5. TRANSPORT

Land and marine transport exert significant pressures on the physical and biological environment in Lebanon. Impacts of the transport sector begin with the construction of roads, harbors, and airports, which causes significant and sometimes irreversible impacts on landscape, ecosystems, and natural resources. Later, as passenger and freight vehicles travel on the roads, ships dock into harbors and sail off the coast, and planes take off and land, they release harmful pollutants into the air, land, water, and sea.

transport sector have been rather limited and uncoordinated. In the future, such impacts would be mitigated if the MoE
implemented and the Government succeeded in enforcing the recent law on the phase-out of diesel fuel and leaded gasoline. Also, without a serious government commitment to the construction of true expressways, strip development will continue unabated along new highways, transforming them gradually into congested local roads.

5.1 Targeted Description

Land and sea transport activities have significant and widespread impacts on human health and the environment, especially in the coastal zone. Air transport activities are confined to the Beirut International Airport and two small military airports (Riyak in the Bekaa and the Qlaiyaat in the North).

5.1.1 Road Network

Lebanon had about 22,000km of roads in 2001 of which 30 percent are classified and fall under the authority of the MoPWT, while the remaining 70 percent (about 15,400km) are non-classified roads governed by municipalities. As indicated in Table 5.1, international roads make up less than 10 percent

increased in length by about 5 percent from 1995 to

the Non-classified road network, which totals about 15,269 km (Darwish and Timberlake, 1999). Internal roads, town roads, and village roads are the other categories of non-classified roads.

The total road network covers an estimated 138 km², or about 1.4 percent of the total surface area of Lebanon. Non-classified roads alone cover an estimated 92 km² of land (using an average width of 6 meters), or 67 pe
surface area. Therefore, it will be important to build environmental management capacity of both the MoPWT and municipalities in order to mitigate the environmental impacts of roads in the future.

Table 5.1
Classified Road Network in 1995 and 2001

Classified Road Network Category	*Road width (meters)*	*Length*		*Percent Change (1995-2001)*
		1995 [a]	*2001* [b]	
International Roads	10-14	523	548	+4.8%
Primary Roads	8-10	1,640	1,799	+9.7%
Secondary Roads	5-8	1,352	1,474	+9.0%
Local Roads	4-6	2,780	2,770	-0.3% [c]
TOTAL		**6,295**	**6,591**	**+4.7%**

[a] Source: METAP / ERM, 1995
[b] Source: Data supplied to ECODIT by the Ministry of Public Works and Transport / PIU, 2001
[c] Local roads are sometimes upgraded to secondary roads

As illustrated in Table 5.2, Mount Lebanon hosts the longest classified road network (33 percent of total) and the highest density of classified roads (1.05 km per 1 km^2 of surface area) in the country (excluding Beirut). However, its classified road network has the lowest road throughput potential (obtained by multiplying length by width and dividing by number of residential units) in relation to the number of residential units (throughput potential of 31.5 km x m per 1,000 residential units). This finding suggests that the pace of construction of road infrastructure has not kept up with the population growth in Mount Lebanon, compared to the rest of the country.

Table 5. 2
Geographic Distribution of Classified Road Network in Lebanon

Mohafaza	*CRN[a] (km)*	*Percent of Total CRN*	*Density (km/km^2)*	*No. of Residential Units [b]*	*Throughput Potential* (km x m / 1,000 Res. Units)
North Lebanon	1,558	23.6	0.75	179,278	56.0
Mount Lebanon	2,156	32.7	1.05	463,583	31.5
Bekaa	1,555	20.1	0.30	121,305	73.8
South Lebanon & Nabatiyeh	1,322	23.6	0.74	249,202	39.1
Total	**6,591**	**100.0**	**-**	**1,013,368**	**-**

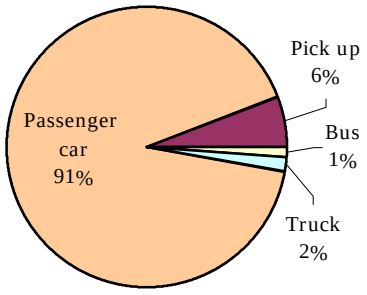
[S] Data supplied by Ministry of Public Works / PIU , 2001
[b] CAS Studies, 1996-98

5.1.2 Vehicle fleet

Fleet Size

It is not possible to know the size of the vehicle fleet with accuracy because (1) there is no information on the number of vehicles removed from circulation each year and (2) many vehicles operate without a license (illegally). Different sources estimate the number of vehicles at between 800 and 900 thousand vehicles nationwide. A study for the Ministry of Transport estimated the vehicle fleet size at 783, 213 in 1997, as per the breakdown in Figure 5.1. It derived this estimate based on the number of vehicles that paid their annual license fees in 1997 (682,213 vehicles), as reported by the MoF, and the estimated proportion of vehicles circulating without paying their license dues (11 percent).

Figure 5. 1
Distribution of Vehicles by Category

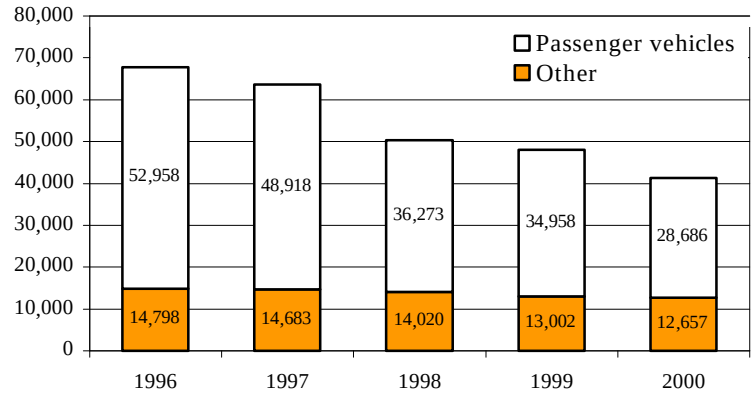


Source: MoPWT, 1999. Page 63

Yearly vehicle registration

Vehicle registration has declined steadily from 1996 to 1999, reaching 47,960 registered vehicles in 1999 (41 percent less than in 1996). Passenger vehicles make up between 70 to 75 percent of the total number of motor vehicles registered each year since pickups, trucks, and buses.

Figure 5. 2
Number of Vehicles Registered (1996-2000)

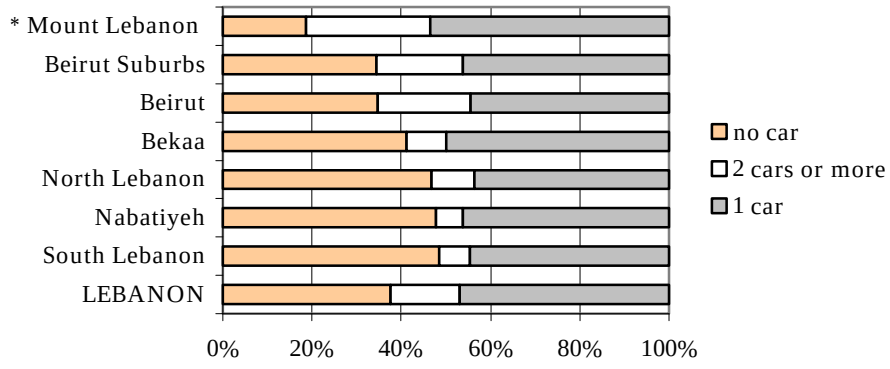


Source: CAS Bulletins, 1996-2001

Vehicle ownership

According to a 1997 survey of living conditions, 62.4 percent of households in Lebanon have at least one car. This percentage is pretty much the same across mohafaza, as indicated in Figure 5. 3. In contrast, while 28 percent of households in Mount Lebanon own two cars, this percentage drops to below 10 percent in each of North Lebanon, South Lebanon, Nabatiyeh, and the Bekaa. In Beirut, 20.6 percent of all households had two cars or more in 1997, up from 8.6 percent in 1969. Over the same time period, the proportion of households without a car has declined from 52 percent to 35 percent.[1]

Figure 5. 3
Vehicle Ownership per Household and by Region (1997)



Source: CAS Study / No. 9, 1998 * Excluding Beirut Suburbs

Fleet Age

The Survey of Living Conditions (in 1997) found that at least 84 percent of all private passenger vehicles dated to 1990 or earlier, including 12 percent of vehicles older than 25 years (dated to 1976 or earlier). Older models typically consume more fuel, emit more pollutants, and use up more lubricating oils on a per-mile basis.

[1] Source: MoPWT / Nakkash, 1999. Page 25 ; CAS Study / No. 9, 1998

5.1.3 Traffic volume

Although there is no national database on road traffic, many studies and reports have examined traffic volume in localized areas. For example, in connection with the Beirut Urban Transport Project (BUTP), daily traffic volume was monitored on select roadways, corridors, and intersections in the GBA (see Table 5.3). Generally, the entrances to Beirut are highly congested, with relatively little daily variation. Between Monday and Friday, traffic peaks from 7 to 11 am and from 5 to 7 pm, but remains fairly high throughout the day. On Sunday evenings, the entrances to Beirut are very busy, while traffic in the downtown area is relatively fluid.

Table 5. 3
Recorded Peak Hour Volumes at Select Roadways

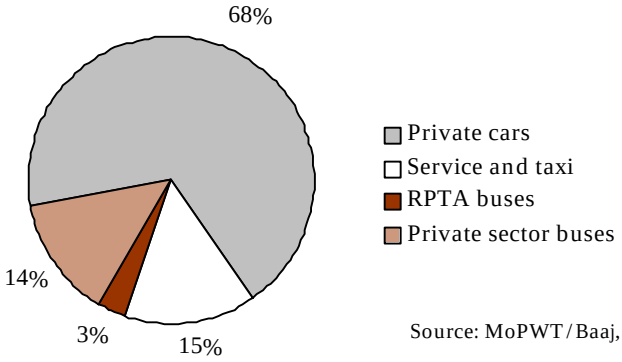
Road Section	*Daily traffic volume*
Jal El-Dib/Dbayeh	221,409
Charles Helou Ave. East of Nahr Beirut	120,731
Airport road north of Chiyah Blvd.	86,222
Mkalles-Mansourieh	40,557

Source: CDR/TEAM, 2000

5.1.4 Passenger Transport

In 1998, there were about 1.75 million motorized trips per day in the GBA and 0.5 million in Tripoli (CDR/TEAM, 1995). Passenger trips in privately-owned vehicles accounted for about 68 percent of those trips in GBA, with buses/vans accounting for an additional 17 percent (see Figure 5.4). Those results are corroborated by the Survey of Living Conditions, which found that 57 percent of respondents nationwide *always* use private passenger vehicles to commute, whereas about 77 percent *never* use mass transport (buses, vans) and 31 percent *never* use taxis or service (see Table 5.4).[2]

Figure 5. 4
Breakdown of Passenger Trips in GBA



Source: MoPWT/Baaj, 1999

[2] Survey on Living Conditions is based on a sample size of 16,864 residential units representing different economic and geographic sections of society.

5.1.5 Public transport system

Public transport vehicles in Lebanon are allowed to move freely anywhere in the country without restriction (MoPWT/Baaj, 1999). In 1994, the GoL allowed the issuance of up to 4,000 licenses for a new category of mass transport vehicles commonly referred to

-fold between 1996 and 1998 (from 10,650 to 32,000 license plates). This brought the total number of public transport vehicles up to about 38,000 including shared-taxis, taxis, buses and minivans. These vehicles are increasing traffic congestion, transport delays, and air pollution, especially since they are suspected of operating well below their capacity.

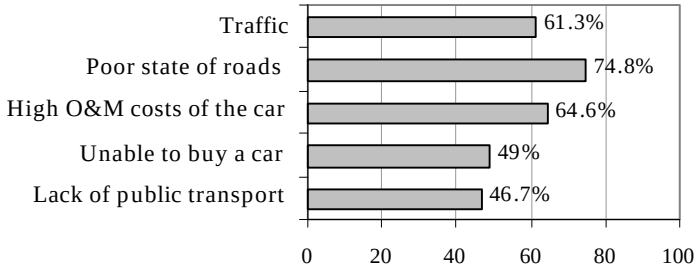
Table 5. 4
Means of Commuting by Region (1997)

Region			
	always use the private passenger vehicle	never use mass transport	never use Taxis or Service
Beirut	52.7	63.1	23.8
Beirut Suburbs	61.6	58.3	26.4
Mount Lebanon	77.8	77.0	48.6
North Lebanon	46.6	89.6	21.2
South Lebanon	43.5	81.8	21.7
Nabatiyeh	52.3	87.7	34.9
Bekaa	54.6	93.6	39.7
NATIONAL	57.0	76.7	30.6

Source: CAS Study/No.9, 1998

Indeed, visual observations suggest that the rate of occupancy of public transport vehicles is currently very low. This low occupancy rate would suggest at first glance that there is excess public transport capacity today (see section for government plans to reduce excess capacity). At the same time, almost half of the population (46.7 percent) in the Survey of Living Conditions referred to the lack of public transport as a problem in commuting (see Figure 5. 5). This would suggest that most people have all but given up on the hope of counting on an efficient, reliable, clean, and cost-effective mass transport system in Lebanon. Any plans to reform the public transport system must aim to achieve such levels of service.

Figure 5. 5
Problems Reported in Connection with Transport
(as Percentage of Survey Respondents)

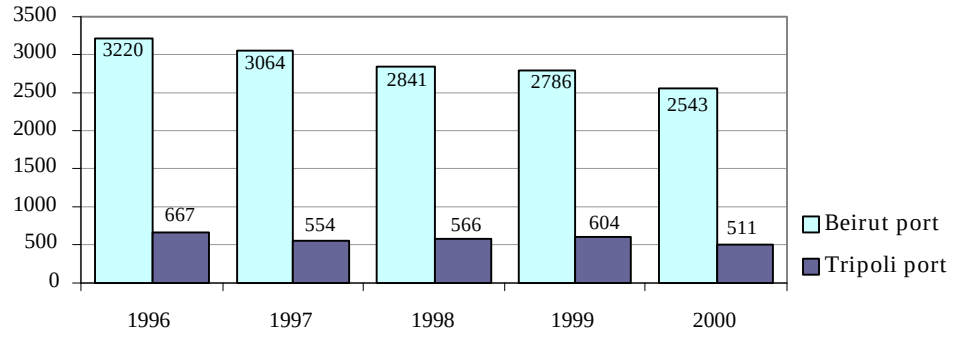


Source: CAS Study/ No. 9, 1998

5.1.6 Maritime transport and fishing harbors

of cargo vessels and tankers docking at these two ports has steadily declined from 3,887 ships in 1996 to 3,054 ships in 2000. At the same time, the Tripoli port has been receiving a larger proportion of the total number of ship arrivals (see Figure 5.6).

Figure 5. 6
Maritime Transport in Beirut and Tripoli



Source: CAS Bulletins, 1996-2001

In the late nineties, the-then MoT implemented a program to build or rehabilitate 15 fishing harbors all along the coast, bringing the total capacity to 3,800 fishing boats. According to engineering bills of quantities prepared by the engineering design firms, this construction and rehabilitation program has required the quarrying and transport of 1.3 Million m^3 of aggregates (quarry runs, gravel, and rocks of all sizes). No overall strategy, economic feasibility study, or environmental assessment was performed for any of these harbors, or for the program as a whole (CDR/ECODIT-IAURIF, 1997).

5.1.7 Aerial transport

Once completed, the new Beirut International Airport (BIA) will be able to receive six million passengers per year. Between 1996 and 2000, aerial traffic has been increasing steadily, at the rate of almost 10 percent a year (see Table 5. 5). The number of planes landing at the BIA peaks during the month of August, when traffic intensity (two landings per hour on average in 2000) is almost 50 percent higher than during February.

Table 5. 5
Aerial Traffic at Beirut International Airport (1996-2000)

BIA	*1996*	*1997*	*1998*	*1999*	*2000*
Total Landings	**10,501**	**11,526**	**12,508**	**13,940**	**14,852**
Landings during August	1019	1126	1126	1416	1512
Average per day (August)	32.9	36.3	36.3	45.7	48.8
Landings during February	768	806	806	968	1010
Average per day (February)	27.4	28.8	28.8	34.6	36.1

Source: CAS Bulletins, 1996-2001

5.2 Pressures on the Environment

Land, sea, and air transport cause significant and diverse impacts on the environment. Most transport infrastructure (in particular roads and harbors) was built without any regard for the protection of landscape and natural resources. Later, as vehicles, ships, and planes use such infrastructure, they routinely release harmful pollutants into the air, land, water, and sea. Over time, people build residential and commercial facilities with direct access to the roads, causing increased traffic congestion, travel delays, accident fatalities, noise and additional air pollution. The maintenance and renewal of the transport fleet generate each year thousands of tonnes of used oils, old tires, and ballast waters that are often dumped indiscriminately into the environment.

5.2.1 Degradation of landscape and natural heritage

Unplanned (or poorly planned) roads and / or bad road construction practices have compromised the landscape and ecosystem integrity and visual amenity in several parts of the country. Most roads are built with utter disregard for the environment, with contractors dumping excavated materials down ravines along the path of the road. Such reckless dumping creates enduring eyesores in the natural landscape (e.g., rock formations disappear under the rubble) and exacerbates soil erosion and rainwater runoff problems. For example, a road was built from the village of Jaj to the famous cedars of Jaj, despite opposition by local community groups and environmental NGOs. This road has irreversibly perturbed the serenity of this unique cedar landscape and is likely to have adverse effects on local tourism. The new highway leading up to Harissa, built in the mid nineties, cuts through a densely forested coastal mountain landscape facing the sea and is an eyesore visible from all around. All those impacts could have been avoided or mitigated if these road projects had undergone proper environmental impact assessment.

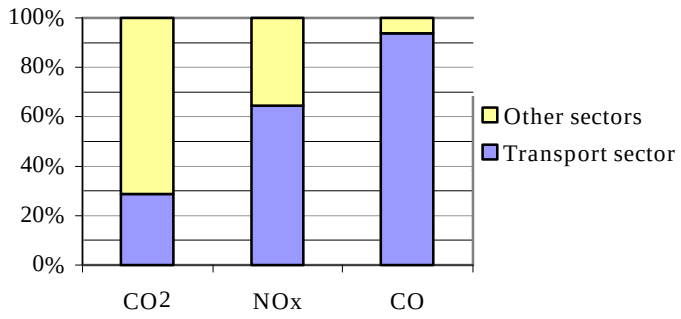
A 24-km highway road was built in the late nineties to connect Afqa in the caza of Byblos with Taraya on the eastern slopes of Mount Lebanon. The road has intruded on a pristine high-mountain landscape; by providing easy and uncontrolled access to hunters, amateurs -

(see solid waste dumping in Ouyoun As-Simane, Section 6.2.2), the road poses significant risks of degrading mountain biodiversity and polluting the water tower of Lebanon.

5.2.2 Air emissions from the transport sector

The transport sector contributes almost 94 percent of total emissions of CO and more than 40 percent of CO_2, as illustrated in Figure 5.7. Emissions from the transport sector result from the combustion of kerosene in airplanes, gas and diesel in vehicles, and fuel oil in ships. Table 5.6 presents the emission loads of major greenhouse gases from the transport sector in 1994. Of course, the situation has significantly changed since. With top-up funding from GEF, the MoE is currently implementing a one year project to Nations Framework Convention on Climate Change. However, rough estimates based on current energy consumption patterns suggest that CO_2 emissions may have increased by about 35 percent, while NO_x and SO_2 may have increased about 16 and 65 percent, respectively.

Figure 5. 7
Transport Sector Share of Total Emissions of CO_2, NO_x, and CO (1994)



Source: MoE-UNDP, 1999a

Table 5. 6

GH Gas Source	*CO_2*	*NO_x*	*CO*	*NMVOC*	*SO_2*
Civil aviation	6.02853	0.0255	0.00851	0.00425	0.001872
Road transportation	3949.839	34.824	447.193	83.8708	2.67669
Navigation	1.2564	0.02734	0.0182	0.00364	0
Total Transport 1994	**3957.124**	**34.877**	**447.220**	**83.879**	**2.679**

Source: MoE-UNDP, 1999a

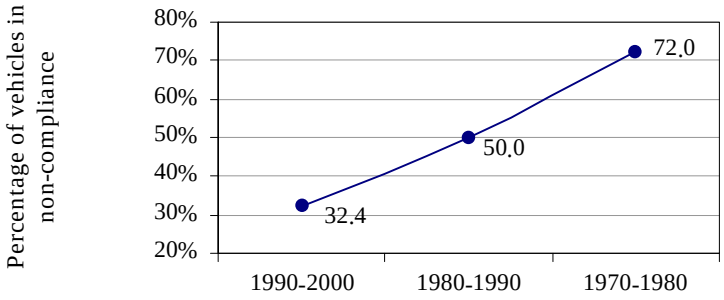
Several factors contribute to the deterioration of air quality in Lebanese cities:

1. strong reliance on private passenger vehicles and traffic congestion;
2. low fuel efficiency in old and/or poorly maintained vehicles;
3. widespread use of diesel engines and poor diesel quality; and
4. continued use of leaded gasoline.

Cars are not inspected or tested for roadworthiness. Although vehicle owners are) each year, the procedure is a simple financial transaction without any vehicle inspection. Poorly-maintained engines burn fuel partially, thus emitting Volatile Organic Compounds (VOCs), the main source of smog in Beirut and other main cities.

The proliferation of diesel engines in about 90 percent of all taxi vehicles and most buses, minibuses and vans constitute a significant source of emissions. Between May 2000 and February 2001, the Tripoli Environment and Development Observatory analyzed exhaust gases from a random sample of 622 diesel-powered vehicles in Tripoli. About three-quarter of the older models (before 1970) failed these exhaust emission tests. Compliance improves slightly for younger models (see Figure 5.8).

Figure 5. 8
Exhaust Emission Test Results for Diesel Vehicles in Tripoli (2001)



Source: Tripoli Observatory, 2000

5.2.3 Ribbon construction alongside roads

Roads have promoted urban sprawl in the form of ribbon construction along them. According to a land use survey conducted in 1999 (MoPWT, 1999), 42.1 percent of lands adjacent to international roads were built up. This percentage is very high since the law prohibits construction along international roads with direct access to them. Interestingly, this percentage is higher than the percentage of land that is built alongside primary and secondary roads in Lebanon (see Table 5.7). This finding confirms the hypothesis that international roads serve as the main conduit for ribbon construction in Lebanon.

Table 5.7
Distribution of Land Use Adjacent to Classified Road Network

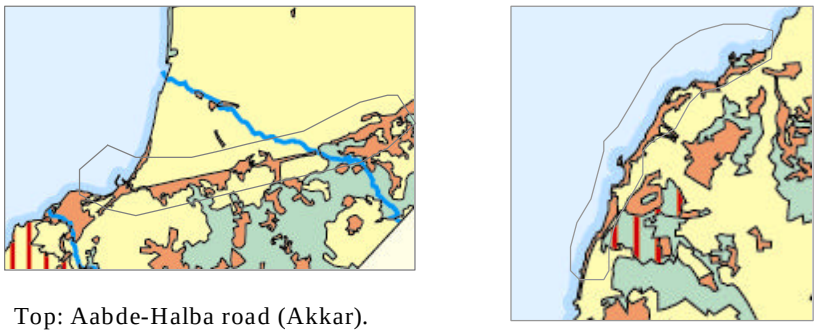
Road Category	*km surveyed (% of total km)*	*Land Use (%)*			
		Forestry and Dry Lands	*Agricultural*	*Developed*	*Undetermined*
International	452 (85%)	8.1	37.5	42.1	12.4
Primary	1,433 (87%)	0.0	32.7	37.7	29.6
Secondary	1,126 (84%)	0.4	34.0	40.4	24.2
Local	2,316 (82%)	0.5	39.8	47.2	12.5
Total	**5,321**	**1.0**	**36.4**	**42.8**	**19.8**

Source: Kayssi, 1999

Residential and commercial developments built and illegally-- open a direct access to the road, which reduces road safety and traffic flow. The same process seems to be repeating itself along the new highways built in the past few years, with new buildings springing up along the Chekka-Tripoli and the Zahle-Baalbeck highways (see Box). Using 1996 satellite images (CDR/ECODIT-IAURIF, 1997), Figure 5.9 reveals ribbon construction along two segments of the coastal highway (Beddawi-Minye in North Lebanon and Saida-Sarafand in South Lebanon).

Today, the new coastal highway in the North provides a quick (15 minutes), scenic (olive tree orchards) trip from Chekka to Tripoli. How long would this trip take, and what would it be like, in 30 years? Would it continue to be fast and pleasant, or would it feel more like traveling from Dora to Jounieh today (i.e., slow, congested, unsafe, and polluted)?

Figure 5. 9
Examples of Ribbon Construction (Minyara and Sarafand)



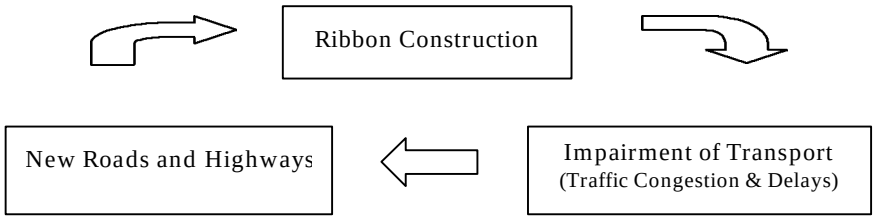
Top: Aabde-Halba road (Akkar).
Right: Khaizarane (Sarafand / Saida)

Note: Pale red extensions represent urban development and free-hand grey polygons delineate ribbon construction

Source: Based on CDR / ECODIT-IAURIF, 1997

Table 5. 11 illustrates the long-term process by which urban sprawl and ribbon construction impair transport along Lebanese roads, generating the need to build new roads and highways. However, since space is limited in Lebanon, building additional highways in the future would prove very difficult and certainly would be at the expense of the remaining agricultural and natural areas left in the country. Hence the need to ensure that the recently built highways preserve their function of expressways linking the -Jounieh highway provides a good illustration. The strip development along this highway (in Zalka, Antelias, Dbaye) has severely reduced its ability to serve as an expressway, which forced the opening of a temporary seaside road, in the right-of-way of the old railway, and plans to build a new expressway further inland, at the edge of the foothills (segments PR1 and PR2 for Hazmieh-Zalqa-Antelias).

Figure 5. 10
Impairment of Road Sector Due to Ribbon Construction



Unplanned strip development is generally followed by the construction of basic infrastructure, such as water, wastewater, electricity and communication networks. The uncoordinated construction of those networks, as well as maintenance and repairs, further burden the road networks. Objects (e.g., waste containers, bus stops, street signs, bill boards) are also installed haphazardly on both sides of the road and, in many cases, on the edge of the pavement, posing a hazard to traveling vehicles.

5.2.4 Traffic delays and traffic signs

The main cities of Lebanon (e.g., GBA, Tripoli, Saida) are notorious for persistent traffic delays and high noise levels. Traffic congestion is also the norm at the entrance to cities and towns due to rampant ribbon construction. When delays were measured along 27 corridors in the GBA, cars were running under 20 km / hr in almost 75 percent of the surveyed roads (MoTPW, 1999). Delays represent 50 to 70 percent of the total travel time between two random points in the GBA. Table 5.8 presents the measured delays during peak hours at select roads and highways.

Table 5. 8
Average Delays on Select Roads and Highways (1998)

Location	*Peak hour average delay per vehicle*
Galerie Semaan	32 min.
Bechara el Khoury	13 min.
Antelias	11 min.
Jal el Dib	7 min.
Adlieh	6.4 min.

Source: CDR / TEAM, 2000

Traffic signs were put up in many cities in the past few years, including the GBA. However, in many instances, the signs have become a source of confusion for drivers -not- posted diagonally so it is not clear which street is not to be entered). Most drivers continue to ignore traffic lights, especially when there is no traffic policeman on duty. Many cities suffer from severe shortage in parking space, primarily due to the conversion, over a period of decades, of underground parking spaces to warehouses, workshops, and stores. The parking deficit compels car owners to park on curbsides, sidewalks and intersections causing more traffic delays and nuisance to pedestrians.

5.2.5 Noise levels

Dense, stop-and-go traffic and old engines, combined with excessive and casual honking, cause substantial noise pollution along road corridors and in cities. In Zahle, for instance, pedestrians and drivers at a major shopping street were exposed to a 75.3 dB equivalent dose at 3:45 pm during a regular weekday in 1999 (MoE-CDR / MVM, 2000). In Barr Elias, the equivalent dose was 74.8 dB outside residential buildings near the Damascus road. Noise levels were also measured at key road junctions to assess baseline noise level conditions in GBA. Equivalent noise levels varied from 71.2 dBA at Hayek / Salloume to 82.0 dBA at Jal el Dib (CDR / TEAM, 2000).

5.2.6 Road accidents and fatalities

Road accidents cause nearly one death per day on average and over 3,000 injuries per year. While the number of accident-related deaths has remained relatively stable from 1996 to 1999, the number of injuries has risen significantly in 1999 (see Table 5. 9). The road safety statistics for 1997 translate into about 10.2 accident-related deaths per 100,000 inhabitants and about 39.6 deaths per 100,000 vehicles. Although such statistics are lower than in some other countries (see Table 5. 10), they remain very high for a country like Lebanon where traveled distances are relatively short. Small improvements to the road sector could significantly decrease the number of road fatalities in Lebanon. Section presents an overview of recent measures and awareness campaigns aimed at improving road safety.

Table 5. 9
Number of Road Accident-Related Deaths and Injuries (1996-1999)

Year	*No. of Accidents*	*No. of Deaths*	*No. of Injuries*
1996	3,112	337	3,215
1997	3,315	357	3,465
1998	3,366	335	3,445
1999	3,760	331	4,208
2000	3,724	306	4,101

Source: CAS Bulletins, 1997-2001

Table 5. 10
International Road Safety Statistics (1997)

Country	*Deaths per 100,000 inhabitants*	*Deaths per 100,000 vehicles*
France	14.4	27.0
Greece	21.0	61.5
Lebanon	10.2[a]	39.6[b]
Portugal	29.0	69.2
Sweden	6.1	30.2

[a/] Assuming a population of 3.5 Million
[b/] Assuming a vehicle fleet of 900,000

Source: Abou Raad, 1999 (except for Lebanon)

5.2.7 Disposal of wastes generated by the transport sector

Vehicles generate spent fluids (every 3-5,000 km), used tires (every 3-4 years), lead-acid car batteries (every 1-2 years) and must be scrapped at the end of their useful lifetime.

Disposal of used oil

The vehicle fleet consumes about 28,000 tonnes of imported motor lubricating oils and generates about 21,000 tonnes of used oil per year (MoE/ETEC, 1998)[3]. A significant proportion of vehicle owners (especially trucks and buses) change their engine oil themselves. Oil change by Do-it-Yourselfers accounts for 6,400 tonnes of lubricating oil

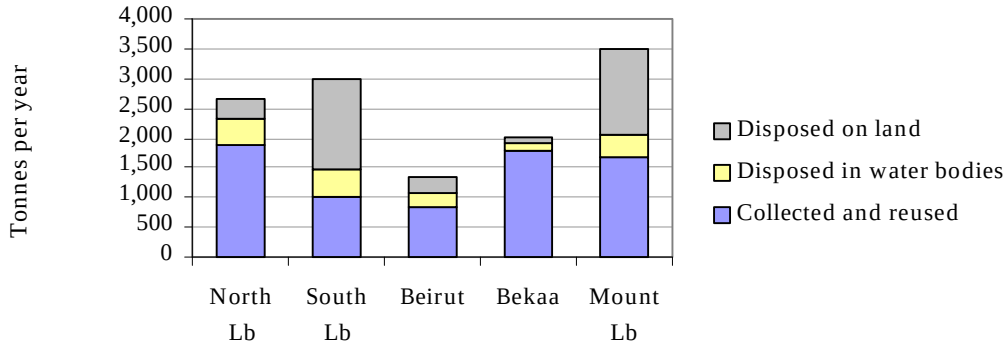
[3] The remainder (approximately 25 percent) is consumed by engines

consumed annually (or 22.3 percent of the total consumption) and corresponding waste oil is presumably discharged directly into the environment (soil and water). Of the remaining consumption (21,600 tonnes), 79 percent (17,000 tonnes) were surveyed (MoE/ETEC, 1998). This quantity of engine oil generates 12,500 tonnes of used oils

Nationwide nearly 58 percent of waste oils are collected and reused, primarily as energy supplements (MoE/ETEC, 1998). Thirteen percent are disposed in water bodies, either directly (streams, rivers) or indirectly (sewers), and the remaining 29.4 percent are disposed on land. Waste collection/reuse reaches 90 percent of waste oils generated in the Bekaa and is as low as 34 percent and 48 percent, respectively, in the South and Mount Lebanon (see Figure 5.11). Using waste oil as energy supplements in furnaces and boilers produces potentially toxic air emissions.

Three years after the MoE/ETEC study, the government has not taken any initiative to promote environmentally sound storage, collection and recovery/recycling of used oil. All private initiatives to build and operate used oil recovery facilities have reached a dead-end when the government refused to provide monopoly for such an endeavor. Private investors need the guarantee of a monopoly in order to ensure a sufficiently large supply of used oils to justify the economic viability of a recycling project.

Figure 5. 11
Disposal Route of Used Oil per Mohafaza



Source: MoE/ETEC, 1998

Disposal of used tires

Vehicles generate about 1,875,000 used tires in Lebanon each year.[4] There are currently no facilities for the recovery or disposal of used tires, which are either stockpiled at various sites across the country, or dumped haphazardly in ravines or in the sea. Within the GBA, the company responsible for municipal solid waste collection shreds used tires before sending them to a designated landfill for inert and bulky materials in Bsalim (see Section 14.2.3 for waste collection in GBA).

[4] MoE, Service of Impact Prevention from Technology and Natural Hazards

Disposal of lead-acid batteries

Lebanon generates approximately 7,000 tonnes of lead-acid batteries from cars and uninterrupted power supply systems. These are fully recycled in Lebanon of which more than 90 percent in two plants with adequate environmental provisions and well know to the MoE (METAP/Tebodin, 1998). These two facilities extract the lead from the batteries and smelt it into lead ores and also manufacture various finished products including new car batteries, pellets (packed into the cartridge of shotguns) and shields (used in hospitals against radiation). The hard plastic casing (usually polypropylene) is also recovered and shredded to produce pots. The remaining 10 percent of lead-acid batteries are processed in a limited number of very small operations without proper environmental control (e.g., lead dust releases) or administrative permits. There is no information on the fate (disposal or recovery) of the acid contained in the batteries.

Disposal of scrapped vehicles

The GoL funded a campaign in 1993-4 to remove abandoned cars from fields and roads. However, due to the absence of a national policy or facility for processing and/or recovering scrapped vehicles, owners continue to abandon their cars in valleys, along roadways, or in open fields. Then in 1998, with the assistance of the municipality of Aley, the MoE prepared a feasibility study for removing abandoned vehicles from public ways by recovering salvageable materials, mainly metal. The plan was implemented in Aley only where, that year, about 200 vehicles were removed. The underlying problem in replicating this plan is the prohibitive cost of collecting abandoned vehicles that are dispersed in the countryside and in view of limited returns from salvageable materials.

Disposal of ballast water

During 2000, over 250 petroleum tankers docked in the ports of Beirut and Tripoli (CAS Bulletin, 2001). In addition, many tankers pump petroleum products directly, through dedicated offshore lines, to coastal industries such as cement plants in Chekka, the fertilizer plant in Sibline, and the power plants of Zouk and Jiyeh. In the absence of port reception facilities (see Box) and stiff coastal monitoring, many petroleum tankers are suspected of discharging their ballast waters into the sea, as evidenced by the presence of oil slicks around ships offshore and of tar balls washing on the shore.

Lebanon has yet to fulfill its obligations, under Protocol 1 (Pollution from ships etc.) of the Barcelona Convention, to design and implement port reception facilities.

In fulfillment of Leba *Barcelone Convention* for the protection of the Mediterranean Sea against pollution and its protocols (in particular protocol 1 on combating oil pollution in case of emergency), the MoE and several other stakeholders have prepared a draft law to prepare Lebanon to respond quickly and efficiently in case of oil spills. Developing a full contingency plan is one of several obligations of signatory states. Implementation of the contingency plan requires a concerted effort among the MoE, the Ministry of Defense, the MoIM (coastal guards), customs, the civil defense and the MoPWT.

5.3 Key Policies and Actions

Key policies and actions in the transport sector range from legal and regulatory development to investment in building new roads and highways, rehabilitating existing ones, or improving traffic safety.

5.3.1 Legal and regulatory development

In 1994, the Parliament enacted two laws allowing the import and use of diesel-engine vehicles (Law 368/1994) and the issuance of thousands of licenses plates for taxis,

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effects of those measures on urban air quality and traffic, the Parliament has reversed those measures by prohibiting certain diesel engines and retrieving 10,000 license plates. Table 5. 11 presents in chronological order the most relevant transport legislation affecting the environment since 1994. Section reviews the key elements of Law 341/2000.

Table 5. 11
Legislative Development in Transport Sector between 1990 and 2000

Legal Instrument (Date)	*Description*
Law 368 (1/8/1994)	Allows the import of pick-ups, trucks and buses less than five years old operating on diesel engines
Law 384 (4/11/94)	Permits the MoI to issue and sell 12,000 license plates for shared-taxi vehicles, 7,000 license plates for trucks, 4,000 license plates for and 1,000 plates for buses
Decree 6603 (4/4/1995)	Defines the standards for operating diesel trucks and buses, as well as the implementation of a monitoring plan and permissible levels of exhaust fumes and exhaust quality
Law 432 (15/5/1995)	Amends Law 368 (1/8/1994). Removes age restriction on imported vehicles for diesel engine vehicles (trucks, buses, and first aid vehicles) that were purchased or shipped before the promulgation of Law 368
Decision 138, MoT (13/10/1999)	Calls for the establishment of the Transport Regulatory Unit (TRU) in the MoT. The TRU is to develop the land public transport reform and supervise its implementation
Decision 9, Council of Ministers (5/4/2000)	Calls for the reform and re-organization of the Land Public Transport Sector in Lebanon and the reduction of the number of public transport vehicles from 39,761 to 27,061
Law 341 (6/08/2001)	Lays legal framework for reducing air pollution from the transport sector and encouraging the use of cleaner sources of fuel. Specifically, the law bans the import of minivans operating on diesel engines, as well as old and new diesel engines for private passenger cars and minivans. Empowers the GoL to retrieve 10,000 public license plates

5.3.2 Government investment

Between January 1992 and December 2000, the GoL has awarded 141 contracts for road and highway projects worth a total of US$564.5 million (consultancy and design as well as works and equipment supply) (CDR, 2001). Capital investment projects include road rehabilitation works in Beirut, Tripoli and Zahle, completion of key segments of the coastal expressway, new peripheral and penetrating roads for Beirut, street lighting, Beirut-Damascus expressway, and new secondary roads in North Lebanon. The Beirut Urban Transport Project (BUTP) aims to streamline traffic flow by improving traffic and parking management and grade separation (see Box 5.1).

Box 5. 1
The Beirut Urban Transport Project (BUTP)

The Beirut Urban Transport Project covers the GBA, from Antelias at the northern entrance of Beirut to Khalde at the Southern entrance and to Mkalles to the East. Started in 1999, the BUTP does not aim to increase road capacity markedly; rather it is designed to streamline mobility on the GBA network by improving traffic and parking management, and grade separations. The BUTP traffic management component will deal with an estimated 1.5 million trips per day, and handle 222 traffic signals (122 within Beirut and 100 outside Beirut). The component will also install 25-30 surveillance cameras that will be synchronized by a proposed traffic control center. The Grade Separation component will oversee the construction of nine overpasses and seven underpasses at 16 heavily congested intersections in GBA. Environmental Monitoring Plans are required during implementation. Finally, the parking management component is split into two phases across 13 priority zones that have been selected in the GBA. The first phase aims to build roadway infrastructure for about 5,000 curbside parking spaces, while the second phase will aim at encouraging the private sector to invest in off-street parking structures. This will shift long-time parked vehicles from the curbside parking spaces into off-street parking locations. The total cost of the BUTP is approximately US$100 million, to be implemented over five years. *The BUTP has no provision for improving traffic through upgrades to the public transport sector.*

National expressways, now entering their final stages of execution, have been a priority issue on the agenda of the CDR since the early 1990s. The CDR is entirely responsible for the North, South and East expressways, as well as the Beirut beltway (the latter two road sections were originally the responsibility of the Executive Council for Major Projects, which was annexed to the CDR in 2001). This expressway network includes five major elements and measures over 400 km (see Table 5.12).

Completion of the network is likely to have a profound impact on urban structure links. For example, the coastal expressway may increase the dependency of regional centers on Beirut, rather than encourage regional growth. It may also accelerate urbanization around the capital. Moreover, the distance separating the expressway from the coastline will set the trend for the development of the coast. Specifically, agricultural development pressures, especially near existing towns and villages (e.g., Jounieh bay). Opportunities for nature tourism and recreation will likewise diminish.

Table 5. 12
Major Expressways under Construction

Section	*Length (km)*
Northern expressway from Beirut to the Syrian border	131
Southern expressway linking Beirut to the Israeli border	90
Eastern expressway (the Arab highway) linking Beirut to the Syrian border in the direction of Damascus	62
Masnaa expressway linking Masnaa to the Syrian border in the direction of Homs, via Baalbeck and Hermel	105
The Beirut ring road (or beltway)	NA

5.3.3 Rehabilitation of select classified roads

The GoL has received a US$42 million loan towards the implementation of the National Roads Project (NRP). The NRP is currently financing a three-year pilot program to rehabilitate 400 km of selected international, primary and secondary roads urgently needing rehabilitation. A Project Implementation Unit (PIU) was established at the MoT to oversee the execution of this component and, in accordance with WB project funding guidelines, oversee the preparation of environmental assessments (Category B) for the road rehabilitation works. While an operational manual was prepared to set the framework for the PIU, and provide guidelines for consultancy firms, it seems that environmental assessments were reviewed in-house (MoPW / PIU) and rarely disclosed or shared with other institutions, such as the Unit of Planning and Programming at the MoE.

5.3.4 Road Safety

In response to the high number of road casualties and mounting pressure from specialized NGOs (e.g., Lebanese Red Cross, YASA and CARLA[5]), the GoL made seatbelt mandatory as of June 1, 2001. This was undoubtedly one of the most significant achievements in a string of hitherto modest government measures to improve road safety and consequently reduce the number of road casualties. Other road safety measures currently in effect include alcohol tests (sporadic implementation), radar equipment for monitoring vehicle speeds (sporadic checks), towing and confiscation of illegally parked vehicles (almost periodic patrolling by urban police). The MoIM has also announced that it would install a high-tech network of monitoring cameras (to aid authorities in spotting offenders), create a centralized operations room, make car insurance mandatory and reduce circulation hours for certain vehicles, such as trucks and lorries.

[5] YASA: Youth Association for Social Awareness, CARLA: Cars Are a Risk to Life, Avoid

5.4 Outlook

Improvements to the road and highway network alone would not be sufficient to alleviate traffic congestion and meet projected demands for transportation. It is necessary to develop public transport infrastructure as well. And while revitalizing the public transport network will undoubtedly generate positive impacts on the environment, the GoL must show greater steadfastness and commitment towards enforcing key transport legislation. *First among these is the landmark recent law to reduce air pollution by the transport sector, but will it be implemented?*

5.4.1 Reform and Organization of the Land Public Transport Sector

1999, participants agreed that the GoL could no longer afford to be both the regulator/planner *and* one of the providers of public transport services (MOTPW/Baaj, Public Transport Authority) owns and operates 302 buses, as compared to 2,400 buses in the private sector, and receives LBP 20 billion in annual subsidy from the Government. Workshop participants further recommended that the government retain the role of planner and regulator, while transferring the supply and financing of the public transport services to the private sector.

As a first step towards reforming and ultimately improving the public transport system in the Lebanon, the MoT established the Transport Regulatory Unit (TRU) in 1999

public transport system, develop a plan of action, and supervise its implementation. Subsequently, Decision 9 of the Council of Ministers (5/4/2000) called for reducing the number of public transport vehicles from 39,761 to 27,061 (i.e., reducing the number of shared taxis by about one-third and of mini-vans by over three-quarters, see Table 5.13).

Table 5. 13
Proposed Reorganization of Land Public Transport Sector [a/]

Transport Operator	*No. of Existing License Plates*	*Proposed Number of License Plates*	*Change*
Shared taxis	32,000	22,500	- 9,500
Taxis	1,300	1,300	-
Buses	2,461	2,461	-
Minivans	4,000	800	- 3,200
Total Number	**39,761**	**27,061**	**12,700**

[a/] Syndicate of Service Owners and Drivers

Source: MoPWT/Baaj, 2000

Notwithstanding the proposed reorganization, the following challenges will continue to face the public transport sector in the foreseeable future:

- Public transport vehicles should have dedicated lanes to encourage people to use them during rush hour (because they are faster);
- Buses should pick up passengers only at well-defined bus stops;

- Bus stops should be designed so that they do not obstruct walkways or traffic (this should be done as part of the road planning and design phase);
- Bus service providers must develop and disseminate clear bus schedules and maps (many buses and most minivans today do not post the route and destination conspicuously instead, a co-pilot bellows out the information leisurely);
- All buses should maintain an adequate level of cleanliness and comfort; and
- It should be possible to buy bus tickets and clip cards (pack of tickets) at competitive rates from various accessible points of sale, such as drugstores, coffee shops and postal offices.

Until some or all of these measures are implemented, public transport in Lebanon is unlikely to assume a prominent share of total passenger trips in the country.

5.4.2 Implementation of Law No. 341/2001 to Reduce Air Pollution by the Transport Sector

Law 341 is perhaps the most ambitious law aimed at reducing air pollution by the transport sector and encouraging the use of less polluting fuels. The law represents the fruit of a concerted, groundbreaking effort by the Parliamentary Environment Committee, NGOs, and other stakeholders. However, there are concerns that the law may not be implemented (or fully implemented). Table 5.14 provides a checklist of measures built in the law and the deadlines for implementing them.

Table 5. 14
Summary of Actions Listed in Law No. 341 (6/08/2001)

Legal Measure	*Implementation date*
❑ Import ban on minivans operating on diesel	Immediate
❑ Import ban on new as well as second-hand diesel engines	Immediate
❑ Retrieval by GoL of up to 10,000 public license plates	Not specified
❑ Promote incentives for vehicle owners to renew their public transport fleet (tax cuts and tariff exemption)	Not specified
❑ Ban the use of diesel in minivans and small pickups	August 9, 2002
❑ Ban the use of leaded gasoline in all vehicles	July 1, 2002
❑ Unleaded gasoline should be: - LBP 1000 cheaper than regular gasoline - LBP 2000 cheaper than regular gasoline	 Immediate January 1, 2002
❑ Catalytic converter becomes compulsory in all vehicle categories	July 1, 2002
❑ Set permissible fuel standards (gasoline and diesel) and ban the use of all other (non-compliant) fuel standards	December 9, 2001
❑ Subject all gasoline powered vehicles that are older than three years to an annual, compulsory, road worthiness test	January 1, 2002
❑ Subject all diesel powered vehicles to compulsory road worthiness tests every six months	January 1, 2002
❑ Set permissible exhaust limit values for all vehicle classes	Not specified