

## **CHAPTER 6**

# **MASTER PLAN EVALUATION**

## CHAPTER 6

### MASTER PLAN EVALUATION

#### 6.1 OPTIMUM TRANSPORT PLAN

##### 6.1.1 Integration in Selected Plan

Plan D as the optimum alternative transport plan is selected as the basis of the Transport Master Plan for the future development of the transport network in the Study Area. Details component of the plan integrate the hard and soft sectors of road network development, transport management measures and bus transport service. In addition, the plan demonstrates some other integration aspects as follows:

**Transport Modes:** the introduction of an advanced and efficient public transport mode such as the bus system realizes the integration between different transport modes. Environmental friendly buses may 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 and larger cities 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.

##### 6.1.2 Planning Tasks

The traffic condition in Greater Tripoli is still understood to be fair and in acceptable range in general, except in the densely developed areas. In Chapter 3, it stated that the traffic conditions, although presently observed in limited areas only, have caused many serious problems, including the followings.

- Traffic pollution and health effects
- Increase in VOC and traffic cost
- Traffic accidents
- Decrease in tourism industry
- Adverse effects on socio-economic activities

As the main objective of the Study is to formulate an environmental friendly urban transport Master Plan, solutions for the above major problems formulated the detailed targets to be achieved by the planned projects for each sector. The major tasks that are applied for the sectorial development components are as follows:

##### Road Network

- 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

- Introduction 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

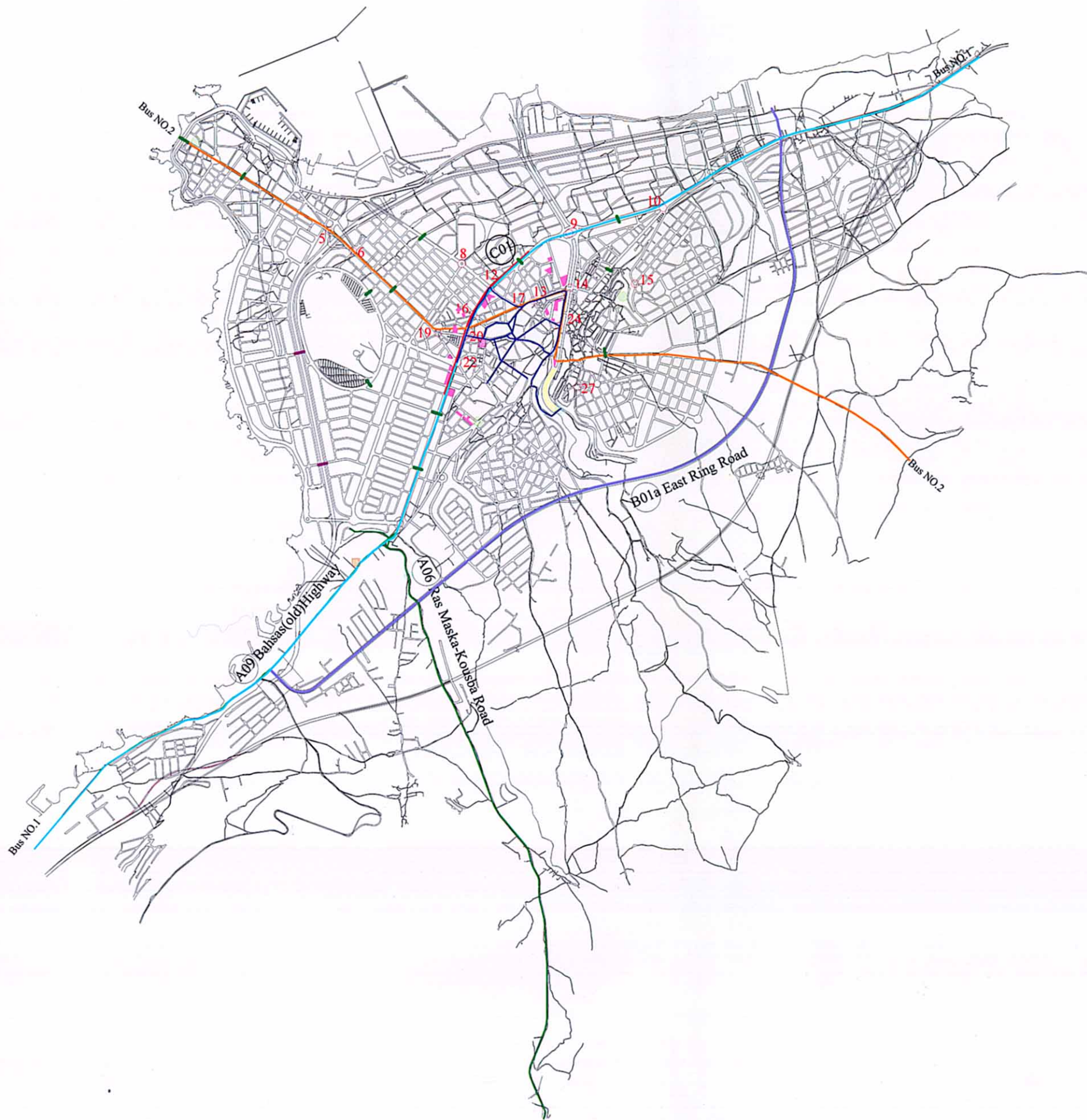
- Signalization of intersections to reduce traffic congestion and improvement of urban environment.
- Construction of off-street parking and prohibition of on-street parking in the selected areas or pay parking along streets.
- Provision for traffic safety facilities.
- Improvement of legislation system.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

### 6.1.3 Major Projects

A summary of the proposed major Master Plan projects is presented in Table 4.4-1 for each developed sector, which are shown graphically on the maps of Figure 4.4-1 for the three target planning terms of; short-term (2001-2005), medium term (2006-2010) and long-term (2011-2020).

Table 6.1-1 Summary of Major Projects

Sector	Major Projects	2001 - 2005	2006 - 2010	2011 - 2020
Road Network	Widening and Improvement	6.2	22.1	6.1
	New Construction	8.5	12.5	11.1
	Grade Separation	1	5	
Public Transport	Bus Operation			
	- Distance	21.5 km	24,5 km	-
	- Number of Buses	85	150	285
	Intercity Terminal	1 (South)	1 (North)	
	City Terminal	4	1	
Traffic Management	Signalized Intersections	15	15	
	Parking Control	Applying Prohibition and Control Measures		
	Off-street Parking	Installing 2,000 Parking-meters		
	Safety Measures	Area required: 81,250m <sup>2</sup>	6,250m <sup>2</sup>	15,625m <sup>2</sup>
	Enforcement Measures	Proving Education and Facilities		
	Legislation System	Strengthening Manpower and Equipment		
		Applying Vehicle Registration System		



**ROAD PROJECTS**

**IMPROVEMENT/WIDENING**

- █ A06 Ras Maska-Kousba Road
- █ A09 Bahsas (Old Highway)

**NEW CONSTRUCTION**

- █ B01a East Ring Road
- █ C01 Underpass(Tripori Blvd)

**PUBLIC TRANSPORT**

- Bus Route NO.1
- Bus Route NO.2
- Intercity & City Buses & Taxi Terminal
- City Bus & City Taxi Terminal
- City Bus Terminal & Taxi Stand

**TRAFFIC MANAGEMENT**

- Traffic Signal
- Overpass or Underpass
- Pedestrian Signal
- ⊕ Warning Signal
- Off-Street Parking
- Tourist Bus Terminal
- Prohibited Parking

Figure 6.1-1 Master Plan Projects - 2005 (1/3)



**ROAD PROJECTS**

**IMPROVEMENT/WIDENING**

- A01 Tripoli-Syria Road
- A02 Tripoli-Sir El Danie Road
- A03 Quobbe-Zgharta Road
- A07 Ras Maska-Barsa Road
- A08 Ras Maska-Dedde Road

**NEW CONSTRUCTION**

- B01b East Ring Road
- B02a West Ring Road
- B02b West Ring Related Roads

**GRADE SEPARATION**

- C02 Inter Change

**PUBLIC TRANSPORT**

- Bus Route NO.3
- Bus Route NO.4
- Intercity & City Buses & Taxi Terminal
- City Bus Terminal & Taxi Stand

**TRAFFIC MANAGEMENT**

- Traffic Signal



**ROAD PROJECTS**

**IMPROVEMENT/WIDENING**

- (A04) Abou Samra East Road
- (A05) Abou Samra West Road

**NEW CONSTRUCTION**

- (B03) Arab Highway

**GRADE SEPARATION**

- (B01) East Ring Road
- (B02) West Ring Road

## **6.2 TRANSPORT MASTER PLAN EVALUATION**

### **6.2.1 Environmental Friendly Plan**

Projects in the M/P promote an environmentally sound and health supporting transport system in the Study Area. The road network is developed to provide direct access between zones to reduce unnecessary detouring traffic. In addition, introducing an advanced and effective public transport system with transport management schemes and an underpass in the densely developed areas will result in eliminating traffic congestion and in considerable improvement of environmental conditions.

### **6.2.2 Plan Integration**

The projects included in the transport Master Plan demonstrate the integration concept either with other city planning components, such as land use activities and urban structure as well as other infrastructure and architectural planning, or between the different hard and soft sectors composing the plan. Integration is also provided between different transport facilities and modes with management schemes and safety measures.

### **6.2.3 Fundamental Aspects**

The specific goals of the Urban Transport Master 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

## **6.3 TRAFFIC ANALYSIS**

### **6.3.1 Traffic Demand Forecast**

Traffic assignment results, presented in Figure 6.3-1 for the “Do Nothing” and “Master Plan” cases in the target years, show that the “Do Nothing” case provides low speeds (less than 20 km/hr) on most of the network especially on the northern and eastern parts of the city. After the completion of the East Ring Road and constructing the Tripoli Boulevard Underpass, almost all the major links on the network will have speeds higher than 30 km/hr.

The year 2010 shows more roads with lower speeds especially in the central areas in the Do Nothing case. By the completion of the northern section of the West Ring Road, improvements on the traffic flow can be noticed on more streets in the central areas. Low speeds, however, are shown on some southern segments of the Eastern Ring Road due to remarkable increase in the traffic volumes.

The year 2020 shows only few roads with speeds higher than 30 km/hr for the Do Nothing case as most of the streets will reach low level of services with low speeds. With the operation of the Arab Highway as the major road project to be implemented during this stage, higher speeds can be observed on many streets especially in the central areas.

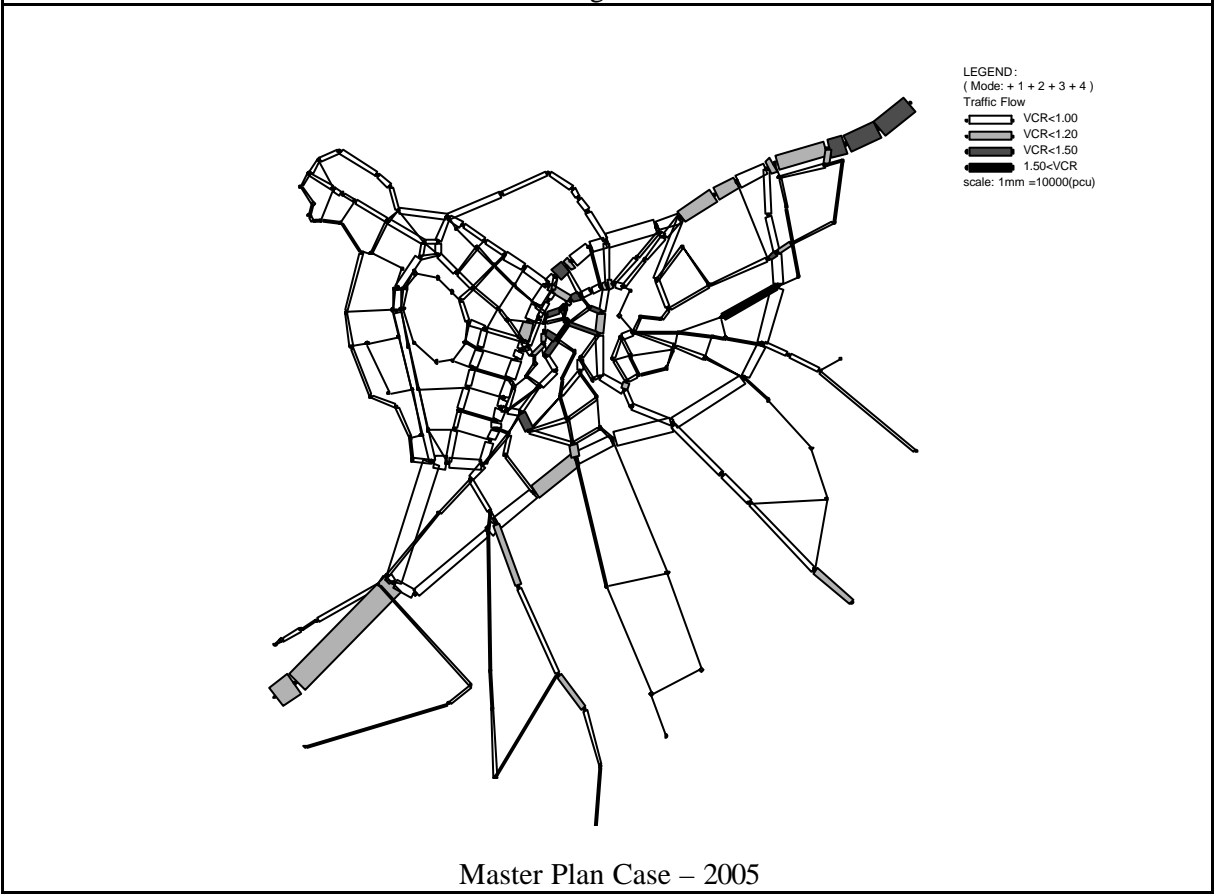
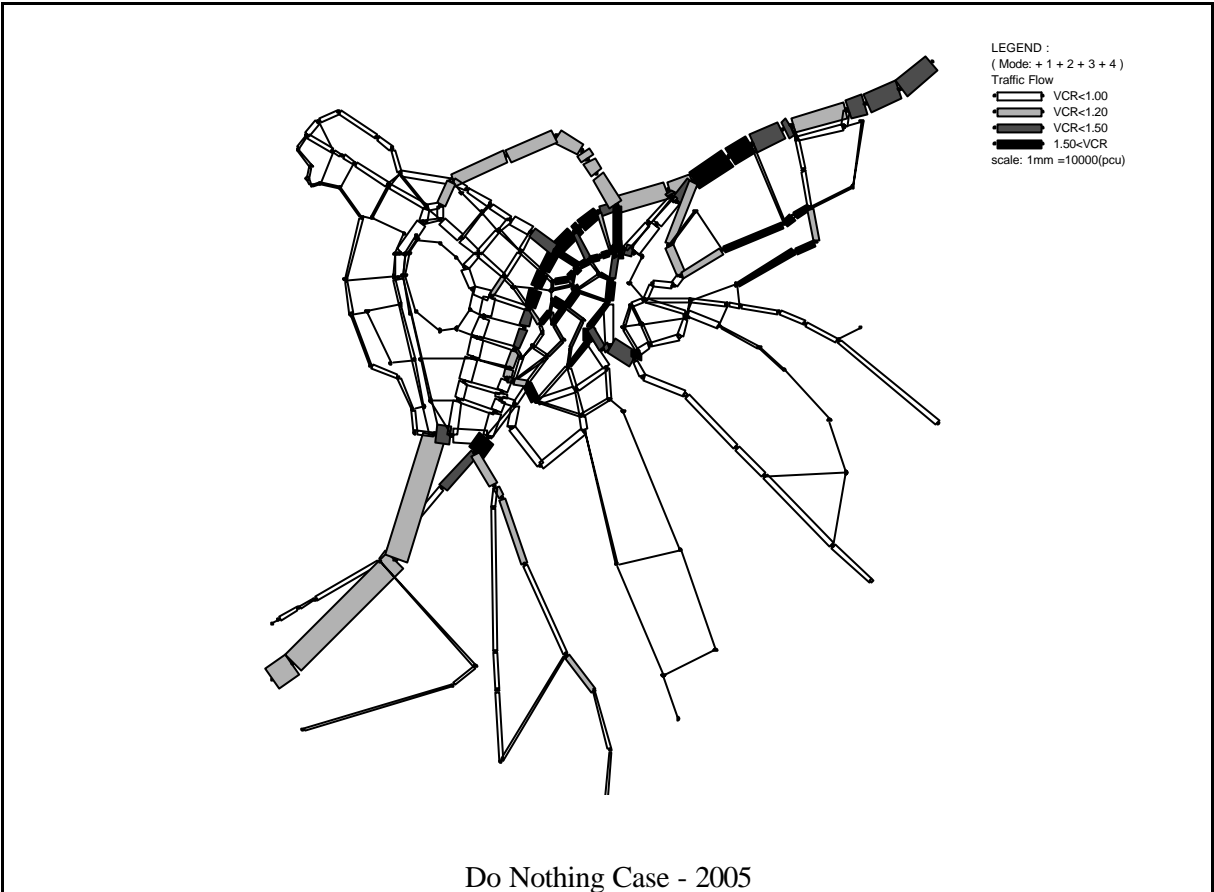


Figure 6.3-1 Traffic Assignment Comparison (1/3)



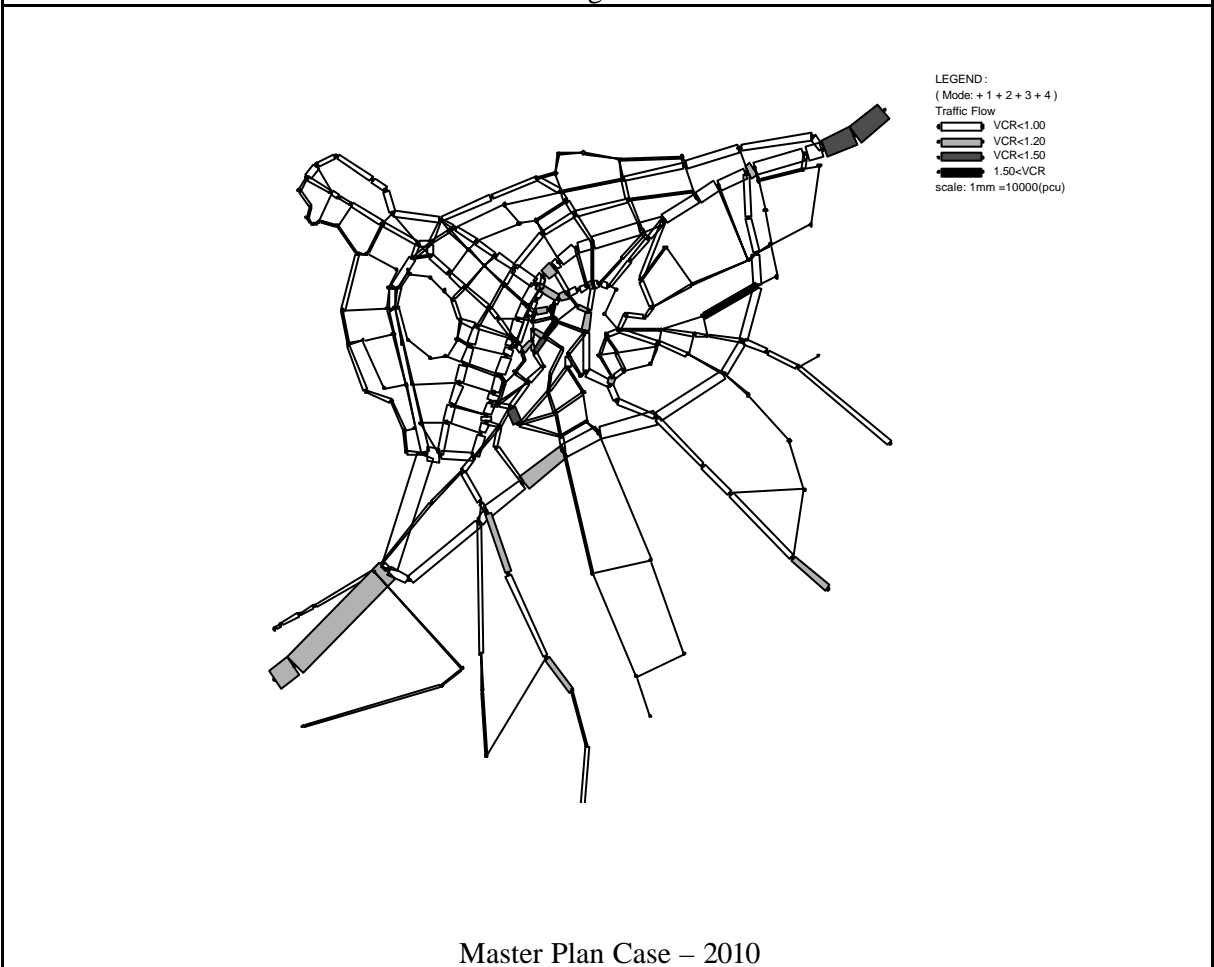
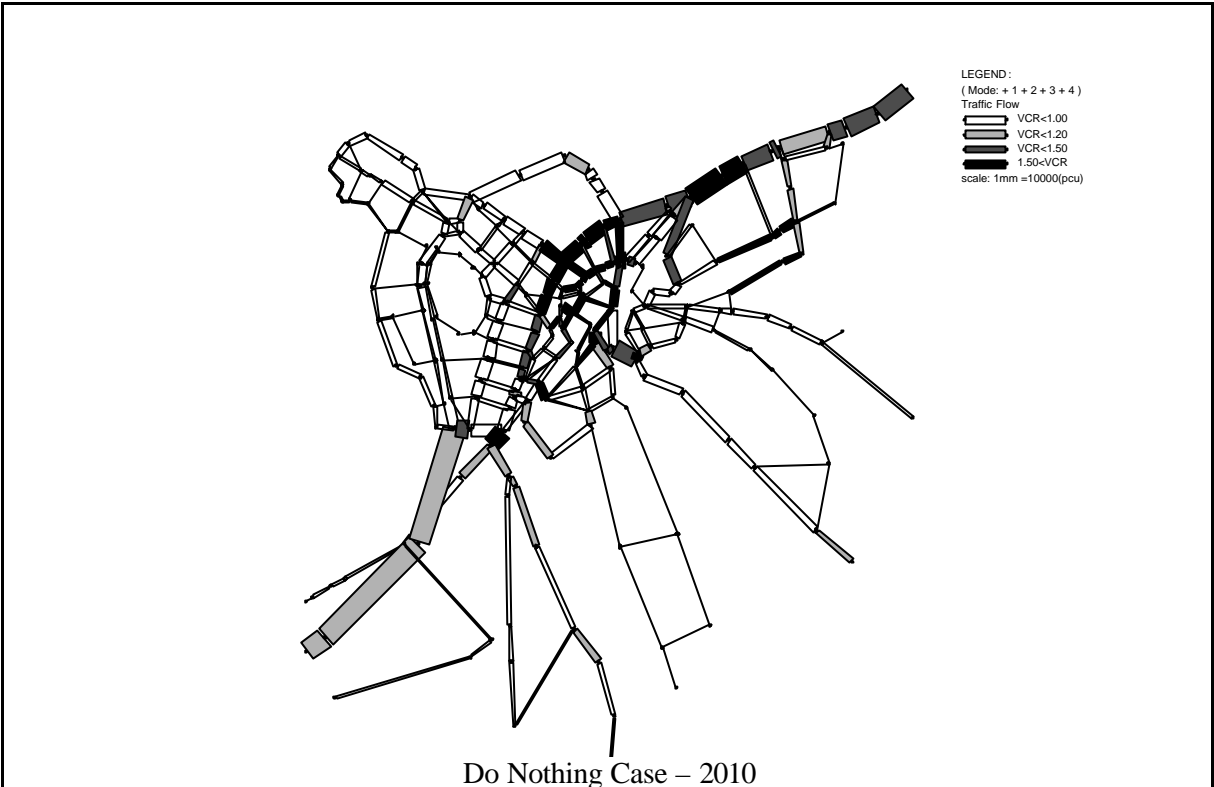


Figure 6.3-1 Traffic Assignment Comparison (2/3)

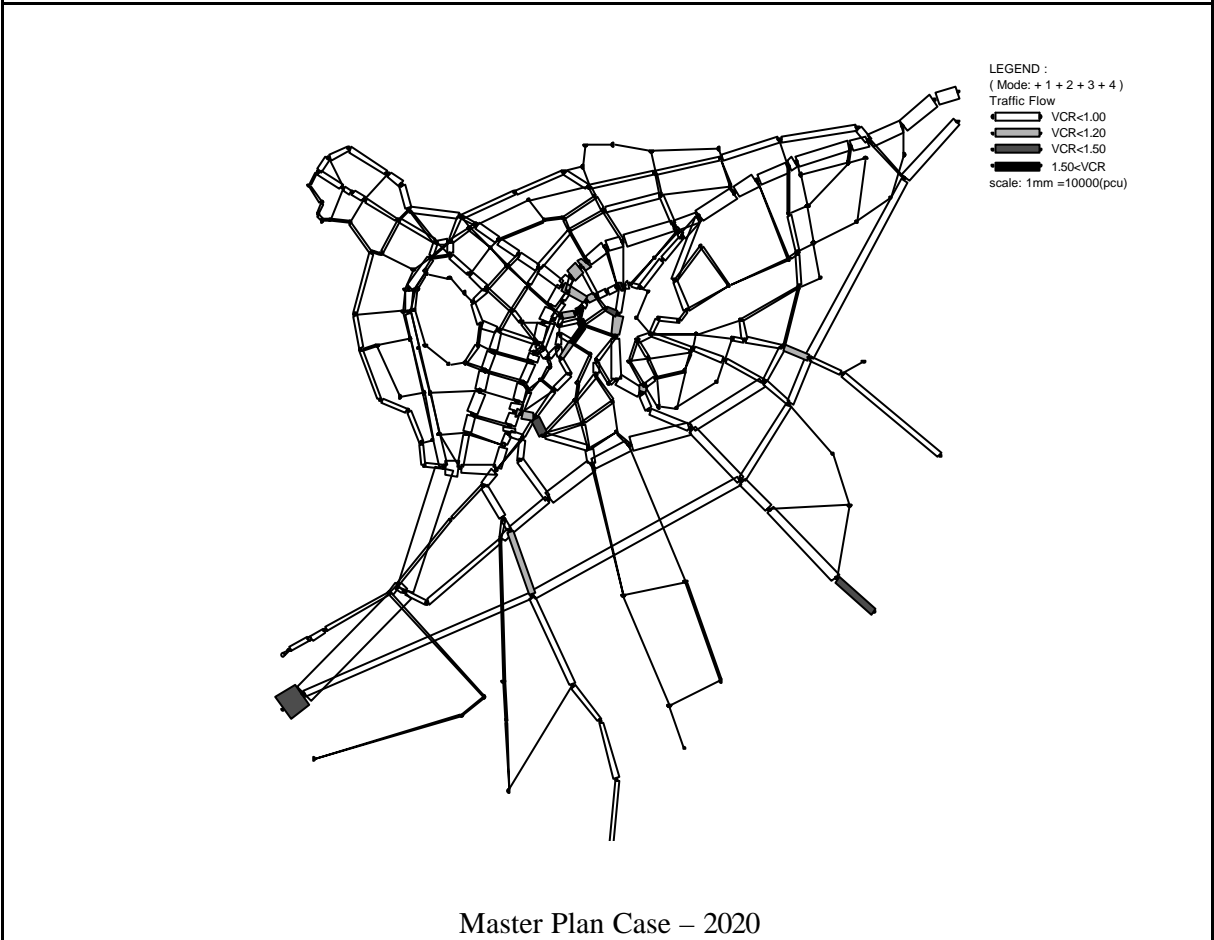
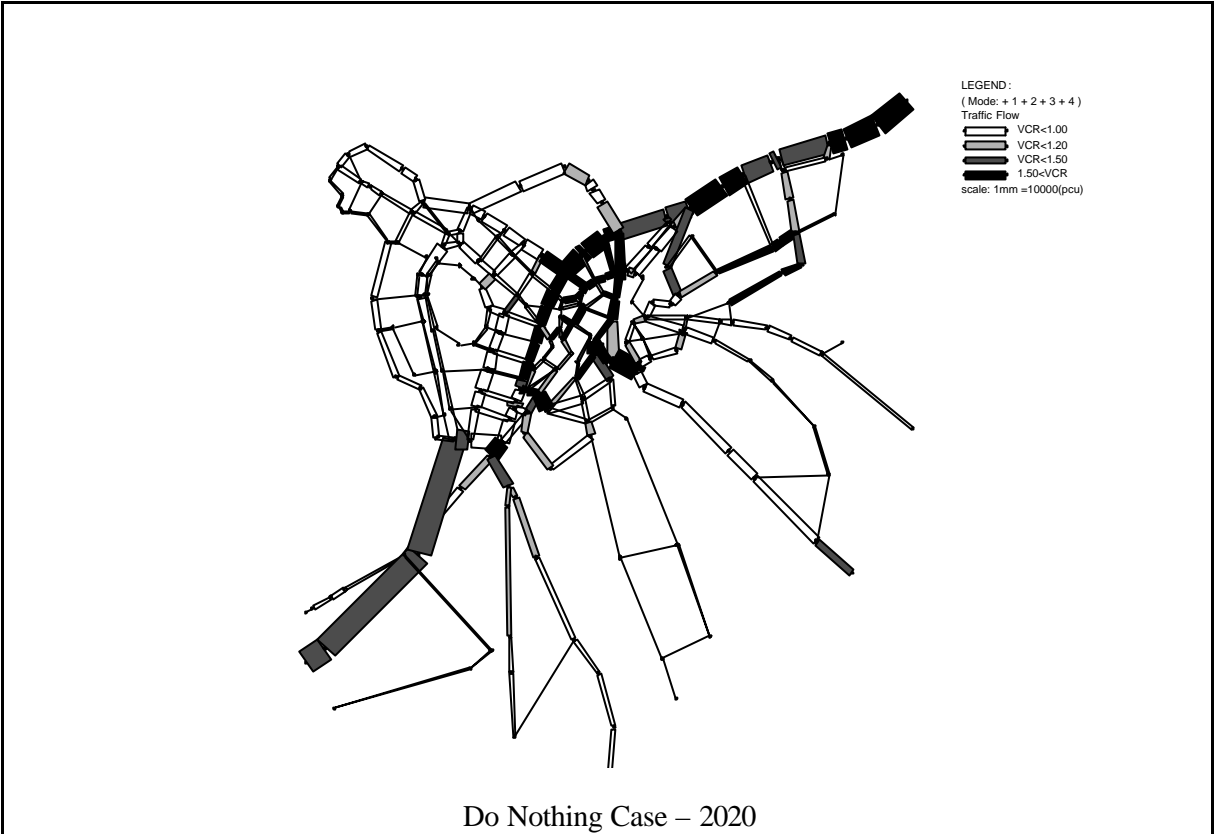


Figure 6.3-1 Traffic Assignment Comparison (3/3)

### 6.3.2 Traffic Parameters

The traffic system performance of the M/P is assessed as shown in Table 6.3-1 based on savings in traffic parameters and traffic cost between the two cases of “Do Nothing” and with “Master Plan”. The M/P will provide an annual savings in traffic cost of 90 Billion LL by the target year 2020.

Table 6.3-1 Traffic Parameters

Year	PCU-Km	PCU-Hour	Capacity-Km
<b>“Do Nothing” Case</b>			
2000	1,454,932	27,192	3,582,567
2005	1,789,023	36,341	3,582,567
2010	2,136,209	48,435	3,582,567
2020	2,788,483	74,557	3,582,567
<b>“Master Plan” Case</b>			
2005	1,638,469	28,412	4,050,002
2010	1,856,863	33,476	4,417,502
2020	2,348,516	42,838	5,057,002

### 6.3.3 Network Efficiency

Traffic parameters of average speeds and congestion rates are used as shown in Table 6.3-2 to assess the efficiency of the network. Low speeds and high levels of congestion on the “Do Nothing” case are widely spread on when compared with the “Master Plan” case.

Table 6.3-2 Speed and Congestion

	2000	2005	2010	2020
<b>Average Speed</b>				
Do Nothing	54.7	46.2	45.4	42.2
M/P		54.5	54.8	56.7
% Increase		117.9	120.7	134.3
<b>Average V/C Ratio</b>				
Do Nothing	0.384	0.545	0.585	0.655
M/P		0.459	0.439	0.424
% Decrease		84.2	75.0	63.8

Table 6.3-3 Accessibility Coverage of Population

Travel Time to City Center (minutes)	2000	2020	
		Do Nothing	Master Plan
0.0 – 4.0	18,850	3,600	3,473
5.0 – 9.9	159,202	112,640	108,604
10.0 – 14.9	77,564	142,266	258,104
15.0 – 19.9	43,248	74,667	62,154
20.0 or more	32,065	121,001	21,839
Total	330,930	454,174	454,174
Average Time	13.1	19.7	14.1

## 6.4 ECONOMIC ANALYSIS RESULTS

### 6.4.1 Economic Parameters

Costs and benefits for the project elements were allocated to each year from 2001 to 2030. The cost

beyond year 2020 is that for maintenance while benefit was assumed to have the same growth rate as in year 2019/2020 and the residual value was calculated assuming a project life of 50 years. Table 6.4-1 presents the economic cash flow of the Master Plan projects.

The economic analysis was carried out for a period of 30 years, as benefits of projects implemented by the end of the Master Plan period will be generated in beyond years.

Net Present Value (NPV) and Benefit-Cost Ratio (B/C) with a discount rate of 12% were calculated at about L.L180 Billion and 2.52. The corresponding value of the Economic Internal Rate of Return (EIRR) was calculated at 27.75.

Table 6.4-1 Economic Cash Flow of Master Plan (Billion L.L.)

Year	Costs	Benefit	B-C	Discounted Values			
				Cost	Benefit	B-C	
1	2001	5,370	-	- 5,370	5,370	-	- 5,370
2	2002	8,450	-	- 8,650	7,545	-	- 7,545
3	2003	26,130	-	- 25,560	20,831	-	-20,831
4	2004	29,880	-	- 29,300	21,268	-	- 21,68
5	2005	17,710	-	- 17,710	11,255	-	-11,255
6	2006	12,670	30,431	17,760	7,189	17,267	10,078
7	2007	12,706	35,106	22,400	6,437	17,786	11,349
8	2008	7,490	39,781	32,292	3,388	17,995	14,607
9	2009	6,559	44,457	37,898	2,649	17,955	15,306
10	2010	5,688	49,132	43,445	2,051	17,718	15,667
11	2011	10,311	53,166	42,855	3,320	17,118	13,798
12	2012	10,373	57,200	46,827	2,982	16,444	13,462
13	2013	12,470	61,234	48,764	3,201	15,717	12,517
14	2014	8,415	65,268	56,852	1,929	14,958	13,029
15	2015	6,758	69,302	62,543	1,383	14,180	12,798
16	2016	22,508	73,336	50,828	4,112	13,398	9,286
17	2017	19,645	77,369	57,725	3,204	12,621	9,416
18	2018	18,645	81,403	62,759	2,715	11,856	9,140
19	2019	18,703	85,437	66,734	2,432	11,110	8,678
20	2020	18,544	89,471	70,927	2,153	10,388	8,235
21	2021	659	93,656	92,996	68	9,709	9,641
22	2022	722	97,996	97,274	67	9,070	9,004
23	2023	919	102,498	101,579	76	8,471	8,395
24	2024	1,113	107,166	106,053	82	7,908	7,825
25	2025	1,075	112,008	110,933	71	7,379	7,308
26	2026	1,653	117,028	115,375	97	6,884	6,787
27	2027	1,633	122,233	120,600	86	6,420	6,334
28	2028	633	127,629	126,996	30	5,985	5,955
29	2029	691	133,223	132,532	29	5,578	5,549
30	2030	-107,496	139,022	245,606	- 3,999	5,197	9,196
				NPV=180.57 (Billion L.L.)			
				B/C=2.52			
				EIRR =27.75%			

## 6.4.2 Sensitivity Analysis

During the implementation of the Master Plan projects, it may faces sudden increase in costs or decrease in benefits. To investigate its economic viability in such cases, an economic sensitivity analysis was carried out for the following three cases:

Case 1: Cost + 10 %

Case 2: Benefit - 10 %

Case 3: Cost + 10 % and Benefit - 10 %

Table 6.4-2 presents the results of the sensitivity analysis, which show that the master Plan is still economically viable even in such critical case of 10% decrease in benefits with 10% increase in cost.

Table 6.4-2 Sensitivity Analysis

Parameter	Base Case	Sensitivity Analysis		
		Case 1	Case 2	Case 3
B/C Ratio	2.52	2.30	2.28	2.07
EIRR (%)	27.75	25.78	25.58	23.70
NPV (LL Billion)	180.57	169.28	151.17	139.37

## 6.5 MASTER PLAN EFFECTS

The formulated Master Plan is designed to be environmental friendly in the concept that Greater Tripoli is a city with heritage and historical places that should be preserved for future generations. The effects of this urban transport Master Plan are summarized as follows:

### 6.5.1 Target Realization

The specific objectives and targets of the Master Plan that are recognized through the strategic plans of each sector are achieved as follows:

In Section 3.7, the target level of the Master Plan was set up as following:

- 1) Level of service
- 2) Accessibility coverage
- 3) Traffic parameters

According to the level of service, the Master Plan network can be achieved the existing target level of travel speed which is an average travel speed of 54.7 km/h in 2000.

As for the accessibility coverage, the accessibility time of the Master Plan is the lowest among the alternatives. In addition, this time under Maser Plan case is much lower than that under do-nothing case. Therefore, it can be said that the Master Plan can be achieved its target level.

Regarding to the traffic parameters, the traffic congestion of the Master Plan is the lowest among the alternatives. In addition, the congestion rate under the Master Plan case is much lower than that under do-nothing case. Therefore, it can be also said that the Master Plan can be achieved its target level.

Taking into account the above-mentioned targets, the Master Plan can be achieved their target levels.

### 6.5.2 Indirect Benefits

- Improving Living Environment  
With a smooth traffic flow on the network of the Study Area, improvement in the environmental conditions will be noticed through the reduction in air pollution and noise of traffic. The environment friendly developed transport system will prevent further deterioration to the urban environment and amenity and promote health sustainability to residents.
- Promotion of Economic Development  
Tripoli will be developed to have a freight transport system and system center by providing infrastructures for movement and storage facilities for social and business logistics. An essential

element in the logistic system, which is the transport network, is provided by the formulated transport Master Plan that will efficiently promote the economic development in the area. More employment opportunities are expected to be generated to activate the economic sector and increase the household income.

- Promotion of Tourism

The Study Area has historical places with heritage in addition to its location as a sea resort area during summer season that attract many tourists from many countries. Preserving this history and urban scenery with an efficient transport system that includes public transportation will increase the tourism potential and attract more visitors.

- Promotion of Trade and International Traffic

With a high efficiency transport network and logistic system for freight transport all together with the strategic location of Tripoli, trade and international traffic are expected to increase in the future. Many countries in the region will recognize that trade through Tripoli Port is more efficient than any other alternatives in the region. Transport terminals will serve the inter-city traffic and will smoothly handle the expected future transport demand.

### Traffic Safety

Implementing the Master Plan projects appropriately will promote traffic safety on the transport network of the Study Area. As all the planned projects will be implemented with all required safety facilities and measures, the number and severity of accidents will decrease to a large extent. The M/P integrates improvements on crossing streets and intersections for improved arterials that may handle higher speeds by motorists after improvement. In addition, the management system to be applied will highly increase the enforcement capabilities and provide more safety facilities and measures on the transport network. The Master Plan includes measures to improve the safety level through education programs for road users as well as other enforcement measures to increase the efficiency of the network.

## **CHAPTER 7**

# **OVERALL IMPLEMENTATION PLAN**

## CHAPTER 7

### OVERALL IMPLEMENTATION PLAN

#### 7.1 IMPLEMENTATION FRAMEWORK

To establish the overall implementation program of the Transport Master Plan, the framework was set up involving time schedule, project implementation capacity and budgetary considerations.

##### (1) Time Framework:

The planning period, 2001 ~ 2020 is divided by the following three (3) stages;

- Short Term Planning Period: 2001 ~ 2005
- Medium Term Planning Period: 2006 ~ 2010
- Long Term Planning Period: 2011 ~ 2020

##### (2) Project Implementation Capacity:

The administration and technical capacities for the implementation of the Master Plan projects should be developed with the governmental human resources reinforced with professional engineers enough to implement projects in accordance with the proposed implementation schedule.

##### (3) Expected Budget:

The Five-Year Development Plan 2000 – 2004 shows the investment scale of transport sector as US\$ 1,879.8 million (LL 2,820 billion) for that period of five years. Based on this investment scale of the transport sector, the budget to be allocated to the transport sector and the transport Master Plan in Greater Tripoli is estimated with the following assumptions:

##### 1) Budget Scale expected for Greater Tripoli in comparison with Five Year Development Plan

- Population Comparison; 8.3 % (4.0 million in Lebanon,  
0.33 million in Greater Tripoli)
- Road Network Comparison; 2.5 % (3,502 km in Lebanon,  
88.4 km in Greater Tripoli)
- Combined comparison assumed for budget allocation for Greater Tripoli; 4.0 %

##### 2) Budget expected for routine road and Master Plan projects in Greater Tripoli

The routine maintenance and rehabilitation works for secondary roads of 55.77 km, and those of international and primary roads of 32.63 km, are classified as routine road projects, allocating 40 % of the total budget expected for Greater Tripoli, considering the importance of the routine works including pavement rehabilitation, during the short and medium planning periods from 2001 to 2010.

As roads projects proposed under the Master Plan will be implemented and completed, routine road projects will become larger, thus require more allocation of budget, which is considered to be 50 % of the annual budget during the long term planning period from 2011 to 2020.

The budget expected to be allocated for the Master Plan projects are, therefore, 60% for the period of 2001 to 2010 and 50% for 2011 to 2020 of the total.

The estimated budget for transport sector in Greater Tripoli is presented in Table 7.1-1.



Table 7.1-1 Estimated Budget for Transport Sector in Greater Tripoli (billion LL)

Item	Short-Term (5 Years) 2001 - 2005	Medium-Term (5 Years) 2006 - 2010	Short-Term (10 Years) 2011 - 2010	Total
Total	$2820 \times 0.04 = 113$	$2820 \times 0.04 \times 1.23^* = 138$	$2820 \times 0.04 \times 1.53^* \times 2 = 345$	596
Routine Works	$113 \times 0.4 = 45$	$138 \times 0.5 = 69$	$345 \times 0.5 = 173$	287
Master Plan	$113 \times 0.6 = 68$	$138 \times 0.5 = 69$	$345 \times 0.5 = 172$	309

\* Escalation

### 3) Budget for each planning period

The budget for each planning period of the Master Plan is estimated based on the budget expected for Greater Tripoli shown in Table 7.1-1, and the annual economic growth of 3% of the country.

## 7.2 IMPLEMENTATION SCHEDULE

Within the condition of implementation framework established, the overall implementation schedule of projects under the Master Plan is proposed as shown in Table 7.2-1.

- Road Projects  
The implementation timing of each project is proposed in accordance with its priority.
- Public Transport Projects  
Taking into consideration the on-going plan of bus transportation, all projects are proposed under the short-term period.
- Traffic Management Projects  
The legislation and system on traffic management shall be established at the earliest possible time, which was assessed to be vital in Greater Tripoli. Enforcement measures also are recommended for implementation just after the declaration of traffic management legislation. Accordingly, facilities such as safety facility, traffic signal, marking including on-street parking system shall be provided.

The proposed overall implementation schedule reveals that transport projects in Greater Tripoli shall be rigorously implemented at least during the first ten (10) years (2001 ~ 2010) requiring four percent (4 %) of the national investment for the transport sector projects. During the next ten (10) years (2010 ~ 2020), the major works will be concentrated to the maintenance and rehabilitation of existing roads with the new construction of Grade Separation projects and the Arab Highway.

Table 7.2-1 Overall Implementation Schedule

Project Code	Project Name	Length Km	Cost LL B.	Short Term					Medium Term					Long Term					Agency/Fund	Status			
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			16	17	18
<b>A</b>	<b>Road Improvement and Widening</b>																						
A01	Tripoli-Syria Road	3.0	2.93																			MOPWT/Local	
A02	Tripoli-Sir El-Danie Road	5.4	2.43																			MOPWT/Local	Ongoing
A03	Qoubbe-Zgharta Road	4.2	1.89																			MOPWT/Local	
A04	Abou Samra East Road	2.5	1.58																			MOPWT/Local	
A05	Abou Samra West Road	3.6	2.27																			MOPWT/Local	
A06	Ras-Maska-Kousba Road	5.0	6.40																			MOPWT/Local	
A07	Ras-Maska-Barsa Road	2.6	2.54																			MOPWT/Local	
A08	Ras-Maska-Dedde Road	2.8	1.26																			MOPWT/Local	
A09	Behsass (Old) Highway	3.6	3.51																			MOPWT/Local	
	<b>Sub Total</b>	<b>32.70</b>	<b>24.81</b>																				
<b>B</b>	<b>New Road Construction</b>																						
B01 (a)	East Ring Road	8.5	28.33																			CDR/Islamic Bank	Design
B01 (b)	Related Roads	4.8	6.87																				
B01 (c)	Grade Separation	(n =10)	22.50																			CDR	
B02 (a)	West Ring Road	6.4 (n=2)	15.06																			CDR	Planning
B02 (b)	Related Roads	1.25	1.50																				
B02 (c)	Grade Separation	(n = 4)	9.00																			CDR	
B03	Arab Highway	11.1	95.00																			CDR	Planning
	<b>Sub Total</b>	<b>32.05</b>	<b>178.26</b>																				
<b>C</b>	<b>Grade Separation / Underpass</b>																						
C01	Tripoli Blvd. Underpass	0.985	29.40																			CDR	
C02	Grade Separation	(n = 5)	51.10																			CDR	
	<b>Sub Total</b>		<b>80.50</b>																				
<b>D</b>	<b>Public Transport</b>																						
D01	Public Bus		23.55																			MOPWT	Committed
D02	Taxi		1.50																			Municipality	
D03	School bus		0.95																				
	<b>Sub Total</b>		<b>26.00</b>																				
<b>E</b>	<b>Traffic Management</b>																						
E01	Signals		2.56																			CDR/Saudi Fund	Ongoing
E02	Signs		0.34																			Municipality/Local	Ongoing
E03	Marking		0.36																			Municipality/Local	Ongoing
E04	Ped. Overpass/Underpass		0.26																			Municipality	
E05	Parking		1.35																			Municipality/BOT	
E06	Education / Safety		4.00																			MOE/MOI	
E07	Enforcement		1.13																			MOI	
	<b>Sub Total</b>		<b>10.00</b>																				
<b>Total Investment in 2001 Prices</b>			<b>319.57</b>	<b>84.23</b>	<b>56.49</b>	<b>178.85</b>																	
<b>Expected Budget in 2001 Prices</b>			<b>386.00</b>	<b>85.00</b>	<b>86.00</b>	<b>215.00</b>																	

## **CHAPTER 8**

# **CONCLUSIONS AND RECOMMENDATIONS**

## CHAPTER 8

### CONCLUSIONS AND RECOMMENDATIONS

#### 8.1 INTEGRATED TRANSPORT PLAN

##### (1) Plan Justification

- The Transport Plan is prepared in comprehensive and systematic way to cope with present and future transport issues. It is integrated with other city plans and integrates both hard and soft components of measures.
- The Plan is also indispensable to improve any negative environmental transport related impacts and provide measures for better environment integrity with urban development plan.
- The Plan is justified to be technically and economically feasible and acceptable from the environmental viewpoints.

EIRR (%):	27.75
NPV: (LL Billion)	180.57
B/C:	2.52

##### (2) Road Development

- The ring-and-radial network pattern shall be completed to ensure smooth mobility and guide the spatial urban development, with improvement of, among others, the following;
  - Ring axis; East Ring Road, West Ring Road.
  - Radial axis; Ras-Maska - Kousba Road, Tripoli - Sir El-Danie Road
  - Central axis; Tripoli Boulevard
- The grade separation structures are required to alleviate traffic congestion and mitigate traffic pollution at the following congested intersection.
  - 3 Intersections along Tripoli Boulevard.
  - 5 Intersections along Arterial Streets

##### (3) Public Transport

- The planned city-bus system shall be implemented at the soonest possible time to provide public transport services and lessens the severe traffic congestion inside the central areas of the city.
- A school-bus system shall be implemented to mitigate drawback effects on road capacity due to created bottlenecks and repeating bus stops.
- The public transport facilities of bus terminals, taxi terminals and stands are provided to support public transport system and improve urban environment, especially the transport center is in urgent need.

##### (4) Traffic management

- The on-going traffic signalization project shall be continued including other congested intersections.
- The transport management plan in Central Tripoli is prepared covering one-way traffic flow system, on-street parking system, geometrical improvement of intersections, bus/taxi terminals, traffic safety facilities, among others.

## 8.2 RECOMMENDATIONS

### (1) Plan Authorization

- The Plan is recommended for authorization for the smooth implementation of sectoral projects and measures at the optimum timing.
- The Plan authorization is vital for systematic implementation of such projects and measures under the authorized policy and plan so that the effort of various agencies concerned can be integrated toward the end.

### (2) Urban Transport Administration and Legislation

- The existing legislation system and regulations related to urban transport in Lebanon, which include traffic law, traffic licensing regulations, parking regulations, traffic offense charges, etc., are well established. There is no need to issue new laws or regulations. However, it is necessary to enforce and apply such laws and regulations.
- The administration system of the Government and municipalities in Lebanon is based on the small-organization principle. Administration related to the development of transport sector is under the same principle. As there are many agencies involved in the implementation of the Master Plan projects, such as CDR, MOPWT, MOI and the Municipalities, it is recommended that a coordination body should be established for the smooth and successful implementation of the Master Plan.
- Even with the small-organization principle, Tripoli Municipality should establish a road and traffic unit, with enough engineers, to carry out maintenance and traffic management and operation tasks and to supervise all the transport sector works.

### (3) Organization and Institution

- The Master Plan includes a large number of projects and measures which require large investments and implementation capability. An effective organization for systematical implementation approach is the vital key for successful realization of the plan.
- Taking into consideration the small-organization principle, the implementing organization shall be strengthened as follows:
  - Involved international organizations should be requested to dispatch experts in the transport sector in order to provide more technical skills in implementing the projects.
  - For construction projects and maintenance works, contract-out system to employ private contractors and consultant should be applied to achieve successful implementation.

### (4) Maintenance and Management

- As the maintenance system in Tripoli is based on the maintenance by contract (MBC) method, it is necessary to upgrade the existing system in order to acquire more efficient and proper maintenance.
  - Establishment of maintenance and management standard and programs.
  - Improving the contents and supervising system on maintenance and management.

### (5) Traffic Operation and Management

- It is necessary to strictly enforce traffic laws and regulations. Therefore, traffic police should be increased and equipped in order to control traffic operation and apply enforcement laws.
- In order to efficiently carry out the tasks of traffic operation and management, a road and traffic unit should be established with the following duties.
  - Establishment of traffic management and operation standard and programs
  - Preparing manuals for traffic management and operation

#### (6) Fund Preparation Measures

- For implementing the proposed projects under the Master Plan, funds to be allocated can be obtained based on the nature and scale of each project, from several resources, such as national budget, CDR's reconstruction fund, BOT and private funds and loans from international institutions.
- In order to implement large-scale projects under the Master Plan, it is necessary to find out the possibility to apply ODA loans of foreign countries, as such projects will contribute in the national social and economic development and will improve the environmental conditions.
- It is recommended to implement the public transport project of city bus service under a BOT scheme by private investments.

#### (7) Urban Environment Considerations

- The Master Plan projects aim to improve the urban environment in the Study Area. The implementation of formulated projects under the short-term plan will alleviate traffic congestion, reduce negative impact of traffic on environment and contribute to the betterment of urban environment conditions.
- Improving the urban environment is a major target that should be taken into account in implementing the Master Plan projects.
- When implementing road projects in areas not located under land-readjustment schemes, land acquisition and resettlement plans should be prepared in early stages together with required fund allocations.
- As air quality is greatly deteriorated in central areas, the early implementation of the Master Plan projects, with additional beautification schemes, will reduce air pollution and improve urban environment.

#### (8) Coordination with Other Related Projects

- Implementation of the Master Plan projects should be carried out as scheduled and in complete coordination with other development plans and projects in order to provide optimum and benefits.

#### (9) Early Implementation of Short-term Projects

- Three (3) projects which are Tripoli Boulevard Underpass Project, (Anti pollution facility to reduce negative environment impact of traffic), Transport Management Project in Central Tripoli (Environmental enhancement in Greater Tripoli) and Behsass Transport Center Project are rationalized to be feasible from the technical, economical and environmental aspects as well as the implementation capacity view point.
- The first two (2) projects should be implemented together as an integrated project to improve traffic and environmental conditions in the central area of Tripoli.
- The third project, which is an urgent and committed project by MOPWT, is recommended for implementation at the soonest possible time to provide a multi-function transport center and accommodate public transport modes.

### **8.3 TECHNOLOGY TRANSFER**

#### (1) Workshop on Inception Report

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. The main topics discussed are:

- Development Direction and Future Urban Transportation Planning of Tripoli

Transport Problems in Greater Tripoli and the Policy on Private and Public Transport in Beirut and Tripoli

- Outline of the Study

Attendants fully understood the necessity of developing an integrated transport plan in order to solve transport issues.

#### (2) Discussion on Interim Report

The discussion conference was held on Interim Report on June 12, 2001 with the participation of Mayor of Tripoli, JICA Advisory Committee, members of the Steering Committee, Counterpart Team and Study Team. The following main output of the Study was explained by the Study Team, and discussed among participants.

- Master plan formulation policy
- Traffic demand forecast
- Plans of road network, public transport and transport management
- Initial environmental Examination
- Overall implementation Plan

The methodology and output of the Study were understood and agreed.

#### (3) Seminar on Study Results

A Seminar was conducted to present the final results as well as to discuss other related topics. The Seminar was held in Tripoli and attended by experts and representatives from all concerned agencies and authorities as well as specialists, politicians and other interested groups.

#### (4) Participation in JICA Training Course

A counterpart member participated in JICA Training Course in Japan on the transport planning from March 20, 2001 to April 7, 2001. In addition, training and field surveys was conducted with the Study Team on major traffic and transport projects in Japan and on the applications of JICA STRADA programs.

#### (5) During the Study

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 other agencies related to the Study.

On-the-job training was partially conducted as all the Counterpart members were not assigned on a full-time basis and they have to carry out their duties for other projects under CDR. CDR Counterpart is experiencing new technology and methodologies in urban transport planning that introduced during the Study.