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Report No. 63a-LE

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

March 29, 1973

Regional Projects Department  
Europe, Middle East, and  
North Africa Regional Office

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FISCAL YEAR

January 1 to December 31

CURRENCY EQUIVALENTS <sup>1/</sup>

Currency Unit	=	Lebanese Pound (LL)
US\$1	=	LL 2.70
US\$0.37	=	LL 1
US\$370.37	=	LL 1,000
US\$370,37	=	LL 1 million

SYSTEM OF WEIGHTS AND MEASURES: METRIC

<u>Metric</u>		<u>British/US equivalent</u>
1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 (mi)
1 square kilometer (km <sup>2</sup> )	=	0.387 square mile (sq mi)
1 metric ton (m ton)	=	2,204 pounds (lb)

ACRONYMS AND ABBREVIATIONS

ACE	-	Associatiated Consulting Engineering Company
BCEOM	-	Bureau Central d'Etudes pour les Equipements d'Outre-Mer
CEC	-	Consolidated Engineering Company
CEGP	-	Conseil Executif des Grands Projets
DGHB	-	Directorate General of Highways and Buildings
DH	-	Directorate of Highways
MPWT	-	Ministry of Public Works and Transport
ADT	-	Average Daily Traffic
km/h	-	kilometers per hour

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<sup>1/</sup> The Lebanese Pound is a freely fluctuating currency. In this report, conversions between Lebanese Pounds and U.S. Dollars were based on the exchange rate existing at the time of loan negotiations in March 1973.

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This report was prepared by Messrs. N. E. Krogh-Poulsen (Economist) and R. Paraud (Engineer), Mr. Snorri Hallgrimsson (Engineer) assisted in preparing the report.

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SUMMARY

- i. The major part of Lebanon's population and economic activity is located along the coast in and around the capital, Beirut, which is also the site of the biggest harbor in the country and its only civilian airport. Most transport along the coast, as well as transit traffic origins in or is destined for Beirut. The main domestic transport arteries are the North-South corridor along the coast and the East-West corridor between Beirut and Syria border which also serves transport to and from Syria, Jordan and Iraq. Both corridors are served by road and rail.
- ii. The main traffic mode is road transport. The highway network, comprising about 7,100 km, is basically well developed. However, serious congestion has developed on the coastal and Beirut-Syrian Border highways. The railway network is small (413 km), in poor condition, has declined steadily in importance and operates with a large deficit. There are no navigable rivers. Coastal shipping is negligible. The small size of the country leaves no scope for internal air transport.
- iii. The Government's Development Plan (1972-77) envisages a total investment of LL 350 million in the transport sector, or about 20% of total proposed public investments over the plan period. Of this total, LL 250 million have been earmarked for the highway sector, for improving the most congested parts of the highway network.
- iv. Planning in the transport sector is carried out by the various agencies responsible for the different modes. Until recently, investment decisions were made on an ad hoc basis. During the last five years, however, a number of highway projects have been subject to technical and economical feasibility studies; and a study to determine the future development of the port of Beirut is about to begin. There is little coordination between agencies concerned with planning of investments in transport infrastructure. This has not been a problem in the past because the transport system is simple. However, as traffic volumes increase rapidly large investments are required in transport infrastructure, which should be properly planned and coordinated. The Government is aware of this and intends to initiate studies to review the operations of the railways, and coordinate a study to be made under the project of a road bypassing the Beirut metropolitan area with urban and other transport studies in the area.
- v. Under the proposed project the most urgent transport infrastructure needs in Lebanon's transport sector will be met. Construction of the Tabarja-Tripoli expressway will provide much needed relief for the presently congested

two-lane coastal highway. Also included in the project are pre-investment studies of other congested highways, such as for a road bypassing Beirut and for the Beirut-Syrian border highway.

vi. There is no formalized planning of highway improvement; the quality and level of maintenance is unsatisfactory and highway administration needs improvement. A study of the organization and operation of the highway administration under the Ministry of Public Works and Transport will be carried out under the project with a view to identifying the needs for organizational improvements and staffing and preparing a highway improvement and maintenance program, including a program for equipment purchases. Preliminary plans for the establishment in Batroun (29 km from Tabarja) of a maintenance center will be reviewed by the consultants for the highway organization and maintenance study. Construction of the maintenance center and procurement of equipment therefor will be financed under the present project.

vii. Two Government authorities will be responsible for execution of the project:

- (a) The Conseil Executif des Grands Projets for construction of the Tabarja-Tripoli Expressway and of a maintenance center in Batroun with procurement of related maintenance equipment, as well as for the administration of the Beirut bypass studies and the detailed engineering of the Beirut-Syrian Border highway; and
- (b) the Ministry of Public Works and Transportation for the highway organization and maintenance study.

The project is expected to be completed by late 1976.

viii. The total project cost is estimated at US\$64.2 million equivalent (excluding US\$13.3 million for right-of-way acquisition) with a foreign exchange component of US\$33.0 million or about 52%. The foreign exchange cost will be financed by the Bank loan and the local costs will be provided by the Government. The Government has asked the Bank to provide retroactive financing for construction of a first section of the expressway which is expected to start in January 1973, and an amount of US\$800,000 is included in the project for this purpose.

ix. The Economic Return on the investments in the expressway, including time savings for non-leisure travel, is calculated at 21%, and the First Year Economic Return at 13%, indicating that construction is economically well justified and appropriately timed. If time savings were excluded from the benefits and assuming an increase in construction costs of 15% and a decrease in benefits of 25% the Economic Return would still be 11%. Benefits accruing from the preinvestment and maintenance studies have not been quantified. These elements, however, are clearly justified since they will contribute to increased efficiency in highway administration, as well as assist the Government in the necessary improvements, expansion and maintenance of its highway network.

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LEBANON

I. INTRODUCTION

1.01 In 1967, the Government of Lebanon asked the Bank to participate in the financing of a highway project. The project was appraised in 1968 but was not carried beyond that stage because the Government could not provide the necessary local funds. In early 1972 the Government informed the Bank that this problem had been overcome. A project preparation mission visited the country in July 1972 and agreed with the Government on the scope and arrangements for updating the 1969 project preparation studies.

1.02 The main purpose of the proposed project, which would be the first lending by the Bank Group in the transportation sector in Lebanon, is: to increase the capacity of the most congested section of the existing coastal highway; to carry out economic and technical studies of high priority highway projects which could be suitable for future Bank financing; and to carry out studies to identify necessary institutional improvement in the transport sector. The project includes consulting services suitable for UNDP financing. The Government has indicated, however, that it wants to use UNDP funds for other high priority sectors and these services are therefore included in the project.

1.03 The appraisal is based on the feasibility study and detailed engineering for the Tabarja-Tripoli expressway prepared by the French consulting firm Bureau Central d'Etudes pour les Equipments d'Outre-Mer (BCEOM) in association with two Lebanese consultants, Associated Consulting Engineers (ACE) and Consolidated Engineering Company (CEC); information obtained from the Government; and the findings of a Bank appraisal mission to Lebanon in September 1972 consisting of Messrs. N.E. Krogh-Poulsen (Economist) and R. Paraud (Engineer). Mr. S. Hallgrimsson (Engineer) assisted in preparing the report.

II. THE TRANSPORTATION SECTOR

A. The Country and its Economy

2.01 Lebanon is located on the Eastern Mediterranean coast with Syria to the north and east and Israel to the south. It covers an area of about 10,500 km<sup>2</sup> and is 190 km in length north-south with a maximum width of only about 90 km east-west. Nearly three-quarters of the country is made up of two mountain ranges: the Lebanon Mountains which run parallel to the Mediterranean, leaving only a narrow coastal strip, and the Anti-Lebanon Mountains which form the eastern boundary with Syria. Between these two ranges at an altitude of about 1,000 m lies the fertile Bekaa Valley which constitutes Lebanon's main agricultural area.

2.02 The major part of population and economic activity in Lebanon is located along the coast which is dominated by Beirut, the country's capital, its most important population and economic center, its biggest harbor and its only civil airport. The population of Lebanon is estimated at about 2.8 million, of which 1.4 million live in the Beirut metropolitan area and 325,000 in Tripoli, the second largest city in the country. The major sectors of the economy are commerce, transport and services, including tourism. Together these sectors contribute about 68% to the gross domestic product.

#### B. The Modes

2.03 Beirut is the origin or destination of most transport along the coast as well as of transit transport to and from Syria, Jordan, Iraq, and other Middle East countries which route part of their international trade through the port of Beirut. The north-south transport corridor along the coast and the east-west transport corridor between Beirut and Damascus therefore are the main arteries of the transport system. Both corridors are served by highway and railway. There are no navigable rivers, coastal shipping is negligible and the small size of the country leaves no scope for internal air transport.

2.04 Highways are the main modes of transport. Mountainous terrain, short distances, and the need for widespread distribution of goods in small quantities to scattered mountain communities have favored the development of road transport. While, apart from the main transport corridors, Lebanon's highway network is generally adequate for serving present traffic volumes, serious congestion is developing on the north-south coastal highway and on the east-west highway between Beirut and Damascus. The Government is, therefore, giving high priority in its road investment program to improving these routes.

##### (a) Highways

2.05 Details of the highway sector are discussed in Chapter III.

##### (b) Railways

2.06 The Lebanese railways are operated by the semi-autonomous Office des Chemins de Fer de l'Etat Libanais, which is controlled by the Ministry of Public Works and Transport (MPWT). The system comprises 413 km of line of which 331 km are standard gauge and 82 km narrow gauge. The narrow gauge section, built in 1895, is part of the rack railway from Beirut to Damascus. The main standard gauge line, built in 1944 for military purposes to establish a railway connection between Egypt and Syria, runs along the coast from the Israeli border through Beirut and Tripoli to join the Syrian and Turkish railways. Between Zahranî and the Israeli border (about 47 km) this line has completely deteriorated and is not being used. A second standard



gauge line, built in 1902, runs from Rayak in the Bekaa Valley to Homs and is carrying almost no traffic. Neither of the lines allow high speeds: the narrow gauge line operates at average speeds of 20 km/h and the standard gauge lines at about 45 km/h. Both infrastructure and equipment are worn out and generally obsolete.

2.07 Freight traffic has been steadily declining in recent years, and amounted to 258,000 m tons in 1970 (195,000 m tons on the coastal and Bekaa Valley lines and 63,000 m tons on the Beirut-Damascus line) (Table 1). On the standard gauge lines three commodities, cement (60%), live animals (26%), and general merchandise (12%) account for 98% of total freight traffic. On the Beirut-Damascus line, two commodities, phosphate (48%) from Jordan and general merchandise (21%) account for 69% of total freight traffic. Total passenger traffic amounted to 76,000 in 1970 (60,000 passengers on the standard gauge line and 16,000 passengers on the narrow gauge line). Average hauls are between 80 km and 100 km for freight and passengers. A payroll of about 1,100 employees and obsolete equipment and infrastructure combined with steadily decreasing volumes of traffic has brought about an operating ratio of 440 in 1971 resulting from expenditures of LL 15.8 million and revenues of only LL 3.6 million.

2.08 The prospects of improving the financial position of the railways are remote. Present total expenditures per ton/km are LL 0.527. If only direct variable operational expenditures are regarded, expenditures per ton/km amount to LL 0.132, which is more than twice the amount charged per ton/km by truck on the coastal road. The present track with steep grades and sharp curves does not allow speeds that would make passenger transport by railway a realistic alternative to road transport, while short transport hauls do not allow the railway much room for competition with highway freight transport, even if rolling stock and the general service level were improved. The Government is aware of the railway problems and is initiating studies to review present operations and recommend future action (para 2.15).

### (c) Ports

2.09 Lebanon has two main ports, Beirut and Tripoli, of which the former is by far the more important. Both ports are controlled by the Ministry of Hydraulic and Electrical Resources. The port of Tripoli is administered by a semiautonomous port authority directly under this Ministry, whereas the port of Beirut is operated by a private concessionary company. Total freight traffic, exclusive of oil, at Beirut increased by 5.8% per annum during the last decade and amounted to 3.0 million tons in 1970 (Table 1). Due to the closure of the Suez Canal, transit traffic especially from Iraq and Jordan increased markedly since 1967 and was about 900,000 tons or 30% of the total volume in 1970. Total freight traffic at Tripoli is growing at an average of 15% per annum and amounted to 650,000 tons in 1970. The capacity of the port of Beirut is becoming insufficient to handle the increasing traffic volumes and will be expanded by construction of a new quay and extension of the existing breakwater in 1973-1974. Proposals for a study (to be financed by the

Government) of a fourth basin and for reorganization of the existing port administration have been invited and the studies are scheduled to start shortly. The port of Tripoli can handle present traffic volumes and no investments have been specified in the 1972-1977 Development Plan.

(d) Civil Aviation

2.10 Beirut has Lebanon's only civil airport, which is one of the most important in the Middle East. It is administered by the Directorate of Civil Aviation under the Ministry of Public Works and Transport. The Directorate is well organized and efficiently operating. Traffic growth has been rapid. Passenger traffic increased by 9% per annum during the last decade and amounted to 1.6 million passengers in 1970. Freight traffic increased by 14.5% per annum during the last five years and amounted to 58,000 tons in 1970 (Table 1). Although the capacity of Beirut airport is adequate at present, an investment program has been proposed for expansion of the airport and construction of a new runway, which would enable it to accommodate increasing traffic volumes.

2.11 There are two Lebanese commercial airlines, Middle East Airlines-Airliban (MEA) and the all cargo Trans Mediterranean Airlines (TMA). MEA is the biggest of the two with 16 jet aircraft of various sizes (Boeing 707 and 720, Caravelle and Comet). MEA operates to all continents. TMA has 4 Boeing 707 aircraft and 5 DC-6 propeller aircraft. Both airlines appear to be efficiently operated.

(e) Pipelines

2.12 Two important oil pipelines terminate in Lebanon, one at Tripoli from Iraq, and the other near Saida from Saudi Arabia. Yearly through-put of oil in 1969 was about 45 million tons. The pipelines remain largely outside the Lebanese economy, except for some employment and receipts from royalties which in 1969 amounted to about LL 35 million.

C. Planning, Financing and Coordination

2.13 A national development plan covering the six-year period 1972-1977 was approved by the Council of Ministers in January 1972. Although the plan has not yet been legally enacted it is an important guideline for public investments and is generally being taken into consideration by the various ministries and autonomous agencies when preparing their programs and budgets. Total proposed public investments under the development plan amount to LL 1,740 million, or on the average about LL 290 million annually. Total investments in the transport sector proposed in the development plan amount to LL 350 million, of which LL 250 million is allocated to highways and LL 50 million each to the port and airport of Beirut. No investments have been proposed for the railways. Considering that the proposed investments for the Tabarja-Tripoli expressway and the Lebanese part of the Beirut-Damascus

highway alone amount to more than LL 270 million, and that the major part of these investments should be completed in the plan period, the amounts proposed for highways are low.

2.14 The development plan stresses the necessity for rational investment planning. Planning in the transport sector is carried out by the agencies responsible for the various modes. Until recently investment decisions were made on an ad hoc basis, in which political considerations rather than potential economic benefits played a significant role. During the last five years, however, a number of highway projects have been subject to technical and economical feasibility studies; and a study to determine the future development of the port of Beirut is about to begin. Minor projects, including improvement and maintenance works for highways are not subject to formalized planning and continue to be determined on an ad hoc basis. In order to improve highway planning the Government has requested inclusion in the project of a highway maintenance and organization study which will include preparation of a five-year highway improvement and maintenance program.

2.15 Little coordination exists between the various agencies concerned with planning of investments in transport infrastructure. This has not been a problem in the past because the transport system is simple, but problems are now arising on railways and transportation in the Beirut Metropolitan Area. The railway problems have been outlined in paras. 2.06 to 2.08. The Government is aware of these problems and in addition to a preliminary review carried out in 1969, it has assigned the Ministry of Planning to carry out a study of the railway, which may serve as a basis for the Government's decision on future railway operations. Assurances have been obtained from the Government that it will review with the Bank the conclusions and recommendations of the study and the proposed implementation plan, if any.

2.16 With the proposed improvements of the main highway connections of Lebanon, all originating in Beirut, the pressure of traffic on the central business district of Beirut must be alleviated through a bypass. The Government has requested inclusion of a study of a bypass in the project; this study will be coordinated with the study for the enlargement of the port of Beirut (para 2.09) as well as with a study of urban development in Beirut being undertaken by the city of Beirut with the assistance of a group of French experts, financed by French bilateral aid.

### III. HIGHWAYS

#### A. The Network

3.01 The length of the highway network is about 7,100 km (Table 2). About 2,000 km are classified as international and primary roads, and the remainder as secondary and local. The north-south coastal highway and the east-west Beirut-Syrian border highway with its northern branch through the

Bekaa Valley are the trunk roads of the highway network. Road density is highest on the coastal plain and on the western slopes of the Lebanon Mountains, where the majority of the population is located.

3.02 More than 80% of the highway network, including all primary roads, consists of two-lane bituminous paved roads, many of them developed from tracks with only a few engineered improvements. They are usually narrow and winding, with steep grades in the mountainous areas where landslides, rockfalls and snow in the winter frequently interrupt traffic. Along the coast, roads are subject to periodic flooding and to accumulation of water on the surface due to poor drainage. Structures vary in width, load capacity and condition. Wayside encumbrances and poor signalling further limit the capacity of some important road sections. Reconstruction to higher standards of part of the primary road system is required, but most of the highway network could be substantially improved through better maintenance and relatively minor betterment works.

#### B. Characteristics and Growth of Traffic

3.03 Between 1961 and 1971 the vehicle fleet increased at an average annual growth rate of 9.5% from about 66,000 to 164,000 vehicles (Table 3). The number of passenger cars has increased most rapidly, and now represents 89% of the total fleet. Trucks account for 10% and buses for 1% of the vehicle fleet. Gasoline consumption has increased at a rate of 11.6% annually from 1961 to 1971, in line with the growth of private cars and taxis over this period (Table 4).

3.04 The growth in the vehicle fleet is paralleled by the growth of road traffic. Traffic counts carried out by the Directorate of Highways (DH) on the main roads permanently and on the remainder of the highway system seasonally show a 13% annual increase in Average Daily Traffic (ADT) on the coastal highway between Beirut and Tripoli from 1960 to 1966, and a 10% annual increase from 1966 to 1970. ADT of 5,000 vehicles are common on the primary roads, reaching levels of more than 30,000 vehicles near Beirut.

3.05 Public freight and passenger transport is subject to Government regulation. At the end of 1971, taxi licenses numbered 10,645, and truck and bus licenses 3,477 and 618 respectively. The number of licenses appears to be adequate for the present transport needs of the country. Public transport is generally in the hands of small operators with one to five vehicles, except for the operation of bus transport in the city of Beirut by the Government.

3.06 Public passenger transport in Lebanon is generally undertaken by taxis. The taxis operate all over Lebanon in direct competition with each other and with the buses in Beirut. Their competition is based on comfort, convenience and speed. They charge rates which are usually about twice those of the buses. Fares for public bus transport in Beirut are controlled by the Government; they are below cost for social and competitive reasons.

Taxi fares are also controlled by the Government, and seem to cover cost and a reasonable profit margin for the operator. Truck rates are not controlled.

3.07 Regulations regarding traffic and vehicle dimensions are generally satisfactory, but permissible axle loads are rather high (14 tons). Regulations are rarely enforced. The consultants for the highway organization and maintenance study will review the traffic regulations and propose measures needed for effective enforcement thereof.

#### C. Administration

3.08 Responsibility for construction and maintenance of highways is shared by the Directorate General of Highways and Buildings (DGHB) and the Conseil Executif des Grands Projets (CEGP). The DGHB is one of the General Directorates of the MPWT, whereas CEGP is a semi-autonomous agency under the direct supervision of the Minister of Public Works and Transport.

3.09 The CEGP is concerned with major construction projects of buildings, electricity, ports, highways, and river flood control, which are assigned to it by the Council of Ministers. It was created in June 1961 as a specialized agency for particularly large projects which could -- by operating outside the civil service structure -- employ qualified professional personnel at competitive salaries without having to increase the size or salaries of the permanent civil service. It has a staff of about 20 engineers and employs consultants for most design and supervision work. CEGP's organization is shown in Chart World Bank 7147(R). So far projects under its responsibility have been properly executed.

3.10 Except for the major projects assigned to the CEGP, responsibility for planning, design and maintenance of highways is entrusted to the DGHB. The DGHB is divided into two directorates, one for buildings and one for highways. The DH has divisions for highway planning and programming, engineering, construction, maintenance, highway safety and a highway laboratory. For maintenance it operates partly through four Regional Public Works Directorates (Chart World Bank 7148(R)). Despite a sufficient supply of competent nationals the DH has not been able to attract and retain capable staff and has therefore been unable to carry out its duties efficiently. Low salaries and lack of opportunity to participate in the important works reserved for the CEGP prejudice the recruitment and retention of capable professionals. This problem will be reviewed by consultants under the proposed highway organization and maintenance study (para. 4.11).

#### D. Planning

3.11 Economic analysis of highway investments received little attention until in 1967, when the Government asked the Bank to participate in the financing of the Tabarja-Tripoli expressway project. A feasibility study was prepared for this project followed, between 1967 and 1971, by feasibility and engineering studies of other important roads. These studies were carried out by consultants (para. 3.15).

3.12 There is no general system of planning, budgeting and control of highway works; no centralized highway inventory kept up-to-date; and little analysis of traffic counts and other data. The Government realizes that there is a need to improve highway data collection and analysis to provide a proper basis for highway investment planning. To achieve this it has agreed that consultants should review and recommend improvements in the organization and operations of the DH under the proposed highway organization and maintenance study (para. 4.11).

#### E. Financing

3.13 Funds for the DH for highway maintenance and improvement works are appropriated each year from the recurrent budget while funds for the CEGP are drawn from the capital budget and are allocated by special laws on a case by case basis. Taxes on highway users consist of taxes and duties on vehicles and fuel, and vehicle registration fees. Highway expenditures have been modest and remained largely constant at about LL 44 million from 1967 to 1971, whereas taxes on ownership and use of vehicles have risen from LL 113 million in 1967 to LL 174 million in 1971 (Table 5). These charges far exceed what would be required to pay for adequate current maintenance and required additions to the highway network.

#### F. Engineering

3.14 The DH has adopted an adequate range of design standards for road construction which take into account terrain, traffic and road class. The standards follow generally accepted engineering practices and can be applied with flexibility to suit specific conditions. When major construction works are to be carried out, as in the case of the present project, the consultants are requested to develop specific design standards. The standards for the proposed project prepared by the consultants BCEOM-ACE-CEC are shown in Table 6. They are acceptable.

3.15 The DH only undertakes design on a limited scale and mainly for improvement works. Design for major construction works is carried out by consultants supervised by the CEGP. About ten local consulting firms are capable of preparing engineering design for highway works. For specialized or difficult designs, however, foreign consultants have so far been engaged. The detailed engineering of the Tabarja-Tripoli expressway (57.5 km), the center line locations of the section Tabarja-Antelias (12 km) and the Beirut Bypass (Antelias-Khalde - 18 km), and the preliminary engineering, including some detailed engineering, of the Khalde-Tyr highway (about 68 km) were prepared by a group led by BCEOM (France) associated with two Lebanese firms. The preliminary engineering of the Beirut-Syrian border highway (about 60 km) was carried out by a group led by X. u. D. Dorsch (Germany) associated with one American and two Lebanese firms.

## G. Construction

3.16 During recent years construction of new highways in Lebanon has been carried out on a very limited scale since efforts were mainly concentrated in improving the existing network. Construction is generally carried out through unit price contracts, awarded on the basis of competitive bidding. The MPWT has a register of contracting firms classified according to their capital, equipment, personnel and working capabilities. There are no restrictions for the registration of foreign firms, which are accepted on the basis of prequalification carried out for each major work. Minor government-financed construction and improvement works are normally supervised by DH staff, whereas supervision of major works is carried out by consultants under the control of the CEGP.

## H. Maintenance

3.17 Routine maintenance is carried out by force account through the regional Directorates and periodic maintenance, consisting mainly of bituminous resurfacing, by the maintenance division of the DH. The useful life of the surfacing is often short due to the inferior quality of aggregate and, although the operations are highly mechanized, they can meet only about half of the requirements. Maintenance operations are inadequately costed and do not provide a clear statement of maintenance expenditures. Budgetary allocations, averaging about LL 8 million per year, are insufficient for proper maintenance of the highway system. The maintenance equipment fleet is inadequate and part of the equipment is obsolete. During recent years, however, about LL 500,000 per year has been spent for the gradual replacement of worn-out equipment; however, this is not sufficient to compensate for equipment depreciation. The Government is aware that highway maintenance should be improved and consultants will review present highway maintenance under the highway organization and maintenance study (para. 4.11).

# IV. THE PROJECT

## A. Description

4.01 The project consists of:

- (i) construction of a four-lane divided expressway between Tabarja and Tripoli (57.5 km), including supervision by consultants;
- (ii) construction of a highway maintenance center in Batroun and purchases of maintenance equipment for the center;

- (iii) a feasibility study of the Beirut Bypass Highway (about 18 km) and detailed engineering of priority sections;
  - (iv) detailed engineering of the Beirut-Syrian Border highway (about 60 km); and
  - (v) studies of highway organization and maintenance, including the preparation of a highway improvement and maintenance program.
- (a) Construction of the Tabarja-Tripoli Expressway

4.02 The proposed Tabarja-Tripoli expressway will be the first phase in the construction of a modern highway network serving the densely populated coastal plain and providing improved connection with Syria and other Middle East countries. Between Beirut and Tabarja (16 km) a four-lane divided highway already exists. The proposed expressway will link with this section and provide an improved connection between Tabarja and Tripoli, the second largest city and an important industrial center. The existing highway from Tabarja to Tripoli now carries over 10,000 vehicles per day. It has a single two-lane paved carriageway and is poorly aligned and narrow. It crosses the railway 15 times, passes through many towns and villages and is heavily congested. After the expressway is opened and through traffic diverts to it, the existing road will be maintained for local traffic.

4.03 Feasibility studies for the expressway were prepared in 1967 and updated in 1972 by the consultants BCEOM in association with ACE and CEC. Detailed engineering was carried out by the same consultants. Both the feasibility studies and the detailed engineering were financed by the Government. Details of the design standards, which are acceptable, are shown in Table 6.

4.04 From Tabarja to Batroun the expressway will follow the coastal plain at the base of the foothills of the Lebanon mountains north of Batroun, traverse a valley to avoid a rocky and unstable peninsula, pass through a tunnel under the Col de Hamat, and then rejoin the coastal plain from Chekka to Tripoli. In designing the expressway, care was taken to find a technically suitable alignment which would avoid high value agricultural land and residential areas, and at the same time open views to natural scenery and historical sites attractive to tourists.

4.05 The expressway will be constructed with separated two-lane carriageways in each direction, full access control and seven grade-separated interchanges with the existing highway system. The design provides for future expansion to six lanes at both ends between Tabarja and Jbeil (13.5 km) and between El Qalamoun and Tripoli (11 km) to accommodate traffic growth.

4.06 The Government intends to retain qualified local consultants for construction supervision. For the Tabarja-Jbeil section of the expressway, CEGP has already engaged a joint venture of local consultants on terms and



conditions satisfactory to the Bank. To assist the CEGP in administering the project and in coordinating supervision, the services of two foreign experts, from the consulting firm which prepared the detailed engineering of the project road (BCEOM-ACE-CEC) will be provided under the Loan.

(b) The Batroun Maintenance Center and Purchases of Maintenance Equipment

4.07 Primarily to ensure adequate maintenance of the expressway, a maintenance center will be established in Batroun, midway between Tabarja and Tripoli. The consultants (BCEOM-ACE-CEC) have prepared preliminary plans for the center and the Loan would provide for its construction as well as for procurement of the necessary maintenance equipment. These plans will be reviewed by the consultants for the highway maintenance and organization study in order to ensure that they are consistent with their recommendations. During negotiations assurances were obtained from the Government that it will review with the Bank the recommendations of the consultants regarding the organization and operation of the maintenance center and the proposed equipment purchases therefor.

(c) Feasibility Study of the Beirut Bypass and Detailed Engineering of Priority Sections

4.08 The planned construction during the next decade of three main highways reaching Beirut from the north (Tabarja-Tripoli) from the south (Khalde-Tyr) and from the east (Beirut-Syrian Border) makes it necessary to undertake now a study of a highway to bypass the city, including its connections with the urban street system. In 1970 at the request of the CEGP the consultants BCEOM-ACE-CEC prepared a feasibility study of the section Tabarja-Antelias (about 12 km) and a pre-feasibility study of the Beirut bypass (Antelias-Khalde, about 18 km). These studies were coordinated with the Directorate of Urban Affairs and the results thereof will eventually be incorporated in the Master Plan of the City of Beirut now being prepared with the assistance of French experts. The loan provides for the financing of a full feasibility study of the Beirut Bypass as well as for detailed engineering of the priority sections that will be determined by the feasibility study. During negotiations, assurances were obtained from the Government that it will review, with the Bank, the findings of the feasibility study and agree on the selection of the road sections for detailed engineering.

(d) Detailed Engineering of the Beirut-Syrian Border Highway

4.09 The Beirut-Syrian Border highway is part of the international highway between Beirut and Damascus. In addition to international traffic, the road serves many populated areas and constitutes an important factor for the economic and social development of Lebanon. Present ADT is 37,000 vehicles on the western slope of the Lebanon Mountains, 15,000 vehicles on the eastern slope and 4,000 vehicles across the Bekaa Valley. The present

road is winding and has steep grades (up to 14%). A section of about 15 km close to Beirut was recently widened to four and six lanes to cope with the growing traffic demand; the remainder has only two lanes.

4.10 A feasibility study of the highway was prepared between 1969 and 1971 by the associated consultants of X. u. D. Dorsch (Germany), Miller-Warden-Western (United States), Antoine Salame (Lebanon), and Moustapha Fawaz (Lebanon). The study showed that early improvement of this highway would be highly justified. The proposed loan provides for the financing of detailed engineering to be carried out by consultants. The reconstruction of the Syrian section of this international highway is expected to start in late 1973 with financing being provided by an IDA Credit (298-SYR of April 1972).

(e) Highway Organization and Maintenance Study

4.11 The study to be carried out by consultants would include:

- (i) preparation of a five-year highway maintenance and improvement program, based on a detailed road inventory;
- (ii) review of the organization and operation of the DH and recommended improvements thereof including the functional relationship between the DH and the CEGP; and
- (iii) determination of the need for maintenance and workshop equipment purchases and for workshop construction necessary for carrying out the proposed highway maintenance and improvement program, including a review of the plans for the Batroun maintenance center and its equipment needs.

The study would be carried out in two stages, each lasting about one year. The principal objectives of the second stage will be to assist in the implementation of the highway maintenance program developed under the first stage.

4.12 During negotiations, assurances were obtained from the Government that it will: (i) review with the Bank the consultants' recommendations for the highway organization and maintenance study (ii) carry out the agreed programs according to a timetable satisfactory to the Bank; (iii) maintain the highway network adequately in accordance with sound engineering and highway practices; and (iv) provide promptly as needed the necessary finance and facilities for adequate highway maintenance.

B. Cost Estimates and Foreign Exchange Component

4.13 The total cost of the project (including contingencies but excluding right-of-way acquisition) is estimated at US\$64.2 million. The foreign exchange component to be financed by the Loan is estimated at US\$33.0 million or about 52%. Detailed costs are shown in the table on page 13.

<u>Project Elements</u>	<u>IL Million</u>			<u>US\$ Million</u>			<u>% Foreign Exchange Component</u>
	<u>Foreign</u>	<u>Local</u>	<u>Total</u>	<u>Foreign</u>	<u>Local</u>	<u>Total</u>	
A. Construction of Tabarja-Tripoli Expressway <sup>/a</sup>	<u>64.5</u>	<u>64.5</u>	<u>129.0</u>	<u>23.9</u>	<u>23.9</u>	<u>47.8</u>	50
B. Supervision of A.	<u>2.4</u>	<u>3.6</u>	<u>6.0</u>	<u>0.9</u>	<u>1.3</u>	<u>2.2</u>	40
C. Batroun Maintenance Center							
Construction	<u>0.6</u>	<u>0.6</u>	<u>1.2</u>	<u>0.2</u>	<u>0.2</u>	<u>0.4</u>	50
Procurement of equipment	<u>1.5</u>	<u>0</u>	<u>1.5</u>	<u>0.6</u>	<u>0</u>	<u>0.6</u>	100
Subtotal	<u>2.1</u>	<u>0.6</u>	<u>2.7</u>	<u>0.8</u>	<u>0.2</u>	<u>1.0</u>	
D. Detailed engineering of Beirut-Syrian border highway	<u>2.8</u>	<u>0.7</u>	<u>3.5</u>	<u>1.0</u>	<u>0.3</u>	<u>1.3</u>	80
E. Feasibility study of Beirut bypass and detailed engineer- ing of priority sections	<u>1.2</u>	<u>0.3</u>	<u>1.5</u>	<u>0.4</u>	<u>0.2</u>	<u>0.6</u>	80
F. Highway organization and maintenance study	<u>2.0</u>	<u>0.5</u>	<u>2.5</u>	<u>0.7</u>	<u>0.2</u>	<u>0.9</u>	80
G. Contingency allowances							
On items A. and B. <sup>/b</sup>	<u>6.7</u>	<u>6.8</u>	<u>13.5</u>	<u>2.5</u>	<u>2.5</u>	<u>5.0</u>	
On all items <sup>/c</sup>	<u>7.5</u>	<u>7.0</u>	<u>14.5</u>	<u>2.8</u>	<u>2.6</u>	<u>5.4</u>	55
Subtotal	<u>14.2</u>	<u>13.8</u>	<u>28.0</u>	<u>5.3</u>	<u>5.1</u>	<u>10.4</u>	
Total	<u>89.2</u>	<u>84.0</u>	<u>173.2</u>	<u>33.0</u>	<u>31.2</u>	<u>64.2</u>	52

<sup>/a</sup> Right-of-way amounting to IL 36 million (US\$13.3 million) is not included.  
<sup>/b</sup> About 10% physical.  
<sup>/c</sup> About 10% price.

4.14 Construction cost of the expressway has been estimated by the CEGP on the basis of completed detailed engineering by BCEOM-ACE-CEC, the amounts of the contracts already awarded for Section 1 (para. 4.19), and unit prices in recent bidding for similar works. They are satisfactory. Construction cost estimates for the maintenance center in Batroun, are based on preliminary engineering prepared by the consultants (BCEOM-ACE-CEC) and cost estimates for equipment are based on items tentatively identified by these consultants. Cost of consulting services have been estimated on the basis of preliminary proposals received by the CEGP and on estimated man-months required.

4.15 Contingency allowances of about 20% for construction and 10% for all other project items are considered adequate. For construction the contingency provision allows 10% for increases in quantities and 10% for increases of local and foreign prices. The latter is based on 5% average annual increases in both foreign and local costs, from the time of receiving bids, until completion of construction. The 10% physical contingency allowance for equipment and consulting services is for increases in quantities and man-months respectively.

4.16 The foreign exchange component of construction has been estimated by the consultants at 50%, based on the assumption that construction will be carried out by foreign firms, in joint venture with, or subcontracting part of the works to local firms. The estimates are reasonable. The foreign exchange component of consulting services for construction supervision has been estimated on the basis that this will be carried out by local firms, coordinated by foreign experts (para 4.06). The foreign exchange component for feasibility studies, detailed engineering and other studies has been estimated on the assumption that these services would be provided by foreign firms with some participation of local firms.

### C. Execution

4.17 Execution of the project will be the responsibility of two Government authorities:

- (a) the CEGP for the Tabarja-Tripoli expressway, the maintenance center, the procurement of maintenance equipment and the pre-investment studies of the Beirut-Syrian Border Highway and the Beirut Bypass; and
- (b) the MPWT for the highway organization and maintenance study.

4.18 The consulting services under the project will be provided by qualified and experienced consultants satisfactory to the Bank. During loan negotiations the proposed terms of reference for the consultants' services were agreed. The maintenance equipment will be procured on the basis of international competitive bidding in accordance with the Bank's "Guidelines

for Procurement". For the purpose of bid evaluation domestic bids for maintenance equipment with a local value added not less than 20% would be accorded a margin of preference by adding 15% of the cost or the actual custom duties, whichever is lower, to foreign bids.

4.19 International competitive bidding for the construction of Tabarja-Jbeil section was invited in April 1972 and proposals received in June 1972. The CEGP awarded construction contracts to the lowest bidders: (i) Domiki (Greece) US\$8.5 million for earthworks and pavement, and (ii) Hourie-Kunz (Lebanon-Germany) US\$1.0 million for construction of major bridges. The Bank has reviewed the awards and found them to be compatible with Bank requirements. Construction works started in November 1972.

4.20 For the remaining sections of the expressway (Jbeil-Batroun, Batroun-Chekka and Chekka-Tripoli) the CEGP will award unit price contracts on the basis of international competitive bidding following the Bank's "Guidelines for Procurement". The proposed bidding arrangements were reviewed and agreed upon during negotiations.

4.21 The CEGP proposes to divide the remaining works into five contracts to stimulate competition and permit participation by various size contractors. The sections are:

- (a) earthworks and pavement of the Jbeil-Batroun section (estimated at about US\$7.2 million);
- (b) major bridges on the Jbeil-Batroun section (estimated cost about US\$1.5 million);
- (c) all construction works on the Batroun-Chekka section, including tunneling works and construction of the maintenance center in Batroun (estimated cost about US\$17.0 million);
- (d) all construction works on the Chekka-Tripoli section (estimated cost about US\$11.7 million); and
- (e) miscellaneous (traffic signs, fencing, etc.) (estimated cost about US\$1.3 million).

It is preferable to execute the Batroun-Chekka section under a single contract, as the earthworks and tunnelling on this section are closely inter-related. The size of the contract is expected to attract reputable firms, experienced in the complicated tunnelling works under the Col de Hamat, for which special equipment and expertise is required. Difficult construction conditions in the built-up area near Tripoli will require temporary deviation of existing roads, extensive utility relocations, etc. This kind of work cannot be handled efficiently by more than one contractor and, therefore, the Chekka-Tripoli section will be executed under a single contract.

4.22 Lebanon has a preferential tariff agreement with the League of Arab States. However, no procurement under the loan is expected to be made from the participating countries.

4.23 In its 1972 budget, the Government allocated adequate funds for construction and right-of-way acquisition of the Tabarja-Jbeil section. The right-of-way for this section has been acquired, and legal procedures for such acquisition on the remaining sections have been generally completed, although the actual transfer of title and payment to owners have not yet taken place. During Loan negotiations the status of right-of-way acquisition was reviewed with the Government and assurances were obtained that the necessary right-of-way from Beirut to Tripoli will be acquired and made available to the contractors as and when needed.

4.24 Works on the Tabarja-Jbeil section were started in November 1972 (para. 4.19), while those on the remaining project sections are expected to start in the first quarter of 1974. Construction is expected to be completed by late 1976. Bids for maintenance equipment will be invited in early 1975 and procurement is expected to be completed early in 1976. All studies under the project are expected to start in 1973 and to be completed by late 1976.

4.25 The rate of unemployment in Lebanon not a major problem; in fact there is a seasonal importation of laborers (up to 150,000 mainly from Syria) for agriculture, construction of buildings, and industry. Furthermore, the expressway construction does not lend itself to labor-intensive methods and the Government has therefore decided that the method of execution would be left to the discretion of the bidders, who are expected to use equipment-intensive methods.

#### D. Financing

4.26 The foreign exchange costs of the project (US\$33.0 million) will be financed by the Loan. Local costs amounting to US\$44.5 million equivalent (including US\$13.3 million for right-of-way) will be met by the Government from budgetary allocations. The Government has asked the Bank for retroactive financing of the construction of the Tabarja-Jbeil section, (including supervision of construction) which started in November 1972 (para. 4.19) and an amount of US\$800,000 has been included in the project for this purpose.

#### E. Disbursements

4.27 Disbursements will be made on the basis of 50% of the cost of construction contracts, 100% of the CIF cost of maintenance equipment and the actual foreign exchange cost of consulting services. Based on this and on the project execution schedule, an estimated Schedule of Disbursements has been prepared (Annex). Any surplus remaining in the Loan Account on completion of the project should be cancelled.

## V. ECONOMIC EVALUATION

### A. Tabarja-Tripoli Expressway

5.01 The proposed expressway aims at alleviating congestion on the present coastal road and providing a modern route that will satisfy the increasing transport demand in the Beirut-Tripoli transport corridor. Without the proposed facility traffic conditions will become seriously congested and impede economic development of the area served. The main beneficiaries of the highway project will be the users of the expressway. Because the project is located in one of the most populous areas of Lebanon and because motorization is fairly high (one vehicle per 17 inhabitants or one per every 3 families), the beneficiaries represent a significant portion of the population. As highway transport is highly taxed (para. 3.13), part of the benefits from the expressway project will be redistributed through the Government budget, thus also benefiting other sectors of the economy.

5.02 In 1971 ADT on the present Tabarja-Tripoli road ranged from 11,100 to 13,600 (Table 7), with seasonal variations of 15% above and below these figures. The traffic was composed of 77% cars and taxis, 5% buses and 18% trucks. The traffic figures correspond to average daily transport volumes of about 30,000 passengers (of which about 12,000 are bus passengers) and about 10,000 tons of goods. The traffic has no marked peak, but is more or less evenly spread out over the day. Based on an origin destination survey, it was determined that about 85% of the traffic was through traffic which would divert to the new facility. Between 1961 and 1966 traffic on the coastal road increased at an annual rate of 13%. Due to the Middle East war, however, traffic declined by about 6% in 1967 but since 1968 it has increased by an average of about 11% per year. The forecast of future traffic on the Beirut-Tripoli route by the consultants, BCEOM-ACE-CEC, assumes an average traffic growth rate between 1971 and 1996 of 5.6% per annum, ranging from 9.3% per annum in the first five years to 4.1% in the last five years (Table 7); this forecast is considered reasonable.

5.03 Various alternatives were examined for accommodating future highway traffic volumes. Upgrading of the existing road on its present alignment to four lanes was eliminated, since it would only provide a temporary solution and at a cost exceeding that of the proposed expressway. Upgrading of the railway to a modern facility would require major reconstruction of the existing poor alignment and substandard infrastructure as well as acquisition of modern rolling stock. Although a detailed feasibility study was not undertaken, this was not considered economically feasible since: (i) neither the passenger volumes involved nor the distribution of traffic throughout the day would justify a commuter railway line; and (ii) the distance between Beirut and Tripoli (75 km) is too short and the transport volumes too small to justify a modern mixed traffic railway line. In addition, a railway line by itself would not improve traffic conditions in the Beirut Metropolitan Area or in

Tripoli, since railway passengers and goods would still require motor vehicles to get to and from the railway stations. While some time in the future a modern railway line might be required to satisfy the increasing transport demand, there is no economic justification for rail operations at the present time or in the near future. The choice was thus limited to a highway on a new alignment with or without access control. To accommodate the forecast traffic, a four-lane expressway with full access control, to be used by through traffic, combined with the existing highway for local traffic, will provide the best solution.

5.04 In addition to the developmental aspects of the expressway in satisfying future transport demand (para. 5.01), the following directly quantifiable benefits would result from its construction:

- (i) reductions in vehicle operating costs and time savings for the traffic, which would otherwise use the congested coastal road;
- (ii) benefits resulting from the induced or generated traffic which is made possible by the larger capacity and improved service level provided by the expressway.

Vehicle operating costs and time costs of vehicle occupants are shown in Table 8. Time savings are based on cost of time of professional drivers and passengers travelling for business purposes. The benefits from induced traffic become increasingly important as traffic on the existing coastal road gets more congested and finally reaches its maximum capacity which is estimated at an average annual daily traffic of 16,000 vehicles. Other benefits, which have not been quantified, are the decongestion benefits for local traffic on the coastal road; increase in safety and comfort for the traffic on both the coastal road and the expressway and reduction in maintenance cost of the coastal road.

5.05 Economic evaluation shows the project construction to be well justified and appropriately timed. Based on an economic life of 25 years, a construction period of 3 years, and on the estimated economic cost of the expressway, the maintenance center, construction supervision and right-of-way acquisition, the Economic Return (ER) of the expressway has been estimated at 21% and the first year return at 13%. If benefits from time savings are excluded from the analysis, the ER would be 15% (Table 9). To determine the sensitivity of the ER to variations in the estimated construction cost and traffic growth, an analysis was carried out assuming an increase or decrease of 15% in construction cost and of 25% in benefits. The results, shown in Table 9, demonstrate that under the most pessimistic assumptions the project would still yield an ER of 16% (ranging from 17% to 14%) with time savings and 11% (ranging from 12% to 10%) without their inclusion.



B. Other Project Elements

5.06 Benefits from the preinvestment studies and the highway organization and maintenance study have not been quantified. These elements, however, are clearly justified since they will contribute to increased efficiency in highway administration, as well as assist the Government in the necessary improvement, expansion and maintenance of its highway network.

VI. AGREEMENTS REACHED AND RECOMMENDATION

6.01 Agreement having been reached on the principal issues discussed in Chapters II and IV, the project is recommended for a Bank loan of US\$33.0 million to the Government for a 25-year term, including 4 years of grace.

March 29, 1973



TABLE 1

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Traffic on Railways and at Beirut Port and Airport, 1961-70

Railway Traffic

Year	Freight		Passengers	
	(thousand m tons)	(million ton-km)	(thousand)	(million pass-km)
1961	523	33.7	71	5.5
1962	509	36.9	73	6.0
1963	590	43.0	64	5.3
1964	660	49.0	73	5.8
1965	559	39.5	80	6.7
1966	561	45.6	80	6.6
1967	491	38.0	80	6.0
1968	489	37.6	88	6.7
1969	313	24.5	78	7.3
1970	258	20.1	76	7.4

Beirut Port Traffic

Year	Dry Cargo			Passengers		
	In	Out	Total	In	Out	Total
1961	1,359	282	1,641	38	30	67
1962	1,229	403	1,632	42	28	71
1963	1,363	377	1,739	53	33	86
1964	1,588	460	2,048	53	36	89
1965	1,717	453	2,170	68	37	105
1966	1,776	461	2,237	77	45	122
1967	1,705	583	2,288	42	29	71
1968	2,145	675	2,820	36	43	79
1969	1,995	699	2,694	33	40	73
1970	2,290	728	3,018	32	36	68

Beirut Airport Traffic

Year	Freight (thousand m tons)	Mail (m tons)	Passengers (thousand)	
			Transit	Total
1961	n.a.	n.a.	150	605
1962	n.a.	n.a.	174	675
1963	n.a.	n.a.	183	796
1964	n.a.	n.a.	194	872
1965	30	1,044	188	1,008
1966	33	1,325	220	1,157
1967	38	1,254	225	1,029
1968	51	1,842	269	1,242
1969	54	2,424	302	1,270
1970	58	2,478	286	1,272

n.a. means not available.

Sources: Office des Chemins de Fer de l'Etat Libanais and Recueil de Statistiques Libanaises, No. 6, 1970; September 1972

March 29, 1973

TABLE 2

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Length of Highway Network, 1963 and 1971  
(km)

<u>Type of Road</u>	<u>1963</u>			<u>1971</u>		
	<u>Paved</u>	<u>Unpaved</u>	<u>Total</u>	<u>Paved</u>	<u>Unpaved</u>	<u>Total</u>
International	570	0	570	570	0	570
Primary	1,220	200	1,420	1,320	100	1,420
Secondary and Local	2,950	1,270	4,220	3,310	1,100	4,410
Local Roads within towns	<u>500</u>	<u>100</u>	<u>600</u>	<u>600</u>	<u>100</u>	<u>700</u>
Total	<u>5,240</u>	<u>1,570</u>	<u>6,810</u>	<u>5,800</u>	<u>1,300</u>	<u>7,100</u>

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Source: Directorate General for Highways and Buildings; September 1972

March 29, 1973

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Motor Vehicle Fleet, 1961-71

Vehicles in Fleet (Units)

<u>Year</u>	<u>Cars</u>	<u>Taxis</u>	<u>Buses</u>	<u>Trucks</u>	<u>Total</u>
1961	53,744	3,200	1,446	7,915	66,305
1962	62,355	3,200	1,512	8,849	75,916
1963	73,143	3,200	1,590	9,839	87,772
1964	84,349	3,200	1,898	10,833	100,280
1965	89,253	9,462	2,207	11,771	112,693
1966	95,901	9,504	2,088	12,009	119,502
1967	104,738	9,504	2,168	12,763	129,173
1968	113,246	10,645	1,645	13,404	138,940
1969	119,029	10,645	1,763	14,473	145,910
1970	125,371	10,645	1,794	14,795	152,605
1971	135,621	10,645	1,896	15,577	163,743

Average Annual Growth of Vehicles in Fleet (%)

<u>Period</u>	<u>Cars</u>	<u>Taxis</u>	<u>Buses</u>	<u>Trucks</u>	<u>Total</u>
1961-71	9.7	12.8	2.7	7.0	9.5
1961-66	12.3	24.3	7.3	8.7	12.5
1966-71	7.2	2.3	- 1.9	5.3	6.5
1969-71	6.7	0.0	1.5	3.7	6.0

Source: Recueil de Statistiques Libanaises, No. 6, 1970; September 1972

March 29, 1973

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Gasoline Consumption, 1961-71

Consumption (million l)

<u>Year</u>	<u>Gasoline</u> <sup>1/</sup>
1961	185.0
1962	235.0
1963	281.0
1964	357.0
1965	395.0
1966	435.0
1967	440.0
1968	481.6
1969	477.5
1970	501.3
1971	552.7

Annual Increase in Consumption (%)

<u>Period</u>	<u>Increases</u>
1961-71	11.6
1961-66	18.7
1966-71	4.9
1969-71	7.6

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<sup>1/</sup> No details are available on diesel consumption.

Source: Conseil Executif des Grands Projets; September 1972

March 29, 1973

TABLE 5

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Highway Revenues and Expenditures, 1967-71  
(LL million)

<u>Revenues</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>
Import duties on vehicles and spare parts	16.4	21.3	21.9	24.0	36.2
Import duties and taxes on gasoline	84.1	88.3	96.5	98.3	111.2
Registration fees and vehicle taxes	12.6	19.6	19.1	21.3	26.2
Total	<u>113.1</u>	<u>129.2</u>	<u>137.5</u>	<u>143.6</u>	<u>173.6</u>
<u>Expenditures</u>					
MPWT and CEGP					
Construction and improvement	10.7	9.2	7.4	5.1	8.2
Maintenance	7.9	8.7	7.6	7.7	18.0
Administration	3.2	3.4	3.3	3.8	4.6
Studies	1.7	1.8	1.2	3.2	1.5
Beirut City <sup>1/</sup>	<u>22.0</u>	<u>22.0</u>	<u>22.0</u>	<u>22.0</u>	<u>22.0</u>
Total	<u>45.5</u>	<u>45.1</u>	<u>41.5</u>	<u>37.8</u>	<u>44.3</u>

<sup>1/</sup> Estimates (no breakdown available).

Sources: Directorate General for Highways and Buildings and Conseil Executif des Grands Projects; September 1972

March 29, 1973

APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Design Standards for the Tabarja - Tripoli Expressway

<u>Item</u>	<u>Unit</u>	<u>Type of Terrain</u>	
		<u>Rolling</u>	<u>Mountainous</u>
<u>Geometric Design Standards</u>			
Speed	km/h	100	--
Minimum Radius of Curvature	m	350	--
Gradient			
Normal	%	4	--
Exceptional (at approaches of the Col de Hamat)	%	--	6
<u>Roadway Features</u>			
<u>Width</u>			
Lanes	m	3.50	3.50
Median (minimum)	m	3.00	3.00
Stabilized Shoulders on:			
Outer lanes	m	2.50	2.50
Inner lanes	m	0.75	0.75
Climbing lanes	m	1.00	1.00
Total Roadway			
4-lane sections	m	23.50	--
4-lane sections, with provision for widening to 6 lanes	m	30.50	--
4-lane sections with additional climbing lanes	m	--	25.50
-----			
<u>Pavement Type:</u>	Bituminous Concrete		
<u>Axle-load for Pavement Design:</u>	13 m tons		
<u>Bridge Design Standards:</u>	Equivalent to HS 20-44		

-- Means not applicable.

Source: BCEOM-ACE-CEC; September 1972

March 29, 1973



APPRAISAL OF  
A HIGHWAY PROJECT  
LEBANON

Traffic between Tabarja and Tripoli, 1971-96

<u>Traffic Volumes (ADT)</u> <sup>1/</sup>							
<u>Section</u>	<u>Traffic</u> <sup>2/</sup>	<u>1971</u>	<u>1976</u>	<u>1981</u>	<u>1986</u>	<u>1991</u>	<u>1996</u>
Tabarja- Jbeil	Through	12,550	19,460	25,590	32,820	40,370	49,460
	Local	1,000	1,390	1,890	2,470	3,070	3,800
	Total	13,550	20,850	27,480	35,290	43,440	53,260
Jbeil- Batroun	Through	8,630	14,000	18,220	23,200	28,380	34,640
	Local	2,420	3,370	4,540	5,940	7,390	9,140
	Total	11,050	17,370	22,760	29,140	35,770	43,780
Batroun- Chekka	Through	8,630	14,000	18,220	23,200	28,380	34,640
	Local	2,590	3,600	4,870	6,360	7,910	9,790
	Total	11,220	17,600	23,090	29,560	36,290	44,430
Chekka- Tripoli	Through	9,750	15,560	20,330	25,950	31,810	38,870
	Local	1,370	1,900	2,930	3,830	4,770	5,900
	Total	11,120	17,460	23,260	29,780	36,580	44,770

Average Annual Traffic Growth Rate (%)

<u>Section</u>	<u>Traffic</u>	<u>1971-76</u>	<u>1976-81</u>	<u>1981-86</u>	<u>1986-91</u>	<u>1991-96</u>
All	Through	9.8	5.5	5.0	4.2	4.1
	Local	6.8	6.8	5.5	4.5	4.3
	Total	9.3	5.7	5.1	4.2	4.1

1/ Traffic composition: cars-54%, taxis-23%, trucks-18%, and buses-5%.

2/ It is estimated that all through traffic will travel on the expressway.

Source: BCEOM-ACE-CEC, Etude Economique Additionnelle de l'Autoroute de Tabarja-Tripoli, September 5, 1972; September 1972

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Vehicle Operating Costs, 1976 <sup>1/</sup>  
(LL/km)

Coastal Road <sup>2/</sup>

<u>Item</u>	<u>Car</u>	<u>Taxi</u>	<u>Bus</u>	<u>Truck</u>
Vehicle operating costs	0.0970	0.1249	0.3157	0.3275
Occupants' time costs	<u>0.0584</u>	<u>0.0174</u>	<u>0.1243</u>	<u>0</u>
Total	<u>0.1554</u>	<u>0.1423</u>	<u>0.4400</u>	<u>0.3275</u>

Expressway <sup>3/</sup>

<u>Item</u>	<u>Car</u>	<u>Taxi</u>	<u>Bus</u>	<u>Truck</u>
Vehicle operating costs	0.0889	0.1026	0.3009	0.3115
Occupants' time costs	<u>0.0280</u>	<u>0.0081</u>	<u>0.0789</u>	<u>0</u>
Total	<u>0.1169</u>	<u>0.1107</u>	<u>0.3798</u>	<u>0.3115</u>

Difference <sup>4/</sup>

<u>Item</u>	<u>Car</u>	<u>Taxi</u>	<u>Bus</u>	<u>Truck</u>
Vehicle operating costs	0.0081	0.0223	0.0148	0.0160
Occupants' time costs	<u>0.0304</u>	<u>0.0093</u>	<u>0.0454</u>	<u>0</u>
Total	<u>0.0385</u>	<u>0.0316</u>	<u>0.0602</u>	<u>0.0160</u>

<sup>1/</sup> Excluding taxes on vehicle use and ownership.

<sup>2/</sup> Average speed of all vehicles 43 km/h.

<sup>3/</sup> Average speed of cars and taxis is 90 km/h and of buses and trucks is 68 km/h.

<sup>4/</sup> Vehicle operating costs on coastal road less vehicle operating costs on expressway.

Sources: BCEOM-AGE-CEC: Economic Feasibility Study: Tabarja-Tripoli Highway, June 1968, and Etude Economique Additionnelle de l'Autroute de Tabarja-Tripoli, September 5, 1972; September 1972

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Estimated Economic Returns of Construction of Tabarja-Tripoli Expressway<sup>1/</sup>  
(%)

<u>Assumptions</u>	<u>Sections and Numbers</u>				
	<u>Tabarja- Tripoli</u>	<u>Tabarja- Jbeil</u>	<u>Jbeil- Batroun</u>	<u>Batroun- Chekka</u>	<u>Chekka- Tripoli</u>
	<u>All</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Including Passenger Time Savings</u>					
<u>Best Estimate of Construction Costs, and</u>					
Most likely value of benefits	21	22	21	21	19
25% increase in benefits	24	25	24	24	22
25% decrease in benefits	17	18	18	17	16
<u>Assumed Increase in Construction Costs (15%), and</u>					
Most likely value of benefits	19	20	19	19	18
25% increase in benefits	22	23	22	22	20
25% decrease in benefits	16	17	16	15	15
<u>Assumed Decrease in Construction Costs (15%), and</u>					
Most likely value of benefits	23	24	23	23	21
25% increase in benefits	26	28	27	27	25
25% decrease in benefits	19	20	19	19	18
<u>Excluding Passenger Time Savings</u>					
<u>Best Estimate of Construction Costs, and</u>					
Most likely value of benefits	15	16	15	16	14
25% increase in benefits	17	18	17	18	16
25% decrease in benefits	13	13	12	13	11
<u>Assumed Increase in Construction Costs (15%), and</u>					
Most likely value of benefits	14	15	13	14	13
25% increase in benefits	16	17	15	17	14
25% decrease in benefits	11	12	11	12	10
<u>Assumed Decrease in Construction Costs (15%), and</u>					
Most likely value of benefits	17	15	18	16	18
25% increase in benefits	19	17	20	18	20
25% decrease in benefits	14	13	15	14	15

<sup>1/</sup> The economic analysis was based on construction costs and traffic costs prevailing at the time of appraisal, September 1972.

Source: Mission Estimates, December 1972



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Estimated Schedule of Disbursements

<u>Bank Fiscal Year and Quarter</u>	<u>Cumulative Disbursement at end of Quarter (US\$ thousands)</u>
<u>1972/73</u>	
June 30, 1973	1,200
<u>1973/74</u>	
September 30, 1973	2,000
December 31, 1973	3,500
March 31, 1974	5,000
June 30, 1974	7,500
<u>1974/75</u>	
September 30, 1974	10,500
December 31, 1974	13,500
March 31, 1975	15,000
June 30, 1975	18,500
<u>1975/76</u>	
September 30, 1975	21,500
December 31, 1975	24,500
March 31, 1976	27,500
June 30, 1976	30,500
<u>1976/77</u>	
September 30, 1976	32,000
December 31, 1976	33,000

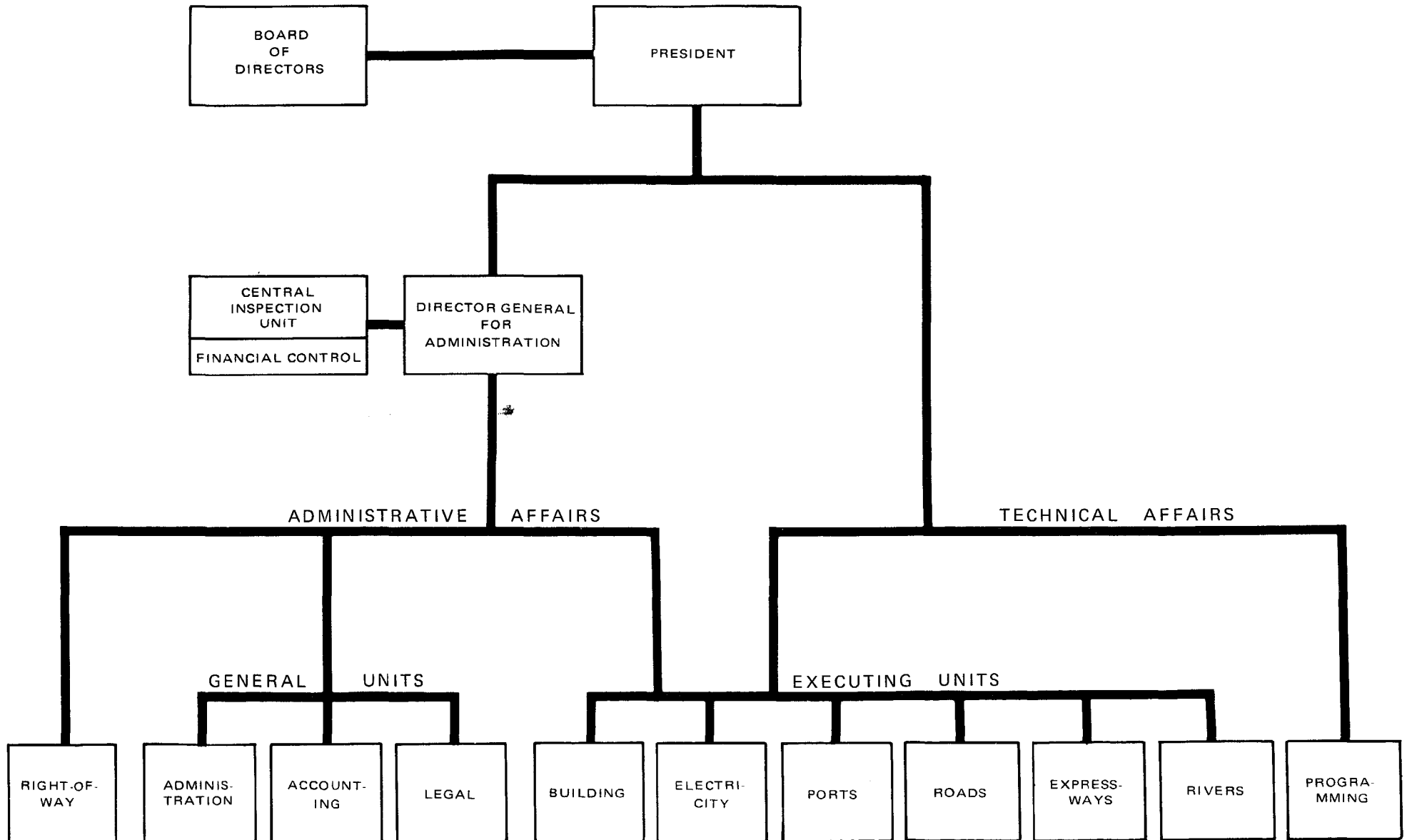
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Source: Mission Estimates, December 1972

March 29, 1973



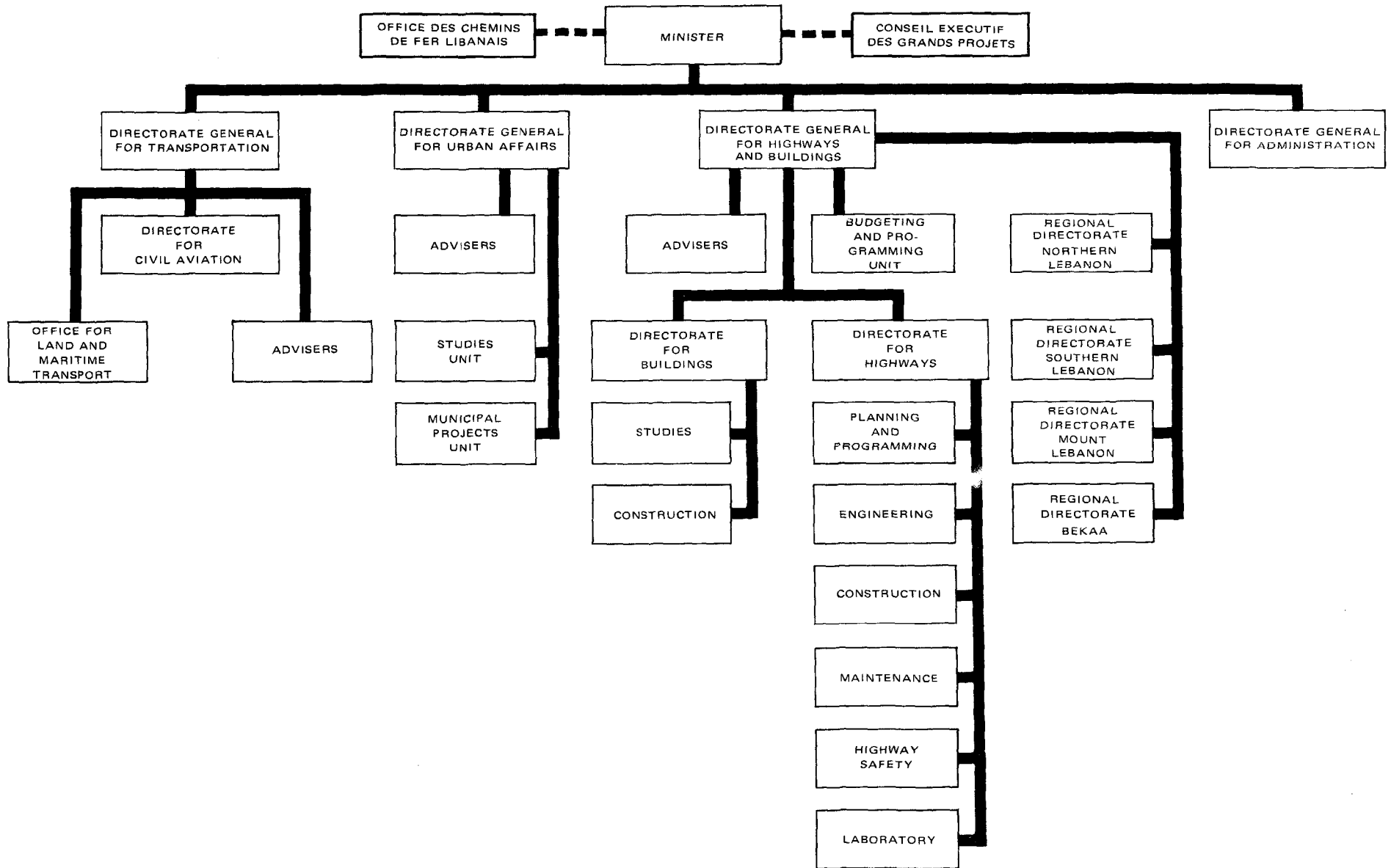
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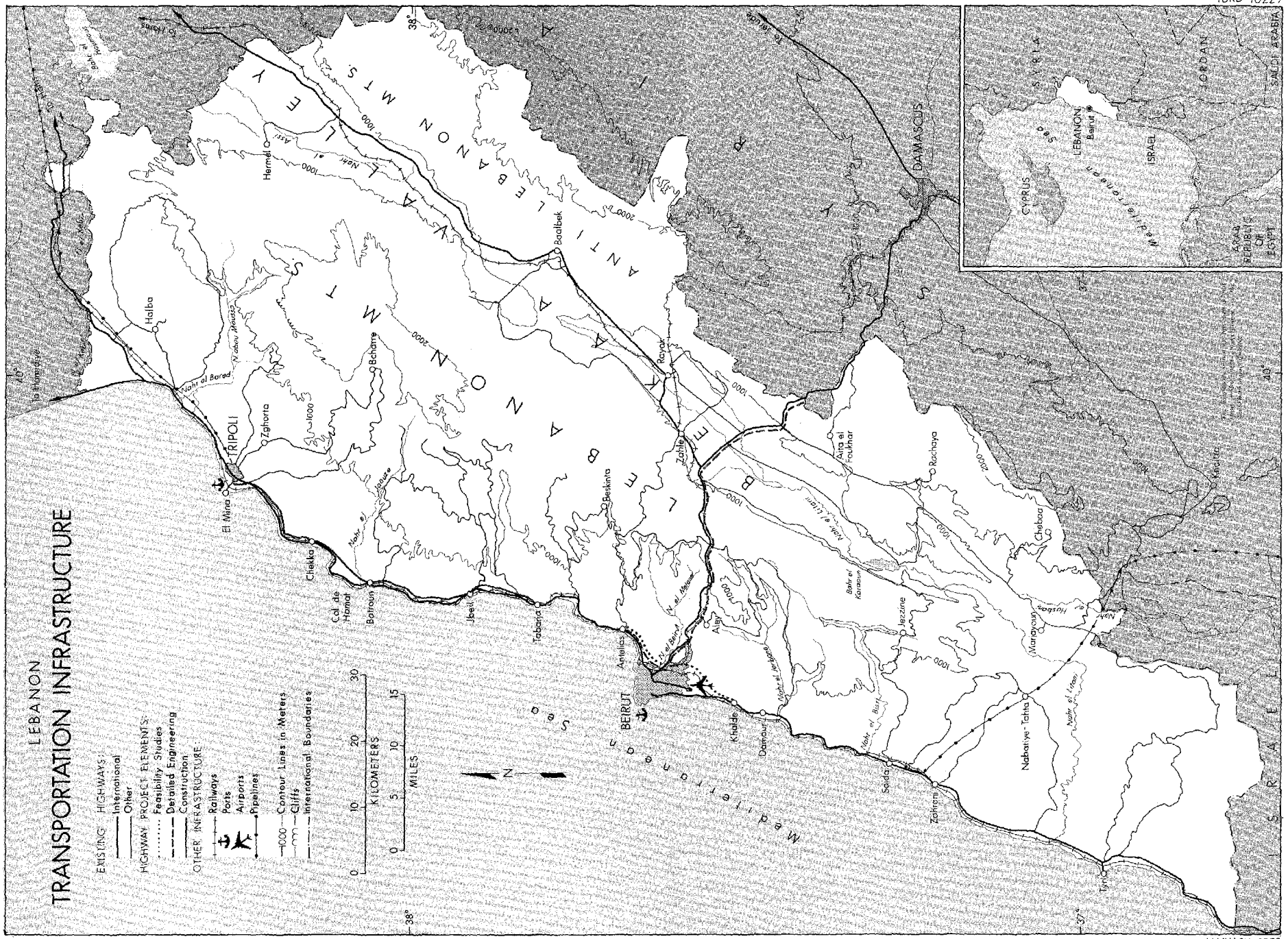




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# LEBANON TRANSPORTATION INFRASTRUCTURE

- EXISTING HIGHWAYS:**
- International
  - Other
- HIGHWAY PROJECT ELEMENTS:**
- Feasibility Studies
  - Detailed Engineering
  - Construction
- OTHER INFRASTRUCTURE:**
- Railways
  - Ports
  - Airports
  - Pipelines

- 1000—Contour Lines in Meters
- Cliffs
- International Boundaries

