within 2001.
<u>Other Studies:</u>		
1) Tripoli Water Supply and Wastewater System	CDR	• The study was completed in 1999.

Name of Study/Plan	Agency	Status
2) Tripoli Sewer Networks	CDR	• The detailed design report was completed in 2000.
3) Quleaat Airport and Free Trade Zone Development	MPWT	• The study was completed in 1999.

## 2.2 URBAN DEVELOPMENT PLANS

### 1) Tripoli West Land Readjustment Plan

The land readjustment plan was formulated in early 1970s. Infrastructure such as road network and water supply was completed in 1998. The area is due for urban development. Since 1999, building permits are being issued, however, over 90% of the land area is still vacant at present.

### 2) Tripoli North Land Readjustment Plan

The land readjustment plan was formulated and authorized by the law in 2000. The land area is currently agricultural land and no infrastructure is developed yet. The plan includes West Ring Road.

### 3) Land Readjustment Plan along East Ring Road

The land readjustment plan was formulated in early 1970s. The plan's objective was to reserve the right-of-way (ROW) of the East Ring Road.

### 4) Tripoli Urban Planning Study

The Urban Planning Study is an ongoing study by a Lebanese consultant under the General Directorate for Urbanization of the Ministry of Public Works to formulate a detailed urban plan for the municipalities of Tripoli, El-Mina, El-Bedaoui and Ras-Maska that belongs to the Cadas of Tripoli and El-Quora, As shown in Figure 2.2-1. The study just started few months before this transport study and is expected to continue for a total period of about two years up to 2002. Objectives of the study are:

1. To formulate urban development plan
2. To identify the technical requirements for formulating a comprehensive administrative plan for the study area mentioned above.
3. To prepare an implementation plan and required administrative procedures

In general, the study has two stages, in which the first stage includes the following tasks:

#### Investigations and Analyses:

1. All available data, information, research works related to the study area will be investigated and collected to compose a part of the study.
2. Field surveys will be conducted to collect information on each building
3. Photo files will be prepared to include old and present photos
4. Related studies in other ministries will be utilized.

#### Components:

- |                              |   |
|------------------------------|---|
| 1. Study Area identification | 6. Historical, archeological and heritage areas |
| 2. Land use survey           | 7. Environmental features                       |
| 3. Demography                | 8. Public works facilities and services         |
| 4. Transport system          | 9. Economic activities                          |
| 5. Infrastructure            | 10. Area development                            |

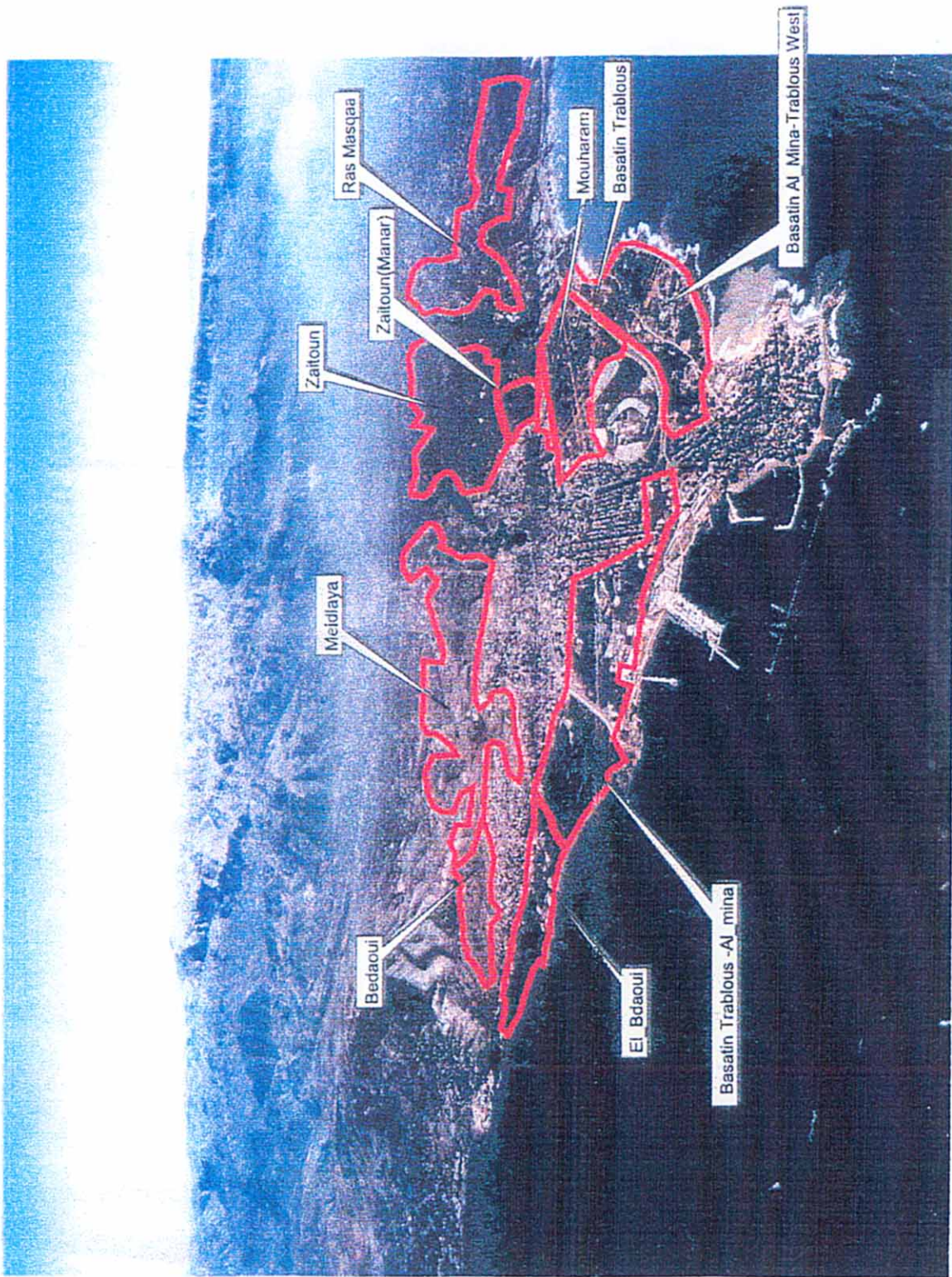


Figure 2.2-1 Proposed Locations of Land Readjustment Schemes

### Conclusions:

1. Conceptual procedure for each of the above components to be used in the future planning
2. Analytical study on existing area of buildings
3. Maps for existing and newly constructed buildings
4. Population projections and required infrastructure
5. Evaluation and recommendations on urban development of the area
6. Obstacles of economic development and means for growth in economic and tourism sectors.

### Planning Alternatives:

Two planning alternatives will be provided to include procedures to protect historical building and proposals for land-use, building classifications and architectural considerations. The General Directorate for Urbanization will select the most appropriate alternative to be the base of activities during the second stage.

The urban development plan will be formulated in the second stage to include the followings:

1. Main features, hierarchy and classification of the road network
2. Land-use classification, zoning system and population density in present and future
3. Infrastructure and land development requirements.

The Interim Report of the study, which covers tasks of the first stage, is being prepared to include the following chapters:

- |           |  |
|-----------|--|
| Chapter 1 | Study Area Definition:<br>Study Area Identification – Location – Historical Background   |
| Chapter 2 | Natural Features<br>Climate – Photographic Survey (Locational Morphology) – Geology of Study Area – Hydrogeology – Soil – Agriculture – Land Cover   |
| Chapter 3 | Cultural Features (Urban Structure)<br>Urbanization – Demography Structure and Characteristics – Housing – Establishments and Economic Facilities – Public Works and NGO – Historical and Features             |
| Chapter 4 | Infrastructure<br>Transportation and Traffic Movement – Electricity and Lighting – Telecommunications – Potable Water – Waste Water – Solid Waste  |
| Chapter 5 | Synthesis<br>Analysis of Building Codes and Approved Plans – Analysis of Existing Building Volumes and Areas – Land Ownership – Land Value – Environmental Assessment – Assessment of Existing Urban Structure |
| Chapter 6 | References   |

## **2.3 PROPOSED TRANSPORT PROJECTS**

### 1) East Ring Road

The Land Readjustment Plan reserves road right of way for East Ring Road. A short section in Abou Samra is under construction with a 4lane divided standard. The Islamic Development Bank has financed for the construction of the remaining sections.

### 2) West Ring Road (Tripoli North Exit Expressway)

This expressway is the Tripoli Western Coastal Expressway, which is an extension of the existing coastal expressway south of the city (Behsass – El-Mina highway). On July 1998, a revised proposal for the consultancy services was prepared to include a description of the proposed expressway and the scope of the consultancy services. The required services are divided into four stages as follows:



Stage (1): Detailed reconnaissance, data collection and site survey;  
Stage (2): Preliminary Design Report  
Stage (3): Draft Final Design Report  
Stage (4): Final Design Report

The proposed expressway has an alignment of 4.5 km that starts at the end of the existing expressway north of Tripoli Fair and runs eastward to El-Bedaoui. It is divided into four segments for implementation and crosses four main roads. It was expected to handle a traffic volume of 18,000 vehicles in 1998. Based on an annual traffic growth rate of 3.5% for 20-year design period, the daily traffic volume is estimated as 35,640 vehicles for both directions in the year 2018.

The proposed cross section accommodates 2 lanes for each direction. The design includes, however, several cross section arrangements due to the complexity of the intersections with the existing roads. For sections require service roads, the right of way is designed as 80 m, while other sections require only 32 m of right of way. Four interchanges are proposed as grade-separation structures at main intersections including an interchange facing the port entrance to allow the direct access from the port to the expressway.

On the basis of a reconnaissance survey, the total cost was estimated as US\$ 13.5 million including overpasses, underpasses, interchanges, service roads, equipment, street lighting and 10% as contingencies, but excluding land acquisition cost. A preliminary economic analysis on the estimated cost and benefit shows that the expected Internal Rate of Return is 12% after implementing the project.

### 3) Arab Highway (Coastal Motorway Study)

A feasibility study was conducted, on May 1998 by a Lebanese consultant, on two sections of the proposed coastal motorway, which extends from Tripoli to the Syrian border. The first section has a length of 23km from Qalamoun, just south of Tripoli to Abdeh. The second section is going from Abdeh to the Syrian border at the two locations of Arida on the Mediterranean and Abboudieh with a total length of 28.5km. The economic feasibility study was carried out basically to support applications for international funding.

The adopted methodology in the study included an analysis of the travel needs in the corridor between Tripoli and Syrian border, and its influence area. Traffic surveys that were performed included roadside origin - destination (OD), automatic counting, turning movement counts, classification counts, speed-delay studies and road network inventory. Trip interchange identified from the OD surveys was utilized to calibrate a model that replicates traffic volumes on each link of the network. The OD surveys conducted in 1996 were updated based on additional traffic counts conducted in early 1998 and the detected growth rate during this period was amounted to about 3.4% annually. In 1997, and due to political instabilities, growth in GDP was reported at only 3-4%, which may result in low traffic growth. Additional trips were added for the committed plan of the free industrial area and airport development in Qlaiaat.

Required improvement schemes were determined based on field surveys of the existing roads and investments were estimated based on costs in similar projects. Vehicle operating costs and benefits were calculated for various vehicle types, speeds and road conditions.

Results of the feasibility study clarify that the improvement of the corridor under study, which comprises widening and improvement of the section Abdeh – Homs to a 6lane highway and the section of Abdeh – Abboudieh and Arida roads to a 4lane cross-section, shows a modest EIRR. In addition, it was found that the combination of such improvements with a motorway from Qalamoun to Abdeh presents a viable high level-of-service facility connecting Lebanon and Syria, which is economically feasible and that requires much less investment than constructing a motorway on a new alignment between Abdeh and the Syrian borders in Arida and Tel Hmaira.

#### 4) Traffic Signalization Project

This project was initiated in 1996 as a part of a comprehensive project to be financed by a Saudi grant for installing signals for 23 intersections in Tripoli city and 6 intersections in El-Mina city as well as for improving the lighting system in the two cities. The locations of proposed intersections for signalization are shown in Figure 2.2-2. A large portion of the fund, however, was used for the renovation of the municipality building and to construct two grade-separation projects in Tripoli.

The remaining fund is expected to cover only 16 signals comprising of 12 intersections in Tripoli and 4 in El-Mina, for which tendering announcements were done twice without success. CDR is going to proceed in implementing the project in the near future for these 16 selected intersections.

Basically, the project intersections were selected based on experience of local conditions without due consideration to traffic volume measurements or estimations. They were not also subject to planning and prioritization procedures or feasibility studies and the existing design may contradict with future management plans.

#### 5) Public Transport Study in Tripoli and North Lebanon

The report of this study was finalized in January 1995 and four lines were recommended to formulate the first phase of a public transport plan in the study area. The routings of the four lines are:

Line 1: El-Mina – El-Qoubbe	16 buses
Line 2: El-Mina – Abou Samra	13 buses
Line 3: Ras-Maska – El-Bedaoui	7 buses
Line 4: Zgharta – Seraildanie	7 buses

Demand was estimated based on estimated population in major zones from electoral lists as well as observations on existing primary routes of public transport, mainly service taxis. Frequency was estimated to range between 10minutes in peak hours on the first two lines, to 20 minutes on others. Some geometric improvements were proposed to utilize the road network in serving large size of buses to accommodate a number of 50 passengers.

A regional network between Tripoli and major cities in the region, composed of scheduled lines, was established to provide morning and evening services for commuting purposes.

The study also included collective taxi services and recommendations to provide better sidewalk functionality. In addition, a bus terminal was proposed to have other functions such as parking area, freight center, information center and services for operators and management units.

## 2.4 OTHER STUDIES

### 1) Tripoli Water Supply and Wastewater System

The study of Redesign of Tripoli Water Supply and Wastewater System was carried out by the Bureau Technique pour le Development and its Final Design Report was submitted in May 1999 to the Council for Development and Reconstruction (CDR) and Ministry of Hydraulic and Electric Resources. The objective of the study was to update a previous master plan, which was limited to define the rehabilitation works of the existing network. The report gives a description of the characteristics of the project area, a presentation of the project background, an appraisal of the urban development projects, future land-use and population figures and till the requested justification.

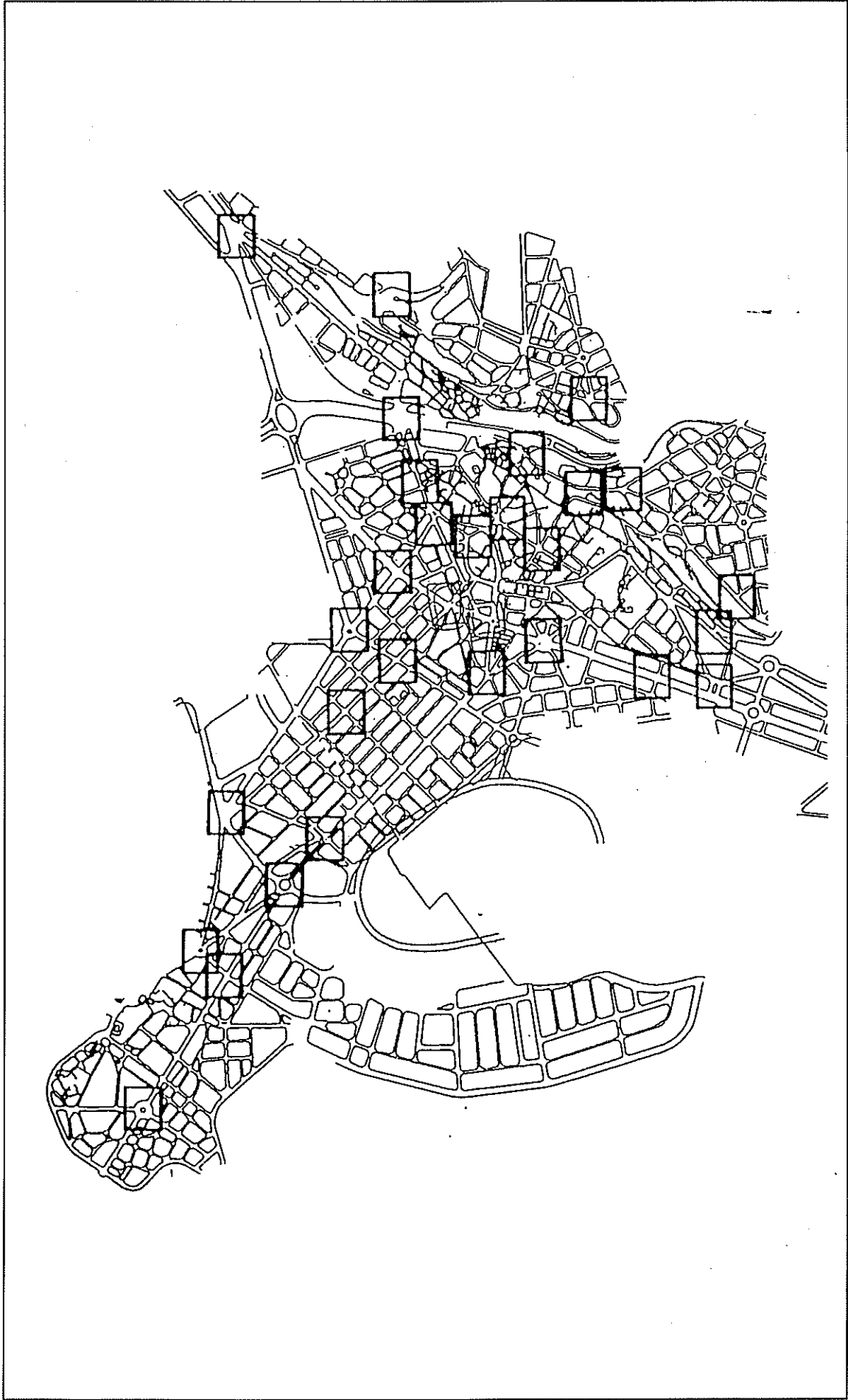


Figure 2.2-2 Locations of Proposed Intersections for Signalization

The project area covers the coastal strip that includes the metropolitan area of Tripoli, El-Mina, New Tripoli, El-Qoubbe and Abou Samra, all of which fall under the jurisdiction of Tripoli Water Authority. The total number of population in the study area was estimated as 368,326 inhabitants. Main tasks of the study include:

1. Evaluation of future water demand of the study area
2. Finding of additional water resources by drilling and equipping new wells in order to satisfy the evaluated demand.
3. Improvement of the water distribution by:
  - Upgrading pumping stations
  - Building new reservoirs
  - Laying new pipelines.

The study was carried out into four phases as follows:

Phase I: Evaluation of future water demand, finding of additional water resources and upgrading of the master plan.

Phase II: Preparation of designs for all works, standard details, layouts and building dimensions.

Phase III: Preparation of design calculations, construction drawings and all contract documents

Phase IV: Preparation of Final Design Report.

The description of various project concepts in the study is followed by a presentation of the design basis and the technical design for the various project concepts, i.e. the transmission system, the distribution network, the reservoirs, the pumping stations and boreholes

## 2) Tripoli Sewer Networks

The study of Redesign of Tripoli Sewer Networks was carried out by the Bureau Technique pour le Development and its Final Detailed Design Report was submitted in August 2000 to the Council for Development and Reconstruction (CDR) and Ministry of Interior and Municipalities.

The objective of this study is to design the first stage of the feasibility study that was previously conducted and concluded that one treatment plant should be constructed to serve Tripoli and the surrounding district with a sea outfall to discharge treated effluent. The site of the wastewater treatment plant and sea outfall headwork is on the north side of Abou Ali River where effluents are discharged to the sea.

In addition, the study concludes that 155 km of main wastewater collection lines and about 130 km of smaller sewers should be laid before the year 2020. As for storm water, 285 km of pipelines with diameters varying between 300 mm and 2000 mm should be laid also before the year 2020.

The first stage works in the feasibility study include 181 km of new collectors, secondary collectors and sewer networks out of the planned 285 km in addition to 19 km of storm water pipelines. The general scope of works include the following:

- Review the feasibility study and prepare the detailed scope of works to be designed, with cost estimates.
- Carry out investigations and data collection as necessary to provide information required for the detailed design.
- Prepare detailed design and engineering drawings for all facilities identified within the scope of design works.
- Prepare all documentation for land expropriation.
- Ensure that the criteria set out in the environmental assessment are satisfied in the detailed design.
- Take all necessary measures to identify and protect antiquities affected by construction works.
- Prepare tender specifications and other tender documents for contract packages.

- Prepare operation and maintenance schedules.
- Define cost estimates and planning schedules.
- Prepare documents for pre-qualification of contractors and review of submissions.
- Assist in review of tenders for construction works.
- Monitor and report on progress of works.

The study was carried out into five phases as follows:

- Phase I: Evaluation of wastewater flows and review of the feasibility study.
- Phase II: Carrying out of investigations and data collection as necessary to provide information required for detailed design.
- Phase III: Preparation of draft detailed design and engineering drawings for all facilities identified within the scope of design works.
- Phase IV: Preparation of final design and design calculations, construction drawings and all contract documents
- Phase V: Preparation of final report and tender documents.

### 3) Quleaat Airport and Free Trade Zone Development

The project area is located 25 km north of Tripoli and 7 km south of the border with Syria. The site covers an area of approximately 5.5 million square meters and features access to the international highway and coastal road as well as the seaport of Tripoli. The project consists of two major objectives: developing a number of zones (free trade zone, light industrial zone, tourism and leisure area) in the northern part of the site, and transforming the military airport in the southern part of the site into an international airport to serve northern Lebanon and new development zones.

The government's intention is to pass the facility over to a private design- build-operate-transfer operator who will develop a program that fulfills the regional objectives of

- Job creation and economic development
- Regional enhancement
- Quality and efficient airport operation
- High-quality development
- Good financial results

The immediate goal is to rehabilitate the airport and to convert it into a joint use civil/military airport. Civil activities would include accommodating passengers and air cargo operations for scheduled or charter aircrafts. Possible uses of the development projects include:

- Creation of a free trading zone: as part of the country's major construction and development program, the government is establishing areas of free trade status to facilitate private investment and to increase trade flows throughout the region. Quleaat has been identified as a possible free trade zone.
- Creation of a tourism and leisure area: the property includes real estate along the Mediterranean coast. The proximity to the sea, as well as numerous existing and potential tourist attractions are likely to create an increase in aviation demand.

The government is interested in the quick and efficient disposition of the existing airport. A concession period is approximately planned for a period of 30 years and the capital cost for the project is estimated to be approximately US\$440 million over the entire concession period.