

CHAPTER 3

URBAN TRANSPORT PLANNING POLICY

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3.1 PROCEDURE OF URBAN TRANSPORTATION MASTER PLAN FORMULATION

The procedure applied for urban transportation master plan formulation is shown in Figure 3.1-1.

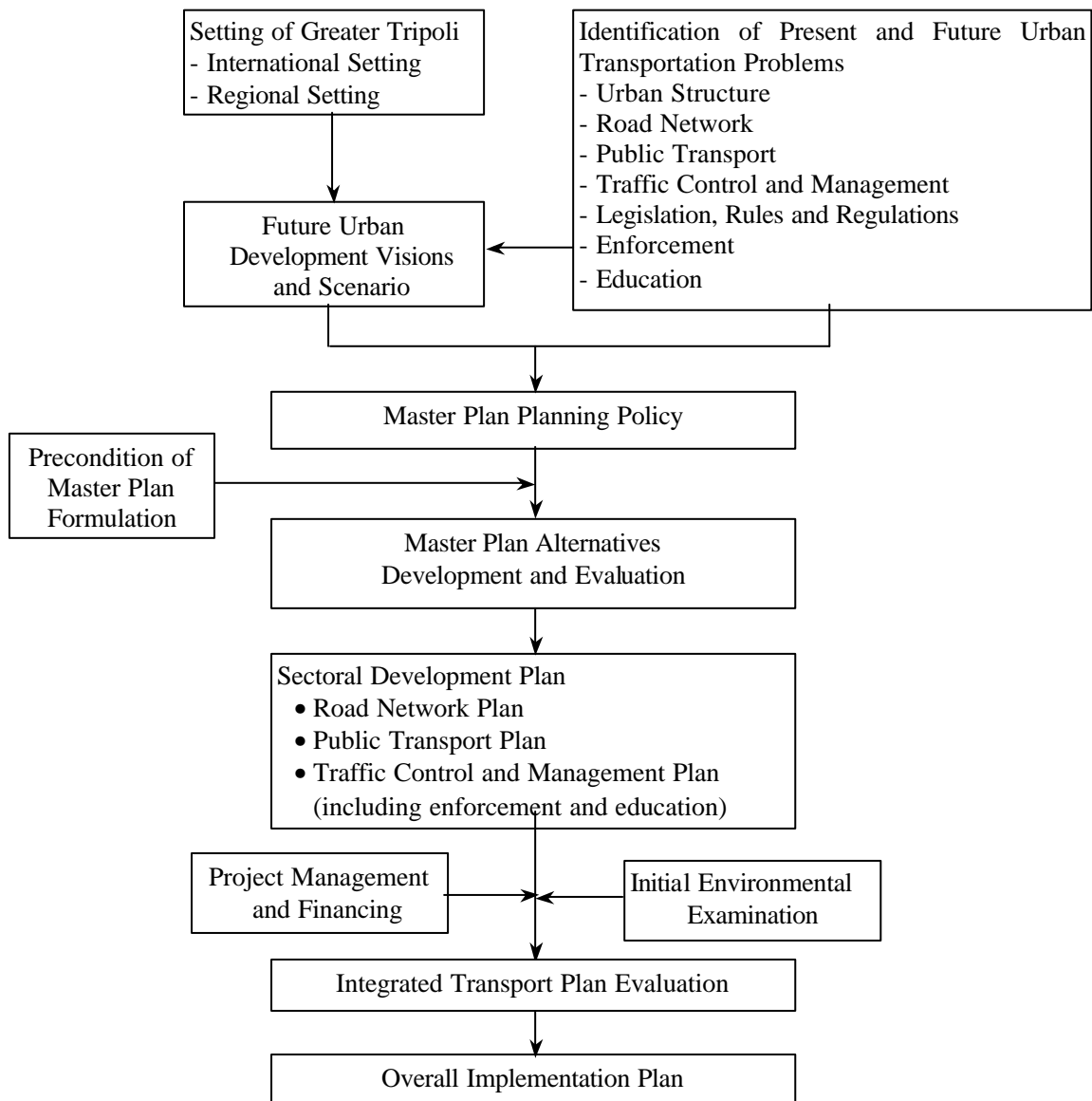


Figure 3.1-1 Procedure of Urban Transportation Master Plan Formulation

3.2 PRESENT TRANSPORT ISSUES AND POSSIBLE SOLUTIONS

The traffic condition in Greater Tripoli is still understood to be fair and in acceptable range in general, except in the densely developed areas, namely the Old City, Downtown, New Tripoli, El-Mina, Abou Samra and El-Qoubbe. The traffic flow on most of the main streets in those developed areas is almost reaching to the level of service E or F (forced flow), which is evaluated far from the acceptable level for road users.

Those traffic conditions, although presently observed in limited areas only, have caused many serious problems, including the followings.

- Traffic pollution
- Increase in traffic cost
- Health effects
- Accidents
- Decrease in tourism industry
- Adverse effects in socio-economic activities

The typical examples of present transport issues and possible solutions are summarized in Table 3.2-1 for the densely developed areas, the planned urban development areas and existing/developing suburban areas separately.

Table 3.2–1 Present Transport Issues and Possible Solutions

Existing Transport Issues	Possible Solutions
<u>Densely Developed Urban Areas:</u>	
1) Disorder traffic flow and urban environment deterioration	1) Installation of traffic instrument such as traffic signal, traffic signs, pavement marking, pedestrian crossing, etc. 2) Implementation of effective/systematic traffic management system 3) Education and enforcement of traffic discipline
2) Decrease in traffic capacity due to on-street parking	1) Designation of on-street parking areas with legitimate control 2) Designation of taxi/bus stops and terminals with legitimate control 3) Legal measures on taxi/bus operation (intra and inter city) 4) Construction of off-street parking areas
3) Increase in traffic accidents and pollution	1) Installation of pedestrian facilities 2) Education and enforcement on Traffic rules 3) Imposition of legal control
4) Encroachment of road space by buildings and vendors	1) Legal measures on illegal encroachment 2) Designation of off-street spaces for markets
5) Inadequate road network with no traffic signal and sign	1) Area control system of traffic Flow 2) Completion/supplement of 3) Lacking road network
6) Insufficient capacity/inadequate geometry of intersection	1) Improvement of intersection Geometry 2) Construction of grade separation structures
7) Insufficient/ineffective public transport system	1) Implementation of policy in favor of bus operation inviting private Enterprise 2) Introduction/encouragement of Bus transport system 3) Introduction of demand type bus System such as school bus, tourist bus, etc.
<u>Planned Urban Development Areas:</u>	
1) Immoderate dependence of urban function and activities on the old city	1) Spatial and harmonized distribution of urban activities over Greater Tripoli, to avoid over- concentration of urban function in the Old City 2) Formation of urban arterial network to promote the development of self-sustainable community
2) Provision of infrastructure in consideration of urban environment and amenity in proposed urban development areas as a site development project	1) Development of such self- sustainable new community in each proposed urban development area with distinguishing characteristics 2) Arrangement of serviceable roads with formation of collector and local road system in harmony with urban arterial network
<u>Existing / Developing Suburban Areas:</u>	
1) Lack of efficient transport system	1) Implementation of functional road hierarchy system 2) Formulation of transport system responsive to future traffic demand
2) Lack of collector road system to /in local community centers, school zones and agricultural areas	Development of suburban collector and local road system, when required

3.3 TRANSPORT DEMAND FORECAST

3.3.1 Socioeconomic Profile

(1) Urban Structure and Present Land Use

The topographical features in the Study Area have great influence on the urban structure and land use activities by dividing the municipality of Tripoli into high and low lands with Abou Ali River between its western and eastern sections. High land is composed mainly of two main areas; Abou Samra and El-Qoubbe. There is only a compact urban area and the population and facilities are concentrated in few zones, namely the Old City, Central area and El-Mina, which cause deterioration to the urban environment. Development of the area is lacking required infrastructure support especially for the transport network. In addition, environment is deteriorating as green areas are disappearing as orange orchards became new Tripoli housing areas and the green belt of olive groves is under the same fate.

Figure 3.3-1 shows the urban structure and topography of the Study Area, while Figure 3.3-2 presents the distribution of the land use activities.

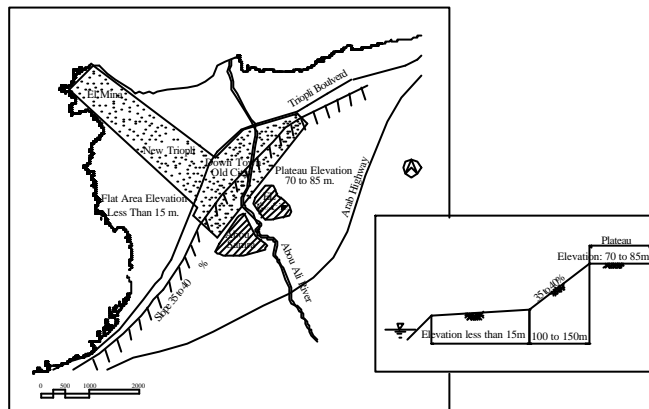


Figure 3.3-1 Urban Structure and Topography

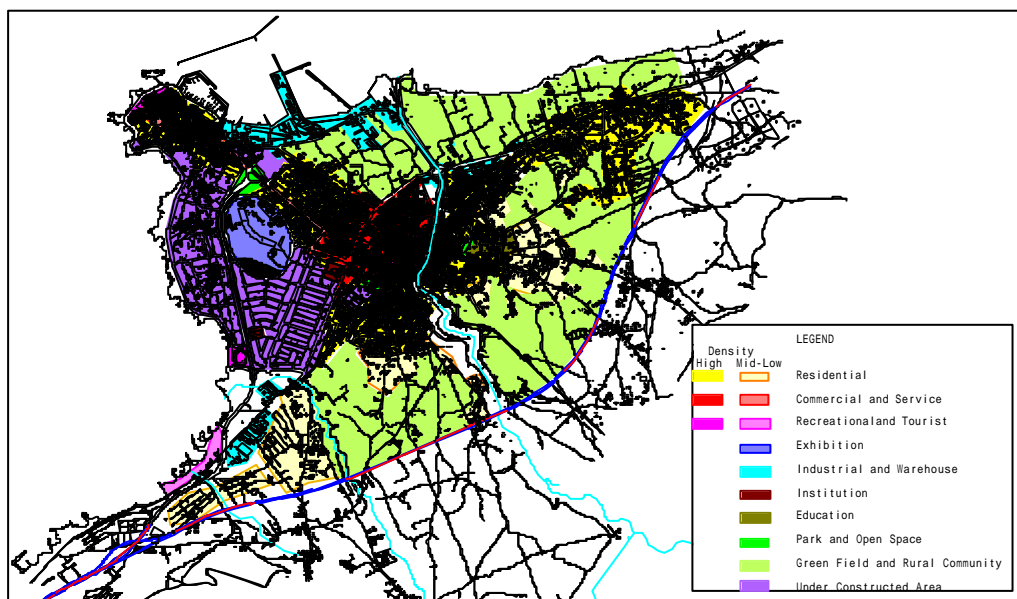


Figure 3.3-3 Present Land Use

Figure 3.3-2 Present Land-use

(2) Present Population Distribution

With the absence of official census data, estimations of population in the Study Area are greatly varied in different studies; between 300,000 and 500,000 inhabitants. Over-estimations are noticed for specific objectives. Estimation of the Study, which is based on housing units and average occupancy, gives about 1/3 million of population. Figure 3.3-3 shows the zonal distribution of population in the Study area. The main features are:

- Highest density: 684 person/ha
- Average density: 87.2 person/ha
- Number of employees: 67,000
- Number of students: 81,000

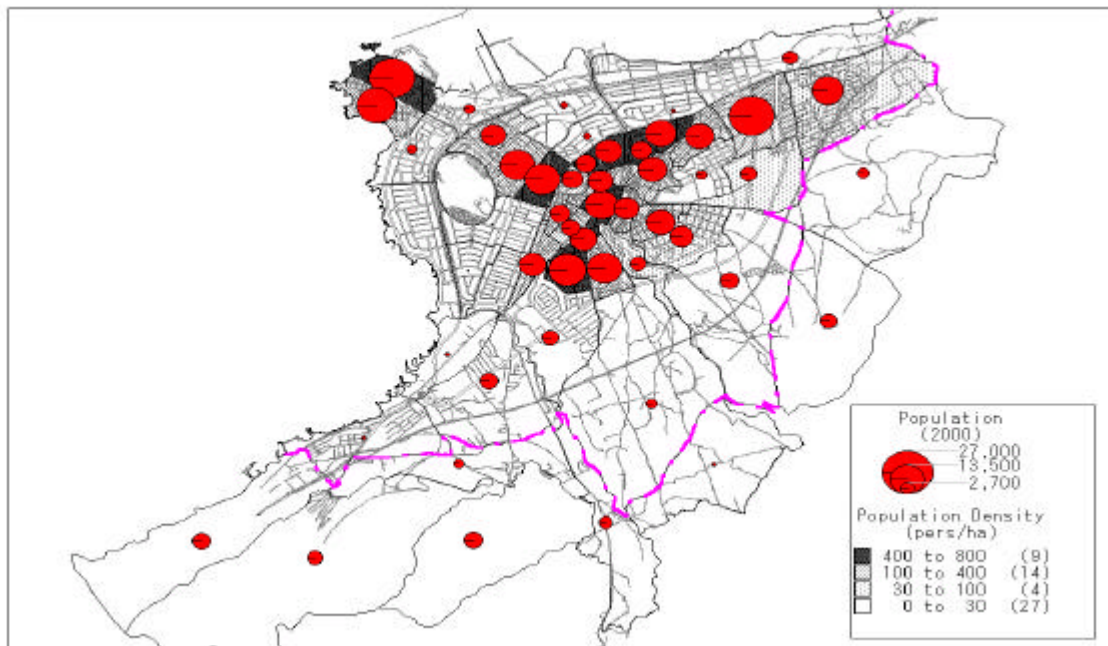


Figure 3.3-3 Present Population Distribution

(3) Income and Vehicle Ownership

The average household income obtained from the Person Trip Interview survey is less than LL 620,000 per month. As shown in Table 3.1-1, with a monthly income of LL 620,000 or more, the vehicle ownership is about 0.77 per household. This high rate shows the high dependency on cars as a transport mode.

Table 3.3-1 Income and Vehicle Ownership

Income (LL 1,000/month)	No. of Households	Full-time Use Vehicles	Vehicle / Household
No Answer	46	26	0.57
0 – 150	48	8	0.17
151 – 300	238	86	0.36
301 – 600	712	376	0.53
601 – 750	668	486	0.73
751 – 1,500	596	556	0.93
1,501 and over	384	528	1.38
Total	2,692	2,066	0.77

3.3.2 Policy of Urban Development and Reform

The basic floor area ratio applied in the different zones of the Study Area, based on the Planning Code is shown in Figure 3.3-4. The main policy established by concerned agencies for urban development include:

- Improvement of environment of densely populated areas
- Planned functional guidance in newly developed areas
- Preservation of historic heritage
- Well-balanced and spatial arrangement of urban functions

In addition, and for urban structure development and improvement, the Study established the following fundamental policy for urban reform:

- Development of urban activity for an internationally focal city
- Realization of environmental friendly city
- Providing safety measures, such as emergency roads and open spaces
- Realization of providing comfort living environment and living style
- Improving the urban structure by strengthening the nature and characteristics of the city
- Improving the urban structure to respond to any drastic increase in population.

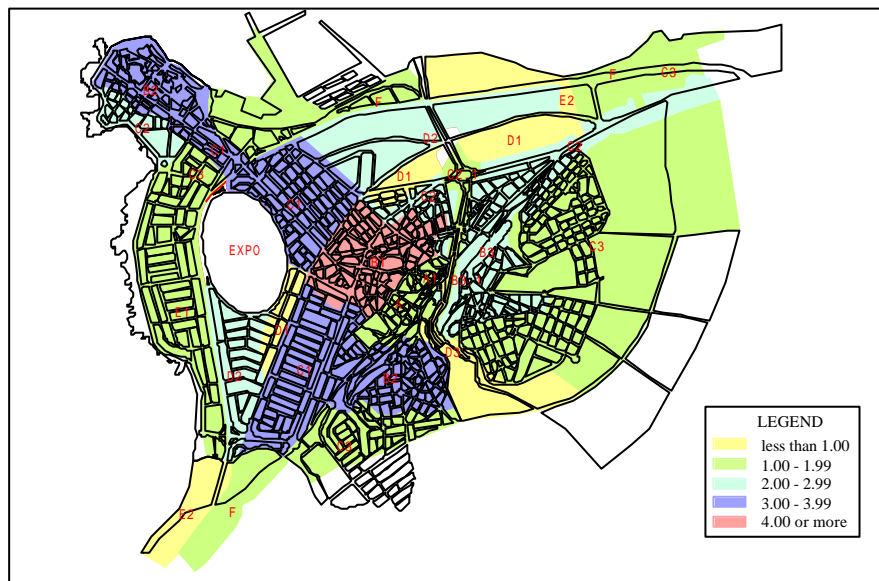


Figure 3.3-4 Basic Floor Area Ratio

3.3.3 Alternative Urban Development Scenarios

Under the Study, and in due consideration of existing problems and urban development policies, three urban development scenarios were developed in order to establish a clear vision and social frame base for the future of the Study Area.

Scenario - 1: Concentrated Urban Development

Development Direction:

- Develop further the existing urban area until its saturation.
- Follow natural Development trend at the planned development areas.

Problems and Actions:

- The existing urban area has already been developed with high density
- This will further aggravate present situation

Scenario - 2: Enlarged Urban Development

Development Direction:

- No active development of the existing urban area
- Guided development toward the fringe areas of existing urban area

Problems and Actions:

- The existing urban function will not be improved
- The existing deteriorated urban conditions will be expanded to its fringe area.

Scenario - 3: Spatial Urban Distribution

Development Direction:

- Controlled development of the existing urban area
- Active development for new planned development areas as self- sustainable communities

Problems and Actions:

- Strictly controlled development of existing urban areas, with the improvement of urban amenity and preservation of heritage and environment
- Only tourism facility improvement to be allowed
- Fewer zones with high population density

Through comprehensive discussions with all involved parties, mayors and governmental agencies, Scenario - 3 was adopted as it exactly meets with their visions. Figure 3.3-5 shows the population distribution based on the concept of Scenario 3.

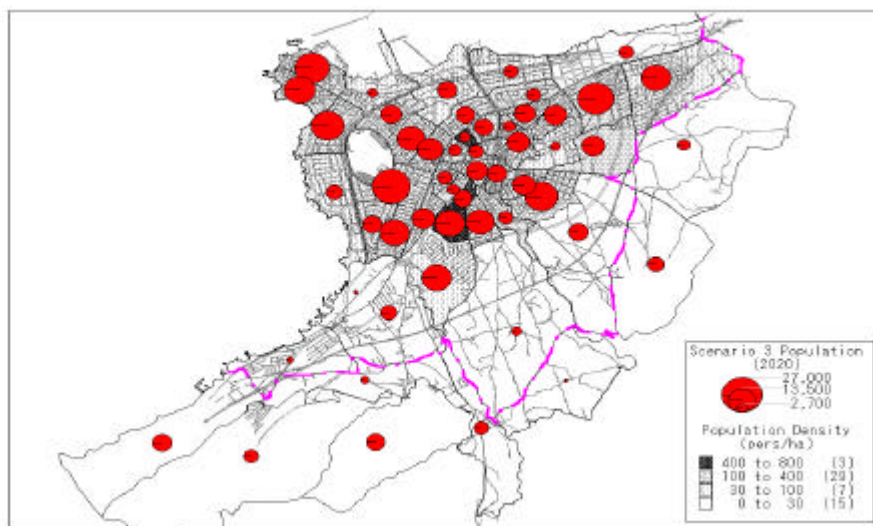


Figure 3.3-5 Population Distribution (Scenario – 3)

3.3.4 Future Land Use – Year 2020

In 1971, a Master Plan for land use for parts of the Study Area was prepared with planning code and zoning system. An on-going plan is being prepared and its main concepts were used in the Study to establish a future land use map, which is presented in Figure 3.3-6, with the following characteristics and features:

- To move commercial and business functions from central areas to the west
- To improve the environment by the land acquired through re-adjustment schemes
- To develop the Old City as a tourist center
- To carry out environment improvement projects in El-Mina as well
- To develop New Tripoli as a business-oriented area
- To preserve the green belt of olive groves

3.3.5 Socioeconomic Framework

Economic parameters for Tripoli are estimated on population-proportion basis in Lebanon. Growth rates and future sectoral development plans are applied to estimate future population, employees and students. Table 3.3-2 presents the socioeconomic parameters of the framework applied in the forecast procedure of future transport demand.

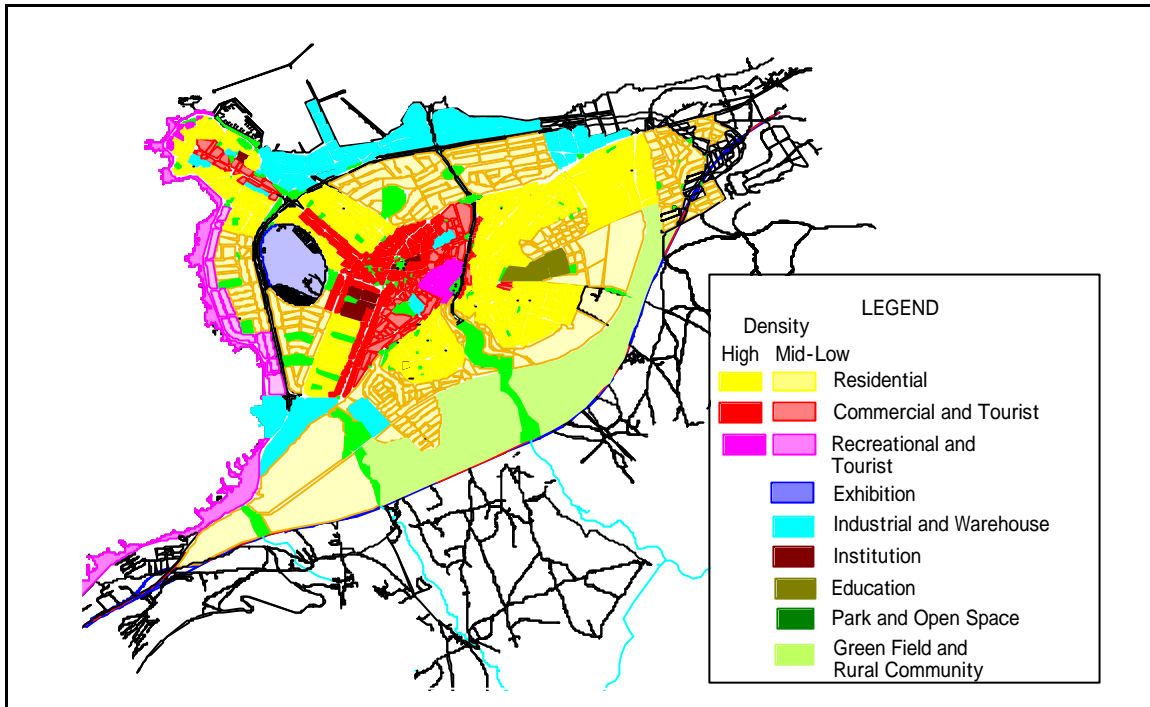


Figure 3.3-6 Future Land Use Plan - 2020

Table 3.3-2 Future Socioeconomic Parameters for Study Area (B.LL)

Parameter	2000	2005	2010	2015	2020
GDP	2,517	3,587	5,112	7,285	10,379
Nominal GDP	2,490	3,551	5,066	7,225	10,305
Population	330,900	360,300	390,400	421,000	454,200
Employees	120,491	143,454	168,870	196,727	228,297
Students	81,122	88,689	96,257	103,824	111,391

3.3.6 Present Transport Pattern

To study the present transport pattern and existing problems as well as to forecast the future demand, the following surveys were conducted in the Study Area:

- Person-Trip
- Commodity Movement
- Cordon Line
- Screen Line
- Intersection Traffic Volume
- Public Transport
- Travel Speed
- Parking
- School Trips

Person Trip Characteristics

The population over 6 years old, which is 297,840 inhabitants, produces a total of 694,423 trips/day, with an average of 2.332 trips/person/day. Average generated trips by males is 2.424 trips/day and for females 2.240 trips/day. Major trip purposes are those for work and school trips. Person trips by mode are distributed between all modes and the highest vehicular share is for taxi trips. Figure 3.3-7 presents the person-trip rate by gender and by age group, while Figure 3.3-8 shows the hourly generated trips by mode and by purpose. Trip generation by time and purpose shows that work and school trips have a high morning peak between 07:00 and 08:00 hrs. The evening peak for home trips is between 14:00 and 15:00 hrs. The evening peak is about 72% of the morning peak.

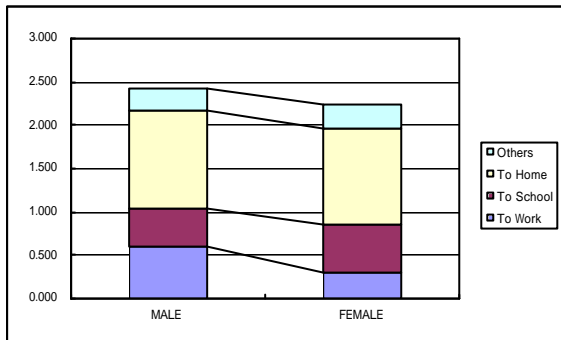


Figure 3.3-7 (1) Person Trip Rate by Gender

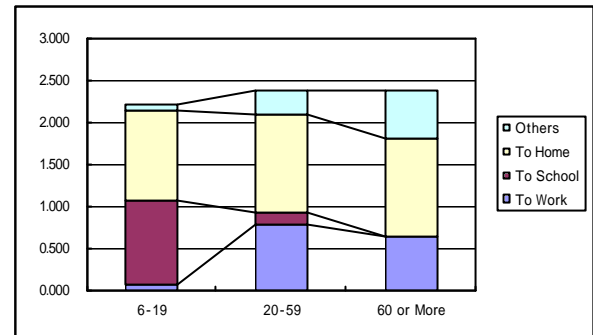


Figure 3.3-7 (2) Person Trip Rate by Age Group

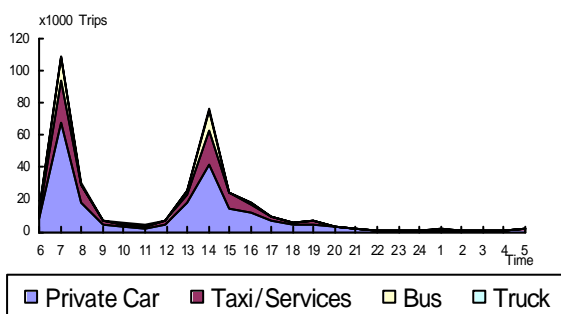


Figure 3.3-8 (1) Generated Trips by Time and Mode

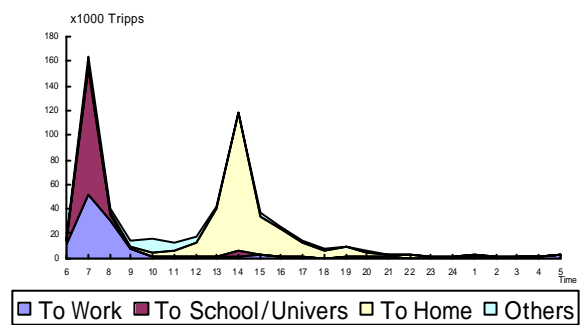


Figure 3.3-8 (2) Generated Trips by Time and Purpose

Figure 3.3-9 shows the purpose and mode composition of the generated person-trips.

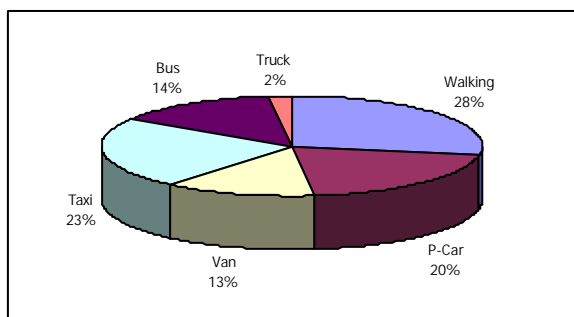


Figure 3.3-9 (1) Person Trip Composition by Transport Mode

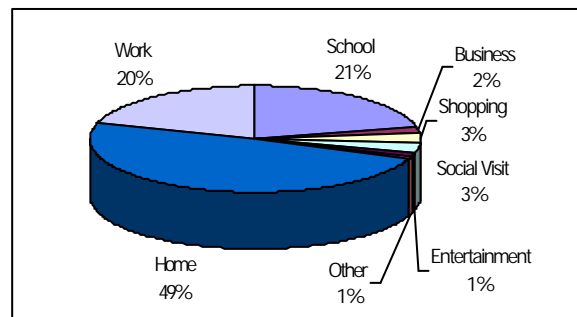


Figure 3.3-9 (2) Person Trip Generation by Trip Purpose

The average person-trip length is about 9,5 kilometer/trip as most of the trip lengths lie in the zone of 5-10 kilometers. It is followed by shorter trips while longer trips are mostly to outside zones.

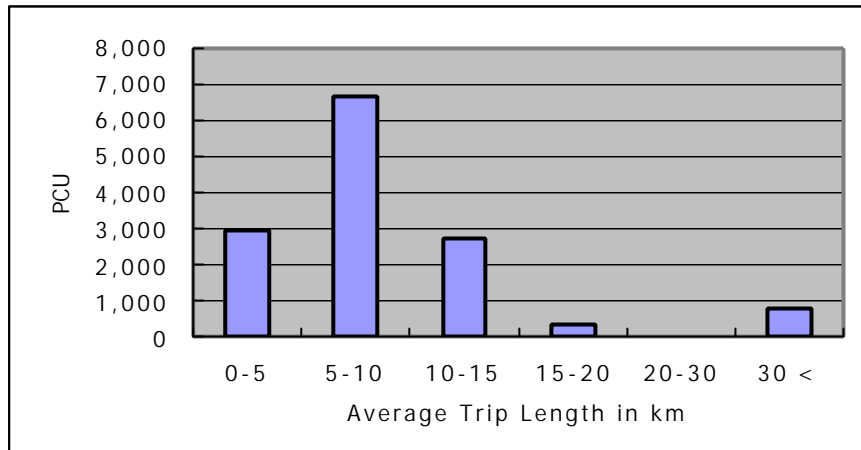


Figure 3.3-10 Person Trip Length Distribution

The average vehicle ownership of 0.77 vehicle/house- hold is relatively high and most of the vehicles are old with more than 16 years in service as shown in Table 3.3-3.

Table 3.3-3 Vehicle Age

Vehicle Age	Vehicle %
Less than 5 years	4.6
6 – 10 years	10.0
11 – 15 years	26.6
More than 16 years	58.8
Total	100.0

Figure 3.3-11 of the desire line chart of the present trip pattern shows concentration of all trips through the city center as most of the socioeconomic activities exist in central zones.

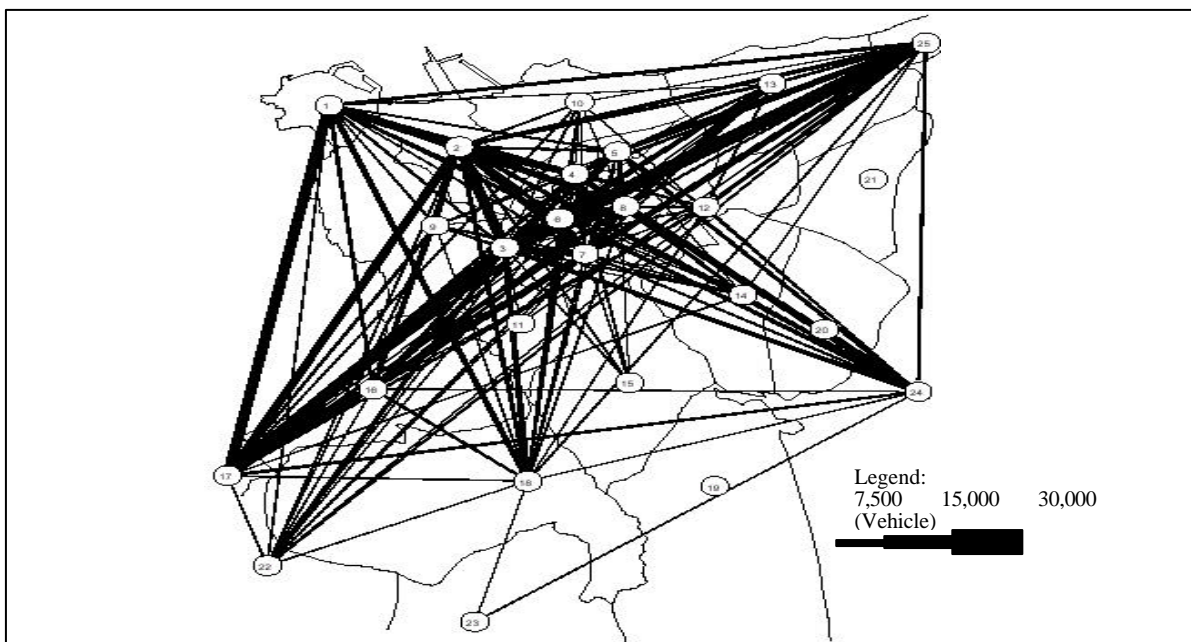


Figure 3.3-11 Present Desire Line Chart

3.3.7 Traffic Demand Forecast

The four-step forecast method is applied in this Study through the use of JICA STRADA models. Based on the present OD matrices estimated through the collected person-trip data and established socioeconomic framework, future generated and attracted trips were forecasted by applying multiple linear regression models.

Generated and attracted trips were distributed on zonal basis to produce future OD matrices that were assigned on the road network in order to identify the magnitude of potential transport problems in the future and to establish required transport improvement components of the Master Plan projects up to the target year 2020. Figure 3.3-12 shows the generated and attracted trips in 2000 and 2020. The desire line chart for trip-ends is presented in Figure 3.3-13. Tables 3.3-4 and 3.3-5 present the number of internal and external trips per vehicle category and trip purpose.

The newly developed areas under the urban readjustment plans will generate a considerably high trip rates. Generation from zones in the central areas of the city are expected to decrease due to tendency in land-use changes from mostly residential areas to more business and commercial activities.

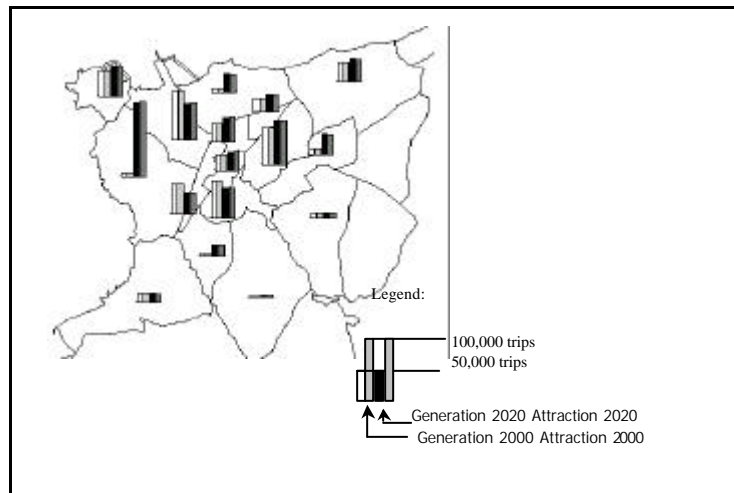


Figure 3.3-12 Present and Future Generated and Attracted Trips

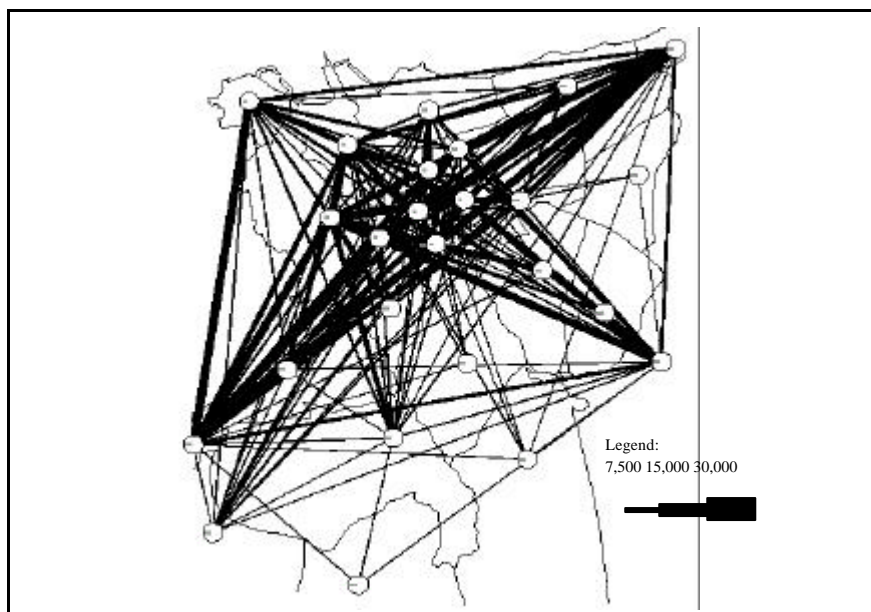


Figure 3.3-13 Future Desire Line Chart – 2020

Table 3.3-4 Present and Future Vehicular Trips

Vehicle Category	2000	2020	2020/2000
Internal Trips	176,418	270,732	1.535
Passenger Car	125,688	181,817	1.447
Taxi	33,466	44,283	1.323
Bus	8,626	11,204	1.299
Truck	8,638	33,428	3.870
External Trips	105,712	143,670	1.359
Passenger Car	79,275	110,812	1.398
Taxi	18,846	24,721	1.312
Bus	2,771	3,317	1.197
Truck	4,820	4,820	1.000
Total	282,130	428,233	1.518
Passenger Car	204,963	292,629	1.428
Taxi	52,312	69,004	1.319
Bus	11,397	14,521	1.274
Truck	13,458	52,079	3.870

Table 3.3-5 Person Trips by Trip Purpose and Mode

Trip	2000		2020	
	Trips	%	Trips	%
Trip Purpose				
To Work	137,169	19.8	231,016	23.6
To School	146,949	21.2	221,833	22.7
Others	79,100	11.4	102,449	10.5
To home	331,205	47.7	423,566	43.2
Mode				
Walking	193,587	27.9	265,507	27.1
Passenger Car	228,494	32.9	330,535	33.8
Bus	97,641	14.1	129,150	13.2
Taxi	161,324	23.2	209,514	21.4
Truck	13,377	1.9	43,958	4.5
Total	694,423	100.0	978,864	100.0

3.3.8 Assigned Traffic Volume

The assignment results of the year 2000 show that the highest daily traffic volumes are those on the expressway to Beirut with a little more than 40,000 vehicles and followed by volumes on the northern highway to Syria with a little less than 40,000 vehicles. Streets in the newly developed areas provide higher travel speed when compared with streets in the densely populated central areas. Tripoli Boulevard, which is the main arterial in Central Tripoli, shows low average speeds and level of service "F" for a length of about 1.3 kilometer.

The assignment results for the year 2020 (Do Nothing Case) show that the northern highway to Syria handle will high daily traffic volumes of more than 60,000 vehicles and the speed is less than 20 km/hr on all the segments. On the expressway to Beirut, volumes are a little lower than 60,000 vehicles and speeds are still over 30 km/hr. Almost all of the streets in the central and northern areas well as roads connecting the Study Area with other neighboring municipalities have speeds less than 20 km/hr. Speeds higher than 30 km/hr exist only on the expressway to Beirut and coastal roads in the municipality of El-Mina.

Table 3.3-6 presents the traffic assignment results in terms of pcu-kilometer and pcu-hour per day as well as the average congestion rates and speeds for the target years. In dealing with the presented results, it should be noticed that the average values are those for the whole network on daily basis. The network

includes a large suburban area with a large portion of suburban roads that produce high average speeds and low congestion rates, while congested roads are concentrated only in the Old City and central areas of Tripoli. Table 3.3-7 presents the road lengths by traffic congestion degree for the target years.

Table 3.3-6 Traffic Assignment Results

Year	PCU- Km	PCU-Hour	Average. Congestion Degree	Average Travel Speed (km/hr)
2000	1,402,912	25,652	0.384	54.7
2005	1,991,996	42,419	0.545	46.9
2010	2,137,628	47,041	0.585	45.4
2020	2,391,839	56,385	0.655	42.2

Table 3.3-7 Road Lengths by Traffic Congestion Degree (Km)

Congestion Degree	2000	2005	2010	2020
>0.5	90.2	66.3	60.8	56.8
0.5-0.8	24.8	33.1	34.7	31.3
0.8-1.0	9.8	10.7	11.7	12.9
1.0-1.2	5.6	12.9	14.1	10.8
1.2-1.5	0.1	4.2	5.9	11.7
>=1.5	0.2	3.5	3.5	7.2
Total	130.7	130.7	130.7	130.7

Figures 3.3-14 and 15 show the assigned traffic volumes, congestion rates and average speeds on the road network for the present condition in the year 2000 and for the future target year of 2020 for the “Do Nothing” case.

In the year 2000, the highest daily traffic volumes are those on the expressway to Beirut with a little more than 40,000 vehicles and followed by volumes on the northern highway to Syria with a little less than 40,000 vehicles. Most of the streets in the newly developed areas provide travel speed over 30 km/hr, while streets in the central areas have average speeds between 20 and 30 km/hr. On the other hand, most of the sections of the northern road going to Syria have speeds less than 20 km/hr.

In the future year of 2020, the northern highway to Syria will handle high daily traffic volumes of more than 60,000 vehicles and the speed is less than 20 km/hr on all the segments. On the expressway to Beirut, volumes are a little lower than 60,000 vehicles and speeds are still over 30 km/hr. Almost all of the streets in the central and northern areas well as roads connecting the Study Area with other neighboring municipalities have speeds less than 20 km/hr. Speeds higher than 30 km/hr exist only on the expressway to Beirut and coastal roads in the municipality of El-Mina.

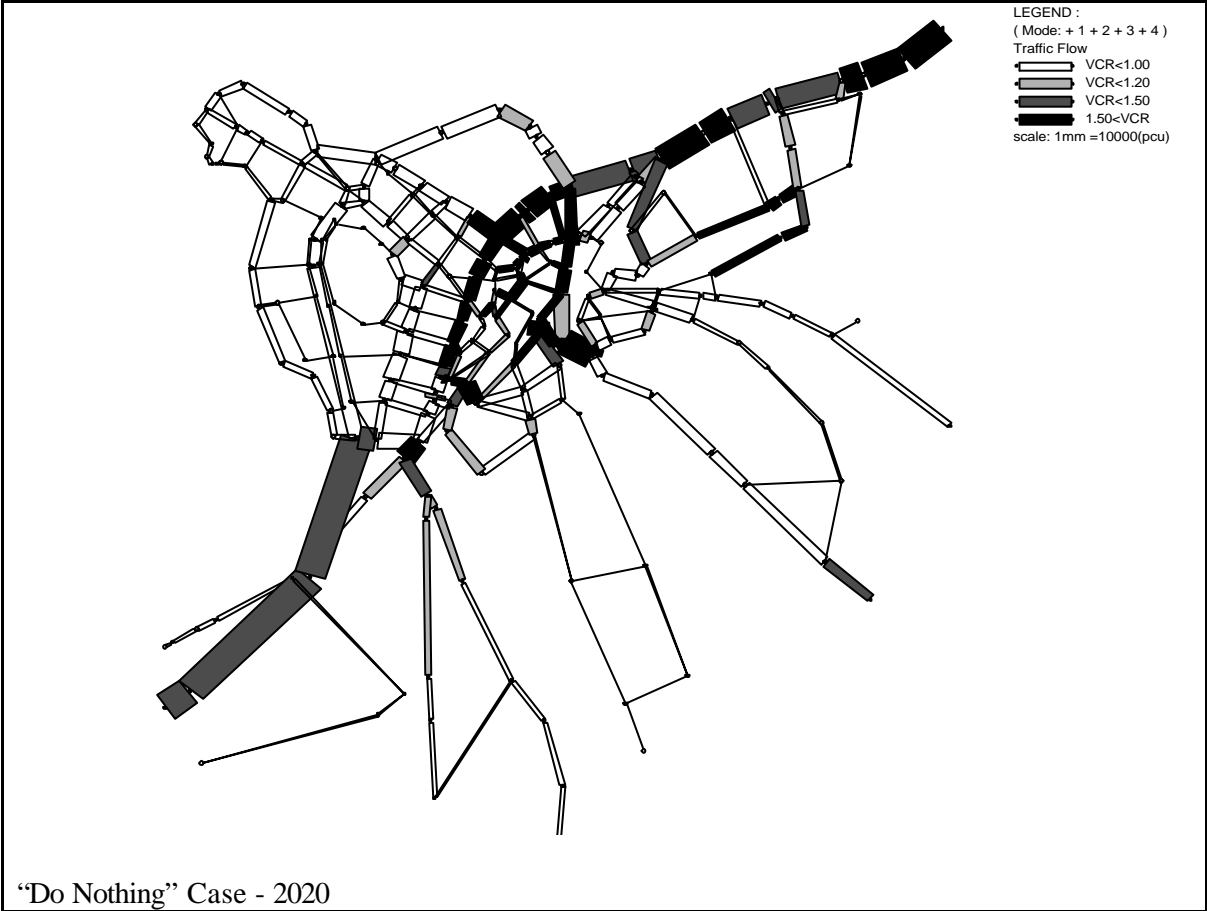
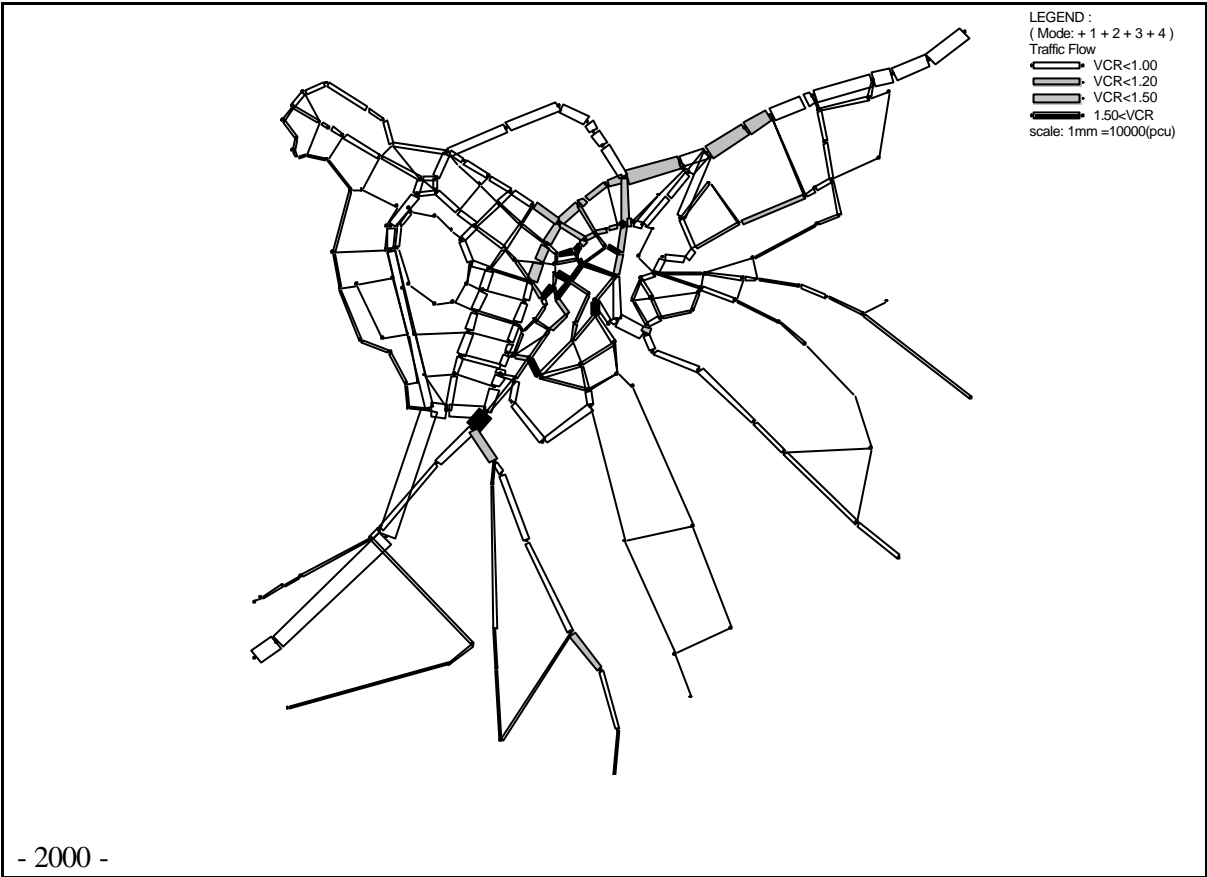


Figure 3.3-14 Present and Future Assigned Traffic (Congestion Rate)

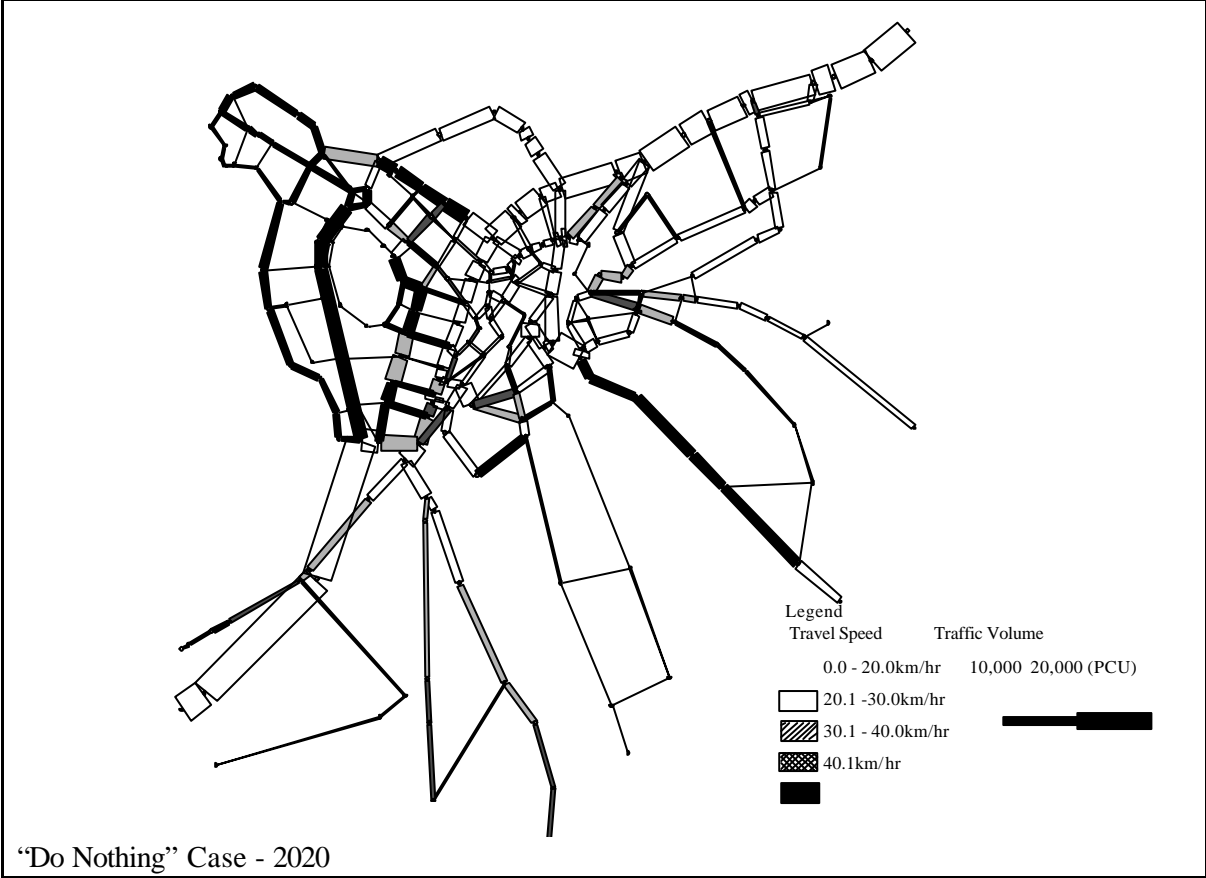
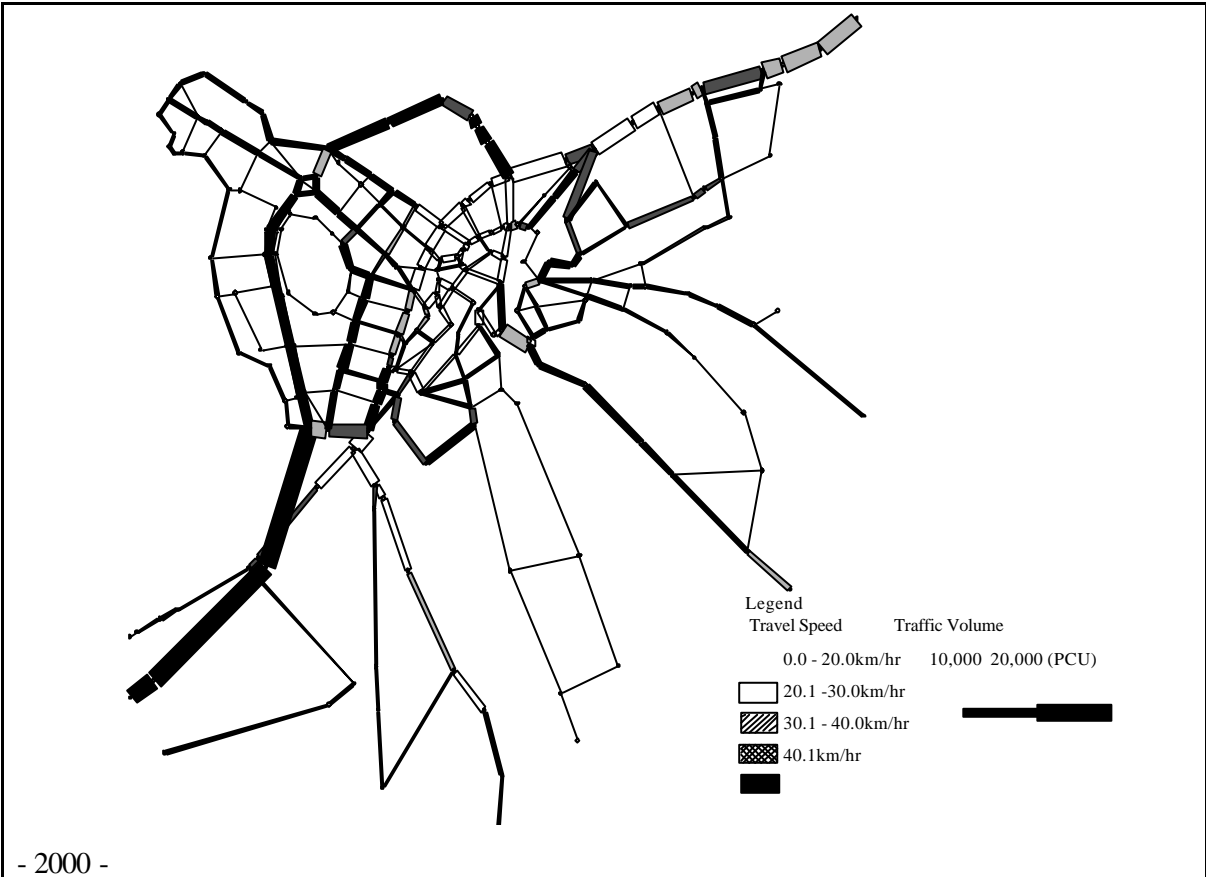


Figure 3.3-15 Present and Future Assigned Traffic (Travel Speed)

3.4 MASTER PLAN PLANNING POLICY

3.4.1 Urban Development Policy

Through the observation on present transport issues and future demands, the following development policies and targets were established through comprehensive discussions with the Lebanese side, as integrated in Figure 3.6-1 under Section 3.6.

From the viewpoint of Regional Setting

- Intensification of the roles of Greater Tripoli

From the viewpoints of Urban Development Strategy

- Spatial and harmonious distribution of urban activities
- Preservation of historic heritage and development potentiality

From the viewpoints of Urban Transportation Development

- Promotion of environmentally sound and health supporting transportation system
- Application of acceptable and serviceable transport measures

From the Viewpoints of realization of the Master Plan

- The implementation plan of the Urban Transport Plan shall be objective and attainable with consensus and informed consent from transport users as well as financial aspects.

The specific objectives of above involving strategic plans are as follows:

(1) Intensification of the Role of Greater Tripoli

Tripoli is the second largest city in Lebanon and the capital of the northern region. The development of Greater Tripoli Area is, therefore, the indispensable condition and key issue for the growth of country as well as for the influence area. Tripoli is located at a distance of about 80 Kilometers from the capital Beirut in the south, and 35 Kilometers from the border of Syria in the north. In the region-wide, Tripoli is surrounded with the inner city zone of about 5 Kilometers in distance (El-Bedaoui, Mejdlaya, and Ras-Maska) and with the outer regional zone of about 15 to 20 kilometers in distance (El-Aabde, Sir ed Danniye, Ehden, Amioun, and Chekka), as shown in Figure 3.4-1.

With such strategic location of Greater Tripoli Area, the role of Greater Tripoli shall be clarified in terms of the regional setting as well as the international level, and the urban function shall be intensified by providing a modern infrastructure facilities, focusing on the following points.

- Fortification: as the international node with transport mobility for the movement of people and goods. (International highway)
- Strengthening: as the regional hub with transport accessibility for the urban activity of the region. (Regional arterial)
- Development: as the freight transport and system center with movement and storage facilities for business and social logistics.

Tripoli is expected to be developed as a freight transport and system center by providing infrastructures for movement and storage facilities for social logistics as well as business logistics. Business logistics is the process of planning, implementing, and controlling the efficient, cost-effective flow and storage of all kinds of material and goods from point of origin to point of consumption. The essential elements of logistics are movement and storage, which involves transport system and storage facilities.

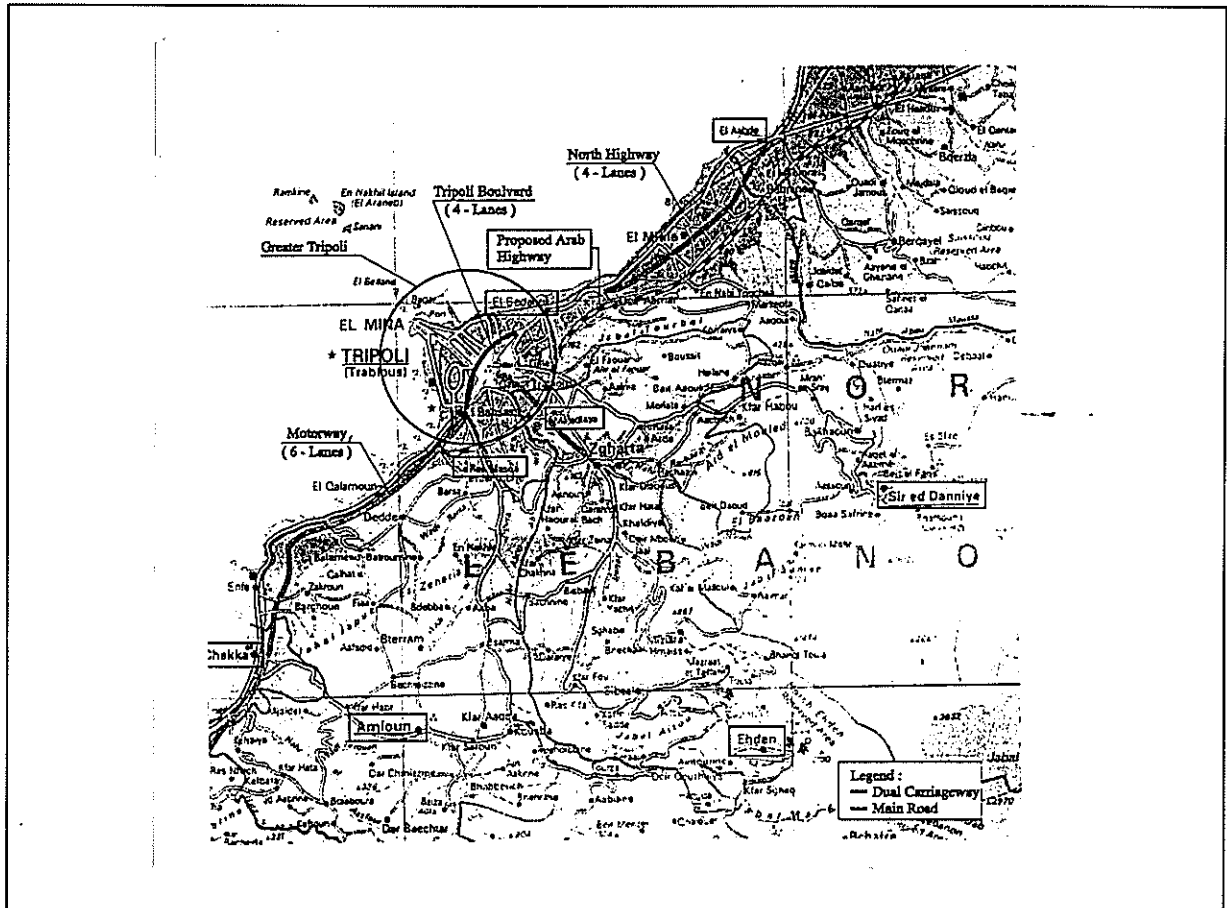


Figure 3.4-1 Regional Setting of Greater Tripoli

Transport function for freight transport and logistics including physical distribution shall be planned in the national and regional level for public purpose, not for a business purpose, employing node-mode-link concept.

Figure 3.4-2 demonstrates the conceptual transport system for freight transport and logistics in Greater Tripoli, which shall be planned in a well-defined hierarchy system.

(2) Spatial and Harmonious Distribution of Urban Activity

The existing urbanization area – the Old City, Downtown, and El-Mina – has limited urban capacity, so that a further concentration of socio-economic activities toward this area will critically hamper the functioning of the city. The immoderate dependence of urban function and activities on this area shall be avoided, implementing the following policies.

- Development of self-sustainable new communities in the planned development areas by spatial distribution of population, employment and urban function.
- Formulation of primary urban arterial network to facilitate the development of such new communities.
- Provision of urban collector and local road system to ensure the favorable urban environment and modern amenity in such new communities.

The spatial and harmonious distribution of population as well as urban activity is the vital key not only for alleviation of existing traffic problem but for regeneration of Tripoli. Infrastructure, especially transport facility shall be developed to promote this policy so that construction of self-sustainable new communities will be induced.

Figure 3.4-3 schematically shows the concentrated areas of population and urban activity (Old City, Downtown, El-Mina and New Tripoli), comparing with areas of the planned development (Tripoli West, Tripoli North, Outer Abou Samra and Outer El-Qoubbe). Table 3.4-1 shows the areas with land use characteristics.

As the government of Lebanon is proposed and with the completion of this plan, Tripoli will be the “New City” providing a favorable urban amenity and environment except traffic jam in some limited areas.

Table 3.4-1 Proposed Development Area

	Existing Urbanized Area	Proposed Development Area	Land Use Characteristics
Old City, Downtown	2.5		Commercial/ Tourism
El-Mina, New Tripoli	2.0		Commercial/ Residential
Tripoli West		2.0	High Class Residential
Tripoli North		1.2	Light Industry
Outer Abou Samra		1.0	Middle Class Residential
Outer El-Qoubbe		1.3	Middle Class Residential
Total	4.5 Km²	5.5 Km²	

(3) Preservation of Historic Heritage and Development Potentiality

The earliest evidence of settlement in Tripoli area dates back to the Late Bronze Age (14th century BC). Since then, Tripoli began to prosper as a center of trade, a position enhanced both by its sea port and easy access to the interior. The main focus of historic heritage are the numerous Mameluke and Ottoman monuments to be found in the old part of Tripoli around the Crusader Castle Construction (12th century AD).

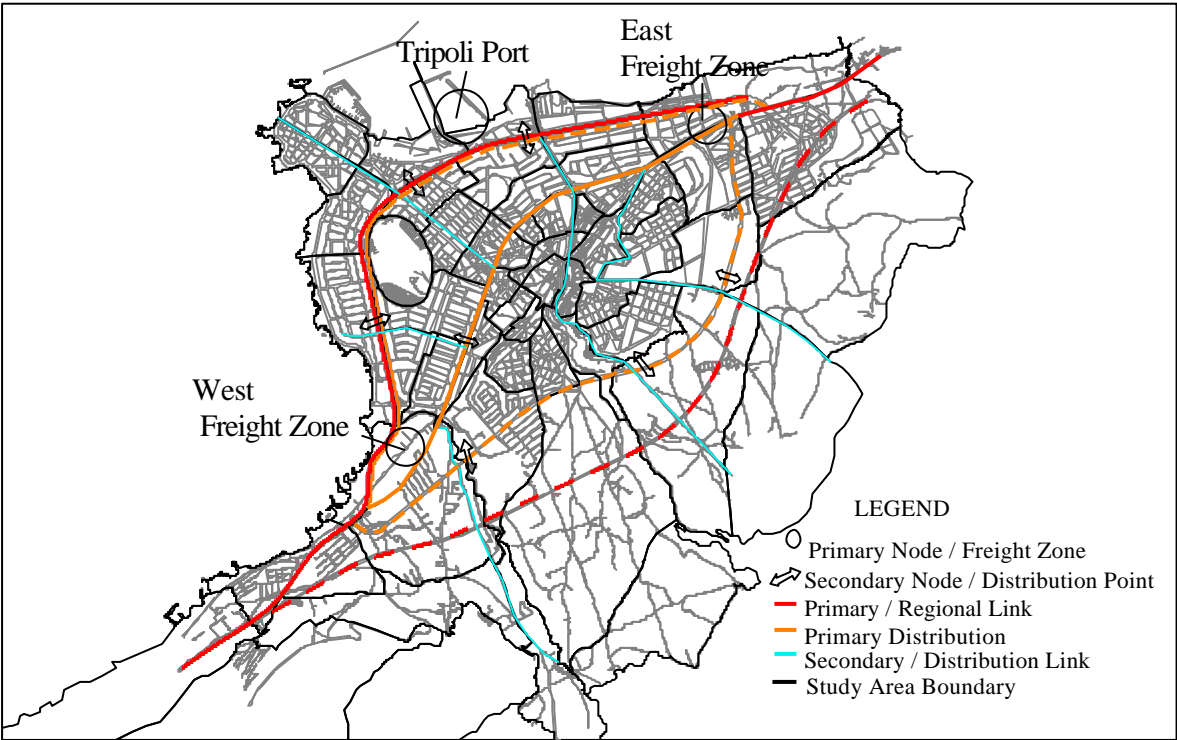


Figure 3.4-2 Freight Transport and Logistics Strategy

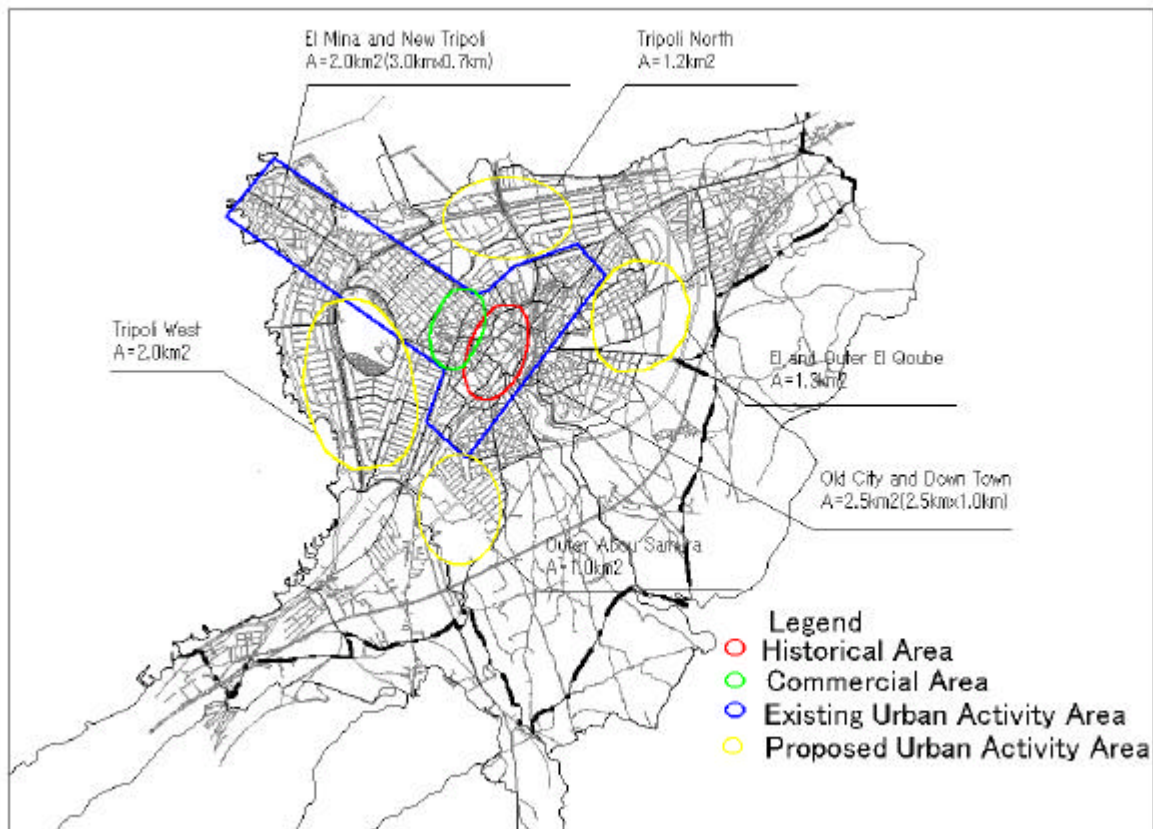


Figure 3.4-3 Spatial Distribution of Population and Urban Activity

These historic heritages are the important momentum for tourism industry in Tripoli which shall be preserved under the coexistence with commercial area near the Old City and development potentiality in the planned development areas in consideration of the followings.

- Preservation of the urban environment in the Old City as the historic and tourism heritage together with the commercial area near the Old City and Downtown.
- Reservation of the development potentiality in the planned development areas towards the Information Technology Century.
- Provision of transport system with reliable mobility and comfortable accessibility between the Old City and planned development areas.

(4) Promotion of Environmentally Sound and Health Supporting Transport System

The transport system and mode friendly with environment and sustainable with health shall be promoted to prevent further deterioration of urban environment and amenity due to traffic pollution with the following measures.

- Introduction of effective transport system (bus, taxi) with implementation of policy in favor of public transport operation, avoiding the over reliance on private transport.
- Removal of existing traffic bottlenecks with serious traffic pollution, thus supporting health care and increasing traffic safety.
- Provision of access roads directly connecting traffic origin areas with desired destinations in order to avoid or reduce unnecessary detouring traffic.

(5) Application of Acceptable and Serviceable Transport Measures

The transport system and measures shall be acceptable with and serviceable for public users, and well harmonized with characteristics of the areas including topography, geography and cultural climate.

- For the existing urbanized area;
 - a) Formulation of traffic management system including traffic system management, traffic demand management and traffic dispensation/ administration management.

The principal objectives of traffic system management is to efficiently use the existing traffic facilities by providing traffic control instruments and appurtenant, and traffic demand management is to control the traffic demand by implementing measures such as public transport system, staggered hours commuting system, imposing traffic regulations, etc. The traffic dispensation/administration aims at distributing traffic demand in line with the planning principles embodied in the land use plan.

- b) Physical Improvement of Traffic Bottlenecks

The traffic bottlenecks, where traffic management can not solve the problems, shall be improved with physical and structural measures as long as the environment and health consideration warrant.

- For the planned development areas and suburban areas;

Development of functional hierarchy transport system integrated with land use plan, friendly with environment and health. Figure 3.4-4 illustrates the conceptual transport system for the Greater Tripoli, classifying through, ring and radial functions integrated with the proposed land use plan.

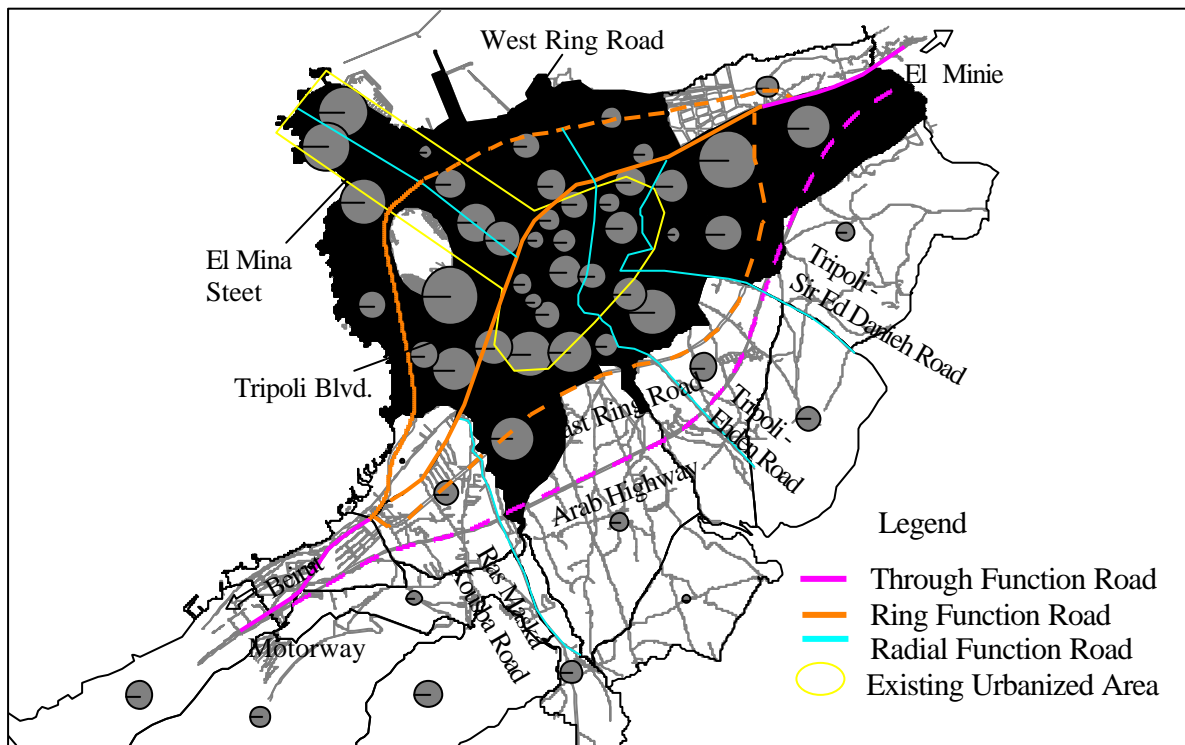


Figure 3.4-4 Conceptual Plan of Transport System

3.5 PRECONDITIONS OF MASTER PLAN FORMULATION

Various plans have been formulated and various transportation projects were proposed as presented in Chapter 2. Among these plans and projects, the following were judged to be firmly and surely implemented, therefore, are considered as preconditions for the master plan formulation:

Urban Development Plans

- Tripoli West Land Readjustment Plan
- Tripoli North Land Readjustment Plan
- Land Readjustment Plan along the Proposed East Ring Road

Transportation Projects

- East Ring Road
- West Ring Road
- Arab Highway (Coastal Motorway)

3.6 MASTER PLAN OBJECTIVES AND COMPONENTS

Based on transport problems identified and on established development policies and strategies, the following objectives of the Plan were established and major master plan components were selected as shown in Figure 3.6-1, for generation of Master Plan alternatives.

Objective 1: Establishment of transport network in accordance with the land use plan.

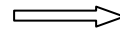
- Formation of road network composed of ring and radial roads to cope with future traffic demand as well as to support spatial urban development and to improve urban environment:
 - West Ring Road
 - East Ring Road
 - Improvement of Tripoli Boulevard
 - Improvement of Ras Maska – Kousba Road
 - Improvement of Tripoli – Ehden Road
 - Improvement of Tripoli – Sir Ed Danie Road
- Strengthening of international/regional roads
 - Arab Highway
- Construction of grade separation structures at congested intersections to reduce traffic congestion and to improve urban environment.
 - Intersections along Tripoli Boulevard
 - Intersections along existing sections of West Ring Road

Objective 2: Introduction of an efficient and modern public transport system

- Implementation of planned city bus system to provide an alternative transport mode and to reduce high dependence on private vehicles
- Construction of bus and taxi terminals and stands to improve urban amenity of the existing built-up area

Greater Tripoli's Setting

- The second largest City in Lebanon
- The regional capital of North Lebanon
- Hub city of international transport linkage
- The city with historical and cultural heritage



Development Policy

- Intensification of the Role of Greater Tripoli
- Spatial and Harmonious Distribution of Urban Activity
- Preservation of Historic Heritage and Development Potentiality
- Promotion of Environmentally Sound and Health Supporting Transport System
- Application of Acceptable and Serviceable Transport Measures



Major Transport Problems

Urban Structure

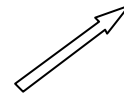
- Too much concentration of people, urban facilities, socio-economic activities, etc., in the existing urban area.
- Aggravation of urban environment due to above.
- Slow development of the planned development areas due to lack of infrastructure support.

Traffic

- High dependence on private vehicles.
- Inefficient public transport system.
- Disorder traffic flow and violation of traffic rules and regulations.
- Decrease in traffic capacity due to illegal on-street parking.
- Increase in traffic accidents and pollution.
- Decrease in travel speed due to uncontrolled intersection and inadequate intersection geometry.
- Concentration of inter-city bus and taxi terminals in the existing urban areas.
- Inadequate enforcement and education.

Road Network

- Incomplete road network
 - Too much reliance on Tripoli Boulevard
 - Lack of accessibility between the flat plain and plateau areas.
 - Lack of road links between sub-divided plateau areas by rivers.
- Low level of services of roads in the existing urban areas.



Development Strategy

- To strengthen the international and regional transport system
- To form transport network to vitally support and realize spatial urban development.
- To intensify traffic management in the area with historic heritage.
- To reduce traffic congestion.
- To provide alternative modes of transportation, particularly public transport modes.



Objectives and Major Components of the Plan

Road Network Development

- Formation of road network composed ring and radial roads to cope with future traffic demand as well as to support spatial urban development and to improve urban environment.
- Strengthening of international/regional roads including Arab Highway.
- Construction of grade separation at congested intersection to reduce traffic congestion and improvement of environment.

Public Transport System

- Implementation of city bus to provide alternative transport mode and to reduce high dependence on private vehicles.
- Construction of bus/taxi terminals and stands to improve urban amenity of the existing urban area.

Traffic Management / Transport Demand management

- Signalization of intersections to reduce traffic congestion and improvement of urban environment.
- Construction of off-street parking and prohibition of on-street parking in the selected areas or pay parking along streets.
- Provision for traffic safety facilities and education.
- Improvement of legislation system.
- Intensification of enforcement and education.

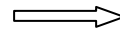


Figure 3.6-1 Development Policy and Plan Components

Objective 3: Development of efficient, comfortable, efficient transport system

- Development of integrated transport system including bus and taxi
- Efficient bus system between central business areas, commercial areas, school zones and residential areas.
- Elimination of traffic congestion at the bottlenecks of main streets
- Establishment of functional transport network

The above items are indispensable for comfortable and safe transport facilities. The following items evaluate functional transport network:

- Degree of congestion: Average V/C ratio of free flow (0.5)
- Average travel time: Degree of improvement from the present situation
- Travel speed: Average travel speed of free flow (50 km/hr)

Objective 4: Establishment of an efficient transport management system

- Signalization of intersections to reduce traffic congestion, improve urban environment and ensure traffic safety
 - Immediate implementation of on-going signalization project
 - Installation of traffic signals in the Old City

Objective 5: Improvement of urban transport environment

- Provision for traffic safety facility and education
- Intensification of enforcement and education
- Construction of on-street parking and prohibition of off-street parking in selected areas or pay parking along streets

3.7 TARGETS OF THE PLAN

- 1) Level of Service: The targeted level-of-service in future is not less than the present average levels of C or D, with an average travel speed not less than the present average speed of 54.7 km/hr.
- 2) Accessibility Coverage: The coverage rate is defined by the travel time of zonal population to the city center. In future, the spatial distribution pattern will be employed and the target rate will be less than the present value and the lowest of all alternatives.
- 3) Traffic Parameters: The parameters of vehicle-kilometer, vehicle-hour and volume/capacity ratio will be used as indicators for Master Plan efficiency and evaluation purposes. The alternative plan with the lowest values of these parameters will be established.

3.8 TRANSPORT PLAN CHARACTERISTICS

Planning refers to the development of policies and goals with sets of strategies that provide the required transport infrastructure improvement over a time-span of planning period. In order to emphasize requirements for the special nature of the Study Area, the proposed urban transport plan can be basically described through two main items that compose the title of the Study. The two main items are: 1) Environmental Friendly Plan, and 2) Integrated Plan.

3.8.1 Environmental Friendly Plan

With the historical, cultural, social and other features of the municipality of Tripoli and its surrounding areas and municipalities, a major target to be realized under the urban transport plan is to formulate the most environmental friendly plan that will improve any existing negative transport related impacts and provide measure for better future environment.

The specific goals of the plan are of a multi-sectoral nature and the final output is based on the major dimensions of:

- Future population growth
- Economic structure
- Social pattern and living style
- Basic land use activities
- Major infrastructure systems
- Environmentally sensitive areas
- Institutional structure
- Legal and financial requirements

Under the environmental tasks, the process of land use planning includes proposals for sectoral policies that should pay particular attention to the following points:

- System of urban, suburban and rural centers
- Protected and preserved areas
- Green areas and open spaces
- Tourism and recreational areas
- Transport corridors
- Spaces for other infrastructure facilities
- Agricultural land and industrial estates

To realize the major targets and objectives of the transport development plan, especially to keep its environmental-friendly dimension, some prerequisites are necessary to be met. Of particular importance are the following ones:

- Political will and public awareness
- Existence of global national strategies.
- Recognition of the value of environmental resources
- Management capability and adequate human resources
- Financial support

Urban growth should be coordinated with the available capacity of infrastructure and uses should not be permitted beyond the absorbing capacity of available services. Open spaces should be maintained to separate urban centers and to ensure the protection of natural and landscape resources.

Planned transport facilities such as new highways and structures should accommodate green areas and open spaces to improve the present conditions. Environmental friendly public transport systems such as buses should be introduced to replace old taxis that are the main public transport system at present.

As major tasks of the Study, the present environmental legislation system and conditions are investigated and examined for both physical and social components based on items included in JICA guidelines for transport development studies. Impact assessment for proposed major projects is also required in order to provide appropriate mitigating measures for any anticipated negative impact.

3.8.2 Integrated Plan

The urban transport plan to be established under the Study demonstrates the need for an integrated plan by considering several integration concepts and tasks that can be completely or partially applied on the Study Area. The first integration concept of the plan is to realize the main target of simultaneously improving both transport network components and environment conditions. In formulating the master transport planning, integration of detailed plans is considered as follows:

Urban Structure: the integration between the transport system and the urban structure of the study area is a main element that is thoroughly considered in the planning process. The staging development in both

urban structure and transport network optimize the utility of transport facilities and provides better living environment.

Land-use Activities: components of the plan provide smooth accessibility between zones with integrated activities. For example, the integration and accessibility between the commercial downtown and historical old city can be realized by providing grade-separation structures at congested intersections in the area such as underpasses. That will provide integration between tourism and urban development.

Planning Components: hard and soft components in the plan are integrated together to get the most optimum transport plan for the city. In addition, the implementation plans for each of the components are integrated to provide the most efficient transport system. For example, the consequence of road improvement projects and bus routing are integrated for maximum efficiency.

Transport Facilities: are planned in an integrated system with transport modes. For example, bus terminals will serve city buses, inter-city buses and taxi. It may accommodate also railway station and car parking. In such way, the movement of people and goods throughout the Study Area can be achieved in a convenient manner.

Transport Modes: the introducing of an advanced and efficient public transport mode such as the bus system realizes the integration between different transport modes. Environmental friendly buses will replace the old diesel-powered taxis that cause traffic pollution and congestion. Other advanced public transport systems such as underground or elevated commuting rail systems serve more populated areas with higher transport demand to be economically viable.

Traffic Management Schemes: are integrated in such a way to decrease delay, increase operating speed, minimize transport cost and improve safety level. For example, there is integration between plans for improving intersections, parking control and enforcement measures.