

## **PART 3**

# **SHORT-TERM IMPROVEMENT PLAN**

PART 3: SHORT-TERM IMPROVEMENT PLAN

13 SHORT-TERM PLAN PROJECTS

Short-term Plan Projects

Projects under the Short-term Improvement Plan have the objective of providing quick and effective solutions, actions and measures to solve severe transport and traffic problems in the Study Area. As concluded in previous sections, Central Tripoli is the most suffering area from both traffic congestion and environmental deterioration. Projects to solve problems in this area are expected to generate high positive impact on both social and natural environment.

Selection Criteria

A selection criteria was established and applied on all the projects included under the first 5-year Plan to identify projects to be subject to further technical, environmental and economic studies during the second phase of the Study, which aims to formulate an integrated Short-term Improvement Plan.

1) Urgency

Projects will be in urgent need for implementation, and to be intended to improve the environment and to solve related traffic problems.

2) Integration

Selected projects for further studies under this phase will provide integration with city and land-use planning activities and between both hard and soft measures.

3) Positive Environmental Impact

Projects are selected to improve the natural and social environment of the city, to increase the green area and to provide positive impacts environment.

4) Project Maturity

Projects should have the readiness for implementation while those involving the acquisition of right of way and relocation of residents are given the low priority.

5) Study Example

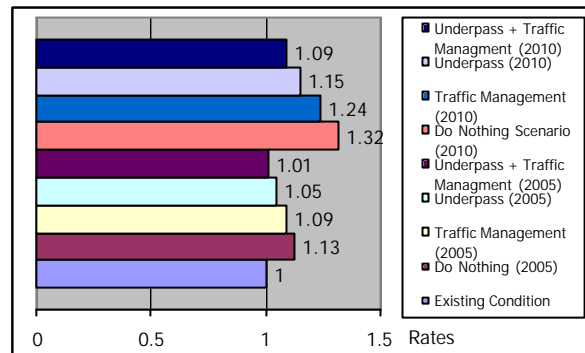
A study with technical, economic and environmental depth is expected to show an example of solving traffic problems involving a new technology.

6) Project Impact

High priority projects are preferable to have high and

fast impact so that the actualization of the Master Plan will be accelerated.

Under this criteria, the two major projects of "Tripoli Boulevard Underpass Project" and "Transport Management Project in Central Tripoli", which are located in the most congested location in the Study Area, were found to have the highest priority. Integration of the two projects aims to improve transport conditions in Central Tripoli, to promote development of commerce and tourism sectors and to improve the environmental characteristics.



Reduction in CO Emission

In addition, the Behsass Transport Center Project, which is an urgent and committed project by MOPWT, is reviewed and included as a pre-conditioned project. Owned land by MOPWT is allocated for the project but funding is not yet available.



Traffic on Tripoli Boulevard

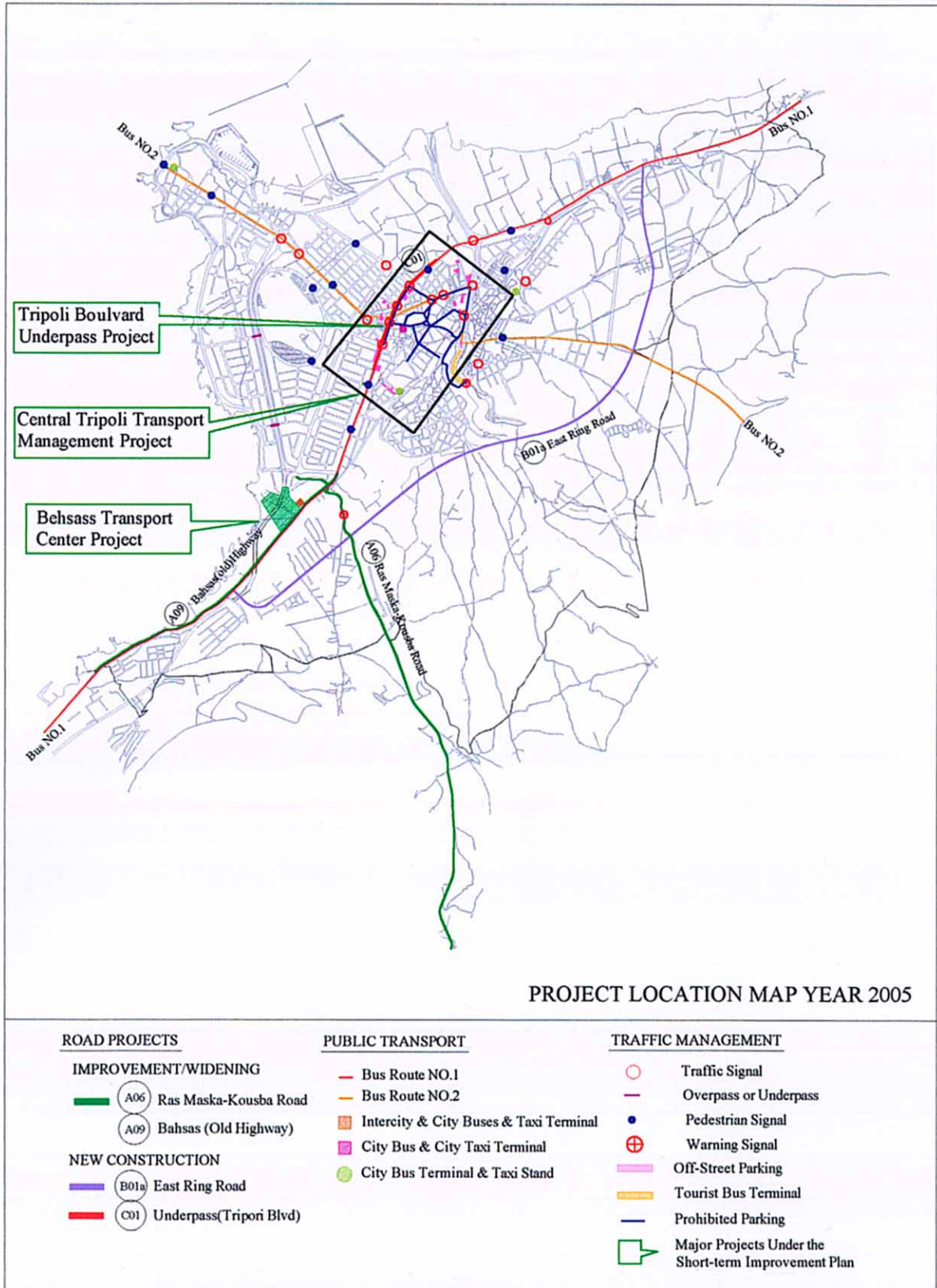


Congestion in Central Tripoli



Tripoli Old City Streets

**PART 3: SHORT-TERM IMPROVEMENT PLAN**



PART 3: SHORT-TERM IMPROVEMENT PLAN

**14 TRIPOLI BOULEVARD UNDERPASS PROJECT**

**Anti-Pollution Facility**

**to Reduce Negative Environmental Impact of Traffic**

**Background**

Tripoli Boulevard is functioning as a primary arterial street and an international highway at the same time. It passes through the central urban area of Tripoli where both through and local traffic are concentrated. The Central Section from Halim Abu Ezz El-Deen Roundabout to Bisar Street is the most critical section in the Study Area in terms of air pollution and traffic congestion. Critical values of daytime air and noise pollution are measured at its two intermediate intersections with Karami and Azmi Streets that connect eastern and western sections of the city.

- Traffic volume:  
Tripoli Boulevard: 25,000 ~ 29,000 vehicle/day  
Intersecting Roads: 9,400 ~ 19,600 vehicle/day
- Travel speed: 8 ~ 20 km / hour.
- Level-of-Service: F
- Noise Level 100 ~ 105 dbA  
(WHO Standard. 72 dbA)

Present Air Quality of Tripoli Boulevard

Location	CO ppm	SO <sub>2</sub> ppm	NO <sub>2</sub> ppm	TSB μg/m <sup>3</sup>
Karami Intersection	8.3	1.8	0.4	200
Azmi Intersection	16.0	1.7	0.2	230
WHO Standards	9.0	0.134	0.21	150

**Project Justification**

Results of field and traffic surveys show that Tripoli Boulevard, from Abed El-Hamid Karami Square to Abd El-Latif Bisar Intersection, is the most suffering link in the road network of the Study Area. This is the main boulevard that connects all arterial roads and handles the highest traffic volumes. In addition, the negative environmental impact in Central Tripoli, especially on air pollution and noise, is mainly due to severe traffic congestion on the boulevard and on its intersecting streets. Accommodating such high traffic volumes in the proposed underpass will clear the road-surface, which can be partially used for environmental improvement and beautification by creating green areas in Central Tripoli.

**Project Objectives**

- To alleviate traffic congestion on the boulevard and its crossing streets and to improve accessibility to commercial and historical areas of the Old City.
- To provide anti-pollution facility for environmental improvement.

**Technical Needs for Underpass**

- Traffic volume exceeds road capacity along the middle section and intersecting streets, causing heavy traffic jam throughout the day, with very slow travel speed of less than 20 km/hour, and high levels of noise and air pollution are recognized.
- Tripoli Boulevard is the only wide road (4-lane road) for the North-South direction. No other wide road in that direction is available west of Tripoli Boulevard

and in central and Old City areas.

- Tripoli West area is being developed. Tripoli North area is being planned for development. Therefore, traffic demand in the North-South direction will continue to increase.
- When East Ring Road, West Ring Road and Arab Highway are completed, through traffic from Beirut to Syria or vis-à-vis will be diverted to these roads, however, due to new traffic demand of West and North area development, traffic volume on Tripoli Boulevard will continue to grow.
- Based on the traffic assignment results, underpass traffic will be about 27,000 pcu per day in 2005 and 34,000 pcu per day in 2020, even though two ring roads and Arab Highway are completed.
- An underpass requires an additional right-of-way at approach sections. As areas along tunnel approach sections are not developed yet; the additional right-of-way should be acquired at the earliest possible time.

Traffic Volumes on Tripoli Boulevard / Underpass (pcu/day)

Section		I	II	III	
2000		28,447	26,734	24,551	
2005	Do Nothing	38,272	34,265	33,725	
	With	At-grade	31,849	33,662	30,843
		Underpass	26,985		
Total		58,834	60,647	57,828	
2010	Do Nothing	38,726	36,524	37,777	
	With	At-grade	34,537	33,771	31,999
		Underpass	23,784		
Total		58,321	57,555	55,783	
2020	Do Nothing	39,594	40,773	41,090	
	With	At-grade	37,661	35,958	33,612
		Underpass	33,918		
Total		71,579	69,876	67,530	

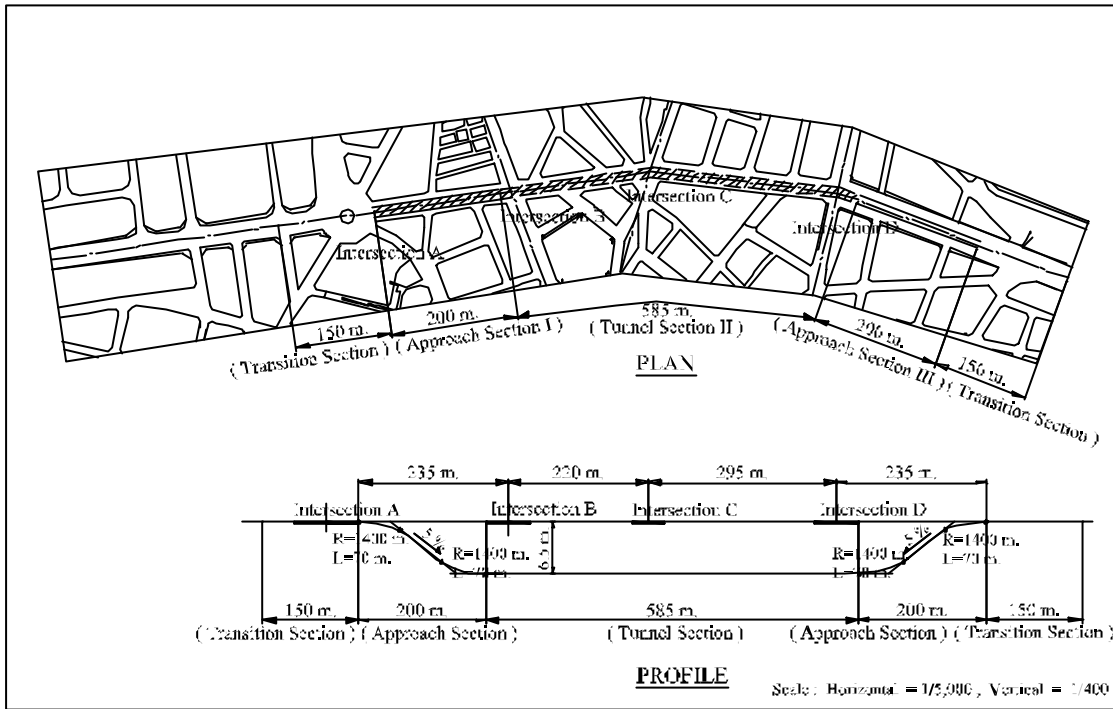
**Alternatives and Plan Selection**

Basically, a scheme of underpass is selected rather than overpass due to landscape and environmental considerations, as overpass schemes are opposed by all concerned authorities. Five alternatives are developed to select the optimum plan for implementation. Alternatives have different lengths and number of intersections to be under-passed, which will affect the cost and efficiency of the underpass.

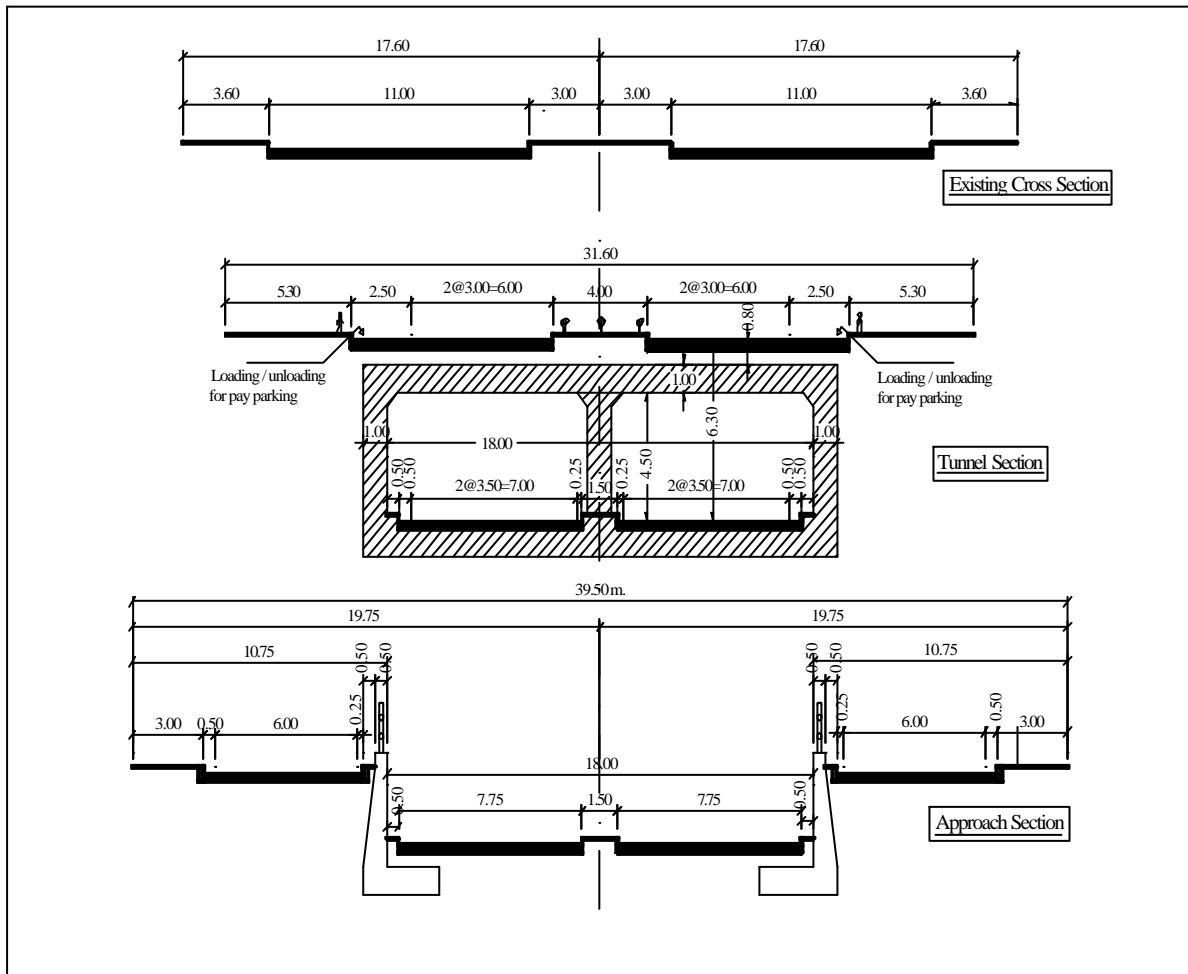
A comparative analysis is carried out and the selected optimum alternative that solves the traffic congestion at intersections along the boulevard and accessibility between eastern and western areas, which will also improve the air and noise pollution in Central Tripoli.

Approaches of the Underpass are accommodated in the most-wider cross sections of the boulevard to eliminate the need for land acquisition, as the right-of-way for Tripoli Boulevard is 42 meters at the northern side and the southern approach is accommodated at a very wide section.

PART 3: SHORT-TERM IMPROVEMENT PLAN



Underpass Plan and Profile



Underpass Cross Section

**PART 3: SHORT-TERM IMPROVEMENT PLAN**

**Preliminary Design**

Design Speed	60 km/hr
Minimum Radius of H. Curve	200 m
Maximum Vertical Grade	5 %
Minimum Radius of V. Curve	1,400 m
Lane width	3.5 m
Shoulder width	0.5 m
Vertical clearance	4.5 m
Live Load for Structural Design	AASHTO HS 20 – 44

- Tunnel section length 585 m
- Approach section length 2 x 200 = 400 m
- Transition section length 2 x 150 = 300 m
- Total length 985 m
- Tunnel size (Box-culvert type) 18.0 m x 4.5 m
- Drainage Pump up System
- Tunnel ventilation system Natural ventilation

**Construction Plan**

As the project site is the most congested area with concentration of commercial and business activities, traffic flow and accessibility to the alongside area of the construction site must be maintained and construction period must be as shorter as possible.

A special traffic management plan with possible detour roads and traffic circulation is prepared for the during-construction stage. Construction needs to be undertaken by two steps; construction of one direction of underpass in the first step, then the other direction in the second step.

Construction will be implemented into two stages for each side of the two traffic directions separately. The total construction period will be as follows:

Mobilization	1.0 month
First segment	12.0 months
Second Segment	10.0 months
<u>Demobilization</u>	<u>1.0 month</u>
<b>Total</b>	<b>24.0 months</b>

**Project Cost**

<i>Project Financial Cost</i>	
Description	Cost (LL million)
Earth Work	2,525
Pavement Work	671
Structural Work	16,926
Drainage Work	432
Road Surface Works	1,843
Beautification Works	90
Fire Fighting System	248
<b>Sub-Total</b>	<b>22,734</b>
Physical contingency (10%)	2,273
<b>Total Construction Cost</b>	<b>24,907</b>
Engineering	3,000
Land Acquisition	1,500
<b>Project Financial Cost</b>	<b>29,407</b>

**Project Evaluation**

The Underpass project is expected to generate traffic benefits due to the resulting shorter travel distance and time with great savings in traffic cost. The project is expected to generate savings that will cover its total construction cost in less than three years of operation.

**Economic Parameters**

The project shows high feasibility, even in sensitivity analysis case, for early implementation.

Net Present Value (NPV)	LL 51.39 Billion
Benefic/Cost Ratio (B/C)	3.15
Economic Internal Rate of Return (EIRR)	32.68%

*Underpass Benefits*

Case	2005		2020	
	PCU-km	PCU-hr	PCU-km	PCU-hr
Without/day	2,074,671	48,884	2,460,805	63,618
With/day	2,043,003	44,422	2,413,528	57,864
Savings/day	31,668	4,462	47,277	5,754
Savings in Traffic Cost	LL 10.3 Billion/year		LL 14.6 Billion/year	

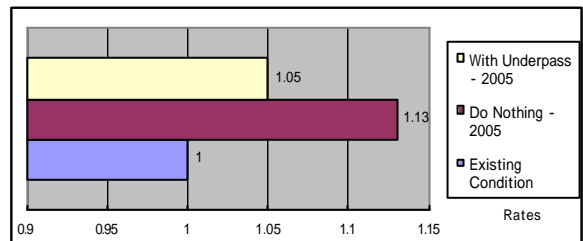
*Sensitivity Analysis*

Case	Cost	Benefit	EIRR %
1	+ 10%	± 0	30.21
2	± 0	- 10%	29.96
3	+ 10%	- 10%	27.68

**Environmental Impact**

Prediction results of the Underpass impact on the air pollution quality at Tripoli Boulevard and surrounding areas is highly recognized due to less travel time and distance together with less delay on the at-grade intersections. With the growth in traffic volumes up to the operation year of 2005, the increase in air pollution of CO is only about 5% of the present condition. Without the underpass, an increase of 13% is expected.

*CO Emission Rates*



**Implementation Organization and Fund Plan**

- To successfully implement this project, the implementing organization will be composed of a team managed by one or two capable and experienced engineer/staff and employ more professional staff and engineers or expertise to cover different tasks of the project.
- For funding resources, the project should be applied for ODA loan because of its environmental positive effects as an anti pollution facility and also for its economic and social benefits.

**PART 3: SHORT TERM IMPROVEMENT PLAN**

**15 TRANSPORT MANAGEMENT PROJECT**

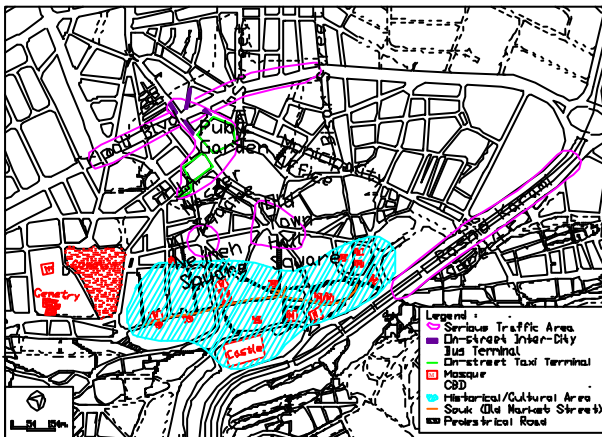
**- For Environmental Enhancement in Central Tripoli**

**Background**

This project covers the Central Area of Tripoli, which includes CBD (Central Business District), Old City, main historical locations and active commercial streets in the Study Area. This area is characterized with heavy traffic congestion that severely decreases the level of service of roads and deteriorates the urban environment.

**Project Justification**

- The Old City of Tripoli includes many historical monuments, edifices, khans and a lot of old houses and traditional markets, and Tripoli Castle. Basically, it has not been planned or designed for car movement, but only for pedestrians and carriages drawn by animal or man. Transport and traffic management schemes for the Old City will result in the preservation of Lebanon's heritage and the existing historical places that attract tourism and promote the development of the city.
- The transport management schemes are easy-to-implement with low-cost that will not require land acquisition or include major structures. Such projects can be implemented in an early stage. They may need, however, effective institutional and capacity building programs and facilities for the successful implementation. In the meantime, their impact on improving the traffic conditions is high and can be acquired in a short period.



Transport Infrastructure in Tripoli Central Area

**Project Objectives**

- To mitigate traffic congestion
- To increase safety of the road users
- To solve parking problems
- To use efficiently existing transport infrastructure
- To promote historical heritage of the city
- To support public transport services
- To improve the environmental conditions

**Major Issues**

- Street Network: The roads are mostly narrow and in downtown and old city are like a maze. The width is not fully used by traffic due to heavy on-street parking. There are no spaces for road widening or construction of new roads.
- Bus Terminals: There is no off-street city bus terminal. The existing roads near to the center are used as on-street terminals.
- Taxi Terminal: There is no off-street taxi terminal. Taxi parking is always on-street that reduce the road capacity.
- Taxi Oversupply: Survey results show that taxi oversupply is occupying road space for long periods, reducing street capacity and increasing parking demand.
- On-Street Parking: Double and triple on-street parking and parking on the sidewalks are daily practice. Illegal parking causes bottlenecks for the traffic flow.
- One-Way Operation: One-way traffic operation is being extensively adopted in many roads. The system is successful but there are some locations where rerouting is required to improve the traffic circulation.
- Traffic Speed: Due to traffic congestion, the travel speed of traffic is slow. The fleet of vehicles includes many old-age modals. Therefore, the air quality is seriously deteriorated.

The current serious traffic problems have severe drawback effects on the socioeconomic activities of the city. For tourism sector, most of the historical places are located in the Old City area that is excessively near to the city center.

**Bus/Taxi System and Terminal**

The operation system for public transport is planned in integration with the provision of off-street terminals. The following operational measures will be implemented immediately until the construction of a permanent terminal at Behsass.

- Transfer the exiting intercity on-street terminals to the designated temporary terminals.
- Keep the current location of taxi terminal as it is but with the control upon over taxi supply.

After constructing the new Behsass Terminal, the following measures will be implemented:

- Transfer the function of the designated temporary terminals to the new Behsass terminal.
- Prohibit the intercity taxis to operate at the Central Parking Area so as to reduce the traffic congestion.
- Allow City taxis to operate within the designated city area and to park at the central parking area.

**PART 3: SHORT TERM IMPROVEMENT PLAN**



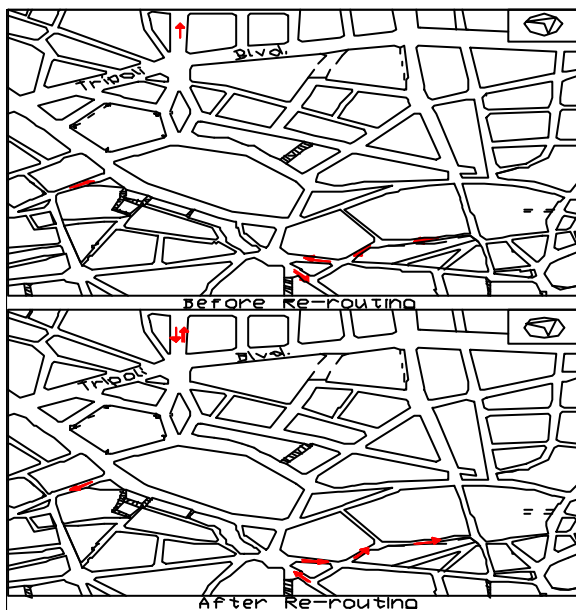
Designated Taxi and Bus Terminals

Other control measures that may be applied to reduce taxi oversupply includes:

- Prohibit old-age models through control of business permission and license renewal.
- Introduce odd-even plate number system
- Apply parking fee

**One-Way Traffic System**

To facilitate traffic circulation in the Central Area, one-way traffic directions are reversed in some corridors to provide the one-way loop circulation or to remove the merging conflict between traffic flows, especially at two areas where the present circulation makes remarkable traffic congestion.



Locations of Geometrical Planning Improvement

**On-Street Parking**

Severe on-street parking problem is existing in the city Central Area where illegal double-parking and parking on sidewalk are common. Survey Results show that 75% of the total length of streets accommodate single-side parking.

Present On-Street Parking Condition

Type of Parking	Ratio (%)
Single-Side	75
Double-Side	15
On-Sidewalk	10
Total	100

The following locations are characterized with the highest demand.

- Sahat Al-Taal
- El-Saraya El-Kadimah
- El-Nejma Square
- Tripoli Boulevard
- Azmi Street
- El-Mitian Street
- Abou-Ali St. near to Old City

Future On-Street Parking Demand

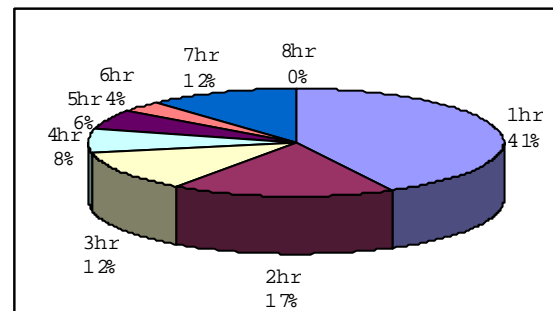
Year	Parking Demand	Garage Demand
2001	3,000	3,150
2005	3,250	3,430
2010	3,500	3,740
2020	4,125	4,330

To completely prohibit the on-street parking in future, the off-street supply must be increased.

Required Off-Street Supply

Up to Year	No. of Required Stalls
2005	1,250
2010	250
2020	625

Analysis of parking durations shows that about 60% of parked vehicles are waiting for less than 2 hours.



Distribution of On-Street Parking Time Duration

**On-Street Parking Policy**

In the Short-term Plan, a complete prohibition of on-street parking is not practicable. Prohibition will be carried out gradually when off-street parking supply is provided. Therefore, by the end of 2005 extra 1,250 off-street parking stalls are required.

Up to the year 2005, the on-street parking will be accepted along the corridors where the street width and traffic volume can allow that. However, Time limit Parking Policy will be managed to control the parking demand and to give priority for the short-term parking.

**Off-Street Parking**

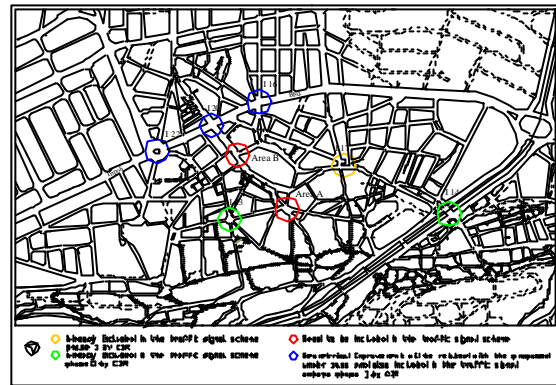
In the Central Area, the existing supply is 556 stalls. The current demand is 192 stalls. In future, the current over supply will not be enough when the



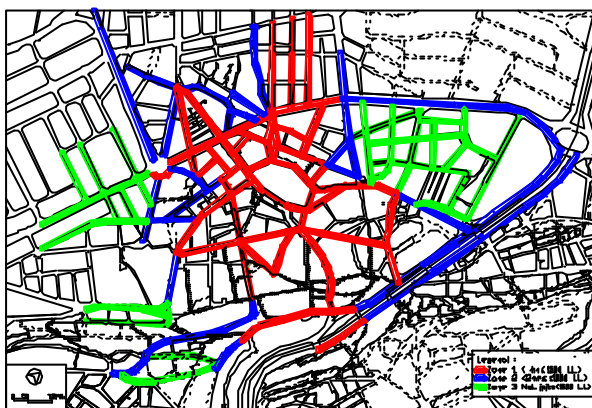
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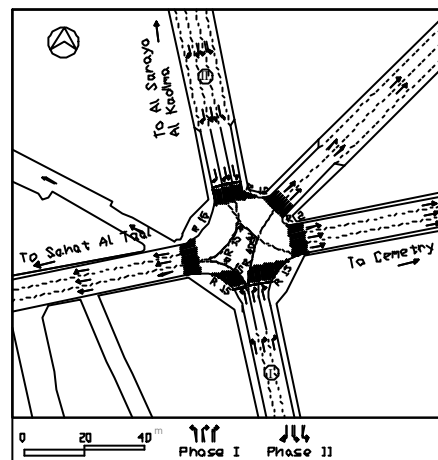
Short-Term On-Street Parking Policy



Intersection Improvement Locations



Time Limit Parking Zoning Plan



Typical Example of Intersection Improvement

on-street parking will be prohibited. By 2005, the required off-street parking supply estimated to be 2750 stalls over the current existing supply of about 500 stalls.

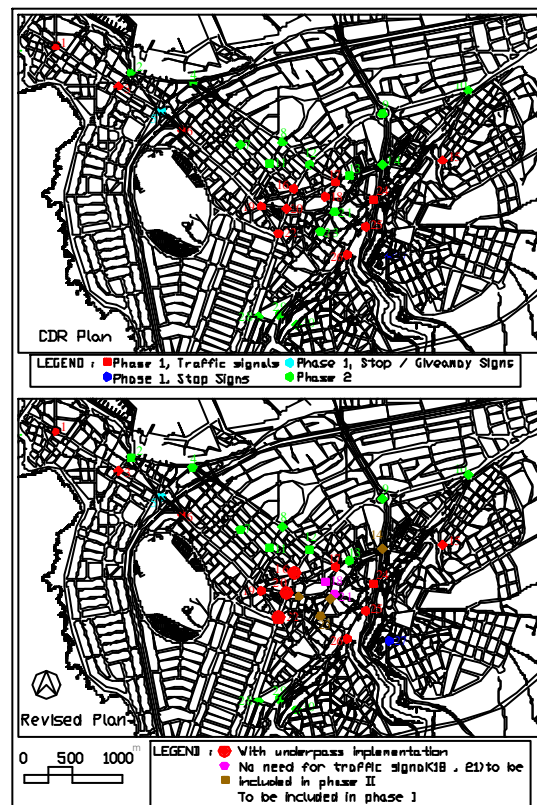
**Off-Street Parking Policy**

The on-street parking will be gradually prohibited and an additional off-street parking will be required. Applying the on-street time limit parking policy will allow the efficient utilization of the off-street parking, especially for long-term parking. To attract drivers to use the off-street parking, the parking fee should be less than on-street parking and shades for the parked vehicles may be constructed.

**Intersection Improvement and Signals**

To optimize the efficiency of the traffic re-routing plan and the construction of Tripoli Blvd. Underpass, improvements at eight main intersections are required. Revision of the on-going traffic signal plan concludes that:

- The intersections at Sahet El-Taal and Al-Saraya Al-Kadimah must be included within the on-going project even; high traffic volumes currently characterize them.
- Intersection No.17 must be implemented in the on-going project, due to its high traffic volume and the application of one-way system in the area.



Review of On-Going Traffic Signal Plan

**PART 3: SHORT TERM IMPROVEMENT PLAN**

**Safety Facilities**

There is a remarkable shortage in traffic safety facilities such as pedestrian crossings and signals, sidewalks, under/overpasses and guardrails. The pavement conditions are bad in some locations that do not only reduce the driver's ability to control his vehicle but to decrease also the capability of the water drainage system especially during the rainy season.

*Sidewalk and Pavement Conditions*

Condition	Sidewalk		Pavement	
	Area m <sup>2</sup>	Ratio %	Area m <sup>2</sup>	Ratio %
Good	8,000	10	30,000	7.5
Fair	32,000	40	360,000	90.0
Bad	40,000	50	10,000	2.5

The improvement plan up to the year 2005 includes mainly the improvement of sidewalks, pavement over-layers and the installation of guardrails.

*Improvement of Safety Facilities*

Item	Quantity
Sidewalk Improvement	72,000 m <sup>2</sup>
Pavement Rehabilitation	370,000 m <sup>2</sup>
Guardrail Construction	40,000 m

**Control Devices**

Lebanese Norm NL130/1-6 is in act since 1999. It includes the standard of traffic signs and marking. The Central Area is out of any standard of traffic signs. Presently, there are few numbers of warning and regulatory signs. Therefore, providing the Central Area with traffic signs is starting almost from the first step.

*Traffic Signs Requirements*

Type of Sign	Quantity
Warning	240
Regulatory	120
Informatory	240

There are few traffic signs in the Central Area that are not enough and marking cannot be observed. Therefore, providing traffic control devices is an urgently required item in the plan.

*Marking Requirements*

Type of Marking	Area (m <sup>2</sup> )
Lane	4,000
Cross-Walk	3,000
Edge	4,000
On-Street Parking	4,800

**Cost Estimate**

*Cost Estimate (LL Billion)*

Component	Cost
Bus/Taxi Terminal	0.078
Parking	1.013
Intersection	0.375
Safety Facilities	3.465
Control Devices	0.409
Subtotal	5.340
10% Physical Contingency	0.534
Engineering Service	0.705
Total	6.570

**Implementation Plan**

*Implementation Schedule*

Activity	2002	2003	2004	2005
D. Design				
Tendering				
Construction				

**Project Evaluation**

This transport management project is low-cost and high-efficiency scheme that will produce immediate positive impacts just after implementation. It does not need any land acquisition and can be started through coordination between local authorities. It has high economic viability and will improve the environmental and safety conditions in the Central Area of Tripoli.

**Economic Parameters** show the feasibility of the project even under extreme cases applied in the sensitivity analysis procedure.

Net Present Value (NPV) LL 4.30 Billion  
Benefit/Cost Ratio (B/C) 1.78  
Economic Internal Rate of Return (EIRR) 28.49%

*Sensitivity Analysis*

Case	Cost	Benefit	EIRR %
1	+ 10%	± 0	25.41
2	± 0	- 10%	25.09
3	+ 10%	- 10%	22.19

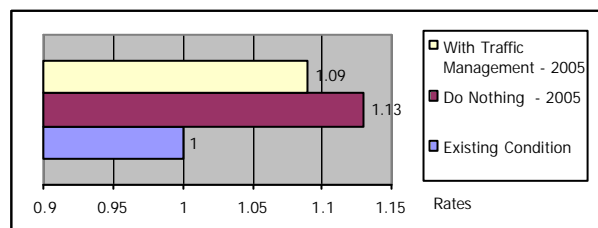
*Management Project Benefits*

Case	2005		2010	
	PCU-km	PCU-hr	PCU-km	PCU-hr
Without/day	2,074,671	48,884	2,205,718	53,536
With/day	2,051,766	46,093	2,182,919	50,730
Savings/day	22,905	2,791	22,799	2,806
Savings in Traffic Cost	LL 5.25 Billion/year		LL 6.30 Billion/year	

**Environment Impact**

A smooth traffic flow with less delay that will result through implementing this management project will positively affect the air quality in Central Tripoli. Emission rates of CO will decrease significantly when compared with the "Do Nothing" case.

*CO Emission Rates - 2005*



**Implementation Organization and Fund Plan**

- For project operation, a Transport Management Unit will be established, composed of Municipality police force and other concerned authorities as an integrated unit to perform traffic management and control tasks.
- For funding resources, the project can be applied for an ODA loan because of its environmental positive impact and socioeconomic benefit.

**PART 3: SHORT TERM IMPROVEMENT PLAN**

**16 BEHSASS TRANSPORT CENTER PROJECT**  
*A Node for Better Movement of People*

**Background**

During the development of the city long years ago, an informal bus/taxi terminal grew-up in the city center on the streets at Al-Taal Square. With the increasing number of parked inter-city taxi and bus at this area, most of the streets are almost closed, causing severe congestions and deteriorating the environment.

A committed plan by the MOPWT (Ministry of Public Works and Transport) to construct a multi-function transport center has not yet secured the required fund for implementation. The center is planned to accommodate public transport modes in addition to other related activities.

**Project Justification**

During the civil war, the transport pattern in Tripoli was changed. Many secondary city-centers were evolved to serve the passenger demand without the need to go or pass through the center of Tripoli and the role of Al-Taal Terminal was reduced. But after the end of the war, a high increase in the transport demand is generating in Tripoli as the capital of North Lebanon. On the other hand, the terminal facilities do not change.

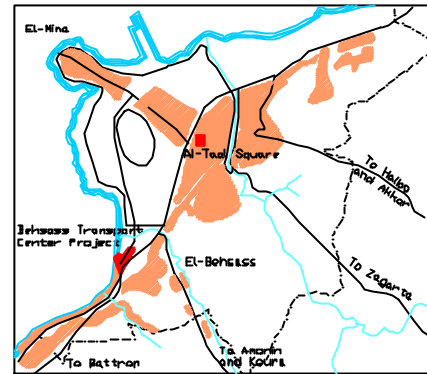
The inter-urban connections between Tripoli and other new developed areas such as Halba in the northeast serving Akkar Region, Amonin in the southeast serving Koura Area, Zagarta in the east, and Battron in the south are in need to be strengthened.

In addition, the city was provided by the railway services before the civil war. The line to north was too active in handling passengers and goods. The railway infrastructure was destroyed during the war. Rebuilding this railway service is important especially to strength the activities of El-Mina Port as the main port in the northern area. MOPWT Plan is to accommodate a railway station under the Transport Center in the future.

The construction of a multi-functional terminal at Behsass that can be utilized as transport center to acquire all the abovementioned requirements will greatly solve severe transport problems in the Study Area.

**Location**

The proposed site is located in the southern side of Tripoli City between the Old Beirut-Tripoli Highway and Beirut-Tripoli Motorway. The railway authority (Office of Rail Road and Public Transport under MOPWT) owns the land. The required area for the center is about 34,000 m<sup>2</sup> that represents 36% of the total land area.



Location of Behsass Transport Center

**Project Objectives**

- To provide Tripoli with anti-pollution environmental friendly transport terminal.
- To mitigate traffic congestion in the city Central Area.
- To facilitate interconnections with surrounding new developed areas and with other regions as a logistics center.
- To interconnect bus trips with others modes of taxis and private cars.
- To enforce the role of Tripoli Port as the main port in the North.

**Project Function**

Tripoli is the capital of North Lebanon and for long time has been the main commercial, industrial, financial and administrative activity center.. Due to the importance and special heritage and historical nature of the city, the project aims to provide the city with the most needed multi-function transport center that will accommodate the transport facilities that are not yet exists in the city, such as:

- Inter-city bus terminal
- City bus terminal
- Inter-city taxi terminal
- City taxi terminal
- Parking area
- Shopping and services center

**Capacity**

Category	Required Parking Capacity			
	2005	2010	2020	Total
Bus				
Intercity	24	15	17	56
City	140	90	95	325
Taxi				
Intercity	106	87	94	287
City	8	16	24	48
Commodity Vehicle	4	8	12	24
Private Car	100	75	25	200

Source: Behsass Transport Center Study, MOPWT, 2000

**PART 3: SHORT TERM IMPROVEMENT PLAN**

**Economic Evaluation**

Estimated economic parameters show high viability.

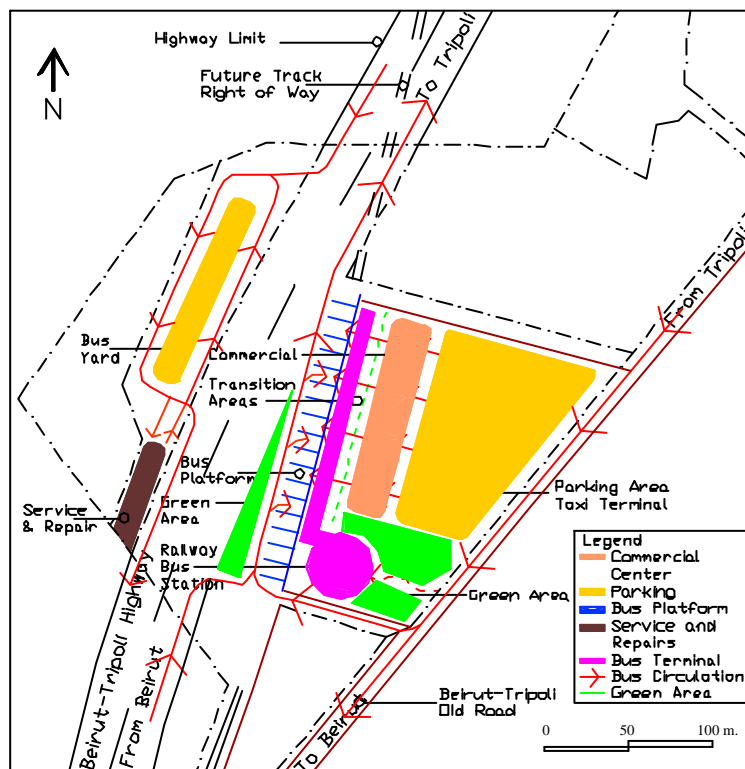
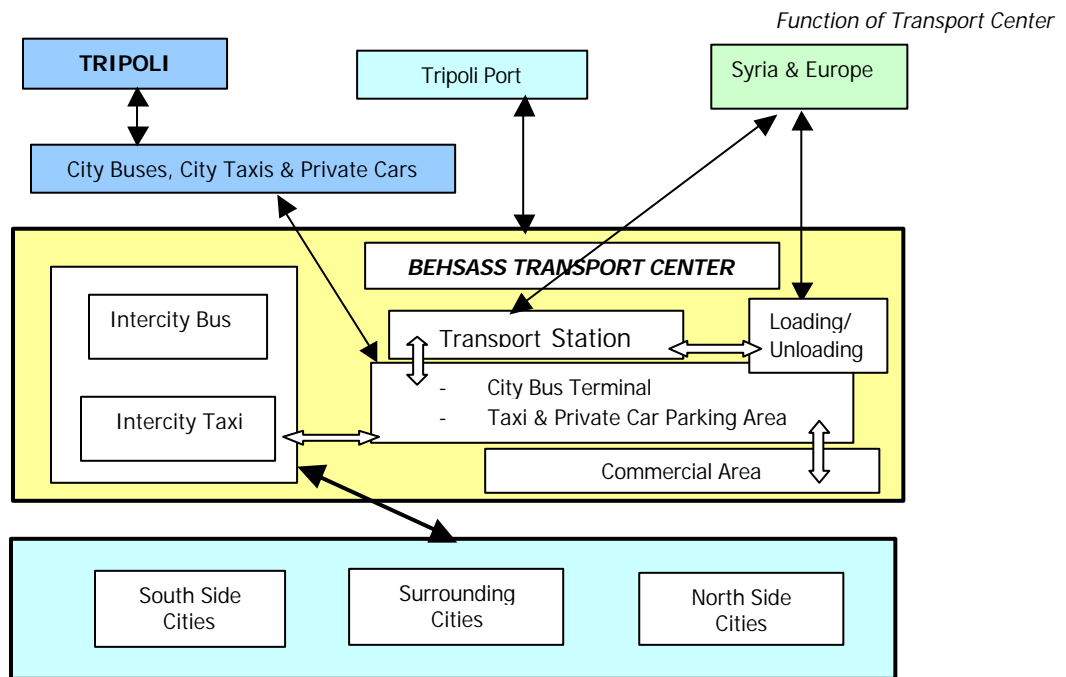
- EIRR %	19.50
- NPV (LL Billion)	7.275
- B/C	2.02

**Implementation Plan**

The total project cost is estimated by Lebanon-side as US\$ 5.53 million (LL 8.30 Billion) that includes both construction and engineering costs. Land price is not included, as it is owned by the MOPWT.

Implementation Plan

Activity	2002	2003	2004	2005
Detail Design				
Tendering				
Construction				



Layout of Behsass Transport Center

## **CONCLUSIONS AND RECOMMENDATIONS**

## CONCLUSIONS AND RECOMMENDATIONS

### 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.

### SHORT TERM PLAN

#### (1) Tripoli Boulevard Underpass Project

- The Project aims to revitalize activities in the City Center and Old City, to alleviate the existing severe traffic congestion at three (3) at-grade intersection along Tripoli Boulevard and to reduce traffic pollution as an Anti Pollution Facility.
- The Project is justified to be technically and economically feasible and very favorable in environmental impact.

EIRR (%)	32.68
NPV (LL Billion):	51.39
B/C:	3.15

- The urgency of project implementation is assessed to be very high because of existing issues in term of severe traffic congestion and traffic pollution, which is seriously hampering the socioeconomic activity of people. In addition, it will support the revitalization of the Old City to regain its role as a tourism and commercial center.
- Based on the above findings, the Project is recommended for implementation at the soonest possible time.

#### (2) Transport Management Plan

- The Project aims to improve the existing disorderly congested flow in Central Tripoli where roads were not designed for car movement, but only for pedestrians and carriage movement practically in the Old City.
- The Project also intends to re-explore Lebanon's heritage and existing historical places that attract tourism and promote the development of the city.
- The Project is evaluated from technical, economical and environmental aspects to be feasible.

EIRR (%):	28.49
NPV (LL Billion):	4.30
B/C:	1.78

- The urgency of project implementation is recognized from the existing traffic situation and decrease in tourism industry.
- Based on results of the above analysis, the early implementation of the Project is recommended with the emphasis that the Project requires the relatively small investment and short time, with an efficient traffic enforcement system.

#### (3) Behsass Transport Center Project

- The Project aims to provide the transport terminal for interconnection of bus trips with other mode of taxi and private cars, thus improving traffic congestion in the city.
- The Project is planned to facilitate interconnections with surrounding new developed areas with other regions and enforce the role of Tripoli as an international city and the capital of the north.
- The Project is evaluated to be feasible from technical and economical aspects and acceptable in environmental impact.

EIRR (%):	19.50
NPV (LL Billion):	7.275
B/C:	2.02

- This Project is a committed plan of the Ministry of Public Works and Transport, which supervises the Office of Railroad and Public Transport that owns the required land. Therefore, the Plan can be implemented at any time.
- Based on the above findings, the Project is recommended to be urgently implemented, but with the efficient operation system.

#### (4) Project Integration

The first (2) Projects are located in Central Tripoli, which is the most congested area with deteriorated environment. When the two projects are integrated, they can create the multiplier effect in traffic efficiency and the improvement of environment. Economic parameters of the two projects package are as follows:

EIRR (%):	35.11
NPV (LL Billion):	64.3
B/C:	3.18

The third Project aims to provide an integrated center for transport multi-function such as bus/taxi terminal and commercial center. When the second and third projects are integrated, the service of bus/taxi, as the public transport system in the Study Area, can be operated efficiently and systematically.

The optimum solution to solve many of the transport problems in the Study Area in the short-term comes with the integration of the three projects. This integrated plan will result in improving the transport system for people and logistics, decreasing traffic congestion in Central Tripoli, ensuring traffic safety and enhancing natural and social environment.

### 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.

### **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.



Technology Transfer Activities

Workshop in Beirut



Training in Japan



Seminar in Tripoli

