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TECHNICAL AND ECONOMIC FINAL REPORT

Tartous to Lattakia
Volume I

prepared for the

SYRIAN ARAB REPUBLIC

and the

U.S. AGENCY for

INTERNATIONAL DEVELOPMENT

LYON associates, inc.

in association with

MORRISON - MAIERLE, INC. and

JAMES R. SNITZLER ASSOCIATES, INC.

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1 November 1978
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Mr. Douglas A. Campbell, Contracting Officer
Regional Operations Division - NE
Office of Contract Management
Department of State
Agency for International Development
Washington, D.C. 20523

Subject: Final Report, Tartous-Lattakia
Contract No. AID/NE-C-1459 (Syria)
Highway Feasibility Studies, Lattakia Region,
Syrian Arab Republic

Dear Mr. Campbell:

We, of Lyon Associates, Inc., in association with Morrison-Maierle, Inc. and James R. Snitzler Associates, Inc. are pleased to transmit herewith 10 copies of the Final Report for Feasibility Studies of the Tartous-Lattakia Highway. We are also submitting 25 copies to the Ministry of Communications of the Syrian Government, 6 copies to USAID/Damascus, and 2 copies to USAID/Reference Center/Washington.

The Final Report has been revised in several limited areas to take into account the comments and recommendations of reviewing agencies and our own findings subsequent to the Draft Final Report.

We have endeavored to include all relevant procedures and data in the report and its appendices; however, if any explanation is required to facilitate your review, we stand ready to assist you and your staff in Washington and/or Damascus.

This submittal, together with the Final Environmental Assessment, fulfills the contractual requirements of the Tartous-Lattakia segment of the subject project.

Very truly yours,

LYON ASSOCIATES, INC.

Frank E. Lyon, Jr.
President

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INTRODUCTION

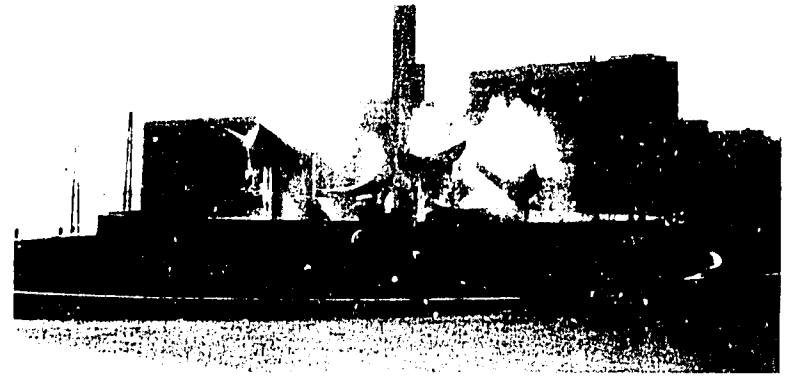
LYON

INTRODUCTION

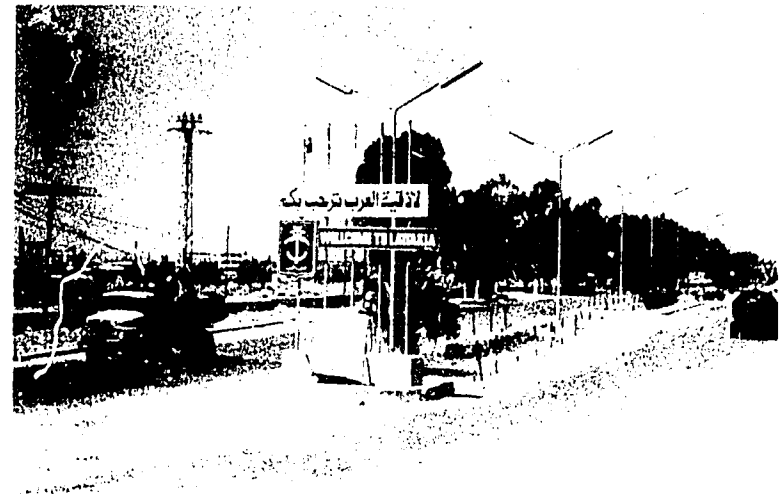
On 23 November, 1977, the United States Agency for International Development awarded to Lyon Associates, Inc., a consulting engineering firm incorporated at Baltimore, Maryland a contract for technical, economic, and environmental studies to determine the technical and economic feasibility of each of three proposed highway projects in the Lattakia region of the Syrian Arab Republic. The three projects are identified as: Tartous to Lattakia, Lattakia to Kassab, and Lattakia to Ariha. This report, prepared in association with James R. Snitzler Associates, Inc., and Morrison-Maierle, Inc., deals solely with the first of the abovementioned projects, the Tartous to Lattakia Highway.

The Ministry of Communications, the agency responsible for highway planning and construction in Syria, desires to extend the nation's network of four-lane limited-access highways so as to serve Lattakia, a major port city. The proposed Tartous-Lattakia Highway, in conjunction with four-lane highways presently under construction, will provide a four-lane highway link between Lattakia and Damascus, the nation's capital city. The project will also serve the other two major ports of Syria, Banyas and Tartous, and will better connect the highly productive agricultural coastal plain, and significant new industrial developments in the area, to Syria's major cities. The project also has international significance in that it will serve large volumes of transit trade enroute via Lattakia to Middle Eastern countries beyond Syria.

This report is presented in five parts. Part A is the Executive Summary which is intended only for the reader whose interest is limited to the major findings of the report without attention to details of procedures, data, and calculations. Part B, Economics, comprises the detailed studies of the economy of the nation and the zone of influence, and projections of transport demand. Part C, Transport Analyses, covers traffic studies and projections, present and desirable loading practices for trucks, user costs analyses, the allocation of construction costs, evaluation of the economic indicators such as benefit cost ratios and internal rates of return, and analyses of project feasibility sensitivity to variations in construction cost, user costs, growth rates, load limit enforcement, and discount rate. Part D, Technical Planning deals with the preliminary engineering requisite to establishment of the project budget cost estimate and describes details of geometric criteria, pavement design analyses (including study of stage construction optimums), bridge criteria, and construction cost estimates. Part E comprises Conclusions and Recommendations.



TARTOUS to LATTAKIA

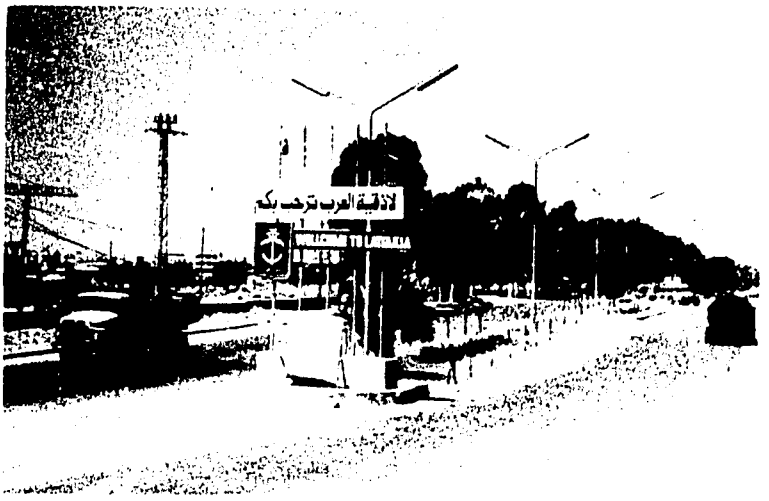


The Executive Summary

PART A

LYON

من طرطوس إلى اللاذقية



الملخص الادارى

الجزء (أ)

LYON

1. Conclusions and Recommendations

The consultant has concluded that a four-lane expressway connecting Tartous and Lattakia is economically and technically feasible. The internal rate of return on the proposed project is estimated to be 27.5 percent and the first year rate of return is estimated to be 15.7 percent. The benefit/cost ratio at a 15 percent discount rate is 2.1.

The project has been subdivided into five segments to facilitate consideration of variations in traffic volumes on the segments, and each segment has been subjected to transport analyses, the results of which are shown below in Table A-1.

TABLE A-1
RESULTS OF TRANSPORT ANALYSES

Road Section	Rate of Return		Benefit Cost Ratio				
	Internal (20 Year) %	First Year	at 10%	at 15%	at 20%	at 25%	at 30%
Tartous-Lattakia	27.5	20.6	5.0	2.8	1.7	1.2	0.9
Tartous Bypass	34.3	27.6	7.2	4.0	2.6	1.7	1.3
Tartous-Banyas	24.1	16.3	4.1	2.2	1.4	0.9	0.7
Banyas Bypass	23.4	15.2	3.7	2.1	1.3	0.9	0.7
Banyas-Jebleh	30.7	26.9	6.0	3.3	2.1	1.4	1.0
Jebleh-Lattakia	29.0	23.0	5.7	3.1	1.9	1.3	0.9

Sensitivity tests for variations in construction costs, user cost savings, and axle load limits have been made; and the consultant's conclusion, based upon those tests, is that the feasibility of the project is not subject to reversal by variation (within reasonable and likely limits) in basic data input for the analyses of economic feasibility. A summary of findings of internal rates of return are shown in Table A-1A. No increases or reductions to construction costs or vehicle operating costs were included in the analysis.

الملخص التنفيذي

١ - النتائج والتوصيات

ان النتائج التي توصل اليها المستشار هي ان بناء طريق عمومي سريع مكون من اربعة دروب يصل طرطوس باللاذقية هو مشروع سليم مجدى اقتصاديا وفنيا . ويقدر معدل ربح دخل المشروع المقترح بـ : ٥ر٢٧ ٪ كما قدّر معدل الربح في السنة الاولى بـ ٧ر١٥ ٪ . وان نسبة المنفعة / التكاليف بعد خصم ١٥ في المئة فهي اثنان الى واحد .

ولقد قسمنا المشروع الى خمسة اجزاء لتسهيل دراسة التفاوت في حجم حركة المرور بين الاجزاء المختلفة ، كما قمنا بتحليل كل جزء منها على حده . ويبين الجدول التالي رقم (أ) - ١ نتائج هذه التحليلات :

الجدول (أ) - ١
نتائج تحليلات النقل والمواصلات

جزء الطريق	معدل الربح		نسبة المنفعة الى التكاليف				
	داخلي (٢٠سنه) ٪	أول سنه	على ١٠٪	على ١٥٪	على ٢٠٪	على ٢٥٪	على ٣٠٪
طرطوس - اللاذقيه	٥ر٢٧	٦ر٢٠	٠ر٥	٨ر٢	٧ر١	٢ر١	٩ر٠
الطريق حول طرطوس	٣ر٣٤	٦ر٢٧	٢ر٧	٠ر٤	٦ر٢	٧ر١	٣ر١
طرطوس - بانياس	١ر٢٤	٣ر١٦	١ر٤	٢ر٢	٤ر١	٩ر٠	٧ر٠
الطريق حول بانياس	٤ر٢٣	٢ر١٥	٧ر٣	١ر٢	٣ر١	٩ر٠	٧ر٠
بانياس - جبله	٧ر٣٠	٩ر٢٦	٠ر٦	٣ر٣	١ر٢	٤ر١	٠ر١
جبله - اللاذقية	٠ر٢٩	٠ر٢٣	٧ر٥	١ر٣	٩ر١	٣ر١	٩ر٠

أما من حيث التأثرية بشتى العوامل تبعا للتفاوت فيتكاليف البناء ، وتوفيرات التكلفه على المستعمل ، وحدود حمولة المحور . والاستنتاجات التي وصل اليها المستشار استنادا الى هذه الاختبارات ، فان جدوى تنفيذ المشروع لا تخضع لانعكاس الاختلافات (في نطاق الحدود المعقولة والمحتملة) في المعطيات الاساسية الداخلة في تحليلات جدوى تنفيذ المشروع اقتصاديا . ولقد عرضنا ملخصا لنتائج معدلات فائدة الدخل في الجدول رقم (أ) - ١ (أ) . ولم تشمل التحليلات اية زيادة او نقص في تكاليف البناء او تشغيل السيارات .

LYON

TABLE A-1A
SENSITIVITY ANALYSIS
2.0 YEAR INTERNAL RATE OF RETURN

Situation	All Items Included	Excluding Occupants Time for Passenger Cars and Buses	Excluding Time Depreciation
Legal Loading			
Including Road Right-of-Way	27.5%	25.7%	25.8%
Excluding Road Right-of-Way	30.8%	28.9%	28.9%
Present Loading Practices			
Including Road Right-of-Way	23.5%	21.2%	22.0%
Excluding Road Right-of-Way	26.2%	23.7%	24.6%

The consultant recommends that the project be funded in accord with the budget cost estimate, and that surveys, design and construction be accomplished without delay to provide for opening of the facility in its entirety in the year 1984. The budget includes a foreign cost component of $60 million (which includes escalation from 1978 to estimated time of contract negotiation), and a Syrian cost component of $52 million (including right-of-way purchase and escalation). The converted Syrian cost component, at an exchange rate of 3.9 Syrian Pounds per U.S. dollar, is SL 203 million.

2. Economics

The Tartous-Lattakia highway is economically and strategically important to the national economy of Syria, and to the specific zone of influence which it serves. This highway serves the nation's three ports of Lattakia, Banyas and Tartous and links these ports (and the adjoining cities), along with the agricultural and industrial - significant coastal region, to other major highways connecting the principal cities of Damascus, Aleppo and Homs.

The Tartous-Lattakia highway also has international significance, since it is a key segment relative to the movement of transit goods via Lattakia to other Middle East countries.

الجدول رقم (أ) - ١(أ)

تحليـــــلات دراســـــــية

٢-٠ معدل دخـل الفائـــــــدة

الحالـــــة	تشـــمل جميـــع الانـواع	بدون وقـــت الركاب للسيارات والاتوبيسات	خصومـــات خفـــض القيمة/الوقت
الشحن القانونـي			
بما فيها حق المرور	٢٧ر٥	٢٥ر٧	٢٥ر٨
بدون حق المرور	٣٠ر٨	٢٨ر٩	٢٨ر٩
طرق الشحن المستخدمة حاليا			
بما فيها حق المرور	٢٣ر٥	٢١ر٢	٢٢ر٠
بدون حق المرور	٢٦ر٢	٢٣ر٧	٢٤ر٦

ويوصي المستشار بأن يمول المشروع وفق تقدير الميزانية للتكاليف ، وبأن تنجز اعمال المسح والتصميم والبناء دونما تأخير لكي يتسنى افتتاح الطريق العام بأكمله في عام ١٩٨٤ . وتتضمن الميزانية بندا للتكاليف الاجنبية مقداره ٦١ مليون دولار (يشتمل على تصاعد النفقات من عام ١٩٧٨ حتى الوقت المقدر لابرام العقد) وبندا للتكاليف السورية مقداره ٥١ مليون دولار (يشتمل على شراء حق المنفعة للأراضي على طول جانبي الطريق وكذلك لتصاعد النفقات) . ويبلغ بند النفقات السورية بعد تحويله حسب سعر تحويل العملة ٣ر٩ ليرات سورية لكل دولار اميركي مبلغ ٢٠٣ مليون ليرة سورية .

٢ - الجوانب الاقتصاديـة

يعتبر الطريق العام بين طرطوس واللاذقية طريقا هاما اقتصاديا واستراتيجيا لاقتصاد سورية القومي وللمنطقة التي يشملها المشروع بالذات . ويخدم هذا الطريق الرئيسي مرافيء البلاد الثلاثة في كل من اللاذقية وبانياس وطرطوس ويصل هذه المرافيء (والمدن الملاصقة لها) مع المنطقة الساحلية الهامة زراعيا وصناعيا بغيرها من الطرق الرئيسية التي تربط بين كبريات المدن السورية الثلاث دمشق وحلب وحمص .

ويتميز طريق طرطوس - اللاذقية ايضا باهمية دولية ، لانه يعتبر قطاعا رئيسيا لانتقال سلع العبور (الترانزيت) عبر اللاذقية الى دول الشرق الاوسط الاخرى .

LYON

The primary zone of influence of the Tartous-Lattakia highway is approximately 2,450 square kilometers in area. The physical characteristics of the zone are: topography dominated by a flat to rolling coastal plain extending from the Mediterranean Sea eastward through foothills to mountains; typical Mediterranean climate, generally free of frost with relatively high summer temperatures and a distinct winter rainy season; and soil conditions largely amenable to agricultural development.

Population of the project's zone of influence was estimated to be 534,000 in 1976, which indicates a population density of 218 inhabitants per square kilometer. The zone's population is predominantly young and predominantly rural; however, there is a strong urban trend.

About 38 percent of the zone's total population was economically active in 1970 (the latest census period), with agriculture accounting for about 61 percent of the economically active population. Manufacture, transport, wholesale and retail trade, construction and services are other important users of the labor force.

New educational facilities costing SL 170 million and reserve projects of another SL 118 million are included in the Fourth Five-Year Plan for the mohafazats of Tartous and Lattakia. The proposed highway will facilitate the development of new, more centralized schools, in that travel time for students and teachers will be greatly reduced.

Planned construction of health facilities for the Tartous-Lattakia zone of influence represents an investment of about SL 143 million in the Fourth Five-Year Plan.

Agricultural production in the zone of influence is a highly specialized commercial type operation with orientation toward horticultural crops. In 1976, agricultural production in the zone totaled 509,600 metric tons of which crop production accounted for 92 percent, and livestock and products the balance. Vegetables represented 57 percent of the total production. Fruits accounted for an additional 19 percent of the total production.

وتبلغ مساحة المنطقة الاساسية المشمولة بمشروع طريق طرطوس - اللاذقية ٢٫٤٥٠ كيلومتر تقريبا . وتضاريس هذه المنطقة هي : طوبوغرافية تتميز بسهل ساحلي يتراوح بين مسطح مستو ومتموج بالهضاب يمتد من شاطيء البحر الابيض المتوسط شرقا ، ثم يتحول الى آكام فجبال . وطقس المنطقة هو المناخ المعتاد لحوض البحر الابيض المتوسط الذى لا يصل عادة الى درجة التجمد ، وتكون درجات الحرارة عالية نسبيا في الصيف . أما الشتاء فيتميز بفصل ممطر وتسمح ظروف التربة بالتنمية والتطور الزراعي الى حد كبير .

ولقد قدّر تعداد سكان المنطقة المشمولة بالمشروع حسب تقديرات عام ١٩٧٦ - بـ ٥٣٤٫٠٠٠ نسمة ، مما يدل على كثوفة سكانية تبلغ ٢١٨ فردا للكيلومتر المربع . وغالبية سكان المنطقة من شباب الريف ، غير انها تتميز بنزعة حضرية قوية .

وكان نحو ٣٨ في المئة من مجموع سكان المنطقة نشطين اقتصاديا في عام ١٩٧٠ (فترة آخر احصاء سكاني) ، وبلغ عدد العاملين في الزراعة ٦١ في المئة تقريبا من مجموع الايدى العاملة ومن المجالات الاخرى الهامة للقوى العاملة هناك هي الانتاج والنقل وتجارة الجملة والقطاعي والبناء والانشاءات وقطاع الخدمات العامة .

وتتضمن الخطة الخمسية الرابعة لمحافظتي طرطوس واللاذقية منشآت تعليمية جديدة تكاليفها ١٧٠ مليون ليرة سورية ومشاريع للمستقبل تكاليفها ١١٨ مليون ليرة سورية اخرى . ومن شأن بناء الطريق العمومي المقترح ان يسهل اقامة مدارس جديدة تتمتع بقدر اكبر من المركزية بفضل تقليص اوقات سفر الطلاب والمعلمين من هذه المدارس واليها تقليصا ملموسا .

ويمثل البناء المعتزم للمرافق الصحية لمنطقة طرطوس - اللاذقية التي يشملها المشروع استثمارا يقدر بنحو ١٤٣ مليون ليرة سورية في الخطة الخمسية الرابعة .

ويتحلى الانتاج الزراعي في المنطقة المشمولة بالمشروع بمزايا تجارية على جانب عال من التخصص مع الاتجاه نحو محاصيل الجنائن والبساتين . وبلغ مجموع الانتاج الزراعي في المنطقة في عام ١٩٧٦ حوالى ٥٠٩٫٦٠٠ طن متري كانت نسبة انتاج المحاصيل منها ٩٢ في المئة ، وتمثل الباقي في المواشي ومنتجاتها . وشكلت الخضروات ٥٧ في المئة من مجمل الانتاج ، في حين كانت نسبة الفواكه ١٩ في المئة من مجمل الانتاج .

LYON

Agricultural marketable surplus was estimated at 422,600 tons for the zone of influence in 1976.

Industrial production in the zone of influence, based primarily on manufacturing and quarrying, is estimated at about 5 million metric tons in 1976. About three-fourths of the total output is produced by public sector plants and one-fourth by the private sector. The major manufacturing sectors are foodstuffs; cement, tile, marble and stone; metal working; and wood and furniture. For the quarrying industry, stone, sand and gravel are the principal tonnage contributors.

The Tartous-Lattakia zone of influence is the principal vacation region of Syria. It includes the country's beaches, mountain resorts, and numerous interesting historic and archaeological sites.

Approximately 518,000 tourists visited the Tartous-Lattakia zone of influence in 1976. Of these, about 316,000 were of Syrian nationality and 202,000 were foreign. Except for the few passengers arriving at Lattakia by sea, all tourists in the zone traveled by highway.

Export and import general cargo traffic for the ports of Tartous and Lattakia totaled 5.4 million tons in 1977; an increase of 700,000 tons over 1976 and nearly 2,000,000 tons over 1975. Major sources of the increases have been growing volumes of imports (at both ports) such as iron and metals, cement, foodstuffs, machinery and tools and construction materials; and rapidly rising exports of phosphates and fuel oil from Tartous. In contrast, exports from the port of Lattakia, consisting primarily of agricultural commodities, have fluctuated widely over the 1970 - 1977 period largely due to fluctuations in barley and wheat production which are significantly dependent upon annual rainfall.

International transit traffic of goods moving through the ports of Tartous and Lattakia totaled about 353,000 tons in 1976 compared to 291,000 tons in 1975 and 147,000 tons in 1977. About 70 percent of this transit tonnage in 1976 and 1977 was handled by the port of Lattakia, the balance by the port of Tartous.

The sharp fall-off in the transit trade in 1977 was primarily due to decreases in goods destined for Iraq, Jordan and Saudi Arabia. To further elaborate upon the 1977 decline, all types of commercial exchange between Syria and Iraq had been virtually terminated by 1977, while for both Jordan and Saudi Arabia, 1976 had been an unusually high year for transit traffic via the ports of Tartous and Lattakia.

Another form of international transit traffic which presently moves only via the port of Tartous is referred to as roll-on/roll-off. This traffic comprises vehicles on wheels which are transported by ship from Greece to the port of Tartous for transiting by road to other Middle East countries. Part of the roll-on/roll-off traffic (about 36 percent in 1977) terminates in Syria and is thus a Syrian import.

وقدر الفائض الزراعي التسويقي ب : ٤٢٢ر٦٠٠ طن للمنطقة التي يشملها المشروع في عام ١٩٧٦ .

ويقدر الانتاج الصناعي في المنطقة التي يشملها المشروع والذى يستند اساسا الى الانتاج وصناعة التحجير من المقالع والمحاجر بنحو خمسة ملايين طن مترى في عام ١٩٧٦ . وتنتج مصانع القطاع العام قرابة ثلاثة ارباع مجمل الانتاج بينما يقدم القطاع الخاص الربع الباقي . وقطاعات الانتاج الرئيسية هي الاغذية ، والاسمنت والبلاط والرخام والحجارة والتعدين والخشب والمفروشات . وتسهم صناعة المقالع والمحاجر بانتاج الاحجار بانتاج الاحجار والرمل والحصى كمواد للبناء والانشاءات .

وتعتبر منطقة طرطوس ـ اللاذقية التي يشملها المشروع منطقة الاصطياف الرئيسية في سورية ، اذ انها تضم الشواطيء السورية والمنتجعات والمصايف الجبلية وعددا من الاماكن الاثرية ذات الاهمية التاريخية .

وقد زار منطقة طرطوس ـ اللاذقية المشمولة بالمشروع قرابة ٥١٨ر٠٠٠ سائح عام ١٩٧٦ . وكان من بين هؤلاء نحو ٣١٦ر٠٠٠ مواطن سورى وكذلك ٢٠٢ر٠٠٠ اجنبي. وفيما عدا قلة من الركاب وصلت بحرا الى اللاذقية فان جميع الزوار قد سافروا برا الى المنطقة .

وقد بلغ وزن الصادرات والواردات عن طريق مينائي طرطوس واللاذقية ٥ر٤ مليون طن في عام ١٩٧٧ ، أى بزيادة ٧٠٠ر٠٠٠ طن عما كان عليه الحال في عام ١٩٧٦ وبزيادة ما يقرب من ٢ر٠٠٠ر٠٠٠ طن عما كان عليه الحال في عام ١٩٧٥ . وتتمثل المصادر الرئيسية لهذه الزيادات في ازدياد حجم الواردات (في كلا الميناءين) كالحديد والمعادن والاسمنت والاغذية والالآت والادوات ومواد البناء ، كما تمثلت في الارتفاع السريع لصادرات الفوسفات وزيت الوقود من مرفأ طرطوس . وفي مقابل ذلك ، كانت الصادرات من مرفأ اللاذقية ـ وجلها سلع زراعية ـ متقلبة بصورة واسعة خلال الفترة ما بين عامي ١٩٧٠ ـ ١٩٧٧ . ومرد ذلك في المقام الاكبر الى التقلبات في انتاج الشعير والقمح اللذين تعتمد وفرة محاصيلهما الى حد كبير على موسم الامطار السنوى .

وبلغ مجموع سلع العبور الدولية (الترانزيت) عبر مينائي طرطوس واللاذقية نحو : ٣٥٣ر٠٠٠ طن في عام ١٩٧٦ بالمقارنة مع ٢٩١ر٠٠٠ طن في عام ١٩٧٥ و ١٤٧ر٠٠٠ طن في عام ١٩٧٧. وقد قام ميناء اللاذقية بتصريف قرابة ٧٠ في المئة من الوزن الطني لسلع الترانزيت في عام ١٩٧٦ و ١٩٧٧ بينما قام ميناء طرطوس بتصريف النسبة الباقية .

وكان السبب الرئيسي لهبوط تجارة الترانزيت هبوطا حادا في عام ١٩٧٧ هو تناقص حجم السلع المرسلة الى العراق والاردن والمملكة العربية السعودية . ولقد زاد من تفاقم هذا الهبوط عام ١٩٧٧ توقف جميع اوجه التبادل التجارى بين سورية والعراق توقفا كاملا تقريبا عند حلول عام ١٩٧٧ ، في حين ان عام ١٩٧٦ شهد بالنسبة لكل من الاردن والمملكة العربية السعودية نشاطا كبيرا غير معهود في تجارة الترانزيت عبر مينائي طرطوس واللاذقية .

ومن الانماط الاخرى لتجارة الترانزيت الدولية التي تمر الان فقط عبر ميناء طرطوس ما يسمى بالدلفنة ، وهي عبارة عن عجلات تحمل مجموعات من السيارات التي تنقل بالسفن

Since the inception of roll-on/roll-off service in 1975, the number of vehicles received annually in roll-on/roll-off service at Tartous has ranged from 36,000 to 44,000 vehicles, representing a tonnage of 91,000 to 111,000 tons.

The final category of transit traffic passing through the Tartous-Lattakia zone of influence is that of empty vehicle movement through the Kassab customs post. The traffic consists largely of empty used cars and trucks moving from Europe for resale in Lebanon and other neighboring countries. They are thus in transit through Syria and to reach their final destinations they travel over the Tartous-Lattakia highway. Annual movements in the three-year period, 1975-1977 ranged from 19,000 to 26,000 vehicles, with approximately 80 percent of the total movement being southbound.

Zone domestic imports moving over the Tartous-Lattakia road consist of commodities which are produced or processed in other parts of Syria and are shipped to the zone of influence for direct consumption or ultimate consumption after processing. The zone domestic imports also include foreign imports which may have entered the zone via the ports of Tartous and Lattakia, have been shipped to such manufacturing and wholesale centers as Damascus, Aleppo and Homs for processing or storage, and have then been reshipped into the zone for consumption.

These zone domestic imports were identified by the consultants as comprising four groups of commodities with the following tonnages in 1976: petroleum products - 750,000; consumer goods - 198,600; manufacturing inputs - 65,700; and agricultural inputs - 10,000. Total tonnage is thus estimated at 1,024,300 metric tons.

To arrive at future, anticipated flows of total traffic over the proposed Tartous-Lattakia expressway, projections are required not only for each of the sectors of the economic base previously discussed, but also for normal passenger traffic in addition to that of tourism.[1/] In May, 1978 the average daily passenger traffic for the Tartous-Lattakia road was 1,357 vehicles of which cars and taxis totaled 1,124 and buses 233.[2/]

Projections of normal passenger traffic for the Tartous-Lattakia road were based upon the historical relationship of passenger traffic growth to population growth for the Homs - Tartous road and zone of influence, an area and road with similar characteristics to that of Tartous-Lattakia. This relationship, (or ratio

1/ Normal traffic refers to that portion of the traffic which would continue to use the road whether or not it was improved.

2/ Data are from the Consultant's Origin and Destination Survey.

من اليونان الى ميناء طرطوس لنقلها برا الى دول الشرق الأوسط الاخرى . وينتهي جزء من هذه الحركة التجارية (نحو ٣٦ في المئة في عام ١٩٧٧) في سوريا مكونا بذلك واردات لسورية نفسها .

ومنذ مستهل خدمة الدلفنة عام ١٩٧٥ تراوح عدد السيارات التي وصلت كل عام من ميناء طرطوس ما بين ٣٦٫٠٠٠ و ٤٤٫٠٠٠ سياره . ويتراوح الوزن الطني لذلك ما بين ٩١٫٠٠٠ و ٠٠٠٫٠٠٠ طن .

ويتمثل الصنف الاخير لتجارة الترانزيت عبر منطقة طرطوس ـ اللاذقية المشمولة بالمشروع في نقل سيارات فارغة عن طريق مركز الجمارك في كسب . وتتألف هذه الشحنات في معظمها من سيارات وشاحنات مستعمله فارغة تشحن من أوروبا لاعادة بيعها في لبنان وغيرها من الدول المجاورة . وبذلك تعتبر هذه الشحنات ضمن تجارة الترانزيت التي تمر عبر سوريا في طريقها الى مآلها النهائي . وبذلك فهي تسير على الطريق العمومي بين طرطوس واللاذقية . وبلغ عدد السيارات التي قطعت هذا الطريق خلال فترة السنوات الثلاث ١٩٧٥ ـ ١٩٧٧ ما بين ١٩٫٠٠٠ و ٢٦٫٠٠٠ سيارة ، وكان ما يقرب من ثمانين في في المئة من هذه السيارات متجها جنوبا .

وتتألف الواردات المحلية للمنطقة التي تمر عبر طريق طرطوس ـ اللاذقية من سلع تنتج او تصنع في انحاء اخرى من سوريا ثم تشحن بحرا الى المنطقة المشمولة بالمشروع اما لاستهلاكها مباشرة او لاستهلاكها في نهاية الامر بعد تصنيعها . وتشتمل الواردات المحلية للمنطقة ايضا على مستوردات اجنبية ربما دخلت المنطقة عبر مينائي طرطوس واللاذقية بعد ان شحنت الى مراكز الانتاج والبيع بالجملة مثل دمشق وحلب وحمص من أجل تصنيعها او خزنها ثم اعادة شحنها الى المنطقة للاستهلاك . ويعرّف المستشارون هذه المستوردات المحلية للمنطقة على انها تمثل اربع مجموعات من السلع كان وزنها الطني في عام ١٩٧٦ كما يلي : المشتقات البترولية ٧٥٠٫٠٠٠ طن ، السلع الاستهلاكية ١٩٨٫٦٠٠ طن ، السلع الانتاجية ٦٥٫٧٠٠ طن ، والسلع الزراعية ١٠٫٠٠٠ طن . وبذلك يقدر الوزن الطني الاجمالي لهذه السلع بـ : ١٫٠٢٤٫٣٠٠ طن متري .

وللحصول على استمرارية متوقعة في المستقبل للحركة التجارية الكاملة على الطريق العمومي المقترح بين طرطوس واللاذقية فان الحاجة تدعو ليس لتقدير احتمالات المستقبل فقط بالنسبة لكل من قطاعات القاعدة الاقتصادية التي شرحناها آنفا بل ايضا بالنسبة لحركة السفر العادية ، فضلا عن الحركة السياحية [١]. ففي شهر ايار عام ١٩٧٨ بلغ معدل عدد سيارات الركاب التي تسير يوميا على طريق طرطوس ـ اللاذقية ١٫٣٥٧ سياره منها ١٫١٢٤ سياره خصوصية وأجره (تاكسي) والباقي ٢٣٣ اتوبيسا [٢] .

(١) ترجع حركة المرور العادية الى ذلك الجزء الذى سيظل يستعمل الطريق سواء تم تحسينها ام لا .

(٢) هذه المعلومات مستقاة من احصاء أخذ من دراسة المستشار لحركة السير من نقطة البدء الى نقطة الوصول .

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factor) resulted in the following values and growth rates for the projected normal passenger traffic on the Tartous-Lattakia road:

	Ratio Factor	Projected Annual Average Population Growth Rate (%)	Projected Annual Average Normal Passenger Growth Rate (%)
1977-1983	3.31	3.3	10.9
1984-1993	2.97	3.2	9.5
1994-2003	2.58	3.1	8.0

Application of the above growth rates to all cars and buses gives the following projected ADT's for normal passenger traffic: 1983 - 2,420; 1993 - 5,997; 2003 - 12,947.

Projections of agricultural marketable surplus are based upon the use of historical growth rates, target goals of the Fourth Five-Year Plan and the development by the consultant of such weighting factors as use of fertilizers, improved varieties and improved cultural practices. Potential and achievable annual average growth rates were then estimated by the consultant by taking into consideration all of the referenced influences with the results summarized below for Agricultural Marketable Surplus.

	1976-1983	1984-1993	1994-2003
Annual Average Growth Rate	12.4%		
Potential		11.0%	9.5%
Achievable		8.5%	8.3%

	1983	1993	2003
Projected Tonnage	690.9		
Potential		3,135.1	5,863.1
Achievable		2,172.7	4,690.5

Industrial production of the zone of influence was categorized by the consultants as manufacturing (less cement production), quarrying (less production for the port of Lattakia breakwater) and petroleum production associated with the operation of the new refinery at Banyas. Cement production was eliminated from the manufacturing base for purposes of projections in order to avoid distortion of the normal manufacturing growth rate.[1/] The production of quarry materials for the port of Lattakia breakwater was studied separately from the quarry base because of the limited duration of this movement (only five of the projected twenty years).

1/ Cement production is subsequently later added back to the project manufacturer totals.

وقد استندت تقديرات حركة المرور العادية على طريق طرطوس ـ اللاذقية الى العلاقة التاريخية بين ازدياد حركة المسافرين وازدياد عدد السكان بالنسبة للطريق بين حمص وطرطوس والمنطقة المشمولة بالمشروع وهي منطقة وطريق لهما خصائص مشابهة لمنطقة طرطوس ـ اللاذقية . وتتمثل هذه العلاقة او النسبة في القيم ومعدلات النمو التالية بالنسبة لحركة السفر العادية المرتقبة على طريق طرطوس ـ اللاذقية .

	نسبة المعامل	المعدل السنوى المرتقب للنمو السكاني (٪)	المعدل السنوى المرتقب لنمو حركة المرور العادية (٪)
١٩٧٧–١٩٨٣	٣ر٣١	٣ر٣	١٠ر٩
١٩٨٤–١٩٩٣	٢ر٩٧	٣ر٢	٩ر٥
١٩٩٤–٢٠٠٣	٢ر٥٨	٣ر١	٨ر٠

وتطبيق معدلات النمو الآنفة الذكر على جميع السيارات والأوتوبيسات تعطي النسبة التقديرية التالية لحركة السير العادية : ١٩٨٣–٢ر٤٢٠ ، ١٩٩٣–٥ر٩٩٧ ، ٢٠٠٣–١٢٩٤٧

وتستند تقديرات الفائض الزراعي التسويقي الى استعمال معدلات النمو التاريخي والاهداف المتاخاه من الخطة الخمسية الرابعة ، واعتبارات المستشار لعوامل ذات ثقل راجع كاستعمال الاسمدة والمخصبات وتحسين النوعيات والنهوض بالمستويات الثقافية . كما قدرّ المستشار معدلات النمو السنوى المحتملة والممكن تحقيقها فأخذ في الاعتبار جميع الدلائل المشار اليها . وقد لخص النتائج بالنسبة للفائض الزراعي التسويقي كما يلي :

	١٩٧٦ – ١٩٨٣	١٩٨٤ – ١٩٩٣	١٩٩٤ – ٢٠٠٣
معدل النمو السنوى	١٢ر٤ ٪		
المحتمل		١١ر٠ ٪	٩ر٥ ٪
الممكن تحقيقه		٨ر٥ ٪	٨ر٣ ٪

	١٩٨٣	١٩٩٣	٢٠٠٣
الوزن الطني المعتزم	٦٩٠ر٩		
المحتمل		٣ر١٣٥ر١	٥ر٨٦٣ر١
الممكن تحقيقه		٢ر١٧٢ر٧	٤ر٦٩٠ر٥

وقد صنف المستشارون الانتاج الصناعي للمنطقة المشمولة بالمشروع على النحو التالي : النوع الانتاجي (انتاج اقل من الاسمنت) المقالع والمحاجر (انتاج اقل بالنسبة للحركة عند حاجز الامواج في مرفأ اللاذقية) والانتاج البترولي المتعلق بعمل المصفاة الجديدة في بانياس . وقد الغي انتاج الاسمنت من القاعدة الانتاجية من أجل تقدير الاحتمالات المستقبلة لتفادى تشويه نسبة النمو العادية للانتاج(١) . وقد درست قضية انتاج المقالع بالنسبة لنشاط ميناء اللاذقية في معزل عن قاعدة صناعة المقالع

(١) ولقد اضيف انتاج الاسمنت فيما بعد مرة اخرى الى مجمل منتجات المشروع .

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Projections of industrial production for the zone are based upon such considerations as major plants currently under construction; additional plants to be built under the Fourth Five-Year Plan; target goals for various industry sectors under the Plan previously referenced and national industry sector historical growth rates for similar sectors. The projected growth rates and production for the entire industrial sector are as follows:

	1976-1983	1984-1993	1994-2003	1984-2003
Annual Average Growth Rate	16.4	(Percent) 8.1	5.3	6.7

	1976	1983	1993	2003
Industrial Production	3,127.9	(000 MT) 9,086.2	19,874.5	33,382.8

Projections of tourism traffic included in the study relate only to that portion of the traffic which will result from the development of new tourism facilities in the Tartous-Lattakia area. This development is now underway through Syria's National Tourism Plan and is not therefore dependent upon the proposed new Tartous-Lattakia highway (though it would benefit therefrom).

Data on number of projected beds by site location were obtained from the National Tourism Plan, while other necessary data for converting bed nights into numbers of tourists, and tourists into average daily traffic during the heavy tourist season of four months, were obtained from local tourism officials and other knowledgeable persons.

The projected ADT's of cars and buses (for a four months' period), resulting from new tourism facilities in the zone of influence is shown below:

	1983	1993 (ADT)	2003
No. for the period	312	989	1,229
Accumulative Total		1,301	2,530

Projections of general cargo exports and imports refer to all exports and imports at the port of Lattakia and all imports at the port of Tartous. General cargo exports from Tartous by definition exclude crude petroleum. In addition, phosphates and fuel oil exports from Tartous have been excluded from the adjusted 1976 base since these items will all be moving by rail prior to 1983.

In making the projections, considerations were given to historical growth rates, current and future port expansion programs, and commodity expansion programs such as in the Euphrates River Basin.

وذلك بالنظر للفترة الزمنية المحدودة لهذا النشاط (خمس سنوات فقط من بين السنوات العشرين المعتزمة).

وتستند تقديرات الانتاج الصناعي للمنطقة الى اعتبارات اخرى مثل المصانع الرئيسية قيد الانشاء في الوقت الحاضر والمصانع الاضافية التي ستبنى بمقتضى الخطة الخمسية الرابعة والاهداف المتوخاه لمختلف قطاعات الصناعة بموجب الخطة المشار اليها انفا وقطاع الصنوعة الوطنية ومعدلات النمو التاريخي لبطاعات مماثلة . وفيما يلي معدلات النمو المرتقبة وكذلك الانتاج للقطاع الصنوعي بأكمله .

	١٩٧٦-١٩٨٣	١٩٨٤-١٩٩٣	١٩٩٤-٢٠٠٣	١٩٨٤-٢٠٠٣
		(بالمئة)		
معدل النمو السنوي	١٦ر٤	٨ر١	٥ر٣	٦ر٧

	١٩٧٦	١٩٨٣	١٩٩٣	٢٠٠٣
		(بالالف طن متري)		
الانتاج الصناعي	٣ر١٢٧ر٩	٩ر٠٨٦ر٢	١٩ر٨٧٤ر٥	٣٣ر٣٨٢ر٨

ولا تتعلق تقديرات حركة السياحة المشمولة ضمن هذه الدراسة الا بذلك الجزء من النشاط الذى سينجم عن تطوير المرافق السياحية الجديدة في منطقة طرطوس - اللاذقية . وتجرى مشاريع التطوير الانّ عن طريق خطة السياحة القومية السورية ، ولذلك فانها لا تعتمد على انشاء الطريق العام الجديد المقترح بين طرطوس واللاذقية (وان كانت ستستفيد منه). ولقد حصلنا على المعلومات المتعلقة بعدد أسرة نوم السياح في المواقع السياحية من خطة السياحة القومية بينما حصلنا على المعلومات الاخرى الضرورية لتحويل عدد اسرة النوم الى اعداد من السياح ، واعداد السياح الى حركة المرور اليومية العادية خلال موسم السياحة الذى يستمر اربعة اشهر - حصلنا عليها من المسوءولين عن دوائر السياحة في المنطقة ومن جهات عليمه اخرى . وفيما يلي الجدول الذى يبين تقدير عدد السيارات والاوتوبيسات (لفترة اربعة اشهر) التي ستسلك الطريق العمومي بفضل المنشآت السياحية الجديدة المشمولة ضمن المشروع :

	١٩٨٣	١٩٩٣	٢٠٠٣
		(المعدل اليومي للمرور)	
عدد السيارات لتلك الفترة	٣١٢	٩٨٩	١ر٢٢٩
المجموع الكلي		١ر٣٠١	٢ر٥٣٠

وتشير تقديرات صادرات وواردات الحمولة العامة الى جميع الصادرات والواردات التي تمر بميناء اللاذقية وجميع المستوردات في ميناء طرطوس . ويستثنى البترول الخام من صادرات الحمولة العامة من طرطوس . كما استثنيت صادرات الفوسفات وزيت الوقود من طرطوس من القاعدة المعدلة لعام ١٩٧٦ وذلك لان جميع هذه المواد ستنقل بالسكك الحديدية قبل حلول عام ١٩٨٣ .

وعند وضع هذه التقديرات كانت هناك اعتبارات خاصة لمعدلات النمو التاريخي وبرامج توسيع الموانيء مستقبلا وبرامج التوسع في السلع كما هو الحال في مشروع حوض نهر الفرات .

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The combined adjusted general cargo export and import projections for both ports are shown as growing from about 4,056,500 metric tons in 1976 to 6,015,400 tons by 1983, 9,801,800 tons in 1993, and to 14,637,500 tons by 2003. Projected annual average growth rates are:

1976-1983	1984-1993	1994-2003
5.8%	5.0%	4.1%

Projections of international transit traffic cover three categories of movements namely: international transit goods via the ports of Tartous and Lattakia; roll-on/roll-off through the port of Tartous; and empty vehicle movements through the Kassab Customs Post.

Historical trends for projections of the transit movements may reflect political as well as economic decisions by a host of shipping and receiving countries in addition to the SAR. In view of this the consultant has utilized for the transit traffic via the ports, the mid-points of annual average growth rates for the two ports by shifting base and terminal years. This gave an 8 percent rate for the 1976-1983 period, with the two additional ten-year periods projected at annual rates of 6 percent and 4.5 percent.

In the absence of any trend data for roll-on/roll-off traffic via Tartous and empty vehicle movements via Kassab, modest annual average rates of 5 percent for the former and 3 percent for the latter were utilized by the consultant.

The results of the projections are summarized below:

	1976	1983	1993	2003
International Transit Traffic - via Tartous and Lattakia (000 MT)	353.4	605.0	1,084.0	1,683.0
Roll-On/Roll-Off - via Tartous (000 Vehicles)	11.6	16.3	26.6	43.3
Empty Vehicle Movements via Kassab (000 Vehicles)	22.6	27.8	37.5	50.4

Zone domestic imports projections cover three main groups of goods; consumer goods, manufacturing inputs and agricultural inputs. Consumption of domestic petroleum products was eliminated from this traffic category since it is included as industrial production within the zone (with opening of the Banyas refinery in January, 1979).

Consumer goods were projected on the basis of population growth rates (for the zone) of 3.3 percent, 1976-1983; 3.2 percent, 1984-1993; and 3.1 percent, 1994-2003 -- all on an annual average basis.

وتبين جداول التقديرات لحركة تصدير واستيراد البضائع العامة في كلا الميناءين بعد تعديلها ان حجمها ينمو من نحو ٤٫٠٥٦٫٥٠٠ طن متري في عام ١٩٧٦ الى ٦٫٠١٥٫٤٠٠ طن بحلول عام ١٩٨٣ ومن ٩٫٨٠١٫٨٠٠ طن في عام ١٩٩٣ الى ١٤٫٦٣٧٫٥٠٠ طن بحلول عام ٢٠٠٣ . أما تقديرات معدلات النمو السنوية فهي :

١٩٧٦-١٩٨٣	١٩٨٤-١٩٩٣	١٩٩٤-٢٠٠٣
٨٫٥٪	٠٫٥٪	١٫٤٪

وتشمل تقديرات حركة الترانزيت الدولية ثلاثة اصناف من الحركات هي : بضائع الترانزيت الدولية عبر مينائي طرطوس واللاذقية ، وحركة نقل السيارات بالدلفنة عن طريق ميناء طرطوس ، وحركة نقل السيارات الفارغة عن طريق مركز الجمارك في كسب .

وقد تعكس الاتجاهات التاريخية للتذبذبات المحتملة لحركة تجارة الترانزيت قرارات سياسية واقتصادية تتخذها مجموعة من الدول البحرية والدول التي تتلقى البضائع فضلا عن الجمهورية العربية السورية . ونظرا لذلك استفاد المستشار من نقاط منتصف معدلات النمو السنوية لحركة الترانزيت عن طريق الميناءين وذلك بتبديل القاعدة والسنوات التي تنتهي فيها مراحل المشروع . وقد نجم عن ذلك معدل ثمانية في المئة بالنسبة للفترة ١٩٧٦-١٩٨٣ ،مع تقدير معدلات نمو سنوية تبلغ ٦ في المئة و ٤٫٥ في المئة للفترتين الاضافيتين اللتين تمتد كل منهما عشر سنوات .

ومع عدم توفر اى معلومات عن اتجاه حركة نقل السيارات بحرا عن طريق طرطوس ونقل السيارات الفارغة عن طريق كسب فان المستشار اكتفى بمعدلات نمو سنوية متواضعة تبلغ ٥ في المئة لحجم الحركة الاولى وثلاثة في المئة لحجم الحركة الاخيرة .

وفيما يلي ملخص لنتائج التقديرات :

	١٩٧٦	١٩٨٣	١٩٩٣	٢٠٠٣
تجارة الترانزيت الدولية عن طريق طرطوس واللاذقية (٠٠٠ طن متري)	٣٥٣٫٤	٦٠٥٫٠	١٫٠٨٤٫٠	١٫٦٨٣٫٠
حركة الدلفنة - عن طريق طرطوس (٠٠٠ سياره)	١١٫٦	١٦٫٣	٢٦٫٦	٤٣٫٣
حركة نقل السيارات الفارغة عن طريق مركز الجمارك في كسب (٠٠٠ سياره)	٢٢٫٦	٢٧٫٨	٣٧٫٥	٥٠٫٤

وتشمل تقديرات الواردات المحلية للمنطقة ثلاث مجموعات رئيسية من السلع هي : السلع الاستهلاكية والسلع الانتاجية والسلع الزراعية . وقد الغي استهلاك مشتقات البترول الداخلية من هذا التصنيف لانها مشموله كمنتجات صناعة داخل المنطقة (مع فتح مصفاة بانياس في شهر كانون ثاني عام ١٩٧٩) .

وقد قدرت السلع الاستهلاكية على اساس معدلات نمو السكان (بالنسبة للمنطقة) بنسبة ٣٫٣ في المئة للفترة ١٩٧٦-١٩٨٣ ، و ٣٫٢ في المئة للفترة ١٩٨٤-١٩٩٣ و ٣٫١ في المئة للفترة ١٩٩٤-٢٠٠٣ ،كل ذلك على اساس معدل سنوى .

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Manufacturing inputs (consisting primarily of cotton lint, cotton seed, wool, hides and similar raw products) were projected at annual average rates of 8.0 percent for 1976-1983; 7.6 percent, 1984-1993; and 6.2 percent, 1994-2003.

Agricultural inputs (primarily fertilizer) were projected on the basis of continuation from 1976 through 1993 of the 9.8 percent historical trend for annual average growth rate. From 1994 through 2003 the estimated growth rate is 5.0 percent.

Projections of total zone domestic imports on a tonnage basis are as follows: 1983 - 375,900 tons; 1993 - 602,200 tons, 2003 - 929,000 tons.

A summary of projected freight tonnages representing the economic sectors of the zone of influence shows the total tonnage rising from about 8.0 million tons in 1976 to 17.0 million tons by 1983, to 35.5 million tons by 1993 and finally to 55.3 million tons by 2003. The annual average growth rate for the period 1976-2003 is 7.4 percent, while for 1984-2003 it drops to 6.1 percent.

Projected passenger traffic on an ADT for the Tartous-Lattakia road is expected to total about 11,000 cars and 3,000 buses by the year 2003, while truck ADT for the same year is about 9,800 vehicles.

3. Transport Analyses

Present traffic volumes have been determined from consultant's surveys in 1978 in combination with 1976 data obtained from the Ministry of Communications and growth rates from economic projections. Present (1978) traffic volumes are summarized in Table A-2.

TABLE A-2
BASE YEAR TRAFFIC DATA - 1978

Vehicle Type and Situation	Tartous Bypass	Tartous-Banyas	Banyas Bypass	Banyas Jebleh	Jebleh - Lattakia
A. Total Volumes					
Automobile	1,863	897	1,003	1,108	1,477
Pickup	1,511	575	550	525	764
Bus	529	247	187	127	342
Truck, 2 Axle	963	455	498	540	672
Truck, 3 Axle	176	61	68	75	89
Combination	414	138	134	130	144
Total	5,456	2,373	2,440	2,505	3,488
B. New Route, Diverted Volumes					
Automobile	879	785	876	967	1,306
Pickup	1,079	502	480	459	675
Bus	52	89	74	59	129
Truck, 2 Axle	675	376	430	484	600
Truck, 3 Axle	139	57	61	65	79
Combination	371	138	134	130	144
Total	3,195	1,947	2,055	2,164	2,933
C. Existing Route, Remaining Volumes					
Automobile	984	112	127	141	171
Pickup	432	73	70	66	89
Bus	477	158	113	68	213
Truck, 2 Axle	288	79	68	56	72
Truck, 3 Axle	37	4	7	10	10
Combination	43	0	0	0	0
Total	2,261	426	385	341	555

وقدرت السلع الانتاجية (التي تتألف اساسا من نسالة وبذور القطن والصوف والجلود ومنتجات خام مشابهة) على اساس معدلات سنوية تبلغ نسبتها ٨ر٠ للفترة ١٩٧٦-١٩٨٣ و ٧ر٦ للفترة ١٩٨٤-١٩٩٣ و ٦ر٢ للفترة ١٩٩٤-٢٠٠٣ .

اما السلع الزراعية (التي تتألف اساسا من الاسمدة والمخصبات) فقد قدرت على أساس الاستمرارية من عام ١٩٧٦ مع الاتجاه التاريخي بنسبة ٩ر٨ لمعدل النمو السنوى . ومن عام ١٩٩٤ - ٢٠٠٣ يكون معدل النمو التقديرى ٥ر٠ .

وفيما يلي تقديرات الواردات المحلية الاجمالية للمنطقة على اساس الوزن الطني ١٩٨٣- ٣٧٥ر٩٠٠ طن ، ١٩٩٣-٦٠٢ر٢٠٠ طن ، ٢٠٠٣-٩٢٩٠٠٠ طن .

ويبين ملخص وزن الحمولات المعتزمة والذى يمثل القطاعات الاقتصادية للمنطقة المشمولة باللمشروع ازدياد الوزن الطني الاجمالي من ٨ر٠ مليون طن تقريبا في عام ١٩٧٦ الى ١٧ر٠ مليون طن بحلول عام ١٩٨٣ ، و ٣٥ر٥ مليون طن بحلول عام ١٩٩٣ ،واخيرا يصل الى ٥٥ر٣ مليون طن بحلول عام ٢٠٠٣ . ويبلغ معدل النمو السنوى للفترة ١٩٧٦-٢٠٠٣ : ٧ر٤ في المئة في حين ينخفض الى ٦ر١ في المئة خلال الفترة ١٩٨٤-٢٠٠٣ .

ومن المتوقع ان يبلغ حجم حركة السير على اساس المعدل اليومي على طريق طرطوس اللاذقية نحو ١١ر٠٠٠ سيارة و ٣٠٠٠ سيارة اوتوبيس بحلول عام ٢٠٠٣ بينما سيبلغ عدد الشاحنات التي ستسير على الطريق يوميا في نفس السنة قرابة ٩٨٠٠ شاحنة .

٣ - تحليلات النقل والموصلات

لقد حددت احجام حركة السير العادية من الاحصائيات واعمال المسح التي قام بها المستشار في عام ١٩٧٨ بالاضافة الى المعلومات المتعلقة بعام ١٩٧٦ التي حصل عليها من وزارة المواصلات ومعدلات النمو للتقديرات الاقتصادية . ويلخص الجدول أ-٢ الاحجام الحالية (١٩٧٨) لحركة المرور.

الجدول (أ) - ٢
المعلومات الاساسية لحركة المرور لعام ١٩٧٨

نوع السيارة والوضع	الطريق حول طرطوس	طرطوس بانياس	الطريق حول بانياس	بانياس اللاذقية	جبلة اللاذقية
(أ) المرور الكامل					
السيارات العادية	١ر٨٦٣	٨٩٧	١ر٠٠٣	١ر١٠٨	١ر٤٧٧
شاحنات صغيرة (بيك آب)	١ر٥١١	٥٧٥	٥٥٠	٥٢٥	٧٦٤
اتوبيسات	٥٢٩	٢٤٧	١٨٧	١٢٧	٣٤٢
شاحنات بمحورين	٩٦٣	٤٥٥	٤٩٨	٥٤٠	٦٧٢
شاحنات بثلاثة محاور	١٧٦	٦١	٦٨	٧٥	٨٩
تشكيلة سيارات مختلفه	٤١٤	١٣٨	١٣٤	١٣٠	١٤٤
المجموع	٥ر٤٥٦	٢ر٣٧٣	٢ر٤٤٠	٢ر٥٠٥	٣ر٤٨٨
(ب) الطريق الجديد المرور المحول					
السيارات العادية	٨٧٩	٧٨٥	٨٧٦	٩٦٧	١ر٣٠٦
شاحنات صغيره (بيك آب)	١ر٠٧٩	٥٠٢	٤٨٠	٤٥٩	٦٧٥
اتوبيسات	٥٢	٨٩	٧٤	٥٩	١٢٩
شاحنات بمحورين	٦٧٥	٣٧٦	٤٣٠	٤٨٤	٦٠٠
شاحنات بثلاثة محاور	١٣٩	٥٧	٦١	٦٥	٧٩
تشكيلة سيارات مختلفه	٣٧١	١٨١	١٣٤	١٣٠	١٤٤
المجموع	٣ر١٩٥	١ر٩٤٧	٢ر٠٥٥	٢ر١٦٤	٢ر٩٣٣
(ج) الطريق الحالي المرور المتبقي					
السيارات العادية	٩٨٤	١١٢	١٢٧	١٤١	١٧١
شاحنات صغيرة (بيك آب)	٤٣٢	٧٣	٧٠	٦٦	٨٩
اتوبيسات	٤٧٧	١٥٨	١١٣	٦٨	٢١٣
شاحنات بمحورين	٢٥٨	٧٩	٦٨	٥٦	٧٢
شاحنات بثلاثة محاور	٣٧	٤	٧	١٠	١٠
تشكيلة سيارات مختلفه	٤٣	صفر	صفر	صفر	صفر
المجموع	٢ر٢٦١	٤٢٦	٣٨٥	٣٤١	٥٥٥

Estimated traffic growth rates derived from economic studies are shown in Table A-3.

TABLE A-3
VEHICLE GROWTH RATES BY
SPECIFIED VEHICLE

Vehicle Type	1976-1983	1983-1993	1993-2003
Automobile	9.5%	9.3%	7.4%
Pickup Truck	10.3%	7.1%	5.6%
Bus	9.1%	10.7%	9.6%
Truck, 2 Axle	10.3%	7.1%	5.6%
Truck, 3 Axle	10.3%	7.1%	5.6%
Truck Combinations	10.3%	7.1%	5.6%

Future traffic projections comprise 90 tables which can be found in Appendix C, Tables 1 through 90 . Data selected from those tables to indicate the order of magnitude of traffic in the corridor in selected years is presented in Table A-4.

TABLE A-4
TRAFFIC PROJECTIONS FOR SELECTED YEARS[1/]

Traffic (ADT)
Both Directions

Year	Vehicle	Tartous Bypass	Tartous to Banyas	Banyas bypass	Banyas to Jebleh	Jebleh to Latakia
1984	Car	3,205	1,542	1,725	1,905	2,541
	Pickup	2,700	1,027	983	939	1,364
	Bus	906	422	320	218	584
	Truck, S.U.	3,258	1,476	1,618	1,758	2,174
	Truck, Comb.	1,182	394	382	372	413
	Total	11,251	4,861	5,028	5,192	7,076
1994	Car	7,662	3,686	4,123	4,555	6,072
	Pickup	5,216	1,983	1,900	1,815	2,634
	Bus	2,480	1,154	875	598	1,598
	Truck, S.U.	6,294	2,852	3,127	3,399	4,198
	Truck, Comb.	2,284	764	740	720	798
	Total	23,936	10,439	10,765	11,087	15,300
2003	Car	14,566	7,010	7,839	8,662	11,545
	Pickup	8,163	3,102	2,973	2,840	4,120
	Bus	5,658	2,633	1,998	1,366	3,644
	Truck, S.U.	9,850	4,463	4,893	5,316	6,569
	Truck, Comb.	3,572	1,196	1,158	1,129	1,250
	Total	41,809	18,404	18,861	19,313	27,128

1/ Assumes that legal load limits are enforced.

ويبين الجدول (أ) – ٣ معدلات النمو التقديرية لحركة المرور كما استقيناها من الاحصائيات الاقتصادية .

الجدول (أ) – ٣
معدلات ازدياد السيارات
حسب تصنيفها

نوع السيارة	١٩٧٦ – ١٩٨٣	١٩٨٣ – ١٩٩٣	١٩٩٣ – ٢٠٠٣
سيارات عادية	٩ر٥ %	٩ر٣ %	٧ر٤%
شاحنات صغيرة (بيك آب)	١٠ر٣%	٧ر١ %	٥ر٦%
اوتوبيسات	٩ر١ %	١٠ر٧%	٩ر٦%
شاحنه بمحورين	١٠ر٣%	٧ر١ %	٥ر٦%
شاحنه بثلاثة محاور	١٠ر٣%	٧ر١ %	٥ر٦%
تشكيلة سيارات مختلفه	١٠ر٣%	٧ر١ %	٥ر٦%

وتضم تقديرات حركة المرور المرتقبة ٩٠ جدولا يمكن الاطلاع عليها فى الملحق (ج) من واحد الى ٩٠ . ويمثل الجدول (أ) – ٤ المعلومات المختاره من هذه الجداول للدلالة على نمط حجم حركة المرور فى السنوات المحددة فى العمود الايمن .

الجدول (أ) – ٤
تقديرات حركة المرور فى السنوات المختاره (١)

حركة المرور (المعدل اليومى)
فى الاتجاهين

السنة	نوع السيارة	الطريق حول طرطوس	طرطوس بانياس	الطريق حول بانياس	بانياس جبله	جبله اللاذقيه
١٩٨٤	سيارات عاديه	٣ر٢٠٥	١ر٥٤٢	١ر٧٢٥	١ر٩٠٥	١ر٥٤١
	شاحنات صغيرة (بيك آب)	٢ر٧٠٠	١ر٠٢٧	٩٨٣	٩٣٩	١ر٣٤٦
	اوتوبيسات	٩٠٦	٤٢٢	٣٢٠	٢١٨	٥٨٤
	شاحنة مفرده	٣ر٢٥٨	١ر٤٧٦	١ر٦١٨	١ر٧٥٨	٢ر١٧٤
	تشكيلة شاحنات مختلفة	١ر١٨٢	٣٩٤	٣٨٢	٣٧٢	٤١٣
	المجموع	١١ر٢٥١	٤ر٨٦١	٥ر٠٢٨	٥ر١٩٢	٧ر٠٧٦
١٩٩٤	سيارات عاديه	٧ر٦٦٢	٣ر٦٨٦	٤ر١٢٣	٤ر٥٥٥	٦ر٠٧٢
	شاحنات صغيرة (بيك آب)	٥ر٢١٦	١ر٩٨٣	١ر٩٠٠	١ر٨١٥	٢ر٦٣٤
	اوتوبيسات	٢ر٤٨٠	١ر١٥٤	٨٧٥	٥٩٨	١ر٥٩٨
	شاحنة مفرده	٦ر٢٩٤	٢ر٨٥٢	٣ر١٢٧	٣ر٣٩٩	٤ر١٩٨
	تشكيلة شاحنات مختلفة	٢ر٢٨٤	٧٦٤	٧٤٠	٧٢٠	٧٩٨
	المجموع	٢٣ر٩٣٦	١٠ر٤٣٩	١٠ر٧٦٥	١١ر٠٨٧	١٥ر٢٠٠
٢٠٠٣	سيارات عاديه	١٤ر٥٦٦	٧ر٠١٠	٧ر٨٣٩	٨ر٦٦٢	١١ر٥٠٥
	شاحنات صغيرة (بيك آب)	٨ر١٦٣	٣ر١٠٢	٢ر٩٧٣	٢ر٨٤٠	٤ر١٠٠
	اوتوبيسات	٥ر٦٥٨	٢ر٦٣٣	١ر٩٩٨	١ر٣٦٦	٣ر١٤٤
	شاحنة مفرده	٩ر٨٥٠	٤ر٤٦٣	٤ر٨٩٣	٥ر٣١٦	٦ر٥٦٩
	تشكيلة شاحنات مختلفة	٣ر٣٧٢	١ر١٩٦	١ر١٥٨	١ر١٢٩	١ر٢٥٠
	المجموع	٤١ر٨٠٩	١٨ر٤٠٤	١٨ر٨٦١	١٩ر٣١٣	٢٧ر١٢٨

(١) نفترض الالتزام بمحددات الحموله القانونيه .

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Tables of highway user costs have been developed for representative types of vehicles under various highway and speed conditions. These tables, even in summary form. are too voluminous for inclusion in this Executive Summary, but are to be found in Appendix C as Table 126 through Table 140. The unit user costs have been applied to estimated future traffic volumes on both the existing and proposed highway and the savings in user costs have been taken as benefits attributable to the proposed Tartous-Lattakia highway. The gross value of the user savings is estimated to the $1.6 billion and the corresponding net value, using a discount rate of 15 percent is $0.3 billion.

The costs of maintaining the existing road with no traffic relief by additional construction is compared with the maintenance cost of the existing road with greatly reduced traffic plus the maintenance cost of the proposed highway. The net benefit of this factor is minus $2 million (i.e., net cost to proposed project of $2 million).

In addition to the user cost benefits the project has other benefits to the nation which are difficult to quantify, but nevertheless significant. The transportation network is a major element in the nation's defense, and the significance of the proposed expressway serving the nation's major ports is obvious. The project is also beneficial in terms of national pride and international stature. Education, health, and other sectors which require transport, benefit substantially from the proposed expressway. The economic analyses presented in this report place no value on any of the above benefits and to that extent are clearly conservative.

4. Technical Planning

The design criteria for the proposed highway have been chosen in general accord with the standards set by the Ministry of Communications of the Syrian Government and with consideration for recommendations of AASHTO. The facility proposed is a four-lane divided limited access highway with wide median, except in areas of urban development or extensive excavation requirements wherein the median width is reduced to limit costs to reasonable levels. The design speed is 120 kilometers per hour except in a three kilometer section near Banyas wherein speed is reduced to 80 kph (in the interest of construction economy) and in the 2 kilometer section approaching the city of Lattakia wherein the speed is reduced to 100 kph.

Pavement design studies have been carried out to determine the economic value of stage construction with the conclusion that design for overlay in the tenth year of use is the most economical of designs considered. Pavement design included in the basic cost estimate assumes imposition of rigid enforcement of legal axle load limits. The pavement stages considered in the feasibility study included single stage construction, 2-stage construction with second stage in year 7, 2-stage construction with second stage in year 10, and 2-stage construction with second stage in year 15. Pavements were analyzed for each of 8 segments of the Tartous-Lattakia

وقد وضعت جداول بتكاليف استخدام الطريق العام السريع لتبيان انواع السيارات في ظل مختلف الظروف التي تسود الطريق ومختلف السرعات . وهذه الجداول حتى مع اختصارها اوسع من ان نشملها كلها في هذا الملخص الاجرائي ، ولكن يمكن العثور عليها في الملحق (ج) من الجداول من ١١٦ الى ١٣٠ . وقد استخدمت تكاليف استخدام الوحدات على الاحجام التقديرية لحركة السير مستقبلا بالنسبة لكل من الطريق العمومي القائم حاليا والطريق المقترح والتوفيرات في تكاليف الاستعمال احتسبت كمنافع نسوبه للطريق العمومي المقترح بين طرطوس واللاذقية . وتقدر القيمة الاجمالية لهذه التوفيرات بألف وستمئة مليون دولار والقيمة الصافية المقابلة مع استعمال نسبة خصم قومها ١٥ في المئة هي ثلاثمئة مليون دولار وتقارن تكاليف صيانة الطريق الحالي دون ان نأخذ في الاعتبار البناء الاضافي لاعانة حركة السير بتكاليف الصيانة للطريق مع الاخذ بعين الاعتبار انخفاض حركة السير الى حد كبير زائد تكاليف صيانة الطريق العمومي المقترح . والمنفعة الصافية لهذا العامل هي ناقص مليوني دولار (أي التكلفة الصافية للمشروع المقترح بمليوني دولار) .

وعلاوة على منافع تكاليف الاستعمال ان هذا المشروع يعود بمنافع اخرى على الجمهورية العربية السورية من العسير تحديدها بالضبط وان تكن على جانب من الاهمية . فشبكة المواصلات تعتبر عنصرا رئيسيا في الوسائل الدفاعية لابد منه . ولذلك فان اهمية بناء الطريق العمومي المقترح لخدمة الموانيء الرئيسية للبلاد اهمية واضحه وجليه . كما ان هذا المشروع مفيد من حيث الكرامة القومية لسوريا وسمعتها الدولية . ناهيك عن ان المرافق التعليمية والصحية وغيرها من القطاعات التي تتطلب النقل والمواصلات تستفيد بصورة محسوسة من الطريق السريع المقترح . ولا تولي التحليلات الاقتصادية المقدمة في هذا التقرير اهمية لأيٍّ من الفوائد الآنفة الذكر ولذلك فان تقديراتها من هذه الناحية متحفظة بصورة واضحة .

٤ - التخطيط الفني

لقد اختيرت المعايير التصميمية للطريق العمومي المقترح وفق القواعد والمتطلبات التي حددتها وزارة المواصلات السورية مع الأخذ بعين الاعتبار توصيات الاتحاد العربي العام للنقل والمواصلات . والطريق المقترح بناءها ستكون طريقا عموميا رئيسيا سريعا موءلفا من اربعة دروب بمداخل محدودة وله جذع اوسط واسع الا في المناطق الحضرية المكتظة او حيثما تقتضي متطلبات الحفريات الواسعة تقليص عرض الجذع الأوسط الى مستويات معقولة بتكاليف محدودة . وستكون السرعة القصوى ١٢٠ كيلومترا في الساعة باستثناء مقطع طوله ثلاثة كيلومترات بالقرب من بانياس حيث تخفف السرعة الى ٩٠ كيلومتر في الساعة (لمصلحة اقتصاد البناء والانشاءات) ومقطع طوله كيلومتران عند مشارف مدينة اللاذقية حيث تخفف السرعة الى ١٠٠ كيلومتر في الساعة

وقد اجريت دراسات تصميميه على حجارة الرصف لتقرير القيمة الاقتصادية للبناء المرحلي مع الاستنتاج بان تصميم النفقات والتكلفه في السنه العاشرة من الاستعمال هو اكثر التصاميم المطروحه على بساط البحث توخيا للاقتصاد في الانفاق . ويفترض تصميم حجاره الرصف والسطح المرصوف للطريق العمومي ، وهو التصميم المشمول في تقدير التكلفة الاساسية ان تطبق بصورة مشددة القيود القانونية المتعلقة بحمولة المحاور . وتشتمل مراحل السطح المرصوف المتداوله في هذه الدراسة على بناء المرحلة المفرده وبناء المرحلتين معمرحلة ثانية في السنة السابعة وبناء المرحلتين مع مرحلة ثانية في السنة العاشرة وبناء المرحلتين معمرحله ثانية في السنة الخامسة عشرة . وقد حللت حجارة الرصف لكل ثمانية مقاطع من طريق طرطوس - اللاذقية

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highway, with a separate analysis for northbound and southbound traffic. Pavement designs were also prepared for consideration in the sensitivity analysis for continuation of present loading practice (with frequent heavy overloads) for each of the segments at the beforementioned stages. The total number of pavement designs prepared and costed out was therefore 2 x 2 x 8 x 4 or 128.

The construction cost of the highway has been determined by a contractor type estimate to be $71,946,192, to which must be added the $16,303,846 cost of right-of-way, the $4,316,800 cost of surveys and design, and the $2,877,800 cost of construction supervision. The total budget cost is therefore $95,444,638. The construction cost was proportioned in the analysis by Capital Recovery Factor and Series Present Worth with the estimated life of the proposed construction determined from weighted life of 7 categories of construction cost. The weighted life of the project is estimated as 60 years.[1/] The components of the feasibility cost estimate are shown in Table A-5.

TABLE A-5
TARTOUS-LATTAKIA HIGHWAY PROJECT
SYRIA

SUMMARY: FEASIBILITY COST ESTIMATE

	- In 1978 U. S. Dollars -		
	U.S. $ Expenditure	Syrian Expenditure	Total Expenditure
Construction Cost Estimate	$48,093,455	$23,852,737	$71,946,192
Engineering Design Estimate . . . . . (Includes, but not limited to, detailed survey and field investigation, soils investigation and testing, total engineering design and documentation, pre-qualification and tendering assistance.)	3,021,700	1,295,100	4,316,800
Construction Supervision	1,582,800	1,295,000	2,877,800
Appropriation of Land.	-	16,303,846	16,303,846
Totals	$52,697.955	$42,746,683	$95,444,638

1/ Includes high percentage of right-of-way costs at life of 100 years.

مع اجراء تحليل منفصل لحركة السير شمالا وجنابا. وتم ايضا اعداد تصاميم السطح المرصوف فينطاق تحليل سرعة تأثر هذا السطح بالعوامل الطبيعية من اجل استمرار ممارسات الشحن الحالية (مع حمولات زائدة بكثره) لكل من المقاطع في المراحل الآنفة الذكر. ولذلك كان العدد الاجمالي لتصاميم السطح المرصوف التي اعدت وقدرت نفقاتها : ٢×٢×٨×٤ أو ١٢٨ .

وقد حدد تقدير على نمط تقديرات المقاولين كلفة بناء الطريق العمومي بـ ٧١ر٩٤٦ر١٩٢ مليون دولار يضاف اليه مبلغ ١٦ر٣٠٣ر٨٤٦ مليون دولار ثمنا للامتداد الارضي المستملك على طول جانبي الطريق وكذلك ٤ر٣١٦ر٨٠٠ مليون دولار تكلفه لاعمال المسحوالتصميم و ٢ر٨٧٧ر٨٠٠ مليون دولار تكلفة الميزانية الكامله للمشروع ٩٥ر٤٤٤ر٦٣٨ مليون دولار. وقدقسمت تكلفة البناء بهذه النسب الواردة في التحليل على اساس عامل انتعاش لا أس المال والقيمة الراهنة وتقدير فترة بقاء البناء المقترح من الاعتبارات الراجحه لسبعة تصنيفات لتكاليف البناء. ويقدر عمر المشروع مع الاعتبارات الراجحه بستين عاما (١) ويبين الجدول أ ـ ٥ مكونات تقدير كلفة تنفيذ المشروع .

الجدول أ ـ ٥

مشروع الطريق العمومي من طرطوس الى اللاذقية

الجمهورية العربية السورية

ملخص : تقدير كلفة التنفيذ

ـ بالدولارات الاميركية لعام ١٩٧٨ـ

	الانفاق بالدولارات الاميركية	الانفاق بالليرات السورية	الانفاق الكامل
تقدير كلفة البناء	٤٨ر٠٩٣ر٤٥٥	٢٣ر٨٥٢ر٧٣٧	٧١ر٩٤٦ر١٩٢
تقدير التصميم الهندسي (يشتمل ذلك ، ولكن دون ان يقتصر على اعمال المسح المفصله والتحقيقات الميدانية وابحاث التربه والاختبار والتصميم الهندسي الكاملوالتوثيق والاهليه المسبقه وتقديم العون في العطاءات) .	٣ر٠٢١ر٧٠٠	١ر٢٩٥ر١٠٠	٤ر٣١٦ر٨٠٠
الاشراف على البناء	١ر٥٨٢ر٨٠٠	١ر٢٩٥ر٠٠٠	٢ر٨٧٧ر٨٠٠
اعتماد الأراضي	ـ	١٦ر٣٠٣ر٨٤٦	١٦ر٣٠٣ر٨٤٦
المجموع	٥٢ر٦٩٧ر٩٥٥	٤٢ر٧٤٦ر٦٨٣	٩٥ر٤٤٤ر٦٣٨

(١) يشمل ذلك نسبة مئوية عالية من تكاليف حق المرور على مدى مئة عام .

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The feasibility cost estimate in 1978 dollars was required in economic analyses, wherein all costs and benefits are stated at 1978 value. Project financing; however, must be based on cost including escalation at prevailing rates, which the consultant assumes to be 7 percent for U.S. costs and 11 percent for Syrian costs. The consultant assumes further that the design contract will be negotiated at the beginning of 1979 and will be subject to one-half year of inflation; and that construction and right-of-way costs will be negotiated at mid 1980 and be subject to two years inflation. The escalated cost estimate which applies for budget purposes is shown in Table A-6.

TABLE A-6
TARTOUS-LATTAKIA HIGHWAY PROJECT
SYRIA

SUMMARY: BUDGET COST ESTIMATE

	- In U. S. Dollars -		
	U. S. $ Expenditure	Syrian Expenditure	Total Expenditure
Construction Cost Estimate	$55,062,197	$29,388,957	$84,451,154
Engineering Design Estimate. . . . . (Includes, but not limited to, detailed survey and field investigation, soils investigation and testing, total engineering design and documentation, pre-qualification and tendering assistance.)	3,125,671	1,364,473	4,490,144
Construction Supervision	1,812,148	1,595,570	3,407,718
Appropriation of Land.	-	20,087,969	20,087,969
Totals.	$60,000,016	$52,436,969	$112,436,985

وقد استدعت التحليلات الاقتصادية تقدير كلفه التنفيذ بالدولارات الامريكية حسب قيمتها عام ١٩٧٨ حيث شمل ذلك جميع التكاليف والمنافع غير ان تمويل المشروع يجب ان يستند الى التكلفه بما فى ذلك تصاعد الاسعار الحاليه التى يفترض المستشار انها سوف تتزايد بنسبة ٧ فى المئه فيما يتعلق بالتكاليف الامريكية ونسبة ١١ فى المئة فيما يتعلق بالتكاليف السورية • ويفترض المستشار ايضا ابرام عقد التصميم فى بداية عام ١٩٧٩ وسوف يخضع لمعدل تضخم على مدى نصف عام فى حين سيتم الاتفاق على تكاليف البناء والامتداد الارضى المستملك على طول جانبى الطريق فى منتصف عام ١٩٨٠ وسيخضع لمعدل تضخم على مدى عامين • ويبين الجدول (أ) – ٦ تقدير التكلفه المتزايده التى تنطبق على بنود الميزانية •

الجدول (أ) – ٦

مشروع الطريق العام من

طرطوس الى اللاذقية

الجمهورية العربية السورية

ملخص : تقدير تكلفة الميزانية

– بالدولارات الامريكية لعام ١٩٧٨–

	الانفاق بالدولارات الامريكية	الانفاق بالليرات السورية	الانفاق الكامل
تقدير تكاليف البناء • • • • • •	٥٥ر٠٦٢ر١٩٧	٢٩ر٣٨٨ر٩٥٧	٨٤ر٤٥١ر١٥٤
تقدير التصميم الهندسى • • • • • (يشتمل ذلك ولكن دون ان يقتصر على اعمال المسح المفصله والتحقيقات الميدانيه وابحاث التربية والاختبار والتصميم الهندس الكامل والتوثيق والاهليه المسبقه وتقديم العون فى العطاءات)	٣ر١٢٥ر٦٧١	١ر٣٦٤ر٤٧٣	٤ر٤٩٠ر١٤٤
الاشراف على البناء • • • • • •	١ر٨١٢ر١٤٨	١ر٥٩٥ر٥٧٠	٣ر٤٠٧ر٧١٨
اعتماد الاراضى • • • • • • • • •	–	٢٠ر٠٨٧ر٩٦٩	٢٠ر٠٨٧ر٩٦٩
المجموع	٦٠ر٠٠٠ر٠١٦	٥٢ر٤٣٦ر٩٦٩	١١٢ر٤٣٦ر٩٨٥

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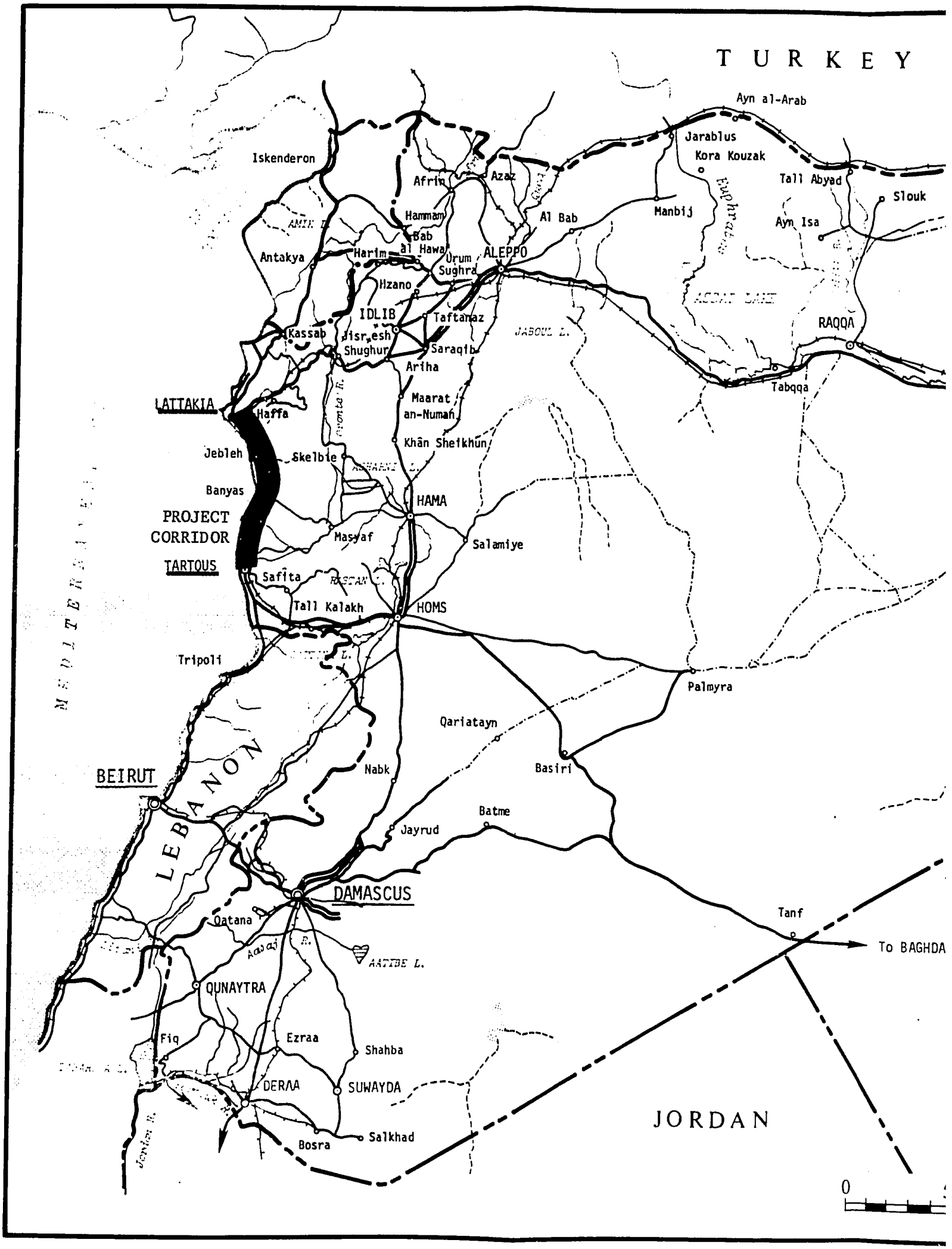
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Al Bab
Manbij
Antakya
Harim
Urum Sughra
ALEPPO
Hzano
IDLIB
Taftanaz
Kassab
Jisr esh Shughur
Saraqib
Ariha
RAQQA
Tabqqa
LATTAKIA
Haffa
Maarat an-Numan
Khân Sheikhûn
Jebleh
Skelbie
Banyas
HAMA
PROJECT CORRIDOR
Masyaf
Salamiye
TARTOUS
Safita
Tall Kalakh
HOMS
Tripoli
Palmyra
Qariatayn
Basiri
BEIRUT
LEBANON
Nabk
Batme
Jayrud
DAMASCUS
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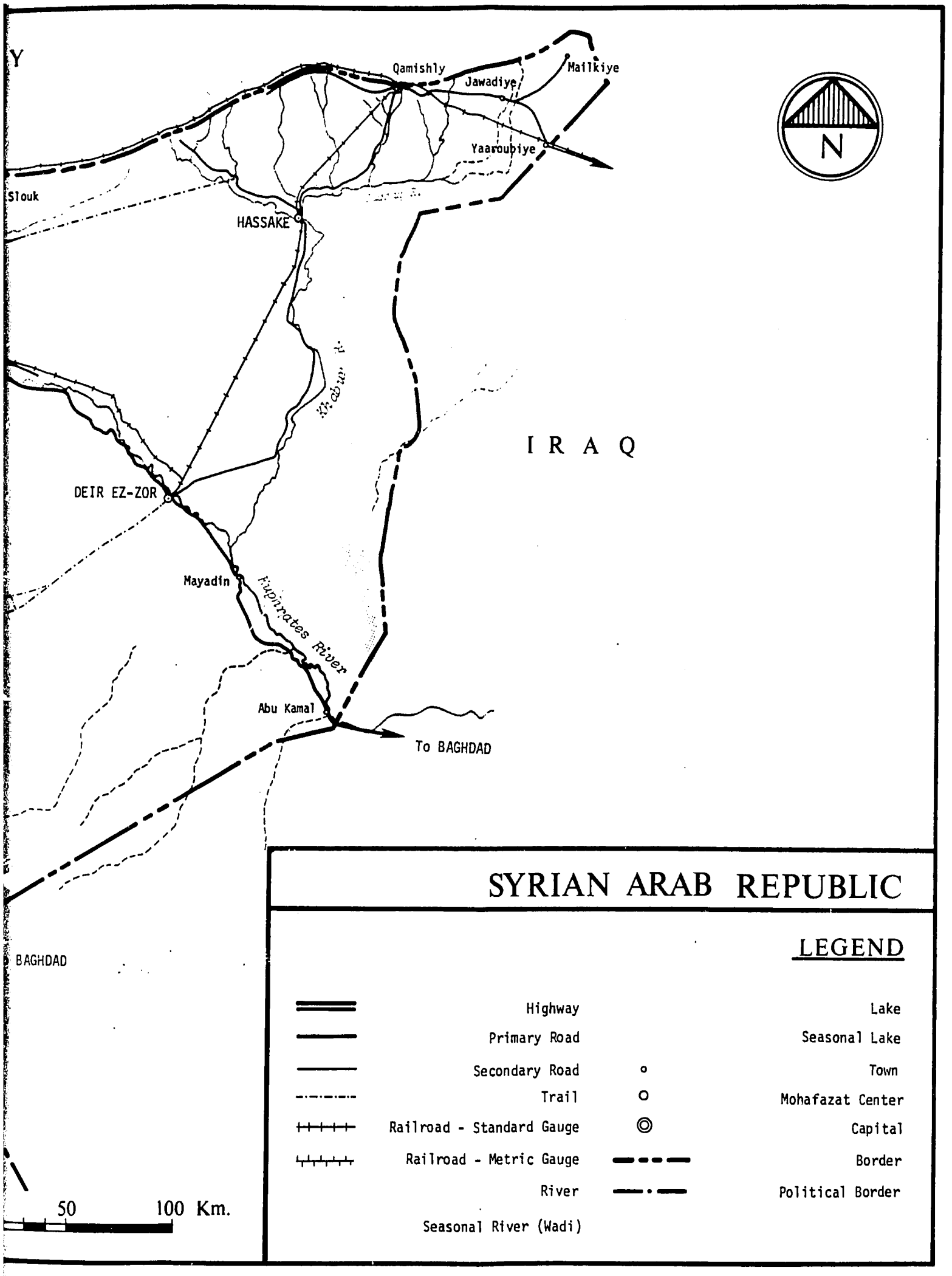
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DEIR EZ-ZOR
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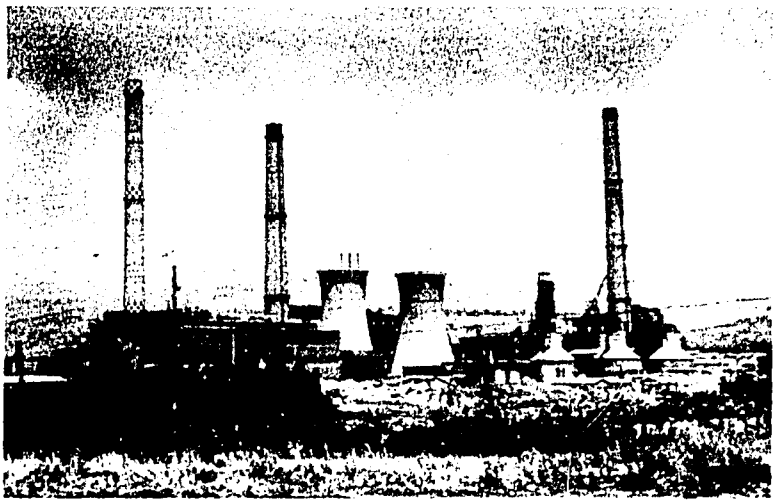
Euphrates River
Abu Kamal
To BAGHDAD
BAGHDAD
N
50
100 Km.
SYRIAN ARAB REPUBLIC
LEGEND
Highway
Primary Road
Secondary Road
Trail
Railroad - Standard Gauge
Railroad - Metric Gauge
River
Seasonal River (Wadi)
Lake
Seasonal Lake
Town
Mohafazat Center
Capital
Border
Political Border



General Economics

PART B

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1. THE SYRIAN ECONOMY

a. General

The Syrian Arab Republic (SAR) lies at the eastern end of the Mediterranean Sea, bounded by Turkey on the north, by Iraq on the east, by Palestine and Jordan on the south, and by Lebanon and the sea to the west. The Syrian Arab Republic has a total area of 185,180 (km^2), of which about 58,200 km^2 are classed as cultivable lands, 85,490 km^2 are classed as steppe and pasture lands, and the remaining 40,870 km^2 include mountains, deserts, marshes and lakes as well as land occupied by roads, cities and villages, and industrial areas. [1/]

Geographically, the nation may be divided into four major zones: (1) the coastal region extending from the sea east to the north-south mountains reaching 2,000 meters or higher, and the intervening hills and plateaus; (2) the interior or plains region which is generally sub-humid in climate; (3) the semi-arid steppe lands which are utilized largely as grazing lands, and (4) the extensive desert regions which occupy much of the central interior and the eastern and southern regions of the country.

The major economic sections of the economy, as measured by shares of the Gross Domestic Product at constant prices in 1976, are:

Mining and Manufacturing	20.1%
Trade	19.3
Agriculture	18.7
Transport & Communication	7.7
Building & Construction	4.7

b. Human Resources

1) Population

The total population of Syria was estimated at 7,595,000 as of July 1, 1976. This estimate by the Central Bureau of Statistics was based upon extrapolation of the annual average growth rate of 3.3 per cent achieved during the census periods 1960 to 1970. Although this is a high growth rate, neither the Central Bureau of Statistics nor other governmental and international agencies anticipate a decrease in the rate; it has thus been used for

[1/] Central Bureau of Statistics, Statistical Abstract, 1977, p. 189.

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long range forecasts by these agencies.

Based upon the annual growth rate of 3.3 percent, Syria's total population as of 12/31/77 is estimated at 8,000,000. This gives an average density of about 43 persons per square kilometer.

The urban/rural split of the country's population in 1970 was in the ratio of 43/57. Between 1960 and 1970 the urban population grew at an annual rate of 5.0 per cent, while for the same period the rural population increased at an annual average rate of 2.1 percent.

2) Manpower

Manpower resources of the Syrian Economy equaled about 5.2 million people or about two thirds of the total population according to the sample census of September 1976.[1/] The labor force for the same period (economically active population, 10 years of age and over) was 1.8 million or about 35 per cent of the manpower resources. The unemployed portion of the labor force was 6.2 per cent.

3) Education

The educational system of the Syrian Arab Republic includes the following components: kindergarten, primary schools (grades 1 through 6), intermediate and secondary schools (grade equivalent 7 through 12), vocational and special schools, and higher education at collegiate and university levels. Kindergartens are located principally in larger centers of population, and are supported by private agencies, with state sanction. Education in primary and secondary schools is legally compulsory; but in practice, the degree of compliance is conditioned by availability of school buildings and teachers. This is increasingly difficult in more remote and thinly populated regions, but is more nearly adequate in the western more heavily populated regions. Substantial progress has been made in reducing illiteracy in the recent decade by improving primary and secondary education for all youths (male and female). The total illiteracy in the entire population was as follows:

	1960	1970
Males	28.9%	22.0%
Females	54.2%	47.2%[2/]

All educational institutions (including vocational and higher education) are receiving special attention through the Ministry of Higher

1/ The Central Bureau of Statistics. Cited in the Central Bank of Syria, Quarterly Bulletin, Vol. XIV, No. 4, 1976, p.79.

2/ Central Bureau of Statistics, Statistical Abstract 1977, pp. 86, 87.

Education. Although the coverage of skills, crafts, disciplines and areas of learning is far from comprehensive in terms of national needs, there has been sustained improvement in recent years. Special education to support agricultural sectors, however, is significantly deficient. Budget outlays for all forms of higher education increased from 21.4 per cent in 1970 to 38.5 per cent in 1977. Nevertheless, serious weaknesses in higher education still persist.

Improvements being made in road networks directly increase opportunity for youths to reach schools, and assist in attracting the teachers needed at schools in villages and more remote areas. Improved roads also facilitate the establishment of more central schools, with better facilities and teaching staff than would be feasible in small dispersed schools in rural areas. It has been found easier to more nearly balance female and male youth attendance in such central schools, which is an important goal. Vehicular transport of students presently constitutes a constraint. The current educational targets include enforcement of compulsory primary education for all children by 1980, reduction of class size to a maximum of 40 students, a balance of 50 per cent each of boys and girls in secondary schools by 1980, and strong action to increase percentages of girls in teacher training and vocational schools.

Eight additional technical schools are scheduled for construction by 1980, in six population centers, as well as three professional institutes in three strategically located centers. Such construction is in addition to further construction to serve all other educational levels throughout the nation. The plan also includes construction and staffing of school dispensaries to provide health services to pupils. There are also extensive plans for construction of camps to serve the growing "pioneer" (Tala'eh) groups for young people in the school systems.

The budget allocations for pre-higher, and higher education in 1977 were about five times as great as those of 1970, showing growing strength in the field of higher education.[1/]

4) Health

The health situation is influenced by the composition of the national population as well as other factors. The Syrian population is characterized by a high growth rate (3.3% per year between 1960 and 1970), by rapid urbanization and by a very young population.[2/] The rapid growth in population

1/ Central Bureau of Statistics, Statistical Abstract 1977, p. 461.

2/ About half of the population is currently under 14 years of age.

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is currently putting stress on the economically active mature population responsible for support of youth. Life expectancy is reported as about 55 years. The crude death rate is at least 14 per thousand, and the infant mortality rate is about 123 per thousand.

In 1976, there were 1,555 beds in private hospitals, and 5,282 beds in state hospitals. Occupancy rates were 67 per cent in state hospitals, and 42 per cent in private hospitals. There were also 296 clinics and health centers in 1976. The Government of Syria is improving health services to cope with endemic diseases common to the Mediterranean region, as well as locally infectious diseases and other health problems.

The general statistics on malnutrition, morbidity and mortality do not seem abnormal for the region. Nevertheless the Government recognizes that substantial improvement is needed, and is moving to increase the number of physicians, dentists, pharmacists, nurses and mid-wives in the country, as well as clinics and hospital beds, to provide better health services to the total population. Private health services are available to some extent in cities, but usually at higher prices than in state-supported institutions. In 1976, ratios of medical personnel to national population were:

1 physician per 2,690 people
1 dentist per 9,241 people
1 pharmacist per 5,948 people 1/

The Government's continuing concern for national health is essential to achieving better distribution of health services to rural, thinly populated and more remote areas of the country.

c. Agriculture

1) Importance of the Sector

Agriculture continues to rank as one of the largest sectors in the Syrian economy, accounting for 18 to 22 percent of gross domestic product (GDP) in recent years. (See Appendix B, Table 1.) In 1976, GDP was estimated at SL 23 billion ($5.9 billion), and the contribution of the agricultural sector was SL 5.1 billion ($1.3 billion), or 22.1 per cent. In constant prices, the GDP increased at an average annual rate of 10.3 per cent, and the rate for agriculture was 9.8 per cent over the 1971-76 period.

Agriculture is the major source of employment in the nation. The 1970 population census reported that about half of the labor force was employed in the agricultural sector, and a 1975 sample survey indicated that the relative

1/ Central Bureau of Statistics, Statistical Abstract 1977, p. 512.

share of employment in this sector has remained at slightly over 50 per cent. In addition, substantial numbers of people are also employed in the marketing, transporting and processing of agricultural commodities.

Agricultural products, chiefly cotton, continue to be an important source of export earnings for the nation, although their relative share has declined in recent years due to the major expansion of crude oil exports. (See Appendix B, Table 2.) Agricultural exports accounted for about 55 to 60 per cent of total exports in the early 1970's but for 21.5 per cent in 1976. Total value of agricultural exports has fluctuated from year to year, but rose from SL 530 million in 1970/72 to SL 822 million in 1974-76, an annual average growth rate of about 11 per cent.

Imports of agricultural products have continued to increase in order to meet expanding domestic food requirements. The value of food imports rose from an average of about SL 0.5 billion in 1970-72 to nearly SL 1.2 billion in 1974-76, or at an annual average rate of about 25 per cent. (See Appendix B, Table 3.) However, food imports as a percent of total imports declined from 26.1 per cent in 1970 to 11.9 per cent in 1976. Among the more important food imports are sugar, dairy products, fresh fruit and cereals (especially rice and wheat flour).

The gross output of the agricultural sector, as measured by producers' value in constant prices, has fluctuated substantially from year to year, largely as a result of annual rainfall variations. The long term trend in value of agricultural production, however, was essentially flat from the early 1960's to early 1970's, rising at an annual rate of 0.2 per cent from 1963-65 to 1970-72. Since then, from 1970-72 to 1974-76, the value of agricultural output has grown at an annual rate of 8.0 per cent. The annual rate over this same period, 1970-72 to 1974-76, was 9.8 per cent for crop production and 2.3 per cent for livestock and livestock products. (See Appendix B, Table

2) Land Use

Syria's cultivated land area covered about 5.5 million hectares in 1976, or 30 per cent of the country's total area of 18.5 million hectares. This percentage has been relatively stable during the 1970's. About 8.5 million hectares, or 46 per cent of the total area, is steppe and pasture, and nearly one-half million hectares, or 2.4 per cent, is forested. Most of the remaining area, or 20 per cent of the total, is desert. (See Appendix B, Table 5.)

In 1976 about 77 per cent of the cultivated area, or 4.2 million hectares, was cropped with the remaining 23 per cent lying fallow. Cropped

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land as a percentage of the total cultivated area has continued to increase during recent years, rising from the 50 per cent cropped/50 per cent fallow pattern prevailing in 1970-72.

Irrigated land increased from about 14 per cent of total cropped land in 1970 to 20 per cent, or 625,000 hectares, in 1972. But since then it has decreased to about 13 per cent, or 547,000 hectares, in 1976. This decline was caused primarily by a rise in irrigated land salinity and inadequate drainage. Of the total irrigated land, 79 per cent, or 432,000 hectares, is irrigated by pumps with about half the pumps operating from wells and half from rivers.

The major crops produced on the 3.7 million hectares of rainfed lands are wheat, barley and pulses (chiefly lentils and chickpeas). The bulk of these crops are produced on lands located across the northern part of the country. Because of substantial variations in the quantity and timing of rainfall, production has fluctuated from year to year for these crops, as well as other rainfed crops such as olives, grapes, figs, summer vegetables, and range and crop residues for sheep grazing. The western zone of the country has the highest average rainfall and a major part of these lands are used for fruit and vegetable production. Cotton is the major non-food crop, and it normally utilizes about one-third of the half million hectares of irrigated land. The chief cotton producing regions are in the Euphrates Valley and the northeast. Animal production is concentrated very largely on sheep raising, which production has been expanding rapidly and is nearly sufficient to meet domestic needs. Dairy production is expanding more slowly and domestic requirements must be met through large imports of dairy products. Growth rates for area production and yield of major commodities are shown in Appendix B, Table 6.

3) Forestry

Forests cover only 2.5 per cent of Syria's total land area, and essentially all of this forest land is located in the mountains running north and south parallel to the Mediterranean Sea. In 1976, the Statistical Abstract reported 457,000 hectares of Syria's 18.5 million hectares classified as forest. (See Appendix B, Table 5.) Of the 457,000 hectares, 248,000 hectares, or 55.6 per cent, were located in Homs, Hama and Aleppo Mohafazats, and 160,000 hectares, or 35.9 per cent, were in Tartous, Lattakia and Idlib Mohafazats.

In view of the limited area of forest land, the production of timber is relatively small. For the three Mohafazats of Lattakia, Tartous and Idlib, which include essentially all of the zones of influence of the three highways, total timber production is estimated by the Ministry of Agriculture's

Forestry Department at about 10,000 metric tons per year. Of this total, about 6,000 tons is selectively cut from Government owned forests and is transported to plywood factories in Lattakia and Damascus. About 4,000 tons of timber is produced on privately owned land within the zones. This timber is primarily in the form of poles which are transported to Aleppo for use in building construction.

4) Fisheries

Total tonnage of fish caught in the Mediterranean Sea by Syrian fishermen averages about 1,500 metric tons per year, according to the General Organization for Fisheries. Purchase of three additional modern fishing ships from France is expected to increase the annual catch by about 500 tons.

In addition to sea fishing, plans are underway for the cultivation of fish in lakes and man-made fish ponds. Largest of the inland fisheries will be Lake Assad (on the Euphrates River) which is about 80 kms. long and 8 kms. wide. A feasibility study on use of this lake for fish production is being undertaken with assistance from West Germany.

Three ponds for commercial production of fish are being developed within the zones of influence of the three highways. Two are located along the Sinn River near Jebleh in Lattakia Mohafazat; one of these will produce annually up to 330 tons of carp and similar fish, and the other will produce annually up to 250 tons of trout. West of Idlib in the Rouj area, a fish pond for cultivation of carp will produce up to 360 tons per year. In addition, limited quantities of fish are caught in rivers and streams, but no tonnage data are available.

Since the total catch of fish from all sources in the three zones of influence is only about 3,000 tons per year, this tonnage was omitted from the marketable surplus calculated for the agricultural sector.

5) Land Tenure

Before 1958 about 50 percent of the country's cultivated land was owned by 0.6 percent of the rural population. Though there had been earlier concern with such maldistribution of land, it was the implementation of agrarian reform laws and related legislation during the 1960's which brought about major changes in land tenure. These changes were nationwide, but especially affected the Mohafazats of Aleppo, Hama, Homs, Idlib and Raqqa.[1/]

1/ Dr. Yahia Bakour, Supporting policies and services for agrarian reform programme in Syria, Agricultural Engineers Syndicate, Damascus, April 1978.

Up to 1975 more than 1.4 million hectares of agricultural lands had been expropriated under agrarian reform laws, and of this total, about 466,100 hectares were distributed to farmers and another 254,000 hectares were allocated to cooperatives and various Ministries.

Other lands were unsuitable for distribution (covered by Lake Assad, etc.). (See Appendix B, Table 7.) It is reported that the expropriated land, which had previously been owned by 4,085 landlords, was distributed to 52,504 farm families.

In addition to the agrarian reform laws, other legislation in 1968 brought about the distribution of 379,328 hectares of State-owned lands to 32,120 farm families. Also, 1969 legislation resulted in the allocation of 52,788 hectares of State-owned lands in Al Ghab, Al Rouj, Tar Al Ala and Al Asharneh regions. This land, mostly irrigated, was distributed to 17,614 farm families.

As a consequence of the land reform programs, the proportion of small and medium-sized farms increased at the expense of large land holdings as follows:

		Percent of all Farms	
Farm size (ha.)	Class	Before Reform	After Reform
Less than 100	Small	13	35
10 to 100	Medium	38	52
More than 100	Large	49	13

According to the Agricultural Census of 1970-71, the average size of agricultural land holdings in the country was 10.3 hectares. (See Appendix B, Table 8.) Farm size, however, varied by type of agricultural area and ranged from an average of 2.0 hectares in Lattakia Mohafazat to an average of 25.9 hectares in Al Hasakeb Mohafazat.

Ownership of agricultural lands in 1976 was primarily in private hands. Of the cultivable area totalling 5.9 million hectares, 76.7 percent was privately held, while 22.4 percent was in the cooperative sector and 0.9 percent in the public sector. (See Appendix B, Table 9.)

6) Supporting Services

a) Cooperatives. The formation of cooperative associations has been required of farmers who received land under agrarian reform legislation, and accordingly the number of associations and members increased substantially over the past decade and a half. This growth is summarized as follows:[1/]

1/ Ibid., Dr. Yahia Bakour. See also Appendix B, Table 10.

Year	Cooperative Associations	Cooperative Members
1960	277	17,925
1970	1,598	103,689
1976	3,413	256,036

Until 1970, in addition to the cooperatives formed with agrarian reform participants, there were other cooperatives assisted by the then Ministry of Agriculture. However, following the merger of the Ministry of Agrarian Reform with the Ministry of Agriculture in 1968, all types of cooperatives were organized at various levels (village, Mantika and Mohafazat) under one central cooperative union. The government technical staffs supervising and assisting the cooperatives were also combined. In 1974 further legislation combined the Central Cooperative Union with the General Peasant's Union.

Over 90 percent of the cooperatives are of the multipurpose type, and the balance are specialized associations relating to sheep, cattle, poultry and fisheries. The multipurpose cooperatives can engage in wide-ranging activities, but the majority of them emphasize one or more of the following: obtaining credit for members from the Agricultural Cooperative Bank, marketing members' agricultural crops and products, and acquiring and operating modern agricultural machinery.

Legislation on cooperatives sets out an essential role of farmer-members in the operation of the associations. However, technical staff are also provided to direct and assist with the management and activities of the cooperatives at all levels of organization.

In addition to the development of cooperatives, 20 State-farms have been established. Of these, 13 are for production of crops, chiefly cereals, and 7 are dairy farms for milk production. (See Appendix B, Tables 11 and 12.) In 1976, output from all these farms amounted to about one percent each of national production of cereal, legumes and milk.

b) Credit. The Agricultural Cooperative Bank extends credit to farmers and agricultural cooperatives through a nation-wide network of 53 branch offices. Though the agrarian reform administration previously had extended these types to credits to farmers cooperatives in its program, since 1966 the Agricultural Cooperative Bank has also handled these functions.

At the end of 1976, the Agricultural Cooperative Bank had outstanding loans of SL 458.1 million. This compares with SL 209.0 million at the end of 1970. (See Appendix B, Table 13.) Substantial amounts of credit

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are also extended to the agricultural sector through specialized commercial banks. (See Appendix B, Table 14.)

The Agricultural Cooperative Bank provides loans in cash as well as in-kind loans in the form of fertilizer, seeds, etc. With regard to repayment periods, the loans are extended as follows:

Short-term. Credit for one-year periods are made to farmers to finance purchase of production requirements such as fertilizer, seed, insecticides, land preparation, animal feeds, etc. Interest rates for individuals are 5.5 percent per year, although where the loan exceeds SL 50,000, the rate is 7.5 percent. Short-term loans are also extended to cooperatives for marketing and storage of agricultural products. The interest rate on these loans is 4 percent per year.

Medium-term. Loans for five-year periods are made to farmers chiefly to finance mechanization of agricultural production (tractors and other equipment), irrigation works and wells, fish ponds, and purchase of livestock. The interest rate for individuals on these loans is 3 percent per year, although for loans over SL 50,000 the rate is 6 percent. Cooperative associations use medium-term loans to finance the purchase of marketing equipment, fishing boats, etc. Interest rates for cooperatives are 2 percent per year for these loans.

Long-term. Credits for 10-year periods are used by farmers chiefly for establishment of orchards, and irrigation systems, as well as for purchase of machinery, dairy cattle, etc. The interest rate for individuals is 3 percent per year for the first 5 years, and 5.5 percent thereafter. For loans over SL 50,000 the rates are 6 and 7.5 percent. Long-term loans are used by cooperatives for marketing facilities such as storage and refrigeration units, for machinery maintenance and storage buildings, etc. Interest rates for cooperatives on long-term loans are 2 percent per year for the first 5 years and 4 percent per year thereafter.

c) Extension. Following the merger of the Ministry of Agriculture and the Ministry of Agrarian Reform in 1968, agricultural extension staff, as well as personnel supervising cooperative and state-farm operations, were brought into the same Ministry. Since that time, however, the role of extension has been given low priority, with the Directorate of Agricultural Extension being abolished and its activities placed in a section of another Directorate. Various extension activities were assigned to cooperative supervisors, and the needs for specialized extension services were to be met by the various technical departments themselves rather than by extension specialists. Generally, extension units operate at the local level with a university graduate

(agricultural engineer) in charge. He is assisted by several technicians who are secondary school graduates and who deal with insecticide spraying, irrigation practices, etc.

In early 1977, following a national seminar on agricultural problems (held in Damascus), a special committee formed by the Prime Minister recommended the strengthening of extension services and re-establishment of a Directorate of Extension. At the same time, the Agricultural Engineers Syndicate was instrumental in having extension training at University level expanded from one course of one-half hour per week for one semester increased to four hours per week for two semesters.

7) Marketing and Pricing

a) Product Marketing. The role of the agricultural marketing system has increased in importance as various farming regions have become more specialized with regard to the commodities they produce, such as wheat, barley and cotton in the northeast, fruits and vegetables in the west, and cereals in the south. With the increased specialized production of crops for market, and concern for the weak position of farmers vis-a-vis marketing agencies, the government after 1963 decided to develop the marketing system through the use of both cooperative and governmental organizations.[1/]

As noted above, the agrarian reform program included encouragement and establishment of cooperative associations among farmers who were participating in the land distribution. The program also required that farmers market their agricultural production from these lands through the cooperatives. Currently the marketing functions being carried out by these associations include the assembly of members' production at the cooperatives' centers, the transport of these products to various market outlets, and the sale of the products to the buyers offering the best prices. In 1976, tonnages of crops marketed cooperatively were reported as follows: cotton - 100,496; wheat - 30,863; sugar-beets - 137,203; grapes - 131,888; peanuts - 7,883; watermelons - 155,087; tomatoes - 23,706; and potatoes - 1,822. Also cooperatively marketed were some milk, garlic, barley and bran. Sheep fattening associations are also marketing animals cooperatively.[2/]

State trading companies or other specialized official agencies handle practically all of the country's agricultural imports and exports, and

1/ Ibid., Dr. Yahia Bakour.

2/ Ibid., Dr. Yahia Bakour.

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are also involved in the processing of certain commodities as well as in domestic marketing. Domestically produced commodities are purchased by these companies both from cooperative associations and from individual farmers. Among the state organizations dealing with agricultural products are the following:

General Organization for Cereal Processing and Trade

The Cotton Marketing Organization

General Organization for Tobacco

General Organization for Food Industries

General Organization for Fodder

General Organization for Marketing and Processing Peanuts

General Organization for Fruits and Vegetables

b) Input Marketing. The marketing of input supplies required for agricultural production is also handled by state companies and official agencies. Fertilizers and agricultural chemicals are imported through the Foreign Trade Organization for Chemicals and Foodstuffs, (TAFCO). (See Appendix B, Table 15.) Domestic manufacture of fertilizer is presently carried out at the country's only plant at Homs which produces synthetic nitrogen (azotic) fertilizer. With a designed capacity of 150,000 tons, this plant produced 81,128 MT in 1976. (See Appendix B, Table 15.) A second nitrogen fertilizer and urea plant is presently under construction, as well as a phosphate plant which will convert local rock phosphate into triple superphosphate fertilizer. Utilization of fertilizer has increased rapidly in recent years, rising from 28,900 MT in 1969-70 to 70,500 MT in 1975-76. (See Appendix B, Table 16.)

Through the Ministry of Agriculture and Agrarian Reform, high yielding varieties of wheat have been introduced, as well as a new variety of cotton (Aleppo I) adapted to local climatic conditions. The Ministry also produces fruit tree seedlings and distributes them at nominal cost. In addition, the government imports and produces improved breeds of dairy cattle and other livestock.

To provide for increased use of mechanized equipment, the government has supplied machinery and equipment to cooperative associations, as well as to individual farmers, with credits for their purchase supplied through the Agricultural Cooperative Bank. The government also established an agricultural machinery factory in 1969 which is now producing 20 tractors daily. In addition, three stations for maintenance and repair of machinery have been set up, as well as some mobile workshops. Utilization of various items of

mechanized equipment have expanded rapidly in recent years. From 1970 to 1976, numbers of threshers have tripled, while numbers of tractors, modern plows, disk harrows and pulverizers have doubled. (See Appendix B, Table 17.)

c) Pricing. Prices at which government agencies purchase crops from farmers have been set by the Ministry of Supply since the end of the 1950's. In 1976, however, the function was turned over to the Supreme Agricultural Council (SAC). Currently the SAC meets to consider the agricultural production plans for the coming year, approves goals for crop and livestock production, and sets acreage allotments for major crops. The SAC also sets rices for input supplies, such as seed, fertilizer and some animal feeds, as well as support prices for the major crops. The announcements of these support levels set the prices at which state marketing agencies are obligated to purchase from producers. Other public sector agencies also meet their needs at the support price level. See Appendix B, Table 18, which shows the upward trend in official producer prices from 1968 through 1977.

There are also controls on egg and broiler prices, as well as on milk, slaughter prices for sheep, and some meat prices. These are generally administered by the Ministry of Supply and Internal Trade and usually prevail for those products sold by state farms and state operated processing facilities. The bulk of these items, however, are handled by private traders who market them at prices dependent on supply and demand conditions.

While consideration is given to various factors that affect prices when the support prices are being set, the 1977 agricultural seminar mentioned above recommended that it be obligatory that more detailed attention be made to such factors as production costs, supplies of the product and of competing products, quality variations, prices in foreign markets, etc.

Marketing margins and ceilings on wholesale and consumer prices for agricultural products are set weekly by price committees in each Mohafazat. The committees have representatives from the Ministry of Supply, the Ministry of Agriculture, the General Organization for Fruits and Vegetables, the Farmers' Union and the Baath Party. In addition, a few staple commodities -- rice, sugar and vegetable oil -- have two prices. One price is for amounts consumers are permitted to buy with ration cards; the other, higher price, applies to quantities purchased above these rations. Prices of flour and bread, as well as rice, are set at a uniform price throughout the country.

8) Agricultural Development Strategy. Agricultural sector goals set forth in the Fourth Five-Year Plan for national development (1976-80) can be stated as follows:

a) To achieve a real annual average growth rate in agricultural

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GDP between 8 and 10 percent;

b) To meet consumer needs for food, and achieve self-sufficiency in important commodities;

c) To provide raw materials for domestic industry;

d) To achieve a surplus for export; and

e) To raise nutritional levels of the population.

The main elements of the agricultural development strategy to be followed in reaching these goals include:

a) Extension of irrigated areas in order to increase the volume and stability of production;

b) Intensification of land use;

c) Complementary crop and livestock production;

d) Emphasis on investments in directly productive projects; and

e) Selection of productive units with the largest volume.

Funds allocated over the 5 year period for the agricultural sector total SL 12.9 billion ($3.3 billion), or 23.8 percent of the Plan's 5 year total of SL 54.2 billion ($13.9 billion). Public investment in the agricultural sector totals SL 10.4 billion, allocated as follows: Euphrates - SL 7.4 billion, Irrigation and Land Reclamation - SL 1.1 billion, and Agriculture - SL 1.9 billion.

In addition, investments from private, cooperative and mixed sources are set at SL 2.5 billion.

Major agricultural production targets for the Fourth Plan are as follows (in 000MT):

Commodity	Base Year 1975	Target Year 1980	Annual Average Growth Rate %
Cereals	2,222	3,388	9
Legumes for food	140	435	25
Oil Crops	34	157	36
Sugar beets	198	2,000	60
Cotton	392	404	1
Potatoes	144	395	22
Tomatoes	363	475	6
Onions	117	189	10
Fodder legumes	44	151	28
Green forages	371	7,911	85
Fruit	675	1,133	11

Meat and fish	93	194	16
Milk	567	960	11
Eggs (millions)	600	1,500	20

d. Industry

1) Scope of the Sector

Syria's industrial activities are carried on by approximately 39,500 enterprises of which 97 percent are private and 3 percent public. (See Table B-1.) Most of the private sector firms, however, are small with a range of one to four workers, while the public sector firms are all in the "10 workers and over" category.1/

Between 1974 and 1976, the number of industrial enterprises in Syria increased by about 13 percent with most of the actual increase attributable to the manufacturing sector. (Table B-1.)

In 1976, the industrial sector (including manufacturing, mining and quarrying, building and construction, and electricity, gas and water) contributed 24.7 percent of the country's Gross Domestic Product (in constant market prices of 1963) compared to 22.6 percent in 1970.2/

Although fully comparable data are not available to indicate the growth of the public versus the private sectors for these years, data for 1973 and 1975 for the industrial sector (excluding building and construction) show that the relative growth has all occurred with the public sector as indicated below:

Industrial Sector as Percentage of the GDP 3/

	1973	1975
Public	10.7	17.3
Private	9.9	6.0
Total	20.6	23.3

1/ Statistical Abstract, 1972, p. 148.

2/ In constant market prices of 1963, Statistical Abstract, 1977, p. 735.

3/ Based upon GDP at current market prices. Computed from data in the Statistical Abstract, 1977, pp. 265 and 751.

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TABLE B-1

OWNERSHIP OF INDUSTRIAL ENTERPRISES, SYRIA, 1974 AND 1976

Type	No. of Enterprises 1974	1976
A. Manufacturing		
Public	281	380
Private	33,093	37,518
Sub-total	33,374	37,898
B. Extractive (mining and quarrying)		
Public	17	31
Private	150	152
Sub-total	167	183
C. Building and Construction		
Public	90	97
Private	824	669
Sub-total	914	766
D. Electricity, Gas and Water		
Public	661	661
Private	1	1
Sub-total	662	662
Grand Total	35,117	39,509
Public	1,049	1,169
Private	34,068	38,340

Source: Statistical Abstract, 1977, p. 715.

Growth of industrial production by type of industry shows that extractive (mining, quarrying, and petroleum) has had the largest relative growth since 1970 followed in turn by building and construction, electricity and water, and manufacturing (Table B-2).

Nationalization of key or strategic industries in such areas as food, chemicals, textiles and engineering occurred in the mid 1960's. The Government serves as the sole distributor for such products as cement, salt, sugar and tobacco.

The largest concentration of private industrial enterprises are in the Mohafazats of Damascus and Aleppo. These two areas account for about 90 percent of private investment in the industrial sector, 60 percent of the private industrial establishments, and 80 percent of the private industrial labor force.[1/]

The Syrian Government provides certain tax benefits to industries. The major benefits are:

a) Exemption from payment of the profits tax during the first three years of operation (under specific conditions);

b) Exemption from the profits tax of 10% of net profits of industrial enterprises to finance expansion;

c) Exemption of certain small businessmen from the profits tax;

d) Exemption of payment of customs duties on imported capital goods and equipment required for industrial (including tourism) development.

1/ Antoine Guine, "Situation des Industries Mecaniques in Syria", in Syria & Monde Arabe, September-October, 1977, p. 11.

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TABLE B-2

INDICES OF INDUSTRIAL PRODUCTION, SYRIA, 1970-1976
(1970=100)

Year	Manufacturing	Extractive	Building and Construction 1/	Electricity and Water
1971	107	119	129	109
1972	114	155	129	126
1973	120	186	126	121
1974	132	294	151	138
1975	143	413	169	169
1976	168	345	296	186

Source: Statistical Abstract, 1977, p. 246, 731 and 796.

1/ Converted from a 1963 base.

Low labor productivity and shortage of skilled labor have been important impediments to Syria's industrial growth. The Government is stressing health, housing and education programs to improve productivity. Specific training schools have been established to train workers in such industries as metal working, earthen ware and glass, tanning, cement production, iron and steel, electric motors and aluminum handling. The Government is also attempting to encourage technology transfer from abroad through joint venture and licensing agreements with foreign industrial firms. Accelerated development of free customs zones is an additional incentive designed to encourage investment in the manufacturing sector. Free zones are to be enlarged or established at Damascus, the Damascus airport, Adra, Aleppo, Tartous, and Lattakia.

The Fourth Five-Year Plan (1976-1980) calls for an annual growth rate of 15.4 percent [illegible] the industry sector (excluding building and construction). The previous annual growth rates for this sector were 5.3 percent for 1960-64; 8.3 percent for 1965-69; 12.8 percent for 1970-74; and 6.4 percent for 1974-76 (a depressed period in the Syrian economy). A comparison of planned investments in the industrial sectors in the various Five-Year Plans is shown in Table B-3.

2) Manufacturing

The manufacturing industries accounted for about 83 percent of industrial production (excluding building and construction) based upon value added in 1970 according to data from the Central Bureau of Statistics (see Table B-4). Major components of the manufacturing industry are foods, textiles, chemicals, wood and non-metallic minerals and their products. These five groups represented about 78 percent of all manufacturing in 1970. Among the groups with the greatest relative increases in production between 1970 and 1976 were: basic metals and products, fabricated metal and machinery, and paper and products. (Table B-4.)

3) Extractive Industries

Syria is endowed with a variety of minerals utilized for energy generation, construction and building. (See Table B-5.)

a) Petroleum refining is being increased. The refinery at Homs is being expanded to 4.6 million tons annually, from 2.7 million tons in 1977. A new refinery is under construction at Banyas, with capacity of 3 million tons annually. This will operate with 50 percent high-sulfur crude from local Syrian production, and 50 percent low-sulfur imported crude.

In 1974, the Homs refinery produced 20,000 metric tons of naphtha, 283,000 tons of motor spirit, 207,000 tons of kerosene, 517,000 tons of distillate fuels, 609,000 tons of residual fuel oils, and 204,000 tons of other petroleum products. Despite this production, Syria imported 975,253 metric tons of refined petroleum products in 1974.

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TABLE B-3

PLANNED INVESTMENTS IN THE INDUSTRIAL SECTOR IN SUCCESSIVE FIVE-YEAR PLANS, SYRIA (MILLION SL)

Sub-sector	First Plan 1960-65 1/		Second Plan 1966-70		Third Plan 1971-75		Fourth Plan 1976-80	
	SL	%	SL	%	SL	%	SL	%
Manufacturing and mining)	509	18.7	398	8.0	1,843	22.7	11,300	20.8
Power and fuel)			612	12.4	1,428	17.6	8,000	14.8
Housing and utilities	260	9.5	1,278	25.8	605	7.5	8,100	14.9
Sub-sector total	769	28.2	2,288	46.2	3,876	47.8	27,400	50.5
Plan Total	2,720	100.0	4,955	100.0	8,120	100.0	54,200	100.0

Source: Industrial Development in the Syrian Arab Republic, A. S. Salem, UNDP Senior Industrial Advisor, July 1976.

1/ Period for First Five-Year Plan extended to 1965.

TABLE B-4

INDICES OF MANUFACTURING, SYRIA, 1971, 1975 AND 1976
(1970=100)

Type of manufacturing	Weights 1/	1971	1975	1976
Food, beverages and tobacco	26.42	106	144	176
Textiles and products	36.02	106	128	151
Wood and products	5.01	105	130	141
Paper and products	1.18	112	167	203
Chemicals and products	5.51	118	145	157
Non-metallic mineral products	4.86	99	118	131
Basic metals and products	0.11	130	285	327
Fabricated metal and machinery	3.40	114	246	288
Other manufactures	0.19	-	137	151
Total manufacturing	82.70	107	143	168

Source: Statistical Abstracts, 1973 and 1977.

1/ Based on 1970 value added. Comparable weights of 10.40 for extractive industry and 6.90 for electricity and water make up the 100.0.

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TABLE B-5

PRODUCTION OF PRINCIPAL EXTRACTIVE COMMODITIES, SYRIA, 1972, 1975 AND 1976

Commodity	Unit	1972	1975	1976
Crude petroleum	000 MT	5,862	9,572	10,039
Phosphate rock	000 MT	112	857	511
Salt	000 MT	50	34	54
Natural asphalt	000 MT	21	31	125
Sand and gravel	000 M^3	1,693	3,265	4,341
Gypsum	000 M^3	20	39	27
Stone	000M^3	396	1,009	748
Semi-marble stone	M^3	5,356	50,966	54,522

Source: Statistical Abstract, 1977, p. 252.

The Fourth Five-Year Plan calls for production of 52 million cubic meters of crude oil by 1980, and expansion of refining capacity to 11 million tons yearly.

b) Phosphate rock is mined in the Kniefess area, from deposits with an estimated 100 million tons of reserves. Output of 511,000 metric tons of raw rock (washed to remove excess chloride) was reached in 1976. Output is scheduled to ultimately reach 2 million tons by expansion of present facilities. In 1978, new facilities at Homs will permit initial production of triple superphosphate (TSP) by acid treatment of raw rock phosphate. TSP is the form of phosphate fertilizer suited for use on Syrian alkaline soils. The scheduled output of TSP is scheduled to reach 500,000 metric tons in a few years. Superphosphate may be produced both at Deir ez-zor and at Homs. Additional storage facilities for phosphate are under construction at Banyas.

Natural asphalt deposits occur in Lattakia Mohafazat, some 30 kilometers east of Lattakia, and also in Deir-ez-zor, at Al Beshri. The deposit at Al Beshri is providing 60 percent of current production.

Building materials are abundantly quarried in various parts of Syria for use in road building and other civil works, houses and in the manufacture of cement. These materials include sand, gravel, rock, and crushed rock.

4) Building and Construction

Indices of building and construction, using 1970 as the base year, rose to 129 percent in 1972, 169 in 1975, and to 296 in 1976. 1/ The strong upward surge resulted from major government efforts to provide housing, schools, and health services to accommodate its rapidly increasing population. After remaining virtually unchanged from 1970 to 1975, building and construction advanced from 2.9 percent of Gross Domestic Product in 1975, to 4.7 percent in 1976, and has continued to rise thereafter.

Syria has an abundance of construction materials, particularly natural asphalt, sand and gravel, stone, gypsum, and semi-marblestone. Cement production is being increased by construction of new factories and round iron bars are now being produced. The production, in the years 1970, 1975, and 1976, of these building and construction materials is reported in Table B-6.

The heavy demand for building materials has been a major factor in the rising wholesale price trend in cost of construction. The index (based upon 1962 as 100) rose to 164 by 1972, and reached 307 in 1976.

1/ Computed from the Statistical Abstract, 1977, pp. 734-735.

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Except for small houses and wayside stands, mainly in rural areas, all building is licensed by the Government. Both residential and non-residential construction increased at least three-fold between 1965 and 1976 (Table B-7). This upsurge in construction is continuing in 1978. Except for a portion of the round iron bars, aluminum frames, and a portion of the cement that is imported, basic construction is principally from locally available materials.

5) Electricity, Gas and Water

In 1976, the electricity, gas and water industrial public sector employed about 10,200 people, of which about 70 percent were in electricity and gas, and the balance in water supply. 1/ This sector of the industry is almost exclusively public. There is only one private firm in the country. (See Table B-1.)

Earnings of this industrial sector increased about 2.5 times over a five-year period, from about SL 31 million in 1971 to SL 78 million in 1976. 2/ During the same period, production of electricity, gas and water increased by 71 percent. (Table B -2.)

Electric power output in Syria has grown from 1,223 million kilowatts in 1972 to 1,732 million kilowatts in 1976, equivalent to a compound annual growth rate of 9.1 percent. Output is to be expanded under the Fourth Five-Year Plan (1976-1980) to achieve equilibrium between demand and supply. Thus, new generating plants with a capacity of 1,442 megawatts are to be built; hydraulic and natural gas resources are to be developed; and other sources of energy are to be investigated. The proportion of users of electric power is to be raised from 47 percent of the population in 1975 to 65 percent in 1980. This will raise per capita consumption of electricity from 224 KWH in 1975 to 779 KWH in 1980 if the development goals are met.

6) Marketing and Credit

a) Marketing

Syrian industry is characterized by numerous small factories, most of which sell only in local markets. The few plants that have wider markets (e.g., electric motor factory in Lattakia; silk manufacturers in Tartous) utilize wholesale distributors to place their products in retail outlets. Any export sales require prior permission of a government agency, such as the Ministry of Internal Trade, which attempts to assure adequate domestic availability of a product before approving an application for an export license. Import licenses for competitive products also require government approval.

Producers utilize newspaper, and other advertising to promote

1/ Statistical Abstract, 1977, P.259.

2/ Statistical Abstract, 1977, p. 258.

TABLE B-6

PRODUCTION OF BUILDING AND CONSTRUCTION MATERIALS, SYRIA, 1970 · 1975 AND 1976 (000 MT) 1/

Type of material	1970	1975	1976
Cement	964	994	1,110
Round iron bars	-	85	98
Natural asphalt	24	31	125
Sand and gravel	2,419	4,666	6,203
Stone	739	2,634	1,953
Gypsum	16	44	30
Semi-marble stone	11	137	148

Source: Statistical Abstract, 1973, pp. 221 and 225;
Statistical Abstract, 1977, pp. 252 and 807.

1/ Conversion factors from cubic meters to metric tons:

Sand and gravel: 1 cubic meter = 1.429 MT
Stone: 1 cubic meter limestone = 2.611 MT
Gypsum: 1 cubic meter = 1.1213 MT
Semi-marble stone: 1 cubic meter = 2.6911 MT

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TABLE B-7

LICENSED BUILDING CONSTRUCTION, SYRIA, 1965-76
(000 SQUARE METERS)

Type	1965	1970	1975	1976
A. Residential 1/	1,014	1,826	2,799	3,296
B. Non-residential				
Commercial 2/	69	124	231	314
Industrial	4	28	93	55
Other 3/	-	6	85	89

Source: Statistical Abstract, 1977, p.272.

1/ Includes modern residential buildings, wooden buildings, and the residential part of commercial-residential buildings.

2/ Includes commercial buildings and the commercial part of residential buildings.

3/ Includes offices, shops, and warehouses.

sales of their products; and foreign specialists are brought in from time to time to advise on improving output and quality. Sales of government-produced commodities are regulated by State agencies, which attempt to assure adequacy of supplies around the country. Few private factories have other than local markets.

b) Credit Facilities

The Syrian banking system in State-owned. It comprises the Central Bank of Syria and five "Specialized Banks": The Commercial Bank of Syria; the Industrial Bank; the Agricultural Cooperative Bank; the Real Estate Bank; and the Popular Credit Bank. As of January 1, 1977, there were 10 branches of the Central Bank and 127 branches of the Specialized Banks in Syria. Their distribution, and the cities of location in the Mohafazats of Tartous, Lattakia, and Idlib, are shown in Appendix B, Table 19. The Fourth Five-Year Plan (1976-1980) contemplated the creation of a special development bank to finance the Plan and secure financing from various sources. However, as of April 30, 1978, this bank had not been established. The leading credit institution in Syria is the Commercial Bank of Syria. It lends not only for commercial transactions but for agricultural and industrial needs as well.

Credit, for a period of up to one year, is available to both public sector and private sector producers, but preference is given to those in the public sector. Moreover, the latter are assisted by government subsidies to a large extent. The main sources of credit are the Commercial Bank of Syria, the Industrial Bank, and the Real Estate Bank. Private borrowers must have acceptable balance sheets to be eligible for credit.

Financial transactions in Syria are mainly on a cash basis, although there has been increasing use of checking accounts in the past 25 years. Currency in circulation accounted for 76 percent of the money supply in 1963 but for only 62 percent in 1976. Thus, demand deposits rose from 14 percent of the money supply in 1963 to 38 percent in 1976. The structure of specialized banks' interest rates is shown in Appendix B, Table 20.

e. Tourism

1) Importance of the Industry

The tourist industry is an important element in the Syrian economy, both from the viewpoint of its contribution to the gross domestic product (GDP) and to the country's foreign exchange earnings. Syria's balance of payments

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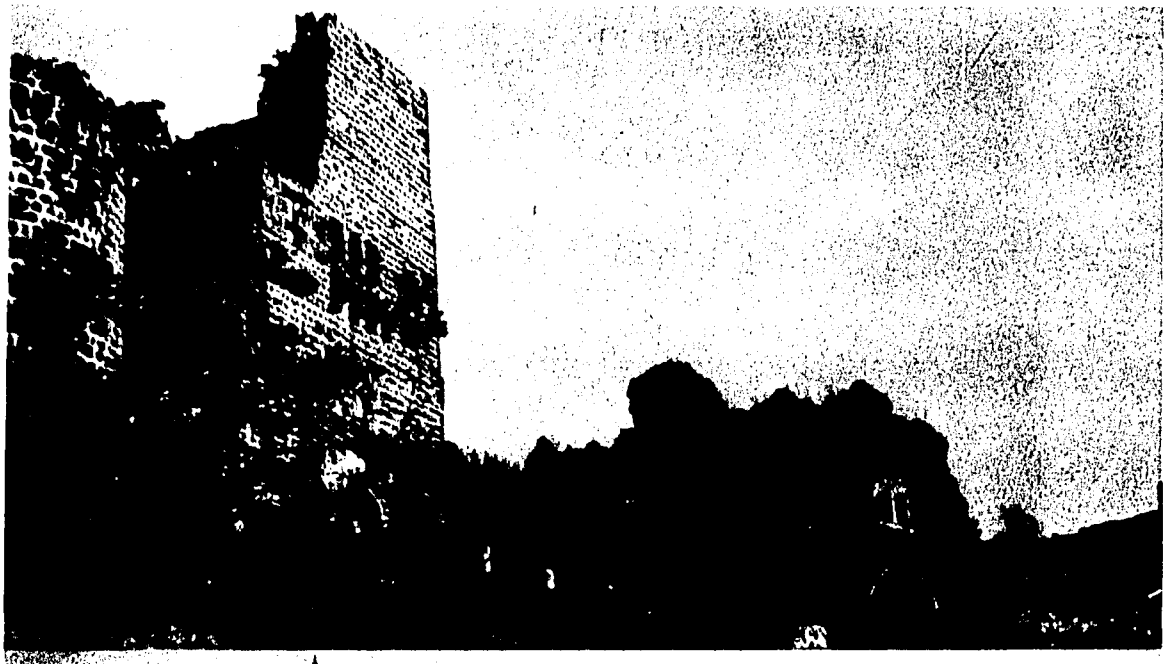

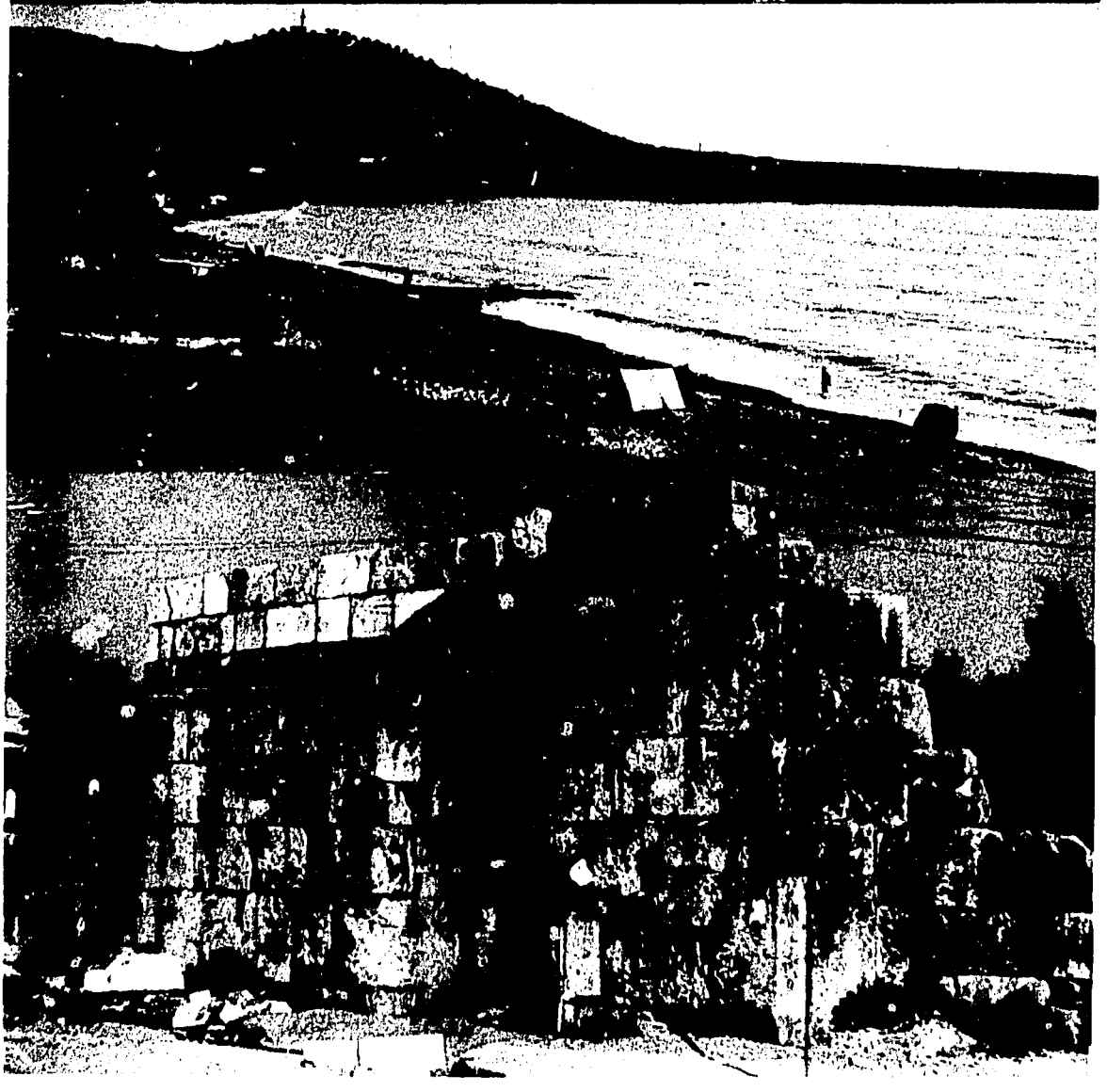

THREE OF THE MANY ATTRACTIONS OF THE TOURIST
INDUSTRY ALONG THE TARTOUS - LATTAKIA CORRIDOR

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statements show foreign exchange earnings from travel and tourism in recent years to have been as follows (in millions of Syrian pounds): 1/

1970 - 100.1	1974 - 319.8
1971 - 108.7	1975 - 344.1
1972 - 206.8	1976 - 388.5
1973 - 216.0	

2) Tourism Flows

In 1976, foreign arrivals totaled about 1,390,000 of which 57 percent or 793,400 were tourists. (See Table B-8.) The percentage of tourists was about the same for Arab and non-Arab visiters, but the Arab visitors outnumbered the non-Arabs by a ratio of about three to one.

The number of nights spent in Syria by foreign tourists totaled about 1.6 million in 1976, with the average stay per tourist equaling two nights. (Table B-8.) In contrast, nights spent by Syrian tourists totaled nearly 2.0 million with the average per tourist at 1.6 nights.

The peak season for domestic tourism is June-September, while the peak months for foreign tourists are July to October. The cooler weather along the Mediterranean coast in summer, and the climate at higher altitudes (500 to 1500 meters) in the mountains, are pleasant for travelers. Although the winter season (October-March) is the season of rains in the western portions of the country, the cooler climate in winter is far milder than for most European countries. Moderation of winter temperatures by well heated lodgings may be effective in attracting foreign tourists in winter, particularly in interior regions. The seasonality of tourism is currently a limiting factor in exploitation of national tourism.

The flow of tourists that are lodged in resident hotels is shown in Table B-9. Foreign tourism increased substantially between 1970 and 1976-1977. The tourist-nights spent in hotels also increased greatly. However, the numbers of Syrian tourists resident in hotels showed little change for the same years, and the number of tourist-nights by Syrians declined somewhat.

The yearly changes in patronage of different classes of hotel accommodations as presented in Table B-10 shows that Arab patronage has generally increased between 1965 and 1976. By contrast, the non-Arab patronage declined sharply in 1970, and then recovered to much higher levels in 1976.

1/ Central Bank of Syria, Quarterly Bulletin, 1976

TABLE B-8

CHARACTERISTICS OF TOURISM, SYRIA, 1976

Type of Tourist	Arrivals	Thousands of Tourists	Tourist Nights	Average No. Nights Per Tourist
Foreign				
Arab	1,076	610	1,193	1.95
Non-Arab	314	183	393	2.15
Sub-total	1,390	793	1,586	2.00
Syrian	-	1,239	1,959	1.58
Total	1,390	2,032	3,545	1.75

Source: Statistical Abstract, 1977, p. 561, 568-573

TABLE B-9

TRENDS IN TOURISM, SYRIA, 1970-1977 (THOUSANDS)

	1970	1976	1977
Tourist Residents in Hotels:			
Foreign			
Arab	331	610	454
Non-Arab	78	183	227
Sub-total	409	793	681
Syrian	1,323	1,239	1,237
Total	1,732	2,032	1,918
Tourist Nights:			
Foreign			
Arab	653	1,193	868
Non-Arab	186	393	484
Sub-total	839	1,586	1,352
Syrian	2,224	1,959	1,827
Total	3,063	3,545	3,179

Source: Tourism Statistics, 1972-1976, Ministry of Tourism

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TABLE B-10

PATRONAGE OF DIFFERENT HOTEL ACCOMMODATIONS BY FOREIGN TOURISTS, SYRIA, 1965, 1970 AND 1976 (THOUSANDS)

Type of Accommodations	Arab			Non-Arab			Total		
	1965	1970	1976	1965	1970	1976	1965	1970	1976
Deluxe hotels	10	29	20	71	45	51	81	74	71
First class hotels	87	145	111	91	73	98	178	218	209
Second class	70	123	324	37	24	118	107	147	442
Third class	225	311	730	38	39	121	263	350	851
Hostels	31	44	7	6	5	6	37	49	13
Total	423	652	1,192	243	186	394	666	838	1,586

Source: Statistical Abstract, 1977, pp. 576, 577.

The total usage was greatest for third-class accommodations (58.6%), but was substantial for second-class (19.4%), and for first-class hotels (10.8%).

3) Planned Developments

In 1974, a French firm completed a tourism study for the Ministry of Tourism, for Syria's coastal area, which is particularly rich in antiquities. It projected a tourist flow of 3.5 million by 1990, of which 2.7 million were presumed to be foreigners, and the remainder Syrians. The number of tourist-nights was projected at 4.2 million. Such tourist activity should produce 82,000 additional jobs, and earn foreign exchange amounting to 620 million Syrian pounds.

The recommendations of the French study have been incorporated into the Fourth Five-Year Plan and are being implemented by the Ministry of Tourism.

Syria's Fourth Five-Year Plan (1976-1980) aims at increasing the country's tourist accommodations from 18,500 beds in 1975 to 35,000 in 1980. This is to be implemented by both public and private (including foreign) investments, in hotels of various classifications, in camping and trailer parks, tourist villages, villas and apartments. The potential for mineral spas is to be exploited. (Improvements in staff housing facilities are also planned.) Tours linking Syria's tourist attractions with those of other Arab countries are proposed. Also proposed is an increase in capacity of public bus lines. Road improvement in the major tourist areas is stressed in the development plan. Improvement in roads will contribute measurably to the achievement of targeted tourism goals.

f. Balance of Payments and Foreign Trade

Syria's overall balance of payments has shown a surplus during the period 1972-1975 (Table B-11). This surplus has been due principally to transfers of capital -- foreign aid and grants from other Arab states -- as well as from oil transit fees. The balance of trade, however, has been less satisfactory during this period, with deficits in every year culminating in a deficit of SL 4.8 billion in 1976. Although exports increased about three and one-half times during the five-year period 1972-1976, imports rose by over four times (and of greater magnitude) in the same period. Increased imports reflected post-war reconstruction (after the 1973 War), rapid rises in overseas prices, stepped-up socio-economic development efforts, and relaxation of previous restrictions on foreign trade and payments. In 1976 an agreement with Iraq, under which Syria had obtained crude oil at preferential prices and received substantial foreign exchange income from oil transit fees, expired and was not renewed. Official transfer payments to Syria peaked in 1975, and fell about 35 percent in 1976.

Syria thus has an urgent need to conserve foreign exchange and to obtain sizeable flows of foreign aid. In 1976, the Government imposed a ban on starting new projects, and the ban continued into 1977. Severe restrictions also were imposed on the issuance of import letters of credit.

Between 1964 and July 1973, Syria utilized a dual exchange system. On the latter date, the system was eliminated operationally. The official rate and the actual parallel market rate had been very close for some time.

TABLE B-11

SUMMARY BALANCE OF PAYMENTS, SYRIA, 1972-76 1/
(IN MILLIONS OF SYRIAN POUNDS)

		1972	1973	1974	1975	1976(p)
A.	Goods and services	-334.7	-235.4	-1094.7	-2267.6	-4768.5
	Exports, f.o.b.	1211.4	1363.1	2913.9	3440.0	4141.2
	Imports, c.i.f.	2089.3	2344.6	4175.9	5697.1	8826.5 2/
	Trade balance	-877.9	-981.5	-1262.0	-2256.2	-4685.3
	Services (net)	543.2	746.1	167.3	-11.4	-83.2
B.	Transfer payments (net)	355.7	1530.4	1714.4	2611.4	1765.9
	Private	167.9	143.2	166.6	194.8	205.4
	Government	187.8	1387.2	1547.8	2416.6	1560.5
	Current Account Balance	21.0	1295.0	619.7	343.8	-3002.6
C.	Non-monetary capital (net)	61.7	95.2	-2.0	-35.5	1048.1
	Public	64.8	198.4	-65.2	-103.3	767.6
	Private	-3.1	-103.2	-63.2	67.8	280.5
D.	Errors and omissions	-79.8	-188.8	-26.9	-18.2	-66.0
E.	Surplus or deficit	82.7	1390.2	617.7	308.3	1954.5
F.	Monetary capital and gold movements (net)	-27.6	-1201.4	-590.8	-290.1	2020.5
G.	Allocation of special drawing rights	24.7	-	-	-	-

(p) = preliminary.

Source: Central Bank of Syria, Quarterly Bulletin, various issues.

1/ Corrected at parallel market rates.

2/ Includes imports of non-monetary gold valued at SL 1472.1 million.

The bulk of Syria's foreign trade is transacted by the public sector (Table B-12). This situation facilitates planning in the external sector of the economy and maintenance of a stable exchange rate.

A small proportion of Syria's trade is conducted under bilateral payment payment agreements which are in force with Sri Lanka, the Socialist Republic of Vietnam, the People's Republic of China, North Korea and the U.S.S.R.

The direction of Syrian trade has shifted appreciably over the past decade. (See Appendix B, Table 21.) Whereas slightly over 64 percent of the value of Syrian exports went to the Arab and Socialist Countries in 1968, by 1976 nearly 64 percent of the country's exports went to EEC, other European, and other Free-World countries. With respect to its import trade, the share of Syrian purchases from the Arab countries and Socialist Bloc declined from 47.7 percent in 1968 to 22.9 percent in 1976. Its imports from EEC, other European, and other Free-World countries rose from 52.3 percent of total value in 1968 to 77.1 percent in 1976. This shift in imports reflects, in part, a greater concern by Syria for the quality of goods it acquires abroad, compared with its earlier emphasis on their prices. Credit facilities have also become available more readily from Western Europe, America, and Japan. Loosened exchange restrictions, and policies aimed at promoting repatriation of capital held abroad (by permitting the private sector to pay for imports out of such foreign holdings of exchange) are other factors influencing the changing pattern of the import trade.

Syria's exports consist almost entirely of raw materials from the extractive and agricultural sectors of the economy. (See Appendix B, Table 22.) Crude petroleum accounts for the bulk of the export tonnage; phosphate and raw cotton are other important export products. Cotton plantings and exports fluctuate with world price movements for this commodity. Syria's phosphate industry is undergoing a sizeable expansion and it is anticipated that, in a few years, the phosphate will be processed into fertilizer within the country and exported in that form. The conversion of phosphate rock to fertilizer is a weight-reducing process; accordingly, while the value of fertilizer exports will exceed those of the raw material, the tonnage movements to ports may be expected to decline. As for Syria's leading export -- crude petroleum -- the prospects for a sustained rise in export quantities appears to depend upon the success of proposed government efforts to reduce the sulphur content of domestic crude oil. If these plans succeed, imports of crude oil should decline substantially, and exports may decline as more domestically refined petroleum is consumed in Syria.

Some shifting has occurred in the composition of Syrian imports in the 1970s. (See Appendix B, Table 23.) As development activities have accelerated, imports of capital goods have become of relatively greater importance in the total import trade. Also, because of the expiration of the petroleum accord with

TABLE B-12

DISTRIBUTION OF FOREIGN TRADE BETWEEN THE PUBLIC AND PRIVATE SECTORS
SYRIA 1976

Categories of Trade	Exports			Imports		
	Public Sector	Private Sector	Total	Public Sector	Private Sector	Total
	(1,000 metric tons)					
Food & beverages	102.8	40.6	143.4	417.0	309.5	726.5
Primary	86.2	24.9	111.1	20.9	256.7	277.6
Processed	16.6	15.7	32.3	396.1	52.8	448.9
Industrial supplies	10615.7	157.1	10712.8	4919.3	365.6	5284.9
Fuels & lubricants	10037.4	2.9	10040.3	2801.5	10.3	2811.8
Other, n.e.s. 1/	578.3	54.2	732.5	2117.8	355.3	2473.1
Capital Goods 2/	0.8	17.5	18.3	150.0	60.3	210.3
Consumer Goods	1.3	13.0	14.3	11.0	18.8	29.8
Other 3/	-	-	-	-	1.8	1.8
Total	10720.6	228.2	10948.8	5497.3	754.2	6251.5
Total value ($ million)	3600.4	540.9	4141.3	5571.2	2123.4	7964.6

Source: Statistical Abstract, 1977, pp. 336-337

1/ Not elsewhere specified.

2/ Including transportation equipment and assessories.

3/ Goods imported by passengers.

TABLE B-13

GROSS DOMESTIC PRODUCT AT MARKET PRICES, 1968, 1972 AND 1976
(MILLION SL, AT CONSTANT 1963 PRICES)

Section	1968		1972		1976	
	Value	Percent	Value	Percent	Value	Percent
Agriculture, forestry, hunting & fishing	1,087.1	22.9	1,524.5	22.6	1,891.3	18.7
Mining & manufacturing 1/	826.0	17.4	1,326.1	19.5	2,027.9	20.1
Building & construction	159.0	3.3	204.3	3.0	470.4	4.7
Transport & communications	506.0	10.7	650.6	9.6	778.8	7.7
Wholesale & retail trade	829.0	17.4	1,150.0	16.9	1,948.0	19.3
Finance & insurance	91.8	1.9	156.5	2.3	207.8	2.0
Ownership of dwellings	326.0	6.9	390.8	5.5	432.4	4.3
Government	574.0	12.1	917.6	13.4	1,577.7	15.6
Services	350.0	7.4	486.4	7.2	768.6	7.6
Total	4,748.9	100.0	6,786.8	100.0	10,102.9	100.0

Source: Central Bureau of Statistics, Statistical Abstract, 1977, p. 735.

1/ Includes electricity, gas and water.

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Iraq in December, 1975, Syria must now import crude oil at world prices. In consequence, the value of oil imports in 1976 accounted for 8.2 percent of total imports compared with only 4.4 percent in 1972. Syrian crude oil is a heavy, high-sulphur type. It must be blended in equal part with higher-grade imported crude to meet domestic refinery requirements.

g. National Accounts

The Syrian economy, as measured by the Gross Domestic Product (GDP) in constant 1963 prices grew at an annual average rate of 9.9 percent during the period 1968-1976.[1/] The relative shares of the GDP by sector have shifted substantially in some cases, especially in the period 1972 through 1976. For example, agriculture's share declined very little between 1968 and 1972, but from 1972 to 1976 it had dropped from 22.6 percent of the total to 18.7 percent of the total (Table B-13). Other sectors registering declines were transport and communications and ownership of dwellings. Sectors with significant relative increases during this period were mining and manufacturing at 20.1 percent in 1976, up from 17.4 percent in 1968; building and construction at 4.7 percent, up from 3.3 percent in 1968; wholesale and retail at 19.3 percent compared with 17.4 percent in 1968; and government at 15.6 percent compared with 12.1 percent in 1968.

Expenditure on private consumption is the major outlay in Syria's GDP, although Government purchase of goods and services is becoming of increasing importance. (See Appendix B, Table 24.) Private consumption represented 60 percent of total GDP expenditures in 1976 compared with 69 percent in 1969, while Government purchases of goods and services represented 25 percent of GDP expenditures in 1976, up from 18 percent in 1969.

Total gross domestic investment is of similar magnitude to government purchases of goods and services, while public sector investment accounted for approximately 68 percent of this in 1976 compared with 58 percent in 1969. Building and construction accounted for about 50 percent of the investment in 1976. (See Appendix B, Table 24.)

1/ Computed from data in Table B-13

Per capita GDP at 1963 market prices rose from SL 811 in 1968 to SL 1,019 in 1972 and to SL 1,330 by 1976 as shown in the tabulation below:

Year	Per Capita GDP (SL)
1968	811
1970	899
1972	1,019
1973	1,007
1974	1,162
1975	1,268
1976	1,330

The annual average growth rate between 1968 and 1972 was 5.8 percent, while from 1974 (excluding 1973, the war year) to 1976 the annual rate was 7.1 percent. At the official exchange rate of SL 3.90 to the U.S. dollar, real per capita GDP in 1976 amounted to the equivalent of US $341.

h. National Planning

The Syrian Government relies upon central planning for the country's socio-economic development. The nation currently is in the midst of its Fourth Five-Year Plan (1976-1980). The basic annual plan is the consolidated national budget which contains both the administrative and development outlays of the public sector.

Budgeted expenditures for development have accounted for more than one-half of total planned outlays during most of the 1970s. In 1976, such outlays represented 64.4 percent of budgeted expenditures, and they declined to 61.0 percent in the 1977 budget. (See Appendix B, Table 25.)

A State Planning Office (SPO) was created in 1960. It was reorganized in 1967 when the statistical operations were separated with the latter becoming the Central Bureau of Statistics. The SPO coordinates the work of planning offices in the various ministries, formulates the national five-year plans, and monitors their implementation.

In the four five-year plans that have been formulated thus far, the Syrian Government has placed increasing reliance upon public sector investment to meet its growth targets. The contemplated shares of public and private sector

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investments in each of the successive five-year plans has been as follows (in million SL): 1/

Five-Year Plan	Public Sector	Private Sector	Total	Percent Public
First	1,720	1,000	2,720	63.3
Second	3,454	1,501	4,955	69.7
Third	6,567	1,553	8,120	80.9
Fourth	44,800	9,400	54,200	80.8

During the 1970s there has been a marked shift in emphasis in the Syrian Government's budgeted expenditures. Outlays for industry and mining (including petroleum extraction) have increased sharply, as have expenditures for government administration (legislative, executive, and judicial). On the other hand, there has been a sizeable reduction in the proportion of budgeted outlays for agriculture and social services. (See Appendix B, Table 26.)

The general aims of the Fourth Five-Year Plan are to achieve a real growth rate of 12 percent in the gross domestic product, with an average per capita increase of 7.9 percent annually during 1976-1980; improving the nation's economic structure, with a developed agricultural-industrial base for stable self-development; to achieve an optimal geographic distribution of projects to improve employment prospects around the country and to improve standards of living in the interior; to achieve self-sufficiency in main foodstuffs and clothing, and to attempt to reach that stage in other commodities; improvement of the diet of the population, especially its consumption of animal protein and "high-class" foodstuffs; development of the transport and communications network of the nation, internally and externally, especially contacts with other Arab countries; and to restrict inflation to no more than 30 percent during the period of the plan. The sectoral targets of the Fourth Five-Year Plan are shown in Table B-14.

1/ A. S. Salem, Industrial Development in the Syrian Arab Republic, UNDP, July 1976, p. 10.

TABLE B-14

SECTORAL TARGETS UNDER THE FOURTH FIVE-YEAR PLAN, 1976-1980,
(IN MILLIONS OF SYRIAN POUNDS, AT 1975 PRICES)

Sector	Base Year Data	%	Target Year Figure	%	Compound Annual Growth Rate
A. Material Production:					
Irrigation & agriculture	3,094	16.3	4,545	13.6	8.0%
Industry, mining, and energy	4,267	22.4	8,725	26.2	15.4%
Building & construction	1,203	6.3	2,530	7.5	16.0%
Subtotal	8,564	45.0	15,810	47.3	13.1%
B. Other Sectors:					
Transport and communications	1,121	5.9	2,395	7.1	16.4%
Trade	4,848	25.5	7,875	23.5	10.2%
Finance	195	1.0	345	1.0	12.1%
Rents	653	3.4	1,125	3.4	11.5%
General administration	2,597	13.7	4,195	12.5	10.1%
Services	1,040	5.5	1,765	5.3	11.2%
Subtotal	10,454	55.0	17,700	52.8	11.1%
Grand Total	19,018	100.0	33,510	100.0	12.0%

Source: Fourth Five-Year Economic and Social Development Plan of the Syrian Arab Republic: 1976-1980, p. 6.

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2. THE PROJECT ROAD AND THE NATIONAL TRANSPORTATION NETWORK

a. Significance of the Project Road

The project road from Tartous to Lattakia is economically and strategically important to the national economy of Syria, and to the specific zone of influence which it serves. The Tartous-Lattakia road serves the country's three major ports of Lattakia, Banyas and Tartous. It also represents a major link to the highway from Tartous to Damascus. The latter highway is being improved as a four-lane limited access facility. Improvement of the Tartous-Lattakia segment to similar standards (a modern, high-traffic capacity road) will thus connect the ports and port cities with Damascus, the nation's capital and largest city, as well as with Homs, an important industrial center.

b. The National Highway Network

1) Historical Growth

Syria's highway network has slightly more than doubled during the period 1960 to 1976 (see Table B-15). Growing from about 7,600 kilometers in 1960 to about 16,300 kilometers in 1976, the annual average rate of increase was 4.9 per cent. The emphasis in the road improvement program has clearly been with paved roads. In 1976 paved roads accounted for 75 per cent of the total highway kilometers compared with 55 per cent in 1960 (see Table B-15).

TABLE B-15

TOTAL LENGTH OF ROADS BY TYPE OF SURFACE, SAR, 1960, 1965 AND 1970-1976
(KILOMETERS)

Year	Paved	Gravel	Earth	Total
1960	4,170	660	2,780	7,610
1965	5,914	1,099	2,179	9,192
1970	8,096	1,500	2,091	11,687
1971	8,688	1,466	1,554	11,708
1972	9,086	1,311	1,439	11,836
1973	9,831	1,381	2,363	13,575
1974	10,578	1,527	2,354	14,459
1975	10,740	1,500	2,364	14,604
1976	12,051	2,025	2,263	16,339

Source: Statistical Abstract for the respective years.

2) Highway Distribution and Density

Highway distribution by mohafazats in 1976 shows Damascus with the largest number of paved kilometers followed by Hama, Tartous, Homs, and Aleppo (see Table B-16). These five mohafazats combined had 6,690 paved kilometers or 56 per cent of the total. They also accounted for 8,127 kilometers of all roads or about 50 per cent of the total. The relationships of the five mohafazats to total paved roads and all roads have remained about the same during the years 1971, 1973 and 1976.

TABLE B-16

HIGHWAY DISTRIBUTION BY MOHAFAZAT, SAR, 1971, 1973 AND 1976
(KILOMETERS)

Mohafazat	1971		1973		1976	
	Paved	Total	Paved	Total	Paved	Total
Damascus	1,497	1,814	1,487	1,943	1,644	1,939
Homs	831	918	924	1,011	1,238	1,238
Hama	779	1,072	1,107	1,358	1,410	1,589
Tartous	726	868	847	1,491	1,267	1,574
Lattakia	749	953	923	1,289	970	1,393
Idlib	717	930	715	942	984	1,331
Aleppo	848	1,136	937	1,166	1,131	1,787
Al-Rakka	364	503	435	550	490	740
Al-Hassakeh	454	753	540	759	551	1,014
Deir ez-zor	309	937	370	1,007	445	1,297
Al Sweida	440	648	520	728	790	885
Deraa	605	747	651	837	681	956
Quanaytra	369	459	375	494	450	596
Total	8,688	11,738	9,831	13,575	12,051	16,339

Source: Statistical Abstract for the respective years.

When highway kilometers are related to population, the highest densities are shown for the mohafazats of Quanaytra, Al Sweida, Tartous, Deir-ez-zor, Deraa, Lattakia and Idlib (see Table B-17).

3) Motor Vehicle Registrations

Motor vehicle registrations in the Syrian Arab Republic have grown at an annual average rate of nearly 10 per cent during the 1963-1976 period (see Table B-18). Much of this growth, however, has occurred over the last three years of the period. Prior to the 1973 war, the Government had held down

TABLE B-17

HIGHWAY DENSITY BY MOHAFAZAT, SAR, 1976

Mohafazat	Population 1/ (000)	Total Highway (kms.)	Density (kms. per 1,000 inhabitants)
Damascus	1,842	1,939	1.1
Homs	648	1,238	1.9
Hama	617	1,589	2.6
Tartous	359	1,574	4.4
Lattakia	453	1,393	3.1
Idlib	442	1,331	3.0
Aleppo	1,571	1,787	1.1
Al Rakka	290	740	2.6
Al Hassakeh	548	1,014	1.9
Deir ez-zor	341	1,297	3.8
Al-Sweida	168	885	5.3
Deraa	297	956	3.2
Quanaytra	19	596	31.4
Total	7,595	16,339	2.2

1/ Mid-year estimates.

Source: Statistical Abstract, 1977, pp.101 and 304.

TABLE B-18

MOTOR VEHICLE REGISTRATIONS BY TYPE OF VEHICLE, SAR, 1963, 1965, 1968 AND 1970-1976 (IN THOUSANDS)

Year	Cars 1/	Buses	Pick-ups 2/	Trucks 3/	Sub-total	Temporary Entry All Types	Total 4/
1963	23.1	1.8	1.5	11.3	37.7	-	37.7
1965	27.2	1.6	4.0	8.7	41.5	-	41.5
1968	28.5	1.6	4.0	9.9	44.0	-	44.0
1970	30.3	1.8	5.3	12.6	50.0	-	50.0
1971	30.7	2.0	4.8	12.1	49.6	2.2	52.8
1972	31.0	2.2	5.2	13.3	51.7	2.8	54.5
1973	34.7	2.5	6.2	14.4	57.8	3.1	60.9
1974	37.3	2.8	5.8	15.2	61.1	3.0	64.1
1975	50.2	4.2	9.9	21.2	85.5	4.3	89.8
1976	62.8	5.6	27.2	25.2	120.8	5.4	126.2
Annual Average Growth Rates (per cent):							
1963-76	8.0	9.1	25.0	6.4	9.4	-	9.7
1963-73	4.2	3.4	15.3	2.4	4.4	-	4.9
1974-76	29.8	42.0	100.0	29.0	41.0	34.0	40.0

1/ Includes cars and land rovers.

2/ Includes pick-ups and three-wheel motorcycle pick-ups.

3/ Includes trucks and tankers.

4/ Excludes all two-wheel motorcycles.

Source: Statistical Abstract for the respective years.

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the rate of imports to about 5 per cent per year because of shortages of foreign exchange and the emphasis upon developing the railroad segment of the traffic. After the 1973 war, import quotas were discontinued as a result of increased oil prices and an influx of foreign capital. The response to the ending of the quotas was immediate and very strong, with the result that in the three-year period 1974-1976 the entire fleet nearly doubled.[1/]

4) Motor Vehicle Fuel Consumption

Total consumption of petroleum products in the Syrian Arab Republic has grown from 899,000 tons in 1960 to 3,773,000 tons in 1977 (see Table B-19). This is approximately a four-fold increase, and is equivalent to an annual average rate of 8.8 per cent.

TABLE B-19

GROWTH IN CONSUMPTION OF PETROLEUM PRODUCTS, SAR, 1960, 1965, AND 1970-1977 (000 TONS)

Year	Gasoline Ordinary and Super	Kerosene	Gas Oil	Fuel Oil	Jet Fuel	Butane Gas	As-phalt	Total
1960	72	82	433	288	-	5	19	899
1965	117	125	681	393	10	10	29	1,365
1970	196	171	850	587	94	20	86	2,004
1971	212	183	1,035	652	90	24	88	2,284
1972	251	210	1,189	735	113	29	102	2,629
1973	281	207	1,253	621	157	28	58	2,605
1974	332	236	1,563	561	168	34	83	2,977
1975	399	264	1,758	544	204	39	87	3,295
1976	456	296	1,944	487	219	51	109	3,562
1977	482	285	1,981	603	192	59	171	3,773

Source: Syrian-Arab Petroleum Company (SADCOP).

Fuel consumption by motor vehicles includes all of the gasoline tonnage, and about 50 per cent of gas oil (diesel) according to officials of the Syrian-Arab Petroleum Company (SADCOP). The balance of the gas oil is used by industry and for irrigation pumping. Total motor vehicle fuel

1/ For increases in the vehicle fleet of the Mohafazats of Lattakia, Tartous, Idlib and Hama, see Appendix B, Table 27.

consumption thus totals about 1,472,500 tons in 1977, or about 39 per cent of all fuels consumed in that year.

For the 1960-1977 period, total motor vehicle fuel consumption has increased at an annual average rate of 9.7 per cent (assuming that 50 per cent of the gas oil consumption in 1960 was by motor vehicles). This is the same annual rate of growth which occurred during the last four years of the period 1974-1977.

c. Railways

1) Track and Rolling Stock

The Syrian Railway System consists of two governmental railroads operated under separate managements. The Northern Railways, of standard gauge, serve Aleppo and the northern portion of the country. The Hedjaz Railway, of narrow gauge, serves Damascus and the southern portion of the country. Through traffic between the two railroads is impossible at present because of the differences in gauges. The combined trackage of the two railways (entirely single track) consisted of 1,672 kilometers in 1976 compared to 1,259 kilometers in 1971 (see Table B-20).

The Northern Railways is part of the international rail route from Istanbul to Baghdad. The route crosses into Syria over the Midan Ekbes-Aleppo-Jopanbey sector in the north and the Nassibin Al Yar'ubieh sector in the extreme northeast. The Homs-Koussair and Homs-Akkari sectors also serve as international rail links into Lebanon. The Homs-Akkari sector was opened to traffic in 1968, but it is now undergoing rehabilitation with completion anticipated by 1980. The Akkari-Tartous track and roadbed were recently completed with stations and signaling to be installed by the end of 1978.

The recent extensive addition in track and roadbed for the Northern Railways represents completion of the Al Kamishli- attakia section which connects the Port of Lattakia with Aleppo and the northeastern part of the country. This project was begun in the 1960's with the final section of track completed in 1976. Operations on the line, however, have been on a very limited basis pending installation of telecommunications equipment. In May 1978, one freight and one passenger train were operating daily between Lattakia and Aleppo. Sections of the Northern Railways currently under construction are Homs to Damascus (210 kms.) and Mhine to Palmyra (168 kms.). The latter section will connect the phosphate mines near Palmyra to a fertilizer processing plant for domestic use at Homs, and to the Port of Tartous for export of the phosphate rock. Completion of this line is anticipated for the middle of 1980.

2) Historical Trends of the National Industry Sector

The indices of production (1970 equals 100) for the major industrial sectors of Syria rose during the period 1970-1976 to the following 1976 levels:

Manufacturing - 168
Extractive - 345
Building and Construction -296
Electricity & Water - 186 [1/]

The annual average growth rates for these sectors over the 1970-1976 period are as follow:

	Percent
Manufacturing	9.1
Extractive	23.0
Building & Construction	19.8
Electricity & Water	10.9

On a value added basis, the industrial sector's contribution to the nation's Gross Domestic Product grew at an annual average rate of 12.0 percent from 1970 to 1976. During the same period, the annual rate for mining and manufacturing was 10.6 percent and that of building and construction was 19.8 percent per year; while the GDP as a whole grew at an annual average rate of 10.3 percent.

3) Projected Industrial Growth Under the Fourth Five-Year Plan

Industrial growth targets under the Fourth Five-Year Plan for the Syrian economy have been established at an annual average rate of 15.4 percent for the manufacturing and mining, electricity, gas and water sectors combined, and at 16.0 percent annually for building and construction.

Among individual commodity production targets, annual average growth rates for the base year (1976) to target year (1980) range from a low of 1.2 percent for vegetable oil to a high of 61.5 percent for metal products (see Appendix B, Table 42).

Incorporated within the growth targets are such goals as optimum geographical distribution, self-sufficiency in main foodstuffs, clothing, and other items through economically feasible import substitution; increases in labor employment and productivity, and increased importance of industrial goods exports.

[1/] See Table B-2.

4) Projections of Industrial Production in the Zone of Influence.

For purposes of projections, the consultant categorized industrial production in the zone of influence as follows: manufacturing (less cement production), quarrying (less production for the port construction in Lattakia), and petroleum production associated with the new refinery at Banyas (Table B-67).

Production of cement at the existing plant near Lattakia and at the plant currently under construction near Tartous was isolated from the manufacturing base of the zone to avoid distortion of the growth curve projected for the manufacturing sector. The potential for distortion is illustrated in Table B-68, in which the manufacturing sector (without cement) has a projected annual growth rate from 1976-1983 of 10.0 percent, while the rate jumps to 16.0 percent when cement is included. The effect is due almost entirely to the opening of the new cement plant at Tartous with initial domestic production, excluding a small quantity of exports, of about 1 million tons. Prior to 1993, the second phase expansion of the Tartous plant is expected to be completed, and production is then expected to be about 2 million tons. The manufacturing sector (less cement) is projected by the consultants at an annual average growth rate of 8.5 percent, 1984-1993 and at 6.5 percent, 1994-2003. With cement, the annual rates for the same periods are 7.9 and 4.8 percent. The lower rates of manufacturing with cement included result from cement production leveling off at about 2 million tons in 1993.

Production of the manufacturing sector excluding cement is projected as increasing from about 1,075,000 tons in 1976 to about 8,344,000 tons by the year 2003. With cement production included, total production in the year 2003 is estimated at 10,437,000 tons.

Projections of quarrying production (less production for the Port of Lattakia breakwater) are related to concrete production (the use of sand and gravel for concrete mixes) and to other aspects of the construction industry. For purposes of projecting the 1976 base, a deduction was made for the stone, sand and gravel required for the Port of Lattakia breakwater (about 3.0 million tons). The limited duration of this large movement in the projected period (only five of the twenty years - 1985 to 1989) necessitated its elimination from the base.

The consultants have projected quarrying production in the zone of influence at about the same overall rate for the period 1984-2003 as the manufacturing industry including cement (Table B-68). The construction industry has been growing rapidly in the Tartous-Lattakia zone of influence and growth is expected to continue although at diminished rates over the longer period.

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TABLE B-67

PROJECTIONS OF INDUSTRIAL PRODUCTION, ZONE OF INFLUENCE, 1976-2003

Industry Category	1976	1983	1993	2003
		(000 MT)		
Manufacturing (less cement)	1,075.5	1,966.0	4,445.0	8,344.0
Lattakia cement plant	-	83.0	83.0	83.0
Tartous cement plant	-	1,000.0	2,000.0	2,000.0
Total	1,075.5	3,049.0	6,528.0	10,437.0
Quarrying (less production for Port of Lattakia breakwater) as follows: (000/MT)				
Stone - 2,348.7				
Less Breakwater - 1,800.0	548.7			
Sand & gravel - 2,610.1				
Less Breakwater - 1,200.0	1,410.1			
Sub-total	1,958.8			
Semi-marble stone	38.8			
Gypsum	36.0			
Asphalt	18.8			
Total	2.052.4	4,537.2	9,795.5	15,955.8
Petroleum Products				
Banyas refinery 1/	-	1,500.0	3,551.0	6,990.0
Total Industry	3,127.9	9,086.2	19,874.5	33,382.8

1/ Only that portion of production to be consumed in the Lattakia-Banyas-Tartous areas.

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TABLE B-68

ANNUAL AVERAGE GROWTH RATES OF PROJECTED INDUSTRIAL PRODUCTION, ZONE OF INFLUENCE, 1976-2003

Industry Category	1976-1983	1984-1993	1994-2003	1984-2003
		(Percentage)		
Manufacturing (less cement)	9.0	8.5	6.5	7.5
Manufacturing (including cement) 1/	16.0	7.9	4.8	6.3
Quarrying (less production for Port of Lattakia breakwater	12.0	8.0	5.0	6.5
Petroleum products Banyas refinery 2/	-	9.0	7.0	8.0
All Industry - Weighted Average	16.4 3/	8.1	5.3	6.7

1/ Future cement production at Lattakia and Tartous based upon data received from plant officials.

2/ Only that portion of production to be consumed in the Lattakia-Banyas-Tartous areas.

3/ The weighted average is higher than any of the above averages because it reflects the addition of the one and one-half million tons of petroleum products associated with the Banyas refinery.

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The quarrying industry is expected to follow a similar pattern of growth. From 1976 to 1983, total quarry production in the zone is expected to about double, and from 1984 to 1993 a second doubling is forecast. For the last ten years of the study period it is estimated that production will increase by a factor of 1.5.

Production of petroleum products at the new Banyas refinery is expected to begin in 1979 with an annual capacity of 3,000,000 tons. According to government officials, about one-half of this production will be shipped by pipeline to Homs for distribution from that point, while the other half will be consumed in the Lattakia-Banyas-Tartous areas. This is the amount shown as production for the zone of influence, since its distribution will be road-related. This consumption is estimated by government officials to include:

	Tons
Fuel oil for the Banyas electrical plant	500,000
Fuel oil for the Tartous cement plant	200,000
Kerosene, gasoline and gas-oil:	
For Lattakia area	400,000
For Tartous area	240,000
For Banyas area	160,000
Total	1,500,000

For the 1984-1993 period, production of the Banyas refinery to be consumed in the Tartous-Lattakia zone of influence is projected at an annual average rate of 9.0 percent, while for the last ten years of the period (1994-2003), the projected annual rate drops to 7.0 percent. For purposes of comparison, consumption of all petroleum products in the SAR increased at an annual rate of 9.5 percent from 1970 to 1977, while motor vehicle fuel consumption is estimated to have increased at an annual average rate of 9.7 percent from 1974-1977. 1/ From 1971 to 1976, motor vehicle registrations in the Mohafazats of Lattakia and Tartous increased at an annual average rate of 18.2 percent. 2/

Projections of total industrial production for the zone of influence average out to be 6.7 percent for the twenty-year period, 1984-2003. (See Table B-68.)

1/ See Section B.2.

2/ See Appendix B, Table 27.

e. Tourism

1) Methodology

The tourism traffic being projected in this section refers only to that portion of the traffic which will result from the development of new tourism facilities in the Tartous-Lattakia area. This development is now underway through Syria's National Tourism Plan, and is not therefore dependent upon the proposed Tartous-Lattakia limited access highway. Existing tourism traffic and projected tourism traffic which will occur in the Tartous-Lattakia zone of influence without the new tourism facilities have been included in the existing and projected passenger traffic, and are therefore excluded from the projections of this section.

Data for determining the amount of additional tourism traffic associated with the new facilities being constructed under the National Tourism Plan (in terms of projected bed nights by location within the area for the years 1980, 1990 and the year 2000) were obtained from the Ministry of Tourism. From interviews with officials of the Ministry of Tourism and other people knowledgeable of the tourism industry in the Tartous-Lattakia areas, information was obtained regarding assumptions essential to converting bed nights into number of tourists, and the latter into average daily traffic over the highway. These assumptions are as follow:

a) Eighty percent of the total number of beds planned will be available by the year 2000.

b) Average length of stay per tourist is four days.

c) Ratio of Syrian to Non-Syrian tourists equals 61/39. (Calculated from actual data for Tartous-Lattakia area in 1976.)

d) Occupancy rate for the season is 90 percent.

e) In the 1980-2000 period, arrival of tourists in the area is estimated to be 85 percent via the highway mode and 15 percent by other modes (rail, sea, and air).

f) Bus/car ratio for Syrians is 75/25 and for Non-Syrians is 45/55.

g) Average bus occupancy is 38 people and average automobile occupancy is 4 people.

Calculations of the tourism projections, based upon the above referenced National Tourism Plan data and the enumerated assumptions, are shown in the following section.

2) Projections of Tourism Traffic

According to the National Tourism Plan, new tourism facilities in the Tartous-Lattakia area will have provided about 14,000 beds by 1980, an additional 59,000 by 1990 and a further increase of about 61,000 by the year 2000. (See Table B-69.) Total projected additional beds for the entire period 1980-2000 are thus approximately 134,000. In terms of actual accomplishment, however, because of unforseen delays in a project of this magnitude, about 80 percent of the entire plan is expected to be accomplished by the year 2000. Estimates of the projected accomplishments throughout the period are as follows:

	Number of Projected Beds, Tartous-Lattakia			
	1980	1990	2000	Total 1980-2000
Target goals	14,040	58,680	60,918	133,638
Anticipated % of accomplishment	58	75	90	80
Anticipated number of beds completed 1/	8,100	44,000	54,800	106,900

The percentage and net number of projected beds to be occupied by car and bus arrivals is estimated as shown below:

	1980	1990	2000	1980-2000
Total Number	8,100	44,000	54,800	106,900
Percentage to be occupied by car and bus arrivals	97	89	80	85
Number to be occupied by car and bus arrivals	7,900	39,100	43,000	90,800

The balance of the bed occupancies are by tourists arriving by rail, sea and air. Conversion of number of beds to number of tourists and then to average daily traffic is shown below (for the year 1980). The same type of calculations were performed for the other projected periods.

a) Projected number of beds divided by average length of stay times occupancy rate equals number of tourists on a daily basis throughout the tourist season. (Approximately four months.)

1/ Totals are rounded.

TABLE B-69

SYRIA NATIONAL TOURISM PLAN

NUMBER OF PROJECTED BEDS BY REGION AND AREA.

1980 - 2000

REGION AND AREA		Number of Beds 1980	1990	2000	TOTAL
Lattakia					
1.	Ras-el-Bassit	5,000	6,390	6,000	17,390
2.	Slaieb Turkmane	625	1,210	1,500	3,335
3.	Lattakia North	4,400	30,780	-	35,180
4.	Lattakia South				
5.	Jebleh	1,360	3,940	4,375	9,675
	Sub-total	11,385	42,320	11,875	65,580
Tartous					
6.	Banyas	1,525	2,435	10,043	14,003
7.	Tartous	1,130	4,755	21,000	26,885
8.	Hamidia	-	9,170	18,000	27,170
	Sub-total	2,655	16,360	49,043	68,058
	Total	14,040	58,680	60,918	133,638

Source: Ministry of Tourism,SAR, April 1978.

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1980

7,900/4 equals 1,975 x .90 = 1,778 (round to 1,780).

b) Estimated number of Syrians versus Non-Syrians equals:

1,780 x .61 = 1,086 Syrians

1,780 x .39 = 694 Non-Syrians

c) Number of Syrian and Non-Syrian bus and car passengers:

Syrian bus passengers = 1,086 x .75 = 814

Syrian car passengers = 1,086 x .25 = 272

Non-Syrian bus passengers = 694 x .45 = 312

Non-Syrian car passengers = 694 x .55 = 382

d) Number of buses and cars required for Syrian and Non-Syrian passengers:

Syrian - 814 bus passengers/38 =22 buses

Syrian - 272 car passengers/4 = 68 cars

Non-Syrian - 312 bus passengers/38 = 8 buses

Non-Syrian - 382 car passengers/4 = 96 cars

e) Total ADT of tourism associated with the new facilities equal:

Buses - (22 plus 8) = 30

Cars - (68 plus 96) = 164

Total 194

Using the above method of calculation for each of the additional projected periods, 1990 and 2000, gives ADT of 955 and 1,070 (cars and buses) as shown in the tabulation below:

Average Daily Traffic Associated with New Tourism Facilities

(Four Months Period)

	1980	1990		2000	
	Added ADT	Added ADT	Accumulative Total Added ADT	Added ADT	Accumulative Total Added ADT
Buses	30	147	177	165	342
Cars	164	808	972	905	1,877
Total	194	955	1,149	1,070	2,219

Adjustment of the above data on the basis of the projected growth rates so that the time periods will correspond gives the following results:

(Four Months Period)

	1983 Added ADT	1993 Added ADT	1993 Accumulative Total Added ADT	2003 Added ADT	2003 Accumulative Total Added ADT
Buses	48	152	200	172	372
Cars	264	837	1,101	1,057	2,158
Total	312	989	1,301	1,229	2,530

f. General Cargo Exports and Imports

1) Methodology

Projections of general cargo exports and imports as used in this section refer to all items of export and import for the Port of Lattakia and all imports for the Port of Tartous. In the case of general cargo export projections for the Port of Tartous, the consultant has adjusted the 1976 base to exclude exports of phosphates and fuel oil, as well as crude petroleum. This is to prevent inflation of the projected road-oriented export tonnages since crude petroleum moves only by pipeline, while phosphates and fuel oil will be moving exclusively by rail prior to 1983).[1/]

In making the projections for each of the ports, the consultant has given consideration to the current expansion programs and future expansion plans at each facility.

2) Projections of Exports and Imports for the Port of Lattakia

Exports from the Port of Lattakia consist primarily of agricultural commodities. For example, as shown in Table B-70, the identified commodities accounting for 73 percent of the total exports were all agricultural. Even the category of other commodities undoubtedly contained such agricultural raw and processed commodities as hides and skins, oilseeds, olive-oil cake, and processed fruits and vegetables, in addition to textiles and clothing.[2/] Analysis of the historical trend data for the exports through Lattakia over the period 1970-1977 revealed very substantial annual fluctuations for most commodities.[3/] Extreme examples are barley and wheat, most of which production

[1/] See Section 4.c.4 for further details.

[2/] Data are not available from the Port Administration on the exact composition of this group, but analysis of exports in general for Syria by the consultant indicate that they likely consist of the commodities enumerated above.

[3/] See Table B-44.

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TABLE B-70

PROJECTIONS OF GENERAL CARGO EXPORTS AND IMPORTS FOR THE PORT OF LATTAKIA

1976-2003

Commodity	1976	1983	EXPORTS 1993	0003
Barley	14.8	30.0	30.0	30.0
Cotton (lint, cake and meal)	143.7	154.4	170.6	188.5
Groundnuts	2.4	2.6	2.9	3.2
Lentils & vegetables	22.0	37.7	61.4	95.4
Tobacco	4.8	9.0	12.4	19.6
Wheat	-	38.0	38.0	38.0
Wool	2.5	3.2	4.5	6.3
Other Commodities	71.8	187.5	439.8	865.1
Total	262.0	462.4	759.6	1,246.1

	IMPORTS			
	1976	1983	1993	2003
	(000 MT)			
All Imports	1,920.4	2,812.1	4,580.6	6,780.4

	EXPORTS AND IMPORTS			
	1976	1983	1993	2003
	(000 MT)			
Total	2,182.4	3,274.5	5,340.2	8,026.5

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TABLE B-71

ANNUAL AVERAGE GROWTH RATES OF PROJECTED GENERAL CARGO EXPORTS AND IMPORTS, PORT OF LATTAKIA, 1976-2003

Commodity	EXPORTS 1976-1983	1984-1993	1994-2003	1984-2003
	(Percentage)			
Barley	1/	1/	1/	1/
Cotton (lint, cake and meal)	1.0	1.0	1.0	1.0
Groundnuts	1.0	1.0	1.0	1.0
Lentils & vegetables	8.0	5.0	4.5	4.8
Tobacco	4.7	4.7	4.7	4.7
Wheat	1/	1/	1/	1/
Wool	3.5	3.5	3.5	3.5
Other Commodities	14.7	8.9	7.0	7.9
Weighted Average	8.4	5.1	5.1	5.1

	IMPORTS 1976-1983	1984-1993	1994-2003	1984-2003
	(Percentage)			
All Imports	5.6	5.0	4.0	4.5

	EXPORTS AND IMPORTS 1976-1983	1984-1993	1994-2003	1984-2003
	(Percentage)			
Weighted Average	6.0	5.0	4.2	4.6

1/ Based upon weighted average export tonnage for the period 1970-1977.

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and export are dependent upon sufficient rainfall, a variable which is highly erratic in behavior. In view of this problem, the consultant averaged the exports of each of these commodities over the eight-year period, and used the averages as the bases for the future projections.

Less variable, as well as increased production of wheat, can be expected from new irrigated lands as they are developed in the Euphrates River Basin. However, development of major wheat export is likely to require many years. Assuming that 500,000 hec. of land are irrigated by 2003 and that half of it is planted to high-yielding varieties (HYV) of wheat, the annual output would be on the order of 625,000 MT. Also by 2003 domestic consumption of wheat would be about 2.4 million MT, based on a population estimate of 17.7 million and use of the FAO per capita consumption estimate of 133 kg/yr. With national production varying between 0.6 and 1.8 million MT since 1970, the output from the new lands will probably be required for domestic consumption.

Cotton (lint, cake and meal) and groundnuts are projected at modest growth rates of one percent annually throughout the entire period. The one percent rate for cotton is based upon the target goal of the Fourth Five-Year Plan, and little change is anticipated in exports beyond 1980, as increasing quantities of cotton are used for domestic manufacturing rather than for exports as raw cotton. Although exports of groundnuts have declined in recent years, there is current interest in increasing future production, and this is reflected in the modest increase in exports. Exports of lentils and vegetables have grown rapidly in 1976 and 1977, and with the emphasis being placed upon expanded production of these commodities, the outlook appears good for their continued growth. Tobacco and wool are also other commodities with good prospects for growth in the future, although their tonnages are small.

With the possible exception of lentils and vegetables, the category "other commodities" has shown the most consistent growth pattern over the 1970-1977 period. The annual growth rate has also been high, averaging about 14.7 percent. As enumerated previously, this group consists of such commodities as hides and skins, oilseeds, olive-oil cake, processed fruits and vegetables and textiles and clothing. The consultant has projected the historical growth rate of 14.7 percent as continuing through 1983. The rate for the 1984-1993 period is estimated at 8.9 percent after which the estimated rate drops to 7.0 percent for the 1994-2003 period.

The weighted annual average growth rate for all export commodities from Lattakia is 8.4 percent from 1976 through 1983 and 5.1 percent thereafter (Table B-71).

The consultant projected import tonnages as a whole, rather than commodity groups, for Lattakia. This method was used because the imports are quite well dispersed throughout the 13 commodity categories. In fact, nine of the thirteen categories each have tonnages in excess of 100,000 tons, and collectively they accounted for 94 percent of the total import tonnage in 1977.

Although relative shifts will undoubtedly occur among the various import groups, it is not anticipated that these shifts will drastically affect the projected total increases in imports. For example, as Syria's national cement production is increased in the future, imports will probably decline but not disappear entirely, since certain varieties of cement such as White Portland will continue to be imported. At the same time, very substantial increases are anticipated in such imports as iron and metals, machinery and tools, timber and wood products, to enumerate a few, as Syria's economy continues to expand.

The consultant's estimate of the 1976-1983 growth rate for imports through Lattakia is 5.6 percent annually which equals the historical rate determined by averaging the rates for the 1970-1972 period and the 1975-1977 period (Table B-71). For the 1984-1993 period the estimated rate is 5.0 percent and for the 1994-2003 period 4.0 percent.

3) Projections of Exports and Imports for the Port of Tartous

Projections of general cargo exports for the Port of Tartous were made as a group, rather than by individual commodities since, after elimination of phosphate and fuel oil from the 1976 base, the balance of the export tonnage is very small (only 36,000 tons, Table B-62). This adjusted base was then projected throughout the entire period by applying the historical annual average growth rate for this same tonnage category which occurred during the average of the years 1970-1972 and 1975-1977. By 2003 the general cargo imports were projected as increasing to 121,000 tons.

Import tonnage projections for the Port of Tartous were made at the same annual average growth rates as applied for imports at Lattakia (Table B-72). It does not appear that the likely composition of the general cargo imports for the two ports will differ substantially over the projected period. These projected growth rates showed import tonnages growing from about 1.8 million tons to 6.5 million tons (Table B-72).

The combined tonnages of the two ports show exports rising from 298,000 tons in 1976 to about 1,367,000 tons by the year 2003 (Table B-73). For the same period, imports were projected as growing from about 3,759,000 tons to 13,270,000 tons. Total exports and imports for both ports are thus expected to increase from about 4,057,000 tons in 1976 to about 14,638,000

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TABLE B-72

PROJECTIONS OF GENERAL CARGO EXPORTS AND IMPORTS, PORT OF TARTOUS, 1976 - 2003

	EXPORTS				
	1976	1983	1993	2003	1984-2003
	(000 MT)				
Net Total 1/	36.0	49.3	77.3	121.2	
Growth rate	4.6%	4.6%	4.6%		4.6%
	IMPORTS				
	1976	1983	1993	2003	
	(000 MT)				
Net Total	1,838.1	2,691.6	4,384.3	6,489.8	
Growth rate	5.6%	5.0%	4.0%		4.5%
	EXPORTS AND IMPORTS				
	1976	1983	1993	2003	
	(000 MT)				
Net Total 1/	1,874.1	2,740.9	4,461.6	6,611.0	
Growth rate	5.6%	5.0%	4.0%		4.5%

1/ Excludes fuel oil and phosphate since they will not require truck transport in future years.

TABLE B-73

COMBINED PROJECTIONS OF GENERAL CARGO EXPORTS AND IMPORTS
PORTS OF TARTOUS AND LATTAKIA 1976-2003

	1976	1983	1993	2003
		EXPORTS (000 MT)		
Lattakia	262.0	462.4	759.6	1,246.1
Tartous 1/	36.0	49.3	77.3	121.2
Total	298.0	511.7	836.9	1,367.3

	1976	1983	1993	2003
		IMPORTS (000 MT)		
Lattakia	1,920.4	2,812.1	4,580.6	6,890.4
Tartous	1,838.1	2,691.6	4,384.3	6,489.8
Total	3,758.5	5,503.7	8,964.9	13,270.2

	1976	1983	1993	2003
		EXPORTS AND IMPORTS (000 MT)		
Lattakia	2,182.4	3,274.5	5,340.2	8,026.5
Tartous 1/	1,874.1	2,740.9	4,461.6	6,611.0
Total	4,056.5	6,015.4	9,801.8	14,637.5

1/ Excludes fuel oil and phosphate exports.

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tons by 2003. This is equivalent to an annual average growth rate of 4.9 percent.

g. Transit Traffic

1) Methodology

Projections of international transit through Syria via the ports of Lattakia, Tartous, and the customs post at Kassab are subject to significant variations relative to future decisions of the Syrian government and the governments of the countries shipping and receiving goods via Syria. Historical trend data are useful in providing a picture of what has happened in the recent past, but may or may not be indicative of future trends, particularly long range trends. For example, Iraq's almost complete termination of transit trade through Syria reduced its transit tonnage passing through Lattakia from the 1975 peak of 211,000 tons to one ton in 1977. This dramatic drop was primarily responsible for the decline in Lattakia's transit trade volume from 273,500 tons in 1975 to 102,700 tons in 1977.

The key to a really substantial growth in Syria's transit trade passing through the ports of Lattakia and Tartous depends to a large extent on the future of Syrian-Iraqian relations. If the diplomatic breach is healed so that normal trade relations may be resumed, a rapid and substantial growth could be anticipated since not only Iraq but Iran as well would derive an economic advantage from Syrian transit. The previous discussion in Chapter IV on Comparative Economics of the Transit Traffic showed that Syria has a clear comparative advantage in transit shipments to Iraq and Iran from European and other western origin ports.

For shipments to the Gulf Emirates with their final destinations largely the port cities, the advantage, if any, of transiting Syria is less clear. At the present time, both routes are used to these destinations; that is, the all-sea route via the Suez Canal and Syrian transit.

In the case of shipments to Riyadh, Saudi Arabia, which requires a long land haul from the port of Jiddah, greater in depth investigation than was possible in this study will be necessary to determine whether or not Syrian transit has a comparative advantage. Relatively large numbers of container shipments are being made via the Port of Jiddah to Riyadh. Shipments are also being made by transiting Syria.

In view of the location of the Port of Aqaba, its high handling and internal land transport costs, will probably continue to favor transiting via Syria. Prior to the Lebanese Civil War, the Port of Beirut was a major transit port for Jordanian goods. If conditions sufficiently improve in Lebanon, Beirut may once again serve as a major transit port for Jordan.

Projections of the international transit traffic passing through the Tartous-Lattakia zone of influence are made for each of three components which comprise this traffic; namely, international goods traffic through the Ports of Lattakia and Tartous, roll-on/roll-off movements through the Ports of Lattakia and Tartous, and empty vehicle movements which pass through the Kassab Customs Post for movement beyond Syria.

2) Projections of International Transit Goods Via the Ports of Lattakia and Tartous

Total international goods transit traffic (excluding crude petroleum) passing through Syria grew at an annual average rate of 9.8 percent based upon averages of 1971-1972 and 1975-1976. For the closely comparable period, 1970-1971 and 1975-1976, the combined international transit goods traffic at the Ports of Lattakia and Tartous increased at an annual average rate of 12.0 percent. Utilizing the average of the base years 1970-1971 and the end years 1976-1977, the annual average growth rate of international transit for the two ports equals 5.5 percent. This significant difference in average growth rates reflects the termination of transit traffic by Iraq, as well as a significant decline in goods in transit to Saudi Arabia. In view of the very large change in the computed annual average growth rates introduced by variation of a year or two in the base, the consultant elected to utilize the approximate midpoint of the two above historical growth rates (12.0 percent and 5.5 percent) for the initial projection 1976-1983. This gives an approximate annual rate of 8.0 percent. For the two decades following, annual average growth rates of 6.0 percent and 4.5 percent, respectively, appear to be reasonable prospects for this portion of the transit trade. The results of these projections are shown in the tabulation following. The relatively small tonnage of transit goods traffic through Tartous necessitated combining this port with Lattakia for purposes of projecting this particular traffic.

	Ports of Lattakia and Tartous (000 MT)			
	1976	1983	1993	2003
International Transit Traffic	353.4	605.0	1,084.0	1,683.0
Annual Average Growth Rates (percent)	8.0	6.0	4.5	

The projections reflect a partial resumption of intransit trade with Iraq but at substantially less than the scale of 1975, the peak year for Iraqian goods received for transit at the ports of Lattakia and Tartous. In that year, 72 percent of the total transit goods passing through Lattakia and Tartous were for Iraqi destinations, while in 1976, 20 percent of the total was destined for Iraq. The 1976 base as well as the projected growth rates thus reflect a significant participation by Iraq.

The projected rates could prove to be conservative, especially for the periods beyond 1983, in the event of a full resumption of intransit trade with Iraq along with the possibilities of serving Iran from Tartous and Lattakia by transiting Iraq. From the standpoint of justification of the current road project, however, even a doubling of the projected transit tonnage at the two ports by the year 2003 would have only a small positive affect upon the internal rate of return in view of the magnitude of the total projected tonnages for the zone of influence.[1/]

3) Roll-On/Roll-Off Traffic Through the Ports of Lattakia and Tartous

About 80,000 tons of goods were received at the Port of Lattakia from ro/ro ships in 1976 of which about 32,000 tons were transit, and the balance of 48,000 tons were for Syrian destinations. In 1977, the total ro/ro ship tonnage had risen about 24 percent to about 100,000 tons with most of the increase representing Syrian imports. The latter tonnage rising to about 66,000 tons, and the transit tonnage increasing to 34,000 tons. Ro/ro traffic movements through the Port of Tartous since 1975 have averaged about 90,000 tons per year, representing about 40,100 vehicles annually. About 64 percent of the vehicle tonnage is transit (58,000 tons), while the balance is Syrian imports.

There are no discernible trends for either port over the very short time period. Ro/ro transit traffic at Lattakia increased only about 2,000 tons in 1977 over 1976, while at Tartous, the data show a slight fall-off in 1977 from 1975, and a slight peak in 1976. Partial data for 1978 indicate a possible decrease in tonnage for the year, although the number of ro/ro ships are up. Discussions with government sources and shipping agents indicate an optimistic view concerning future prospects for this traffic. In the absence of any firm data on trends or prospects, the consultant has utilized a relatively modest annual average growth rate of 5 percent throughout the entire 1976-2003 period for both ports combined. The projections are shown in the following tabulation:

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Roll-On/Roll-Off International Traffic, Ports of Tartous and Lattakia

(000 of MT and 000 of Vehicles)

	1976	1983	1993	2003
Number of tons	90.0	126.6	206.2	335.9
Number of vehicles	13.1	18.4	30.1	48.9
(000 of Vehicles)				
Number of cars[1/]	8.8	12.4	20.2	33.0
Number of buses[1/]	1.0	1.4	2.3	3.6
Number of trucks[1/]	3.3	4.6	7.6	12.3
Total	13.1	18.4	30.1	48.9

1/ Allocations for the Port of Tartous are based upon 1977 data. All tonnage for the Port of Lattakia was assigned to trucks at the average weight of 21.10 tons.

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4) Empty Vehicle Movements Through the Kassab Customs Post

In discussions of these movements in Section 4, it was pointed out that, for the limited time period (1975-1977) for which data were available, a slight downward trend was indicated. This trend, however, was undoubtedly due to changes in tariff policies and thus does not provide a basis for projections. In view of the difficulties of anticipating future changes in tariff policies, the consultants have assumed a very modest increase of 3 percent annually throughout the study period for vehicle movements through the Kassab frontier point. The results are shown in Table B-74.

TABLE B-74

PROJECTIONS OF ANNUAL VEHICLE MOVEMENTS THROUGH THE KASSAB CUSTOMS POST BY VEHICLE TYPE, 1977-2003 1/

	1977	1983	1993	2003
Southbound				
Cars	15,000	18,500	24,900	33,500
Buses	40	50	70	90
Trucks	3,020	3,700	5,000	6,700
Total	18,060	22,250	29,970	40,290
Northbound				
Cars	4,400	5,400	7,300	9,800
Buses	20	25	34	46
Trucks	100	123	165	222
Total	4,520	5,548	7,499	10,068

h. Zone Domestic Imports

1) Methodology

In projecting growth rates of commodities imported into the zone from other regions of Syria, the tonnage of petroleum products was eliminated. This is because these products are scheduled to be produced at the Banyas refinery and then trucked directly to consumers within the zone of influence. The projected tonnages and growth rates for domestic imports of consumer goods, manufacturing inputs, agricultural inputs, and forestry products are presented in the following sections.

1/ These are primarily empty vehicle movements.

Taken as a group, these domestic imports totaled 274,300 tons in 1976 and are projected at 375,900 tons in 1983, or at an annual average growth rate of 4.6 percent. (See Tables B-75 and B-76.) By the year 2003, these imports are estimated at 929,000 tons, based on growth rates of 4.8 and 4.4 percent in the 1984-1993 and 1994-2003 periods.

2) Consumer Goods

Food and non-food consumer items imported from other regions of Syria were estimated at 198,600 tons in 1976. It is expected that growth of these imports will depend largely on population increases in the zone, with foreign imports and production within the zone itself continuing as important sources for goods of this type. With population growth projected to average 3.2 percent over the 1984-2003 period, domestic import of consumer goods is estimated at 464,000 tons in 2003.

TABLE B-75

PROJECTIONS OF ZONE DOMESTIC IMPORTS, 1976-2003

(000 MT)

Commodity Group[1/]	1976	1983	1994	2003
Consumer goods	198.6	249.3	341.6	464.0
Manufacturing inputs	65.7	112.9	235.0	427.0
Agricultural inputs	4.0	7.7	19.6	32.0
Forestry products	6.0	6.0	6.0	6.0
Total	274.3	375.9	602.2	929.0

1/ Excludes petroleum products since these will be produced within the zone of influence at the Banyas refinery, and therefore are included in the projections for industry.

TABLE B-76

ANNUAL AVERAGE GROWTH RATES OF PROJECTED ZONE DOMESTIC IMPORTS, 1976-2003

(Percentage

Commodity Groups	1976-1983	1984-1993	1994-2003	1984-2003
Consumer goods	3.3	3.2	3.1	3.2
Manufacturing inputs	8.0	7.6	6.2	6.9
Agricultural inputs	9.8	9.8	5.0	7.4
Forestry products	1/	1/	1/	1/
Weighted average	4.6	4.8	4.4	4.6

1/ No increase projected in timber output.

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3) Manufacturing Inputs

Domestic imports of raw materials for the zone's manufacturing industry totaled 65,700 tons in 1976, and were comprised mainly of cotton lint, cotton seed, wool, hides and similar raw products. While the tonnage of cotton seed for processing into oil is not expected to increase, the growth of other inputs was projected at the same rates applied to the zone's manufacturing industry, less cement (see Table B-68). Over the 1984-2003 period, domestic imports of manufacturing inputs are projected at an average annual growth rate of 6.9 percent, and a total tonnage at 427,000 tons by the year 2003.

4) Agricultural Inputs

Utilization of fertilizer within the zone was projected to increase from 4,000 tons in 1976 to 32,000 tons by 2003, or at an average annual growth rate of 7.4 percent for this period. The growth rate in fertilizer use from 1976 to 1993 was based on a continuation of the historical trend, while in the last ten year period the growth rate was expected to slow down as benefits from additional fertilizer inputs decline

Production of timber from government forest lands in the Kassab region is projected to continue throughout the 1976-2003 period at about 6,000 tons per year.

i. Summary of Economic Projections

Total projected freight tonnages representing all of the economic sectors of significance to the Tartous-Lattakia Highway Improvement Project are expected to about double over the 1976-1983 period, and then to nearly double again for the ten-year period 1984-1993. (Table B-77.) In the final ten years of the study period, the estimated tonnage increase is about 67 percent over 1993. For the twenty-year period, total tonnage rises from about 17 million tons to about 55 million tons. The largest contributors to the total freight tonnage are industry, and general cargo exports and imports.

The annual average growth rate for the entire economic sector freight tonnage is 6.1 percent over the twenty-year period, 1984-2003, while from 1976-2003 the annual average rate rises to 7.4 percent. (Table B-78.) The relatively high rate of growth in the 1976-1983 period accounts for the increase. This growth reflects allocations in the Third and Fourth Five-Year Plans for very substantial investments in the zone of influence,for industry and port expansion, both of which make large contributions on a tonnage basis to the economic sector.

Conversion of the total projected freight tonnages to truck ADT's on the basis of average truck cargo weights obtained from the consultant's Origin and Destination Study shows the base of 1,450 in 1976 rising to 9,797 by 2003.

(Table B-79.)

Projected automobile and bus traffic for the Tartous-Lattakia road consists of normal passenger traffic; tourism related to the construction of new facilities in the zone over the 1980-2000 period; empty vehicle movements via the Kassab Customs Post; and international transit traffic via the roll-on/roll-off service at Tartous (Table B-80). The total ADT for cars and buses increases from about 1,400 in 1977-1978 to about 14,000 by the year 2003.

The projected ADT's for cars, buses and trucks are summarized in Table B-81, with the annual average growth rates calculated for each of the projected periods shown in Table B-82. Total ADT of cars, buses and trucks is slightly less than 24,000 by the year 2003, with the weighted annual average growth rates of all traffic ranging from a high of 9.9 percent in 1976-1983 to a low of 6.9 percent for 1994-2003.

TABLE B-77

SUMMARY OF BASE AND PROJECTED FREIGHT TONNAGES BY ECONOMIC SECTOR, TARTOUS-LATTAKIA ZONE OF INFLUENCE, 1976-2003

(000 MT)

Economic Sector	1976	1983	1993	2003
Agriculture (Marketable Surplus)	422.6	960.9	2,172.7	4,690.5
Industry	3,210.9	1/ 9,086.2	19,874.5	33,382.8
General Cargo - Exports and Imports	4,056.5	6,015.4	9,801.8	14,637.5
Transit Traffic 2/	353.4	605.0	1,084.0	1,683.0
Zone Domestic Imports	274.3	375.9	602.2	929.0
Total	8,043.4	17,043.4	33,535.2	55,322.8

1/ Includes production of the cement plant at Burj Islam, but excludes quarry production for Port of Lattakia breakwater.

2/ Excludes roll-on/roll-off vehicles via the Ports of Lattakia and Tartous and empty vehicle movements via the Kassab customs post.

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TABLE B-78

ANNUAL AVERAGE GROWTH RATES OF PROJECTED FREIGHT TONNAGES BY ECONOMIC SECTOR, TARTOUS-LATTAKIA ZONE OF INFLUENCE, 1976-2003

Economic Sector	1976-1983	1984-1993	1994-2003	1984-2003	1976-2003
			(Percent)		
Agriculture (Marketable Surplus)	12.4	8.5	8.0	8.3	9.3
Industry	16.0	8.1	5.3	6.7	9.0
General Cargo - Exports and Imports	5.8	5.0	4.1	4.6	4.9
Transit Traffic 1/	8.0	6.0	4.5	5.3	6.0
Zone Domestic Imports	4.6	4.8	4.4	4.6	4.6
Weighted Average - All Sectors	11.3	7.0	5.1	6.1	7.4

1/ Excludes roll-on/roll-off vehicles via the Ports of Lattakia and Tartous and empty vehicle movements via the Kassab customs post.

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TABLE B-79

CALCULATIONS OF TRUCK ADT BY ECONOMIC SECTOR, TARTOUS-LATTAKIA ROAD, 1976-2003

Economic Sector	1976	1983	1993	2003	Average Tons per Truck 1/
Agriculture					
Fruits, Vegetables, and Other	192	451	1,041	2,264	5.60
Livestock	21	27	31	43	4.00
Sub-total	213	478	1,072	2,307	
Industry					
Manufacturing (less Cement)	214	390	883	1,657	13.80
Cement	15	192	368	368	15.50
Quarrying	221	487	1,052	1,714	25.50
Petroleum Products	141 2/	281	666	1,312	14.60
Lattakia Port Breakwater	-	81	81	81	25.50
Sub-total	591	1,431	3,050	5,132	
General Cargo					
Exports & Imports	527	781	1,273	1,901	21.10 3/
Transit via Ports	46	79	141	219	21.10
Truck Roll-On/ Roll-Off	9	13	21	34	- 4/
Empty Vehicles (Trucks) through Kassab Customs Post	9	11	14	19	-
Zone Domestic Imports	59	81	130	200	12.75 5/
Total	1,454	2,874	5,701	9,812	

1/ Based upon data obtained from the Consultants' O&D Survey, May 1978.

2/ Consumption only.

3/ Average of cargo truck weights for containers, construction materials, industrial products, general merchandise, bulk goods, and lumber.

4/ Projected by number of vehicles for the Port of Tartous and by tonnages for the Port of Lattakia averaging 21.10 tons per truck.

5/ Average of industrial products and general merchandise cargo truck weights.

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TABLE B-80

SUMMARY OF PROJECTED ADT OF CARS AND BUSES BY TRAFFIC SOURCE, 1977 - 2003

	1977-78	1983	1993	2003
Normal Passenger Traffic				
Cars	1,124	2,004	4,858	10,046
Buses	233	416	1,139	2,901
Tourism 1/				
Cars	-	88	367	719
Buses	-	16	67	124
Empty Vehicle Movements-Kassab Customs Post				
Cars	12	66	88	119
Buses 2/	1	1	1	1
Transit Traffic-Roll-On/ Roll-Off				
Cars	24	34	55	91
Buses	3	4	6	10
All Traffic				
Cars	1,160	2,192	5,368	10,975
Buses	237	437	1,213	3,036
Total	1,397	2,629	6,581	14,011

1/ Adjusted from the four months period to the full year.

2/ Rounded up to 1 ADT.

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TABLE B-81

PROJECTED AVERAGE DAILY TRAFFIC BY TYPE OF VEHICLE,
TARTOUS-LATTAKIA HIGHWAY
1976-2003

	1976	1983	1993	2003
Cars	1,160	2,192	5,368	10,975
Buses	237	437	1,213	3,036
Trucks	1,454	2,874	5,701	9,812
Total	2,851	5,503	12,282	23,823

TABLE B-82

ANNUAL AVERAGE GROWTH RATES OF PROJECTED TRAFFIC,
TARTOUS - LATTAKIA HIGHWAY
1976-2003

	1976-1983	1984-1993	1994-2003
		(Percent)	
Cars	9.5	9.3	7.4
Buses	9.1	10.7	9.6
Trucks	10.2	7.1	5.6
Weighted Average	9.9	8.4	6.9

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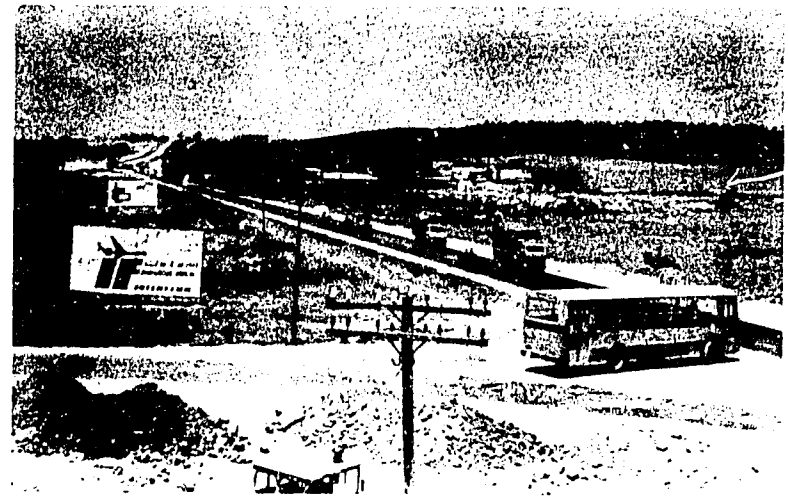

Transport Economics

PART C

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PART C. TRANSPORT ANALYSIS

1. General Concepts and Procedures

The transportation economy analysis is basically a comparison of the cost of construction, maintenance, and use of the proposed project versus the cost of continued maintenance and use of the existing facility. Other costs and benefits which can be quantified, and are clearly attributable to the project, are also taken into consideration.

The selected period of analysis is 20 years which is a commonly used period for the analysis of highway projects. The proportion of the construction costs attributable to the 20 year period of analysis is determined by use of the 20 year Series Present Worth Factor and the Capital Recovery Factor for the estimated (weighted) life of the project.

Annual user costs are based on traffic, traffic growth rates, and unit user operating costs. Critical to their determination is the assumption of the time of opening of the proposed highway. For purposes of the analysis the Consultant has assumed that the proposed highway can be designed and constructed for opening on January 1, 1984.

Transport economy analyses have been run for each of five segments of the proposed highway and for the five segments combined. Analyses of the segments as individual items do not indicate that these segments deserve consideration as individual projects. However, these analyses were required to identify and incorporate widely differing conditions of traffic and physical factors that are attributable to the various segments. The five segments are: Tartous Bypass, Tartous to Banyas, Banyas Bypass, Banyas to Jebleh, and Jebleh to Lattakia.

Calculations required in the transportation economy analyses were accomplished utilizing the Consultant's program and IBM 1130 computer facilities in Baltimore. The program uses the vehicle running cost format published by Winfrey[1/] and the vehicle time cost procedures published by de Weille,[2/] and evaluates construction costs, road maintenance costs, vehicle operating costs (and such other benefits and costs as are quantified and supplied as data input) by methods developed by Winfrey and Lipka.[3/]

1/ Economic Analysis for Highways, Robley Winfrey, International Textbook Co., Scranton, Penn.

2/ Quantification of Road User Savings, Jan de Weille, IBRD, Washington, D.C.

3/ Trans Java Highway, Transportation Economy, New Analysis Procedures, R. Winfrey and S. Lipka, Lyon Associates, Transportation Research Record No. 490, Washington, D.C.

2. Traffic

a. Vehicle Types

There are six basic vehicle types presently in use on Syrian highways. Descriptions of the six types and discussions of their significance in the project study follow:

1) Motorcycles

There are relatively few motorcycles operating in Syria. Their unit operating costs are very low and will be only slightly reduced by the proposed project. Few motorcycles will be attracted to the proposed facility. Motorcycle user cost savings attributable to the proposed Tartous-Lattakia expressway are therefore assumed to be negligible.

2) Three-Wheel Vehicles

Three-wheel vehicles on Syrian highways generally have steering apparatus and an engine in the configuration of a motorcycle, and have covered section at the rear for transport of goods and/or passengers. These vehicles are not suitable for long trips at high speeds and will not be attracted in numbers to the proposed expressway. They should, in fact, be restricted from using the proposed expressway. Three-wheel vehicles continuing to operate on the existing highway will experience less traffic congestion but will not make significant cost savings since they tend to operate at or near the speed of the slowest vehicles on the road. Three-wheel vehicle user cost savings attributable to the proposed Tartous-Lattakia expressway are therefore assumed to be negligible.

3) Farm Tractors

Farm tractors constitute only a very small percentage of the traffic stream but, cause a disproportionate degree of congestion and are directly or indirectly responsible for numerous accidents. The use of farm tractors on the proposed expressway should not be allowed. Those farm tractors continuing to use the existing highway will do so under more favorable traffic conditions but will not experience significant user cost reductions as they tend to operate at about 30 kph regardless of traffic volumes. Farm tractors are therefore omitted in the operating cost analyses contained in this report. It is the Consultant's opinion that this omission does not introduce statistical bias.

4) Automobiles (Including Taxis)

Automobiles constitute about 30 to 40 percent of the traffic stream. Sedans (other than taxis) are predominately of the smaller European type, with

Peugeot being the most popular manufacturer. Land Rovers, Jeeps and station wagons are also common. Taxis, which constitute about 30 to 40 percent of the automobiles are predominately Mercedes vehicles several years old. Taxis are commonly used for long trips at high speeds and frequently operate at speeds as high as 150 kph in areas where the posted limit is 100 kph. Essentially all automobile traffic involved in trips exceeding 20 km will find the proposed expressway an attractive alternative.

5) Buses

Buses, which are numerous in the project corridor, are classified as either mini buses, or large buses. Mini buses have a seating capacity of 20 to 22 passengers and generally make shorter trips at lower fare rates than do the larger buses. The most common model is a two axle, six wheeled, Fiat model "OM" chassis with a locally produced body. The mini bus category also includes several vehicle types which can be considered as elongated station wagons with four wheels.

The large buses (operated by Karnak) on long runs such as Damascus to Lattakia are generally 44 seat Mercedes Benz buses imported as a complete unit. They operate between city terminals and do not make indiscriminate stops between designated terminals. Seats are assigned at time of ticket purchase and ticket sales are limited to seats available (i.e., no standing passengers). These buses operate with an extremely high load factor.

The city of Lattakia operates large buses on the relatively short run (20 km) to the city of Jebleh. There are also a number of older large buses in operation which function in the same manner as mini buses, traveling at slow speeds and stopping at random locations to pick up and discharge passengers. These buses have a seating capacity of about 40 to 45 but, in practice, carry as many passengers as can possibly crowd into the vehicle.

6) Trucks

Trucks are present in a large variety on the highways, ranging in size from small pick-up trucks to multi-axle tractor-trailer combinations. Table C-1 lists different truck axle and tire combinations that were observed by the Consultant's traffic engineer in the project corridor during a six week period in February and March, 1978.

Pick-up trucks in evidence, are of various types and styles and range in capacity from about 1/4 ton to 1-1/2 tons. Vans are generally of the closed delivery type and are classified in the pick-up category for this analysis.

Single unit trucks are primarily two-axle six-tire trucks used for general goods movements and three-axle 10-tire trucks used on construction projects (and occasionally for general goods movements). Exceptions to the above are trucks of similar axle configuration and size, but used for government service.

TABLE C-1

VEHICLES OBSERVED IN THE ROUTE CORRIDOR

	Axles			Tires		
	Truck	Trailer	Total	Truck	Trailer	Total
Single Unit Truck						
Flat Bed or Dump			2			6
			3			10
			2			4 1/
			3			6 1/
Tankers			2			6
			3			10
			3			6 1/
Combinations						
Truck and Full	2	2	4	6	8	14
Trailer	3	2	5	10	8	18
	2	3	5	6	12	18
	3	3	6	10	12	22
Tractor and Semi Trailer						
Flat Bed	2	1	3	6	4	10
	2	2	4	6	8	14
	2	3	5	6	12	18
	3	2	5	10	8	18
	3	2	5	10	16	26
	3	3	6	10	12	22
	3	4	7	10	16	26
	3	8	11	10	64	74
Tanker	2	1	3	6	4	10
	2	2	4	6	8	14
	3	2	5	10	8	18

1/ Government Vehicles.

These government vehicles normally have four tires on the two-axle trucks or six tires on the trree-axle trucks. In addition, there are single unit tanker trucks carrying liquid commodities such as petroleum projects and water.

Truck combinations include full trailers and half trailers. The majority of truck-trailer combinations consist of two-axle six tire trucks pulling two-axle eight tire trailers. There were observations, however, of two-axle trucks pulling three-axle trailers and three-axle trucks pulling either two-axle or three-axle trailers.

There are a number of variations to the tractor-half trailer combination with tractors being either two-axle or three-axle type, with the two-axle most common. The semi-trailers vary from one to eight axles with two-axles being the most common. There were a noticeable number of triple-rear-axle semi-trailers; however, it is understood that these vehicles have registrations other than Syrian. Many of the larger semi-trailers are of the lowbed configuration for carrying vehicles with treads or cleats and are of larger than standard width (approximately 3 to 3½ meters).

b. Vehicle Inventory

A truck inventory was made and used to establish a proportion reflecting various vehicle types, to obtain vehicle make and model data and to determine (along with the traffic count data used) the most prominent types of trucks and truck-trailer combinations on the road. The inventory was conducted at the truck staging area in Lattakia where trucks report when coming into the city (whether bringing goods or to await shipment of goods to other destinations). The inventory did not include vehicles under (or awaiting) repairs, unattached trailers or semi-trailers and tractors without semi-trailer attached due to indeterminate combination configuration.

The results of the inventory taken on Tuesday, February 14, 1978 are shown on Table C-2.

TABLE C-2
TRUCK INVENTORY, LATTAKIA

Vehicle Type	Number	Percent
2-axle 6-tire truck	124	46%
3-axle 10-tire truck	16	6%
2-axle truck plus 2-axle trailer	49	18%
2-axle tractor plus 1-axle semi-trailer	2	-
2-axle tractor plus 2-axle semi-trailer	72	26%
3-axle tractor plus 2-axle semi-trailer	10	4%
	273	100%

On the day of the inventory a total of 273 vehicles were counted which is in contrast to the average daily 362 trucks in the area as noted in a report prepared by the trucking office. The difference can be attributed to the fact that not all of the trucks park in the staging area and some trucks were dispatched during the inventory study.

c. Truck Movements

Daily records are kept at the Lattakia truck depot concerning loaded truck arrivals, loaded truck departures, and empty truck arrivals (to obtain load). No records are kept concerning trucks departing the Lattakia area without load.

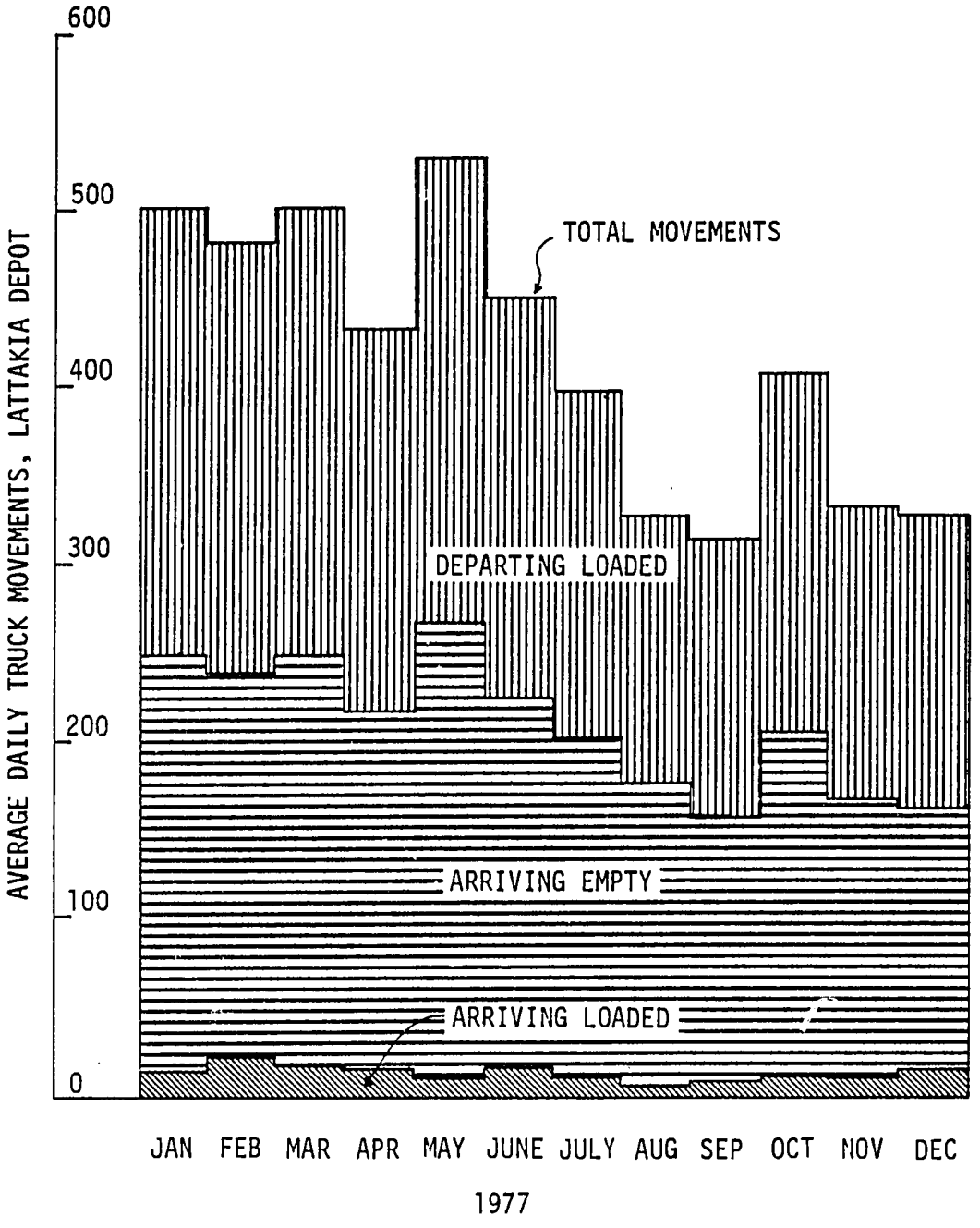
The Lattakia truck depot tabulated by months for the year 1977 is shown on Table C-3 and is presented graphically in Figure C-1. From Table C-3, on a daily average, the 15 incoming loaded and 197 incoming empty vehicles are approximately equal to the 207 outgoing loaded vehicles. It should also be noted there are approximately 360 vehicles remaining in Lattakia each day which indicates that on an average, trucks wait two days prior to departing with a load.

TABLE C-3
TRUCK MOVEMENTS LATTAKIA DEPOT

Month	Incoming Loaded (trucks)	Incoming Empty (trucks)	Outgoing Loaded (trucks)	Total (trucks)	Layover in Lattakia (truck days)
January	489	7,299	7,754	15,542	6,952
February	620	6,148	6,801	13,569	7,327
March	585	7,117	7,781	15,483	8,304
April	549	6,058	6,483	13,090	9,273
May	431	7,862	8,122	16,415	11,133
June	505	6,293	6,844	13,642	13,635
July	370	5,964	6,060	12,394	11,482
August	260	5,324	4,572	10,156	11,831
September	325	4,459	4,745	9,529	9,378
October	409	5,915	6,354	12,678	12,858
November	359	4,880	5,098	10,337	12,569
December	472	4,612	5,117	10,201	17,307
TOTAL	5,374	71,931	75,731	153,036	132,049
Monthly Average	448	5,994	6,311	12,753	11,004
Daily Average	15	197	207	419	362

FIGURE C-1
LATTAKIA TRUCK DEPOT

TRUCK MOVEMENTS, 1977



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The personnel operating the Lattakia truck depot advised that about two-thirds of the incoming loaded vehicles come from Aleppo and one-third from Damascus. Of the incoming empty vehicles, one-third come from Aleppo and two-thirds from Damascus. Of the outgoing loaded vehicles, one-third go toward Aleppo and two-thirds go toward Damascus. These percentages and directions noted do not necessarily refer to the specific cities of Aleppo or Damascus, but to the general direction. For example, the direction of Damascus can indicate travel to the city of Homs or to neighboring countries such as Jordan and Lebanon.

d. Weighting Factors

Weighting factors are necessary to equalize a traffic count to a yearly basis and are desirable on a monthly or seasonal basis and if possible, daily. The ideal situation would be to have daily traffic counts over a year's period so that a daily average would not have to be weighted. A considerable number of traffic counts would also be acceptable if such counts were made on varying days and months throughout the year, in which case an average could be considered representative of an annual count. An actual traffic count divided by known factors equate the count to a yearly basis.

Annual counts did not exist and a traffic survey for the project was conducted during May 1978. Because this traffic represented one month of the year, it was necessary to establish a relationship between the count and known traffic movements. A review of data from various organizations and agencies was made in such statistical items as tonnages of goods moved in and out of the ports, passenger volumes on various bus lines and the numbers of trucks assigned in and out of the trucking depot in Lattakia. After considering the possible value of such data, it was decided that the number of trucks using the depot in Lattakia would constitute the best basis for developing a monthly weighting factor. The truck volumes would be representative of the monthly or seasonal flows of traffic in and out of the ports with respect to industrial, manufactured and agricultural goods.

1) Monthly Factors

Monthly factors shown in Table C-4 and graphically in Figure C-2 were established using the year 1977 truck data shown in Table C-3. May had the highest volume of trucks on the road while September was the month with the lowest truck volume. The first six months of the year had volumes greater than average while the latter six months were below average.

TABLE C-4

MONTHLY WEIGHTING FACTORS
TRUCK TRAFFIC
LATTAKIA DEPOT
1977

Month	Truck Volumes	Weighting Factor
January	15,542	121.9
February	13,569	106.4
March	15,483	121.4
April	13,090	102.6
May	16,415	128.7
June	13,642	107.0
July	12,394	97.2
August	10,156	79.6
September	9,529	74.7
October	12,678	99.4
November	10,337	81.1
December	10,201	80.0
TOTAL	153,036	—
Monthly Average	12,753	—

2) Daily Factors

In addition to the monthly factors, it was necessary to determine factors to apply against daily traffic counts. To establish these factors, traffic counts taken during a 14 day period during March, 1977 were used and are presented in Table C-5 and graphically on Figure C-2.

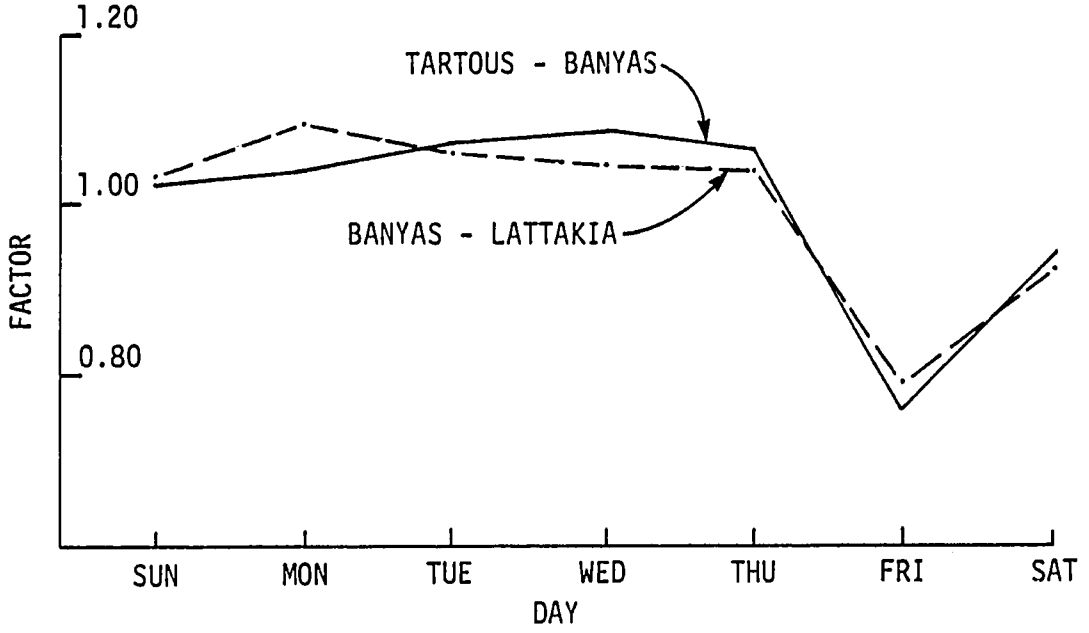
C-5
DAILY WEIGHTING FACTOR
TRUCK TRAFFIC
MARCH 1977

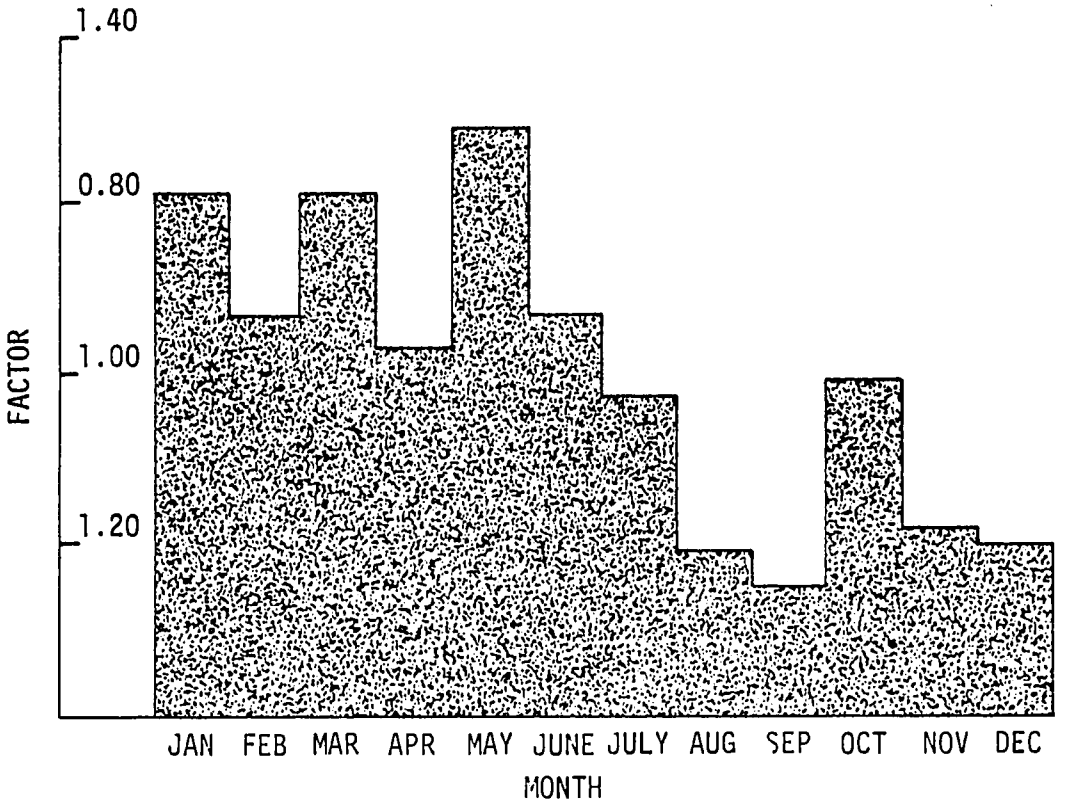
Day	Tartous-Banyas	Banyas-Lattakia
Sunday	1.026	1.036
Monday	1.047	1.092
Tuesday	1.075	1.064
Wednesday	1.082	1.043
Thursday	1.068	1.043
Friday	0.766	0.791
Saturday	0.935	0.931

FIGURE C-2
1977 TRAFFIC WEIGHTING FACTORS

SEASONAL

DAILY





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In addition, using this data, a daily percentage was established for each day of the week with results shown in Table C-6

TABLE C-6
DAILY TRAFFIC AS
PERCENT OF WEEKLY VOLUME
MARCH 1977

	Tartous-Banyas	Banyas-Lattakia
	Daily Percent	Daily Percent
Sunday	14.6	14.8
Monday	15.0	15.6
Tuesday	15.4	15.2
Wednesday	15.5	14.9
Thursday	15.3	14.9
Friday	10.9	11.3
Saturday	13.3	13.3
Total	100.0	100.0

Monday, Tuesday, Wednesday, and Thursday are the higher volume days of the week. Friday, the Islamic Holy Day, has the lowest traffic volume.

e. Traffic Surveys

Classified traffic counts were necessary to establish the types and volumes of various vehicles on the road. Forms were developed and prepared in both English and Syrian language versions, upon which the various types of vehicles on the road could be recorded and the input needs for the analysis tabulated. Appendix C contains the English language version of the field and summary sheets, Forms 1 and 2, and the Arabic version used by the field and office crews, Forms 3 and 4, for field sheet and summary sheet respectively.

Prior to the actual survey, enumerators were given training at several locations in the field in order to familiarize them with the various vehicle types, the use of the form, and to decide if any changes were required in the form. During the training period it was determined that two men should be

utilized at each count station during each day shift because of vehicle volumes and categories encountered and at night by virtue of safety requirements. Difficulty was experienced in hiring local personnel at the respective count stations, therefore, men were transported from Lattakia for this purpose. The counting day started at 6:00 a.m. and continued for 24 hours ending 6:00 a.m. the following day. The survey was conducted for 72 consecutive hours starting 6:00 a.m. Tuesday, 23 May and concluding 6:00 a.m., Friday, 26 May. Counts were made in eight-hour shifts under continuous supervision by the Consultants Lattakia office personnel.

Hourly tabulations were made on the field forms and they were picked up at the end of each shift to enable summary details to be prepared during subsequent counting periods. Hourly data was transferred to the summary sheets in the Lattakia office, and at the end of each 24-hour counting period, the summary sheet was totaled and daily count established.

Four count station locations were established on the route, as follows: at northern limits of Tartous, and between Jebleh (North Road Junction) and Lattakia, between Banyas and Jebleh (North Road Junction), between Tartous and Banyas.

The traffic volumes obtained were processed to reflect seasonal and daily variations and to establish volumes considered as remaining on the existing road and those diverted to the proposed road. Base year traffic volumes are contained in Tables C-7, C-8, C-9 and C-10.

The diversion analysis, 1/ was conducted to determine those vehicles which would ultimately use the new facility as opposed to those vehicles which would continue to use the existing road. Because this procedure applies to all vehicles on the road, it must be quite comprehensive when considering all the factors related to choice. Salient factors which are instrumental in the final determination are certainly those dealing with time and monetary savings and origin and destination considerations. Vehicles using the new facility can generally expect to experience substantial time and monetary savings if not required to travel out of their way to do so.

Based on accepted procedure, if the time via the new route is approximately half the time on the existing road, all vehicles would be considered as using the new route. In this study, it was found that 92-93 percent of passenger cars would use the new route while 93-94 percent of the trucks and buses would use the new route. These numbers are further tempered by best

1/ Traffic Diversion Curve, Figure 18.21, page 702, Traffic Engineering Handbook, Institute of Traffic Engineers, Washington, D.C. 1965.

TABLE C-7
TRAFFIC ANALYSIS
TARTOUS-LATTAKIA ROUTE
NORTH TARTOUS

	NORTHBOUND				SOUTHBOUND				TOTAL	
Vehicle Type	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN. EXIST	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE
Passenger Car, sedan	652	482	248	234	717	531	249	282	497	516
Taxi	558	413	191	222	591	437	191	246	382	468
Pick up Truck	974	721	532	189	1,067	790	547	243	1,079	432
Micro Bus	288	213	19	194	292	216	5	211	24	405
Bus	66	49	15	34	69	51	13	38	28	72
2 axle truck	615	455	334	121	687	508	341	167	675	288
3 axle truck	113	84	67	17	124	92	72	20	139	37
Truck plus trailer	43	32	32	0	73	54	49	5	81	5
Tractor plus ½ trailer	188	139	125	14	256	189	165	24	290	38
Sub Total	3,497	2,588	1,563	1,025	3,876	2,868	1,632	1,236	3,195	2,261
Motorcycle	358	265	--	265	421	312	--	312	--	577
Farm Tractor	48	36	--	36	53	39	-	39	--	75
Sub Total	406	301	--	301	474	351	--	351	--	652
Non Motorized	197	146	--	146	292	216	--	216	-	362
Grand Total	4,100	3,035	1,563	1,472	4,642	3,435	1,632	1,803	3,195	3,275

NOTE: Columns do not total due to truncating.

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TABLE C-8
TRAFFIC ANALYSIS
TARTOUS-LATTAKIA ROUTE
TARTOUS TO BANYAS SEGMENT

	NORTHBOUND				SOUTHBOUND				TOTAL	
Vehicle Type	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN. EXIST	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE
Passenger Car, sedan	435	322	282	40	417	309	270	39	552	79
Taxi	185	137	120	17	174	129	113	16	233	33
Pick up Truck	401	297	259	38	375	278	243	35	502	73
Micro Bus	137	101	25	76	122	90	22	68	47	144
Bus	43	32	24	8	32	24	18	6	42	14
2 axle truck	293	217	187	30	321	238	189	49	376	79
3 axle truck	39	29	27	2	43	32	30	2	57	4
Truck plus trailer	24	18	18	0	33	24	24	0	42	0
Tractor plus ½ trailer	54	40	40	0	76	56	56	0	96	0
Sub Total	1,613	1,194	982	211	1,593	1,180	965	215	1,947	426
Motorcycle	59	44	-	44	57	42	--	42	--	86
Farm Tractor	18	13	--	13	19	14	--	14	--	27
Sub Total	77	57	--	57	76	56	--	56	--	113
Non Motorized	18	13	--	13	14	10	--	10	--	23
Grand Total	1,708	1,264	982	281	1,683	1,246	965	281	1,947	562

NOTE: Columns do not total due to truncating.

TABLE C-9
TRAFFIC ANALYSIS
TARTOUS-LATTAKIA
BANYAS TO JEBLEH (NORTH ROAD JCT.) SEGMENT

	NORTHBOUND				SOUTHBOUND				TOTAL	
Vehicle Type	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN. EXIST	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE
Passenger Car, sedan	484	350	305	45	450	325	284	41	589	86
Taxi	308	223	195	28	290	210	183	27	378	55
Pick up Truck	386	279	244	35	340	246	215	31	459	66
Micro Bus	57	41	10	31	41	30	7	23	17	54
Bus	46	33	25	8	32	23	17	6	42	14
2 axle truck	364	263	229	34	383	277	245	22	474	56
3 axle truck	51	37	32	5	52	38	33	5	65	10
Truck plus trailer	27	20	20	0	39	28	28	0	48	0
Tractor plus ½ trailer	55	40	40	0	58	42	42	0	82	0
Sub Total	1,771	1,286	1,100	186	1,680	1,219	1,054	155	2,154	341
Motorcycle	80	58	--	58	87	63	--	63	--	121
Farm Tractor	38	27	--	27	37	27	--	27		54
Sub Total	118	85	--	85	124	90	--	90	--	175
Non Motorized	14	10	--	10	15	11	--	11	--	21
Grand Total	1,903	1,381	1,100	281	1,819	1,317	1,054	256	2,154	537

NOTE: Columns do not total due to truncating.

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TABLE C- 10
TRAFFIC ANALYSIS
TARTOUS-LATTAKIA ROUTE
JEBLEH (NORTH ROAD JCT) TO LATTAKIA SEGMENT

	NORTHBOUND				SOUTHBOUND				TOTAL	
Vehicle Type	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE	FIELD COUNT	WEIGHTED VOLUME	DIVERTED NEW ROUTE	REMAIN. EXIST	DIVERTED NEW ROUTE	REMAIN EXIST. ROUTE
Passenger Car, sedan	687	497	440	57	659	476	420	56	860	113
Taxi	352	254	224	30	346	250	222	28	446	58
Pick up Truck	543	392	347	45	515	372	328	44	675	89
Micro Bus	185	134	34	100	169	122	31	91	65	191
Bus	66	48	36	12	53	38	28	10	64	22
2 axle truck	437	316	282	34	493	356	318	38	600	72
3 axle truck	59	43	39	4	63	46	40	6	79	10
Truck plus trailer	40	29	29	0	39	28	28	0	57	0
Tractor plus ½ trailer	54	39	39	0	66	48	48	0	87	0
Sub Total	2,423	1,752	1,470	282	2,403	1,736	1,463	273	2,933	555
Motorcycle	217	157	--	157	193	139	--	139	--	296
Farm Tractor	100	72	-	72	103	74	--	74	--	146
Sub Total	317	229	--	229	296	213	--	213	---	442
Non Motorized	28	20	--	20	34	25	--	25	-	45
Grand Total	2,768	2,001	1,470	531	2,733	1,974	1,463	511	2,933	1,042

NOTE: Columns do not total due to truncating.

judgement, especially with regard to buses, since micro buses would, of necessity, use the existing road for their numerous local passenger pick up and drops while the larger buses traveling increased distances or between terminal destinations perfer to use the existing road.

In order to properly treat the origin and destination factor it was necessary to establish those traffic volumes desiring to stop at the cities of Jebleh, Banyas and Tartous. An O-D questionnaire, shown in Appendix C, Forms 5 and 6 (in English and Arabic respectively) was prepared to obtain data on those vehicles desiring to stop at either one or any combination of the three cities. The data obtained were analyzed with respect to the volumes counted, the adjusted volumes weighted by monthly and daily factors, and ultimately those diverted volumes reflecting route assignments for those vehicles with origins and/or destinations of Jebleh, Banyas and Tartous.

Daily hourly percents were established from the traffic data and are presented in tabular form in Table C-11 and graphically as Figures C-3, C-4 C-5 and C-6 for the four respective segments. Traffic volumes between the hours of 7:00 a.m. and 5:00 p.m. exhibit only slight variation. Data from all stations indicate that little traffic flows during the night or in the early morning hours reflecting the ports being closed during these hours.

f. Loading Surveys

1) General

No previous study of truck weights and load distribution in Syria has been accomplished. The Consultant therefore found it necessary to conduct such a study in order to relate traffic volume to tonnage in transit (for economic studies) and to determine equivalent axle loads (for pavement design studies). For purposes of the study the Consultant's personnel were granted permission (and the secuurity clearances necessary) to utilize two scales of 30 metric ton capacity and two scales of 50 metric ton capacity. These scales are permanent installations within the Port of Lattakia. In addition to the abovementioned scales, privately owned scales of 60 metric ton capacity, located near the port entrance, were used to weigh vehicles which could not be accomodated by the scales in the port.

FIGURE C-3
TRAFFIC ANALYSIS, NORTH TARTOUS

HOURLY PERCENTS

HOURLY CUMULATIVE

MAY, 1978

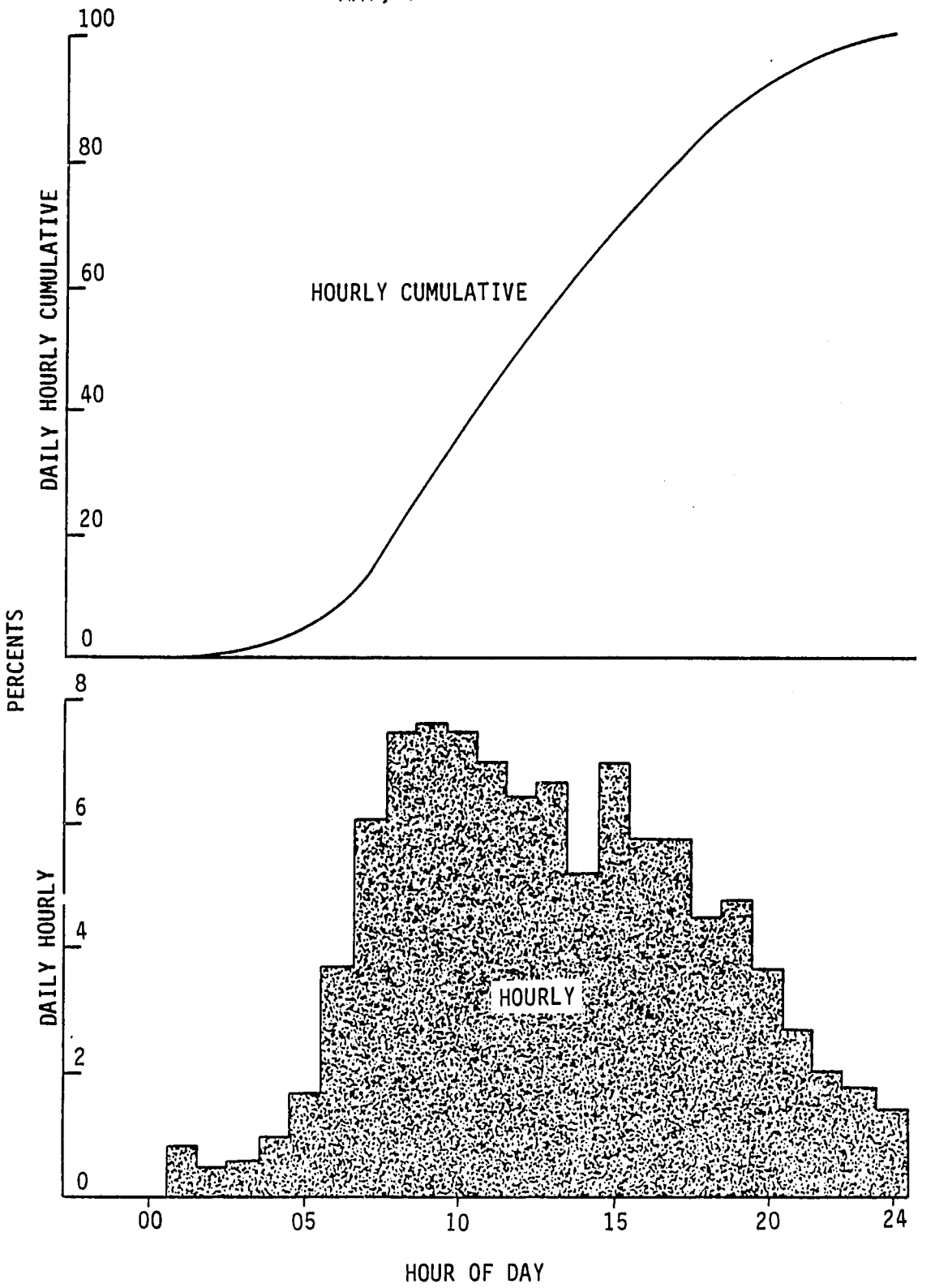

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FIGURE C-4
TRAFFIC ANALYSIS, TARTOUS - BANYAS

HOURLY PERCENTS

HOURLY CUMULATIVE

MAY, 1978

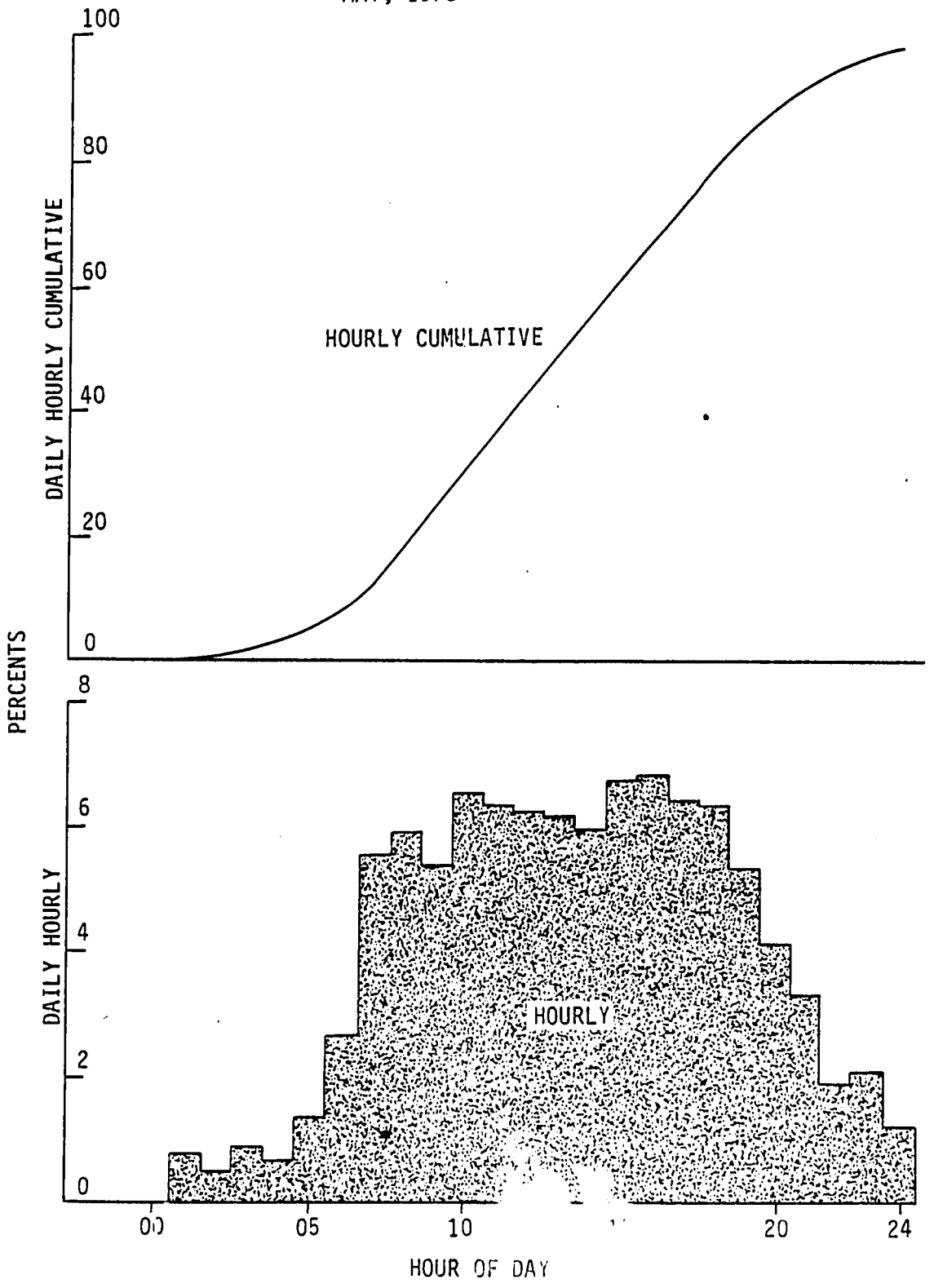

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FIGURE C-5
TRAFFIC ANALYSIS, BANYAS - JEBLEH

HOURLY PERCENTS

HOURLY CUMULATIVE

MAY, 1978

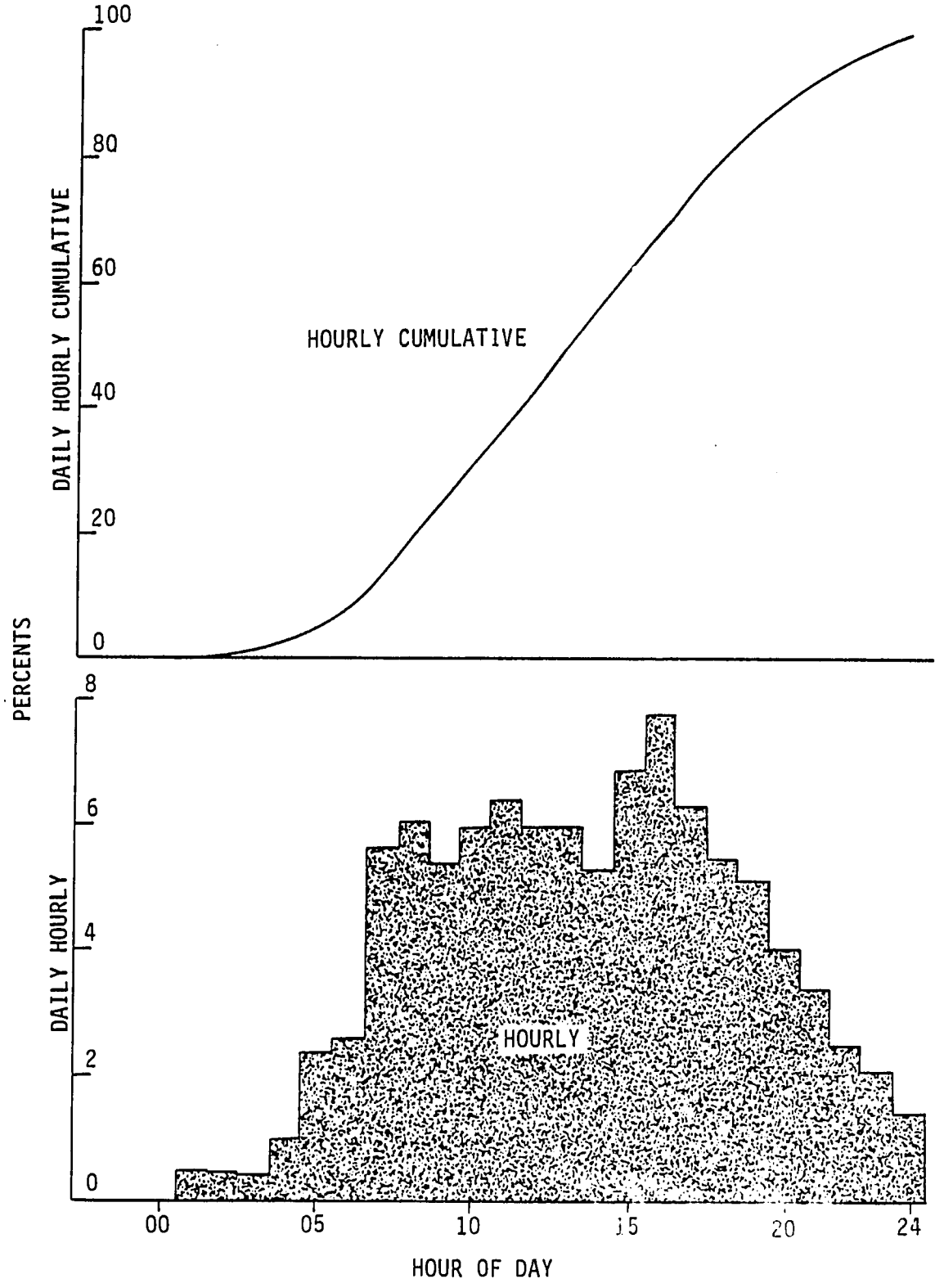

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FIGURE C-6
TRAFFIC ANALYSIS, JEBLEH - LATTAKIA

HOURLY PERCENTS

HOURLY CUMULATIVE

MAY, 1978

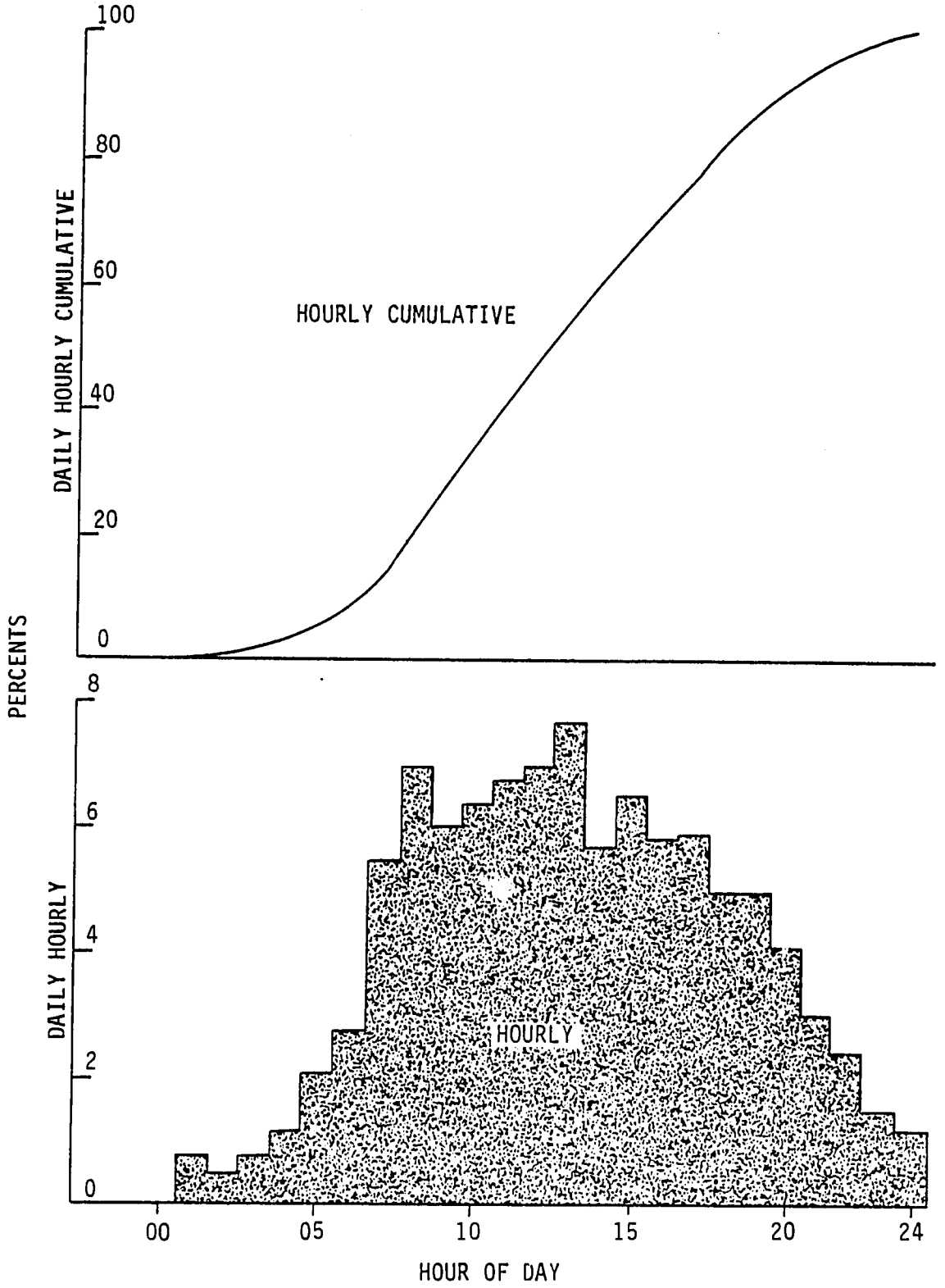

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TABLE C-11

Hourly Traffic Volumes
As Percent of Daily
6:00 a.m. 23 May - 6:00 a.m. 26 May 1978

Hours	North Tartous Percents		Tartous Banyas Percents		Banyas Jebleh (North Road Jct) Percents		Jebleh (North Rd. Jct) Lattakia Percents	
	Hourly	Cumulative	Hourly	Cumulative	Hourly	Cumulative	Hourly	Cumulative
00-01	0.8	0.8	0.8	0.8	0.6	0.6	0.8	0.8
01-02	0.5	1.3	0.5	1.3	0.6	1.2	0.4	1.2
02-03	0.5	1.8	0.8	2.1	0.5	1.7	0.8	2.0
03-04	0.8	2.6	0.7	2.8	1.1	2.8	1.1	3.1
04-05	1.6	4.2	1.4	4.2	2.3	5.1	2.1	5.2
05-06	3.8	8.0	2.7	6.9	2.6	7.7	2.8	8.0
06-07	6.1	14.1	5.6	12.5	5.7	13.4	5.5	13.5
07-08	7.2	21.3	6.0	18.5	6.2	19.6	6.9	20.4
08-09	7.4	28.7	5.3	23.8	5.3	24.9	5.9	26.3
09-10	7.2	35.9	6.5	30.3	6.0	30.9	6.3	32.6
10-11	6.9	42.8	6.4	36.7	6.6	37.5	6.8	39.4
11-12	6.4	49.2	6.3	43.0	6.0	43.5	7.0	46.4
12-13	6.6	55.8	6.3	49.3	6.0	49.5	7.8	54.2
13-14	5.2	61.0	6.0	55.3	5.3	54.8	5.7	59.9
14-15	6.8	67.8	6.7	62.0	6.9	61.7	6.5	66.4
15-16	5.7	73.5	6.8	68.8	7.9	69.6	5.8	72.2
16-17	5.7	79.2	6.5	75.3	6.3	75.9	5.9	78.1
17-18	4.5	83.7	6.4	81.7	5.5	81.4	4.9	83.0
18-19	4.7	88.4	5.4	87.1	5.2	86.6	4.9	87.9
19-20	3.7	92.1	4.2	91.3	4.0	90.6	4.2	92.1
20-21	2.7	94.8	3.3	94.6	3.3	93.9	2.9	95.0
21-22	2.0	96.8	1.9	96.5	2.5	96.4	2.3	97.3
22-23	1.8	98.6	2.2	98.7	2.2	98.6	1.5	98.8
23-24	1.4	100.0	1.3	100.0	1.4	100.0	1.2	100.0

2) Weighing Procedures

The normal port weighing procedures yielded the required data and were therefore employed without modification. Single unit trucks were weighed as a unit while varying procedures were required for truck combinations. For truck and trailer with a load known not to exceed 50 tons (at the port scale) or 60 tons (at the private scale) the entire combination was weighed as one unit. When the load was questionable, the truck was first driven onto the scale (and a weight recorded), and then driven off the scale to enable the trailer to be weighed. The combined weights were the accepted weight with one weigh ticket showing all information.

Port weighing procedures require that tractor and semi-trailer combinations be weighed as one unit. When the weight was known to be less than 50 metric tons the vehicle was weighed as one unit at the port scale. For loads exceeding 50 tons, the driver would normally go first to the private scales of 60 ton capacity.

In one instance noted, a tractor semi-trailer of more than 50 tons was turned away from the port scale and went to the private scale where the recorded weight was 58 tons. The Consultant did not observe any tractor semi-trailer combination weights exceeding 60 metric tons; however the team did observe several truck-trailer combinations with total loads exceeding 60 metric tons. In several instances, loads were too wide to fit the configuration of the scale and weigh house, and in such cases, the net weight noted on the goods was used as the basis for documentation.

Because of the wide variations in types and loads of trucks, the Consultant elected to analyze truck data in six categories which follow:

2 axle trucks, medium
2 axle trucks, large
3 axle trucks
2 axle truck and trailer combinations
4 axle combinations, tractor and semi-trailer (2-S2)
5 axle combinations, tractor and semi-trailer (3-S2)

A differentiation was made between large two axle trucks and medium two-axle trucks because of the great range of weights noted for two-axle trucks. The medium two-axle truck was defined as having an average loaded weight approximately 60 percent of that carried by the larger two axle truck.

3) Vehicle Weights

The range of observed vehicle weights by vehicle type is presented in Table C-12. The numbers of vehicles included in the study are shown, by vehicle type and weight in Table C-13 and C-14.

For each truck type the percentage of loaded vehicles having any given weight are shown graphically in Figure C-7. The percentages for empty vehicles of given weights are shown in Figure C-8.

TABLE C-12
RANGE OF WEIGHTS
METRIC TONS
PORT OF LATTAKIA, FEBRUARY 1978

Vehicle Type	Empty		With Load	
	Low	High	Low	High
Single Unit Trucks				
2 axle truck, medium	2.51	7.50	6.51	20.50
2 axle truck, large	7.51	11.50	19.51	30.50
3 axle truck	10.51	19.50	28.51	44.50
Combination Vehicles				
Truck + Trailer	12.51	19.50	41.51	64.50
4 axle combination	11.51	20.50	25.51	60.50
5 axle combination	14.51	21.50	40.51	57.50

Figures C-5 and C-6 show the cumulative percents of the increasing weights of each of the six vehicle types with loads and vehicle empty weights respectively.

4) Average Loads

Although the data reflect weights for vehicles loaded and empty, it was not possible during the course of the study to systematically weigh specific vehicles in both the loaded and empty condition to determine true net load. Average loads for each vehicle type have therefore been determined by subtracting the average empty weight for any given vehicle type from the average loaded weight for the type. The results of this analysis are shown in Table C-15.

FIGURE C-7
TRUCK WEIGHTS WITH LOADS

CUMULATIVE PERCENTS

PORT OF LATTAKIA, FEBRUARY 1978

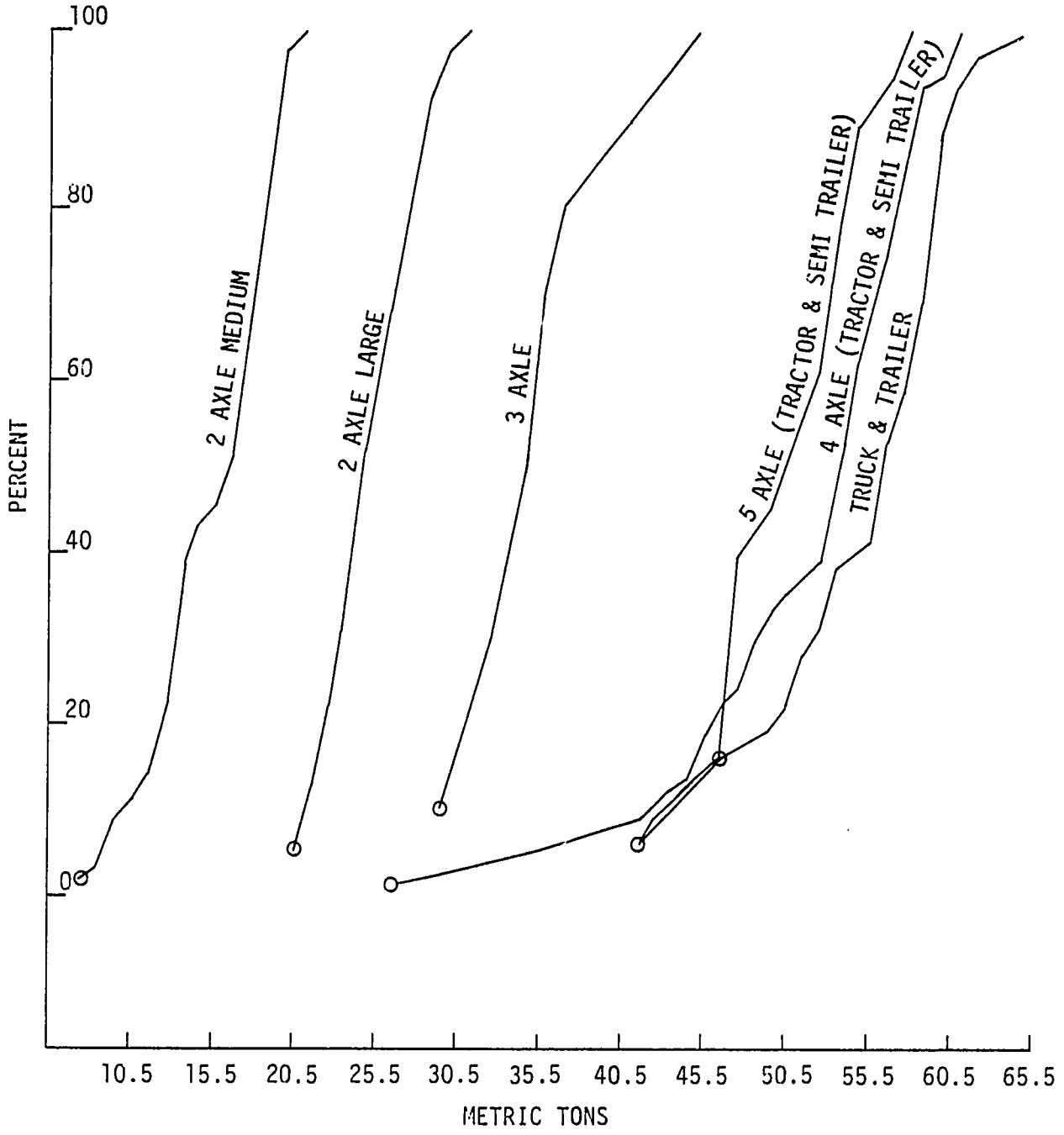

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TABLE C-13
NUMBER OF VEHICLES BY TYPE AND WEIGHT
PORT OF LATTAKIA, FEBRUARY 1978
SINGLE UNIT VEHICLES

Weight Metric Tons	2 Axle Medium		2 Axle Large		3 Axle		Total	
	With Load	Without Load	With Load	Without Load	With Load	Without Load	With Load	Without Load
0 - 2.50								
2.51 - 4.50		15						15
4.51 - 6.50		51						51
6.51 - 8.50	3	34		5			3	39
8.51 - 10.50	8			43			8	43
10.51 - 12.50	11			2		5	11	7
12.51 - 14.50	24					6	24	6
14.51 - 16.50	8					1	8	1
16.51 - 18.50	35					-	35	-
18.51 - 20.50	17		2			1	19	1
20.51 - 22.50			7				7	
22.51 - 24.50			12				12	
24.51 - 26.50			9				9	
26.51 - 28.50			9				9	
28.51 - 30.50			3		1		4	
30.51 - 32.50					2		2	
32.51 - 34.50					2		2	
34.51 - 36.50					3		3	
36.51 - 38.50					-		-	
38.51 - 40.50					1		1	
40.51 - 42.50					-		-	
42.51 - 44.50					1		1	
Total	106	100	42	50	10	13	158	163

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TABLE C-14
NUMBER OF VEHICLES BY TYPE AND WEIGHT
PORT OF LATTAKIA, FEBRUARY 1978
COMBINATION VEHICLES

Weight Metric Tons	Truck plus Trailer		4 Axle Combination (Tractor + Semi Trailer		5 Axle Combination Tractor + Semi Trailer		Total	
	With Load	Without Load	With Load	Without Load	With Load	Without Load	With Load	Without Load
0 -10.50								
10.51 -12.50				2				2
12.51 -14.50		1		6				7
14.51 -16.50		6		7		1		14
16.51 -18.50		28		11		6		45
18.51 -20.50		6		13		3		22
20.51 -22.50						3		3
22.51 -24.50								
24.51 -26.50			1				1	
26.51 -28.50			-				-	
28.51 -30.50			1				1	
30.51 -32.50			-				-	
32.51 -34.50			-				-	
34.51 -36.50			2				2	
36.51 -38.50			-				-	
38.51 -40.50			-				-	
40.51 -42.50	3		3		1		7	
42.51 -44.50	1		4		-		5	
44.51 -46.50	1		7		2		10	
46.51 -48.50	-		6		4		10	
48.51 -50.50	2		5		2		9	
50.51 -52.50	3		3		2		8	
52.51 -54.50	2		19		5		26	
54.51 -56.50	5		11		1		17	
56.51 -58.50	5		16		1		22	
58.51 -60.50	8		5				13	
60.51 -62.50	1						1	
62.51 -64.50	1						1	
Total	32	41	83	39	18	13	133	93

TABLE C-15
AVERAGE WEIGHTS (kg)
PORT OF LATTAKIA, FEBRUARY 1978

	Vehicles with Loads		Vehicles Without Loads		
Vehicle Type	No. of Vehicles Weighed	Average Weight	No. of Vehicles	Average Weight	Average Load
2 axle truck					
Medium	106	15,080	100	5,800	9,280
Large	42	24,754	50	9,569	15,185
3 axle truck	10	34,907	13	13,134	21,773
2 axle truck & trailer	32	54,329	41	17,535	36,794
4 axle (tractor + semi trailer)	83	51,469	39	17,078	34,391
5 axle (tractor + semi trailer)	18	50,188	13	19,076	31,112

5) Axle Loadings

It is desirable to have axle load data for the study and design of the pavement section. The axle loadings are readily convertible to a number of standard axle loads by use of equivalency factors which convert the given loadings to a standard 8.2 metric ton (18,000 lb.) single axle load.

The axle load data includes both single and tandem axles since the effect of tandem axles is different from that of a single axle. Seperate factors have been established for each through prior research.

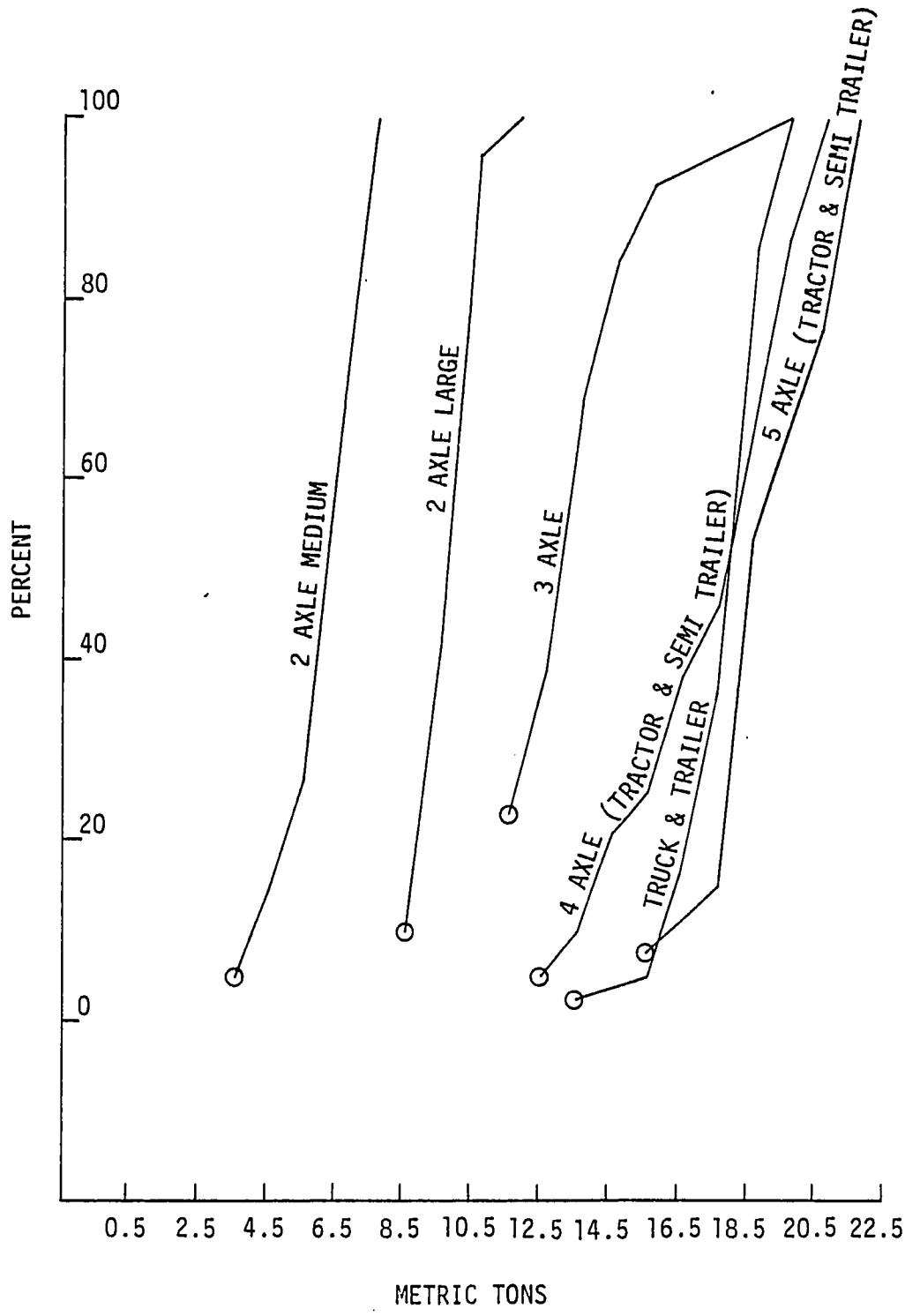
6) Load Distribution

In order to accomplish the study and design of pavement sections by utilizing total vehicle weights, it was necessary to make determinations of the load distribution to the various axles. (Originally, in Lattakia Port, individual axles were weighed, however due to the considerable disruption to the traffic flow, it was decided to obtain total loads.) A procedure then

FIGURE C-8
TRUCK WEIGHTS EMPTY

CUMULATIVE PERCENTS

PORT OF LATTAKIA, FEBRUARY 1978



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established from trucks weighed as a single vehicle. In this case trucks of the truck trailer combination would have constant weights with the trailer weight, a variable, being the difference between the truck weight and the total weight. The second procedure would use data from separate weighings of the truck and trailer in which case a proportion was established for each unit relative to the total weight of the combination.

It was decided to use the latter procedure so that a varying truck and trailer weight would be used throughout the analysis which is more representative of the weights on the road. Therefore, for the truck and trailer combinations with loads, 48 percent of the total weight will be apportioned to the truck and 52 percent to the trailer. For the empty combinations, 63 percent of the total weight was apportioned to the truck and 37 percent to the trailer.

Based upon the axle load distribution percentages noted in Table C-16, total vehicle weights noted in Tables C-13 and C-14 were further analyzed. Axle loadings were established and noted in Tables C-17 and C-18 for the single unit trucks and combination vehicles respectively.

g. Projections and Descriptions of Methods of Projection.

1) Yearly Traffic Volume Projections

Utilizing the growth rates established by the project economists and the average daily traffic as determined in an earlier section of this chapter, annual traffic projections were established for each of three possible project situations, namely: the existing road with no improvements, the proposed road with diverted traffic, and the existing road with no improvements with remaining traffic. These were further examined for each of three conditions involving direction, namely - both directions, northbound, and southbound and also for each of the five selected road segments: Tartous Bypass, Tartous-Banyas, Banyas Bypass, Bayas-Jebleh, and Jableh-Lattakia. The traffic projections under present loading practices for the various combinations are shown in Appendix C, Tables 1 to 45.

The Consultant, in the course of the study, recognized a high incidence of loading over the legal limit. Its implications on design requirements were noted and conveyed to the Steering Committee. The Steering Committee instructed the Contractor to assume a strict level of weight enforcement and to report on its effect.

TABLE C-16

AXLE LOAD DISTRIBUTION BY PERCENTAGE

Vehicle Type	Number of Vehicles Weighed	Axle Location Front	Next Type	%	Next Type	%	Next Type	%
Single Unit Vehicles								
2 axle, 6 tires								
Empty								
Abu Dhabi	1,011	44	Single	56	-	-	-	-
U.S.A.	7,964	44		56	-	-	-	-
Syria	42	46		54	-	-	-	-
Loaded								
Abu Dhabi	914	30	Single	70	-	-	-	-
U.S.A.	13,282	35		65	-	-	-	-
Syria	39	31		69	-	-	-	-
3 axle, 10 tires								
Empty								
Abu Dhabi	12	37	Tandem	63	-	-	-	-
U.S.A.	2,716	40		60	-	-	-	-
Syria	4	32		68	-	-	-	-
Loaded								
Abu Dhabi	17	24	Tandem	76	-	-	-	-
U.S.A.	3,073	28		72	-	-	-	-
Syria	3	34		66	-	-	-	-
Combination Vehicles								
Truck plus trailer								
Empty								
Abu Dhabi 1/	-	28	--	35	-	18.5	-	18.5
U.S.A.	-	-	--	-	-	-	-	-
Syria	19	27	Single	34	Single	20	Single	19
Loaded								
Abu Dhabi 1/	-	15	--	35	-	25	-	25
U.S.A.	-	-	--	-	-	-	-	-
Syria	6	15	--	34	-	26	-	25
Tractor plus 1/2 trailer (2 axle + 2 axle)								
Empty								
Abu Dhabi	6	24	Single	31	Tandem	45	-	-
U.S.A.	3,151	28	-	32	-	40	-	-
Syria	18	28	-	31	-	41	-	-
Loaded								
Abu Dhabi	18	13	-	31	-	56	-	-
U.S.A.	5,910	18	-	32	-	49	-	-
Syria	7	12	-	33	-	55	-	-
Tractor plus 1/2 trailer (3 axle + 2 axle)								
Empty								
Abu Dhabi	18	21	Tandem	38	Tandem	41	-	-
U.S.A.	10,311	27	-	42	-	31	-	-
Syria	4	25	-	39	-	36	-	-
Loaded								
Abu Dhabi	16	11	-	36	-	53	-	-
U.S.A.	19,848	15	-	43	-	53	-	-
Syria	1	17	-	34	-	49	-	-

1/ Percents reflect weights of single unit truck plus 50/50 split for axles of full trailer. See page of this report.

TABLE C-17
AXLE LOADINGS
SINGLE UNIT TRUCKS
PORT OF LATTAKIA, FEBRUARY 1978

Weight Metric Tons	2 Axle Medium		2 Axle Large		3 Axle			
	With Load	Without Load	With Load	Without Load	With Load		Without Load	
	Single Axle	Single Axle	Single Axle	Single Axle	Single Axle	Tandem Axle	Single Axle	Tandem Axle
0 - 1.50	-	5						
1.51 - 2.50	3	38						
2.51 - 3.50	13	117						
3.51 - 4.50	32	40		43			5	
4.51 - 5.50	42			36			6	
5.51 - 6.50	23		6	21			1	
6.51 - 7.50	5		17		1		1	3
7.51 - 8.50	7		16		6			6
8.51 - 9.50	22		3		1			2
9.51 - 10.50	7				2			1
10.51 - 11.50	4							-
11.51 - 12.50	29							1
12.51 - 13.50	23							
13.51 - 14.50	2		2					
14.51 - 15.50			6					
15.51 - 16.50			6					
16.51 - 17.50			9					
17.51 - 18.50			6					
18.51 - 19.50			7					
19.51 - 20.50			5					
20.51 - 21.50			1					
21.51 - 22.50						1		
22.51 - 23.50						-		
23.51 - 24.50						2		
24.51 - 25.50						-		
25.51 - 26.50						3		
26.51 - 27.50						2		
27.51 - 28.50						-		
28.51 - 29.50						-		
29.51 - 30.50						1		
31.51 - 31.50						-		
32.51 - 33.50						1		
33.51 - 34.50						-		
Total	212	200	84	100	10	10	13	13

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TABLE C-18
AXLE LOADINGS
COMBINATION VEHICLES
PORT OF LATTAKIA, FEBRUARY 1978

Metric Tons	Truck & Trailer With Load Single Axle	Truck & Trailer Without Load Single Axle	Tractor & Semi-Trailer (4 Axles) With Load Single Axle	Tractor & Semi-Trailer (4 Axles) With Load Tandem Axle	Tractor & Semi-Trailer (4 Axles) Without load Single Axle	Tractor & Semi-Trailer (4 Axles) Without load Tandem Axle	Tractor & Semi-Trailer (5 Axles) With Load Single Axle	Tractor & Semi-Trailer (5 Axles) With Load Tandem Axle	Tractor & Semi-Trailer (5 Axles) Without load Single Axle	Tractor & Semi-Trailer (5 Axles) Without load Tandem Axle
0 - 1.50										
1.51 - 2.50		2								
2.51 - 3.50		74	1		8				1	
3.51 - 4.50		8	1		29				12	
4.51 - 5.50		41	5		20		9			
5.51 - 6.50	4	31	22		21	8	9			2
6.51 - 7.50	4	8	45			7				9
7.51 - 8.50	17		10			14				12
8.51 - 9.50	7		1			10				3
9.51 - 10.50	-		-							
10.51 - 11.50	10		2							
11.51 - 12.50	2		-							
12.51 - 13.50	12		6							
13.51 - 14.50	15		10							
14.51 - 15.50	11		9	1				1		
15.51 - 16.50	17		8	-				1		
16.51 - 17.50	5		25	1				5		
17.51 - 18.50	7		17	-				3		
18.51 - 19.50	7		4	-				5		
19.51 - 20.50	7			2				3		
20.51 - 21.50	3			-				-		
21.51 - 22.50				-				1		
22.51 - 23.50				3				-		
23.51 - 24.50				3				2		
24.51 - 25.50				5				4		
25.51 - 26.50				5				2		
26.51 - 27.50				4				1		
27.51 - 28.50				6				4		
28.51 - 29.50				3				2		
29.51 - 30.50				18				2		
30.51 - 31.50				10						
31.51 - 32.50				16						
32.51 - 33.50				2						
33.51 - 34.50				4						
Total	128	164	166	83	78	39	18	36	13	26

Based upon past experiences, despite the enforcement of loading at the legal limit, loads over the legal limit would still occur, however, they would be restricted to a fraction of the present incidence and be of much smaller magnitude The situation of existing trucks being forced to carry smaller loads than they now carry, particularily in view of modification of a sizeable portion of the fleet to handle the large loads currently being carried, would certainly create short range financial problems for their owners and an urgent necessity to change the character and growth rate of the present day fleet. Legal load enforcement could and should be partially implemented during the project construction period to soften its impact.

This problem can be addressed by a comprehensive study to evaluate the number and character of additional trucks required to handle the present and projected goods to be moved and to determine the effect of such an increase in vehicle imports on the economy. The full range of such a study is not within the scope of this project.

The traffic projections along with the attendant compositions, assuming legal load enforcement, have been computed and are presented in Appendix C - Tables 46 to 90 in parallel fashion to the present loading situations.

In the preparation of traffic projections assuming legal load enforcement the following considerations are taken into account:

Present Laws governing legal loading

Vehicle types in the present and projected fleet

Present and projected loading practices

Vehicle weights

Present Traffic law governing the Legal Loads

Vehicle load requirements are governed by Traffic Law No. 19, effective 30/3/74, adopted by Parliament 3/3/74 which superceded Traffic Law No. 71 adopted 26/9/53 and its subsequent modifications. The relevant part of the law dealing with vehicle weights is Chapter Seven, Section No. 158 which specifies the following maximum loads for various vehicles and vehicle combinations:

(a) Two -axle trucks will have a maximum loading of 19 metric tons.

(b) Trucks with more than two axles will have a maximum loading of 26 metric tons.

(c) Combination vehicles of truck and trailer or tractor and semi-trailer which have a two-axle pulling vehicle will have maximum loads of 30 metric tons.

(d) Combination vehicles of truck and trailer or tractor and semi-trailer which have a pulling vehicle of more than two axles will have maximum loads of 35 metric tons.

The above noted maximum weight restrictions are modified by individual axle restrictions as follows:

(i) The heaviest loaded single axle cannot be greater than 13 metric tons.

(ii) A vehicle or combination of vehicles having more than two axles, shall have a maximum load per axle computed as follows: If the distance between axles is 90 cm. or less, the maximum axle load will be 7,350 kg. (therefore, tandem axles with a separation of 90 cm. or less have an allowable loading of 14,700 kg.). If the distance between axles is greater than 90 cm., the maximum axle load can be increased at a rate of 350 kg. for every 5 cm. additional distance between the axles beyond the 90 cm., however, the maximum for any single axle will not exceed 13 metric tons, as noted above.

Plate C-1 shows various vehicle types seen on Syrian highways and the legal weights which can be assigned.

Vehicle Types - Present and Projected Fleet

As shown in Plate C-1 there are a considerable number of trucks, truck-trailers, and tractor-semi trailer combinations in the present vehicle fleet. It was necessary to establish a reasonable number of vehicle types to be considered for analysis.

As previously stated in the report, there are six major truck/truck combination types encountered on the road, namely:

Truck, 2 axle, medium

Truck, 2 axle, large

Truck, 3 axle

Truck (2 axle) plus trailer (2 axle)

Tractor (2 axle) plus semi trailer (2 axle)

Tractor (3 axle) plus semi trailer (2 axle)

Consideration of legal load enforcement with respect to the projected fleet results in a further reduction to four major types. The truck plus trailer combination (2+2 axles) was eliminated for several reasons. The combined load permitted by law for this combination is 30 metric tons with the truck permitted to weigh 19 tons, allowing 11 tons remaining for the trailer. The average tare weight of the trailer in Syria was found to be 8 tons, leaving an available pay load for the trailer of only 3 tons. Reduction in the trailer weight would have to be of considerable proportion before the trailer would be an economic vehicle for hauling cargo. Trailers are locally produced, and are not made of lightweight products, such as aluminium, therefore, it was not practical to include in this analysis situations which would necessitate the introduction and evaluation of an industry which is not now being utilized. The two classes

(medium and large) of two axle trucks were considered as one truck type for the analysis.

Present and Projected Loading Practices

It was also necessary to consider the effect upon the number of empty vehicles that would be on the road with the legal loads being enforced.

The weighing survey conducted along with analysis of available weighing and traffic data established the high incidence of overloads, the large number of empty vehicles on the highways and considerable delays encountered in loading. Under legal load enforcement the proportionate number of overloads can be expected to reduce.

The number of empty vehicles on the highway are assumed to be either returning for cargo or searching for cargo. They would be reduced only if the portion searching for cargo is provided increased opportunity for success. This portion is thought to be small and it would seem while that increased opportunity might be afforded by enforcement it would be negated by the fact that facilities to accomplish it may not be available.

Trucks in the Lattakia staging area regularly experience a two day delay prior to picking up a load. Therefore, with more trucks required under enforcement it can be assumed that empty trucks are going to experience longer delays unless loading facilities are increased or improved. It is therefore assumed the net effect of these factors is offsetting. Therefore, the total number of empty trucks on the road today will be considered increased by the additional percent of trucks needed to move the goods.

Vehicle Weights

Vehicle weights for present traffic were previously examined through analysis of available weighing data and the weighing survey. In order to project traffic assuming legal load enforcement, it is necessary to examine the vehicle weights both empty and loaded that would prevail under this condition. This study shows that all trucks are not loaded to their legal maximum and trucks of various types exhibit a considerable load range empty and loaded.

One source of data which aided in this determination was a report[1/] which contained average empty and loaded weights of a large number of truck and combination vehicles. In addition, the data also included the range of weights for each vehicle studied so that it was possible to plot an S curve reflecting the entire distribution.

1/ Truck Traffic Volume and Weight Data for 1971 and Their Evaluation, Federal Highway Administration, Offices of R & D, Washington, D.C., Report No. FHWA-RD-76-138, December 1976, Final Report

PLATE C-1

LEGAL WEIGHTS 1/
OF VARIOUS TRUCK CONFIGURATIONS
(METRIC TONS)

	N/A
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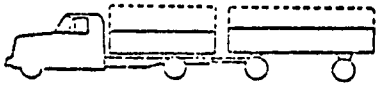
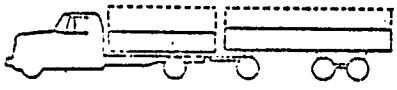
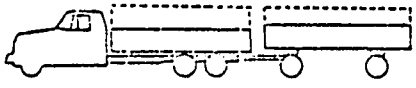
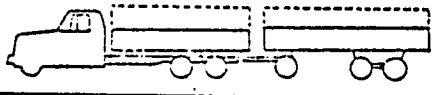
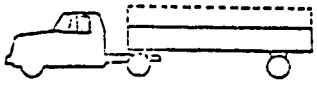
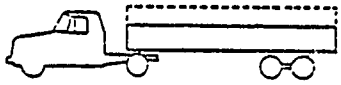
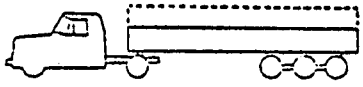
	19
	26
	26
	30
	30
	35
	35
	30

	30
	30
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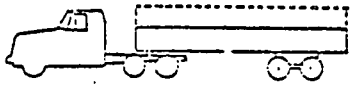
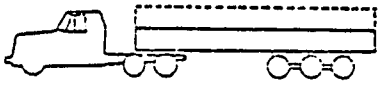
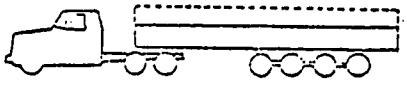
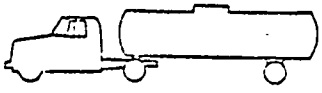
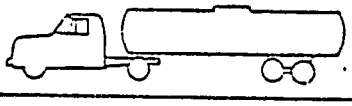
	35
	35
	35
	30
	30
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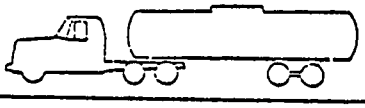	35

1/ Based upon traffic law no. 19, dated 30/3/74

LYON

In order to establish a data base for Syria, it was necessary to determine the approximate size of vehicles that would be on the road. It was assumed that these vehicles are constructed to carry a practical maximum gross weight. Based on this premise, empty weights of trucks were established for trucks intended to carry legal weights as prescribed by Syrian Law. The procedure adopted utilized U.S. empty vehicle weights and practical maximum weights for these vehicle types and then applied to Syrian legal loads to establish an estimated empty weight.

Utilizing the previously noted S curves and the estimated number of overloads which could be expected to occur under enforcement, the Syria loaded weight for each of the four vehicle types was established. The Syria average payload was then determined.

Average Weights Used for Syria Legal Loadings

Vehicle Type	U.S. Average Empty Weight	U.S. Practical Maximum	Syria Legal	Syria Determined Empty	Syria Loaded Weights	Syria Average Payload
2 axle truck	4.7	12.0	19.0	7.5	15.7	8.2
3 axle truck	8.6	19.5	26.0	11.5	21.0	9.5
2 axle tractor plus 2 axle semi-trailer	11.6	26.8	30.0	13.2	22.6	9.4
3 axle tractor plus 2 axle semi-trailer	13.6	33.4	35.0	14.3	31.6	17.3

Data below shows the range of weights used in establishing the vehicle loadings.

Range of Weights to Establish Vehicle Loadings

Vehicle Type	Empty	Loaded
2 axle truck	4-13 tons	9-23 tons
3 axle truck	7-18 tons	13-38 tons
2 axle truck plus 2 axle semi-trailer	9-22 tons	11-37 tons
3 axle tractor plus 2 axle semi-trailer	10-25 tons	21-45 tons

The above noted weight distributions were analyzed and resulted in vehicle weights being used in the study.

2) Yearly Equivalent Axle Loads

For pavement design, it is necessary to utilize the actual axle loadings and convert them to yearly equivalent axle loadings taking into account current and projected traffic volumes and equivalency factors. These annual forecasts are accumulated and used to establish the number of loadings for any given time period considered in the design of the pavement elements throughout the project life.

Equivalent axle factors have been established through research procedures with the most commonly used factors established at the AASHTO Road Test in the United States, which were derived empirically from experimental results. The AASHTO equivalence factors were converted to metric tons for use on this project reflecting specific axle loads based upon a serviceability factor of 2.0 and a structural number of 3. It is noted that the equivalence factors in the reference 1/ were limited to loads of 19 tons for the single axle and 22 tons for the tandem axle. Because the loads encountered in Syria, in many cases, were greater than the maximum noted in the equivlence tables, the given factors were plotted and additional factors extraploated from the graph. The extrapolated data was needed to consider single axle loads to 21.5 metric tons and tandem axle loads to 34.5 metric tons.

Equivalence factors also apply to buses, however, as noted previously, no weight data was obtained for these vehicles. It was, therefore, considered that a large bus would have a factor of 0.15 representing one vehicle. Because the bus volumes used in this report include a considerable number of micro buses, it was decided to give a weighted axle load equivalent of 0.05 to all buses considered in the study.

The vehicle weight data and axle load equivalent data were analyzed with results shown in Table C-19 indicating the magnitude of the loads being carried on the highway. The vehicle reflecting the greatest number of axle load equivalents is the loaded truck and trailer combination which consists of a two-axle, six tire large truck and two-axle trailer. A loaded two-axle, six tire truck alnoe had an average axle load equivalent of 31.11 while the truck and trailer combination had an axle load equivalent of 63.60. The effect of the axle configurations are noted in a comparison between the three types of conbination vehicles. The three types of combinations have similar total weights, 54 tons, 51 tons, and 50 tons, however the equivalent axle loads are 63.60, 37.33, and 13.27.

1/ "Principles of Pavement Design", by Yoder and Witczak.

As expected, for similar loads, tandem axles do less damage than single axles. From the survey data, the vehicle with the greatest load was a truck and trailer combination with four single axles weighing 64.1 metric tons with an equivalent axle load of 119.36. The heaviest single unit vehicle was a truck that weighed 29.6 metric tons with an equivalent axle load of 68.7.

Table C-19

Axle Load Equivalents
Port of Lattakia, February 1978

Vehicle Type	Status	Average Axle Load Equivalents				
		Front	Second	Third	Fourth	Total
Single Unit Vehicles						
2 Axle, 6 Tire, Medium	Empty	0.02	0.03	-	-	0.05
	Loaded	0.12	3.98	-	-	4.10
2 Axle, 6 Tire, Large	Empty	0.07	0.20	-	-	0.27
	Loaded	0.71	30.40	-	-	31.11
3 Axle, 10 Tire	Empty	0.15	0.11	-	-	0.26
	Loaded	1.22	10.95	-	-	12.17
Combination Vehicles						
Truck + Trailer (2 Axles + 2 Axles)	Empty	0.14	0.33	0.02	0.02	0.51
	Loaded	0.92	38.80	11.94	11.94	63.60
Tractor + ½ Trailer (2 Axles + 2 Axles)	Empty	0.07	0.20	0.07	-	0.34
	Loaded	0.47	21.73	15.13	-	37.33
Tractor + ½ Trailer (3 Axles + 2 Axles)	Empty	0.06	0.06	0.07	-	0.19
	Loaded	0.22	2.18	10.87	-	13.27

A summary of the weighted equivalent axle loads for the five selected study segments are shown in Table C-20. Details of the calculations are shown in Appendix C - Tables 91-95. Using these weighted equivalent axle loads for trucks, and applying the 0.05 factor for buses, tabulations were prepared for the route under study for the five traffic segments for both the northbound and southbound lanes and are shown in Appendix C - Tables 96 to 105.

TABLE C-20
SUMMARY
PRESENT LOADING PRACTICES
WEIGHTED DAILY EQUIVALENT AXLE LOADS

Road Segment	Direction To: Damascus	Direction To: Lattakia
Tartous Bypass	15.95	11.26
Tartous-Banyas	14.96	9.63
Banyas Bypass	14.34	9.25
Banyas-Jebleh (North Road Jct)	13.97	9.12
Jebleh (North Road Jct) - Lattakia	13.52	8.95

Forecasting future annual axle loads or cummulative equivalent axle loads presents considerable difficulty for the following reasons: Currently many vehicles carry loads which exceed the present legal maximums; however, these could change at any time depending on the regulations controlling axle loads and the degree of enforcement of these regulations. Axle load limits may or may not change in the future; however, they may be applied selectively to specific classes of highways in the system.

Advanced technology could introduce vehicle types and engine sizes heretofore not known or used in Syria which could affect single or tandem axle frequencies and magnitudes.

Equivalent Axle Loads

Assuming legal load enforcement equivalent axle loading factors for each of the vehicle types were established and applied to the truck percentages on each of the five road segments analyzed. The factors are noted in Table C-21.

Table C-21

Assuming Legal Load Enforcement
Equivalent Axle Loadings

Vehicle Type	Empty	Loaded
2 Axle truck	0.11	4.31
3 axle truck	0.12	1.82
2 axle tractor plus 2 axle semi-trailer	0.11	1.20
3 axle tractor plus 2 axle semi-trailer	0.06	2.03

One conclusion arrived at in the final analysis is that a high volume of tractor and semi-trailers of 5 axles would predominate on the road assuming legal load enforcement as opposed to the existing 4 axle combination vehicles under present loading. This is due to the larger weights that can legally be carried by the 5 axle truck combination 35 metric tons vs. 30 metric tons. Future combination vehicles would be composed of five axle combinations which would comprise the remaining 10 percent of the total. A summary of the weighted EAL for trucks on the 5 study segments are shown in Table C-22. Details of the calculations are shown in Appendix C - Tables 106-110.

In determining the effect of assumed legal load enforcement on trucking, it was necessary to establish an average load being carried by each truck. Economic data shown in this report indicates that in the year 1976, there were a total of 8,318,000 metric tons of goods carried daily in 1,399 total trucks for an average 16.3 tons per truck. Under assumed legal load enforcement, an average truck would have a payload of 10.2 metric tons per vehicle. By direct proportion, a 60 percent increase in the number of truck loadings would be needed to move the goods. Using this volume as the base, growth rates were established for the time groupings. These growth rates varied with the rates originally established by the project economists as follows:

Table C-22

Summary
Legal Loading Practices
Weighted Daily Equivalent Axle Loads

Road Segment	Direction	
	To: Damascus	To: Lattakia
Tartous Bypass	2.16	1.46
Tartous-Banyas	1.72	1.55
Banyas Bypass	1.74	1.59
Banyas-Jebleh (North Road Jct.)	1.75	1.61
Jebleh (North Road Jct.)-Lattakia	1.76	1.64

	Time Periods		
	1976-1983	1983-1993	1993-2003
Original Rates, Present Existing Loading Practice	10.3	7.1	5.6
Revised Rates, Legal Load Enforcement	10.8	7.0	5.1

The projection procedure used for the tables reflects the number of trucks needed to carry legal loads as of the year 1978 and carried through to the end of analysis time period of 2003. An alternate procedure would have been to increase the truck volumes gradually to the year 1984 when the project would be opened to traffic. In either case, the truck volume in 1984, the year the project is to be opened to traffic, would be the same and therefore, the resulting economic analysis is similar over the actual life of the project.

Using projections of the weighted equivalent axle loads for trucks, and applying the 0.05 factor for buses, tabulations of equivalent axle loads for the five traffic segments for both the northbound and southbound lanes are shown in Appendix C - Tables 111 to 120.

3. Highway User Costs

a. General

The proposed project's economic impact upon present and future traffic operating in the highway corridor may be measured primarily in terms of its effects on motor vehicle running costs and other related vehicle operating costs. User costs "with" the project are therefore to be compared to user costs "without" the project. The determination of such costs excludes taxes, duties and levies to preclude the transfer of costs within the government.

The analysis gives consideration to both mileage related and time related costs. Mileage related costs include such items as fuel, tires, oil, vehicle maintenance and depreciation. The time related costs cover such items as travel time, accidents, interest on investment, time depreciation and management expenses.

It is here noted that fuel costs prevailing in early 1978, at the time the Consultant prepared the running costs tables, have since come into a state of flux, experiencing both increases and in some cases roll-back of the increases. The consultant has continued to utilize the original running cost tables. Any bias which is introduced by an understatement of fuel costs will necessarily be conservative with respect to the economic feasibility of the proposed project.

b. Motor Vehicle Running Costs.

The basic costs for ten representative vehicle types were developed to indicate operating costs of motor vehicles in the current traffic stream. These basic costs were calculated using Syrian costs for fuel, tires, engine oil, vehicle maintenance and vehicle depreciation. The ten vehicle types were then consolidated by weighted averages to five representative vehicle types which are: car, pickup truck, bus, single unit truck and truck-combination. Motorcycles, three wheeled vehicles and farm tractors are not included in this analysis for reasons discussed in preceding sections. The tax free costs used in the analysis are shown in Table C-25.

The depreciation cost of each vehicle is based upon its cost new, less the price of a set of tires. This cost refers only to that portion of total depreciation assigned to highway use (distance traveled), as distinguished from that portion attributed to passage of time (and considered a motor vehicle related cost). The division between time and distance is a variable, dependent upon speed, average annual travel and vehicle type. Highway use depreciation

(related to distance driven) was established using vehicle speed on the assumption that the higher the speed driven, the greater the annual kilometers of travel and total lifetime kilometers. The Syria tables were calculated using the procedures developed by de Weille, which consider such factors as: annual kilometers of travel, lifetime kilometers of travel, speed and average service life. The procedures yield rate of depreciation for distance (1,000 kilometers) driven at a range of speeds.

Sets of tables were prepared to provide total running costs in Syrian pounds per 1,000 vehicle-kilometers of travel. The tables were inclusive of costs for fuel, tires, engine oil, vehicle maintenance, and vehicle depreciation; and apply to high type pavement in good condition. The individual tables prepared include the following:

Highway user costs on level tangent road in good condition, showing the component items of vehicle running costs and other related costs. (Appendix C, Tables 121 to 125.)

Running costs of vertical grades from minus eight percent to plus eight percent by uniform speeds. (Appendix C, Tables 126 to 135.)

Running costs on horizontal curves from 1500 meter radius to 60 meter radius. (Appendix C. Tables 136 to 140.)

1) Depreciation and Maintenance from Mileage

a) Vehicle Costs

The vehicle costs are the most important item considered in the analysis in that the cost items of mileage depreciation, maintenance, time depreciation, insurance, and investment charges are all related to the cost of the vehicle. In determinating representative costs the Consultant has considered the cost components following: the CIF (cost, insurance, freight cost); domestic transportation cost (to Damascus from Tartous or Lattakia); administrative expenses for the selling or importing agency; cost for a trailer, semi-trailer, or bus body (as the case may be;) and cost of vehicle chassis modifications.

(1) Cost-Insurance Freight (CIF)

The CIF costs for all vehicles were established at either the port of Tartous or Lattakia. Because of the large number of makes and models of vehicles involved, representative vehicles were used in the cost determination as follows:

Passenger Car: an average of eight vehicle costs were used which varied from 9,145 pounds to 27,500 pounds. The vehicles considered were Peugeot, Fiat, Toyota, Mazda, Mercedes, Volkswagen, Opel and Dodge.

Pick-up Truck: an average of two vehicle costs were used which varied from 13,000 pounds to 16,900 pounds. The vehicles considered were Volkswagen and Mazda.

Micro Bus: the Fiat OM chassis is the only import used for micro buses (the body is locally constructed.) The chassis cost was 33,000 pounds.

Large bus: the large bus model imported was a Mercedes D302 which had a CIF price of 210,000 pounds.

Truck, 2-axle 6 tire, medium: the Consultant used an average cost of three truck chassis which varied in price from 53,500 pounds to 69,550 pounds. The vehicles considered were Mercedes, Volvo and Fiat.

Truck, 2-axle 6 tire, large: an average cost of two truck chassis costing 96,300 Syrian pounds and 123,050 Syrian pounds was used. The vehicles considered were a Mercedes and a Volvo.

Truck, 3 wheel, 10 tires: the average cost of two dump-truck chassis, which varied in price from 85,600 to 93,090 Syrian pounds was used. The vehicles considered were a Volvo and Fiat.

Truck (used in combination with trailer): Identical to vehicle described above as the "Truck, 2-axle, 6 tire, large".

Tractor (2 axle, used with 1/2 trailer): the cost of this vehicle was established from one model, a Volvo, which had a cost of 107,000 Syrian pounds.

Tractor (3 axle, used with 1/2 trailer): an average cost of two tractors which varied in price from 144,450 to 155,000 Syrian pounds was used. The vehicles considered were a Mercedes and a Fiat.

(2) Domestic Transportation Costs

All seaborne imported vehicles come into Syria through the ports of Tartous or Lattakia and are transported to Damascus where they are picked up by the purchaser. The domestic transportation costs involved are: for driver transportation to the port, living expenses, fuel costs for transporting the vehicle to Damascus, and insurance costs to cover the vehicle while in transit. These transportation costs varied little between the various vehicles. The Consultant has, therefore, uniformly applied 500 Syrian pounds

as the domestic transportation cost for all vehicles.

(3) Administration Cost

AFTOMACHINE a government controlled organization handles vehicle imports. Based upon discussions with personnel from AFTOMACHINE, it was determined that 10 percent is added to the CIF price to cover the administration costs and profit for passenger cars and that 5 percent of the CIF price is added to cover the administration costs and profit for all other vehicle types.

(4) Body Costs

Large vehicle imports (except large bus and pickup trucks) consisted of a chassis only and the purchaser obtained a locally produced body, or trailer, in order to complete his unit.

For the micro bus, the body cost, including assembly, was 22,060 Syrian pounds plus 5 percent profit.

For the medium and large 2 axle, 6 tire truck chassis, the most commonly used body (that of the goods carrier) costs 15,000 Syrian pounds.

For the 3 axle, ten tire truck chassis; a dump truck body costs 20,000 Syrian pounds.

For the truck plus trailer; in addition to the 15,000 pound cost of body to be placed upon the chassis, the trailer costs 25,000 Syrian pounds, for a total additional cost of 40,000 Syrian pounds.

For the 1/2 trailer which would be used with either the 2 or 3 axle tractor, the cost was 60,000 Syrian pounds.

(5) Modification Costs

In order to take advantage of the heavy loading presently permitted in Syria, truck springs and body structure are frequently modified to accomodate loading in excess of the original manufacturer's design limits. Trucks, particularly those involved in international transit, are frequently further modified to double the fuel capacity to take advantage of the low price of gasoil in Syria. The average cost of such modifications has been estimated by the Consultant to be 1,500 Syrian pounds.

(6) Distribution of Depreciation Costs to Mileage and Time.

Vehicles depreciate in some proportion to both time and distance driven.(Example: a vehicle in storage for one year depreciates in value; however, an identical vehicle driven 50,000 kilometers during

the same one year period depreciates more than the idle vehicle). Winfrey [1/] states that the percentage of total depreciation attributable to distance of travel is proportional to the total lifetime travel of the vehicle. The Consultant's computer program for user costs was developed in consultation with Winfrey and incorporates his methods and data on depreciation proportioning. [2/]

b. Vehicle Maintenance Costs

Vehicle maintenance costs were established as a relationship between costs and average vehicle speed, separately for two component items, "parts" and "labor". This data was derived from several sources based upon a wide range of conditions. [3/] The parts costs were established as a percent, per 1,000 kilometers of the new value of the vehicle and the labor costs were expressed in hours per 1,000 kilometers of travel. Costs used in this analysis are total vehicle costs noted in Table C-33 and a mechanics wage of S.L. 2.88 per hour.

2) Fuel:

Two types of vehicle fuel are used in Syria, benzine (gasoline) and gasoil (diesel). The smaller and older vehicles generally use benzine while the buses and trucks use gasoil. Since the analysis is prepared for vehicles upon the road in future years, cars, taxis and pickup trucks are assumed to have benzine engines while the micro bus, large bus and all categories of larger trucks are assumed to have gasoil engines.

In order to establish net fuel costs, it was necessary to determine the various duties and levies paid on petroleum products. The values are shown in the following tabulation:

Item	Benzine	Gasoil	Engine Oil
Customs duty	2.88 per liter	50 p/ton	10% x CIF price
Flammable substance fee	(8.5+3.5) per liter	none	none
Defense	15% x customs	15% x customs	15% x customs
Consumption	4% x CIF price	4% x CIF price	4% x CIF price
Education	2% x (customs + defense)	2% x (customs + defense)	2% x (customs + defense)
	10% x consumption	10% x consumption	10% x consumption
Port	3% x (customs + defense)	3% x (customs + defense)	3% x (customs + defense)
Retirement Fund	0.2% x CIF price	0.2% x CIF price	0.2% x CIF price

1/ Economic Analysis for Highways, p. 345-346; R. Winfrey, International Textbook Company, Scranton, Pa.

2/ Personal records of unpublished data, Robley Winfrey

3/ Quantification of Road User Savings, p. 23, 67-78, by Jan de Weille, World Bank Staff Occasional Papers Number Two.

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Fuel costs were established from imported products since Syria does not currently produce sufficient petroleum products to satisfy local demand. In discussions with the local petroleum importing organization (SADCOP), the Consultant obtained the cost per ton as supplied by various oil companies around the world. In addition, the specific gravity of each product was obtained to establish the liters per ton of product and thereby the cost per liter. To this cost was added estimated distribution costs and profit for the SADCOP corporation and distribution costs and profit for the private distributor.

(a) Benzine (Gasoline)

The cost per liter of benzine is calculated as follows: Price per liter: at 534.30 Syrian pounds per ton (U.S. $137.00 per ton), and specific gravity of 0.72, the price is 38.47 piasters per liter.

Duties and levies per liter:

Customs duty: 2.88 piasters

Flammable substances levy: 8.5 + 3.5 = 12.0 piasters

Defense levy: 15 percent x 2.88 = 0.432 piasters

Consumption levy: 4 percent x 38.47 = 1.54 piasters

Education: 2 percent x (2.88 + 0.432) = 0.066 piasters

10 percent x 1.54 = 0.154 piasters

Port: 3 percent x (2.88 + 0.432) = 0.099 piasters

Retirement Fund: 0.2 percent x 38.47 = 0.077 piasters

Total duties and levies: 17.248 piasters

For benzine, the imported price is 38.47 piasters per liter and total duties and levies are 17.248 piasters per liter. Deducting the duties and levies from the pump price of 82.5 piasters, gives the cost without taxes of 65.252 piasters per liter.

In summary, the following have been established for benzine:

Retail selling price	82.5	piasters per liter
Price in port	38.47	piasters per liter
Customs duty	2.88	piasters per liter
Other duties and levies	14.368	piasters per liter
Total customs, duties and levies	17.248	piasters per liter
Profit Margin and distributions costs	26.782	piasters per liter

Based upon discussions with SADCOP personnel, it is noted that the profit margin and distribution costs for the private dealer is 2.5 piasters per liter and for SADCOP, 24.282 piasters per liter.

(b) Gasoil (diesel)

The cost per liter of gasoil is established as follows:

Price per liter: at U.S. $125.00 (487.5 Syrian pounds) per metric ton, and specific gravity of 0.8, the unit price is 39.0 piasters per liter.

Duties and levies per liter:

Customs duty: at 50 piasters per ton, the cost is 0.04 piasters

Flammable substances levy: not levied

Defense levy: 15 percent x 0.04 = 0.0006 piasters

Consumption levy: 4 percent x 39.0 = 1.56 piasters

Education: 2 percent x (0.04 + 0.006) = 0.001 piasters
10 percent x 1.56 = 0.156 piasters

Port: 3 percent x (0.04 + 0.006) = 0.001 piasters

Retirement Fund: 0.2 percent x 39.0 = 0.078 piasters

Total duties and levies: 1.842 piasters per liter

For gasoil, the imported price is 39.0 piasters per liter, total duties and levies 1.842 piasters per liter, and retail selling price 15.0 piasters per liter. The dealer profit and distribution costs are established as 25.082 piasters per liter for both the station owner and SADCOP combined. A government subsidy of 49.082 piasters per liter is therefore required to maintain the price level. Fuel cost data is summarized in Table C-23 which follows:

TABLE C-23
FUEL COST COMPONENTS

Item		(Cost in Piasters per Liter) Benzine	Gasoil
Price in port		38.470	39.000
Customs duty		2.880	0.040
Flammable substances levy		12.000	0.000
Defense levy		0.432	0.006
Consumption levy		1.540	1.560
Education levy	a.	0.066	0.001
	b.	0.154	0.156
Port levy		0.099	0.001
Retirement Fund		0.077	0.078
Total duties and levies		17.248	1.842
Profit margin and distribution costs		26.782	25.082
Selling price at station		82.5	15.0
Cost without duties and levies		65.252	64.082 1/

1/ Includes government subsidy of 49.082 piasters per liter

3) Engine Oil

Engine oil was studied in two categories, oil for small vehicles such as passenger cars and pickups and oil for larger heavy-duty vehicles.

(a) Light Duty

Price per liter: at 3,705 Syrian pounds per metric ton (U.S. $950) and specific gravity of 0.91, the price is 337.16 piasters per liter.

Duties and levies per liter:

Customs duty: 10 percent x 337.16 = 33.716 piasters

Flammable substances levy: none

Defense levy: 15 percent x 33.716 = 5.057 piasters

Consumption levy: 4 percent x 337.16 = 13.486 piasters

Education: 2 percent x 38.773 = 0.775 piasters per liter

10 percent x 13.486 - 1.349 piasters per liter

Port: 3 percent x 38.773 = 1.163 piasters per liter

Retirement fund: 0.2 percent x 337.16 = 0.674 piasters per liter

Total duties and levies: 56.220 piasters per liter

Additional cost data are:

Distributors profits and distribution costs: 206.62 piasters per liter.

Retail selling price: 6 Syrian pounds per liter (600 piasters)

Cost without taxes: 337.16 + 206.62 = 543.78 piasters

(b) Heavy Duty (Bus and Truck)

Price per liter: at 4,095 Syrian pounds per metric ton (U.S. $1,050.00) and specific gravity of 0.91, the price is 372.65 piasters per liter.

Duties and levies per liter:

Customs duty: 10 percent x 372.65 = 37.265 piasters

Flammable substances levy: none

Defense levy: 15 percent x 37.265 = 5.590 piasters.

Consumption leby: 4 percent x 372.65 = 14.906 piasters

Education: 2 percent x 42.855 = 0.857 piasters
10 percent x 14.906 x 1.491 piasters

Port: 3 percent x 42.855 = 1.286 piasters

Retirement fund: 0.2 percent x 372.65 = 0.745 piasters

Total duties and levies: 62.140 piasters per liter

Additional costs data are:

Distributors, profits and distribution costs: 180.53 piasters per liter.

Retail selling price: 4 Syrian pounds per liter (400 piasters)

Cost without taxes: 372.65 + 180.53 = 553.18 piasters

4) Tires

The Consultant has selected representative tire sizes for each vehicle category. The tire and tube sizes, number per vehicle and duty free cost as used in the study are shown in Table C-24.

TABLE C-24

TIRE AND TUBE DATA
FOR VARIOUS VEHICLE TYPES

Vehicle Type	Number of Tires and Tubes (including one spare)	Size	Cost per tire and tube (pounds)
Passenger Car	5	1.75-14	90
Pickup Truck	5	1.85-14	160
Micro Bus	7	1.85-14	160
Bus, Large	7	10.00-20 11.00-20 12.00-20	850
Truck, 2-axle 6 tires	7	12.00-20 12.00-24	520
Truck, 3 axle 10 tires	11	12.00-20 12.00-24	520
Truck and Full-Trailer	15	12.00-20 12.00-24	520
Tractor and 1/2 Trailer (2 axles + 2 axles)	15	12.00-20 12.00-24	520
Tractor + 1/2 Trailer (3 axles + 2 axles)	19	12.00-20 12.00-24	520

c. Motor Vehicle Related Costs

The preceding section, Motor Vehicle Running Costs, defines cost items affected by travel distance, highway conditions and traffic conditions. This section, in contrast, discusses items affected by time that can be proportioned to distance of travel by use of certain logical procedures. These items are: value of travel time, accidents, interest on the investment, vehicle time depreciation and management expense for commercial vehicles.

TABLE C-25

PRICES FOR CALCULATION OF TABLES OF MOTOR VEHICLE RUNNING COSTS
(SYRIAN POUNDS)

Vehicle Type	CIF Cost 1/	Transp Cost 2/	Adm. Expenses 3/	Trailer, Body or Box Cost	Modifying Cost	Vehicle Total Cost	Tires & Tubes Cost	Vehicle Cost Less Tires	Fuel	Oil
Passenger 4/	15,430	500	1,540	-	-	17,470	(5) 90	17,020	65.25	543.78
Pick Up	14,950	500	750	-	-	16,200	(5) 160	15,400	65.25	543.18
Micro Bus	33,000	500	1,650	23,160 5/	-	58,310	(7) 160	57,190	64.12	553.18
Bus	210,000	500	10,500	-	-	221,000	(7) 850	215,050	64.12	553.18
2-Ax. Trk, Med.	62,420	500	3,120	15,000	1,500	82,540	(7) 520	78,900	64.12	553.18
2-Ax. Trk, Lar.	109,680	500	5,480	15,000	1,500	132,160	(7) 520	128,520	64.12	553.18
3-Ax. Trk.	89,350	500	4,470	20,000	1,500	115,820	(11) 520	110,100	64.12	553.18
2-Ax.(Trk+Trl)	109,680	500	5,480	40,000 6/	1,500	157,160	(15) 520	149,360	64.12	553.18
4-Ax.(Trk+Trl)	107,000	500	5,350	60,000	1,500	174,350	(15) 520	166,550	64.12	553.18
5-Ax.(Trk+Trl)	149,730	500	7,490	60,000	1,500	219,220	(19) 520	209,340	64.12	553.18

1/ Port of Lattakia or Tartous as point of entry

2/ P.O.E. to Damascus

3/ 10 percent of passenger car CIF price; 5 percent of other vehicle CIF price

4/ Taxi prices considered similar to Passenger Car Prices

5/ Includes cost of body, assembly cost, and 5 percent profit on assembly cost

6/ Cost for truck body plus full trailer

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Two basic considerations in the determination of various motor vehicle related costs for each vehicle type are annual kilometers driven and average operating speed. Table C-26 shows data developed by the Consultant from discussions with vehicle owners and fleet owners (including government organizations) in Syria.

TABLE C-26
ANNUAL KILOMETERS
AND AVERAGE OPERATING SPEEDS

Vehicle	Annual Kilometers Driven	Annual Average Operating Speed
Passenger Car	20,000	60
Taxi	60,000	60
Pickup	30,000	60
Bus	100,000	50
Trucks	75,000	50

1) Value of Travel Time

(a) Summary

Travel time reduction is one of the objectives of highway improvements. However, the question of placing a time value upon masses of people, including leisure travelers, low wage earners and some not gainfully employed poses a problem. For purposes of the study, the consultant has assumed that 25% of passengers are employed and are traveling on time that does, or could, earn a wage. For commercial vehicles, only the driver's time has been considered to be of value; while on public passenger vehicles, there would be a driver, helper (where applicable) and the passengers. (While commercial vehicles may be carrying passengers, a value of travel time is assigned only to the driver since time savings can be directly related to his income).

In summary, Table C-27 shows the hourly time values for the various vehicle classes:

TABLE C-27
HOURLY TIME VALUES

Vehicle Class	Per Hour Time Value (Pounds)
Passenger Car	10.50
Pickup Truck	3.33
Bus	23.97
Truck	7.69

(b) Hourly Wage Rates

A review of salaries and wages for various employment categories was made and averages were established based upon discussions with vehicle operators, various agencies, and judgement. The salaries deemed by the Consultant to be representative for use in the transportation economy analysis are shown in Table C-28. It is noted that salaries reflect total monthly earnings which, in some instances, include benefits and compensations that add income to the base pay. Benefits include such items as clothing allowance, medical care, transportation, and living allowance when traveling.

TABLE C-28

HOURLY WAGE RATES

	Wages, in Syrian Pounds Per Hour		Other Occupants	
Vehicle	Driver	Helper	No.	Value, each
Private passenger car	7.21 1/	-	2	7.21
Taxi	3.33	-	4	7.21 (10%) 2.75 (90%)
Pickup Truck	3.33	-	-	
Micro Bus	5.02	2.24	20	2.75
Bus, Large	5.77	2.24	40	7.21 2.75
Trucks	7.69	-	-	-

1/ Owner considered as driver

(c) Vehicle Time Charges

(1) Passenger Cars

Two categories of vehicles are classified as passenger cars, the privately operated sedan and the sedan operated as a taxi. The driver of a private car is most frequently the owner, as chauffeur driven vehicles are rare. The Consultant's Origin and Destination Survey data indicates that private cars, on the average, carry 2.2 passengers (in addition to the driver) whose hourly wages are estimated to be 7.21 pounds per hour, the same as the driver's. The driver wages were considered full time

for the vehicle, but the occupants were considered to be on business only 25 percent of the time. Therefore, the hourly time charges for the privately used sedan are:

Driver	7.21 pounds
2.2 Occupants, at 7.21 per hour at 25%	3.97 pounds
Total Hourly Cost	11.18 pounds

The origin and destination survey indicated that taxis are involved in long range trips as well as short trips. They were found to carry businessmen on about 10% of the trips and were further found to carry an average of four businessmen on such trips. The time value of such taxi trips is therefore 4 occupants times 7.21 pounds times 10% per hour. The remaining 90% of the trips were to transport passengers of whom 25% are estimated to be chargeable at 2.75 pounds per hour. The time value of such taxi trips is therefore 4.9 occupants x 25% x 2.75 pounds per hour. In all cases the driver's time is taken at 3.33 pounds per hour.

The total time value of taxi occupants is therefore:

Driver	3.33 pounds per hour
Businessmen	2.88
Others	3.03
Total	9.24 pounds per hour

Surveys indicated that 65 percent of the passenger cars are private vehicles and 35% are taxis. Therefore the average time value of passenger cars is:

65% of 11.18 (for private cars)	=	7.27 pounds
35% of 9.24 (for taxis)	=	3.23
The average passenger car		10.50 pounds

(2) Pickup trucks

Pickup trucks were considered to be used for business purposes at all times with driver wages of 3.33 pounds per hour.

(3) Buses

(a) Micro Buses

Micro buses carry an average of 14.7 passengers plus driver and helper. It is estimated that 25% of the passengers have time value of 2.75 pounds per hour.

Micro Bus		
Driver		5.02
Helper		2.24
Passengers	14.7 x 25% x 2.75 =	10.11
Total		17.37

(b) Large Buses

Of the large buses 25 percent are on long runs and an estimated 25% of their passengers have time value of 7.21 pounds per hour. The remaining 75% of the buses carry local traffic and it is estimated that 25% of their passengers have time value of 2.75 pounds per hour. The average passenger load for large buses is 37. The time value of the occupants is calculated as follows:

Large Bus		
Driver		5.77
Helper		2.24
Passengers	25% of 25% of 37 x 7.21	16.67
	25% of 75% of 37 x 2.75	19.08
	Total	43.76

Micro buses constitute 75% of buses and large buses constitute 25% of buses. The weighted average hourly cost of occupant time for buses is:

75% of 17.37	13.03 pounds
25% of 43.76	10.94
Total average for all buses	23.97

(4) Trucks

Trucks have driver time costs of 7.69 pounds per hour. Temporary helpers are usually hired at the origin and destination and rarely travel with the vehicle.

2) Accidents

Following usual practice, the Consultant utilized insurance rate data for preparation of the accident analysis. The Consultant has established the cost of insurance for various vehicle types and, based upon past experiences, assumes that 60 percent of the premiums are used in repaying accident claims while the remaining 40 percent is used by the insurer for administration and profit.

(a) Types

Accident data tabulated by Mohafazats was available from the Traffic Police. It is therefore difficult to determine related to Tartous-Lattakia highway. Accident statistics are presented as found. For the year 1977, the severity of accidents is indicated by Table C-29 while the number of vehicles involved in accidents is shown in Table C-30. When the data in Table C-29 is converted into average fatalities per accident we find that the ratio is extremely high. In Lattakia Mohafazat for example, there were 0.22 fatalities per accident.

TABLE C-29
SEVERITY OF ACCIDENTS
IDLIB, LATTAKIA AND TARTOUS MOHAFAZATS

Mohafazat	Property Damage	Personal Injuries			Fatalities			Grand Total
		Child	Adult	Total	Child	Adult	Total	
Lattakia	73	31	151	182	24	47	71	326
Tartous	123	35	82	117	20	36	56	296
Syria	2,656	861	2,414	3,275	486	2,129	2,615	8,546

TABLE C-30
VEHICLES INVOLVED IN ACCIDENTS
IDLIB, LATTAKIA AND TARTOUS MOHAFAZATS

Mohafazat	Private Small Vehicles	Taxi	Bus	Truck	Tanker	Farm Tractor	Bicycles	Misc. Incl. Military	Total
Lattakia	61	36	25	38	16	24	53	50	303
Tartous	64	44	12	91	11	11	22	46	301
Syria (not compiled at the time of this report preparation)									

(b) Insurance Rates

Insurance rates in Syria are based upon several items, including the vehicle use, kind of vehicle, engine power, cost and number of passengers. Furthermore, the insurance premium is composed of three items, compulsory (which includes personal liability), property damage (which covers

the other party), and a comprehensive coverage (which covers the vehicle driven). The insurance rates established are shown in Table C-31.

TABLE C-31
INSURANCE RATES
% OF PRICE WITHOUT TAXES

Vehicle Type	Rate
Passenger Car	6.4%
Pickup truck	6.4%
Bus	6.5%
Truck, Single unit	4.8%
Truck, Combination	4.4%

The calculations of traffic accident costs, based on insurance premium prorated to the kilometers driven, are shown in Table C-32 for each specific vehicle type.

TABLE C-32
INSURANCE RELATED COST DATA

Vehicle Class	Price, w/o taxes (Pounds)	Annual Premium Rate %	Annual Premium (Pounds)	Annual Kilometers Driven	Premium Cost per 1,000 km. (Pounds)
Passenger Car	17,470	4.7	820	20,000	41
Taxi	17,470	8.1	1,420	60,000	24
Pickup Truck	16,200	6.4	1,040	30,000	35
Micro Bus	58,310	6.6	3,850	100,000	39
Bus, Large	221,000	5.9	13,040	100,000	130
Truck, 2 axle, medium	82,540	5.1	4,210	75,000	56
Truck, 2 axle, large	132,160	4.5	5,950	75,000	79
Truck 3 axle	115,820	4.6	5,330	75,000	71
Truck + Trailer	157,160	4.5	7,070	75,000	94
Tractor + ½ Trailer (2 + 2 axles)	174,350	4.4	7,670	75,000	102
Tractor + ½ Trailer (3 + 2 axles)	219,220	4.2	9,210	75,000	123

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(c) Adjustment Factors

Because highway conditions affect accident frequency and severity, adjustment factors have been established to reflect variations of surface types, surface conditions, and percent passing sight distance. These factors are shown in Tables C-33 and C-34.

TABLE C-33
ACCIDENT FREQUENCY FACTORS RELATED TO SURFACE TYPE, SURFACE CONDITION AND PASSING SIGHT DISTANCE

Highway Condition	High Type Pavement % P.S.D. 2/		Bituminous Treated % P.S.D. 2/		Gravel % P.S.D. 2/		Earth % P.S.D. 2/	
	0-40	60-100	0-40	60-100	0-40	60-100	0-40	60-100
Good	.70	.75	.70	.75	.30	.85	.80	.85
Fair	.85	.90	.85	.90	.95	1.00	.95	1.00
Poor	.95	1.00	.95	1.00 1/	1.05	1.10	1.05	1.10

1/ Base number
2/ P.S.D. - Passing Sight Distance

TABLE C-34
ACCIDENT SEVERITY ADJUSTMENT FACTORS RELATED TO SURFACE TYPE, SURFACE CONDITION AND PASSING SIGHT DISTANCE

Highway Condition	High Type Pavement % P.S.D. 2/		Bituminous Treated % P.S.D. 2/		Gravel % P.S.D. 2/		Earth % P.S.D. 2/	
	0-40	60-100	0-40	60-100	0-40	60-100	0-40	60-100
Good	1.40	1.30	1.30	1.25	1.20	1.15	1.15	1.05
Fair	1.35	1.25	1.15	1.10	1.05	1.00	.95	.90
Poor	1.20	1.10	1.05	1.00 1/	.95	.90	.85	.80

1/ Base number
2/ P.S.D. = Passing Sight Distance

The factors for frequency and severity are combined to determine the relationship of accident costs to highway conditions. This relationship, expressed as an insurance premium multiplier, is presented in Table C-35.

TABLE C-35
TOTAL ACCIDENT ADJUSTMENT FACTOR
RELATED TO SURFACE TYPE, SURFACE CONDITION
AND PASSING SIGHT DISTANCE

Highway Condition	High Type Pavement		Bituminous Treated		Gravel		Earth	
	% P.S.D. 2/		% P.S.D. 2/		% P.S.D. 2/		% P.S.D. 2/	
	0-40	60-100	0-40	60-100	0-40	60-100	0-40	60-100
Good	.98	.97	.91	.94	.96	.98	.98	.89
Fair	1.15	1.13	.98	.99	1.00	1.00	.90	.90
Poor	1.14	1.10	1.00	1.00 1/	1.00	.99	.89	.88

1/ Base number
2/ Passing Sight Distance

3) Interest on Investment

One of the economic costs of owning and operating a motor vehicle is a charge against the capital investment in the vehicle. This charge is commonly called "interest on the capital investment," even though no interest is actually paid. This factor of economic cost has been calculated following the concept and procedure of de Weille 1/.

The procedure assumes that the investment in the vehicles on the highway will average 50 percent of their cost new and that the interest charge per kilometer driven will be the total annual interest charge divided by the annual distance driven. The calculations of the economic charge against the investment are made for an interest rate of 15 percent per year.

1/ See pages 66-67 of "Quantification of Road User Savings," by Jan de Weille, International Bank for Reconstruction and Development, Washington, D.C., 1966.

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4) Time Depreciation

The running cost items discussed in the preceding section include that portion of total vehicle depreciation assigned to vehicle use (distance driven). The remaining portion of the total depreciation, time depreciation, is not included in the running cost tables but considered a motor vehicle related cost.

5) Management Expense on Commercial Vehicles

The operating costs of all vehicles include a factor for management expense. The management factor is 5% for passenger cars and 10 percent to pickups, buses and trucks. The factor is additive to the total of all other cost items calculated for each speed.

4. Computer Analyses Described

Lyon Associates has developed a comprehensive computer program (compatible with their in-house IBM 1130 system) for economic analyses of transport projects. The program, which was employed on the Tartous-Lattakia highway study, considers physical characteristics, (such as gradients, curves, pavement condition, and miscellaneous speed controls) and traffic characteristics on alternative highway systems (normally a "with proposed construction" versus a "without proposed construction" set of conditions) in conjunction with forecast traffic volumes to determine user benefits by vehicle type and total user benefits in each of the years of the assigned analysis period; considers construction costs in 7 categories (grouped for estimated useful life) and determines weighted life of the project prior to apportioning the construction cost to each year of the analysis period by Capital Recovery Factor and Series Present Worth; calculates maintenance costs and/or benefits resulting from the proposed project; considers all miscellaneous benefits which are quantified; discounts all costs and benefits (at various assigned discount rate) to the base year; determines benefit cost ratio at the assigned discount rates; determines the first year rate of return; and determines the internal rate of return for the investment. The Consultant then analyzes the sensitivity of findings by rerunning the analyses with higher and lower construction costs, and higher and lower user costs. In the particular case of the Tartous-Lattakia study, the Consultant also tested the sensitivity to variation in enforcement of legal axle loads, and exclusion of right-of-way cost from the analysis. In all analyses, currency conversions are accomplished at the rate of 3.90 Syrian pounds per one U.S. dollar.

The following discussion presents examples of basic calculations accomplished in the computer program.

a. Base Year Traffic Data

The base year traffic data used in the analyses are recapitulated in Table C-36. (Traffic volumes were further divided to reflect direction of flow for the divided highway analysis.)

Table C-36

BASE YEAR TRAFFIC DATA - 1978
REFLECTING PRESENT LOADING PRACTICES FOR TRUCKS

Vehicle Type & Situation	Tartous Bypass	Tartous-Banyas	Banyas Bypass	Banyas-Jebleh	Jebleh-Lattakia
A - Total Volumes					
Automobile	1,863	897	1,003	1,108	1,477
Pick Up	1,511	575	550	525	764
Bus	529	247	187	127	342
Truck, 2 axle	963	455	498	540	672
3 axle	176	61	68	75	89
Combination	414	138	134	130	144
Total	5,456	2,373	2,440	2,505	3,488
B - New Route, Diverted Volumes					
Automobile	879	785	876	967	1,306
Pick Up	1,079	502	480	459	675
Bus	52	89	74	59	129
Truck, 2 axle	675	376	430	484	600
3 axle	139	57	61	65	79
Combination	371	138	134	130	144
Total	3,195	1,947	2,055	2,164	2,933
C - Existing Route, Remaining Volumes					
Automobile	984	112	127	141	171
Pick Up	432	73	70	66	89
Bus	477	158	113	68	213
Truck, 2 axle	288	79	68	56	72
3 axle	37	4	7	10	10
Combination	43	0	0	0	0
Total	2,261	426	385	341	555

b. Vehicle Growth Rates

The vehicle growth rates prepared by the project Economists have been presented previously in Part B of the report, and are reported for convenience in Table C-37.

Table C-37

VEHICLE GROWTH RATES
REFLECTING PRESENT LOADING PRACTICES FOR TRUCKS

Vehicle Type	1976-1983	1983-1993	1993-2003
Automobile	9.5%	9.3%	7.4%
Pick Up Truck	10.3%	7.1%	5.6%
Bus	9.1%	10.7%	9.6%
Truck, 2 axle	10.3%	7.1%	5.6%
Truck, 3 axle	10.3%	7.1%	5.6%
Truck combinations	10.3%	7.1%	5.6%

c. Sub-sections

The criteria used in establishing highway sub-sections for analysis are:

a) Traffic volume (ADT)
b) Traffic volume exchange between routes
c) Topography, land use, and population distribution
d) Continuity of design standards and adaption of traffic safety to changes in design
e) Requirements for a construction contract

With construction costs estimated for each road section, different combinations of successive sections can be tested for construction priority and construction contracts.

d. Engineering

Input for each road section to be analyzed consisted of:

1) Traffic volumes
2) Length of grades and curves
3) Locale
4) Terrain
5) Design speed
6) Operating speed
7) Traffic growth rates
8) Percent passing sight distance

9) Surface type, width and condition

10) Riding characteristics

11) Shoulder type, width and condition

e. Traffic Analysis

1) Passenger Car Units (P.C.U.)

For studies of speed and other vehicle operating characteristics, all vehicle types are converted to an equivalent number of passenger car units relative to their effect upon the traffic stream. These equivalent values vary significantly with terrain. For instance, a truck has far more impact on traffic flow in mountainous terrain than in flat terrain. The complete set of equivalency factors used in this study is presented as Table C-38.

Table C-38

PASSENGER CAR UNITS

Type of Vehicle	Flat Terrain	Rolling Terrain	Mountain Terrain
Passenger Car	1	1	1
Pick Up Truck, Delivery Van	1	1	1
Bus	3	6	12
Single Unit 2 Axle Truck	2	4	8
Single Unit 3 Axle Truck	2.5	5	10
Truck/Tractor Combination	3	6	12

2) Volume/Speed Relationships

These show the relationship between volumes of vehicles and theoretical speeds for various design criteria and were established for speeds of 30, 40, 50, 60, and 80 KPH. Studies of existing volume/speed relationships were taken into consideration.

For the input item of vehicle operating speed, the "Before" situation reflects the existing conditions while the "After" situation reflects the operating speed based upon proposed improvements to the surface type, surface width, and shoulder width.

3) Congestion Limits

The traffic analysis was based upon the acceptance of a designated level of congestion since projected volume in some instances will be quite high. It is unlikely that roads will continuously carry traffic at a high level of service ("C" for example) for full 24 hours of the day. Peak hours exist and ar

characterized by overall travel speed slower than in remaining daily hours and by congested conditions requiring considerable stop and go traffic movements.

The ideal situation of having traffic moving at a desirable speed with little or no interference from cross traffic would be extremely expensive to create. Recognition of the fact that congestion must be tolerated brings the analysis closer to reality. Therefore, as traffic builds up over time, more congestion is encountered and the peak flows increase in time duration. In addition, while working hours or habits may change, it can be anticipated that travel time and congestion will increase relative to continuous land use changes and population increases.

The approach to the traffic analysis was to establish volumes which were judged to be acceptable under the circumstances. The basic premise was that two hours per day of congestion is considered to be the tolerable design situation with subsequent increase to four hours per day.

4) Traffic Projections

The vehicle volumes for all vehicle types were projected year by year to establish annual total P.C.U. volumes which were divided into peak hour and off peak hour volumes. For these divisions, operating speeds were established for cars and pick-ups as a group and trucks and buses as a group.

f. Operating Costs

1) Running Costs (See Appendix C, Tables 126 through 140)

Running costs are established from several items, two of which are vertical gradients and horizontal curves. The road data for the proposed construction were taken from plan and profile sheets, and for the existing highway data was obtained from road inventory.

The primary item for analysis are vehicle running costs on gradients where operating speeds are the main factor considered. In addition, operating costs for horizontal curves are included. In both situations, the operating speed is based upon one of two items; congestion which is determined by P.C.U.'S, or the maximum speed the vehicle could travel the grade or curve. The lowest of the two speeds is used in the analysis.

2) Occupant's Time

The time values established as representative for all vehicle types being analyzed are shown below:

TIME VALUES BY VEHICLE TYPE

Vehicle Type	Hourly Time Value (Pounds Per Hour)
Passenger Car	10.50
Pick Up Truck	3.33
Truck, Single Unit	7.69
Truck, Combination	7.69
Bus	23.97

Occupant time value per kilometer at any given speed is calculated from the time required per kilometer, the hourly time value for the vehicle, and the total vehicle kilometers. For example, to calculate the annual cost of occupants time for 80 pickups per day moving at 50 kph on a 10 km section of road, the procedure is as follows: at 50 kph the time required to travel 1,000 km is 1,000/50 or 20 hours; the number of vehicle kilometers of operation is 80 vehicles per day times 365 days per year times 10 kilometers of operation or 292,000 veh. km.; at 20 hours per 1,000 km the time required is 20 times 292 or 5,840 hours; from hourly time value tables, pickups costs run 3.33 pounds per hour with total cost, therefore, 5,840 hours times 3.33 pounds per hour or 19,447 pounds.

3) Accident Costs

Accident costs and adjustment factors established in Section C.3.c, Page C-58, are utilized by multiplying vehicle kilometers for each vehicle type by the applicable annual premium at any speed. Then to establish final accident costs, consideration is given to the fact that of total insurance premiums paid, approximately 40 percent is retained by the insurance company as profit, overhead, and administration costs while 60 percent is that part returned to the public in accident claims. The 60 percent is therefore used to determine accident costs.

The following example is used reflecting 800 cars at an operating speed of 50 kph, on a bituminous road, in good condition, nine kilometers in length, and 40 percent passing sight distance.

(a) Find annual Km driven at 50 KPH

$$\frac{\text{Aver. Ann. Km}}{\text{Aver. Ann. Speed}} = \frac{X}{\text{Oper. Speed}}; \quad \frac{20{,}000}{60} \times 50 = 16{,}670 \text{ km.}$$

(b) Find premium cost per 1000 veh. Km.

$$\frac{\text{Total Premium Cost}}{\text{Annual Km Driven (000)}} = \frac{820}{16.67} = 49.2 \text{ pounds}$$

(c) Find Total Pound Cost

$$\frac{\text{Veh. Volume x Length x 365 days x cost}}{\text{1000 Veh. Km.}}$$

$$\frac{800 \times 9 \times 365 \times 49.2}{1000} = 129{,}298 \text{ pounds}$$

(d) Find Equivalent Dollar Cost

$$\frac{\text{Total Pound Cost}}{\text{3.9 pounds}} = \frac{129{,}298}{3.9} = \$33{,}153$$

(e) Apply Adjustment Factor for Road Condition and Percent Passing Sight Distance

Dollar Cost x Factor - $33,153 x 0.91 = $30,169

(f) Apply 60 percent factor as cost of accidents

Dollar cost x factor = $30,169 x .60 = $18,101

4) Investment Costs

Investment costs are based upon the vehicle cost, interest rate and distance of travel at a specified speed. They are established by use of the vehicle price (excluding taxes and duties), the annual kilometers driven, annual average operating speed and the speed for the situation being analyzed.

The procedure uses the following formula:

$$\text{Cost} = \frac{\text{1/2 vehicle cost x interest rate}}{\text{Distance (in 1,000 veh-km) at specific speed}}$$

An example is as follows:

Vehicle and Volume : 800 Passenger Cars

Cost of Vehicle : 17,470 pounds

Speed : 50 KPH

Annual distance traveled : $\frac{50}{60} \times \frac{20{,}000}{} = 16{,}670$ km.

Interest rate = 15%

Segment Length = 9 Km

$$\text{Cost} = \frac{(1/2 \times 17{,}470) \times 0.15}{16{,}670} = 78.6 \text{ pounds per 1,000 veh. km.}$$

Total investment costs in dollars are:

$$\frac{\text{Cost x veh. no. x length x 365 days}}{3.9 \times 1000}$$

$$\frac{78.6 \times 800 \times 9 \times 365}{3.9 \times 1000} = \$52,964$$

It should be noted that the interest rate used in all investment calculations is 15 percent.

5) Time Depreciation

Time depreciation was calculated by using the mileage depreciation established in basic cost data and the percent of cost attributed to the mileage use at the specified speed. A proportion of mileage depreciation to its percent use was established to determine the time depreciation to its percent use. An example is as follows:

Vehicle:	Passenger Car
Speed:	50 KPH
Mileage depreciation cost:	49.4 pounds
Mileage depreciation:	73.0 percent

Time depreciation percent is considered as 100.0 - 73.0 = 27.0% and costs are calculated as:

$$\frac{\text{Mileage Depr. Cost}}{\text{Mileage Depr. \%}} = \frac{\text{Time Depr. Cost}}{\text{Time Depr. \%}}$$

$$\frac{49.4}{73.0} = \frac{X}{27.0}$$

Time depreciation costs = 18.3 pounds or $4.68 per 1000 vehicle kilometers.

6) Management Costs

The management cost percentage added to the sub-total of all other operating costs is shown for each vehicle type in the following tabulation.

Passenger Cars	5 percent
Pick Ups	10 percent
Buses	10 percent
Trucks	10 percent

7) Additional Cost Considerations

For the analysis to reflect actual road conditions and operating conditions additional items included were the effect of speed changes, speed distributions, fuel type, surface condition factors and riding characteristics

(a) Speed Changes

Speed changes are frequent on the existing highway and have a strong effect on the running cost of the vehicles on the existing road.

It has been noted, however, that the number of changes in vehicle speed generally decrease as speed increases until at the higher speeds, speed changes are not significant, which is assumed to be the case on the proposed expressway.

(b) Speed Distributions

Speed distributions were considered because a vehicle does not drive over a road segment at a constant speed and all drivers do not drive at the same speed. While a vehicle may average 40 KPH over a length of road, there is a great probability that vehicle speeds range from a lesser to a greater speed below and above the 40 KPH.

Distribution curves are initially based upon spot speeds from which an average running speed is established. The running speed is then analyzed including stop time to establish an average operating speed and ultimately the final speed distribution.

(c) Fuel Type

Since different fuel types are used by various vehicles, cars and pick-up trucks are analyzed using benzine (gasoline) while buses and trucks are analyzed using gasoil (diesel) fuel.

(d) Surface Condition Factor

User cost tables have been developed for vehicles operating on high type pavements in good condition.

For the existing road, surface condition factors are required to account for pavements in less than "high type" condition. There are numerous segments where the pavement is cracked, broken, patched, or wavy; and there is one short segment near the Cement Plant under construction at Tartous where the pavement has disintegrated to the state of an earth road in poor condition. The factors applied for surface condition (see Table C-39) were developed by the Consultant on a previous study, but are considered applicable to the Tartous-Lattakia highway since factors are multipliers of a base condition (high type pavement in good condition) which is the basis of the development of user running costs for the project under study.

User costs on pavements in less than "high type good condition" are found by multiplying the appropriate surface condition factor selected from Table C-39 times the user costs from the user cost tables (Appendix C, Tables 126 through 140) which are based on "high type pavement in good condition."

Table C-39

SURFACE CONDITION FACTORS
BY TYPE AND CONDITION

	Surface Type			
Condition	High Type	Bituminous Treated	Gravel	Earth
Good	1.00 1/	1.09 1/	1.27 1/	1.54 1/
Fair	1.09	1.19	1.40	1.71
Poor	1.20	1.31	1.55	1.94

1/ Base number

Where riding characteristics do not approximate those of the nominal surface type as would be found in developed countries (where surface factors were developed) the surface is evaluated as that surface type which is most nearly representative of actual riding characteristics.

As an example: an existing high type pavement in extremely poor condition could be assigned a riding characteristics evaluation equal to a bituminous treated in poor condition.

g. Highway Capital Costs

Highway capital costs have been established in seven investment categories as follow:

Right-of-Way
Earthwork
Pavement
Structures
Small Drainage and Miscellaneous
Incidental Costs
Start Up Costs

h. Example of Analysis Procedure

The preceding section presented all items included in the vehicle operating cost analysis. However, in order to prepare the final transportation analysis, it was necessary to analyze the "Before" and "After" situations. The following table shows items included in each analysis.

Item	Before	After
Vehicle Operating Costs	X	X
Highway Maintenance Costs	X	X
Capital Costs	-	X

Results are obtained by equating Capital Costs to the sum of all "Before" costs less the sum of all "After" costs.

1) Procedures Used for Calculating Rate of Return

The procedure used to calculate the rates of return uses January 1 of the first year after construction completion as the base year. Therefore, all costs noted during construction years are compounded to the base year while all cost items beyond the base year are discounted back to the base year.

The procedures used in calculating the rates of return are illustrated in the following example in which it is assumed two alternative situations are studied, namely B and P. B is used as a base for the comparison being the existing situation with road user and maintenance costs. P is the proposed alternative with capital, road user and maintenance costs. To reduce the length of the example, only four years of road user and maintenance costs are shown. The computer program performs the analysis over a 20-year time period.

(a) General Information

Date of beginning of construction - January 1, 1981

Date highway opened to traffic - January 1, 1984

End of Analysis period - December 31, 2003

Service lives of all highway components:

Rights-of-Way/Util. Reloc.	-	100 years
Pavement	-	20 years
Earthwork	-	75 years
Small Drainage and Misc.	-	25 years
Structures	-	50 years
Start Up	-	30 years
Incidental	-	5 years

(b) Weighted Service Life

Weighted service life of a hypothetical example is established as follows:

LYON

Highway Investment Component	Service Life Years	Investment Proposed Alternative P	Weighting Factor (Life x Investment)
Right of Way	100	44,000	4,400,000
Pavement	20	400,000	8,000,000
Earthwork	75	90,000	6,750,000
Small Drainage	25	70,000	1,750,000
Structures	50	96,000	4,800,000
Start Up	30	50,000	1,500,000
Incidental Costs	5	20,000	100,000
Total		770,000	27,300,000

The weighted average service life is $\frac{27,300,000}{770,000}$ = 35 years.

(c) Terminal Value of Investment Components

The analysis is based upon a 20-year time period beyond construction completion, however, most of the components in the physical make up of the highway have useful average service lives of 20 and more years. Therefore, the investment cost of each of the seven highway components is spread over its full service life period by use of the capital recovery factor corresponding to the discount rate being used. This produces an equivalent uniform annual cost over the service life period and conversely the present worth of these costs is equal to the original investment. The first 20 years (only) of the uniform annual cost are included in the benefit cost analysis. The remaining value (salvage value) of the road at year 20 does not then enter the analysis.

(d) Yearly Capital Investments

In this example, it is assumed the procurement of right-of-ways and construction operations are to start in the year 1981 and be completed in 1982. Equal cash expenditures of $385,000 are to be spent annually.

Year	Base Alternative B	Proposed Alternative P	Difference P - B
1982	0	$385,000	$385,000
1983	0	385,000	385,000
TOTAL:		$770,000	$770,000

(e) Yearly Road User Cost Plus Highway Maintenance Cost

Year	Base Alternative B	Proposed Alternative P	Difference P-B
1984	$ 958,000	$ 642,000	$ 316,000
1985	964,000	645,000	319,000
1986	973,000	649,000	324,000
1987	979,000	653,000	326,000

Years 1988 to 2003 are omitted in this example.

(f) The Solution

Overall Rate of Return: To reduce the length of example, only four years of benefits are used. The complete procedure uses 20 years for the analysis period.

Calculations for each year are as follows:

1982: Capital Cost x Capital Recovery Factor (CRF) x Series Present Worth (SPW) x Compound Factor (CA); (1 year)

1983: Capital Cost x CRF x SPW x CA; (0 years)

1984: Road User Benefits and Maintenance Benefits x Present Worth (PW); (1 year)

1985: Road User Benefits and Maintenance Benefits x PW (2 years)

1986: Road User Benefits and Maintenance Benefits x PW (3 years)

1987: Road User Benefits and Maintenance Benefits x PW (4 years)

Using the values as found and with 10 percent interest rate, the calculations are:

1982:	$385,000 x (CRF-10%-35) (SPW-10%-20) (CA-10%-1)	
	$385,000 x (.103690) (8.513564) (1.1) =	$374,000
1983:	$385,000 x (CRF-10%-35) (SPW-10%-20) (CA-10%-0)	
	$385,000 x (.103690) (8.513564) (1.0) =	$340,000
1984:	$316,000 x (PW-10%-1) = $316,000 x (.909091) =	$287,000
1985:	$319,000 x (PW-10%-2) = $319,000 x (.826446) =	$264,000
1986:	$324,000 x (PW-10%-3) = $324,000 x (.751315) =	$243,000
1987:	$326,000 x (PW-10%-4) = $326,000 x (.683013) =	$223,000

The present worth of the two years of highway capital cost is $374,000 plus $340,000 for a total of $714,000. The present worth of four years of net benefits is $287,000 + $264,000 + $243,000 + $223,000 for a total of $1,017,000.

Since the costs do not equal the benefits, the computer would try additional discount rates until it locates the rate that equates highway capital cost to road user plus highway maintenance benefits.

First Year Rate of Return: An analysis is also made to produce the first year rate of return. The procedure uses the net benefits the first year after construction completion and divides it by the total construction cost.

For the example noted above, the result would be $316,000 divided by $770,000 construction cost for a result of 41.0 percent.

Benefit/Cost Ratio: An analysis is also prepared on the relationship between net benefits and construction costs at selected discount rates to present a range of benefit/cost ratios.

In the example above, the result for a B/C ratio at a 10 percent discount rate is $1,017,000 net benefits divided by $714,000 construction costs for a B/C ratio of 1.42.

5. <u>The Analyses of Transport Economics</u>

a. The Proposed Project Defined

The basic principles considered in the transport economics analyses are as follow:

1) The "without" project case forces all traffic to utilize the existing highway, with no improvements other than pavement overlays.

2) The "with" project case splits traffic between the existing highway and a proposed four-lane divided limited access expressway.

3) The conditions on the existing highway are as follow:

(a) Length 88.0 kilometers (Tartous to Lattakia)

(b) Surface:	Type	Bituminous
	Width	7.0 meters
	Condition	Poor
(c) Shoulder:	Type	Earth
	Width	1.0 meter
	Condition	Poor

(d) Average Operating Speed:	Rural	Urban
cars and pickups	55 kph	40 kph
buses and trucks	40 kph	30 kph

4) The conditions on the proposed expressway are as follow:

(a) Length, 82.9 kilometers (Tartous to Lattakia)

(b) Surface:	Type	Asphaltic Concrete
	Width	2 at 7.0 meters
	Condition	Good
(c) Shoulder:	Type	Crushed Rock
	Width	2.0 (Median side) + 4.0 (Outside)
	Condition	Good

(d) Operating Speed:	Rural	Urban
cars and pickups	80 kph	not applicable
buses and trucks	60 kph	not applicable

5) Pavement overlays will be required at 6 year intervals on the existing highway.

6) Pavement overlay will be required at the 10th year on the proposed expressway.

7) Legal Load Limits will be strictly enforced so that the number of overloaded vehicles on the proposed expressway and on the existing road will be negligible. (Note that this is a significant deviation from present practice.)

8) The service life of categories of construction cost are as follow:

Category 1.	Right of Way, Utility Relocation and Engineering	100 years
Category 2.	Pavement	20 years
Category 3.	Earthwork	75 years
Category 4.	Small Drainage and Miscellaneous	25 years
Category 5.	Structures	50 years
Category 6.	Start Up (note that this includes permanent camp construction with soils lab, etc.)	30 years
Category 7.	Incidental	5 years

c. Detailed Results of Proposed Project

1) Table C-41 shows condition codes and cash flow for construction costs.

2) Table C-42 shows vehicle operating costs for cars and pickups in the before (or "without") case, the after (or "with") case and the savings resulting from the after (or "with") case.

3) Table C-43 above but for buses

4) Table C-44 as above but for trucks

5) Table C-45 as above but for all vehicles combined

6) Table C-46 shows the stream of costs and benefits, the annual rate of return, the benefit cost ratios at various discount rates and the internal rate of return.

b. The Project Results Divided by Sections

Each individual section of the project has been defined in the manner described in paragraph a. above and has been subjected to full analysis with printout as described in c. below. The computer printout sheets for all sections are voluminous and are therefore not included in the report, however, a summary of all results are shown in Table C-40.

Table C-40

SUMMARY OF FINDINGS
THE PROPOSED PROJECT BY SECTIONS

Section	Internal Rate of Return %	First Year Rate of Return %	Benefit Cost Ratio at Discount Rate of 10%	15%	20%	25%	30%
Tartous-Lattakia	27.5	20.6	5.0	2.8	1.7	1.2	0.9
Tartous Bypass	34.3	27.6	7.2	4.0	2.6	1.7	1.3
Tartous-Banyas	24.1	16.3	4.1	2.2	1.4	0.9	0.7
Banyas Bypass	23.4	15.2	3.7	2.1	1.3	0.9	0.7
Banyas-Jebleh	30.7	26.9	6.0	3.3	2.1	1.4	1.0
Jebleh-Lattakia	29.0	23.0	5.7	3.1	1.9	1.3	0.9

d. Discussion of Unit Results

1) General

Analyses were also prepared for trucks and buses to show costs on the basis of a vehicle kilometer as well as unit results for the goods, movements and passenger movements. These will be used by the project economists to compare costs between competing modes of transportation. The results were prepared for the year 1984, the first year the project is open to traffic. It should be noted the computer procedure used by the consultant evaluates the project on five independent homogeneous segments, which were weighted to establish average units for the discussion which follows.

2) Goods Movements

Goods are carried in a variety of trucks which are categorized either as the pick-up truck, or all other trucks combined. The pick-up trucks are not included in this review since they are normally used for short haul trips making local deliveries.

In the legal loading situation, the weighted average of goods carried is 10.3 tons per truck with the overall cost per vehicle kilometer being 53 cents in the "before" situation and 32 cents in the "after" situation. Further analysis shows ton kilometer costs as 5.1 cents for the "before" situation and 3.1 cents for the "after" situation.

In the present loading situation, the weighted average of goods carried is 18.6 tons per truck, with the overall cost per vehicle kilometer being 54 cents in the "before" situation and 32 cents in the "after" situation. Further analysis shows ton kilometer costs as 2.9 cents and 1.7 cents for the "before" and "after" situations respectively.

Table C-41

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

R O A D W A Y E V A L U A T I O N
(COSTS SHOWN IN DOLLARS)

DATE 28 JULY 1978.

SECTION CODE NUMBER
COMPUTER CODE NUMBER 31 - 50

PROJECT - TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE - TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA,LEGAL LOADS,4 LANES

FROM CODE NO.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
BEFORE OR BASE SITUATION =		7																		
VARIATION NO.	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SURFACE TYPE	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WIDTH	7.0	7.0	7.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SHOULDER TYPE	2	4	2	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COND.	3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WIDTH	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFTER OR ALTERNATE SITUATION =		7																		
VARIATION NO.	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
SURFACE TYPE	0	0	0	0	0	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1
COND	0	0	0	0	0	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1
WIDTH	0.0	0.0	0.0	0.0	0.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
SHOULDER TYPE	0	0	0	0	0	2	4	2	4	4	3	3	3	3	3	3	3	3	3	3
COND.	0	0	0	0	0	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1
WIDTH	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	2.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0

C O N S T R U C T I O N C O S T S

YEAR		R-W/UT.REL (100 YRS)	PAVEMENT (20 YRS)	EARTHWORK (75 YRS)	SM DRN/MISC. (25 YRS)	STRUCTURES (50 YRS)	START-UP (30 YRS)	INCIDENTAL (5 YRS)	TOTAL
1981	BEFORE/BASE	0.	0.	0.	0.	0.	0.	0.	
	AFTER/ALTER.	11999000.	3201120.	3637760.	762240.	7463299.	10847000.	0.	
	DIFFERENCE	11999000.	3201120.	3637760.	762240.	7463299.	10847000.	0.	37910420.
1982	BEFORE/BASE	0.	0.	0.	0.	0.	0.	0.	
	AFTER/ALTER.	11999000.	6757920.	4660880.	762240.	12630200.	0.	180000.	
	DIFFERENCE	11999000.	6757920.	4660880.	762240.	12630200.	0.	180000.	36990240.
1983	BEFORE/BASE	0.	0.	0.	0.	0.	0.	0.	
	AFTER/ALTER.	0.	7824960.	3069360.	857520.	8611500.	0.	180000.	
	DIFFERENCE	0.	7824960.	3069360.	857520.	8611500.	0.	180000.	20543340.
1993	BEFORE/BASE		0.						
	AFTER/ALTER.		7331000.						
	DIFFERENCE		7331000.						7331000.
	UNDISCOUNTED TOTALS	23998000.	25115000.	11368000.	2382000.	28705000.	10847000.	360000.	102775000.

Table C-42

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

V E H I C L E O P E R A T I N G C O S T S
(SHOWN IN 000 U.S. DOLLARS)

PROJECT = TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE = TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA,LEGAL LOADS,4 LANES

C A R A N D P I C K - U P

YEAR	BEFORE RUNN. COSTS	BEFORE OCCUP. TIME	BEFORE ACCID-ENTS	BEFORE ** OTHERS	BEFORE TOTAL	AFTER RUNN. COSTS	AFTER OCCUP. TIME	AFTER ACCID-ENTS	AFTER ** OTHERS	AFTER TOTAL	SAVING RUNN. COSTS	SAVING OCCUP. TIME	SAVING ACCID-ENTS	SAVING ** OTHERS	SAVING TOTAL
1978	3599.2	1963.0	453.4	1337.4	7353.1	2533.9	1525.5	238.4	984.7	5282.7	1065.2	437.4	215.0	352.6	2070.4
1979	3959.5	2170.4	501.9	1463.3	8115.2	2788.5	1674.5	262.3	1084.6	5810.2	1170.9	495.8	239.5	398.6	2305.0
1980	4342.6	2395.9	570.9	1679.2	9048.7	3069.0	1849.3	291.1	1201.6	6411.1	1273.6	606.5	279.8	477.6	2637.6
1981	4802.3	2843.6	662.9	1946.9	10255.9	3376.8	2033.3	321.3	1325.3	7056.8	1425.4	810.3	341.6	621.6	3199.0
1982	5291.4	3129.9	732.3	2149.9	11303.7	3709.9	2269.0	359.9	1482.2	7821.1	1581.5	860.9	372.4	667.7	3482.6
1983	5635.4	3510.9	823.6	2419.1	12589.2	4085.8	2531.3	404.0	1659.5	8680.7	1749.6	979.6	419.6	759.6	3908.4
1984	6324.3	3947.1	921.1	2702.1	13894.8	4426.8	2751.6	436.0	1793.0	9407.5	1897.5	1195.4	485.1	909.1	4487.2
1985	6857.0	4682.6	1086.8	3180.5	15807.0	4797.7	3006.3	474.6	1947.2	10225.9	2059.3	1676.2	612.1	1233.2	5581.0
1986	7427.5	4961.0	1146.1	3353.1	16887.8	5195.2	3337.1	523.8	2147.9	11204.2	2232.2	1623.8	622.2	1205.1	5683.5
1987	8088.4	5520.7	1268.3	3711.6	18559.1	5631.4	3655.9	571.1	2339.3	12197.8	2427.0	1864.8	697.1	1372.2	6361.2
1988	8778.7	6069.4	1435.7	4200.0	20698.0	6104.3	4046.2	631.2	2573.1	13354.9	2666.3	2243.2	804.5	1626.9	7343.0
1989	9848.1	7425.3	1779.5	5208.8	24658.8	6685.9	4538.1	709.8	2875.6	14809.5	3159.1	3287.2	1069.7	2333.1	9849.3
1990	11417.4	8359.8	1832.4	5351.2	25710.9	7192.9	4955.9	765.1	3116.8	16030.9	3234.4	3143.8	1067.2	2234.3	9679.9
1991	11434.7	9142.8	2062.1	6003.8	28643.6	7801.9	5432.5	834.6	3397.7	17466.9	3632.8	3710.3	1227.4	2606.0	11176.6
1992	12603.7	10447.8	2343.4	6828.6	32223.8	8501.2	6029.9	927.2	3751.9	19210.4	4102.5	4417.9	1416.2	3076.6	13013.3
1993	14768.7	13092.2	2917.3	8546.0	38824.4	9254.8	6810.5	1040.0	4205.9	21311.4	5013.8	6281.6	1877.3	4340.0	17512.9
1994	15943.8	15115.1	3542.7	9705.9	43664.7	9898.3	7324.2	1118.1	4505.3	22846.0	5542.5	7790.8	2224.6	5200.5	20758.6
1995	18505.8	16552.0	3643.4	10576.2	47277.1	10630.2	8128.7	1252.3	4981.4	24992.8	5875.0	8423.3	2391.0	5594.8	22284.2
1996	17425.6	18611.1	4059.6	11773.5	52166.4	11309.9	8583.7	1307.7	5230.1	26431.6	6519.0	9927.3	2745.0	6543.3	25734.7
1997	20518.8	22464.3	5185.3	15051.5	64958.0	12069.7	9268.7	1406.7	5622.0	28367.3	8447.1	14535.5	3778.5	9429.4	36190.6
1998	20863.6	22884.5	4959.1	14437.9	63245.0	12956.0	10333.6	1561.3	6222.4	31073.5	8007.4	12550.8	3397.8	8215.4	32171.5
1999	22030.5	24598.5	5311.9	15448.0	67369.0	13899.5	11379.4	1711.2	6820.3	33810.6	8130.9	13219.1	3600.6	8627.6	33578.4
2000	24649.0	30650.6	6625.0	19144.0	81077.1	14899.8	12540.9	1882.8	7475.3	36798.9	9749.2	18117.9	4742.2	11668.7	44278.1
2001	27117.1	37261.2	8011.4	23072.5	95482.4	16090.8	14434.3	2203.4	8544.7	41273.3	11026.3	22846.8	5808.0	14527.8	54209.1
2002	27694.1	36494.7	7818.5	22534.0	94841.5	17167.4	15213.6	2272.0	8983.6	43636.8	10826.6	21281.0	5546.4	13550.4	51204.7
2003	29401.3	39224.4	8368.5	24137.0	101131.3	18388.3	17015.0	2532.4	9997.8	47933.6	11012.9	22209.4	5836.1	14139.1	53197.6

** INCLUDES COSTS FOR VEHICLE INVESTMENT, TIME DEPRECIATION AND MANAGEMENT (WHEN APPLICABLE)

LYON

Table C-43

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

V E H I C L E O P E R A T I N G C O S T S
(SHOWN IN 000 U.S. DOLLARS)

PROJECT = TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE = TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA.LEGAL LOADS.4 LANES

B U S

YEAR	BEFORE					AFTER					SAVING				
	RUNN. COSTS	OCCUP. TIME	ACCID-ENTS	** OTHERS	TOTAL	RUNN. COSTS	OCCUP. TIME	ACCID-ENTS	** OTHERS	TOTAL	RUNN. COSTS	OCCUP. TIME	ACCID-ENTS	** OTHERS	TOTAL
1978	1886.2	1082.5	120.6	552.1	3641.4	1685.3	1134.1	113.8	550.8	3484.2	200.8	-51.6	6.7	1.2	157.2
1979	2055.8	1194.5	132.0	606.2	3968.7	1838.9	1237.2	123.4	601.0	3800.6	216.9	-42.6	8.5	5.1	188.0
1980	2231.5	1360.4	150.9	679.2	4422.3	2008.6	1379.6	138.3	665.3	4192.0	222.9	-19.2	12.6	13.8	230.2
1981	2446.7	1603.7	177.0	780.4	5007.8	2190.9	1509.8	151.1	727.3	4579.3	255.8	93.8	25.8	53.0	428.5
1982	2667.1	1759.2	195.4	855.5	5477.3	2384.5	1692.0	169.7	807.2	5053.6	282.5	67.2	25.6	48.2	423.7
1983	2913.8	1982.7	219.5	952.7	6068.8	2588.4	1943.8	196.1	911.1	5639.6	325.4	38.8	23.3	41.6	429.2
1984	3229.9	2295.8	255.4	1087.2	6868.5	2870.5	2110.7	212.5	995.9	6189.7	359.3	185.1	42.9	91.2	678.7
1985	3596.2	2868.3	317.9	1311.3	8093.9	3175.9	2345.9	236.3	1105.7	6863.9	420.2	522.4	81.5	205.6	1229.9
1986	3995.6	3660.9	340.0	1415.6	8866.3	3515.5	2682.4	269.9	1250.3	7718.3	474.0	378.4	70.1	165.3	1088.0
1987	4439.5	3487.7	388.9	1599.5	9915.8	3904.6	2997.9	302.7	1395.1	8600.4	534.9	489.8	86.2	204.3	1315.3
1988	4907.3	4946.3	450.8	1834.0	11238.6	4331.9	3459.8	350.8	1588.1	9730.8	575.3	586.5	100.0	245.8	1507.7
1989	5357.3	5262.8	583.9	2275.7	13479.8	4949.0	4162.3	424.3	1876.3	11412.0	408.3	1100.5	159.5	399.3	2067.7
1990	5854.3	5419.0	602.0	2398.4	14373.9	5381.7	4417.6	447.7	2011.1	12258.2	572.5	1001.3	154.3	387.3	2115.6
1991	6585.6	6146.3	686.0	2698.0	16116.0	5949.2	4938.0	500.8	2240.0	13628.2	636.3	1208.2	185.2	457.9	2487.8
1992	7244.6	7223.2	804.5	3113.8	18386.2	6662.0	5691.6	578.6	2557.0	15489.4	582.6	1531.6	225.8	556.7	2896.7
1993	8320.5	8880.5	1105.2	4054.4	23369.0	7358.7	6473.2	656.2	2882.5	17370.8	969.7	3407.5	449.0	1171.8	5998.2
1994	9136.210652.8		1182.3	4390.1	25340.5	8185.0	7412.6	756.2	3268.6	19622.6	950.1	3220.1	426.0	1121.4	5717.8
1995	10246.712046.4		1344.5	4935.0	28374.8	9019.1	9355.5	966.3	3971.4	23312.4	1029.5	2690.9	378.2	963.6	5062.3
1996	11012.314027.3		1569.7	5661.4	32270.8	9941.2	9502.7	974.6	4119.2	24537.8	1071.1	4524.6	595.0	1542.1	7732.9
1997	11953.216070.6		2015.3	7018.6	39058.5	10896.310693.2		1099.9	4597.4	27286.9	1057.5	7377.4	915.4	2421.1	11771.5
1998	13173.518138.9		2022.4	7185.7	40520.8	11954.612354.2		1271.3	5238.6	30818.9	1218.9	5784.7	751.1	1947.1	9701.9
1999	14033.919338.2		2154.8	7664.5	43191.5	13125.413769.2		1411.2	5814.0	34120.0	908.4	5568.9	743.5	1850.5	9071.5
2000	14644.724010.4		2681.0	9179.3	50515.5	14323.815678.1		1612.0	6555.0	38169.1	320.9	8332.2	1069.0	2624.2	12346.3
2001	15740.127204.5		3033.8	10273.0	56251.6	15262.319043.3		1972.4	7721.3	43999.4	477.8	8161.1	1061.3	2551.7	12252.1
2002	16831.029678.2		3190.8	10974.2	59574.4	17089.319809.9		2031.5	8180.3	47111.1	-258.3	8868.3	1159.3	2693.9	12463.2
2003	17809.230525.2		3401.5	11355.4	63291.4	18673.522245.1		2271.9	9124.7	52315.4	-864.3	8280.1	1129.5	2430.7	10976.0

** INCLUDES COSTS FOR VEHICLE INVESTMENT, TIME DEPRECIATION AND MANAGEMENT (WHEN APPLICABLE)

Table C-44

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

V E H I C L E O P E R A T I N G C O S T S
(SHOWN IN 000 U.S. DOLLARS)

PROJECT = TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE = TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA,LEGAL LOADS,4 LANES

T R U C K

YEAR	BEFORE RUNN. COSTS	BEFORE OCCUP. TIME	BEFORE ACCID-ENTS	BEFORE OTHERS **	BEFORE TOTAL	AFTER RUNN. COSTS	AFTER OCCUP. TIME	AFTER ACCID-ENTS	AFTER OTHERS **	AFTER TOTAL	SAVING RUNN. COSTS	SAVING OCCUP. TIME	SAVING ACCID-ENTS	SAVING OTHERS **	SAVING TOTAL
1978	12033.0	1759.8	868.3	4196.3	18857.6	8159.0	1338.2	431.2	2926.9	12855.4	3874.0	421.6	437.0	1269.3	6002.1
1979	13377.3	1971.8	972.3	4700.1	21021.6	9042.1	1483.5	477.3	3245.6	14248.6	4335.2	488.2	495.0	1454.5	6773.0
1980	15091.1	2277.6	1124.3	5434.6	23877.7	10029.9	1656.1	534.3	3623.2	15843.7	5011.1	621.5	589.9	1811.3	8034.0
1981	16907.4	2721.8	1342.9	6468.0	27440.2	11122.8	1840.7	593.7	4026.3	17563.7	5784.5	881.0	749.1	2441.7	9856.5
1982	18750.9	3032.5	1495.5	7201.8	30480.8	12378.4	2084.9	672.8	4553.2	19689.4	6372.4	947.6	822.7	2648.5	10791.4
1983	20961.6	3468.2	1712.6	8219.1	34261.7	13781.4	2355.8	764.5	5144.4	22046.2	7080.2	1112.3	948.1	3074.7	12215.4
1984	22736.4	3880.8	1915.0	9197.1	37731.4	14737.7	2515.4	814.5	5493.3	23561.0	8000.6	1365.3	1100.5	3703.8	14170.3
1985	25568.0	4481.1	2310.511073.2		43632.9	15784.1	2701.5	874.9	5900.4	25261.1	9783.8	1979.5	1435.5	5172.8	18371.8
1986	26933.6	4918.9	2380.111405.4		45538.1	16992.4	2963.1	960.4	6470.3	27386.3	9941.1	1955.7	1419.7	4935.1	18151.7
1987	29108.7	5506.0	2622.112540.9		49577.8	18252.1	3194.5	1035.9	6979.4	29462.1	10856.5	2111.4	1586.2	5561.4	20115.7
1988	31760.7	5993.6	2955.814131.7		54951.9	19690.3	3403.3	1133.8	7617.5	31925.0	12190.4	2500.2	1821.9	6514.2	23026.9
1989	35720.1	7539.5	3721.917616.5		64578.2	21128.5	3842.1	1260.8	8398.4	34629.9	14571.5	3697.3	2461.1	9216.1	29948.3
1990	38036.3	7484.1	3697.517656.7		66874.7	22866.2	4136.9	1347.7	9067.0	37417.9	15170.0	3347.2	2349.8	8589.7	29456.7
1991	40773.4	8234.0	4064.719362.8		72435.1	24586.4	4457.6	1451.8	9778.9	40274.9	16187.0	3776.3	2612.9	9583.9	32160.2
1992	43328.9	9365.4	4626.021636.0		79456.4	26450.4	4840.9	1581.910629.0		43502.4	17178.4	4524.4	3044.011206.9		35953.9
1993	49355.712287.8		6074.128097.5		95845.3	28763.2	5427.3	1767.911929.1		47887.7	20622.4	6860.5	4306.116168.4		47957.5
1994	51292.112759.8		6200.526860.3		98912.9	30165.0	5730.9	1876.312579.6		50352.0	21127.0	6828.8	4324.216280.7		48560.9
1995	55885.613544.5		6737.031338.1106805.3			32317.1	6310.1	2101.213848.1		54576.7	22768.4	7334.3	4635.717489.9		52228.6
1996	58946.615257.2		7532.234801.2116539.2			33624.3	6508.4	2144.814277.1		56554.8	25324.2	8748.7	5387.320524.0		59984.4
1997	65209.618800.6		9271.742160.9135462.7			35553.2	6911.6	2285.215172.9		59923.1	29656.111889.0		6986.427007.9		75539.5
1998	69508.916895.2		8924.440762.8132711.5			38223.4	7663.7	2533.316859.9		65280.4	26665.510431.5		6391.023922.9		67431.0
1999	67155.618655.3		9303.742451.9137766.6			40617.8	8298.7	2735.918265.9		69938.3	26537.810556.6		6567.824166.0		67828.3
2000	73311.122364.611039.649822.8156538.2					43299.4	8955.0	2952.119784.6		74991.3	30011.613409.6		8087.430038.1		81546.9
2001	78281.924861.012261.054782.8170106.7					46385.6	9836.1	3273.821748.1		81243.7	31896.115024.8		8987.233034.7		88943.0
2002	80770.725307.612497.256005.1174580.8					49915.410532.4		3464.123427.4		87339.3	30855.314775.2		9033.132577.7		87241.4
2003	83656.926365.613029.758282.5181354.9					53377.111757.7		3843.626161.0		95139.5	30279.814627.9		9186.132121.5		86215.4

** INCLUDES COSTS FOR VEHICLE INVESTMENT, TIME DEPRECIATION AND MANAGEMENT (WHEN APPLICABLE)

LYON

Table C-45

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

V E H I C L E O P E R A T I N G C O S T S
(SHOWN IN 000 U.S. DOLLARS)

PROJECT = TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE = TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA.LEGAL LOADS.4 LANES

A L L V E H I C L E S

YEAR	BEFORE RUNN. COSTS	BEFORE OCCUP. TIME	BEFORE ACCIDENTS	BEFORE OTHERS **	BEFORE TOTAL	AFTER RUNN. COSTS	AFTER OCCUP. TIME	AFTER ACCIDENTS	AFTER OTHERS **	AFTER TOTAL	SAVING RUNN. COSTS	SAVING OCCUP. TIME	SAVING ACCIDENTS	SAVING OTHERS **	SAVING TOTAL
1978	17518.5	4805.4	1442.4	6085.8	29852.2	12378.3	3997.8	783.6	4462.6	21622.4	5140.1	807.5	658.8	1623.2	8229.8
1979	19392.7	5336.8	1606.3	6789.7	33125.7	13669.6	4395.3	663.2	4931.3	23859.6	5723.1	941.4	743.1	1858.3	9266.1
1980	21615.3	6094.0	1846.2	7793.1	37348.8	15107.5	4885.1	963.8	5490.2	26446.8	6507.7	1208.8	882.4	2302.8	10901.9
1981	24156.5	7169.1	2182.9	9195.4	42704.1	16690.6	5383.9	1066.2	6079.0	29219.9	7465.8	1785.2	1116.6	3116.4	13484.2
1982	26709.4	7921.8	2423.3	10207.3	47261.9	18472.8	6046.0	1202.5	6842.7	32564.2	8236.5	1875.7	1220.8	3364.6	14697.7
1983	29810.9	8961.9	2755.9	11591.0	52919.9	20455.6	6831.1	1364.7	7715.1	36366.6	9155.3	2130.8	1391.1	3875.9	16553.2
1984	32292.7	10123.8	3091.6	12966.5	58494.7	22035.1	7377.7	1463.0	8282.3	39158.3	10257.5	2746.0	1628.5	4684.2	19336.4
1985	36721.4	12232.1	3715.2	15565.0	67533.8	23757.9	8053.8	1585.9	8953.3	42351.0	12263.4	4178.2	2129.3	6611.7	25182.6
1986	38350.7	13640.9	3966.3	16674.2	71232.3	25703.3	8982.8	1754.2	9868.5	46308.9	12647.4	3858.1	2112.1	6805.6	24923.3
1987	41606.7	14314.4	4279.4	17852.1	78052.7	27788.2	9848.4	1909.8	10713.9	50260.4	13818.4	4466.0	2369.6	7138.1	27792.3
1988	45869.8	16319.4	4642.4	20165.8	86688.6	30126.6	10989.4	2115.8	11778.8	55010.8	15434.1	5329.9	2726.5	8387.0	31877.7
1989	53962.6	20627.7	6085.4	25101.0	102716.9	32763.5	12542.5	2394.9	13150.4	60851.5	18139.0	8085.2	3690.4	11950.6	41865.3
1990	54416.0	21003.0	6132.1	25406.4	106959.6	35441.0	13510.5	2560.6	14194.9	65707.2	18977.0	7492.5	3571.4	11211.4	41252.4
1991	58793.6	23523.1	6812.9	28064.7	117194.8	38337.7	14828.2	2787.3	15416.7	71370.0	20456.2	8694.9	4025.6	12648.0	45824.7
1992	63477.3	27035.5	7774.0	31778.5	130066.5	41613.7	16562.5	3087.9	16938.1	78202.3	21863.6	10473.9	4686.1	14840.4	51864.1
1993	71883.0	36261.0	10096.7	40697.9	158038.8	45376.9	18711.1	3464.2	19017.6	86570.0	26606.0	16549.8	6632.4	21630.3	71468.7
1994	75861.3	38307.8	10725.6	42956.5	167858.2	48248.4	20467.8	3750.6	20353.7	92820.8	27619.6	17839.9	6974.9	22602.7	75037.4
1995	81635.7	41243.0	11725.0	46649.4	182457.3	51966.6	23794.4	4319.9	22800.9	102882.0	29673.1	18446.6	7405.0	24048.4	79575.3
1996	87785.9	47795.6	13154.7	52236.1	200976.5	54875.5	24594.9	4427.2	23626.6	107524.3	32914.4	23200.6	8727.4	28609.5	93452.1
1997	97680.1	60675.6	16472.3	64251.1	239079.3	58519.3	26873.6	4791.9	25392.5	115577.5	39160.6	33801.9	11680.3	38658.6	123501.8
1998	99048.0	99118.7	15906.0	62406.5	236477.4	63134.2	30351.6	5365.9	28320.9	127172.8	35911.8	68767.0	10540.0	34085.6	109304.5
1999	*******	62792.1	16770.5	65564.5	248347.3	67642.8	33447.4	5858.5	30920.2	137869.0	35577.2	29344.7	10912.0	34644.2	110478.3
2000	*******	77033.9	20345.7	78146.2	268130.9	72523.0	37174.2	6447.0	33815.0	149959.4	40081.8	39859.7	13898.6	44331.1	138171.4
2001	*******	89346.7	23306.3	88128.5	321920.8	77738.7	43313.8	7449.6	38014.1	166516.4	43400.3	46032.8	15856.7	50114.3	155404.3
2002	*******	90480.7	23506.6	89413.5	328996.8	84172.2	45556.0	7767.6	40591.3	178087.3	41423.7	44924.6	15738.9	48822.1	150909.5
2003	*******	96135.3	24799.8	93974.9	345777.7	90439.1	51017.9	8648.0	45283.5	195388.6	40428.3	45117.4	16151.8	46691.4	150389.1

** INCLUDES COSTS FOR VEHICLE INVESTMENT, TIME DEPRECIATION AND MANAGEMENT (WHEN APPLICABLE)

Table C-46

*** *** HIGHWAY FEASIBILITY STUDIES - LATTAKIA REGION *** ***

R O A D W A Y E V A L U A T I O N
(COSTS SHOWN IN 000 U.S. DOLLARS

DATE 28 JULY 1978

CHANGE IN CONSTRUCTION COSTS = 0 PERCENT
CHANGE IN VEHICLE OPERATING COSTS = 0 PERCENT

PROJECT - TARTOUS - LATTAKIA FEASIBILITY STUDY
PROVINCE - TARTOUS AND LATTAKIA
ROAD SECTION TARTOUS - LATTAKIA,LEGAL LOADS,4 LANES

YEAR	CONST COSTS	ROAD MAINT COSTS BEFORE	AFTER	SAVINGS	VEHICLE OPER COSTS BEFORE	AFTER	SAVINGS	ADDED COSTS ECON	SOCIAL	ADDED SAVINGS ECON	SOCIAL	TOTAL SAVINGS	*** ANNUAL R-OF-R
1981	37910.							0.	0.	0.	0.	0.	
1982	35990.							0.	0.	0.	0.	0.	
1983	20543.							0.	0.	0.	0.	0.	
1984		372.	857.	-485.	58495.	39158.	19337.	0.	0.	869.	0.	19721.	20.6 0/0
1985		398.	917.	-519.	67534.	42351.	25183.	0.	0.	869.	0.	25533.	26.7 0/0
1986		426.	981.	-555.	71232.	46309.	24923.	0.	0.	869.	0.	25237.	26.4 0/0
1987		456.	1050.	-594.	78053.	50260.	27793.	0.	0.	869.	0.	28068.	29.4 0/0
1988		488.	1123.	-635.	86889.	55011.	31878.	0.	0.	869.	0.	32112.	33.6 0/0
1989		522.	1202.	-680.	102717.	60852.	41865.	0.	0.	869.	0.	42054.	44.0 0/0
1990		558.	1286.	-728.	106950.	65707.	41253.	0.	0.	869.	0.	41394.	43.3 0/0
1991		597.	1376.	-779.	117195.	71370.	45825.	0.	0.	869.	0.	45915.	48.1 0/0
1992		639.	1472.	-833.	130067.	78202.	51865.	0.	0.	869.	0.	51901.	54.3 0/0
1993	7331.	684.	1575.	-891.	158039.	86570.	71469.	0.	0.	869.	0.	71447.	74.8 0/0
1994		718.	1654.	-936.	167656.	92821.	75037.	0.	0.	869.	0.	74970.	78.5 0/0
1995		754.	1737.	-983.	182457.	102882.	79575.	0.	0.	869.	0.	79461.	83.2 0/0
1996		792.	1823.	-1031.	200977.	107524.	93453.	0.	0.	869.	0.	93291.	97.7 0/0
1997		831.	1915.	-1084.	239079.	115578.	123501.	0.	0.	869.	0.	123286.	129.1 0/0
1998		873.	2010.	-1137.	236477.	127173.	109304.	0.	0.	869.	0.	109036.	114.2 0/0
1999		916.	2111.	-1195.	248347.	137669.	110478.	0.	0.	869.	0.	110152.	115.4 0/0
2000		962.	2216.	-1254.	288131.	149959.	138172.	0.	0.	869.	0.	137787.	144.3 0/0
2001		1010.	2327.	-1317.	321921.	166516.	155405.	0.	0.	869.	0.	154957.	162.3 0/0
2002		1061.	2444.	-1383.	328997.	178087.	150910.	0.	0.	869.	0.	150396.	157.5 0/0
2003		1114.	2566.	-1452.	345778.	195389.	150389.	0.	0.	869.	0.	149806.	156.9 0/0
UNDIS-COUNTED TOTALS	102774.	14171.	32642.	-18471.	3537203.	1969588.	1567615.	0.	0.	17380.	0.	1566524.	

*** ANNUAL RATE OF RETURN DEFINED AS TOTAL SAVINGS DIVIDED BY TOTAL CONSTRUCTION COSTS

BENEFIT COST (B/C) ANALYSIS

DISCOUNT RATE	DISCOUNTED BENEFITS	DISCOUNTED COSTS	B/C RATIO
10 0/0	476204.	94413.	5.0438
15 0/0	259998.	108149.	2.7739
20 0/0	204128.	117591.	1.7359
25 0/0	148281.	125349.	1.1829
30 0/0	113634.	132531.	0.8574

INTERNAL RATE OF RETURN 27.50 0/0

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These analyses clearly show the benefits that would accrue to the economy when comparing the "after" situation with the "before" situation. However, based upon the viewpoint of economics of goods hauling, there is a clear advantage to the economy to move a ton of goods over one kilometer of road in the present loading situation on the existing road in that the cost is 2.9 cents as opposed to the 5.1 cents in the legal loading situation. There would also be a benefit to the economy in the new road situation in that the cost to move goods are 1.7 cents per ton kilometer in the legal loading situation and 3.1 cents per ton kilometer with legal loadings enforced. It should be noted, however, that the transport cost alone in the present loading situation does not adequately reflect such items as the additional cost for pavement construction, stronger bridges, nor additional costs to modify trucks carrying the goods.

In summary, the items compared in the foregoing analysis are:

	"Before" Existing Road	"After" Proposed Road
Legal Loadings		
Average Load Per Truck	10.3 tons	10.3 tons
Cost per Vehicle Kilometer	53 cents	32 cents
Cost per Ton Kilometer	5.1 cents	3.1 cents
Present Loadings		
Average Load per Truck	18.6 tons	18.6 tons
Cost per vehicle Kilometer	54 cents	32 cents
Cost per Ton Kilometer	2.9 cents	1.7 cents

3) Passengers

(a) All Items Included

Passengers are transported on the highway in a variety of vehicles; cars, taxis, micro buses and buses. For this review, two vehicle groups are considered, cars and taxis as one group, and micro buses and large buses as the second group.

The number of occupants per vehicle type was established during the origin-designation survey and is as follows:

Sedan	3.2 occupants
Taxi	5.8 occupants
Micro Bus	17.3 occupants
Bus	38.0 occupants

These numbers were used in establishing a weighted average of occupants for each vehicle grouping by proportioning them according to the number of vehicles on the road. For sedans and taxis, the weighted number of occupants for both the "before" and "after" situations was 4.1 occupants per vehicle. The weighted number in buses was 22.6 occupants for the "before" situation and 28.3 occupants for the "after" situation. This difference reflects the fact that with the new road, many of the micro buses will continue to use the existing road.

On the existing road, the sedan group had operating costs of 14 cents per kilometer while buses had a cost of 51 cents per kilometer. On the proposed facility costs would be 9 cents and 34 cents for the sedans and buses respectively. Further analyses show that on the existing road, the cost for passenger kilometer was 3.4 cents and 2.3 cents for the sedans and buses respectively. On the proposed road, passenger kilometer costs would be 2.2 cents and 1.2 cents repsectively for the sedans and buses. Comparatively, the cost per passenger kilometer for the sedans was reduced by 35 percent from 3.4 cents to 2.2 cents from the existing road costs to the proposed road costs. The passenger kilometer cost for buses was reduced by 48 percent from 2.3 cents to 1.2 cents.

(b) Excluding Occupant Time Charges

Passenger kilometer costs noted above reflect the entire range of items normally included in a vehicle operating costs analysis. However, to establish a cost per passenger kilometer reflecting operating costs to a vehicle owner establishing passenger charges, occupants time must be excluded. From the computer results, it was noted that occupants time was 29 percent of the total sedan operating cost and 34 percent of the total bus operating cost. Excluding the time values, the passenger kilometer costs on the existing road for sedans was 2.4 cents and buses was 1.5 cents. On the proposed road, passenger kilometer costs for the sedans were 1.6 cents and 0.8 cents for the buses. Reductions in costs for the vehicle groups were similar to those previously discussed, sedan passenger kilometer costs being reduced 33 percent from 2.4 cents to 1.7 cents and bus passenger kilometer costs being reduced 47 percent from 1.5 cents to 0.8 cents.

In summary, the items compared in the foregoing analyses are:

	"Before" Existing Road	"After" Proposed Road
Average Number of Occupants		
Car & Taxi, Combined	4.1 occupants	4.1 occupants
Buses, combined	22.6 occupants	28.3 occupants
Cost per Vehicle Kilometer		
Cars & Taxis	14 cents	9 cents
Buses	51 cents	34 cents
Cost per Passenger Kilometer		
Cars & Taxis	3.4 cents	2.2 cents
Buses	2.3 cents	1.2 cents
Occupants Time (as percent of Operating Costs)		
Cars & Taxis	29 percent	29 percent
Buses	34 percent	34 percent
Cost per Vehicle Kilometer (excluding occupants time charges)		
Cars & Taxis	2.4 cents	1.6 cents
Buses	1.5 cents	0.8 cents

6. Sensitivity to Variations in Basic Assumptions

a. Draft Final Report

The Consultant ran a test of sensitivity of study findings encompassing several variations to the project input. Such variations were based upon the assumption that present loading practices will continue resulting in a reduction in truck traffic and an increase in pavement construction costs. In addition, sensitivity results were run including and excluding road right-of-way costs.

1) Present Loading Practice

The results of the analyses for the entire project reflecting existing loading practices are presented as Appendix C-Tables 141-146 in the format described in Section 5.c. of this chapter. A summary for individual segments is presented in Table C-47.

The internal rate of return for the project reflecting present loading practices is 23.5 percent whereas the internal rate for the project with legal load limits enforced is 27.5 percent. The project is, therefore, moderately sensitive to the assumption regarding load limits, and continuing the present loading practices will not result in a reversal of the conclusions regarding project feasibility.

TABLE C-47
SUMMARY OF RESULTS OF ANALYSIS BY SECTION
SENSITIVITY TO LOADING PRACTICE
EXISTING LOADING PRACTICE

	Rate of Return		Benefit Cost Ratios				
	Overall	1st Year	10%	15%	20%	25%	30%
Tartous-Lattakia	23.5	15.7	3.8	2.1	1.3	0.9	0.7
Tartous Bypass	28.2	19.7	5.2	2.9	1.8	1.2	0.9
Tartous-Banyas	21.2	13.3	3.2	1.8	1.1	0.8	0.6
Banyas Bypass	19.6	11.1	2.8	1.5	1.0	0.7	0.5
Banyas-Jebleh	25.2	19.0	4.3	2.4	1.5	1.0	0.7
Jebleh-Lattakia	25.3	18.0	4.5	2.5	1.5	1.0	0.7

2) Excluding Road Right-of-Way Costs

There are some grounds for the assumption that right-of-way appreciates in value, and that right-of-way costs should not be taken as an economic cost. The project has therefore been tested for sensitivity to the exclusion of right-of-way costs from the economic analysis. For the legal loading situation, the internal rate of return is 30.8 percent while for the present loading situation the internal rate of return is 26.2 percent. The project feasibility, therefore, is only moderately sensitive to road right-of-way costs. The completed analysis for the entire route and individual sections are contained in Table C-48.

TABLE C-48
SUMMARY OF RESULTS OF ANALYSIS
EXCLUDING RIGHT OF WAY COSTS

	Rate of Return		Benefit Cost Ratios				
	Overall	1st Year	10%	15%	20%	25%	30%
Legal Loadings							
Tartous-Lattakia	30.8	24.9	6.0	3.4	2.1	1.4	1.0
Tartous Bypass	38.1	32.8	8.5	4.8	3.1	2.1	1.5
Tartous-Banyas	27.0	19.5	4.9	2.7	1.7	1.1	0.8
Banyas Bypass	25.8	17.8	4.3	2.4	1.5	1.1	0.8
Banyas-Jebleh	35.0	33.2	7.4	4.1	2.6	1.8	1.3
Jebleh-Lattakia	32.6	28.1	6.9	3.8	2.4	1.6	1.2
Present Loadings							
Tartous-Lattakia	26.2	18.8	4.5	2.5	1.6	1.1	0.8
Tartous Bypass	31.1	23.1	6.1	3.4	2.2	1.5	1.1
Tartous-Banyas	23.7	15.9	3.7	2.1	1.3	0.9	0.7
Banyas Bypass	21.6	12.9	3.2	1.8	1.1	0.8	0.6
Banyas-Jebleh	28.5	23.2	5.2	2.9	1.8	1.3	0.9
Jebleh-Lattakia	28.3	21.9	5.4	3.0	1.8	1.3	0.9

3) Summary of Results

The total range of sensitivity conditions tested comprise a 25 x 25 matrix reflecting a range of sensitivities of ±20 percent, ±10 percent, and no change to the two major items of Construction Cost and Vehicle Operating Costs. These variations were prepared for the situations reflecting legal loading enforcement, present loading practices, and inclusion and exclusion of right-of-way costs. Summaries of results are presented as Tables C-49 through C-52, as follows:

Table C-49: Present Loadings, Including Road Right-of-Way

Table C-50: Legal Loadings, Including Road Right-of-Way

Table C-51: Present Loadings, Excluding Road Right-of-Way

Table C-52: Legal Loadings, Excluding Road Right-of-Way

The Consultant concluded that the project feasibility is not sufficiently sensitive to any of the variables tested to warrant concern that the project might be subject to reversal with a reasonable alteration in project variables. It is interesting to note that in the least favorable of all sensitivity combinations considered, that of the Banyas Bypass with present loading practice and construction costs increased 20 percent and user savings reduced 20 percent, the internal rate of return exceeds 15 percent which is frequently considered to be the minimum attractive rate of return for projects of this type.

b. Additional Results

Subsequent to discussions with personnel from USAID/Washington, additional sensitivity results were prepared. These results were to reflect similar basic situations; Legal loadings, Present loadings, and with and without road right-of-way costs; however, the sensitivities were to:

- exclude occupants time for passenger cars and buses
- exclude time depreciation for all vehicles
- construction costs to reflect additional sensitivity to +30%
- vehicle operating costs to reflect additional sensitivity to -30%.

Results were prepared for the entire route only and a summary of findings showing the overall rate of return, first year rate of return, and a range of benefit cost ratios are presented in Table C-53.

TABLE C-49

SENSITIVITY OF
INTERNAL RATE OF RETURN

Present Loads Including Right-of-Way		PERCENT CHANGE IN CONSTRUCTION COST				
		-20	-10	0	+10	+20
A. Tartous-Lattakia						
Percent Change	-20	23.5	22.0	20.7	19.5	18.6
in	-10	25.1	23.5	22.1	20.9	19.9
Vehicle	0	26.6	24.9	23.5	22.2	21.1
Operating	+10	28.1	26.3	24.8	23.5	22.3
Costs	+20	29.5	27.6	26.0	24.6	23.4
Construction Costs (U.S.$)		$ 89,677,000	$ 99,613,000	$ 109,550,000	$ 119,486,000	$ 129,422,000
B. Tartous Bypass						
Percent Change	-20	28.3	26.5	24.9	23.6	22.5
in	-10	30.1	28.2	26.6	25.2	24.0
Vehicle	0	31.9	29.9	28.2	26.8	25.5
Operating	+10	33.6	31.5	29.7	28.2	26.9
Costs	+20	35.3	33.0	31.2	29.6	28.2
Construction Costs (U.S.$)		$ 8,912,000	$ 9,879,000	$ 10,846,000	$ 11,812,000	$ 12,779,000
C. Tartous-Banyas						
Percent Change	-20	21.2	19.8	18.6	17.5	16.6
in	-10	22.7	21.2	19.9	18.8	17.9
Vehicle	0	24.1	22.6	21.2	20.0	19.0
Operating	+10	25.5	23.8	22.4	21.2	20.1
Costs	+20	26.8	25.0	23.6	22.3	21.2
Construction Costs (U.S.$)		$ 32,409,000	$ 35,988,000	$ 39,568,000	$ 43,147,000	$ 46,726,000
D. Banyas Bypass						
Percent Change	-20	19.6	18.3	17.1	16.1	15.3
in	-10	21.0	19.6	18.4	17.3	16.4
Vehicle	0	22.4	20.9	19.6	18.5	17.5
Operating	+10	23.6	22.1	20.7	19.6	18.6
Costs	+20	24.9	23.2	21.8	20.6	19.6
Construction Costs (U.S.$)		$ 12,414,000	$ 13,819,000	$ 15,225,000	$ 16,630,000	$ 18,035,000
E. Banyas-Jebleh						
Percent Change	-20	25.3	23.6	22.2	21.0	20.0
in	-10	27.0	25.3	23.8	22.5	21.4
Vehicle	0	28.7	26.8	25.2	23.9	22.7
Operating	+10	30.2	28.3	26.6	25.2	24.0
Costs	+20	31.7	29.7	28.0	26.5	25.2
Construction Costs (U.S.$)		$ 17,605,000	$ 18,850,000	$ 20,096,000	$ 22,541,000	$ 24,386,000
F. Jebleh-Lattakia						
Percent Change	-20	25.3	23.7	22.4	21.2	20.2
in	-10	27.0	25.3	23.9	22.6	21.6
Vehicle	0	28.6	26.8	25.3	24.0	22.9
Operating	+10	30.1	28.2	26.6	25.3	24.1
Costs	+20	31.6	29.6	27.9	26.5	25.3
Construction Costs (U.S.$)		$ 19,562,000	$ 21,702,000	$ 23,842,000	$ 25,981,000	$ 28,121,000

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TABLE C-50

SENSITIVITY OF
INTERNAL RATE OF RETURN

Legal Loadings Including Right-of-Way		PERCENT CHANGE IN CONSTRUCTION COST				
		-20	-10	0	+10	+20
A. Tartous-Lartakia						
Percent Change	-20	27.5	25.7	24.2	23.0	21.8
in	-10	29.4	27.5	25.9	24.6	23.4
Vehicle	0	31.2	29.2	27.5	26.1	24.8
Operating	+10	32.9	30.8	29.0	27.5	26.2
Costs	+20	34.5	32.3	30.5	28.9	27.5
Construction Costs (U.S.$)		$ 83,685,000	$ 93,229,000	$ 102,774,000	$ 112,318,000	$ 121,862,000
B. Tartous Bypass						
Percent Change	-20	34.3	32.1	30.3	28.7	27.3
in	-10	36.6	34.3	32.3	30.7	29.2
Vehicle	0	38.8	36.4	34.3	32.5	31.0
Operating	+10	40.9	38.3	36.1	34.3	32.7
Costs	+20	42.9	40.2	37.9	36.0	34.3
Construction Costs (U.S.$)		$ 8,095,000	$ 9,018,000	$ 9,941,000	$ 10,864,000	$ 11,787,000
C. Tartous-Banyas						
Percent Change	-20	24.1	22.6	21.2	20.1	19.1
in	-10	25.8	24.1	22.7	21.5	20.4
Vehicle	0	27.4	25.6	24.1	22.9	21.7
Operating	+10	28.9	27.1	25.5	24.1	23.0
Costs	+20	30.4	28.4	26.8	25.4	24.1
Construction Costs (U.S.$)		$ 30,015,000	$ 33,490,000	$ 36,966,000	$ 40,441,000	$ 43,917,000
D. Banyas-Bypass						
Percent Change	-20	23.4	21.8	20.5	19.4	18.4
in	-10	25.1	23.4	22.0	20.8	19.7
Vehicle	0	26.6	24.9	23.4	22.1	21.0
Operating	+10	28.1	26.3	24.7	23.4	22.3
Costs	+20	29.6	27.6	26.0	24.6	23.4
Construction Costs (U.S.$)		$ 11,812,000	$ 13,168,000	$ 14,525,000	$ 15,881,000	$ 17,237,000
E. Banyas-Jebleh						
Percent Change	-20	30.8	28.8	27.1	25.6	24.4
in	-10	32.9	30.7	29.0	27.4	26.1
Vehicle	0	34.9	32.6	30.7	29.1	27.7
Operating	+10	36.8	34.4	32.4	30.8	29.3
Costs	+20	38.6	36.2	34.1	32.3	30.7
Construction Costs (U.S.$)		$ 15,689,000	$ 17,446,000	$ 19,203,000	$ 20,960,000	$ 22,717,000
F. Jebleh-Lattakia						
Percent Change	-20	29.0	27.2	25.7	24.4	23.2
in	-10	30.9	29.0	27.4	26.0	24.9
Vehicle	0	32.8	30.7	29.0	27.5	26.3
Operating	+10	34.5	32.3	30.5	29.0	27.7
Costs	+20	36.1	33.9	32.0	30.4	29.0
Construction Costs (U.S.$)		$ 18,142,000	$ 20,183,000	$ 22,224,000	$ 24,264,000	$ 26,305,000

TABLE C-51

SENSITIVITY OF
INTERNAL RATE OF RETURN

Present Loadings Excluding Road Right-of-Way		PERCENT CHANGE IN CONSTRUCTION COST -20	-10	0	+10	+20
A. Tartous-Lattakia						
Percent Change	-20	26.2	24.5	23.1	21.8	20.8
in	-10	28.0	26.2	24.7	23.4	22.2
Vehicle	0	29.7	27.8	26.2	24.8	23.6
Operating	+10	31.4	29.3	27.6	26.2	24.9
Costs	+20	32.9	30.8	29.0	27.5	26.2
Construction Costs (U.S.$)		$ 76,633,000	$ 84,939,000	$ 93,246,000	$ 101,552,000	$ 109,858,000
B. Tartous Bypass						
Percent Change	-20	31.2	29.2	27.5	26.1	24.8
in	-10	33.3	31.2	29.4	27.9	26.5
Vehicle	0	35.2	33.0	31.1	29.5	28.1
Operating	+10	37.1	34.8	32.8	31.1	29.7
Costs	+20	38.9	36.5	34.4	32.7	31.1
Construction Costs (U.S.$)		$ 7,749,000	$ 8,570,000	$ 9,392,000	$ 10,213,000	$ 11,034,000
C. Tartous-Banyas						
Percent Change	-20	23.7	22.2	20.8	19.7	18.7
in	-10	25.4	23.7	22.3	21.1	20.0
Vehicle	0	27.0	25.2	23.7	22.4	21.3
Operating	+10	28.5	26.6	25.0	23.7	22.5
Costs	+20	29.9	27.9	26.3	24.9	23.7
Construction Costs (U.S.$)		$ 27,752,000	$ 30,749,000	$ 33,747,000	$ 36,744,000	$ 39,741,000
D. Banyas Bypass						
Percent Change	-20	21.6	20.1	18.9	17.8	16.9
in	-10	23.1	21.6	20.3	19.1	18.1
Vehicle	0	24.6	22.9	21.6	20.4	19.3
Operating	+10	26.0	24.3	22.8	21.6	20.5
Costs	+20	27.3	25.5	24.0	22.7	21.6
Construction Costs (U.S.$)		$ 10,840,000	$ 12,049,000	$ 13,258,000	$ 14,466,000	$ 15,675,000
E. Banyas-Jebleh						
Percent Change	-20	28.6	26.7	25.2	23.8	22.6
in	-10	30.6	28.6	26.9	25.5	24.2
Vehicle	0	32.4	30.3	28.5	27.0	25.7
Operating	+10	34.2	32.0	30.1	28.5	27.1
Costs	+20	35.9	33.6	31.6	30.0	28.5
Construction Costs (U.S.$)		$ 14,331,000	$ 15,842,000	$ 17,353,000	$ 18,863,000	$ 20,374,000
F. Jebleh-Lattakia						
Percent Change	-20	28.4	26.6	25.1	23.8	22.6
in	-10	30.3	28.4	26.8	25.4	24.2
Vehicle	0	32.1	30.1	28.3	26.9	25.6
Operating	+10	33.9	31.7	29.9	28.4	27.0
Costs	+20	35.5	33.2	31.3	29.7	28.3
Construction Costs (U.S.$)		$ 16,589,000	$ 18,357,000	$ 20,125,000	$ 21,892,000	$ 23,660,000

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TABLE C-52

SENSITIVITY OF
INTERNAL RATE OF RETURN

Legal Loadings Excluding Road Right-of-Way		PERCENT CHANGE IN CONSTRUCTION COST -20	-10	0	+10	+20
A. Tartous-Lattakia						
Percent Change	-20	30.8	28.9	27.2	25.7	24.5
in	-10	33.0	30.9	29.1	27.5	26.2
Vehicle	0	35.0	32.7	30.8	29.2	27.8
Operating	+10	36.9	34.5	32.6	30.8	29.4
Costs	+20	38.7	36.2	34.1	32.4	30.8
Construction Costs (U.S.$)		$ 70,642,000	$ 78,556,000	$ 86,470,000	$ 94,383,000	$ 102,297,000
B Tartous Bypass						
Percent Change	-20	38.1	35.7	33.6	31.9	30.4
in	-10	40.7	38.1	35.9	34.1	32.4
Vehicle	0	43.1	40.4	38.1	36.1	34.4
Operating	+10	45.4	42.5	40.1	38.1	36.3
Costs	+20	47.6	44.6	42.1	39.9	38.1
Construction Costs (U.S.$)		$ 6,931,000	$ 7,709,000	$ 8,487,000	$ 9,264,000	$ 10,042,000
C. Tartous-Banyas						
Percent Change	-20	27.0	25.3	23.8	22.5	21.4
in	-10	28.9	27.0	25.4	24.1	22.9
Vehicle	0	30.7	28.7	27.0	25.6	24.3
Operating	+10	32.4	30.3	28.5	27.0	25.7
Costs	+20	34.0	31.8	30.0	28.4	27.0
Construction Costs (U.S.$)		$ 25,358,000	$ 28,251,000	$ 31,145,000	$ 34,038,000	$ 36,931,000
D. Banyas Bypass						
Percent Change	-20	25.8	24.1	22.6	21.4	20.3
in	-10	27.6	25.9	24.3	23.0	21.8
Vehicle	0	29.4	27.4	25.8	24.4	23.2
Operating	+10	31.0	29.0	27.3	25.9	24.6
Costs	+20	32.6	30.5	28.7	27.2	25.8
Construction Costs (U.S.$)		$ 10,237,000	$ 11,397,000	$ 12,557,000	$ 13,716,000	$ 14,876,000
E. Banyas-Jebleh						
Percent Change	-20	35.1	32.8	30.9	29.2	27.8
in	-10	37.5	35.0	33.0	31.2	29.8
Vehicle	0	39.8	37.2	35.0	33.2	31.6
Operating	+10	42.0	39.2	37.0	35.0	33.3
Costs	+20	44.1	41.2	38.8	36.8	35.0
Construction Costs (U.S.$)		$ 13,015,000	$ 14,438,000	$ 15,861,000	$ 17,283,000	$ 18,706,00
F. Jebleh-Lattakia						
Percent Change	-20	32.7	30.6	28.9	27.4	26.2
in	-10	34.8	32.7	30.8	29.3	27.9
Vehicle	0	36.9	34.6	32.6	31.0	29.6
Operating	+10	38.8	36.4	34.4	32.6	31.1
Costs	+20	40.7	38.2	36.0	34.2	32.6
Construction Costs (U.S.$)		$ 15,167,000	$ 16,836,000	$ 18,506,000	$ 20,175,000	$ 21,844,000

TABLE C- 53
SUMMARY OF FINDINGS
SENSITIVITY RESULTS
TARTOUS- LATTAKIA

	Internal Rate of Return	First Year R-O-R	Benefit Cost Ratio 10%	15%	20%	25%	30%
Excluding Occupants Time for Car & Bus							
With R-O-W Present Loading	21.2	14.1	3.1	1.7	1.1	0.8	0.6
With R-O-W Legal Loading	25.7	19.2	4.3	2.4	1.5	1.0	0.8
W/O Road R-O-W Present Loading	23.7	16.9	3.7	2.1	1.3	0.9	0.7
W/O Road R-O-W Legal Loading	28.9	23.1	5.2	2.9	1.9	1.3	0.9
Excluding Time Depreciation							
With R-O-W Present Loading	22.0	14.4	3.4	1.9	1.2	0.8	0.6
With R-O-W Legal Loading	25.8	18.8	4.4	2.5	1.5	1.1	0.8
W/O Road R-O-W Present Loading	24.6	17.2	4.0	2.2	1.4	1.0	0.7
W/O Road R-O-W Legal Loading	28.9	22.7	5.3	3.0	1.9	1.3	0.9

LYON

1) Excluding Occupants Time for Passenger Cars and Buses

Because the masses of people who ride the passenger cars, taxis, and buses have relatively low income, it was decided that they did not materially derive benefits from the proposed new road and, therefore, these occupant time savings were excluded from the analysis. Truck drivers were considered more critically since their wages and earnings were definitely tied to the speed at which their trucks moved along the highway and, therefore, were included in the analysis. The results of this analysis are contained in Table C-53.

2) Excluding Time Depreciation

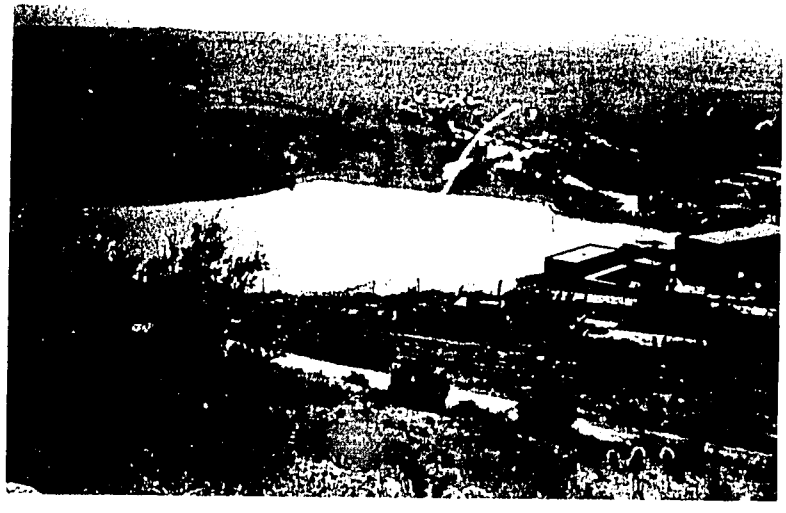
It was decided that time depreciation does not necessarily represent a cost to the project inasmuch as the vehicle is not on the study road during the time considered for this item. Therefore, it's inclusion was of question for the project. The results of this analysis are contained in Table C-54.

TABLE C- 54
SENSITIVITY RESULTS
EXCLUDING OCCUPANTS TIME FOR SEDANS & BUSES

Percent Change in Vehicle Operating Costs	Percent Change in Construction Cost					
	-20	-10	0	+10	+20	+30
With R-O-W Costs Present Loadings						
-30	19.6	18.2	17.1	16.1	15.2	14.5
-20	21.2	19.8	18.5	17.5	16.6	15.7
-10	22.7	21.2	19.9	18.8	17.8	16.9
0	24.2	22.6	21.2	20.0	19.0	18.1
+10	25.6	23.8	22.4	21.2	20.1	19.1
+20	26.9	25.1	23.6	22.3	21.2	20.2
Construction Costs (000 U.S.$)	89,677	99,613	109,550	119,486	129,422	139,359
With R-O-W Costs Legal Loadings						
-30	23.8	22.2	20.8	19.7	18.7	17.8
-20	25.7	24.0	22.6	21.3	20.2	19.3
-10	27.5	25.7	24.2	22.9	21.7	20.7
0	29.3	27.3	25.7	24.3	23.1	22.1
+10	30.9	28.9	27.2	25.7	24.4	23.2
+20	32.5	30.4	28.6	27.0	25.7	24.5
Construction Costs (000 U.S.$)	83,685	93,229	102,774	112,318	121,862	131,406
W/O Road R-O-W Present Loadings						
-30	22.0	20.5	19.2	18.1	17.2	16.3
-20	23.8	22.2	20.8	19.6	18.6	17.7
-10	25.5	23.8	22.3	21.1	20.0	19.0
0	27.1	25.3	23.7	22.4	21.3	20.3
+10	28.6	26.7	25.1	23.7	22.5	21.5
+20	30.1	28.1	26.4	25.0	23.7	22.6
Construction Costs (000 U.S.$)	76,633	84,939	93,246	101,552	109,858	118,164
W/O Road R-O-W Legal Loadings						
-30	26.8	25.0	23.5	22.2	21.1	20.1
-20	28.9	27.0	25.4	24.0	22.8	21.7
-10	31.0	28.9	27.2	25.7	24.4	23.3
0	32.9	30.7	28.9	27.4	26.0	24.8
+10	34.7	32.5	30.5	28.9	27.5	26.2
+20	36.5	34.1	32.1	30.4	28.9	27.6
Construction Costs (000 U.S.$)	70,642	78,556	86,470	94,383	102,297	110,211

TABLE C-55
SENSITIVITY RESULTS
EXCLUDING TIME DEPRECIATION

Percent Change in Vehicle Operating Costs	Percent Change in Construction Cost -20	-10	0	+10	+20	+30
With R-O-W Costs Present Loadings						
-30	20.4	19.0	17.9	16.9	16.0	15.2
-20	22.0	20.6	19.3	18.3	17.3	16.5
-10	23.6	22.0	20.7	19.6	18.6	17.7
0	25.0	23.4	22.0	20.8	19.8	18.9
+10	26.4	24.7	23.2	22.0	20.9	19.9
+20	27.7	25.9	24.4	23.1	22.0	21.0
Construction Costs (000 U.S.$)	89,677	99,613	109,550	119,486	129,422	139,359
With R-O-W Costs Legal Loadings						
-30	23.9	22.3	21.0	19.8	18.8	17.9
-20	25.8	24.1	22.7	21.4	20.4	19.4
-10	27.6	25.8	24.3	23.0	21.8	20.8
0	29.2	27.4	25.8	24.4	23.2	22.1
+10	30.9	28.9	27.2	25.8	24.5	23.4
+20	32.4	30.3	28.6	27.1	25.8	24.6
Construction Costs (000 U.S.$)	83,685	93,229	102,774	112,318	121,862	131,406
W/O Road R-O-W Present Loadings						
-30	22.8	21.3	20.0	18.9	17.9	17.1
-20	24.6	23.0	21.6	20.4	19.4	18.5
-10	26.3	24.6	23.1	21.9	20.8	19.8
0	28.0	26.1	24.6	23.3	22.1	21.1
+10	29.5	27.6	26.0	24.6	23.4	22.3
+20	31.0	29.0	27.3	25.8	24.6	23.4
Construction Costs (000 U.S.$)	76,633	84,939	93,246	101,552	109,858	118,164
W/O Road R-O-W Legal Loadings						
-30	26.8	25.0	23.6	22.3	21.2	20.2
-20	28.9	27.0	25.4	24.1	22.9	21.8
-10	30.9	28.9	27.2	25.8	24.5	23.4
0	32.8	30.7	28.9	27.4	26.0	24.9
+10	34.6	32.4	30.5	28.9	27.5	26.3
+20	36.4	34.0	32.1	30.4	28.9	27.6
Construction Costs (000 U.S.$)	70,642	78,556	86,470	94,383	102,297	110,211



Technical Planning

PART D

LYON

1. DESCRIPTION OF THE TERRAIN AND HIGHWAY NETWORK

The study corridor for this project is approximately eighty-five kilometers long, oriented in a North-South direction, and is located on the coastal plain of Syria between the port cities of Tartous and Lattakia.

The coastal plain varies from one to fifteen kilometers in width in the study corridor and is bounded on the east by the lower foothills of Al Nusayriyah Mountains. The foothills, which are as much as two hundred meters above sea level, are severely folded having steep slopes followed by the gently rolling to flat terrain of the coastal plain. The coastal plain varies in elevation from approximately twenty to five meters above sea level before reaching the coastline of the Mediterranean Sea. Seven major rivers plus hundreds of small streams, drainage courses and irrigation channels dissect the coastal plain. Generally the major rivers and streams flow East from the mountains and foothills to the sea in the West.

The two principal urban areas between the termini of Tartous and Lattakia are the city of Banyas and the town of Jebleh. There are numerous small villages and farms other than these two urban areas. Most of the remaining land is cultivated. Two major industrial sites along the route corridor are a cement factory North of Tartous and an oil refinery North of Banyas. Major existing utility right-of-way corridors within the study area provide for the transmission of petroleum between Tartous, Banyas and Lattakia, and water from Banyas to Lattakia. There are also numerous electrical transmission lines.

The existing two-lane north-south roadway is the only through route between Tartous and Lattakia. It is narrow with either no shoulders or with only narrow gravel shoulders. It carries heavy volumes of truck traffic as well as a diversity of other modes, including pedestrians, animal drawn carts, bicycles, tractors, and an increasing number of conventional automobiles. The surface condition is from fair to poor and passing is hazardous. The facility in general is inadequate for the present traffic volumes because of poor alignment, limited sight distance and cross traffic. Bridges are narrow, often restricted to one-way traffic when used by large trucks. There are many minor roads connecting to the existing north-south roadway. These minor roads are primarily gravel or bituminous stabilized surfaces that serve villages off the main roadway or tourist attractions. Only two of these minor roads provide access out of the study corridor. They are east-west oriented with one originating

north of Tartous and the other at Banyas. Both cross Al Nusayriyah Mountains and provide separate corridors to Masyaf where they join and continue toward Hama.

2. GEOMETRIC CRITERIA

The traffic volumes projected in Part C Transport Analysis indicate that within the period of analysis a four-lane facility with limited access will be required. This facility will hereinafter be referred to as an "expressway".

The selection of the vehicle speed is one of the most important factors governing the design of the expressway. The economic value of the expressway can be directly related to the speed and safety of transporting people and goods. Four factors which relate to the speed that a vehicle operator will select are:

1. Physical Characteristics of the Roadway
2. Weather
3. Influence of Other Vehicles
4. Speed Limitations

While all of the above factors are interrelated, the physical characteristics of the roadway will have the greatest influence on speed (other factors being equal). Examples of these physical characteristics are such items as lane width, grade, curvature, stopping sight distances and lateral clearances. Selection of values for all of these parameters is dependent on design speed. The design speeds selected for the expressway should be most liberal to afford the greatest ease of driver operation and safety. Construction costs, however, restrict the selection of high design speeds for the expressway. Terrain becomes an important consideration and the selected design speed must be optimized by evaluating construction costs versus savings in vehicle operating costs. The interrelationship of these factors has been the subject of study by many highway construction agencies for a number of years, and certain generally accepted conclusions have evolved. For the purposes of this report the recommendations of AASHTO have been considered in conjunction with the standards currently in use by the Ministry of Communications to arrive at recommendations for design speed in relationship to terrain encountered by the route. Terrain has been categorized into level, rolling, and mountainous, and the design speeds

have been specified according to the terrain. Design speeds recommended are as follows: 120 KM/HR for level terrain and 100 KM/HR for rolling terrain. The proposed expressway does not traverse mountainous terrain.

The stopping sight distance used for the expressway is based on the design speed and employs methods as prescribed by AASHTO with driver's eye approximately 1.15 meters above the pavement and the height of the object (obstacle) 15 centimeters. Appropriate allowance for stopping sight distance must be made for significant grade changes.

The horizontal alignment selected for the expressway will provide for safe, continuous operation at a uniform design speed and minimums will be avoided where practicable. Minimum radii will be used only when the cost of realizing a higher standard is disproportionate to benefits. Transition spirals are recommended for all horizontal curves.

Gradients are generally controlled by terrain, highway classification, horizontal alignment, safety, construction costs, drainage and aesthetics. In level terrain the gradients are primarily controlled by drainage considerations. A 0.5 percent minimum gradient was selected as necessary to provide drainage for a median ditch. In rolling terrain, undulation in gradient is advantageous from the standpoint of truck operations and construction economy. AASHTO recommends that grades in rolling terrain not exceed a maximum of four to five percent depending on the type of expressway.

Preliminary design criteria selected for ramps, frontage roads, and crossroads are shown in Figure D-1.

The expressway will have two basic typical sections as shown in Volume II Part A of this report. The first and most common section will have very few restrictions on the median width. The median width may vary to accommodate wide planting strips or benching and separation of roadways serving opposite directions of travel. The second type envisioned is a much tighter section, with a narrow median. This section will be employed where right-of-way is restricted by physical or cultural features such as pipelines, railroads, historic sites, and urban development. The restricted width may also be employed to reduce construction costs in areas of deep cut or high embankment and at bridge approaches where the bridge structure includes a median.

A lane width of 3.5 meters has been selected for the preliminary design of the expressway. Three and one half meters has generally been used in the past for design of expressways in Syria. This width approaches the width recommended

by AASHTO. The high percentage of truck traffic influences the requirement for wide lanes. The extra cost of the wide lanes will be offset to some extent by a reduction in the cost of shoulder maintenance and a reduction in surface maintenance due to lessened wheel concentrations at the edges of pavements. A cross slope of 2 percent has been selected for the traffic lanes. This will provide positive drainage toward the shoulder and eliminate any "birdbath ponding" which might otherwise result from inadequate construction control.

Figure D-1

RECOMMENDED DESIGN CRITERIA

DESCRIPTION	EXPRESSWAY	EXPRESSWAY RIGHT-OF-WAY RESTRICTED	RAMPS	FRONTAGE ROADS AND CROSSROADS
DESIGN SPEED MINIMUM (KM/H)				
Level Terrain	120	100	60	80
Rolling Terrain	100	80	60	60
STOPPING SIGHT DISTANCE (M)				
120 KM/H	200	200	-	-
100 KM/H	150	150	-	150
80 KM/H	110	110	-	110
60 KM/H	-	-	80	80
PASSING SIGHT DISTANCE (M)				
100 KM/H	-	-	-	700
80 KM/H	-	-	-	550
60 KM/H	-	-	-	425
MINIMUM RADIUS OF CURVATURE (M)				
120 KM/H	675	675	-	-
100 KM/H	420	420	-	420
80 KM/H	230	230	-	230
60 KM/H	-	-	145	145
MAXIMUM SUPERELEVATION (%)				
120 KM/H	6	6	-	-
100 KM/H	6	6	-	6
80 KM/H	8	8	-	8
60 KM/H	-	-	8	8
TRANSITION CURVES	YES	YES	NO	NO
MINIMUM GRADE	0.5%	0.5%	0.5%	0.5%
MAXIMUM GRADE				
LEVEL TERRAIN	3%	3%	7%	3%
ROLLING TERRAIN	4%	5%	7%	5%

Shoulder widths of three meters and one meter have been selected for the right-of-way side and median side of the expressway respectively. The one meter median shoulder is primarily to help the vehicle operator correct any driving errors without losing control if he inadvertently steers off the traffic lane. The shoulder on the right-of-way side is wide enough to accommodate a disabled truck. Cross slopes of both shoulders are set at 4 percent to provide positive drainage away from the roadway.

Ditches will be required in wide medians, along both sides of the roadway and as interceptors on the tops of cuts. Interceptor ditches and steep roadside ditches will require paving.

Embankment (fill) slopes have been set at a maximum of 2:1 for ease of maintenance and to reduce erosion. Construction of the expressway will require excavation of materials (cuts) that will include consolidated soils, unconsolidated soils, weathered rock and sound rock. The following safe side slopes are recommended as a guide for design:

MATERIAL	CUT SLOPES
Soil, (Unconsolidated and Consolidated)	2:1
Weathered Rock	1:1
Sound Rock	½:1

The recommended safe slopes are to avoid large slides. In limestone the problem of individual rocks separating from the face of the slope exist. In these areas, that are difficult to delineate, it would be more advantageous to have steeper slopes with a debris area at the toe-of-slope. Slopes of ½:1 or flatter tend to promote rock bounce and roll thereby presenting greater danger to traffic. Deep cuts must include benching as a means of increasing overall stability. The interval of benching depends upon the overall competence of the rock. A recommended design guide would be to bench the slopes every 10 meters maximum. Subdrains will be required in all cuts where subsurface water is encountered or anticipated.

The median width shall be 12.0 meters from edge of shoulder to edge of shoulder where there are no right-of-way restrictions. The 12 meter median width is advantageous for future expansion of the expressway. Median slopes in this area shall be 6:1. The transition from the section with a wide median to the section of narrow medians shall be accomplished by a 50:1 minimum taper

on tangent sections and by transition spiral on curves. Medians for expressway with right-of-way restrictions are set at 3.0 meters from the edge of the shoulder to the edge of the shoulder. The narrow median may be surfaced and have guard rail or precast concrete median barriers to prevent vehicles from entering opposing traffic lanes.

Other features required for the expressway include:

1. Lighting at interchanges in urban areas.
2. Turn outs and rest areas at scenic points along the route.
3. Fencing to preclude stray or herded animals or people from crossing the traffic lanes.

Minimum right-of-way required for the expressway will be 60 meters and 40 meters for the unrestricted and restricted sections respectively.

The recommended cross-section elements for expressways, ramps, frontage roads, and crossroads are summarized in Figure D-2.

Figure D-2

CROSS-SECTION ELEMENTS

DESCRIPTION	EXPRESSWAY	EXPRESSWAY RIGHT-OF-WAY RESTRICTED	RAMPS	FRONTAGE ROADS AND CROSSROADS
Cross Slope of Roadway	2%	2%	2%	2%
Lane Widths (M)	3.50	3.50	4.20	3.50
Shoulder Cross Slope	4%	4%	4%	4%
Shoulder Width, R/W Side (M)	3.00	3.00	1.00	3.00
Shoulder Width, Median Side (M)	1.00	1.00	-	-
Side Ditch Slopes	2:1	2:1	2:1	2:1
Median Ditch Slopes	6:1	6:1	6:1	6:1
Median Width (M)	12.00	5.00	-	-
Guard Railing or Barriers				
Median	NO	YES	-	-
Fill Slopes Greater than 3M	YES	YES	YES	YES
Lighting	NO	YES	YES	NO
Fencing	YES	YES	YES	YES
Right-of-Way (M)	60	VARIES	-	VARIES

3. GEOLOGY

a. Geomorphology

The alignment lies almost entirely within the Marine Aggradation Plain and the low foothills of the north-south trending Al Nusseiryeh ridge to the east. The surface of the Marine Aggradation Plain is slightly dissected by streams and flood plains. The greater part of the plain is made up of Lower and Middle Quaternary terraces which to the east are covered by a thin proluvial layer.

The Marine Plain is much wider between Banyas and Lattakia than it is to the south. Three terrace elevations are discernible above the present stream flood plain elevations. The upper terrace extends as much as 6 kilometers east from the coast. The terraces south of Banyas are evident for only about 12 kilometers midway between Tartous and Banyas. These are narrow and poorly developed.

Al Nusseiryeh and the Az Zawiyeh are two related horst-anticlines separated by a graben. The graben is bounded on the west by the Lebanon-Syrian fault which is the northern extension of the West-Arabian fault that passes through the Gulf of Aqaba and the Dead Sea.

Al Nusseiryeh horst-anticline is sharply asymmetrical. The eastern limb is steep, being bounded by faults. The western limb slopes gently toward the coast at 5° to 10° and is somewhat complicated by local flexures near the coast.

b. Stratigraphy

The rocks exposed along the alignment include Cretaceous dolomites, limestones and clays; volcanic tuff-breccias of Neogene age; and Quaternary Proluvial, alluvial, and marine deposits. North of Banyas the alignment lies almost entirely in the Quaternary deposits. The rock types are shown on the Soils and Materials Plan, Plates 1 & 2, Appendix D.

1) Cretaceous - Cenomian - Turonian undifferentiated. These dolomites, limestone and clays which are exposed on the western flank of Al Nusseiryeh range, are massive but intercalated with chalky limestones and marls. Four units have been established. The basal unit is composed of thick-bedded dolomites and limestones 30 to 50 m thick. This is overlain by a marker unit of marls and chalky limestone about 25 m thick. The marls are overlain by a characteristic cliff-forming member of massive limestone and dolomite which is 35 to 45 m thick. This is capped by thin-bedded clayey limestone and marls which contain lenses of

flint and silicified limestone. These rocks are exposed along or within short distances of the alignment between Tartous and Abu Raiya.

2) Middle Eocene limestones. In the coastal area these rocks vary from soft and chalky to hard and silicified. These beds contain nummulites and thin intercalations of grey and brown flint. These are exposed just north of Abu Raiya, north of Banyas and just east of Lattakia.

3) Pliocene continental deposits. These are a complex grouping of conglomerates, grits, sandstones, marls, limestones, clays, marine clays and tuff-breccia. This sequence is exposed southeast of Lattakia.

Interbedded with the Pliocene continental sediments are Pliocene effusive rocks. These include both basalt and pyroclastic formations. The pyroclastic rocks are most widespread between Abu Raiya and Banyas. These rocks are dark brown to black fragments of basalt, ash and volcanic glass shards. A characteristic feature of these tuffs and volcanic breccias is the coarse oblique bedding.

4) Quaternary and Recent sediments. Proluvial sediments cover the coastal plain north of Tartous and between Banyas and Jebleh. These are pebble beds, brown loams and sandy loams mixed with unsorted debris and pebbles. These overlie marine sediments and terrace surfaces. The marine silts and clays are exposed north of Jebleh.

Recent sediments are alluvial and aeolian. The alluvial sediments include pebble beds and sandy loams of the Nahr El-Kabir river bed and flood plains. Sand dunes constitute the eolian sediments. A zone of dunes up to 1 km wide is located south of Lattakia.

c. Engineering Geology

The geomorphology and stratigraphy are generally favorable for highway construction and materials sources. The Marine Aggradation Plain forms acceptable foundation materials although some of the soils are expansive and most are fine-grained. The faulting associated with Al Nusseiryeh range to the east has no discernible affect on the alignment. The horst-anticline of Al Nusseiryeh represents the major geological structure and is reflected in the present topography of the region.

The rock types vary from excellent to poor in quality but plentiful quantities of high-quality aggregates are available from several sources, quarries and stream gravels. Some of the gravels contain chert and flint which are reactive with concrete and potentially expansive. The rock sources and soil types are described in the following section.

4. PAVEMENT DESIGN

a. Introduction

The soils and materials were evaluated in order to select suitable design parameters for pavement thicknesses and pavement component standards. The areas of study included the following:

1) A study of existing pavements to familiarize the Consultant with local construction practices and to evaluate the performance of local materials that have experienced traffic loadings similar to those expected throughout the design period of the proposed expressway.

2) The roadbed soil evaluation to determine the engineering characteristics of the subgrade soil.

3) Material evaluations to determine the engineering characteristics of materials available for use in construction of the expressway.

In the course of the investigations existing information was utilized including the following:

1) Geological Map of Syria
2) Projet d'Execution Route Lattaquie-Tartous, Societe Centrale pour l'Equipement du Territoire
3) Construction Plans of Various Bridge Structures

This information was augmented with field sampling, laboratory testing, seismic surveys and soil borings.

The combined information was analyzed and recommendations made for pavement design and pavement component standards. The recommendations are of a preliminary nature. Additional soil investigations will be required prior to final design. The nature of these design studies should include the following:

1. More accurate delineation of the subgrade soils
2. Additional laboratory testing of material sources including physical crushing of the material by mechanical means followed by compaction and CBR testing
3. Evaluation of possible stabilizing agents for subgrades and base course materials
4. Additional borings and/or seismic profiles at the locations of bridge abutments and piers.

b. Study of Existing Pavements

Five test pits were excavated within existing pavements to determine

the performance of local materials that have been subjected to vehicle loadings similar to that expected during the design period. Thickness measurements were taken of each structural layer. Samples were taken for laboratory testing. The in-situ moisture content of subgrade soils was determined, which is of particular importance. The location of the test pits are shown on the Soils and Materials Plan, Plates 1 & 2 of Appendix D. The results of the study of existing pavements are shown in Figure D-1 thru D-5. The following is a brief summary of the findings:

TLTP-1. The pavement section appears to have performed well under the imposed vehicle loadings. The pavement structure includes: 11.25 cms of asphalt concrete; 12.5 cms of what might be considered as a "Black base" and 18.75 cms of subbase. The overall pavement structure above the subgrade is 42.5 cms. The basic construction is trench type, that is the pavement components are not extended through the shoulders. The open graded subbase had an excessive amount of moisture.

TLTP-2. The pavement section appears to have performed satisfactorily under the imposed vehicle loadings. The pavement structure includes: 6.25 cms of asphalt concrete; 8.75 cms of what might be considered as a "Black base" and 22.5 cms subbase. The overall pavement structure above the subgrade is 37.5 cms. The subgrade is bedrock. The pavement section would normally be expected to perform well. Trench-type construction was used. The open subbase was saturated and no doubt responsible for the premature deformation of the pavement surface.

TLTP-3. The pavement section appears to have performed fairly well under the imposed vehicle loadings. The pavement structure includes: 8.75 cms of asphalt concrete; 11.25 cms of what might be considered as a "Black base" and 12.5 cms of subbase. The overall pavement structure above the subgrade is 32.5 cms. The subgrade is stiff to medium stiff in consistency.

TLTP-4. The pavement section appears to have performed poorly under the imposed vehicle loadings. The pavement structure includes: 12.5 cms of asphalt concrete; 15 cms of what might be considered as a "Black base" and 20 cms of subbase. The overall pavement structure above the subgrade is 47.5 cms. The subgrade is of medium stiff consistency. The basic construction is the trench type. The "Black base" is poorly graded with little bonding between particles. The layer is saturated. The subbase is very open-graded and has been intruded by the subgrade. This is no doubt responsible for the poor condition of the pavement surface.

TLTP-5. The pavement section appears to have performed well under the imposed vehicle loadings. The pavement structure includes: 12.5 cms of asphalt concrete; 12.5 cms of what might be considered as a "Black base" and 32.5 cms of subbase. The overall pavement structure above the subbase is 57.5 cms. The subgrade is of medium stiff consistency.

An analysis of soil moisture in the subgrade below existing pavements is given in Table D-1. The equilibrium moisture content is 69 to 124 percent of the plastic limit.

The conclusions of this study are as follows:

1. The base and subbase layers should not be open-graded aggregates but should be close-graded (well-graded).

2. Trench type designs should not be adopted.

3. The gradation of the lower subbase or select fill should be such so as to prevent intrusion of the subgrade.

4. Moisture contents within subgrades of existing pavements indicate that if adequate drainage is provided, excessive moisture would not accumulate in the subgrade. Excessive moisture here means in-situ moisture contents exceeding the plastic limit of the soil.

TABLE D-1

ANALYSIS OF SOIL MOISTURE IN THE SUBGRADE
BELOW EXISTING PAVEMENTS

TEST PIT NO.	AASHTO CLASSIFICATION	MOISTURE CONTENT	PLASTIC LIMIT	RATIO Wa/Lp
TLTP-1				
(1)	A-7-6	24	26	0.92
(2)	A-7-6	26	21	1.24
TLTP-2				
		NO SAMPLES TAKEN		
TLTP-3				
(1)	A-7-5	30	33	0.91
(2)	A-7-5	25	33	0.76
(3)	A-7-5	27	39	0.69
TLTP-4				
(1)	A-7-5	27	34	0.79
(2)	A-7-5			
(3)	A-7-6	26	28	0.93
TLTP-5				
(1)	A-6	16	18	0.89
(2)	A-6	18	20	0.90
(3)	A-7-5	24	33	0.73

c. Subgrade Evaluation

The roadbed soils along the proposed alignment have been evaluated by the Consultant and others. The results of these studies are shown in Figures D-8 thru D-10 and Tables D-2 and D-3. The AASHTO classifications range from A-1-a thru A-7-5. The design CBR ranges from 2 to 40. The delineation of subgrade sections are shown on the Soils/Materials Plan, Plates 1 & 2 of Appendix D. The recommended CBR values for the various subgrade sections are given in Table D-5.

TABLE D-2

SUBGRADE TESTING BY OTHERS

SAMPLE NO.	AASHTO CLASSIFICATION	CBR	% SWELL
TLSGO-1	A-7-5 (9)	3	--
TLSGO-2	A-7-5 (7)	5	--
TLSGO-3	A-2-7 (0)	5	--
TLSGO-4	A-1-b	55	--
TLSGO-5	A-1-a	67	--
TLSGO-6	A-7-5 (4)	4	6-7
TLSGO-7	A-7-5 (12)	4	5
TLSGO-8	A-7-5 (14)	5	5
TLSGO-9	A-7-5 (0)	7	4
TLSGO-10	A-2-7 (0)	14	--
TLSGO-11	A-2-4 (0)	46	--
TLSGO-12	A-3	35	--

There are subgrade soils along the proposed alignmnet that exhibit undesirable swell characteristics, in some cases, up to 10 percent. These soils will be incorporated in the pavement structure as subgrade layers. In the final design the thickness of some pavement sections required to limit the swell to an

acceptable limit (2%) may override the thickness requirement based on CBR. The CBR values selected for this study were grouped based on tests conducted on samples taken from the major subgrade soil groups. More accurate delineation of subgrade soils will be required during the Design Phase.

TABLE D-3

CBR TEST RESULTS

SECTION	STATIONS	CBR(%)
1	10 + 000 - 20 + 000	4
2	20 + 000 - 26 + 000	3
3	26 + 000 - 32 + 000	5
4	32 + 000 - 47 + 000	40
5	47 + 000 - 62 + 250	3
6	62 + 250 - 66 + 600	2
7	66 + 600 - 71 + 600	3
8	71 + 600 - 85 + 000	5
9	85 + 000 - 90 + 250	20
10	90 + 250 - END	3

d. Material Sources

Materials for aggregates, base, subbase, embankment and backfill are available from stream deposits, surface gravels and quarry rocks. These are made up mostly of limestone and basalt. Both are sound; the highest LA wear value is 24 percent. Some of the limestones include thin strata of chert, flint and mud rock. The chert and flint are reactive with concrete and potentially expansive and should not be used as aggregate. The basalt is vesicular due to trapped gases during cooling of the molten rock. The results of the field and laboratory investigation of available material sources are given in Figures D-11 thru D-18. The location of samples are shown on the Soils and Materials Plan, Plates 1 & 2 of Appendix D.

1) Stream Deposits

The alluvial materials are mostly limestone that ranges from boulders to sand-size. The limestone is mixed with chert and flint and, in some areas, mudstone. The stream deposits would require processing (crushing and grading)

prior to use as aggregates for base and subbase material. This processing would remove the mudstone; however, the chert and flint would remain. To be used as high-quality aggregates the chert and flint would have to be selectively removed. The quantities are, for all practical purposes, unlimited. An estimate would be 1-2 cubic meters of bulk rock for every square meter of river bottom. The rivers have crossed their flood plains many times, thereby increasing the quantity available.

2) Surface Rocks

Surface rocks include both limestones and basalt. The limestone outcrops and surface rocks are the remnants of weathering processes and are therefore, the most durable. These occur in sizes ranging from boulders to gravel but mostly angular cobbles to larger gravel. The surface rocks are found south of Jebleh and in the Tartous area where they are widely exposed. The areas are indicated on the Soils and Materials Plan. It would not be unreasonable to assume one cubic meter of bulk rock to each five square meters of land surface. The surface rock on the Tartous end of the project road is underlain by the parent rock that could be quarried producing the same quality of material. This would have to be proven by exploratory borings.

The basalt surface rocks are also the remnants of the weathering processes and are therefore, the most durable. These occur in sizes ranging from boulders to gravel but mostly cobble-size. The cobbles are rounded, the product of spheroidal weathering, and the gravel is highly angular due to jointing. The rounded rock usually contains vesicles due to trapped gases during cooling of the molten rock. The vesicles could be undesirable for aggregates for asphalt concrete or Portland cement concrete. The highly angular gravel is not vesicular. The surface rocks, which are found southeast of Banyas, are underlain by the parent rock. The nature and quality of the parent rock would have to be proved by exploratory borings.

3) Quarry Rock

There are several rock quarries in operation south of Banyas. These are, in all cases, limestone quarries. The rock that is being excavated at the present time in some quarries is suitable as aggregates, base, subbase, embankment and backfill material. The quality of any limestone source (other than that reported) would have to be determined by exploratory borings and associated laboratory testing. The quantity is, for all practical purposes, unlimited.

e. Pavement Design

The pavement design procedure should insure that the pavement structure will maintain an acceptable level of riding quality throughout the design period. The design procedure should also provide a structure that can be rehabilitated to extend its design life without major re-construction of the basic structural components. The flexible pavement design procedure selected is based on one developed by Lyon Associates, Inc. for the United States Agency for International Development. While the basic concepts of the design procedure were developed for tropical environments, the process of pavement design in itself is based on sound engineering principles that apply to semi-tropical and temperate regions as well.

The initial consideration of the design procedure is to insure that components of the pavement structure will not be subjected to plastic deformations to keep all component layers well within their elastic range. The consideration is stated as a minimum cover requirement based on the CBR of the underlying layer. The first component is the subgrade. The minimum cover for the subgrade sections are shown in Table D-4.

TABLE D-4

MINIMUM COVER REQUIREMENTS

SECTION	STATION	CBR	MEAN VALUE SELECTED	MINIMUM COVER BASED ON CBR	MINIMUM COVER SELECTED
1	STA 10 + 000 to 20 + 000	4		40 cm	
2	STA 20 + 000 to 26 + 000	3	4	45 cm	40 cm
3	STA 26 + 000 to 32 + 000	5		38 cm	
4	STA 32 + 000 to 47 + 000	40	40	10 cm	10 cm
5	STA 47 + 000 to 62 + 250	3		45 cm	
6	STA 62 + 250 to 66 + 600	2	3	50 cm	45 cm
7	STA 66 + 600 to 71 + 600	3		45 cm	
8	STA 71 + 600 to 85 + 000	5	5	38 cm	38 cm
9	STA 85 + 000 to 90 + 250	20	20	20 cm	20 cm
10	STA 90 + 250 to END	3	3	45 cm	45 cm

The minimum cover is a fundamental consideration based on CBR. In design, the swell potential of the subgrade or the strength requirements of the structural layers (surface, base and subbase) may override these requirements; however, in no case will the combined thickness of the structural layers be less than shown in Table D-4.

A second consideration of the design procedure is the total strength of the pavement structure required for given traffic and variations of subgrade strength and/or construction practices. The design traffic is stated as the "Sum of the equivalent 18 kip single axle loadings (AE-18K SAL) expected within the design period". The design period in the case of the expressway is 20 years. The design traffic for the various road segments are given in Table D-5 for both the legal axle load limits and the actual axle loads for both southbound and northbound traffic.

TABLE D-5

EQUIVALENT 18-KIP LOADS (x 10^6)

STATION LIMITS	LEGAL LOADS NORTH	LEGAL LOADS SOUTH	ACTUAL LOADS NORTH	ACTUAL LOADS SOUTH
10 + 000 - 17 + 300	157	250	32.6	54.1
17 + 300 - 47 + 000	65.6	112	16.9	20.6
47 + 000 - 57 + 000	68.8	116	18.9	22.5
57 + 000 - 74 + 000	73.3	122	20.7	24.4
74 + 000 - 92 + 900	87.2	147	25.6	30.6

Due to possible variations of subgrade material, a coefficient of variation of 25% has been used in this Preliminary Engineering Study to determine the required strength of the pavement structure. After thorough evaluations of the subgrade during the Design Phase, it may be acceptable to use 15%. The exception is the section between STA 32 + 000 and 47 + 000 where the subgrade material is suitable as a subbase layer.

The flexible pavement design thickness is based on the design traffic, subgrade strength, CBR values of the base and subbase materials as well as thickness requirements for the surface course.

Rigid pavement was also considered but found to be impractical. Concrete

pavements of 25 to 30 cm would be required, at least for the existing loads. This translates to over 100,000 metric tons of cement, or more than the annual production of the local industries. Preliminary cost comparisons also indicated that flexible pavements would be more economical.

Consideration of Stage Construction for Pavement

The Consultant analyzed a total of 128 pavement sections with, and without, overlays; and determined the present value of their individual costs at a discount rate of 15% so as to choose the sections with best economy. All pavements were designed for a total life of 20 years. Design conditions considered were as follows:

- Section 1
  - Northbound Lanes
    - Legal Load Limits Enforced
      - Single Stage Construction
      - 2nd stage in year 7
      - 2nd stage in year 10
      - 2nd stage in year 15
    - Present Loading Practice Continued
      - Single Stage Construction
      - 2nd stage in 7th yr.
      - 2nd stage in 10th yr.
      - 2nd stage in 15th yr.
  - Southbound Lanes
    - Legal Load Limits Enforced
      - Stages as above
    - Present Loading Practice Continued
      - Stages as above
- Sections 2 through 8, subdivisions as above.

The specific designs for the 128 sections are shown in Volume II on Plate A-54.

There is a distinction between unit cost of asphaltic concrete placed in the initial contract and unit cost of asphaltic concrete placed in overlays at a later date (requiring re-mobilization). Direct costs have been calculated for each case and are similar, however indirect costs for initial construction are 20% while indirect costs for later construction are 30%. (Inasmuch as this is an economic evaluation rather than a financial analysis the rate of inflation is not considered.) The cost estimate for overlays includes the contractor's

cost of maintaining traffic; however, the user cost differential is assumed to be negligible on the grounds that the contractor would be required to limit operations to one roadway at any given time and that traffic could move freely on a relatively short stretch of two lane roadway. The various pavement section costs, including discounted cost of overlays, are shown in Table D-6. These costs indicate that a two stage construction program with the second stage (overlay) in the 10th year is preferable for the basic design case (Legal Load Enforced). The preliminary designs contained in this report therefore assume such staging.

f. Pavement Component Standards

1) Asphalt Surface Course

The asphalt concrete surface course should be of high quality. The design mix should incorporate well graded aggregates and an asphalt content of about 6 percent. The air voids should be about 3 percent and the retained penetration about 40 percent. Low air voids and high stability are essential to restrict cracking and rutting to acceptable levels throughout the design period. An asphalt surface course of 15 cm is recommended for the subject road if constructed for existing loads and 10 cm (except for segment 1 where 15 cm is recommended) if constructed for the legal loads. The thickness requirement is based on the design traffic as well as the stability of the base course. The thicker asphalt paving surface consists of a binder course and a surface course. The minimum recommended thickness of the surface course is 10 cm. The lower binder course can incorporate larger aggregate and less bitumen than the surface course. The asphalt content can be in the order of 4-5 percent.

2) Granular Base

The pavement is expected to substain a very large number of heavy truck loadings throughout the design period. To insure that the pavement exhibits the desired performance characteristics throughout its design life the base course material must be of high quality. It should possess high internal friction and exhibit a CBR greater than 100. Previous tests (by others) have shown that limestone along the proposed alignment is capable of exhibiting CBRs in excess of 100. However, prior to use of any source of limestone, laboratory testing would be required to verify the quality of the limestone. Furthermore, additional laboratory testing of sources sited in this report as base materials is recommended prior to final design. The laboratory testing should include physical crushing of the material by mechanical means followed by compaction and CBR testing.

TABLE D-6

STAGE CONSTRUCTION PAVEMENT ANALYSIS

Cost in Dollars per 100 M^2

with Overlay Costs Discounted at a Rate of 15%

	Legal Load Limits Enforced				Present Loading Practice			
Section Number	Cost Without Overlay	Cost With Overlay at 7 yr.	Cost With Overlay at 10 yr.	Cost With Overlay at 15 yr.	Cost Without Overlay	Cost With Overlay at 7 yr.	Cost With Overlay at 10 yr.	Cost With Overlay at 15 yr.
1 NB	1815	1213	1201	1163	1815	1638	1474	1592
1 SB	1414	1406	1283	1191	2342	1815	1609	1895
2 NB	1123	1158	1008	1093	1524	1555	1363	1258
2 SB	1123	1158	1008	1093	1815	1610	1418	1368
3 NB	930	789	817	930	1194	1052	1010	970
3 SB	930	789	817	930	1457	1174	1090	1010
4 NB	1123	1091	1008	1080	1524	1433	1283	1285
4 SB	1123	1091	1035	1108	1815	1610	1418	1368
5 NB	1123	1091	1008	1108	1524	1433	1228	1285
5 SB	1123	1091	1035	1108	1815	1610	1418	1368
6 NB	1331	1091	1035	1108	1524	1488	1391	1301
6 SB	1331	1091	1035	1163	1815	1638	1446	1592
7 NB	1194	981	898	970	1331	1296	1173	1108
7 SB	1194	981	898	970	1595	1296	1253	1371
8 NB	1331	1091	1035	1150	1524	1488	1338	1301
8 SB	1386	1213	1035	1205	2078	1638	1474	1631

Note: NB = Northbound
SB = Southbound

3) Asphalt Base Course

The predominate material for base course construction is limestone. The limestones are capable of providing high quality base course materials. Due to inherent variations in quality, the source of limestone would have to be carefully selected and proven by laboratory testing. A design alternate would be to use an asphalt base course (black base) where the aggregates can be of lower quality. The asphalt base layer should be designed to incorporate a high stone content with void content less than 10 percent and bitumen content not less than 3.5 percent. The design mix would be established through laboratory testing. The black base would be used on a cm-for-cm basis with graded, crushed aggregate base course. There are natural bituminous limestones that show promise as acceptable base materials. These "rock asphalts" occur along the Lattakia-Ariha road and have been used in the area as wearing surfaces. The Consultant encountered old surface layers while excavating test pits which exhibited high strength and durability as sublayers in the pavement structure. It is recommended that the natural rock asphalts be evaluated during the Design Phase. The laboratory testing should include stability testing of the compacted material.

4) Subbase Course and Select Fill

The purpose of the subbase course is to provide an additional stress-distributing layer within the pavement system. The strength requirements are not as rigid as those of the base course. There are several sources available for use as subbase layers. The primary requirement is that the material exhibit a minimum design CBR of 40. A second requirement is that the gradation of the material be such as to prevent the intrusion of the underlying fine-grained roadbed soils. Detrimental intrusion may occur when the ratio (D15/D85) is greater than about 5, where

D15 = Particle size wherein 15 percent of the subbase course particles are smaller than this size

D85 = Particle size wherein 85 percent of the roadbed soil particles are smaller than this size.

Those design segments with over 50,000,000 A18KSAL require very thick pavement section. When the total pavement thickness exceeds 50 cm., select fill may be substituted for subbase material as long as it exhibits a minimum design CBR of 20. If select fill is used, the gradation should comply with the requirement above to prevent intrusion of subgrade fines. In both cases, subbase or select

fill, it may be more economical to provide a 10 cm sand layer above the subgrade.

5) Subgrade Soils

The roadbed soils along the proposed alignment have been evaluated by the Consultant and others. The design CBR's ranged from 2 to 40. These have been delineated and shown on the Soils and Materials Plan in Appendix D. There are soils along the proposed alignment that exhibit undesirable swell characteristics. These soils will be incorporated in the pavement structure as subgrade layers. The swelling characteristics of these soils is shown in Figure D-19. Several samples were compacted and placed in a soak tank. Surcharge weights were used to determine the weight required to limit the swell to an acceptable limit (2%). Although more complete testing will be required during the design phase, the results indicate that a minimum pavement thickness of 76 cm may be required to accomplish these design goals. The required thickness of pavement would therefore, be controlled by the undesirable swell characteristics instead of CBR. A design alternate would be to stabilize these soils with an agent such as lime in order to reduce the swell potential of these soils.

The high design traffic for the selected design period requires a high quality pavement in order to fulfill the desired performance standards. As a means of providing an economical design it is recommended that consideration be given to soil stabilization during the design phase. The objectives would be to improve the design CBR of the subgrade to a minimum of 20. This can be accomplished by the addition of lime or cement. The percent additive, which would have to be determined through laboratory testing during the Design Phase, would probably be 6-8 percent. The stabilization of the roadbed soils would not only reduce the thickness requirements of the upper pavement layers but also reduce the swell characteristics of the subgrade soils. A construction alternate would be to place select material instead of stabilizing the subgrade. There are numerous sources of material including the river deposits. The primary requirements are that the material be granular in nature and exhibit a minimum design CBR of 20. In construction, thickness specified as improved subgrade would be replaced with select borrow material. If grades are raised above the existing ground for drainage considerations, the depth of stabilization will be proportionately reduced. There may be no requirement for stabilization if the embankment is higher than 40 cms, above the existing ground providing the embankment material has a CBR greater than 20.

LYON

DEPTH BELOW SURFACE (cm.)

LOG	DESCRIPTION	CONE PENETRATION	LABORATORY TESTS LL	PI	W
0–10	ASPHALT CONCRETE WITH CRUSHED LIMESTONE - WELL GRADED AGGREGATE.				
10–20	ASPHALT CONCRETE WITH LIMESTONE - BLOCKY & POORLY GRADED AGGREGATE.				
20–30	COBBLES & GRAVEL. DENSE CREAM LIMESTONE. SURFACE ROCK				
30–40					
40–50	SILTY CLAY. MEDIUM PLASTICITY. MEDIUM STIFF. REDDISH BROWN.	160,160,150 160 (158)	60	34	24
50–60		150,160,160 (157)			
60–70					
70–80		120,130,120 120 (123)	44	23	26
80–90					

TEST PIT IDENTIFICATION: TLTP - 1

PAVEMENT RATING: 4+/5.0

FIGURE D-3 SUMMARY - STUDY OF EXISTING PAVEMENTS, TLTP-1

LYON

TEST PIT IDENTIFICATION: TLTP - 2

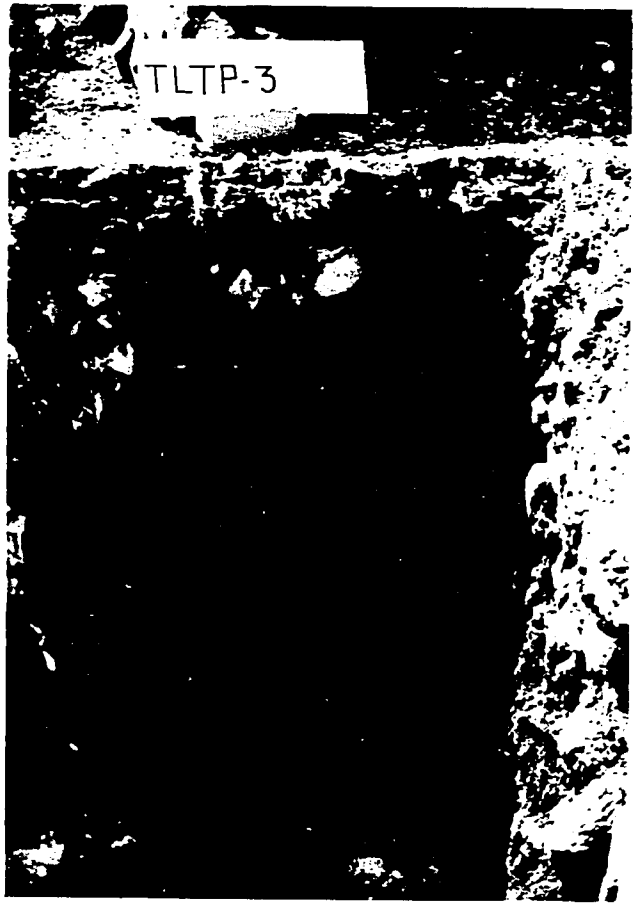
PAVEMENT RATING: 3.0/5.0

DEPTH BELOW SURFACE (cm.)

	LOG	DESCRIPTION	CONE PENETRATION	LABORATORY TESTS		
				LL	PI	W
0		ASPHALT CONCRETE WITH RIVER GRAVEL - WELL GRADED.				
10		ASPHALT CONCRETE - POORLY BONDED RIVER GRAVEL AGGREGATE.				
20		BOULDERS, COBBLES & GRAVELS WELL GRADED, MEDIUM DENSE. CREAM LIMESTONE WITH SOME TO LITTLE CLAY FILLING. CLAY SUPERSATURATED.				
30						
40		BEDROCK (BASALT)				
50						
60						
70						
80						
90						

FIGURE D-4 SUMMARY - STUDY OF EXISTING PAVEMENTS, TLTP-2

LYON



DEPTH BELOW SURFACE (cm.)

LOG	DESCRIPTION	CONE PENETRATION	LABORATORY TESTS LL	PI	W
0–10	ASPHALT CONCRETE WITH CRUSHED AGGREGATE & RIVER GRAVEL.				
10–20	ASPHALT CONCRETE WITH LIMESTONE AGGREGATE - BLOCKY GRAVEL.				
20–30	ROCK & COBBLES POORLY GRADED, MEDIUM DENSE. CREAM LIMESTONE.				
30–40	SILTY CLAY. MEDIUM PLASTICITY. STIFF TO MEDIUM STIFF. BROWN. EMBANKMENT MATERIAL.	240,240,230 240 (238)	67	34	30
40–70		140,140,110 120,110 (124)	52	18	25
70–80		100,90,90 80 (90)	53	14	27

TEST PIT IDENTIFICATION: TLTP - 3

PAVEMENT RATING: 3.5-4.0/5.0

FIGURE D-5 SUMMARY - STUDY OF EXISTING PAVEMENTS, TLTP-3

LYON

DEPTH BELOW SURFACE (cm.)

LOG	DESCRIPTION	CONE PENETRATION	LABORATORY TESTS LL	PI	W
0–10	ASPHALT CONCRETE (POOR QUALITY AC) WITH RIVER GRAVEL. SOME CRUSHED AGGREGATE.				
10–20	GRAVEL, POORLY GRADED, MEDIUM DENSE. VARI-COLORED RIVER GRAVEL WITH A LITTLE BITUMIN & SATURATED.				
20–30	GRAVEL (LARGE), POORLY GRADED, MEDIUM DENSE WITH SOME SILTY SAND. SATURATED.				
30–40	INTRUSION OF SUBGRADE INTO SUBBASE.				
40–50	SILTY CLAY. MEDIUM STIFF. MEDIUM PLASTICITY. REDDISH BROWN.	120,120,120 (120)	65	31	27
50–60					
60–70					
70–80		120,120,120 (120)			
80–90			59	31	26

TEST PIT IDENTIFICATION: TLTP - 4

PAVEMENT RATING: 2.0/5.0

FIGURE D-6 SUMMARY - STUDY OF EXISTING PAVEMENTS, TLTP-4

LYON

DEPTH BELOW SURFACE (cm.)

LOG	DESCRIPTION	CONE PENETRATION	LABORATORY TESTS LL	PI	W
0–10	ASPHALT CONCRETE, CRUSHED & ROUNDED AGGREGATE. WELL GRADED.				
10–20	ASPHALT CONCRETE (POOR QUALITY). POORLY GRADED AGGREGATE WITH A LITTLE SAND - CLAY FILLING.				
20–30	BOULDERS & COBBLES, PITRUN, CREAM TO GREY LIMESTONE WITH SOME SAND - CLAY FILLING.				
30–40					
40–50	GRAVEL (LARGE/BLOCKY) & SAND - CLAY. MEDIUM PLASTICITY. MEDIUM STIFF. REDDISH BROWN. TERRACE DEPOSIT.	220,240,220 260 (240)	37	19	16
50–60					
60–70	SAME AS ABOVE WITHOUT GRAVEL	100,160,140 140 (135)	38	18	18
70–80					
80–90		100,120,80 140 (110)	63	30	24

TEST PIT IDENTIFICATION: TLTP - 5

PAVEMENT RATING: 4.0/5.0

FIGURE D-7 SUMMARY - STUDY OF EXISTING PAVEMENTS, TLTP-5

LYON

DESCRIPTION OF MATERIAL

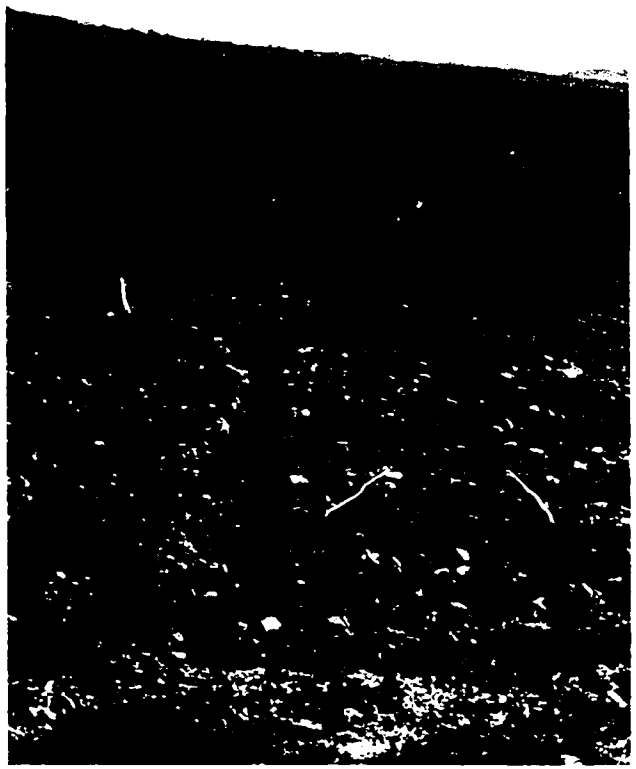
ROCKY SOIL, PARENT MATERIAL
CENOMANIAN - TURONIAN LIMESTONE

LABORATORY TEST RESULTS

MOISTURE CONTENT	9
ATTERBERG LIMITS	
LL	43
PL	26
PI	17
GRADATION % PASSING 200 SIEVE	43
STANDARD PROCTOR	
MAXIMUM DENSITY	1.64
OPTIMUM MOISTURE	19
RECOMMENDED DESIGN CBR	4
% SWELL	2

FIGURE D-8 SUBGRADE EVALUATION SAMPLE, TLSG-1

LYON



DESCRIPTION OF MATERIAL

ALLUVIAL DEPOSITS (UPPER TERRACE)

LABORATORY TEST RESULTS

MOISTURE CONTENT	9
ATTERBERG LIMITS	
LL	42
PL	25
PI	17
GRADATION	
% PASSING SIEVE	53
STANDARD PROCTOR	
MAXIMUM DENSITY	1.53
OPTIMUM MOISTURE	18
RECOMMENDED DESIGN CBR	3
% SWELL	4

FIGURE D-9 SUBGRADE EVALUATION SAMPLE, TLSG-2

LYON

DESCRIPTION OF MATERIAL

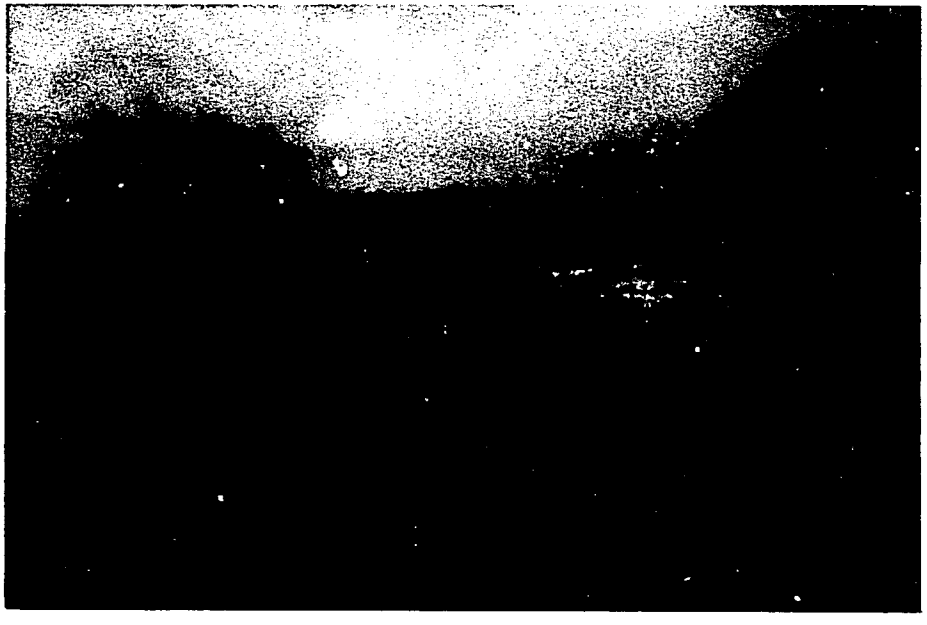
QUATERNARY DEPOSITS (GREY)

LABORATORY TEST RESULTS

MOISTURE CONTENT	25
ATTERBERG LIMITS	
LL	44
PL	28
PI	16
GRADATION	
% PASSING 200 SIEVE	84
STANDARD PROCTOR	
MAXIMUM DENSITY	1.64
OPTIMUM MOISTURE	17
RECOMMENDED DESIGN CBR	2
% SWELL	5

FIGURE D-10 SUBGRADE EVALUATION SAMPLE, TLSG-3

LYON



DESCRIPTION OF MATERIAL

BASALT SURFACE ROCK. OCCURS IN BOTH ROCK & COBBLE SIZES. THE ROCK IS SOUND BUT VESICULAR DUE TO TRAPPED GASES DURING COOLING OF THE MOLTEN ROCK.

LABORATORY TEST RESULTS

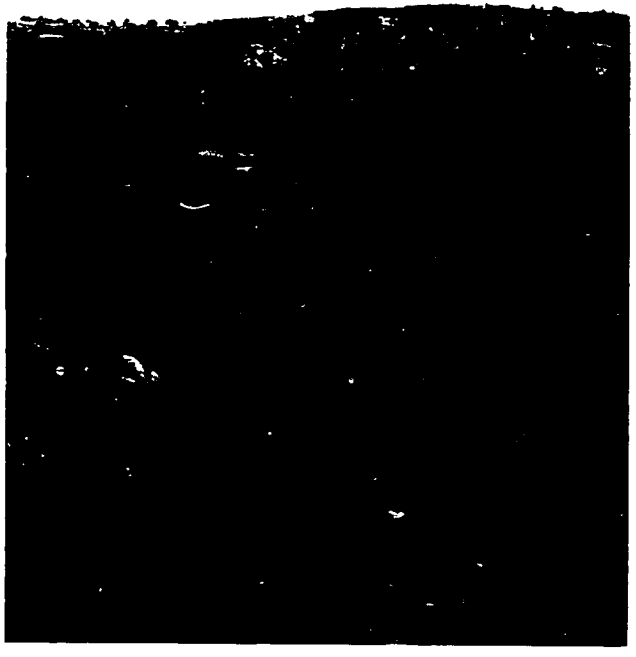
LA WEAR TEST	12-15%
SOUNDNESS	2.8-4.4

RECOMMENDED USE

THE MATERIAL IS SUITABLE FOR BASE COURSE LAYERS. THE MATERIAL COULD POSSIBLY BE USED AS AGGREGATES FOR ASPHALT CONCRETE AND PORT LAND CEMENT CONCRETE IF PROVEN SATISFACTORY BY COMPLETE LABORATORY TESTING. THE PRESENCE OF VESICLES MAY RESULT IN EXCESSIVE BITUMIN REQUIREMENTS FOR ASPHALT CONCRETE AND LOW COMPRESSIVE STRENGTHS FOR THE PORTLAND CEMENT CONCRETE.

FIGURE D-11 MATERIAL EVALUATION SAMPLE, TLMS-1

LYON



DESCRIPTION OF MATERIAL

THE SAMPLE WAS TAKEN FROM AN EXISTING QUARRY. THE MATERIAL IS PRESENTLY USED IN BULK FOR SEAWALL CONSTRUCTION. THE LIMESTONE IS MASSIVE WITH SOME CLAY SEAMS AND ISOLATED CHERT AND FLINT.

LABORATORY TEST RESULTS

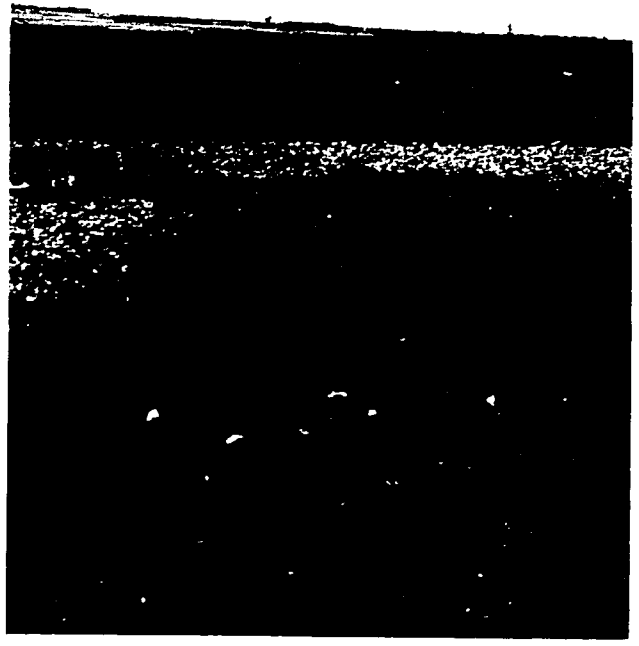
LA WEAR TEST	14-16%
SOUNDNESS	0.6-10.1

RECOMMENDED USE

THE MATERIAL (BY SELECTION) IS SUITABLE AS AGGREGATES FOR BASE AND SUBBASE COURSES. PIT RUN MATERIAL IS SUITABLE AS EMBANKMENT BACKFILL, ETC.

FIGURE D-12 MATERIAL EVALUATION SAMPLE, TLMS-2

LYON



DESCRIPTION OF MATERIAL

LIMESTONE SURFACE ROCK. OCCURS IN BOTH COBBLE AND GRAVEL SIZES. THE LIMESTONE IS SOUND BEING THE MORE RESISTANT REMAINS OF THE WEATHERING PROCESS.

LABORATORY TEST RESULTS

LA WEAR TEST	15-17%
SOUNDNESS	7.6-8.9

RECOMMENDED USE

THE MATERIAL IS SUITABLE AS SUBBASE AGGREGATE AND BY SELECTION MAY BE SUITABLE FOR BASE COURSE.

FIGURE D-13 MATERIAL EVALUATION SAMPLE, TLMS-3

LYON

DESCRIPTION OF MATERIAL

IT IS ASSUMED THAT THE SAMPLE WAS TAKEN FROM THE EXISTING QUARRY SITE. THE LIMESTONE IS MASSIVE BUT SLIGHTLY CHALKY.

LABORATORY TEST RESULTS

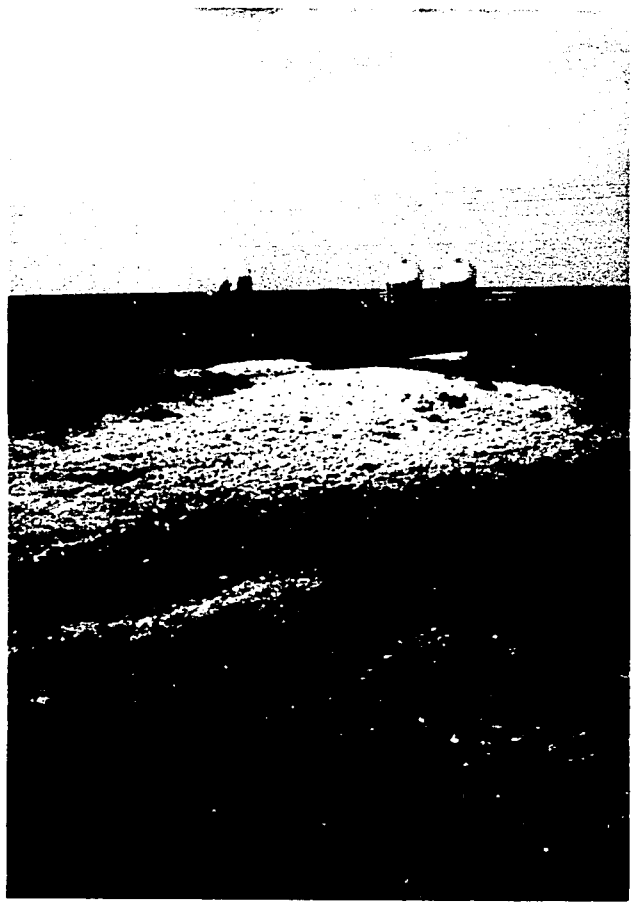
LA WEAR TEST	21%
ATTERBERG LIMITS	NON-PLASTIC
CBR	68%

RECOMMENDED USE

THE MATERIAL IS SUITABLE FOR A LOWER BASE COURSE OR SUBBASE LAYER. PIT RUN IS SUITABLE AS EMBANKMENT, BACKFILL, ETC.

FIGURE D-14 MATERIAL EVALUATION SAMPLE, TLMSO-1

LYON



DESCRIPTION OF MATERIAL

RIVER DEPOSITS. MOSTLY LIMESTONE WITH CHERT AND FLINT. SIZE RANGES FROM BEDROCK THROUGH SANDS.

LABORATORY TEST RESULTS

LA WEAR TEST	22%
ATTERBERG LIMITS	NON-PLASTIC
CBR	>100%

RECOMMENDED USE

THE MATERIAL (BY SELECTION) CAN BE SUITABLE AS BASE AND SUBBASE MATERIAL. UNPROCESSED MATERIALS SUITABLE FOR EMBANKMENT, BACKFILL, ETC.

FIGURE D-15 MATERIAL EVALUATION SAMPLE, TLMSO-2

LYON

DESCRIPTION OF MATERIAL

IT IS ASSUMED THAT THE SAMPLE WAS TAKEN FROM THE EXPOSED CUT. THE LIMESTONE IS MASSIVE.

LABORATORY TEST RESULTS

LA WEAR TEST _____ 24%

RECOMMENDED USE

THE MATERIAL IS SUITABLE AS A SUBBASE LAYER. IF PROVEN BY ADDITIONAL LABORATORY TESTING, IT COULD BE SUITABLE AS A BASE COURSE LAYER. PIT RUN MATERIAL IS SUITABLE FOR EMBANKMENT, BACKFILL, ETC.

FIGURE D-16 MATERIAL EVALUATION SAMPLE, TLMSO-3

LYON

DESCRIPTION OF MATERIAL

RIVER DEPOSITS. MOSTLY LIMESTONE WITH CHERT, FLINT AND MUDSTONE. SIZE RANGES FROM BOULDERS TO SAND.

LABORATORY TEST RESULTS

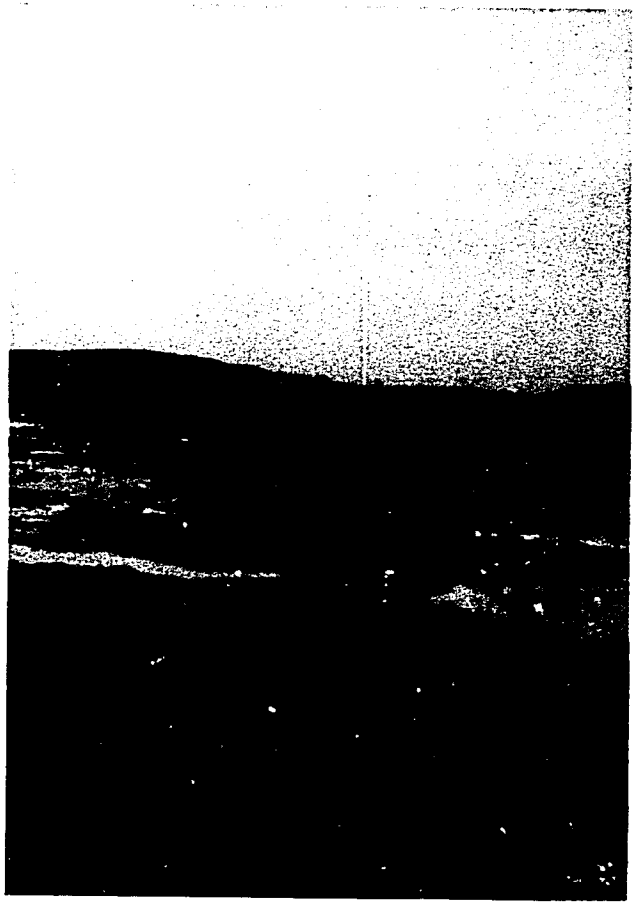
LA WEAR TEST _____ 24%
ATTERBERG LIMITS _____ NON-PLASTIC

RECOMMENDED USE

THE MATERIAL IS SUITABLE AS A SUBBASE LAYER. THE MATERIAL (BY SELECTION) SUPPORTED BY ADDITIONAL LABORATORY TESTING COULD BE SUITABLE AS A BASE COURSE LAYER. UNPROCESSED MATERIAL IS SUITABLE FOR EMBANKMENT, BACKFILL, ETC.

FIGURE D-17 MATERIAL EVALUATION SAMPLE TLMSO-4

LYON



DESCRIPTION OF MATERIAL

RIVER DEPOSITS. MOSTLY LIMESTONE WITH CHERT AND FLINT. SIZE RANGES FROM BOULDERS TO SAND.

LABORATORY TEST RESULTS

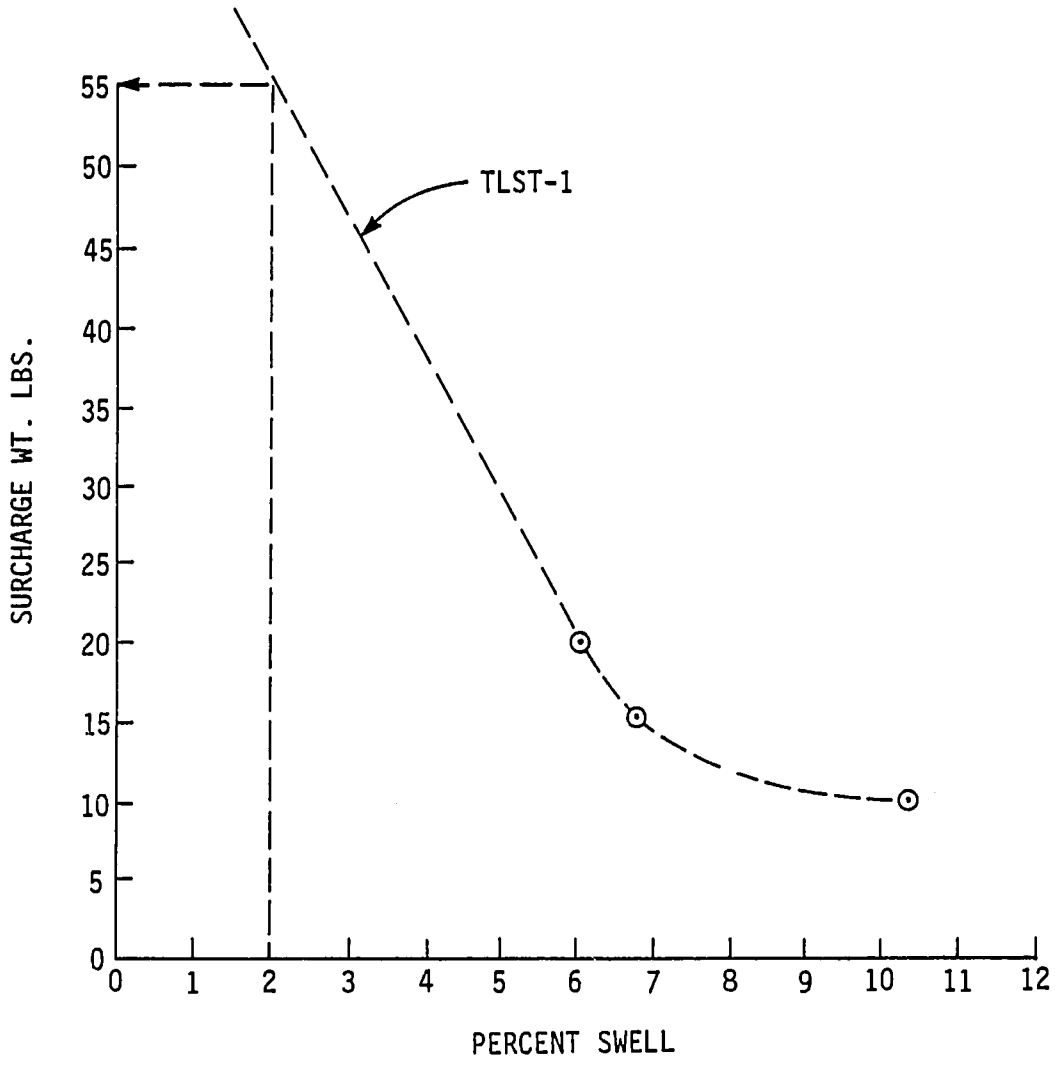
LA WEAR TEST	20%
ATTERBERG LIMITS	NON-PLASTIC
CBR	>100%

RECOMMENDED USE

THE MATERIAL (BY SELECTION) CAN BE SUITABLE AS AGGREGATE. IT IS SUITABLE AS BASE AND SUBBASE MATERIAL. UNPROCESSED MATERIAL IS SUITABLE FOR EMBANKMENT, BACKFILL, ETC.

FIGURE D-18 MATERIAL EVALUATION SAMPLE TLMSO-5

FIGURE D-19
SWELL CHARACTERISTICS OF UNDESIRABLE SUBGRADE SOILS



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5. DRAINAGE

a. Contributing Drainage Area

The contributing drainage area of the Tartous to Lattakia route corridor averages approximately 115 kilometers in length by about 30 kilometers in width, encompassing an area of approximately 3,500 square kilometers. The drainage boundaries of the area are: Al Kabir Al Shamaly River watershed on the north; the ridge line of the Uabal An Nusayriyah mountains on the east; and the Gamkah River watershed on the south.

The area slopes in a general east to west direction and varies in elevation from approximately 1,660 meters in the mountains to approximately 10 meters at the low point along the proposed route, neglecting bottom elevations of watercourses. Runoff from approximately 94% of the area is collected and discharged through major river courses which originate in the mountains and foothills. Runoff from drainage areas within the coastal plain are collected and discharged through minor streams and watercourses constitute the remaining 6% of the overall contributing drainage area. Approximately 26% of the overall contributing drainage area is within the coastal plain bordering the Mediterranean Sea which is devoted primarily to agricultural production. The Uabal An Nusayriyah mountain range and its foothills constitutes the remainder of the contributing drainage area with development primarily limited to tree crops at the lower elevations and small areas of row crops confined to stream valleys and plateaus.

Annual precipitation averages from 900 to 1,000 millimeters per year occurring mainly between the months of March and October. Rain is generally gentle, occurring in cycles of two to three days, interspersed with rain-free periods. Total annual rainfall increases with rises in elevation. Although winter temperatures tend to be mild because of the moderating effect of the movement of air masses from the Mediterranean, occasional snow storms occur at the higher elevation; however, the magnitude of these storms is insufficient to develop and sustain a snow pack.

Major river courses passing through the route corridor are indicated on Plates A-3 through A-50, Volume II of this report. They are (in order from south to north) Al Gamkai, Hussan, Markleh, Banyas, Jober, Sinn, Rous, Samkh, Snouber, and Kibir-Shamaly Rivers.

Flooding has been a problem at Al Hussan River in Tartous where floodwaters have flowed over the existing Tartous-Lattakia highway bridge at Al Hussan River; and Al Kabir Al Shamaly River south of Lattakia. Floodwater from Al Kabir Al Shamaly River has not topped the bridge roadway of the existing Tartous to Lattakia highway, but has passed over the roadway north of the bridge and has flooded the area upstream including roads and small factories. Gauging station records for the Khan Stallah bridge plus observed high water records for the bridge structure were analyzed to estimate flow at this structure.

The contributing areas for secondary water courses, streams, creeks and irrigation channels along the route are indicated in Tables D-7 through D-11.

b. Runoff Estimates

Crossroad drainage structures are proposed on the basis of the following:

1) Crossings for rivers, major watercourses and watercourses with deep [illegible]s are accomplished with bridge structures at the locations indicated on Plates A-3 through A-50, Volume II. Estimates of the high water level of record at all river locations were made by observation of water marks and/or inquiries of local residents.

2) Crossings for secondary watercourses are to be accomplished with box shaped or round pipe conduits in accordance with runoff estimates indicated in Tables D-7 through D-11. Contributing drainage areas of secondary watercourses were determined from 1:25,000 scale topographic maps of the area. Estimates of runoff for these areas are based on the rational formula Q = CIA.

Where: Q = Discharge at the Point of Concentration

I = Rainfall Intensity for the Selected Design Storm Based on Estimated Time of Concentration.

A = Area of the Contributing Watershed

C = Runoff Coefficient

Rainfall Intensity-Duration-Frequency curves for the area as described hereinafter were developed from records of two recording stations - one in the vicinity of Tartous and one in the vicinity of Lattakia. The curves developed from the Tartous and Lattakia station records were used for runoff estimates for the areas and north of Banyas respectively. The intensities used for sizing all drainage structures other than bridge crossings are based on a frequency (storm return period) of 25 years. The Rainfall Intensity-Duration-Frequency curves are shown on Plate 3, Volume II.

The runoff coefficients "C", developed for the area, are as follows:

Orchards	0.30
Uncultivated land with grass cover and impervious soils	0.40
Cultivated land and uncultivated land with pervious soils	0.30
Uncultivated land with sparse ground cover and impervious soils	0.50

Times of concentration were determined for each contributing drainage area by application of the empirical formula:

$$t_c = 7.25 \left(\frac{L^2}{S}\right)^{\frac{1}{3}}$$

Where: t_c = The length of time for water to travel from the upper reach of the contributing watershed to the point of discharge

L = The horizontally projected length of the contributing watershed between its upper reach and point of discharge

S = The average slope of the contributing watershed based on the difference in elevation between its upper reach and point of discharge and its horizontally projected length.

The following procedure was used to determine preliminary runoff estimates for all secondary watercourses:

(a) Contributing drainage areas for each individual watercourses along the route were delineated and control elevations noted using 1:25,000 scale topographic maps of the area.

(b) The area of each contributing watershed was measured by planimeter.

(c) The projected lengths and average slopes between extreme limits were scaled.

(d) Estimated coefficients of runoff were selected based on average and known ground cover and use condition.

(e) Times of concentration were determined by applying the lengths and slopes to the aforementioned empirical formula.

(f) Intensities for each case were determined from applicable Intensity-Duration-Frequency curves for computed times of concentration based on return period storm frequencies of 25 years.

(g) Resulting discharges were then computed by application of the rational formula Q = CID.

Since the estimates of runoff are considered preliminary, basic topographic information and existing conditions of the individual watersheds were primarily limited todata available from 1:25,000 topographic maps. Detailed studies of each watershed and the application of routing techniques, especially for the larger contributing areas, must be employed during final design of the drainage facilities.

Additional topographic information is required for a more detailed division of watersheds and points of concentration along the route. The contributing drainage areas can then be subdivided into smaller areas which will result in an additional number of structures of smaller sizes. Allowances for these additional smaller structures have been made for estimating project costs.

c. Structures

The following summarizes drainage structure guidelines for the proposed expressway:

1) Single and multi-span bridges will be provided for rivers, major watercourses and deep ravines.

2) Single and multi-celled reinforced concrete box structures of the sizes indicated are provided for watercourses where maximum flows and channel configurations permit. All box type structures will be provided with upstream and downstream retaining walls and aprons to insure proper hydraulic characteristics, retain slopes, control erosion and minimize maintenance. The drainage channel section will be protected with ungrouted stone lining upstream and downstream from the structure to prevent erosion.

3) Single pipe conduit is provided as indicated at minor watercourses and streams consistent with estimated discharges. Single pipe crossings larger than 100 centimeters in diameter will be provided with reinforced concrete entrance and exit structures having retaining walls and aprons. Upstream and downstream channel erosion protection will be accomplished with ungrouted stone lining. Single pipe crossings less than 100 centimeters in diameter will include either precast or cast-in-place inlet and outlet structures. Channels will be protected from erosion upstream and downstream from the structure by ungrouted stone lining. In order to provide access for proper maintenance, no pipes shall be less than 60 centimeters in diameter.

4) Drainage of the expressway median will be accomplished by means of conduits or grated inlets discharging into side ditches or into crossroad drainage conduits.

TABLE D-7
DRAINAGE AREAS AND STRUCTURES FOR
SECONDARY WATERCOURSES

Station	Area HA	Q_{25} M^3/sec.	Recommended Structure
10 + 300	23	2.5	120 cm ø concrete pipe
10 + 300	22	2.42	120 cm ø concrete pipe
11 + 720	17	1.95	100 cm ø concrete pipe
12 + 130	15	1.63	100 cm ø concrete pipe
12 + 600	32	3.25	1.5 m x 1.5 m reinforced concrete box
12 + 990	103	9.30	2.5 m x 2.5 m reimforced concrete box
13 + 600	795	65.76	Double 2.5 m x 3.5 m reinforced concrete box
13 + 850	12	1.33	80 cm ø concrete pipe
14 + 220	7	0.77	60 cm ø concrete pipe
14 + 480	18	1.89	100 cm ø concrete pipe
14 + 960	100	8.92	2.0 m x 2.0 m reinforced concrete box
15 + 500	309	28.10	Double 2.5 m x 2.5 m reinforced concrete box
16 + 300	120	11.67	2.0 m x 2.0 m reinforced concrete box
17 + 470	84	8.1	1.5 m x 1.5 m reinforced concrete box
18 + 000	6	0.7	60 cm ø concrete pipe
19 + 000	46	5.52	1.5 m x 1.5 m reinforced concrete box
19 + 300	310	24.30	Double 2.5 m x 2.5 m reinforced concrete box
20 + 000	40	4.3	1.5 m x 1.5 m reinforced concrete box
20 + 600	42	4.5	1.5 m x 1.5 m reinforced concrete box
21 + 200	63	6.4	1.5 m x 1.5 m reinforced concrete box
21 + 600	18	2.1	100 cm ø concrete pipe
22 + 100	125	13.22	2.5 m x 2.5 m reinforced concrete box
22 + 850	670	65.40	Double 2.5 m x 3.5 m reinforced concrete box
23 + 600	100	10.58	2.0 m x 2.0 m reinforced concrete box
24 + 800	670	60.90	Double 2.5 m x 3.5 m reinforced concrete box
25 + 350	60	6.35	1.5 m x 1.5 m reinforced concrete box
25 + 950	135	12.84	2.0 m x 2.0 m reinforced concrete box

TABLE D-8
DRAINAGE AREAS AND STRUCTURES FOR
SECONDARY WATERCOURSES

Station	Area HA	Q_{25} M^3/sec.	Recommended Structure
26 + 200	145	11.90	2.0 m x 2.0 m reinforced concrete box
27 + 000	140	13.50	2.5 m x 2.5 m reinforced concrete box
28 + 000	65	6.27	1.5 m x 1.5 m reinforced concrete box
29 + 450	115	9.87	2.0 m x 2.0 m reinforced concrete box
30 + 260	105	10.84	2.0 m x 2.0 m reinforced concrete box
31 + 600	25	2.64	120 cm ø concrete pipe
31 + 950	40	4.23	2.5 m x 2.5 m reinforced concrete box
32 + 850	70	7.23	1.5 m x 1.5 m reinforced concrete box
33 + 300	125	10.14	2.0 m x 2.0 m reinforced concrete box
33 + 570	10	1.00	80 cm ø concrete pipe
33 + 800	45	4.76	2.5 m x 2.5 m reinforced concrete box
34 + 150	40	4.23	1.5 m x 1.5 m reinforced concrete box
34 + 550	450	35.33	Double 2.5 m x 2.5 m reinforced concrete box
34 + 750	20	2.12	100 cm ø concrete pipe
35 + 200	50	4.94	2.5 m x 2.5 m reinforced concrete box
35 + 700	10	1.00	80 cm ø concrete pipe
35 + 850	190	16.12	2.0 m x 2.0 m reinforced concrete box
36 + 050	17	1.68	100 cm ø concrete pipe
36 + 450	15	1.48	2.5 m x 2.5 m reinforced concrete box
36 + 860	5	0.5	60 cm ø concrete pipe
37 + 470	925	65.6	Double 2.5 m x 3.5 m reinforced concrete box
37 + 700	11	1.10	80 cm ø concrete pipe
38 + 000	20	1.97	100 cm ø concrete pipe
38 + 300	4	0.4	60 cm ø concrete pipe
38 + 470	1	0.1	60 cm ø concrete pipe
38 + 530	1	0.1	60 cm ø concrete pipe
38 + 750	12	1.18	80 cm ø concrete pipe
39 + 400	495	42.3	Double 2.5 m x 2.5 m reinforced concrete box

TABLE D-9
DRAINAGE AREAS AND STRUCTURES FOR
SECONDARY WATERCOURSES

Station	Area HA	Q_{25} M^3/sec.	Recommended Structure
39 + 800	22	2.17	100 cm ϕ concrete pipe
40 + 350	21	2.67	120 cm ϕ concrete pipe
40 + 900	14	1.38	80 cm ϕ concrete pipe
41 + 500	40	3.64	120 cm ϕ concrete pipe
42 + 050	17	1.68	100 cm ϕ concrete pipe
42 + 300	7	0.69	60 cm ϕ concrete pipe
42 + 530	40	4.23	1.5 m x 1.5 m reinforced concrete box
43 + 100	21	2.22	100 cm ϕ concrete pipe
43 + 450	145	15.94	2.0 m x 2.0 m reinforced concrete box
43 + 650	125	14.22	2.0 m x 2.0 m reinforced concrete box
43 + 800	12	1.69	100 cm ϕ concrete pipe
44 + 300	8	1.00	80 cm ϕ concrete pipe
44 + 400	9	1.11	80 cm ϕ concrete pipe
44 + 500	80	11.29	2.0 m x 2.0 m reinforced concrete box
44 + 800	28	2.96	1.5 m x 1.5 m reinforced concrete box
45 + 300	77	9.51	2.0 m x 2.0 m reinforced concrete box
45 + 960	13	1.37	80 cm ϕ concrete pipe
46 + 450	14	1.52	100 cm ϕ concrete pipe
46 + 750	151	13.09	2.0 m x 2.0 m reinforced concrete box
47 + 270	120	11.71	2.0 m x 2.0 m reinforced concrete box
49 + 150	120	12.29	2.0 m x 2.0 m reinforced concrete box
50 + 450	228	19.60	2.5 m x 2.5 m reinforced concrete box
51 + 600	229	20.96	2.5 m x 2.5 m reinforced concrete box
52 + 800	10	1.04	80 cm ϕ concrete pipe
53 + 000	19	1.98	2.5 m x 2.5 m reinforced concrete box
53 + 300	88	6.98	1.5 m x 1.5 m reinforced concrete box

TABLE D-10
DRAINAGE AREAS AND STRUCTURES FOR
SECONDARY WATERCOURSES

Station	Area HA	Q_{25} M^3/sec.	Recommended Structure
53 + 450	21	2.19	100 cm ø concrete pipe
54 + 400	36	3.75	120 cm ø concrete pipe
55 + 000	1125	62.30	Double 2.5 m x 3.5 m reinforced concrete box
55 + 550	32	4.44	1.5 m x 1.5 m reinforced concrete box
55 + 800	95	8.79	2.0 m x 2.0 m reinforced concrete box
57 + 020	857	53.79	Double 2.5 m x 2.5 m reinforced concrete box
57 + 350	75	6.75	1.5 m x 1.5 m reinforced concrete box
65 + 200	40	4.86	2.5 m x 2.5 m reinforced concrete box
66 + 640	45	5.18	1.5 m x 1.5 m reinforced concrete box
68 + 180	40	4.86	1.5 m x 1.5 m reinforced concrete box
58 + 500	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
59 + 300	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
59 + 500	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
59 + 880	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
60 + 780	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
61 + 950	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
63 + 430	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
64 + 350	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
65 + 350	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
67 + 100	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
68 + 780	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
69 + 670	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
69 + 860	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
70 + 670	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
71 + 770	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
72 + 410	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box

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TABLE D-11
DRAINAGE AREAS AND STRUCTURES FOR
SECONDARY WATERCOURSES

Station	Area HA	Q_{25} M^3/sec.	Recommended Structure
72 + 620	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
73 + 200	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
73 + 440	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
73 + 740	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
74 + 730	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
75 + 480	Irrigation Canal		2.5 m x 3.5 m reinforced concrete box
77 + 520	110	6.42	2.5 m x 2.5 m reinforced concrete box
77 + 810	111	5.92	1.5 m x 1.5 m reinforced concrete box
78 + 450	30	2.4	120 cm ø concrete pipe
80 + 650	1258	74.08	Double 2.5 m x 3.5 m reinforced concrete box
84 + 020	654	42.25	Double 2.5 m x 2.5 m reinforced concrete box
84 + 530	5	.69	2.5 m x 2.5 m reinforced concrete box
84 + 930	6	.83	60 cm ø concrete pipe
85 + 500	653	46.77	Double 2.5 m x 2.5 m reinforced concrete box
87 + 700	427	35.76	Double 2.5 m x 2.5 m reinforced concrete box
88 + 050	30	3.24	1.5 m x 1.5 m reinforced concrete box
88 + 420	40	5.02	1.5 m x 1.5 m reinforced concrete box
88 + 850	152	13.40	2.5 m x 2.5 m reinforced concrete box

6. BRIDGES AND DRAINAGE STRUCTURES

a. Introduction

The primary objective of the structural portion of the feasibility study is the development of an accurate estimate of structure cost within the scope of work. In the determination of quantities and costs, consideration was given to the structural systems that would have the most practical application for the project. Engineering soundness, simplicity, duplication in construction and appearance comprise the primary criteria for the selection process. Although the bridge types used as a basis for this study would provide sound economical structures, other types of construction might also serve the needs of the highway. Therefore, flexibility in making final selections of structural systems should be reserved for the final design stage of the project.

b. Classification of Structures

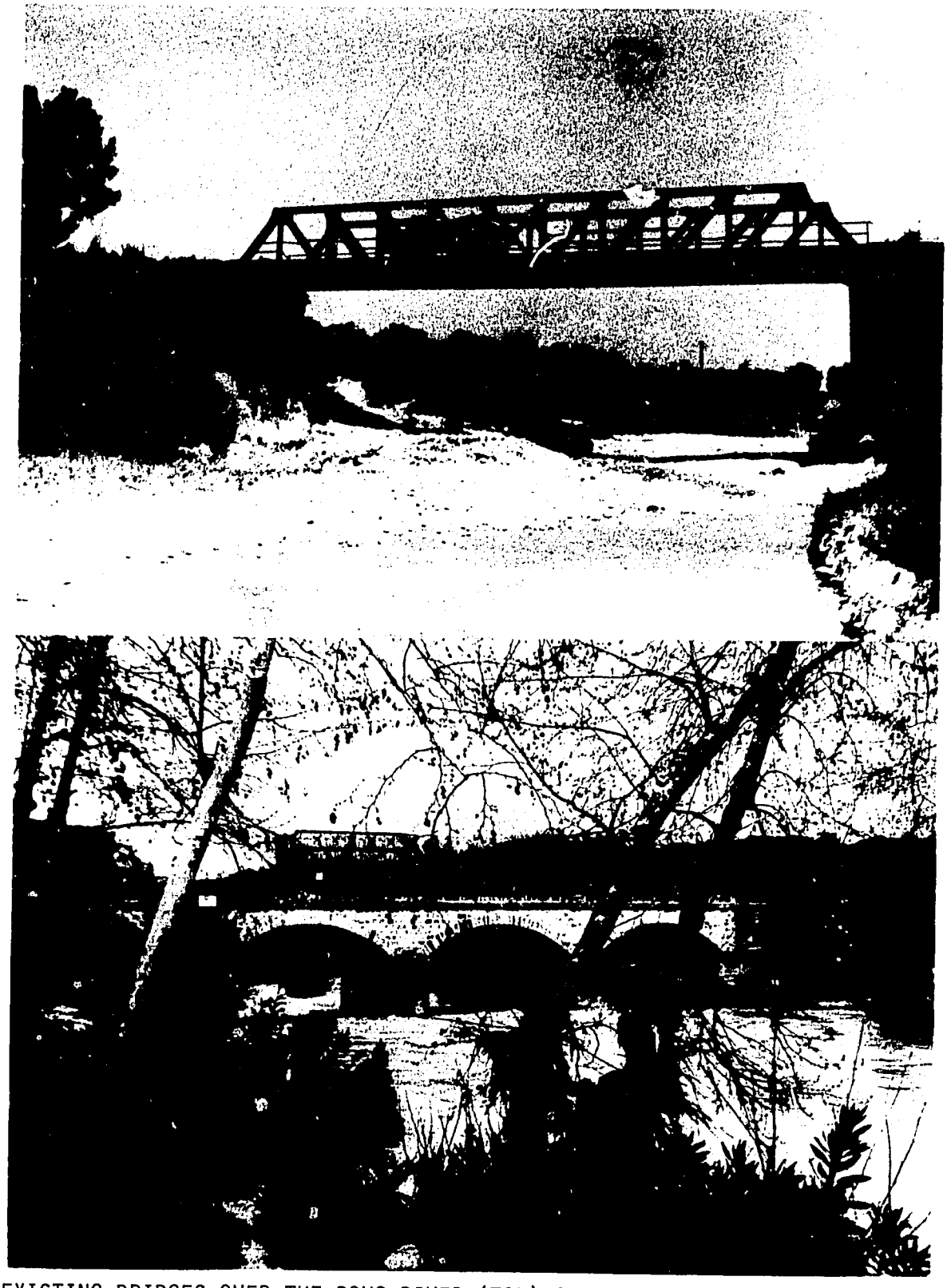
Bridges for this project have been classified as overpasses, underpasses, bridges over rivers and bridges over streams. The overpass and underpass terms apply to the proposed highway either going over or under a local road, connecting road or existing highway. The bridge over river term applies to those crossings at which a river is designated by name in the study. All other bridges are labeled as bridges over streams.

Single pipe culverts in sizes of 60 cm, 80 cm, 100 cm, and 120 cm and single and double box culverts have been considered for secondary watercourses.

c. General Features of Bridges

Bridges have been considered as being in areas of unrestricted R.O.W. Three span and four span structures with open end spans have been selected for typical overpasses and underpasses. Open end spans will increase the length of bridges and, therefore, will result in higher superstucture costs; however, the increase in cost will be more than offset by eliminating massive cantilever abutments. At an underpass a relatively unobstructed view of the area beyond the structure has been provided by placing a single pier in the middle of the median and the outside piers beyond the swale. The generous distances from running lanes to pier obstructions at underpasses also add a degree of safety in affording a recovery area for vehicles straying off the roadway.

All bridges supporting the proposed highway will utilize parapets with sloping inside faces which have proved effective in deflecting vehicles



EXISTING BRIDGES OVER THE ROUS RIVER (TOP) AND THE SNOUBER RIVER (BOTTOM)

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striking at an angle. Sidewalks are provided at underpasses to accommodate the large amount of pedestrian traffic expected on the local roads and highways.

Bridges for highways crossing over the proposed expressway have been analyzed on the assumption that they will all be two lane structures with full shoulders on both sides. It is recognized that this is an ultra-conservative assumption relative to economic feasibility of the proposed expressway; however, until such time as further traffic analyses of the crossing traffic are accomplished it would be less than conservative to assume otherwise. The total cost reduction possible relative to deletion of shoulders from bridges crossing over the expressway is in the order of one million dollars. The relative effect of such reduction can be observed from the analysis run for sensitivity to variations in construction cost.

d. Long Bridges

The bridges for the project generally comprise routine overpasses, underpasses, and waterway crossings over defined channels. However, the following structures have lengths determined by unique factors:

1) Bridge over Al Gamkah River at Sta. 11+175

The proposed bridge is approximately 210 meters in length. A relatively high profile over the river valley is the governing factor in determining the length. A ten meter height of embankment was set as the cut-off point between structure and fill for this situation.

2) Bridge over Al Hussan River at Sta. 11+800

The proposed bridge is 220 meters in length. The length was determined by the high roadway profile over the river valley.

3) Bridge over Al Sinn River at Sta. 58+25

The proposed bridge crossing is 150 meters in length. This crossing is over a wide marshy area below the reservoir where subsurface conditions must be investigated during the design stage of the project to determine the feasibility of placing embankment over the natural ground adjacent to the river.

4) Bridge over Al Kabir Al Shamaly River at Sta. 91+20

The proposed bridge crossing is 120 meters in length. The area immediately upstream from the existing bridge has been flooded in recent years and flood water was reported as passing over the road to the north of the bridge. This condition could have been caused by impounding of the water by the existing embankment and the parallel road upstream. For this reason we have considered a bridge which will span the most defined portion of the flood channel.

A detailed flood plain analysis must be made for all rivers during the design stage of the project in order to determine the primary and relief openings required.

e. Design Criteria

The design of structures for this project should be in accordance with the Standard Specifications for Highway Bridges of AASHTO that are current at the time of design. The design live load should be for HS 35 truck loading or french military tank loading for a 110T tank, whichever governs. (Appendix D, Plate 8.)

Longitudinal and transverse horizontal forces and loading combinations for vertical and applicable horizontal forces should be in accordance with AASHTO design criteria.

Computer searches have been secured from the U.S. Department of Commerce, the National Geophysical and Solar-Terrestrial Data Center, and the International Sersmological Center for earthquakes within the following area : Latitude 34°N to 37°N and Longitude 35°E to 38°E. This area encompasses the proposed project. (Appendix D, Plates 9 through 16.)

During the preliminary design phase of the project, available data should be evaluated to determine the effect of earthquakes and the parameters for computing equivalent static forces.

f. Superstructure

The superstructure includes the bridge decks, parapets and supporting beams. (Appendix A, Sheets 51 through 53.)

Precast concrete channel sections have been considered for bridges with spans up to 14 m in length. Spans in this range occur at some stream crossings and at the viaduct over Al Sinn River. The channel section is economical in the span range considered and serves as a form for a poured in place concrete deck. Other precast sections such as box beams or plank could also be utilized for shorter spans; but box beams would be more difficult to form, and plank would be used most economically with a bituminous or minimum thickness concrete surface course which might not be as durable under the heavy live loads for which the structures must be designed. Optional methods for forming the deck slab could be provided in order to afford the most economical method of construction. Cast-in-place prestressed concrete soffit slabs spanning between I-beams have been indicated on Plates A-51 and A-52. The soffit slabs would serve as both formwork for the cast-in-place deck and a transverse reinforcement in the bottom of the deck.

Because of the very large volume of precast concrete estimated for the project, a central precasting yard has been proposed. A permanent plant should afford better quality control of the precast members with such features as permanent precasting beds, bulkheads, and curing facilities. All prestressing would be accomplished with bonded pretensioned strands.

g. Substructure

The substructure includes the pile caps at the stub abutments, abutment wingwalls, and the piers above the footings. For the typical overpass and underpass the Consultant has assumed a very simple pier composed of a rectangular cap and individual columns. In some rivers and streams, and for structures with high profiles, solid piers have been considered.

h. Foundations

In an earlier feasibility study, a cone penetrometer was used to investigate foundation conditions at major bridge crossings. The results of the investigation indicated that approximately 2/3 of the structures could be founded on spread footings at depths ranging from 1.5 m to 5.0 m with allowable bearing capacities for most of the foundations given as 2.5 kg/cm^2. This suggests that the foundation levels are mostly in stream gravels and subject to scour during flood flows. Pile foundations were indicated for the remaining 1/3 of the structures.

These earlier soundings were augmented by the Consultant with seismic refraction profiles at selected bridge crossings along the length of the proposed alignment. The locations of seismic investigations are shown on the Soils and Materials Plan, Plates 1 & 2 of Appendix D. The seismic velocities of the various layers as well as the interpretation of the results are given in Table D-12. Approximate bearing values are also shown although it must be recognized that river deposits vary greatly and borings will have to be conducted, at the location of abutments and piers, prior to final selection of foundation types.

Examination of rivers at existing bridges indicates that the velocities of these rivers are sufficient to develop scour at abutments and piers. Bridge footings will have to be based below all stream bed material, including gravel, cobbles and boulders. These materials are subject to horizontal scour during flood flows.

Evaluation of foundation conditions at individual bridge locations will be possible only after detailed final drilling investigations.[1/] Footings founded on piles extending below the scouring depth would be a reasonable consideration at these locations. Available information also indicates that deep foundations might be required at approximately half of the overpass and underpass structures. The stub abutments proposed at the overpasses and underpasses also require piles driven through the approach fill. Therefore, for the purposes of this report, pile foundations have been assumed at all locations to assure a conservative study.

For the bridge over Al Sinn River a short span viaduct structure on pile bents has been considered. This crossing is below the reservoir on the River where a broad marshy area is visually evident. Soil borings and testing obtained during the design stage of the project could show that filling across the marsh would be feasible. Short spans on pile bents have also been considered for a number of stream crossings at locations where the highway has a relatively low profile.

Although prestressed precast piles have been considered as a basis for estimating foundation costs for the feasibility study, the final foundation type selection, resulting from a complete soils exploration at each bridge site (during the design stage of the contract), will probably include both pile foundations and (less costly) spread footing foundations.

[1/] Feasibility study includes representative site studies only.

TABLE D-12

INTERPRETATIONS OF SEISMIC PROFILES

Seismic Profile	Station	Depth, meters	Velocity, fps	Interpretation
TLSSS-1	18+850	0-2	1587	sand, some cementation subject to scour
		2 to 10	5850	stream gravels, well-graded, partly cemented; approx. allowable bearing value 3-4 kg/cm^2
TLSSS-2	28+750	0-1.5	1050	clayey sand, subject to scour
		1.5 to 10	5000	stream gravels, partly cemented or weathered limestone; approx. allowable bearing value 3-4 kg/cm^2
TLSSS-3	54+125	0-1.75	1676	sandy clay, subject to scour
		1.75 to 10	4000	stream gravels (limestone), subject to scour at higher river velocities; approx. allowable bearing value 2-3 kg/cm^2
TLSSS-4	58+150	0-2.25	1080	clayey sand, subject to scour
		2.25 to 10	4135	stream gravels (limestone), loose & poorly graded, subject to scour at higher river velocities; approx. allowable bearing value 2-3 kg/cm^2
TLSSS-5	76+050	0-2.5	982	clay, subject to scour
		2.5 to 10	5400	stream gravel, well-graded, partly cemented or weathered limestone; approx. allowable bearing value 3-5 kg/cm^2
TLSSS-6	79+900	0-3.5	1090	clayey sand, subject to scour
		3.5 to 10	4162	sands & gravels, loose to medium, subject to scour at higher river velocities; approx. allowable bearing value 2-3 kg/cm^2
TLSSS-7	83+600	0-2.0	1085	clayey sand, subject to scour
		2.0 to 10	5614	weathered sandstone; approx. allowable bearing value 4 kg/cm^2
TLSSS-8	90+650	0-2.0	1105	clayey sand, subject to scour
		2.0 to 10	2350	sand and gravels, loose, subject to scour; approx. allowable bearing value 1.5 kg/cm^2

7. PRELIMINARY ROADWAY DESIGN

a. Alignment Guidelines

Specific alignment considerations that governed the location development of the expressway are discussed in detail in the following paragraph (7.b.); however, the following general guidelines formed the basis of the alignment selection process:

1) Consideration was given to the planned expansion of the cities of Tartous, Banyas, Jebleh, and Lattakia as well as the industrial sites such as the refinery near Banyas and the cement plant near Tartous.

2) A Railroad Feasibility Study prepared for the Ministry of Transport, Syrian Railways in June 1976, presents a recommended railroad alignment between Tartous and Lattakia. Officials state that no decision for implimentation of its design or construction have been made. All involved agencies realize the importance of minimizing conflicts between the expressway alignment and the proposed railroad alignment. Maximum effort was made to accommodate the railroad whenever possible.

3) Consideration was given for locating optimum sites for bridge river crossings and highway grade separations.

4) Grades were optimized for minimum disruption of the current land use in order to minimize right of way requirements.

5) Alignment selection avoided close proximity with the sea coast even though this alternate affords the driver with pleasant vistas. It was felt that such an alignment selection would conflict with plans to develop tourist facilities and would be objectionable from an aesthetic and environmental standpoint.

b. Horizontal-Vertical Alignment and Interchanges

The proposed alignment for the Tartous to Lattakia Expressway is illustrated on the plan and profile drawings included in Part A, Volume 11 of this report.

Plate A-3 shows the beginning of the project with a station designation of 10+000 (KM10) with the stationing increasing from south to north. The expressway begins approximately three kilometers southeast of the City of Tartous at the intersection of the existing highway to Safita and the end point of a new four-lane divided highway to Akkari currently under construction. The proposed expressway will be an extension of this new four lane divided highway. A grade separation and interchange at this location is also under construction. A minor modification to the designed alignment of the northbound ramp, Northeast quadrant of this interchange must be made to accommodate a horizontal curve that begins at 10+350. This curve and the next curve in the opposite direction at 11+800 are required to accomplish the following:

1) Avoid the planned development area for Tartous City.

2) Provide an interchange with the road from Daher Al Bellan at a location which avoids conflict with a proposed military hospital site.

3) Provide a connection for a new access stree to central Tartous City and the port area as provided for in the city expansion plan.

An interchange is necessary at 18+550 where the expressway crosses the existing Tartous-Lattakia highway. The primary purpose of this interchange is to provide the most direct access to Tartous port for southbound traffic while maintaining the countinuity of the existing highway. The area required for this interchange is limited by the POL right-of-way, the alignment of the existing highway and Al Hussan River; however, the interchange can be accommodated.

The site of the new Tartous Cement Plant (currently under construction) is approximately 400 meters east of the proposed expressway at 22+000. The POL right-of-way and the existing Tartous-Lattakia highway both lie within the 400 meter strip separating the cement plant and the proposed expressway. A grade separation structure is required at 21+875 to provide access between the marine carrier loading facilities and the cement plant. The interchange proposed at 23+550 and the frontage road between 23+550 and 21+875 will provide access to the cement plant with the added advantage of providing for other local traffic in the area.

An interchange is proposed at 33+000 to provide access to the villages of Mazra't Al Afandy, Bazzak, Al Jenieneh, Zaher Safra, et. al. east of the expressway.

The topography and culture between 38+000 and 50+000 pose challenging problems from the standpoint of expressway geometrics. The coastal plain is the narrowest of the entire project along this segment as the steep foothills approach the coastline. The most restrictive section is between 38+000 to 45+000 where the foothills approach to within two hundred meters of the coast and this narrow corridor must be shared by the existing Tartous-Lattakia Highway, the POL right-of-way, several historical sites and the proposed expressway. The one hundred meter wide (average) coastal plain between 46+000 and 50+000 contains the urban area of the city of Banyas and is almost entirely developed throughout its width.

The steepest grade of the project, five percent (5%) begins at 38+000 and is necessary for crossing a prominent ridge line with minimal cut. The alignment through the ridgeline at this location is necessary for obtaining the best possible alignment at 39+500 where the coastal plain is at its minimum width. The proposed expressway follows the same alignment as the existing Tartous-Lattakia Highway between 39+350 and 40+050. The existing highway can be easily relocated closer to the adjacent foothills immediately to the east since geometric criteria for the frontage road is more liberal than what is required for the expressway.

The alignment between 42+600 and 48+800 requires four curves alternating in direction connected by short tangents. These curves whose radii varies from a minimum of 300 meters to a maximum of 425 meters are necessary to avoid uneconomical fills and cuts in this scenic area.

Interchanges have been provided at 46+925 and 49+825 for the main access to the city of Banyas for northbound and southbound traffic respectively. The remaining section through the city of Banyas to 49+825 parallels the contours along the lower elevations of the foothills thus affording the widest uninterrupted area between the proposed expressway and the city center.

The geometrics imposed by all of the aforementioned restrictions necessitate a minimum expressway section (See Volume II, Plate A-2 Typical Expressway Section , Right-of-Way Restricted) throughout the length of this segment. This expressway cross section has a narrow paved median (5 meters) with opposing lanes of travel separated by a guard rail or concrete median safety barrier. The entire segment between 38+000 and 50+000 must be signed to have a maximum legal speed of 80 KPH.

The expressway is aligned to pass between the Banyas Refinery and the foothills at 54+000. This alignment was selected for the following reasons:

1) It provides an area for the city of Banyas to expand northward on the coastal plain toward the Jober River Valley which is the southern boundary of the Banyas refinery.

2) The alignment presents no conflicts with the existing Tartous-Lattakia Highway which serves both the refinery and the city of Banyas.

3) The selected alignment presents the least conflicts with the refinery, the petroleum tank farm and the planned residential complex of the Banyas refinery workers.

4) The right-of-way costs will be less than other available areas.

5) The alignment avoids the corridor of the petroleum pipelines.

An interchange is required at the intersection of the proposed expressway and the existing Tartous-Lattakia Highway at 56+850. This interchange will serve to accommodate traffic bound for the Banyas Refinery and the local roads in the vicinity.

The widest expanse of flat coastal plain between the shoreline and the existing Lattakia-Tartous highway occurs between 58+000 and 83+000. The proposed expressway alignment is within this plain. The dominant land use is agricultural. There are only two major surfaced roads extending west from the present highway and both lead to the city of Jebleh. Interchanges are required where the proposed expressway intersects these two roads at 70+200 and 74+025.

The one major river in the area is Al Sinn River. Its source of supply consists of springs at the base of the hillside east of 59+000 from where it flows for a distance of only six kilometers to the sea. Sinn Reservoir located near the river headwaters is impounded by a small dam. The proposed expressway crosses the river approximately 600 meters downstream from the dam. Al Sinn Reservoir is a source of water supply for Lattakia. An existing seventy centimeter diameter pipeline is now in use and another one hundred centimeter diameter pipeline parallel to and six meters from the existing pipeline is under construction. The waterlines extend

north from the Sinn Reservoir across the fields for eight kilometers where they approach the existing highway alignment.

An interchange is recommended at 81+325 where the expressway intersects the existing Tartous-Lattakia Highway. This interchange will accommodate traffic desiring access to or from the expressway between Jebleh and Lattakia.

The expressway location between 58+000 (North of the Banyas Refinery) and 83+000 (North of Jebleh) presents the least problems from an alignment standpoint. The major portion of the recommended expressway alignment in this section is tangent. Frontage roads are provided to accommodate secondary roads severed by the expressway at selected locations in this segment.

The proposed expressway alignment remains on the east side of the existing Tartous Lattakia Highway between 83+000 and 92+000 prior to intersecting the existing Tartous-Lattakia Highway at 92+000. The proposed expressway alignment coincides with the existing Tartous-Lattakia Highway alignment between 92+000 and the end of the Expressway at 92+900. The proposed expressway crosses low rolling ground beginning at 83+000 which contains few buildings and intersects the highway at Haffa at 90+525 just before crossing Al Kabir Al Shamaly River at 91+295. An interchange is recommended at this intersection. Improvements to the at-grade junction with the road to Alleppo occurs at this terminal point of the expressway. Currently, the existing Tartous-Lattakia Highway is being widened to a four lane, divided, limited access, urban arterial street from the terminal point of the proposed expressway toward Lattakia.

The grades between 90+600 and 92+000 must be set to provide an optimum bridge opening at Al Kabir Al Shamaly River which would preclude overbank flooding from reaching the subbase of the proposed expressway. Additional bridge openings to accommodate overbank flooding may be required on the existing Tartous-Lattakia highway which is approximately parallel to and west of the proposed expressway between 91+100 and 91+500. Final determination of these grades and additional bridge openings requirements will require a very comprehensive analysis which is beyond the scope of this feasibility study.

The existing Railroad overpass structure at 92+200 will accommodate the proposed expressway section with minor modifications (e.g. median width, side ditchs, etc.).

c. Fencing and Access Control

Fencing is a means of preventing unwanted and likely hazardous intrusion of animals, people, vehicles, etc., from outside the right-of-way line into the vicinity of moving traffic.

The controlled access expressway operation, wherein drivers will move at high speeds with expectation of protection from roadside interference makes fencing a

definite requirement for this project. It is recommended that the expressway be fenced continuously throughout its length.

Multistrand barbed wire for controlling livestock is recommended for all sections except in the Banyas urban area where chainlink is desirable for controlling pedestrian traffic. The fence should be sited on long, straight continous runs within the right-of-way but outside the limits of grading for side ditches.

Pedestrian/livestock underpasses have been provided at existing trails and at reasonable intervals along the expressway route to discourage this traffic from crossing the expressway traveled lanes after breeching the fence. Frontage roads have been located to encourage vehicle operators to use the interchanges for points of entry. Placed-stone side ditches with a trapizodial section and 1½:1 side slopes will also prevent most vehicles from illegally entering the expressway given an adequate depth of ditch.

d. Lighting, Marking and Signing

Lighting will have a direct effect on the safety of the proposed expressway and on the ease and comfort of operating vehicles. Lighting of rural sections of the expressway is desirable; however, highway research studies have proven that the costs usually exceed the benefits except at interchanges or long bridges. Lighting for this project is recommended only in the urban sections of Banyas and the terminal junction in Lattakia.

Lanes and edge striping must be provided the expressway, frontage roads and cross-roads. Reflectorized prismatic lane delineators separating adjacent traffic lanes are recommended for the entire expressway. Recent studies have indicated that these delineators greatly contribute to the ease and comfort of operating vehicles at night on highways without lighting.

Signing standards will be in accordance with those set by the European conference of Ministers of Transport in Geneva 1971 as modified by the Ministry of Communications Syria Arab Republic. It is recommended that all signing supports be designed as "breakway" type for this project.

8. PROJECT COST ESTIMATE

The objectives stated in the scope of services directed the Consultant to prepare the report in a format that may be used to obtain financing for detailed design, construction and inspection/supervision from external sources such as AID and IBRD and to assess the phasing of the construction of the project road or segments thereof and to recommend the optimum overall construction schedule for the project road network.

The cost estimate for this project was planned, developed and is presented to satisfy the demands of these stringent requirements.

The culmination of project cost estimates is the Budget Cost Estimate shown below and in Appendix D, Summary Sheet 1 for ready reference.

The feasibility cost estimate in 1978 dollars was required in economic analyses, wherein all costs and benefits are stated at 1978 value. Project financing, however, must be based on cost including escalation at prevailing rates, which the Consultant assumes to be 7 percent for U.S. costs and 11 percent for Syrian costs. The Consultant further assumes that the design contract will be negotiated at the beginning of 1979 and will be subject to one-half year of inflation; and that all other costs will be negotiated at mid-1980 and be subject to two years inflation.

TARTOUS-LATTAKIA HIGHWAY PROJECT
SYRIA

SUMMARY: BUDGET COST ESTIMATE

	- In U.S. Dollars -		
	U. S. $ Expenditure	Syrian Expenditure	Total Expenditure
Construction Cost Estimate	$55,062,197	$29,388,957	$84,[illegible]
Engineering Design Estimate. . . . . (Includes, but not limited to, detailed survey and field investigation, soils investigation and testing, total engineering design and documentation, pre-qualification and tendering assistance.)	3,125,671	1,364,473	4,[illegible]
Construction Supervision	1,812,148	1,595,570	3,407,718
Appropriation of Land.	-	20,087,967	20,087,967
Totals.	$60,000,016	$52,436,969	$112,436,985

(The feasibility cost estimate in 1978 dollars was required in economic analyses, wherein all costs and benefits are stated at 1978 value. Project financing, however, must be based on cost including escalation at prevailing rates, which the consultant assumes to be 7% for U.S. costs and 11% for Syrian costs. The consultant further assumes that the design contract will be negotiated at the beginning of 1979 and will be subject to one-half year of inflation; and that all other costs will be negotiated at mid-1980 and be subject to two years inflation. The escalated cost estimate which applies for budget purposes is shown in Table A-6.)

The culmination of project cost estimates for economic purposes is the Feasibility Cost Estimate shown below and again in Appendix D, Summary Sheet 1 for reference purposes.

TARTOUS-LATTAKIA HIGHWAY PROJECT
SYRIA

SUMMARY: FEASIBILITY COST ESTIMATE

	- In 1978 U. S. Dollars -		
	U.S. $ Expenditure	Syrian Expenditure	Total Expenditure
Construction Cost Estimate	$48,093,455	$23,852,737	$71,946,192
Engineering Design Estimate . . . . . (Includes, but not limited to, detailed survey and field investigation, soils investigation and testing, total engineering design and documentation, pre-qualification and tendering assistance.)	3,021,700	1,295,100	4,316,800
Construction Supervision	1,582,800	1,295,000	2,877,800
Appropriation of Land.	-	16,303,846	16,303,846
Totals	$52,697,955	$42,746,683	$95,444,638

(This Feasibility Cost Estimate is based on the application of unit prices developed in the Preliminary Feasibility Cost Estimate reflecting quantities in full accord with preliminary design.)

The construction cost of the highway has been determined by a contractor type estimate to be $71,946,192, to which must be added the $16,303,846 cost of right-of-way, the $4,316,800 cost of surveys and design, and the $2,877,800 cost of construction supervision. The total budget cost is therefore $95,444,638. The construction cost is proportioned in the analysis by Capital Recovery Factor and Series Present Worth with the estimated life of the proposed construction determined from weighted life of seven categories of construction cost. The weighted life of the project is estimated as 60 years.[1/]

The development work required to build to the Feasibility and Budget Cost Estimates is summarized in the Preliminary Feasibility Cost Estimate placed beside them for convenience on Summary Sheet 1 in Appendix D. Based on interim quantity estimates subsequently refined, it is presented for continuity since it terminates the preliminary work and the samples used to illustrate the methodology.

1/ Includes high percentage of right-of-way costs at life of 100 years.

The work began with the assemblage of a data base of equipment, labor materials and prices required, in the United States and Syria, and was followed by an intense field inspection of the project alignment and area to develop feel or awareness.

It was determined the terrain lends itself to a well organized and efficient construction project. Access points to the alignment are numerous and existing traffic and commerce should experience a minimum of delay and inconvenience during construction. There are no excessive cuts or fills along the proposed alignment. With the exception of surface boulders and an area of questionable soil stability, the bulk of excavation is ideal for rubber tired tractor scrapers which have been utilized in the basic earthmoving spread. The boulders can be scalped off with rock rakes and gathered for crushing if satisfactory and/or utilized for rip rap around bridge abutments. Key to the project is the production and classification of aggregates and their utilization in select material, sub base, base, asphalt surfacing, and concrete. The estimate is based on the manufacture and processing of all aggregates including sand, the majority of which will come from river gravel deposits, particularly on the northern end of the project. The southern end does not appear, from preliminary investigation, to have an abundance of sound durable rock.

The cost estimate was developed hauling select material, sub base, and base direct to the embankment and/or aggregate stock piles located along the alignment as depicted on Plate 6 in Appendix D. Concrete and asphalt materials would be hauled to stockpile and incorporated into the work with a portable hot mix plant and a concrete ready mix plant as the work progresses.

A second concrete ready mix (portable) plant would operate near Banyas where all precast concrete work would be preformed.

Precast members are to be hauled to the various structural locations by low-bed trailers in accordance with the work schedule. In place concrete would be poured using transit mix trucks and reusable metal forms with special form trailers utilized in order to cycle form work every 2 or 3 days depending on the structure. A trial estimate was prepared using stay-in-place steel forms for bridge decks, but does not appear economically feasible due to the high costs of ocean freight.

Box culverts would be poured using 40 foot (12.2 Meter) reusuable gang forms and cycled a minimum of every two days. The inside form is on rollers and advances similar to a slip form operation. The outside forms are advanced by crane and are anchored to a stub wall which is poured monolithic with the invert.

The estimate assumes that slope protection concrete will be poured in place; however, final design criteria may prove pre-cast slabs more economical.

The high cost in the estimate for reinforced concrete pipe headwalls is the result of the small quantities per location and forming, stripping and moving time.

Incidental work such as fencing, guard rails, bridge railing, road signs, and painting has been estimated using small specially trained and independently mobile crews with equipment and tools to execute their speciality.

Following assemblage of the data and completion of the project field inspection, work on the cost estimates entered the analysis and development stage. Initial work in this phase, development of direct costs, began with Typical Production Analyses and preparation of Item Analysis spread sheets. A representative sample of these sheets (prepared for all bid items in the estimate) detailing production analysis and summary of direct costs split in equipment rental, operating expense, services tools and supplies, labor expense and materials is shown on Summary Sheet 2 in Appendix D.

The following statements are offered to provide insight and clarification and to form a basis of estimate for the development of direct costs.

Equipment depreciation (rental) rates were developed in most cases using a five year (10,000 hour) straight line schedule. Heavier plant such as crushing equipment and heavy cranes are given a longer depreciation and bulldozers (for example) with heavy rippers were given a shorter life expectancy. Interest rates at 11 percent were calculated over the average capital investment period and added to depreciation to develop the hourly rental rate.

For Example: Caterpillar D9H w/Dozer & Ripper Delivered CIF Tartous U.S. $256,000

$$\text{DEPRECIATION} = \frac{256{,}000}{8100} - \$31.60/\text{hr.}$$

$$\text{Interest}^{1/} = \frac{(.036)\ (256{,}000)}{1000} = \$9.25/\text{hr.}$$

$$\text{Depreciation (Rental) Rate} = 31.60 + 9.25 = \$40.85/\text{hr.}$$

Reusable forms and similar material and/or equipment was depreciated 100 percent on the project.

Tire life was calculated separately and written out over the expected life, depending on the type of equipment and anticipated severity of wear. The original cost of the tires was deducted from the CIF equipment price and placed into a depreciation cost item as a reserve fund for the purchase of replacements.

1/ Interest based upon procedure in Caterpillar Performance Handbook, Edition 8, Chapter 26, Page 9.

Repair parts are normally calculated between 2 and 10 percent of the CIF price for each particular piece of equipment. Rates vary in accordance with the severity of service and previous operating experience. For example the rates for Motor Graders was developed as follows:

Cat. No. 14G CIF Tartous - $106,300 (less tires)

$$\text{Repair Rate} = \frac{(.0425)\ (\$106,300)}{1000} = \$4.50/\text{hr.}$$

$$\text{Tire Rate} = \frac{\$6900}{3000 \text{ hours life}} \text{ (replacement cost)} = \$2.30/\text{hr.}$$

Rates for F.O.G. (fuel, oil and grease) were developed using the Caterpillar Performance Handbook, 8th edition where applicable. A rule of thumb has proven satisfactory under normal operating conditions which provides 1 gal. of fuel/hour per 10 draw bar horsepower or 15 kilowatts of power.

Syrian costs for fuel are substantially unbalanced with gasoline selling at a government controlled price of approximately U.S. $0.87 per U.S. gallon (SP .90/liter) and Diesel fuel at U.S. $0.24 per U.S. gallon (SP .25/liter). For this reason, Diesel fuel rates have been estimated on the high side, in the expectation they may rise.

Services, tools, and supplies usually amount to approximately 10 percent of repair parts. Such items include, but are not limited to welding rod, acetylene, small tools, on site drinking water and sanitary services, and other expendables.

Wages used on direct cost spread sheets included foreman grade and below only. All supervision and indirect local wages are priced as an indirect cost. The rates for foreman grade and below were obtained during the site investigation in Syria and represent the true cost to obtain qualified operating, maintenance, tradesmen, and laboring personnel. The normal practice is to pay monthly wages based on a 46-hour work week. The rates obtained were equated to an hourly basis and an overtime factor applied since the project is based on a 51-hour work schedule. For example:

Heavy equipment operator S.P. 1800/month
= U.S. $462/month
= U.S. $2.45/hour
overtime factor = 1.20

Hourly Rate = (2.45) (1.2) = U.S. $2.94/hour

Adjustments for lost time due to weather and official holidays have been made by increasing the time of each work item by approximately 10 percent.

Permanent materials directly related to items in the bill of quantities are shown both in estimated dollars and Syrian pounds with the major items being reinforcing steel (U.S. $) and asphalt and cement (Syrian Pounds). It

should be noted that both cement and asphalt are currently in short supply and extensive tests should be conducted to assure that Syrian cement will produce high strength concrete required in prestressed pile and bridge beams.

Ocean freight rates used for permanent materials shipped from the U.S.A. were obtained by the Turkish Cargo Lines, and are generally as follows:

Track Type Tractors	$216.00 per Ton-Cube
Construction Equipment	$240.00 per Ton-Cube
Reinforcing Steel & Shapes	$170 to $195.00 per Ton-Cube
Lime or Cement	$216.00 per Ton (2240#)

The estimate does not reflect possible savings from charter rates or space available consignments, nor has a possible port congestion charge of 25 percent been considered.

Costs shown under sub-contracts are Syrian Pound expenditures and reflect such expenditures as drilling water wells, contractor and engineers housing facilities and a small amount of sub-contract hauling.

Due to the large quantities of most bid items in the bill of quantities, the unit prices developed should remain valid within a quantity variation of plus or minus 15 percent.

Estimation of all direct cost items have been totaled and are shown in the Direct Cost Summary Recap on Summary Sheet 3 in Appendix D.

Following development of all project direct costs, effort concentrated on identification and quantification of Indirect Costs and these costs are displayed in summary form parallel and adjacent to direct costs on Summary Sheet 3 in Appendix D.

The indirect costs shown and include salaries and wages for expatriate staff personnel above foremen grade in addition to salaries and wages for Syrian personnel employed in office and support services. Other indirect costs are transportation, vacation, office expenses, communication, camp operation, repair shop operation, contractors and engineers, housing, insurance, and bonds.

A Proposed Contractors Organizational Chart has been prepared and is displayed as Plate 5 in Appendix D.

The estimate has been developed locating the contractor's and engineer's staff housing near the center of gravity of the project at Banyas. A plan sketch of a suggested housing site layout is included as Plate 7 in Appendix D and provides 2 and 3 bedroom housing for family status personnel and apartment type housing for single status.

Extra units have been estimated as a convenience to V.I.P. personnel representing government agencies or other visitors to the project. The estimate assumes this facility becomes the property of the Government of Syria at the conclusion of the construction project.

The contractor's and engineer's office facility has been estimated as a line item in the bill of quantities and the operation of their office is priced separately as an indirect item. A contractors liaison office in Damascus has been included in the estimate as has certain home office expense (USA) considered normal and usual for this type of venture.

It should be specifically noted that in most cases all mechanical, electrical, and lubrication services to the project are priced as an indirect expense under the general shop operation which is also located near Banyas. The specific exception to this are certain support personnel priced directly to the crushing and asphalt operations.

Following identification of all direct and indirect costs, a final Bid Summary sheet was prepared and is shown as Summary Sheet 4 in Appendix D. Summary Sheet 5 in Appendix D shows a recapitulation summary of total direct and indirect costs on the Project Summary Sheet. An over-all contingency factor of 1½ percent plus a contractors margin (profit) of 15 percent has been applied to the total direct and indirect estimate in order to obtain the preliminary feasibility cost estimate.

Mobilization is shown as a lump sum item in the bill of quantities. This amount was developed by analyzing the first eight months of negative cash flow and added to the direct items and subtracted from the indirects. The balance of indirects were then spread equally among the bill of quantity unit prices using a factor of 1.1961 to obtain a balanced bid for the total budget estimate.

Summary Sheet 5 in Appendix D provides a Currency Requirement Analysis in U.S. dollars and Syrian pounds for both direct and indirect spread sheets based on the preliminary budget cost estimate. This is an analysis for the construction contract only and does not reflect engineering or land appropriation requirements which are listed on the Project Summary Sheet also displayed on Summary Sheet 2.

The appropriation of land values are listed in Syrian Pounds on Summary Sheet 5 in Appendix D and converted to dollars for the Preliminary Feasibility Cost Estimate referred to previously and displayed on Summary Sheet 1 in Appendix D.

Cost Estimates summarizing total construction and right-of-way costs were prepared for each of the five segments and the project as a whole for both the

present loading practice continued and the legal load enforced conditions and are presented in Appendix D, Tables 1 to 12. The individual construction items are grouped into categories representing various service life periods.

Cost Estimates for an asphalt overlay were prepared for each of the five segments and the project as a whole for both the present loading practice continued and the legal load enforced conditions and are presented in Appendix D, Tables 13 and 14. Individual construction items are listed.

The above cost estimates when added to engineering costs form the basis for feasibility cost estimates and with escalation, budget cost estimates.

9. MAINTENANCE COST ESTIMATE

The feasibility cost analysis procedure requires the input of estimates of maintenance costs for the purpose of comparing the cost of maintaining (by normal maintenance and additional construction) the existing road, with no traffic relief, with the cost of maintaining (with normal maintenance) both the existing road, with greatly reduced traffic, plus the proposed highway.

Highway maintenance is defined by the American Association of State Highway and Transportation Officials Manual of Uniform Accounting Procedures as follows: "Highway maintenance is the act of preserving and keeping the rights-of-way and each type of roadway, roadside structure and facility as nearly as possible in its original condition as constructed or as subsequently improved, and the operation of highway facilities and services to provide satisfactory and safe highway transportation. Maintenance does not include construction or betterments."

This definition will serve to define normal maintenance for the purposes of this report and cost estimate with the following clarifications: all categories of physical and general maintenance are included, normal traffic services do not include any form of police patrol and no form of unusual or disaster maintenance to include military operations is included.

The present road with its high incidence of overloads is being resurfaced periodically to prevent total deterioration. For the purposes of this study this additional construction is defined as the extraordinary maintenance required to hold the present highway in a condition where normal maintenance will suffice between construction periods. For cost benefit purposes the construction overlays on the existing road are spaced at four-year intervals for the present loading condition (no new construction) and at six-year intervals for legal loading enforcement with reduced traffic.

The cost analysis was prepared by developing a basic maintenance crew and applying an estimate annual number of hours required to meet normal standards.

Basic Crew & Equipment		Crew	Cost/Hour Equipment	Total
District Engineer (1/3 time x 7.40)		2.47	.86	3.33
Maintenance Foreman - Pickup		4.30	2.58	6.88
1 Driver	1 F.B. Truck	1.90	5.10	7.00
2 Drivers	2 Dump Trucks	3.80	12.00	15.80
1 Oper.	1 Motor Grader	3.40	26.30	29.70
1 Oper.	1 Tractor/Mower	1.90	4.25	6.15
1 Oper.	1 Loader/Hoe	3.26	9.10	12.36
1 Oper.	1 325 CFM Compresser	1.90	4.75	6.65
4 Labor	Misc. Air Tools	5.40	.56	5.96
1 Mechanic		2.70	.05	2.75
1 Painter		2.70	.10	2.80
Crew & Equipment Cost/Hour				99.38

ANNUAL MAINTENANCE, (Normal)

Existing 2 Lane Highway

Estimated Hours Required Equal 1200 Hours/Year

	Cost/Year
1200 Hours x $99.38 =	$119,256
Aggregate for Shoulders (2500 MT)($5.13)	12,825
Aggregate for Base Repair (1500 MT)(5.13)	7,695
Asphalt Cement for Repair (656 MT)(19.20)	12,595
Misc. Concrete (150 M^3) (56.37)	8,455
Replace Road Signs	2,409
Painting and Striping Traffic Lines	18,912
Misc. Work	10,000
Annual General Maintenance Cost	$192,147
15% Overhead	28,822
Total	$220,969

Cost/Kilometer Per Year $= \frac{220,969}{82} = \$2,695.00$

ANNUAL MAINTENANCE, (Normal)

New 4 Lane Limited Access Highway

Hours Required - 1800/Year

	Cost/Year
Crew & Equipment (1800)(99.38)	$178,884
Aggregate for Shoulder (500 MT)(5.13)	2,565
A.C. for Patching (200 MT)(19.20)	3,840
Misc. Concrete (50 M^3)(56.37)	2,819
Repair Fences (2 km)(4300)	8,600
Repair Guard Rail (500 M.L.)(27)	13,500
Replace Road Signs	4,660
Painting and Stripping Traffic Lines	40,224
Misc. Work	5,000
Annual General Maintenance Cost	$260,092
15% Overhead	39,014
Total	$299,106

Cost Per Km Per Year = $\frac{299,106}{82}$ = $3,647.00

Due to the condition of the existing two-lane highway a scheduled reconstruction program would be implemented using a travel mix plant, adding asphalt, re-shaping and compacting the reconstructed surface. If a six and a half year reconstruction program was adopted approximately 12.3 kilometers per year would receive a new wearing surface. The crew and equipment hourly and materials costs for this operation is as follows:

ANNUAL MAINTENANCE, (Reconstruction)

Existing 2-Lane Highway

Hours Required Per Year for 12.3 km = 1100 Hr.

	Cost/Year
Crew & Equip. (1100) (295.10)	$324,610
Asphalt Agg. (9000 MT) (8.78)	79,020
Asphalt (1800 MT) (116.00)	208,800
Signs	1,000
Misc. Costs	20,000
	$633,430
15% Overhead	95,014
	$728,444

Conclusions & Recommendations

PART E

LYON

E. CONCLUSIONS AND RECOMMENDATIONS

The consultant has concluded that a four-lane expressway connecting Tartous and Lattakia is economically and technically feasible. The internal rate of return on the proposed project is estimated to be 27.5 percent and the first year rate of return is estimated to be 15.7 percent. The benefit/cost ratio at a 15 percent discount rate is 2.1.

The project has been subdivided into five segments to facilitate consideration of variations in traffic volumes on the segments, and each segment has been subjected to transport analyses, the results of which are shown in Table A-1.

Sensitivity tests for variations in construction costs, user cost savings, and axle load limits have been made; and the consultant's conclusion, based upon those tests, is that the feasibility of the project is not subject to reversal by variations (within reasonable and likely limits) in basic data input for the analyses of economic feasibility. A summary of findings of internal rates of return are shown in Table A-1A. No increases or reductions to construction costs or vehicle operating costs were included in the analysis.

The consultant recommends that the project be funded in accord with the budget cost estimate, and that surveys, design and construction be accomplished without delay to provide for opening of the facility in its entirety in the year 1984. The budget includes a foreign cost component of $60 million (which includes escalation from 1978 to estimated time of contract negotiation), and a Syrian cost component of $52 million (including right-of-way purchase and escalation). The converted Syrian cost component, at an exchange rate of 3.9 Syrian Pounds per U.S. dollar, is SL 203 million.

While not assigned the task of urban transportation planning with the project zone of influence, the consultant nevertheless believes that a comment on the urban transportation problem within the city of Lattakia is within the assigned area of responsibility. The expressway evaluated and recommended in this study terminates at a point near the urban limits of the city in an area where traffic splits into three orientations: 1) the port, 2) the urban center, and 3) areas to the east of the city (i.e. Aleppo, etc.). Expressway traffic with port or urban center orientation will experience congestion in the urban area of Lattakia. The planned Tartous-Lattakia expressway will not reduce the urban problem and will probably be a factor in increasing congestion.

In order to take full advantage of user cost savings which are possible through transportation facility improvements, the transportation network from the end of the presently planned expressway into the city must be examined in detail (with special emphasis on port oriented traffic), and urban transportation network improvements must be accomplished. The consultant, therefore, recommends that a comprehensive study be undertaken to make recommendations relative to the general urban development master plan, to coordinate the transportation network alternatives with the general urban plan, and to evaluate the economic and environmental consequences of alternative urban transportation network improvements.

The study should be general in nature and should not be keyed to any one facility (such as an urban expressway to the port). High benefit low cost improvements in traffic control should receive study in detail equal to that given to proposals for new facilities, and all proposals should be evaluated in sufficient detail to define their economic feasibility and environmental impact.

TABLE B-20

LENGTH OF RAILWAYS BY COMPANY, SECTION AND GAUGE, SAR, 1971 AND 1976
(KILOMETERS)

	1971	1976
Northern Railways		
(Standard gauge - 1.435 m.)		
Midan Ekbes-Aleppo-Topanbey	166	166
Nassibin-Homs-Al Yar'ubieh	82	82
Aleppo-Homs-Koussair	232	232
Homs-Akkari	63	63
Akkari-Tartous	42	42
Al Kamishli-Lattakia	367	746
Total	952	1,331
Hadjaz Railways		
(Narrow gauge - 1.05 m.)		
Damascus-Dar'a	127	127
Dar'a-Naseeb	13	13
Kumm Garz-Busra	34	34
Dar'a-Al Shajara	41	41
Al Shajara-Al Himmeh	25	25
Sergayu-Damascus	67	67
Al Kadam-Qatana	-	34
Total	307	341
Total-Both Railways	1,259	1,672

Source: Statistical Abstract, 1973 and 1977, pp.280 and 305.

Rehabilitation and modernization is also being scheduled for the Aleppo-Hama-Homs line. The existing line is old and in very poor condition. Priority on rehabilitation is being given to the Homs-Hama section because of its connection with a new railroad line being built from Homs to Mahardi. This latter section will transport oil from Homs to serve a large power plant at Mahardi.

The Hedjaz Railway connects Syria with Jordan and is primarily a passenger operation. Its only recent addition to track and road bed is that of the 34 kilometer section from Al-Kadam to Qatana. Various proposals have been made and studies carried out for improving and strengthening this railway.

They include, among others, rehabilitation and conversion to standard gauge of the Damascus-Dar'a section.

Rolling stock of the Northern Railways has increased about 70 per cent, while that of the Hadjaz Railway by only 5 per cent during the period 1971-1976 (Table B-21). The increase in the Northern Railways has been in its power units and freight equipment with locomotives, freight cars, tankers and miscellaneous types of goods cars all registering very substantial growth during this period. The small increase in rolling stock of the Hadjaz Railway has been entirely in its passenger equipment. The increase in rolling stock is part of the government sponsored overall modernization and expansion program of the railways.

TABLE B-21

ROLLING STOCK OF RAILWAYS BY COMPANY, SAR, 1971 AND 1976

Equipment	Northern Railways		Hadjaz Railways	
	1971	1976	1971	1976
Diesel rail cars	11	11	4	10
Locomotives	46	115	35	37
Passenger cars	144	63	59	83
Freight cars	985	1,479	452	437
Tankers	107	243	25	25
Other cars	200	612	9	24
Total	1,493	2,523	584	616

Source: Ministry of Transport, Annual Statistical Report, 1977.

2) Traffic - Freight and Passenger

In 1976, the two railways of Syria carried 1,672,000 tons of freight and 1,137,000 passengers (Tables B-22 and B-23). Compared with 1971, freight tonnage has increased about 47 per cent which is equivalent to an annual rate of 8.1 per cent, while passenger traffic for the same years increased only about 6 per cent overall. Although the increase in rail freight tonnage was substantial, it still lagged well behind the annual growth in the country's Gross Domestic Product of 10.3 per cent for the same six-year period.

The relative significance of rail transport cannot be determined exactly because of the lack of data on total highway tons and ton-kilometers. Data on goods transported by public goods vehicles show only

TABLE B-22

RAILWAY FREIGHT TONNAGE AND TON-KILOMETERS, 1971-1976

	1971	1972	1973	1974	1975	1976
Northern Railways:						
Tons (1,000's)	1,037	1,072	723	913	993	1,650
Ton-kilometers (1,000's)	115,007	143,803	122,004	142,393	144,711	303,229
Average length of haul (km.)	111	134	169	156	146	184
Hedjaz Railways:						
Tons (1,000's)	98	100	105	143	73	22
Ton-kilometers (1,000's)	9,899	10,242	10,058	14,756	7,657	2,093
Average length of haul (km.)	101	102	96	103	105	95
Combined Railways:						
Tons (1,000's)	1,135	1,172	828	1,056	1,066	1,672
Ton-kilometers (1,000's)	124,906	154,045	132,045	157,149	152,368	305,322
Average length of haul (km.)	110	131	159	149	143	183

Source: Ministry of Transport, Annual Statistical Report, 1977.

TABLE B-23

RAILWAY PASSENGERS AND PASSENGER-KILOMETERS, 1971-1976

	1971	1972	1973	1974	1975	1976
Northern Railways:						
Number of Passengers (1,000's)	519	689	484	730	861	772
Number of Passenger-Kms. (1,000's)	60,000	46,809	46,141	76,126	112,130	149,758
Average length of trip	116	68	95	104	130	194
Hedjaz Railways:						
Number of passengers (1,000's)	553	546	504	507	451	365
Number of Passenger-Kms. (1,000's)	23,735	21,885	22,781	25,156	23,468	16,005
Average length of trip	43	40	45	50	52	44
Combined Railways:						
Number of Passengers (1,000's)	1,072	1,035	988	1,237	1,292	1,137
Number of Passenger-Kms. (1,000's)	83,735	68,694	68,922	101,282	135,598	165,763
Average length of trip	78	66	70	82	105	146

Source: Ministry of Transport, Annual Statistical Report, 1977.

approximately 4,038,000 tons and 1,428,365,000 ton-kilometers for 1975.[1/] On the basis of this comparison alone, the railroads would represent 20.9 per cent of the combined rail and public goods vehicles tonnage, and 9.6 per cent of the ton-kilometers. Transport by private and government sector vehicles is also quite substantial in Syria. If these were included, it is likely that the rail's share of total ton-kilometers would drop about 5 per cent.
Nearly all of the rail tonnage is carried by the Northern Railways (Table B-22). In fact, in the years 1975 and 1976, the freight tonnage of the Hadjaz Railways has dropped off to the point where it is not significant in the railway's operations.

Analysis of the 1976 rail freight tonnage on a commodity basis for the two railroads combined shows that 21 per cent of the commodities accounted for 59 per cent of the total tonnage in that year (1976). (See Appendix B, Table 30). These commodities included: flour, cement, iron bars, crude petroleum, fuel oil and carpets. These are primarily high-density bulk commodities, and are thus items of traffic with which the railways can ordinarily compete most successfully with truck transportation. The combined tonnage of the six commodities was 981,400 tons. In 1971 these same commodities had a combined tonnage of 753,100 tons, or 66 per cent of total rail tonnage.

The miscellaneous commodity category of the railroads is large, representing 32 per cent of the total tonnage in 1976 compared with only 12 per cent in 1971. In order to serve the purpose of more complete traffic analysis, the railroads should give consideration to a further breakout of the miscellaneous category.

The relative shares of passenger traffic for the two railways have undergone significant changes in the 1971-1976 period. In 1971, the Hedjaz Railways accounted for about 52 per cent of total rail passengers and 28 per cent of the passenger-kilometers, but by 1976, its percentage of rail passengers had dropped to 32, and percentage of passenger-kilometers to about 10 (Table B-23).

d. Ports

1) Facilities

Syria has major port facilities located on the Mediterranean at Lattakia, Banyas and Tartous. All three port facilities lie within the zone of influence of the Lattakia-Tartous road.

The Lattakia port was designed for handling general cargo primarily, although the port also has a grain elevator with an annual design capacity of 500,000 tons. The grain elevator, built to handle export grain, has thus far operated well below capacity.

1/ Statistical abstract, 1977, pp. 310-311

The port's existing ship berthing space consists of 600 meters of quay at a water depth of 9.5 meters, and 1,350 meters with water depths ranging from 2 to 7 meters. Because of the present lack of adequate deep water berths many of the freighters are loaded and unloaded in the harbor by means of lighters. This is a slow and expensive method of discharging and loading cargo. Design capacity of the existing port is about 1.5 million tons, although it is now handling over 2.0 million tons. This is being accomplished by working two shifts, and by adding handling equipment such as cranes, vehicles and fork lift trucks. There are some bottlenecks, however, in the port operation, including lack of storage space, especially covered storage, and fluctuations in vehicle supply to quickly move the goods out of the harbor area.

Expansion of the port facilities of Lattakia is presently underway with design capacity being increased to 3.0 million tons annually (practical capacity about 5 million tons) by about 1983. In a planned second phase expansion program, design capacity is expected to be increased to 5 million tons with an actual capacity of 7 million tons.

The Port of Tartous is a relatively new facility with operations starting in 1967. It was designed primarily as a bulk commodity port for handling such traffic as phosphate, petroleum, grain, fertilizers, cement and other items. The port is currently undergoing an expansion program to provide a general cargo pier, a pier for handling containers, and a grain elevator. These are in addition to its phosphate handling pier. Construction is expected to be completed by 1983 with port capacity raised to about 3.5 million tons. When the port is fully developed, it is expected to have an annual capacity of six to seven million tons. Full development is anticipated for about 1990.

The Banyas port facilities, located about 40 kilometers south of Lattakia, are designed solely for the handling of petroleum. They consist of five berths for the export and import of crude and light petroleum with a 1977 capacity of 45 million long tons.

2) Traffic

General cargo traffic (exports and imports) for Lattakia port totalled about 2.1 million tons in 1977 (down very slightly from 1976), while for Tartous the tonnage rose sharply to 3.2 million tons (Table B-24). Thirty per cent of the Tartous tonnage was accounted for by exports of phosphate and fuel oil. [1/] Since 1970, general cargo tonnage at the Lattakia port has

[1/] For data on exports and imports by commodity categories for the ports of Lattakia and Tartous, see Tables B-44 through B-47.

remained relatively stable, aside from the influence of the 1973 war. The limited capacity of the existing facility has held down its growth. In contrast the new port of Tartous, which began operation in 1967, had the capacity for growth and by 1975 its general cargo tonnage had exceeded that of Lattakia.

Exports of Iraqi crude oil through the terminal at Banyas ranged between 22,600,000 and 31,100,000 tons during the period 1970 through 1975 (Table B-24). In April 1976, this movement by pipeline was discontinued and has not been resumed. Exports of Syrian crude oil through the port of Tartous have increased by about 2.5 times during the 1970-1976 period with tonnage in the latter year in excess of 9 million tons.

e. Pipeline

There are two international pipelines for moving crude oil across Syria. One originates from production fields in Iraq, crosses to Homs and then continues through three separate lines to terminals at Banyas (Syria) and Tripoli (Lebanon). As mentioned previously, all flows through this pipeline were terminated in April 1976. The second international pipeline originates in Saudi Arabia and terminates in Saida (Lebanon). In 1977, approximately 1 million tons of crude oil moved via this pipeline, compared with a peak of about 21 million tons in 1972.

Syria's domestic crude oil pipeline connects the producing fields in Karachok with the refinery at Homs and from Homs the pipeline runs to Tartous for the transport of export crude. Annual capacity of the line is 14.5 million tons. In 1976, the Karachok-Homs line handled about 10 million tons of crude, while in 1977, the quantity was about 9 million tons. For the same years, the Homs-Tartous line moved 9.0 million tons and 7.2 million tons, respectively.

f. Air Transport

Syria's air transport traffic is primarily international and is handled through its international airport facility at Damascus. Domestic services are operated between Damascus, Aleppo and Deir-ez-zor. Lattakia also has an airport facility, but regular service was discontinued in 1978, because of insufficient demand. Landing facilities are also located at Al Kamishli, Palmyra and Al Thawra, but in 1976 these facilities reported little or no activity (Table B-25). Domestic passenger traffic in recent years has totalled less than 60,000 passengers annually, while freight volumes have been insignificant.

In 1976, the Damascus airport handled 950,000 passengers, an increase of 298,000 (or 46 per cent) over the previous year (Table B-25). For the same period, air freight handled at the airport totalled 6,695 tons, up 1,159 tons from the previous year. Since 1971, air passenger traffic at the Damascus airport has increased by nearly three and one-half times, while air freigh traffic has grown by nearly three times. Syrian Arab Airlines, the nationally-owned and operated airline, accounted for about 34 percent of the international plane arrivals and 44 percent of the total passengers (arrivals and departures) at Damascus airport in 1975. Construction of a new passenger terminal at the Damascus airport in nearing completion with opening scheduled for 1979.

TABLE B-24

SYRIA'S PORT FREIGHT TRAFFIC BY PORT, 1970-1977
(000 MT)

Cargo Type and Facility	1970	1971	1972	1973	1974	1975	1976	1977
General Cargo								
Lattakia								
Exports	465	254	512	310	147	131	262	336
Imports	1,475	1,379	1,132	988	1,618	1,523	1,920	1,797
Total	1,940	1,633	1,644	1,298	1,765	1,654	2,182	2,133
Tartous								
Exports	55	68	78	281	330	515	645	1,067
Imports	407	677	539	516	875	1,225	1,838	2,159
Total	962	745	617	797	1,205	1,740	2,483	3,226
General Cargo								
Both Ports								
Exports	520	322	590	591	477	646	907	1,403
Imports	1,882	2,056	1,671	1,504	2,493	2,748	3,758	3,956
Total	2,402	2,378	2,261	2,095	2,970	3,394	4,665	5,359
Crude Oil								
Banyas								
Exports (Iraq)	31,100	27,800	22,609	29,700	23,000	26,900	7,698	-
Imports	-	-	-	-	-	-	1,851	3,000
Total	31,100	27,800	22,609	29,700	23,000	26,900	9,549	3,000
Tartous								
Exports (Syria)	3,500	3,500	4,200	4,300	6,200	9,500	9,700	1/
Imports	-							
Total Crude Oil, Both Ports	34,600	31,300	26,800	34,000	29,200	36,400	19,249	

Source: Administrators of Tartous and Lattakia Ports and Banyas Oil Terminal, and Statistical Abstracts for appropriate years.

1/ Data are not available.

TABLE B-25

AIR TRANSPORT TRAFFIC AT SAR AIRPORTS, 1971, 1972, 1975 AND 1976

Facility	1971	1972	1975	1976
	Passenger Traffic-Embarked and Disembarked (In thousands)			
Damascus	279.2	305.6	652.3	949.9
Aleppo	30.4	23.0	17.3	11.5
Al Kamishli	19.9	15.8	1.4	-
Lattakia	0.2	1/	-	0.7
Palmyra	-	-	-	-
Deir ez-zor	28.7	23.6	34.6	17.5
Al Thawra	-	-	0.7	0.1
Total	358.4	368.0	706.3	979.7
	Freight Traffic-Loaded and Unloaded (Tons)			
Damascus	2,283.0	2,345.6	5,535.9	6,694.6
Aleppo	25.1	25.4	75.7	107.3
Al Kamishli	11.0	12.0	0.3	-
Lattakia	2.3	6.9	-	1.7
Palmyra	-	-	-	-
Deir ez-zor	4.9	7.7	22.4	3.7
Al Thawra	-	-	-	-
Total	2,326.3	2,397.6	5,634.3	6,807.3
	Number of Plane Arrivals			
Damascus	5,282	6,083	7,385	9,163
Aleppo	436	321	197	186
Al Kamishli	175	112	10	-
Lattakia	59	85	2	90
Palmyra	-	-	-	-
Deir ez-zor	218	176	237	17
Al Thawra	-	-	10	1
Total	6,170	6,777	7,841	9,457

Source: Statistical Abstract, 1973 and 1977.

1/ Less than 100 passengers.

3. METHODOLOGY

a. General

A combination of micro- and macro-economic analysis was used in the Tartous-Lattakia study.

The micro analysis was applied at the level of the primary zone of influence with data being developed on population by Nahia (sub-district) and Mantika (district); for agriculture by Mantika; and for industry and tourism on a specific location basis. Data at the Nahia level were also used to identify and define each of the primary zones of influence.

Macro-economic analysis has been applied in providing the background on the Syrian Arab Republic economy; the relationships of the project road to the national transportation network in general and to the highway network in particular; the identification and analysis of the country's foreign trade (exports and imports); and its transit trade with respect to the national economy and the specific zone of influence.

The general methodology of the economic analysis has been geared toward appraisal of the road projects primarily by quantification of user savings. The application of user savings is a reliable estimate of project benefits for this road since the traffic is already substantial. Projected normal traffic benefits are thus significant for the project road.

b. Identification of the Primary Zone of Influence

1) Significance of the Zones

For the purpose of determining the human resources and economic activities to be impacted by the road improvement project, it was necessary to identify the zone of influence of the road. In general each road has a primary area which embraces land adjacent to and extending back from the road itself. The extent of the primary zone of influence depends upon a number of factors including existing and probable future feeder roads, topography, alternative secondary and main roads in the same general area, the extent of existing development and similar considerations. These factors were taken into consideration by the economic consultants in defining the limits of the zone through their analysis of available statistical data, map and field studies.

Identification of the primary zone of influence for the road is an essential part of the economic analysis aimed at determining local traffic generating sources such as agriculture, industry, tourism and consumption by the population. The primary zone of influence, however, does not provide the full measure of traffic flows for this particular road, because of the large amount of through traffic (export, import and transit) which is associated with the national ports served by the road.

In view of the national and international nature of the traffic handled by the study road, it has thus been necessary to look beyond the primary zone of influence and to examine the status of the National Economy and its existing and estimated future influence upon the study road.

2) Boundaries and Land Area

A detailed study was made of the road project in order to determine a reasonable set of boundaries for the primary zone of influence. Essentially the study required the following steps:

a) An intensive search was made for maps which would show administrative boundaries at the smallest political unit, the Nahia (sub-district). Such maps were located and blue print copies were made for each of the two Mohafazats (provinces) of Lattakia and Tartous.

b) Comparisons of the administrative maps were then made with topographical maps of various scales ranging from 1/25,000 to 1/200,000 showing the road project, and a preliminary listing was made of the mantikas and nahias likely to be included within the primary zone of influence. This preliminary list served as the initial basis for assembling data at the zone of influence level.

c) A field reconnaissance and map study was made of the road and observations of topographic obstacles (mountains, rivers, etc.) and competing roads which would serve to limit the boundaries of the zone of influence were noted. Distances that people will walk or travel by animal transport (donkeys and mules) to the planned roads were also given consideration.

d) Upon return from the field, further review was made of the topographic and administrative maps for the road.

e) Information was obtained from the engineers on the termini of the road project.

f) The limits of the zone of influence were then drawn on each of the administrative unit maps, and the area of the zone was obtained by planimeter measurements.

3) Adjustments of Zone of Influence to Reflect Population and Agriculture Activity Concentration

Once the boundaries and the land area had been determined for the zone of influence, it was necessary in a number of instances to make adjustments in the land area percentages of mantikas not wholly within the zone of influence

in order to more accurately reflect the actual percentages of population and agricultural activity. This was necessary because population and agricultural activity is not evenly distributed throughout many of the mantikas. For example, the Mantika of Lattakia contains five Nahias (Lattakia Center, including the city and surrounding villages; Ein Al Beida; Kastal Mu-af; Kabalieh; and Kassab). According to the population census of 1970 the Nahia of Lattakia Center contained 79 percent of the total population of the Mantika in that year. If Ein Al Beida is added to Lattakia Center, the combined population of these two nahias represented 90 percent of the total Lattakia Mantika population in 1970.[1/]

Similarly in the case of agricultural activity, the Nahia of Lattakia contained 73 percent of the total irrigated land of Lattakia Mantika, according to the agricultural census data.[2/]

Table B-26 shows the adjustments by mantikas for population and agricultural activity for the road's zone of influence. The key adjustments and underlying assumptions are as follows:

a) Population

1) The population of the City of Lattakia was allocated among the three road zones of influence on the basis of relative percentages of estimated ADT's in 1977: Lattakia-Tartous 62 percent; Lattakia-Ariha 31 percent; and Lattakia-Kassab 7 percent.

2) The balance of the population of Lattakia Nahia was allocated on relative land area percentages as follows: Lattakia-Tartous 40 percent; Lattakia-Ariha 30 percent; and Lattakia-Kassab 30 percent.

3) Al Haffeh. The northern part of this Mantika is mountainous, and from field observation it was known that the southern part is the more densely populated area. The population percentage was thus estimated at 52 percent for the Lattakia-Tartous zone of influence, and at 48 percent for the Lattakia-Ariha zone.

4) Tartous. All of the population of the city of Tartous and the Mantika of Al Souda were allocated to the Lattakia-Tartous zone of influence, plus 60 percent of the balance of Tartous Mantika population based upon relative land area of the Mantika within the zone of influence.

b) Agricultural Activity

The relative percentages of agricultural activity applicable to the zone of influence for the Nahia of Lattakia were based upon the area of irrigated arable land. Irrigated land was used in this instance because of the intensive agriculture of this Nahia near the large consumption center of Lattakia.

1/ See Table B-28.

2/ Central Bureau of Statistics, 1970-71 Agricultural Census Data, First Stage Basic Data, Lattakia Mohafazat, p. 17.

For the balance of the Lattakia Mantika, and for all other mantikas, the relative percentages of agricultural activity for the zone of influence were based upon total arable land.

TABLE B-26

ADJUSTMENTS OF LAND AREA PERCENTAGES OF MANTIKAS TO REFLECT POPULATION AND AGRICULTURAL ACTIVITY IN ZONE OF INFLUENCE

Mohafazat and Mantika	Percentage of Mantika Land Area in Zone of Influence[1/]	Percentage of Mantika Population in Zone of Influence	Percentage of Agricultural Activity in Zone of Influence
Lattakia-Tartous Zone			
Lattakia			
Lattakia	8.6	45	29
Jebleh	100.0	100	100
Al Hafeh	38.3	52	52
Al Kirdaha	100.0	100	100
Tartous			
Tartous	41.7	61	44
Banyas	100.0	100	100
Dreikeesh	100.0	100	100
Safita	-	-	-
Sheikh Badr	100.0	100	100

c. Population and Other Social Data

The primary sources of population data were the censuses of 1960 and 1970. Through reference to the volumes published on Mohafazats (Provinces), data were available for both years at the Mantika (District), and Nahia (sub-district) level, as well as for cities, towns and villages.

However, various changes were made in administrative boundaries between the two censuses. Among the more important changes, for example, was the creation of Tartous Mohafazat from the southern portion of Lattakia Mohafazat. To reconcile 1960 and 1970 population data, cities and villages were matched in various mantikas and nahias where boundary changes had occurred, and 1960 data was then estimated in accordance with administrative boundaries of the 1970 census.

Population data were then calculated by mantikas for the zone of influence, including total, rural and urban population and growth trends for the years 1960, 1970 and 1976. Also calculated were data on population density,

[1/] Source: Table B-27.

distribution by broad age groups and labor force. Data on other social indicators, education and health, were compiled by the consultants from the national and mohafazat offices of the Ministries of Education and Health and from annual volumes of the Statistical Abstract issued by the Central Bureau of Statistics. Since these data were published at the national and mohafazat levels only, adjustments were made for the zone of influence on the basis of relative population data as previously developed. Included are data on educational facilities, enrollment and status, and on health facilities and personnel.

d. The Economic Data Base

1) Agriculture

Data relating to the production of crops and livestock in the zone of influence were assembled for the relevant Mohafazats (Provinces) from annual statistical volumes published by the Central Bureau of Statistics (CBS) and the Ministry of Agriculture and Agrarian Reform (MOA). In addition, data were obtained on the Mantika (district) level for the 1976 base year from statistical offices of the MOA.

Because of the large number of individual crops produced in the zones (over 40 different fruits and vegetables, plus other crops), the most important commodities were selected for analysis on the basis of their involvement in transport to market over the proposed road. The commodities and their relative importance by weight are as follows:

Commodities	Percent of Total	Commodities	Percent of Total
Vegetables		Cereals	
Tomatoes	26.4	Wheat	8.9
Cucumbers	6.7	Other	2.1
Squash	8.9	Sub-total	11.0
Haricot beans	2.6	Industrial crops	
Other	12.3		
Sub-total	56.9	Peanuts	2.8
		Other 1/	2.2
Fruits		Sub-total	5.0
Olives	9.4		
Citrus	3.3	Livestock and Products	
Apples	1.7		
Other	4.9	Milk	6.7
Sub-total	19.3	Animals	0.7
		Poultry/eggs	0.4
		Sub-total	7.8
		TOTAL	100.0

1/ Includes dry legumes for food.

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Growth trends over the period 1970-76 were calculated for the commodities and commodity groups shown above by using 3-year averages, 1970/72 and 1974/76. The 3-year averages were used to better assess the longer term trends because annual data vary considerably as a result of fluctuations in rainfall from year to year, and to some extent, from the alternate year bearing characteristics of certain fruits, such as olives and some citrus. Rainfall in each of the 3-year periods was near the 10-year average, with none of the years having had extremely high or low level of rainfall.

Data on total production of the commodities were calculated for the zone of influence on the basis of the percentage of agricultural activity in each mantika that fell within the prescribed zones. See Table B-26 above. The marketable surplus, or quantity of agricultural commodities transported from the farm to market outlets, was determined by deducting on-farm consumption from total production. On-farm consumption was estimated on the basis of FAO per capita data for Syria, farm population of the zones, and adjustments to reflect commodity transport practices within the zones.

Data on related aspects of the zone's agricultural sectors were obtained through interviews with officials in various departments of the MOA, such as Planning, Extension, Animal Health, Forestry, etc., as well as in other organizations such as the State Planning Commission, Agricultural Cooperative Bank, University of Tishrine (Lattakia), Agricultural Engineers Syndicate, General Organization of Fisheries, United Nations Development Programme, and FAO Agricultural Integration Project. Field observations were also made throughout the zones on private and state farms, research stations, development projects, etc. to supplement and verify published data sources.

2) Industry

Estimates of industrial production for the zone of influence were based upon data obtained from the national Statistical Abstract on production of main industrial commodities of the mohafazats of Lattakia and Tartous, and on number of establishments by industry groups and ownership (public and private); field interviews with directors or managers of major public sector enterprises; and with personnel of Ministry of Industry offices in the mohafazats on private sector production. In many cases the information obtained was incomplete. Estimates thus had to be made for those enterprises for which no actual data were available. In order to arrive at output by industry group and total production for the zone of influence, the following procedure was employed:

a) The industry groupings and number of establishments in each group in both the public and private sectors for the mohafazats of Lattakia and Tartous, were obtained from the Statistical Abstract and used as the

industrial base for those mohafazats.

b) Actual data for the establishments surveyed in the public sector; and for those private establishments for which output was reported by the Ministry of Industry offices were allocated to the respective groups.

c) When data were reported in units other than metric tons, conversion factors were obtained directly from industry sources or from secondary data so that total outputs could be placed on a comparable base.

d) For the remaining plants in each industry group which were unable to provide data or could not be contacted because of the time factor, output was calculated where applicable by applying an average production tonnage derived from those reporting industries for the public and private sectors by mohafazats.

e) In those instances where the procedure in d) above was not possible, because of lack of reported data for a particular industry group and sector, national average output data were utilized. These average production figures were then multiplied by the number of enterprises remaining in the group and sector and the tonnages were added to those of the reported outputs to obtain total production by industry group for the public and private sectors.

f) The industry groups by public and private sectors were then summed to obtain total industry output for each of the three mohafazats.

3) Tourism

Historical data on foreign tourism for the zone of influence of the study road were obtained from the Ministry of Tourism in Damascus and from the mohafazat offices in Lattakia and Tartous. Unfortunately there are no historical data available at the mohafazat level for Syrian tourists. Estimates for 1976 were obtained either through the Consultants utilizing the national ratio of Syrian to Non-Syrian tourists or from Ministry of Tourism officials in the mohafazats.

Data from the National Tourism Plan were utilized for projecting the growth of new tourism facilities and of tourists in the zone of influence.

4) Exports and Imports

Traffic associated with international export and import for the zone of influence was analyzed on the basis of general cargo passing through the ports of Lattakia and Tartous, and of land traffic by customs districts. General cargo traffic excludes the Syrian crude petroleum exports from the Port of Tartous, since the petroleum moves entirely by pipeline.

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Historical trend data were obtained for both ports for the eight-year period 1970-1977 on a commodity or commodity group bases. These data were provided by the Port Administrators of both ports. Other data sources were the Statistical Abstract and Statistics of Foreign Trade of Syria both issued by the Central Bureau of Statistics.

Data were calculated by the consultant which permitted a comparison to be made of general cargo imports and exports of Lattakia and Tartous with those for all of Syria. Crude oil exports and imports were excluded in the comparisons.

5) Transit Traffic

Transit traffic was analyzed by the consultants on a number of bases. They included all movements through Syria by customs post; movements through the zone of influence via the Ports of Lattakia and Tartous; roll on - roll off traffic which is a new type of transit traffic utilizing the Ports of Tartous and Lattakia; and empty vehicle movements through the Kassab Customs Post which use all or portions of the Lattakia-Tartous highway. A limited amount of historical trend data for the overall movements were available at the two ports, but information on type of goods being transited was incomplete. Major origin and destination countries were identified and major shifts in this traffic since 1970 were analyzed.

6) Zone Domestic Imports

Zone domestic imports refer to commodities which are produced or processed in other regions of Syria and are then transported into the road study zone of influence. Foreign imports which move directly into the zone via the ports or by land transport are excluded from this category. In some instances, however, such as the following, foreign imports would be counted if they were received by the ports in the zone; transported to such manufacturing cities as Damascus and Aleppo for further processing or even storage; and then returned to the zone.

Four sources of traffic were identified as contributing to the zone domestic imports. They include: petroleum products, consumer goods, manufacturing inputs, and agricultural inputs.

4. CHARACTERISTICS OF THE ZONE OF INFLUENCE

a. Physical Aspects

1) Size

The area of the primary zone of influence of the Lattakia-Tartous highway approximates 2,450 square kilometers. The zone is roughly rectangular in shape, being about 90 km in length and averaging about 27 km in width (see Figure B-1). Its western edge is the Mediterranean Sea and the eastern edge the Jabal An Nusayriyah mountain range which parallels the sea. The northern boundary of the zone follows the Lattakia-Hafeh-Slenfe Road, and the southern boundary bisects Tartous Mantika and follows the southern edge of Dreikeesh Mantika. The zone covers approximately 56.6 per cent of two mohafazats (Provinces): Lattakia to the north and Tartous to the south. The percentage and amount of land area of the various mantikas which lie within this zone of influence are shown in Table B-27.

2) Topography

The topography of this zone is dominated by the Coastal Plain extending inland from the sea for variable distances of about 5 to 15 kilometers between Tartous and Lattakia. Easterly of the Coastal Plain are the foothills rising toward the mountain range. Average east-west width of the foothills is 15 to 20 kilometers. Beyond the foothills, the terrain becomes much more rugged with peaks over 1,500 meters.

3) Climate

The climate of the Lattakia-Tartous zone is typically Mediterranean, with winter rainfall occurring from October through March and with little or no rain from April through September. Over the past 10 years, annual rainfall has averaged between 825 and 1,088 mm. (32 to 43 in.) at various locations in the zone, the rainfall increasing with rising altitude. Temperatures in winter rarely drop to freezing in the Coastal Plain, and are only slightly colder in the foothills. Citrus and other frost sensitive cool weather crops thrive in the coastal zone, but summer crops may be grown from March through October where irrigation is feasible. The high summer temperatures and low relative air humidity may exhaust temporary soil moisture reserves from the rainy season by midsummer in the Coastal Plain. However, tree crops that are deeper rooted may continue growth and produce a fruit crop for fall harvest.

4) Geology and Soils (Relative to Agriculture)

The Coastal Plain is occupied by marine deposits that have been uplifted some thousands of years ago, but contain appreciable amounts of marl and limestone, so that the soils are never acid. Soil texture ranges from loam to clay loam, and the heavier textured soils may be deficient in internal drainage

TABLE B-27

TARTOUS-LATTAKIA ZONE OF INFLUENCE, DEFINED BY MANTIKA

Mohafazat and Mantika	Area 1/ (Km2)	Percent of Mantika in Zone of Influence	Area of Zone of Influence (Km2)
Lattakia	2,436		
Lattakia	1,000	8.6 2/	86 2/
Jebleh	607	100.0	607
Al Hafeh	457	38.3 2/	175 2/
Al Kirdaha	372	100.0	372
Tartous	1,890		
Tartous	571	41.7 2/	238 2/
Banyas	585	100.0	585
Dreikeesh	188	100.0	188
Safita	347	-	-
Sheikh Badr	199	100.0	199
Total or Average	4,326	56.6	2,450

1/ Data are from Central Bureau of Statistics, Population Census 1970, Lattakia and Tartous Governorates, Vols. 7 and 8.

2/ Based upon planimeter measurements of administration zone maps 1/100,000 Scale.

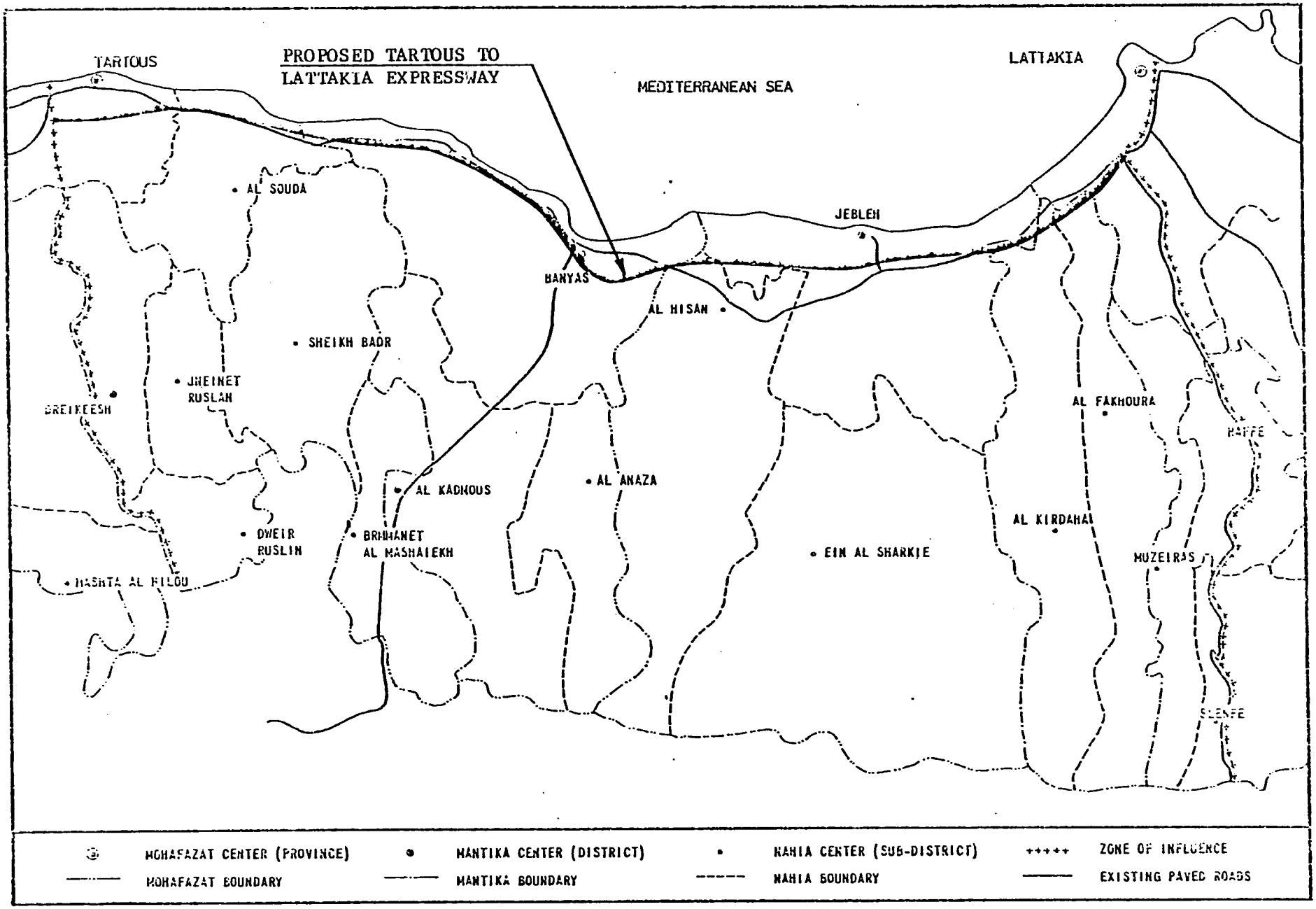

FIGURE B-1
ZONE OF INFLUENCE

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during the winter rainy season. These Coastal Plain soils are quite responsive to the use of fertilizers, particularly phosphates, and also to nitrogen fertilizers for non-legume plant species.

The foothills consist of marl and limestone, usually with thin or stony soils that are relatively low in soil fertility. The relatively steep slopes cause rapid runoff of rains so that erosion is a constraint, and storage of moisture in the soil profile is reduced. At higher elevations, igneous rocks occur, and the soils are less alkaline.

The mature soils of the Coastal Plain upland are typical reddish Mediterranean soils produced by weathering of the marine sediments. The foothill soils are yellowish in color, low in organic matter, and low in native fertility. They are mostly non-arable, but olives and other tree fruits are grown extensively. Alluvial soils occupy the valleys of all streams, and these soils are generally quite fertile. Being generally flat in topography, they are mostly arable.

5) Land Use

A relatively high proportion of the total land area in Lattakia and Tartous Mohafazats is cultivable, with 56.6 per cent being so classified in 1976. In contrast, only 31.8 per cent of Syria's total land area is cultivable. (See Appendix B, Table 5.) In addition, essentially all of the land that is cultivable in these mohafazats is presently being cropped: while 17.8 per cent of this land was held fallow in 1970, by 1976 the per cent fallow was only 1.7 per cent. For the nation as a whole, fallow land was 22 per cent of total cultivable land in 1976.

In 1976, it is estimated that there were approximately 135,763 hectares of cultivable land in the Lattakia-Tartous zone of influence. This was 57.4 per cent of the cultivable land in the two mohafazats. (See Appendix B, Table 31.) Of the zone's cultivable land, 114,946 hectares or 84.7 per cent was rainfed, and 20,817 or 15.3 per cent was irrigated.

The proportion of land brought under irrigation has been increasing during recent years, rising from 10.7 per cent of the cultivable land in the two mohafazats in 1970 to 13.9 per cent in 1976. Of the total irrigated land, about 85 per cent is irrigated with pumps, with just over half the pumps operating from wells and just under half from rivers.

However, the bulk of the zone's cultivable land is rainfed, and as there are substantial annual fluctuations in rainfall, agricultural production can vary considerably from year to year. On the other hand, these rainfall variations are less pronounced in the zone than in the more arid areas of the country.

Color land-use maps of the zone of influence may be found in the environmental impact report prepared for this highway project.

6) Vegetation and Cultivated Crops

Native vegetation is almost non-existent in this zone of influence, and agricultural land use is the index to the total environment. Intensive culture of vegetables, citrus and some tree fruits occur throughout the Coastal Plain. Irrigation from streams, local wells, dams and canals is being strongly developed where suitable lands are adjacent to water sources. Soil zones that are imperfectly drained in the cool season are cropped to summer crops as the main effort. Tree crops are limited to soils with adequate internal drainage in the rainy season. Tree crops constitute the principal use of the foothills, as well as stony lowland soils. Olives predominate, but apricots, apples, pears, peaches, grapes, etc., are grown to some extent.

The Coastal Plain -- both upland and alluvial soils -- is the region of intensive agriculture with vegetables and citrus of greatest importance. This is the region where inter-cropping in citrus and olive orchards, double cropping where irrigation is feasible, and other intensive systems offer potential for increased productivity. The potentials for increases in the hill lands are limited but may include winter forages grown between rows or tree crops.

b. Socio-Economic Aspects

1) Population

a) Present and Historical Growth. The total population of the Lattakia-Tartous zone of influence was estimated at 533,960 in 1976 (see Table B-28). This represents an increase of about 85,000 over the population reported in the 1970 census, and is equivalent to an annual average growth rate of 3.0 per cent for the six-year period. For the same period, the national population is estimated to have grown at an annual average rate of 3.3 per cent.

Mantika growth rates ranged from 4.4 per cent in Lattakia Mantika to 1.2 per cent in Al Kirdaha. Of the eight Mantikas represented in the zone of influence, the four with cities along the coast -- Lattakia, Jebleh, Banyas and Tartous -- together represented about 74 per cent of the total zone population.

b) Density. The population density in the zone of influence averaged 218 persons per square kilometer in 1976 (see Table B-29). In contrast, the national population density averaged about 43 persons per square kilometer for the same year. The zone's major population centers, Lattakia and Tartous, had densities of 1,417 and 310 people per square kilometer, respectively, while the densities in the other mantikas of the zone ranged from 209 to 99 people per square kilometer.

TABLE B-28

TARTOUS-LATTAKIA ZONE OF INFLUENCE TOTAL POPULATION AND ANNUAL GROWTH RATE BY MANTIKA, 1960, 1970, AND ESTIMATED FOR 1976

Mohafazat and Mantika	Population 1/ 1960	Population 1/ 1970	Annual average growth rate Percent	Estimated Population 1976 2/
Lattakia				
Lattakia	61,403	94,135	4.4	121,886
Jebleh	62,344	92,145	4.0	116,592
Al Hafeh	23,740	28,127	1.7	31,121
Al Kirdaha	30,361	34,128	1.2	36,660
Tartous				
Tartous	46,197	61,791	3.0	73,782
Banyas	66,122	77,496	1.6	85,239
Dreikeesh	28,196	34,736	2.1	39,348
Sheikh Badr	21,479	26,100	2.0	29,332
Total or Average	339,842	448,657	3.0	533,960

1/ Calculated by applying population percentage factor of Table B-26 to the total Mantika population shown in Appendix B, Tables 33 and 34.

2/ Based upon extrapolation of annual average growth rate, 1960 to 1970.

TABLE B-29

Tartous-Lattakia Primary Zone of Influence
Population Density by Mantika, 1976

Mohafazat and Mantika	Population 1976	Area in Zone of Influence (km^2)	Density (persons per km^2)
Lattakia			
Lattakia	121,886	86	1,417
Jebleh	116,592	607	192
Al Hafeh	31,121	175	178
Al Kirdaha	36,660	372	99
Tartous			
Tartous	73,782	238	310
Banyas	85,239	585	146
Dreikeesh	39,348	188	209
Sheikh Badr	29,332	199	147
Total or Average	533,960	2,450	218

Source: Base data from Tables B-27 and B-28.

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c) Broad Age Groups. The zone of influence is characterized by a young population. The dominant age group, which accounts for 49.3 per cent of the total population, is composed of persons through fourteen years of age. See Table B-30. This is the same percentage that this age group occupies at the national level, and in the mantikas of the zone this age group's percentage ranges between 48.2 per cent for Lattakia Mantika to 51.7 per cent for Dreikeesh Mantika.

d) Urban and Rural. In 1976, the composition of the zone's population was estimated as 62.9 per cent rural and 37.1 per cent urban. See Table B-31. By comparison, the country as a whole is 56.5 per cent rural and 43.5 per cent urban. The trend within the zone, however, is toward urbanization with the percentage of the rural population dropping from 75.9 per cent in 1960 to 67.6 per cent in 1970 and about 63 per cent in 1976. (See Appendix B, Tables 35 and 36.) Expressed in terms of annual averages, over the 1960-70 period the urban growth rate of the zone was 5.9 per cent while the rural growth rate was 1.6 per cent. As shown in Appendix B, Table 37, the 1970-76 growth rates were estimated at 5.3 per cent for urban population and 1.7 per cent for rural population.

e) Labor Force. The economically active population (10 years of age and over) accounted for 37.8 per cent of the zone's total population in 1970, and the range among mantikas was from 34.0 to 43.0 per cent. See Table B-32. The national percentage of economically active population in 1970 was 38.9 per cent.

The ratio of male to female in the economically active population of the zone was 84/16, compared to a national ratio of 89/11.

Agriculture is the major source of employment in the zone, with 60.7 per cent of the economically active population engaged in this sector in 1970. See Table B-33. Among the industries employing between 5 and 10 per cent of the economically active population were Services, Wholesale/Retail Trade, Manufacturing, Transport and Construction.

While the mantikas having major cities, Lattakia and Tartous, had only 30.8 and 48.7 per cent, respectively, of their economically active population engaged in agriculture, the other mantikas of the zone had between 65.3 and 80.0 per cent of their populations employed in this sector.

2) Education

a) Facilities and Enrollments. Educational facilities in the Lattakia-Tartous zone of influence are almost entirely State-owned. The entering age into primary school is six years, and education is compulsory through the twelfth year of school. This includes six years of primary school, three

TABLE B-30

Tartous-Lattakia Primary Zone of Influence
Population by Broad Age Groups, 1970

Mohafazat and Mantika	AGE GROUPS					
	less than 1 year-14	15-29	30-44	45-59	60 and over	Total
Lattakia						
Lattakia	45,338	20,988	14,814	7,262	5,733	94,135
Jebleh	46,145	19,609	11,642	8,558	6,191	92,145
Al Hafeh	13,509	6,166	3,951	2,368	2,133	28,127
Al Kirdaha	16,998	7,199	4,130	3,320	2,481	34,128
Tartous						
Tartous	29,822	13,946	8,875	4,787	4,361	61,791
Banyas	38,895	16,752	10,609	5,757	5,483	77,496
Dreikeesh	17,952	7,112	4,703	2,578	2,390	34,735
Sheikh Badr	12,846	5,922	3,463	2,042	1,827	26,100
Total	221,505	97,694	62,187	36,672	30,599	448,657
Percentage distribution	49.3	21.8	13.9	8.2	6.8	100.0

Source: Computed from Population Census of 1970.

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TABLE B-31

Tartous-Lattakia Primary Zone of Influence
Estimated Urban and Rural Population by Mantika, 1976

Mohafazat and Mantika	Annual Growth Rate 1960-70[1]		1970 Population		1976 Estimated Population[2]		
	Urban	Rural	Urban	Rural	Urban	Rural	Total
Lattakia							
Lattakia	6.4	-1.9	77,944	16,191	107,424	14,462	121,886
Jebleh	4.6	3.9	16,660	75,485	21,820	94,772	116,592
Al Hafeh	---	1.7	---	28,127	---	31,121	31,121
Al Kirdaha	0.8	1.2	3,357	30,771	3,521	33,139	36,660
Tartous							
Tartous	6.9	0.4	29,842	31,949	42,331	31,451	73,782
Banyas	5.0	1.0	13,787	63,709	18,476	66,763	85,239
Dreikeesh	3.1	2.0	3,357	31,378	4,032	35,316	39,348
Sheikh Badr	---	1.9	467	25,633	558[3]	28,774	29,332
Total or Average	5.9	1.6	145,414	303,243	198,162	335,798	533,960
Percentage			32.4	67.6	37.1	62.9	

[1] Calculated from Appendix B, Tables 35 and 36.

[2] See Appendix B, Table 37 for growth rates used in projecting population.

[3] Estimated by the Consultant by applying a 3.0 percent growth rate 1970-1976.

TABLE B-32

TARTOUS-LATTAKIA PRIMARY ZONE OF INFLUENCE, ECONOMICALLY ACTIVE AND INACTIVE POPULATION (10 YEARS OF AGE AND OVER), BY MANTIKA, 1970

Mohafazat and Mantika	Economically Active		Economically Inactive		Total	
	No.	%	No.	%	No.	%
Lattakia						
Lattakia	24,170	39.3	37,296	60.7	61,466	100.0
Jableh	22,937	38.5	36,659	61.5	59,596	100.0
Al-Haffeh	7,932	43.0	10,517	57.0	18,449	100.0
Al-Kirdaha	7,971	36.1	14,093	63.9	22,064	100.0
Tartous						
Tartous	14,814	36.7	25,600	63.6	40,414	100.0
Banias	18,060	36.3	31,672	63.7	49,732	100.0
Dreikeesh	7,380	34.0	14,350	66.0	21,730	100.0
Sheikh Badr	6,448	38.1	10,466	61.9	16,914	100.0
Total or Average	109,712	37.8	180,653	62.2	290,365	100.0

Source: Computed from the Population Census of 1970.

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TABLE B-33

TARTOUS-LATTAKIA PRIMARY ZONE OF INFLUENCE, ECONOMICALLY ACTIVE POPULATION (10 YEARS OF AGE AND OVER), BY INDUSTRY AND MANTIKA, 1970

Mohafazat and Mantika	Agriculture 1/	Manufacturing 2/	Construction 3/	Wholesale & Retail 4/	Transport 5/	Services 6/	Other 7/	Total
Lattakia								
Lattakia	7,445	3,782	1,627	2,967	2,732	3,970	1,647	24,170
Jableh	17,512	804	627	924	442	1,691	937	22,937
Al-Haffeh	6,198	212	355	282	134	504	257	7,932
Al-Kirdaha	6,215	216	357	183	138	414	448	7,971
Tartous								
Tartous	7,222	932	1,296	1,340	1,270	1,873	881	14,814
Banias	12,101	683	947	855	1,182	1,482	810	18,060
Dreikeesh	4,818	202	480	330	173	581	796	7,380
Sheikh Badr	5,135	131	257	167	160	351	247	6,448
Total	66,636	6,962	5,946	7,048	6,231	10,866	6,023	109,712
Percentage Distribution	60.7	6.3	5.4	6.4	5.7	9.9	5.6	100.0

Source: Computed from the Population Census, 1970.

1/ Agriculture, forestry, hunting and fishing (of which agriculture = 98.6 per cent).
2/ Manufacturing.
3/ Construction and building.
4/ Wholesale and retail trade, restaurants and hotels.
5/ Transport, storage and communications.
6/ Community, social and personal services.
7/ Includes mining and quarrying, utilities, financing, insurance, real estate and business services.

years of intermediate school, and three years of secondary school. Statistics on schools, enrollments, numbers of teachers, and pupil-teacher ratios for 1970/71 and 1975/76 for this zone of influence have been calculated and are shown in Table B-34.

As shown in this table, the pupil-teacher ratios in the zone of influence have improved approximately 25 per cent at the primary school level and 29 per cent at the intermediate and secondary school level between 1970/71 and 1975/76. During this period, the number of primary school students grew at an annual average of 6.3 per cent, whereas the number of primary school teachers increased at a rate of 12.8 per cent annually. The number of schools increased from 466 to 605. At the intermediate and secondary school levels, enrollments grew at a rate of 9.6 per cent a year from 1970/71 to 1975/76, and number of teachers increased at a rate of 14.0 per cent. The number of schools rose from 104 to 142 during the period.

Of Syria's three universities, one (Tishreen University) is located within this zone of influence. New facilities for this university are being built and offerings are to be expanded when the new premises become operative around 1995. In 1976, the university graduated 181 persons: 110 in agriculture, 41 in letters, and 30 in science.

b) Planned Investment

Contemplated investments in education in the Mohafazats of Lattakia and Tartous during the Fourth Five-Year Plan (1976-1980) are shown in Table B-35. However, work on projects of the Third Five-Year Plan (1971-1975) is still in progress, so the goals of the succeeding plan reportedly will not be attained until the early 1980's.

c) Educational Status

The average literacy rate for the zone of influence was 51.9 per cent in 1970. It includes persons who can read or write but do not hold certificates (the definition of literacy in Syria) as well as the holders of degrees (see Table B-36). This was near the national average of 54.2 per cent. Among the various mantikas of the zone, the literacy rate was highest in the major urban areas, with Lattakia and Tartous each having a 55.1 per cent rate. Rates in other mantikas ranged from 43.3 to 53.6 per cent.

3) Health

a) Current Situation

Health services in the Lattakia-Tartous zone of influence have improved markedly in recent years as a result of increased government attention to this sector. The number of professionals and the local population per

TABLE B-34

EDUCATIONAL FACILITIES AND ENROLLMENTS IN THE TARTOUS-LATTAKIA ZONE OF INFLUENCE, 1970/71 AND 1975/76

Type of School	1970/71			1975/76		
	Lattakia	Tartous	Total	Lattakia	Tartous	Total
Primary:						
No. Schools	242	224	466	293	312	605
No. Students	44,959	33,491	78,450	59,370	47,039	106,409
No. Teachers	1,046	744	1,790	1,799	1,470	3,269
No. Classrooms	1,544	1,458	3,002	1,872	2,028	3,900
No. Students per Teacher	43	45	44	33	32	33
Intermediate and Secondary:						
No. Schools	55	49	104	79	63	142
No. Students	19,045	14,381	33,426	30,070	22,752	52,822
No. Teachers	733	575	1,308	1,432	1,083	2,515
No. Classrooms	350	478	828	502	410	912
No. Students per Teacher	26	25	26	21	21	21

Sources: Statistical Abstracts, 1973 and 1977, based on data from the Ministry of Education. See also Appendix B, Table 38.

TABLE B-35

PLANNED EDUCATIONAL PROJECTS IN TARTOUS AND LATTAKIA MOHAFAZATS, FOURTH FIVE-YEAR PLAN, 1976/80

Projects	Project Cost (000 SL)		
	Lattakia	Tartous	Total
New Projects:			
Primary education	36,000	33,000	69,000
Preparatory & Secondary education	30,000	21,000	51,000
Vocational education	16,000	4,000	20,000
Normal schools	16,000	14,000	30,000
Sub-total	98,000	72,000	170,000
Reserve Projects:			
Primary education	50,000	31,000	81,000
Preparatory & Secondary education	21,000	16,000	37,000
Sub-total	71,000	47,000	118,000
Total	169,000	119,000	288,000

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professional in the zone during 1975-77 have been as follows:

Profession	Number of Professionals 1975	1976	1977	Number of Persons Per Professional 1975	1976	1977
Doctors	98	108	198	5,280	4,951	2,778
Dentists	31	34	56	16,851	15,921	9,821
Nurses	71	78	155	7,266	6,823	3,548
Pharmacists	45	48	68	11,647	11,123	8,088

Source: Ministry of Health, Lattakia and Tartous offi[illegible].

Health facilities in the zone of influence include two State hospitals, one of 350 beds in the City of Lattakia, and one of 177 beds in the City of Jableh. Lattakia City also has two health centers, a malaria center, and a quarantine center at the port. Additional facilities comprise health centers at Jebleh, Al Kirdaha, and Jobet Bourgal. A nursing school is under construction in Lattakia City, as are health centers at Al Boudi and Al Fakhourah.

In the southern part of the zone of influence, an existing 150-bed hospital in the City of Tartous is being enlarged. A 500-bed tuberculosis sanitorium is located at Kadmous, and there are health clinics at Banyas, Al Kadmous, Al Anaza, Dreikeesh, Arwad Island, Dwier Rusian and Brimanent Al Mashaiekh.

The principal health problems in the Lattakia-Tartous zone of influence are malaria in the Senn River swamp area; gastro-intestinal disorders (typhoid, cholera, dysentery) during the summer months; and pulmonary diseases during the winter. In general, the health of the population in the zone is good. No dietary diseases are reported, and with the exception of seasonal shortages there appear to be adequate supplies of fruits and vegetables, and protein.

The principal causes of death from disease in the zone are coronaries, malignant tumors, and complications resulting from diabetes. A major non-disease related cause is that of road accidents, especially involving buses.

The Syrian government has just adopted measures to help improve sanitary conditions throughout the country. Two laws were passed in May 1978 providing, respectively, a fine of 100 Syrian pounds for littering the streets, and a fine of 300 Syrian pounds for dumping building materials on the street. Enforcement is assigned to the Police Departments of the respective mohafazats

TABLE B-36

Tartous Lattakia Primary Zone of Influence
Educational Status of Population
(10 Years of Age and Over) by Mantika, 1970

Mohafazat and Mantika	Educational Status							
	Illiterate		Literate 1/		Holders of Certificates Through University Degrees		Total	
	No.	%	No.	%	No.	%	No.	%
Lattakia								
Lattakia	27,569	44.9	16,519	26.9	17,378	28.3	61,466	100.0
Jebleh	27,664	46.4	16,654	27.9	15,278	25.6	59,596	100.0
Al Hafeh	10,469	56.7	4,521	24.5	3,459	18.8	18,449	100.0
Al Kirdaha	11,144	50.5	5,921	26.8	4,999	22.7	22,064	100.0
Tartous								
Tartous	18,138	44.9	12,504	30.9	9,772	24.2	40,414	100.0
Banyas	25,546	51.4	13,147	26.4	11,039	22.2	49,732	100.0
Dreikeesh	10,595	48.7	6,706	30.9	4,429	20.4	21,730	100.0
Sheikh Badr	8,492	50.2	4,752	28.1	3,670	21.7	16,914	100.0
Total or Average	139,617	48.1	80,724	27.8	70,024	24.1	290,365	100.0

Source: Computed from the Population Census of 1970.

1/ Includes all persons who can read or write but do not hold certificates.

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and to the Security Police. In addition, Tartous Mohafazat is requiring its pollution-generating industries to relocate outside the city limits.

b) Planned Development

Planned construction of health facilities in the Lattakia portion of the zone during the Fourth Five-Year Plan (1976-1980) is expected to total about SL 53 million, according to Table B-37. According to the Lattakia Office of the Ministry of Health, the two reserve projects will not be undertaken for some 10 years.

Planned additions to health facilities in the southern portion of the zone of influence (Tartous Mohafazat) include a 400-bed hospital and nursing school in the eastern sector of the City of Tartous; a 100-bed hospital at Banyas (a reserve project that may not be built until the Fifth Five-Year Plan, 1981-1985); and health centers at Al Souda, Al Sheikh Badar and Hmaymim. All new projects in the Fourth Five-Year Plan, except the new hospital at Tartous, reportedly will be completed by the end of 1978. The Tartous hospital will require four years to complete. By the end of 1978, there will be one health center for about each 5,000 persons in the Tartous sector of the zone of influence. The cost of the planned projects in the Tartous sector of the zone of influence is about SL 91 million for the five-year period 1976-1980 as shown in Table B-37.

An additional dispensary, to be located at Al-Rawda in Tartous Mantika, was authorized in May 1978. It is to be built in 1979.

Total planned expenditures for health facilities in the zone of influence are about SL 143 million for the 1976-1980 period.

c. Economic Activity

1) Agriculture

a) Agriculture's Role in the Zone.

The agricultural sector plays a major role in the economic activity of the Lattakia-Tartous zone of influence. Located within the highest rainfall area of Syria, essentially all of the zone's cultivable land is presently used to produce food and other agricultural commodities.

This agricultural activity has developed into a specialized type of production which is oriented chiefly toward horticultural crops. Thus the zone is one of the nation's major tree fruit areas, and produces a wide variety of fruits. The zone is essentially the nation's only producer of citrus, and is a leading producer of olives, apples and plums. In addition, vegetable crops of many types are intensively cultivated. The zone is also the country's primary producer of peanuts, as well as of tobacco, which is an important export commodity and foreign exchange earner.

TABLE B-37

Planned Construction of Health Facilities in
Tartous-Lattakia Zone of Influence
Fourth Five-Year Plan, 1976-1980

Projects	Cost (000 SL)
A. Northern Portion of Zone	
1. Projects carried forward:	
Completion and extension of Lattakia Hospital	10,574
Completion and extension of Jebleh Hospital	2,811
Sub-Total	13,385
2. New projects:	
Advanced health centers	900
Creation of a nursing school in Lattakia	2,500
Sub-Total	3,400
3. Reserve projects:	
Maternity hospital in Lattakia City	27,000
Al-Kirdaha hospital	9,000
Sub-Total	36,000
Total	52,785
B. Southern Portion of Zone	
1. Projects carried forward:	
Completion of Tartous hospital	70,000
2. New projects:	
Health directorate and quarantine station	2,000
Enlargement of old Tartous hospital	6,000
Advanced health centers	2,700
Creation of a nursing school	850
Sub-Total	11,550
3. Reserve projects:	
Construction of Banyas hospital	9,000
Total	90,550

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Along with its specialized type of production, the zone's agricultural sector is also commercially oriented: only a relatively small proportion of the commodities are consumed on the farm. Most of the farm output is produced for sale and is marketed not only within the zone itself but also in various other population centers of the country.

The agricultural sector is also the major source of employment for the zone's economically active population. Nearly 61 per cent of the zone's total labor force is employed in this sector. See Table B-33. In addition, in view of the commercial aspects of the zone's agriculture, substantial numbers of persons are also employed in the marketing, transporting, and processing of agricultural commodities.

In 1976 the farm population of the zone was estimated at 282,406 or 84.1 per cent of the zone's rural population of 335,798.[1/] Of the zone's total cultivable land area, 59.0 per cent was privately held while 40.9 per cent was in the cooperative sector and 0.1 per cent in the public sector. (See Appendix B, Table 9.) Under the agrarian reform program 17,000 hec. of land in Lattakia and Tartous Mohafazats were expropriated, and of this total, 13,400 hec. were distributed to farmers while 3,600 were excluded or sold. (See Appendix B, Table 7.) The average size of farms in Lattakia and Tartous Mohafazats was 2.0 and 4.2 hec. and reflects the more intensive type of horticulturally based agriculture in the zone.

b) Agricultural Practices.

(1) Vegetables. The Coastal Plain is the site of virtually all vegetable production, which is produced under relatively intensive systems of culture. Approximately 15 per cent of total arable land is presently irrigated, but virtually all summer vegetables are grown on such lands. These irrigated crops include tomatoes, haricot beans, eggplant, squash, cucumber and green peppers. Also produced are cabbage, cauliflower, leaf beet and lettuce. However, lettuce is also grown as a spring crop depending on natural rainfall alone. Potatoes are planted in February, and most growth is made with winter and spring rainfall, but supplemental irrigation may be given in early summer to mature the crop if soil moisture is exhausted. Melons and dry onions are spring planted and the crops generally receive no irrigation. Cool season vegetables, grown with natural rainfall only, include broadbeans, chickpeas and lettuce. Broadbean fields vary widely in apparent productivity.

1/ Based on 1970-71 Agricultural Census Data on main occupations of land holders in Lattakia and Tartous Mohafazats.

(2) Fruit. All citrus fruit is grown under irrigation. The following fruits are grown partly under irrigation and partly with natural winter rainfall on both Coastal Plain and in foothills: apricots, apples, plums, peaches and pomegranates. Non-irrigated fruits, grown principally in stony soils of the Coastal Plain and in upland hill zones, include olives, grapes, figs, pears and almonds. There is very little intercropping in fruit orchards, except on new plantings. Present culture does not include the growth of cool season green manure crops nor any soil improving crops.

(3) Cereal Grains. These consist mostly of wheat and barley which are grown as winter crops with natural rainfall. There appears to be little production of summer crops on grain fields as a second crop in the warm season. Yields of these grains appear to be quite low; most fields have thin stands, and plant color indicates nitrogen deficiency.

(4) Industrial Crops. These include tobacco, sesame, and dry beans. They are grown as summer crops with little or no irrigation. Tobacco is by far the most important of these in terms of market value, although the hectareage is not large. There are curing barns in Lattakia, near Jableh, and probably elsewhere, with side vents to facilitate slow curing of fresh leaf. Tobacco is well fertilized on fertile soils as a major cash crop by certain farmers. Sesame is grown to a limited extent for its edible oil and for use in baking rolls and some types of bread.

(5) Livestock. Cows, sheep and goats appear to be maintained by nearly all rural families, largely for family milk requirements. Cows are generally kept on tether and are grazed on roadsides, ditches, and small stony areas. They are sustained in summer by crop residues that are carried to them. Sheep and goats are generally herded, but the numbers are small. The concept of livestock production as an integral part of farming systems does not exist in sufficient quantity to produce any sizeable marketable surpluses. There are insufficient ruminant livestock at present to consume green forage that might well be produced as winter crops, or grown between rows of trees in orchards, or forage plants grown for soil improvement and erosion control. There is no effort to establish a milk collection system for delivery of milk provided from small producers to central processing plants such as exist in some other developing countries. As Syria imports large amounts of dairy products yearly, it appears that local production could substitute for such imports. There is a state dairy farm in the Lattakia area that produces commercial milk. It has a 248-cow herd of imported Freisian cattle, of which 150 cows are lactating at any one time. (See Appendix B, Table 12.) Meat production from cows, sheep and goats is very limited, being a by-product of milk production.

Poultry, broilers, and eggs are produced in small quantities, mostly for home use, although there are limited sales in rural villages. A state poultry farm in the vicinity of Lattakia produces broilers and eggs for the commercial market. Both the state dairy farm and the poultry farm depend heavily on imported grains and feed supplements to achieve substantial production. The relatively high prices for such concentrate feeds is a deterrent to increased production and will remain so until these feeds can be supplied from Syrian sources.

c) Supporting Services

The role of cooperative associations, credit institutions, extension staff and marketing agencies in the agricultural sector of the zone of influence is essentially the same as that previously presented in Section B, 1, c. of this report. In addition, further details on the extent of various services in Lattakia and Tartous Mohafazats can be noted as follows:

Cooperative associations numbered 543 in 1976, and memberships totalled 38,927. The land area of farms served by these cooperatives was 97,000 hec. (See Appendix B, Table 10.)

Two state farms were operating in the zone in 1976, the one being a dairy farm and the other primarily devoted to fruit production. (See Appendix B, Tables 11 and 12.)

The Agricultural Cooperative Bank in 1976 had four branches in Lattakia Mohafazat and three in Tartous Mohafazat. The Lattakia banks had outstanding loans totalling SL 7.3 million, with these loans about equally divided between individuals and cooperatives. Outstanding loans in Tartous Mohafazat totalled SL 15.3 million, of which about 84 per cent were made to cooperatives and the balance to individuals. (See Appendix B, Table 13.)

d) Development Planning.

Annual plans for each of the mohafazats in the zone are prepared to guide agricultural production in accordance with national development strategies and targets. Major targets set for the two mohafazats in the Fourth Five-Year Plan (1976-80) are as follows:

Commodity	Base Year 1975 1/	Target Year 1980	Annual Average Growth Rate (%)
	. . . (000 MT)		
Lattakia Mohafazat:			
Cereals	28.8	40.7	7
Legumes for food	1.2	2.9	19
Oil crops	6.9	14.6	16
Potatoes	2.4	26.7	63
Tomatoes	53.4	90.0	11
Tobacco	6.6	8.4	5
Fodder legumes	1.1	2.5	19
Tartous Mohafazat:			
Cereals	42.0	50.9	4
Legumes for food	2.5	7.3	23
Oil crops	12.7	23.1	13
Potatoes	10.8	51.8	37
Tobacco	1.5	2.5	11
Fodder legumes	1.1	2.6	18

1/ Base year equals 5-year average production (1971-75).
Source: State Planning Commission.

e) Production and Marketable Surplus

In the 1976 base year, production of agricultural commodities in the zone of influence totalled 509,600 metric tons (see Table B-38). Nearly 92 per cent of this tonnage was derived from crop production and the remaining 8 per cent from animal husbandry.

Of the crop production in the zone, 76 per cent was horticultural, with some 20 fruits and nuts plus some 20 vegetables presently being cultivated, primarily for sale in commercial markets. Vegetables of all types accounted for 288,500 MT, or nearly 57 per cent of the total tonnage, with tomatoes the most important individual commodity. Other important vegetables on a tonnage basis were cucumbers, squash, haricot beans, eggplants and broad-beans. Among the more important fruits were olives, citrus, apples and grapes. The non-horticultural crops of the zone were chiefly wheat, peanuts and tobacco.

Livestock production is of more limited extent in the zone, and is dominated by sheep husbandry with much lower numbers of goats and cattle being slaughtered. Milk is the chief livestock product of the zone.

The marketable surplus of the zone's agricultural production in 1976 was estimated at 422,600 metric tons, or 83.4 per cent of total production. (See Table B-38.) A major part of this tonnage, 57.2 per cent, came from vegetable production, with tree fruit crops accounting for another 19.6 per cent of the total marketable surplus. Cereals, chiefly wheat, provided 10.6 per cent of the tonnage, and peanuts and pulses, mainly lentils and chickpeas, were 5.2 per cent of the total. Milk, plus relatively smaller quantities of meat animals, poultry and eggs, accounted for 7.4 per cent of the zone's total marketable surplus.

f) Growth Rates in Production

Although agricultural production in the zone of influence varied from year to year due to rainfall fluctuations and the alternate bearing characteristics of certain fruits, the annual growth rate averaged 10.6 per cent over the 1970-76 period (see Table B-39). The growth rate for all crops as a group averaged 11.5 per cent and that for livestock and livestock products, chiefly milk, was 3.3 per cent.

In the case of vegetables as a group, the average annual growth rate was 15.9 per cent over the 1970-76 period, and the rates for the more important items were: tomatoes, 14.6 per cent; cucumbers, 32.0 per cent; squash, 21.0 per cent; and haricot beans, 16.8 per cent.

Total fruit production over the 1970-76 period showed an annual growth rate of 7.6 per cent, with olives, the major item, averaging 7.1 per cent. For oranges the annual growth rate was 25.0 per cent, and for apples 15.4 per cent.

Among other crops produced in the zone, the average annual growth rates over the 1970-76 period were: wheat, 9.7 per cent; barley, 8.5 per cent; tobacco, 4.7 per cent; and peanuts, -1.6 per cent.

g) Trends in Productivity

The increases noted above in the zone's total output of agricultural products arose partly from additional cultivable land being brought into use, but also from improved productivity, i.e., greater yields of product per hectare of land or per bearing tree. Annual average growth rates (per cent) in the production, area and yield of important crops in Lattakia and Tartous Mohafazats are summarized for the 1970-76 period as follows:

Crop	Production	Area	Yield
Wheat	9.7	1.8	3.0
Barley	8.5	1.3	7.1
Lentils	19.0	5.9	10.8
Tomatoes	14.6	6.9	7.2
Cucumbers	32.0	10.0	19.7
Squash	21.0	10.7	9.6
Tobacco	4.7	3.2	1.2
Peanuts	-1.6	2.4	-1.7
Olives	7.1	9.0	3.9
Apples	15.4	14.9	1.6
Oranges	25.0	11.3	16.9

Source: Appendix B, Table 39.

As shown here, the average annual increase in land area of the two more important cereals, wheat and barley, was less than 2 per cent while yields increased on the average over the 1970-76 period by 3.0 and 7.1 per cent, respectively. The major food legume, lentils, had a yield growth rate nearly double the rate of increase in land area. The annual average increases in land planted to the zone's major vegetables, tomatoes, cucumbers and squash, were large -- 6.9 to 10.7 per cent. For tomatoes and cucumbers, rates in yields exceeded growth rates in land area; and for squash the yield growth rate was only slightly the area growth rate. In the case of fruits, the land areas planted with olive, apple and orange seedlings has expanded substantially -- 9.0 to 14.9 per cent -- over the 1970-76 period. Yields per bearing tree grew very rapidly for oranges and more moderately for apples and olives. Tobacco yields increased annually at 1.2 per cent, while peanut yields declined at -1.7 per cent. As shown in Appendix B, Table 40, both production and yields trends for livestock products have been generally low or negative over the 1970-76 period.

The increases in productivity primarily reflect expanded use of technological improvements rather than increased labor inputs per hectare. Although agricultural output has increased, rural population has remained relatively stable during the 1970's and some labor shortages are developing, such as during olive harvests. Among technological improvements has been increasing use of mechanical equipment such as tractors, modern plows, combines, etc. (see Appendix B, Table 17) and fertilizers (see Appendix B, Table 16).

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TABLE B-38

LATTAKIA-TARTOUS PRIMARY ZONE OF INFLUENCE (Z.I.), PRODUCTION OF AGRICULTURAL COMMODITIES, BASED ON PRODUCTION IN MANTIKAS[1/], LATTAKIA MOHAFAZAT, 1976 (000 MT)

Commodities	Lattakia		Haffeh		Jebleh		Kirdaha		Mohafaza	
	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.
Vegetables-Total	86.4	25.1	5.2	2.8	134.3	134.3	12.2	12.2	238.1	174.4
Tomatoes	34.5	10.0	2.3	1.2	80.1	80.1	5.9	5.9	122.8	97.2
Cucumbers	6.0	1.7	2/	2/	7.4	7.4	.6	.6	14.0	9.8
Squash	16.1	4.7	2/	2/	27.4	27.4	2.2	2.2	45.8	34.3
Haricot beans	4.7	1.4	2/	2/	6.6	6.6	.2	.2	11.6	8.3
Other	25.1	7.3	2.8	1.4	12.8	12.8	3.3	3.3	43.9	24.8
Fruits-Total	49.0	14.2	13.5	7.0	15.0	15.0	2.1	2.1	79.6	38.3
Olives	11.4	3.3	2.6	1.3	6.2	6.2	1.1	1.1	21.3	11.9
Citrus	21.2	6.1	.7	.4	5.7	5.7	.3	.3	27.9	12.5
Apples	11.0	3.2	4.5	2.3	.5	.5	.1	.1	16.1	6.1
Other	5.4	1.6	5.7	3.0	2.6	2.6	.6	.6	14.3	7.8
Cereals-Total	5.3	1.5	11.6	6.0	9.9	9.9	8.1	8.1	34.9	25.5
Wheat	3.6	1.0	9.5	4.9	8.5	8.5	7.2	7.2	28.8	21.6
Other	1.7	.5	2.1	1.1	1.4	1.4	.9	.9	6.1	3.9
Industrial Crops-Total[3/]	2.7	.8	2.2	1.1	10.2	10.2	1.3	1.3	16.4	13.4
Peanuts[3/]	.8	.2	-	-	7.3	7.3	2/	2/	8.1	7.5
Other	1.9	.6	2.2	1.1	2.9	2.9	1.3	1.3	8.3	5.9
Livestock and Products-Total	11.3	3.3	5.1	2.6	7.5	7.5	2.7	2.7	26.6	16.1
Milk	10.1	2.9	4.1	2.1	6.6	6.6	2.1	2.1	22.9	13.7
Animals	1.0	.3	.8	.4	.6	.6	.5	.5	2.9	1.8
Poultry/Eggs	.2	.1	.2	.1	.3	.3	.1	.1	.8	.6
Grand Total	154.7	44.9	37.6	19.5	176.9	176.9	26.4	26.4	395.6	267.7

(continued)

TABLE B-38

LATTAKIA-TARTOUS PRIMARY ZONE OF INFLUENCE (Z.I.), PRODUCTION OF AGRICULTURAL COMMODITIES, BASED ON PRODUCTION IN MANTIKAS 1/, TARTOUS MOHAFAZAT, 1976 (000 MT)

Commodities	Tartous		Banias		Safita		Dreikeesh		Sheikh Badr		Mohafaza	
	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.	Total	In Z.I.
Vegetables-Total	89.6	39.4	64.6	64.6	29.4	-	6.4	6.4	3.7	3.7	193.7	114.1
Tomatoes	11.4	5.0	27.2	27.2	8.0	-	2.8	2.8	1.7	1.7	51.1	36.7
Cucumbers	37.2	16.4	7.5	7.5	4.2	-	.1	.1	2/	2/	49.0	24.0
Squash	6.0	2.6	8.1	8.1	1.7	-	.1	.1	2/	2/	15.9	10.8
Haricot beans	5.1	2.2	2.3	2.3	.6	-	.4	.4	.1	.1	8.5	5.0
Other	29.9	13.2	19.5	19.5	14.9	-	3.0	3.0	1.9	1.9	69.2	37.6
Fruits-Total	38.5	16.9	21.8	21.8	28.2	-	16.4	16.4	4.4	4.4	109.3	59.5
Olives	31.4	13.8	11.0	11.0	22.6	-	8.9	8.9	1.9	1.9	75.8	35.6
Citrus	4.7	2.1	1.2	1.2	1.6	-	.8	.8	2/	2/	8.3	4.1
Apples	.1	2/	1.3	1.3	1.7	-	.7	.7	.5	.5	4.3	2.5
Other	2.3	1.0	8.3	8.3	2.3	-	6.0	6.0	2.0	2.0	20.9	17.3
Cereals-Total	13.5	5.9	15.5	15.5	6.7	-	4.2	4.2	4.6	4.6	44.5	30.2
Wheat	8.5	3.7	12.7	12.7	4.6	-	3.2	3.2	3.7	3.7	32.7	23.3
Other	5.0	2.2	2.8	2.8	2.1	-	1.0	1.0	.9	.9	11.8	6.9
Industrial Crops-Total	12.0	5.3	4.9	4.9	1.7	-	.6	.6	1.1	1.1	20.3	11.9
Peanuts	10.1	4.4	2.3	2.3	.6	-	2/	2/	-	-	13.0	6.8
Other 3/	1.9	.8	2.6	2.6	1.1	-	.6	.6	1.1	1.1	7.3	5.1
Livestock & Products-Total	11.8	5.2	11.3	11.3	7.9	-	4.6	4.6	5.1	5.1	40.7	26.2
Milk	9.3	4.1	9.1	9.1	6.2	-	3.6	3.6	3.4	3.4	31.6	20.2
Animals	1.7	.7	1.7	1.7	1.2	-	.6	.6	1.6	1.6	6.8	4.6
Poultry/Eggs	.8	.4	.5	.5	.5	-	.4	.4	.1	.1	2.3	1.4
Grand Total	165.4	72.7	118.1	118.1	73.9	-	32.2	32.2	18.9	18.9	408.5	241.9

(continued)

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TABLE B-38

LATTAKIA-TARTOUS PRIMARY ZONE OF INFLUENCE (Z.I.), PRODUCTION OF AGRICULTURAL COMMODITIES, BASED ON PRODUCTION IN MANTIKAS 1/, TARTOUS-TARTOUS MOHAFAZATS, 1976 (000MT)

	Total Production In both Mohafazat	Total Production In Zone of Influence	Marketable Surplus in Z.I. 4/
Vegetables-Total	431.8	288.5	241.8
Tomatoes	173.9	133.9	
Cucumbers	63.0	33.8	
Squash	61.7	45.1	
Haricot beans	20.1	13.3	
Other	113.1	62.4	
Fruits-Total	188.9	97.8	82.7
Olives	97.1	47.5	
Citrus	36.2	16.6	
Apples	20.4	8.6	
Other	35.2	25.1	
Cereals-Total	79.4	55.7	44.9
Wheat	61.5	44.9	
Other	17.9	10.8	
Industrial Crops-Total	36.7	25.3	22.1
Peanuts	21.1	14.3	
Other 3/	15.6	11.0	
Livestock and Products-Total	67.3	42.3	31.1
Milk	54.5	33.9	
Animals	9.7	6.4	
Poultry/Eggs	3.1	2.0	
Grand Total	804.1	509.6	422.6

1/ Percentage of Agricultural Activities in the Mantikas included in the Z.I. as follows: Lattakia 29%, Jebleh 100%, Haffeh 52%, Kirdaha 100%, Tartous 44%, Banyas 100%, Dreikeesh 100%, Safita 0%, and Sheikh Badr 100%.

2/ Less than 50 tons.

3/ Includes dry legumes for food.

4/ Marketable surplus in Z.I. is total Z.I. production less on-farm consumption, which was estimated on the basis of 1975 FAO per capita consumption data for Syria; farm population in the Z.I. estimated at 282,406; and adjustments to reflect commodity transport practices in the Z.I.

TABLE B-39

Annual Average Growth Rates of Agricultural Commodities Produced In Tartous and Lattakia Mohafazats, Based on 3-Year Averages, 1970/1972-1974/1976

Commodities	Average Production (000 MT) 1970/72	1974/76	Annual Average Growth Rate (%)
Vegetables - Total	213.3	384.3	15.9
Tomatoes	68.9	118.6	14.6
Cucumbers	25.2	76.0	32.0
Squash	23.9	51.8	21.0
Haricot Beans	9.3	17.3	16.8
Other	86.0	120.6	8.8
Fruits - Total	118.9	159.3	7.6
Olives	57.7	76.0	7.1
Apples	10.7	19.0	15.4
Oranges	6.9	17.1	25.0
Other	43.6	47.2	2.0
Cereals - Total	59.6	83.0	8.6
Wheat	$¢.)	¢¢.¢	(.&
Barley	6.0	8.3	8.5
Other	7.6	8.1	1.6
Industrial Crops - Total 1/	36.3	34.9	-1.0
Peanuts	19.6	18.4	-1.6
Tobacco	7.0	8.4	4.7
Lentils	0.5	1.0	19.0
Other	9.2	7.1	-6.3
Subtotal - Crops	428.1	661.5	11.5
Livestock and Products - Total	54.6	61.4	3.3
Milk	47.7	54.7	3.5
Animals/Poultry/Eggs	6.9	6.7	-0.7
Grand Total	482.7	722.9	10.6

1/ Includes dry legumes.

Source: See Appendix B, Tables 39 and 40.

The proportion of cultivable land that has been brought under irrigation has increased from 10.7 per cent in 1970 to 13.9 per cent in 1976 (paragraph 4.a. above), and a major project of the Ministry of Agriculture and the FAO (of the UN) is adopting modern techniques such as plastic greenhouses to winter vegetable production. In addition, annual production plans which provide for more productive land use allocations are being implemented.

2) Industry

a) Scope of the Industrial Sector

In 1976, there were 3,400 industrial establishments located in Lattakia and Tartous Mohafazats (see Table B-40). Of this total, nearly 3,300 firms, or 96 per cent, were engaged in various manufacturing activities, most of which were oriented toward the production of consumer goods. About 140 establishments were engaged in quarrying, construction, electricity and water. Approximately 60 per cent of all the firms were operating in Lattakia Mohafazat and 40 per cent in Tartous Mohafazat.

In terms of numbers, 96.3 per cent of all the establishments were privately owned and 3.7 per cent were government enterprises. Of the manufacturing firms only, 99.1 per cent were private and 0.9 per cent public. However, in terms of the physical volume of commodities produced, the average annual tonnage of public sector firms was over 50,000 tons per firm (excluding the tonnage for the Lattakia Port breakwater, about 27,000 tons, see Table B-41), while the average physical volume of the private enterprises was only about 460 tons per firm.

Employment in these industries at the same time of the 1970 population census exceeded 13,000 persons, or about 12 per cent of the total labor force of the two mohafazats (see Table B-33). Just over half of this labor force was employed in establishments located in the urban areas of Lattakia and Tartous.

Total production of the industrial sector in Lattakia and Tartous Mohafazats, based on physical output, was estimated at nearly 7.9 million tons in 1976 (see Table B-41). The quarrying industry produced about 6.1 million tons, or 77.3 per cent of the total output, while the manufacturing establishments accounted for nearly 1.8 million tons, or 22.7 per cent of the total. Further aspects of the industrial sub-sectors follow below:

b) Manufacturing

The manufacturing industry of Lattakia and Tartous Mohafazats is characterized, on the one hand, by a large number of relatively small private sector firms, and on the other hand, by a small number of larger public enterprises (see Tables B-40 and B-41). In 1976, the 3,232 private firms had an

TABLE B-40

Number of Industrial Establishments in
Tartous and Lattakia Mohafazats, Sar, 1976

Industry Group	- Lattakia - Public	Private	Total	- Tartous - Public	Private	Total	- Lattakia and Tartous - Public	Private	Total
A. Manufacturing									
Foodstuffs 1/	11	606	617	6	475	481	17	1,081	1,098
Textiles 2/	2	452	454	4	378	382	6	830	836
Wood 3/	1	418	419	-	180	180	1	598	599
Chemicals 4/	-	40	40	1	11	12	1	51	52
Printing 5/	-	14	14	-	8	8	-	22	22
Cement 6/	1	142	143	-	109	109	1	251	252
Metal 7/	3	209	212	-	146	146	3	355	358
Other 8/	-	33	33	-	11	11	-	44	44
Sub-Total	18	1,914	1,932	11	1,318	1,329	29	3,232	3,261
B. Quarrying	4	-	4	1	3	4	5	3	8
C. Construction	9	30	39	4	9	13	13	39	52
D. Electricity and Water	43	-	43	36	-	36	79	-	79
Total	74	1,944	2,018	52	1,330	1,382	126	3,274	3,400
Percentage	3.7	96.3	100.0	3.8	96.2	100.0	3.7	96.3	100.0

1/ Foodstuffs, beverages and tobacco.
2/ Textiles, clothing, leather, shoes and cotton ginning.
3/ Wood and furniture.
4/ Chemicals, fertilizer, paint, soaps and plastic products.
5/ Printing and binding.
6/ Cement, glass, marble and stone.
7/ Metal working, cutting, casting, etc.
8/ Car bodies, tractor trailers, precast blocks, etc.

Source: Statistical Abstract, 1977, pp. 689-696.

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TABLE B-41

ESTIMATED INDUSTRIAL PRODUCTION IN TARTOUS AND LATTAKIA MOHAFAZATS, SAR, 1976
(000 MT)

Industry Group	Lattakia Public	Lattakia Private	Lattakia Total	Tartous Public	Tartous Private	Tartous Total	Lattakia and Tartous Public	Lattakia and Tartous Private	Lattakia and Tartous Total
A. Manufacturing									
Foodstuffs 1/	188.3	337.6	525.9	72.0	133.9	205.9	260.3	471.5	731.8
Textiles 2/	3.7	37.5	41.2	7.5	1.0	8.5	11.2	38.5	49.7
Wood 3/	12.0	55.1	67.1	-	66.8	66.8	12.0	121.9	133.9
Chemicals 4/	0.4 9/	5.6	6.0	6.3	6.9	13.2	6.7	12.5	19.2
Printing 5/	-	8.4	8.4	-	4.8	4.8	-	13.2	13.2
Cement 6/	83.0	281.6	364.6	-	247.0	247.0	83.0	528.6	611.6
Metal 7/	10.1	132.2	142.3	-	74.4	74.4	10.1	206.6	216.7
Other 8/	-	6.1	6.1	-	8.4	8.4	-	14.5	14.5
Sub-total	297.5	864.1	1,161.6	85.8	543.2	629.0	383.3	1,407.3	1,790.6
B. Quarrying									
Stone 10/	2,277.0	-	2,277.0	93.0	278.0	371.0	2,648.0	-	2,648.0
Sand and gravel 11/	2,314.6	12/ 50.0	2,364.6	911.4	12/ 50.0	961.4	3,226.0	100.0	3,326.0
Natural asphalt	40.0	-	40.0	-	-	-	40.0	-	40.0
Gypsum	38.4	-	38.4	-	-	-	38.4	-	38.4
Semi-marble stone	60.0	-	60.0	-	-	-	60.0	-	60.0
Sub-total	4,730.0	50.0	4,780.0	1,004.4	328.0	1,332.4	6,012.4	100.0	6,112.4
Total	5,027.5	914.1	5,941.6	1,090.2	871.2	1,961.4	6,395.7	1,507.3	7,903.0
Percentage	84.6	15.1	100.0	55.6	44.4	100.0	80.9	19.1	100.0

1/ Foodstuffs, beverages and tobacco.
2/ Textiles, clothing, leather, shoes and cotton ginning.
3/ Wood and furniture.
4/ Chemicals, fertilizer, paint, soap and plastic products.
5/ Printing and binding.
6/ Cement, glass, tile, marble and stone.
7/ Metal working, cutting, casting, etc.
8/ Car bodies, tractor trailers, precast blocks, etc.
9/ By-products of vegetable oil factory.
10/ Includes 1.8 million MT of stone used for breakwater at Lattakia Port.
11/ Includes 480,000 MT of sand and 720,000 MT of gravel used for Lattakia Port breakwater.
12/ Dug by individuals.

Source: Statistical Abstract, 1977, pp. 248-251 and 689-696, and interviews with industrial organizations.

average annual volume of about 435 tons, while the 29 public establishments averaged about 13,200 tons. However, despite generally small-scale operations, private firms accounted for 78.6 per cent of the total manufacturing output of the two mohafazats. The developmentof small export-oriented industries in the private sector was also being encouraged through the provision of "free zones" near the cities of Lattakia and Tartous. The zones are free of customs duties, and no more than 20 per cent of the output of the factories can be marketed within Syria.

(1) Foodstuffs. Firms engaged in the processing of foodstuffs, beverages and tobacco accounted for about one-third of all the manufacturing enterprises of the two mohafazats, and for about 41 per cent of the total manufacturing tonnage. The 17 public enterprises had an average output of 15,300 tons, compared to 436 tons for the private firms. Among major public enterprises were the following:

The flour mill in the City of Lattakia produced 34,400 MT of flour in 1976. All of this output was consumed within the Mohafazat of Lattakia; which has been a net importer of flour. Consumption in this mohafazat was 41,143 MT in 1976, and was 29,133 MT in Tartous Mohafazat. A flour mill is to be constructed in Tartous in 1980, and a second one is planned for Lattakia in 1982.

The vegetable oil factory located in the port area of Lattakia processes Syrian cottonseed along with imported palm oil and sodium hydroxide. In 1976 the output of this plant totalled 15,138 MT, and was composed of the following products: cottonseed cake 11,491 MT; cottonseed oil 2,391 MT; linter 1,000 MT; and soap 355 MT. Similar total volumes were estimated for 1977 and 1978. The soap and oil are marketed within the two mohafazats, as well as some oil in Damascus. All linter are exported via the Port of Tartous, and the cottonseed cake is trucked to a feed mixing plant at Hama. In about 1983, the present factory may be relocated to the free zone, or replaced with an olive oil factory, to make way for the expansion of the Port of Lattakia.

The peanut factory in the City of Tartous collects, grades and markets about 12,000 MT of peanuts annually. Some 6,000 MT are exported, with half shipped via the Port of Tartous and half via the Port of Lattakia. Domestic sales of 6,000 MT are made in the two mohafazats. For these local markets, a peanut roaster with an annual capacity of about 3,000 MT is to be built in Tartous around 1981.

The fruit and vegetable canning factory located at Jebleh had a total output of 1,155 MT in 1976 and 2,150 MT in 1977. Tomato paste and peas are the major canned products, although other fruits and vegetables are canned,

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and orange juice is bottled. Raw product is obtained locally, but it is also necessary to truck additional supplies from Homs, Damascus and Aleppo. Tinplate for cans is imported, while bottles and cartons are obtained from Damascus. About one-fourth of the processed output is marketed in Lattakia Mohafazat, and the balance in the Mohafazats of Tartous, Aleppo and Damascus. Since home preserving of fruits and vegetables is substantial, this tends to limit both input supplies and market outlets.

The tobacco factory in the City of Lattakia processed about 11,200 MT of tobacco in 1976 and a like amount in 1977. The raw materials are trucked from farms in the Mohafazats of Lattakia and Tartous, and the processed tobacco is distributed by trucks as follows: 3,000 MT for export, via the Port of Lattakia; 4,080 MT to Aleppo; 1,836 MT to Hama; and 544 MT to Damascus. The remaining 1,740 MT are converted to tobacco products. A new tobacco factory is to begin operations in the City of Lattakia by the end of 1978, raising the local processing of tobacco into products to an annual total of 3,480 MT. A tobacco warehouse, with a capacity of 3,500 MT, began operations in Jebleh in 1976. It receives, sorts and classifies tobacco from growers in the two mohafazats during the November 1 - April 30 season. Tobacco is then trucked to processing plants in Lattakia and Aleppo.

In addition to the public sector firms, nearly 1,100 privately owned manufacturing enterprises were engaged in small-scale processing of various food products throughout the two mohafazats. Accounting for about 90 per cent of these establishments were mills for grinding grain, bakeries, olive oil presses, and firms producing confectionary items, carbonated beverages, dairy products and ice.

(2) Mineral Products. About 46 per cent of the manufacturing output of the two mohafazats is based on mineral products (see Tables B-40 and B-41). Except for the cement plant, essentially all of the firms are privately owned and most are relatively small. In addition to some 250 firms manufacturing tiles and building blocks, as well as cutting marble and other stone products, there are some 350 firms engaged in fabrication of a variety of products from iron, aluminum and other metals. Among these metal-working firms are two relatively new establishments abutting the Lattakia free zone. One factory produces small electric motors as well as transformers for lighting fixtures. The other firm manufactures aluminum frames for doors and windows, and is presently the only factory of this kind in Syria.

A cement factory is located at Burj Islam, about 26 km. northwest of the City of Lattakia. It is the only such plant presently operating in the two mohafazats, although another cement factory is presently under

construction near the City of Tartous. The Burj Islam factory has an annual capacity of 86,000 MT, and about 83,000 MT were produced in 1976. The raw materials are mainly on site, and reserves are adequate for 30 years of operation. The output of cement is consumed entirely within the Mohafazat of Lattakia, the product being transported by truck to consumers. No expansion of this cement plant is being contemplated because it is located in an area being developed for tourism purposes. Beginning in 1977, some 3 million tons of stone are being trucked annually from this location for use in the development of the Port of Lattakia.

(3) Other products. The remaining 13 per cent of the manufacturing output of the two mohafazats is based chiefly on wood, textile and leather products. Nearly all of these products are made in relatively small, privately owned establishments.

Nearly 600 firms are engaged in the wood processing industry. These include carpentry shops and saw mills, as well as establishments making chairs and other furniture, door and window frames, charcoal and other wood products. There is also a factory near the City of Lattakia which produces plywood, chipboard, compressed wood, slat panels, and other wood products. It employs 640 workers, and its present annual volume of 12,000 MT is to be doubled by 1980.

The textile industry is comprised largely of some 400 small-scale private sector establishments which manufacture clothing, as well as a few knitting and weaving firms. However, the government is now completing construction of a 75,000 spindle cotton yarn factory at Jebleh which will have an annual production capacity of 11,000 MT and which will employ 2,150 workers. Input to the factory will be 14,000 MT of domestically produced cotton. In addition, a cotton cloth factory is being constructed on the outskirts of the City of Lattakia. It will produce some 4,000 MT (20 million square meters) per year and will employ 516 workers. Input to this factory will be cotton yarn primarily from Idlib and secondarily from Jebleh.

In addition to firms tanning leather, some 200 establishments in the two mohafazats were engaged in the manufacture of shoes, and some 50 establishments were engaged in the manufacture of chemical products such as soap, detergents, paint and cosmetics. Other firms included some 22 printing and binding establishments, as well as about 20 firms manufacturing tractor trailers and car bodies.

c) Quarrying

In terms of physical output, the quarrying industry is one of the major sources of production in Lattakia and Tartous Mohafazats. See Table B-41. At some 80 sites that have been identified throughout the two mohafazats, large

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quantities of limestone, as well as semi-marble and other stone, are quarried, and sand and gravel are obtained along the sea shore and in river beds. There are also deposits of gypsum and natural asphalt. In 1976, 5 public firms and 3 private firms were engaged in quarrying operations. In addition, many persons building their own residences, especially in rural areas, dig their materials from the closest available sources and also make their own concrete blocks.

In 1976, the total tonnage of the quarrying industry in the two mohafazats was nearly 6.1 million MT, of which about 2.6 million MT was stone and 3.3 million MT was sand and gravel. See Table B-41. At the present time, a major user of these quarry products is the Lattakia Port project where 3.0 million MT per year is being used for extending the breakwater. Annually up through 1982 this project will use about 1.8 million tons of stone and 0.7 million MT of gravel from the Burj Islam site, and about 0.5 million MT of sand from Jebleh.

One of Syria's two natural asphalt deposits is at Kajarieh in Lattakia Mohafazat (the other being in Deir-ez-zor). The output of the Lattakia deposit was 40,000 MT in 1976 and a like amount in 1977. In addition, some 60,000 MT of semi-marble stone was quarried in 1976, as well as about 38,400 MT of gypsum. Of the total gypsum, 36,000 MT was exported by truck to Lebanon and 2,400 MT was used at the Burj Islam cement factory.

d) Construction

The building and construction industry in Lattakia and Tartous Mohafazats expanded rapidly in the 1970's. Completed floor area of licensed private and cooperative buildings in the two mohafazats increased between 1972 and 1976 at an annual average rate of 15.8 per cent. By type of construction, the annual growth rates over this four-year period were 10.0 per cent for residential buildings, 28.5 per cent for commercial/industrial buildings, and over 100 per cent for cooperative buildings. The floor area of completed buildings in Lattakia and Tartous Mohafazats is summarized as follows, in thousands of square meters:

Type of Building	1972	1976
Residential	266.6	390.6
Commercial/industrial	14.7	40.0
Cooperative	4.8	85.0
Other/repaired areas	2.8	3.1
Total	288.9	518.7

Source: Statistical Abstracts, 1973 and 1977. Floor area of licensed buildings in Lattakia and Tartous Mohafazats were adjusted by national "accomplished" rates for type of building.

In addition to these private and cooperative building activities, the construction components of various educational, health, utility, labor and other projects are also being implemented under the current Five-Year Plan. Among major individual projects in the two mohafazats are expansion of the Lattakia and Tartous Ports, and construction of the refinery at Banyas, the cement factory at Tartous and the University of Tishrene at Lattakia.

The construction industry requires the transport of major amounts of cement, stone, sand, gravel and other supplies for the implementation of buildings, roads, and similar projects. However, these demands are met by the manufacturing and quarrying sub-sectors of the two mohafazats, as well as through foreign imports and through the import of materials from other regions of the country. Thus, these quantities are not estimated separately here for the construction industry in order to avoid double counting.

e) Petroleum

There is no production of petroleum products in this zone of influence at the present time. However, a refinery is under construction at the petroleum port of Banyas, about midway between Lattakia and Tartous. It is scheduled for completion by the end of 1978, and is expected to produce some 3 million tons of petroleum products, of which over two-thirds will be gasoline, diesel fuel and fuel oil. Consumption of these and other petroleum products in the Lattakia and Tartous Mohafazats, which was estimated at 750,000 MT in 1977, will be supplied by truck from this refinery when completed. (In 1976, petroleum products for this zone of influence were supplied from the Homs refinery. This tonnage is not included here to avoid double counting.)

f) Production Within the Zone of Influence

In 1976, the total output of industrial production in Lattakia and Tartous Mohafazats was approximately 7.9 million MT. About 6.1 million MT was produced by the quarrying industry and 1.8 million MT by the manufacturing industry (see Table B-41).

Of the total 1976 production in these two mohafazats, 6.2 million tons was allocated to the Lattakia-Tartous zone of influence, including 5.0 million tons from quarrying and 1.2 million tons from manufacturing. The stone, sand and gravel for the Lattakia Port breakwater, as well as gypsum for export to Lebanon, was allocated to the zone. For other output of the quarrying industry, the allocation was based on the population proportions of the two mohafazats located within the zone of influence (64.7 per cent). See Table B-28 and Appendix B, Tables 33 and 34. Allocation on the basis of population provides a conservative estimate of the zone's production since industrial establishments tend to be concentrated in the more urban areas of the mohafazats.

The composition of the zone's industrial production in 1976 is summarized as follows:

Industry/Product	000 MT
Manufacturing	
Foodstuffs, beverages, tobacco	473.5
Cement, tile, marble	395.7
Metal working	140.2
Wood and furniture	86.6
Textiles, clothing, shoes	32.2
Other	30.3
Sub-total	1,158.5
Quarrying	
Sand and gravel	2,610.1
Stone	2,348.7
Semi-marble stone	38.8
Gypsum	36.0
Natural asphalt	18.8
Sub-total	5,052.4
Total	6,210.9

3) Tourism

a) Background

The Lattakia-Tartous zone of influence comprises the principal vacation region of Syria. It includes the country's beaches (over 100 km. in extent) and the best-known mountain resorts (Kassab and Slinfeh), as well as numerous historical and archaeological sites (e.g., Saladin's Castle, Ugarit, the Roman amphitheatre at Jebleh, and the Crusader castle at Markab). The mild Mediterranean climate in the zone of influence provides a welcome relief for Syrian and other Arab tourists from the very hot and dry summers of more inland areas. As the population and family incomes grow in these countries, the flow of tourism is expected to increase very substantially in the Lattakia-Tartous areas. The growth will be abetted by the improvement of means of access to these facilities (road, rail, sea and air) and by the expansion and construction of hotels, villas, tourist colonies, apartments, bungalows, camping areas, and trailer parks.

b) Tourism Flows

The number of foreign arrivals, which is one measure of tourism flows, totalled about 202,000 in 1977 for the Lattakia-Tartous zone of influence

TABLE B-42

FOREIGN TOURISM IN THE TARTOUS-LATTAKIA ZONE OF INFLUENCE
(IN THOUSANDS)

Year	No. Foreign Arrivals			No. Foreign Tourist Nights		
	Arab	Non-Arab	Total	Arab	Non-Arab	Total
			Lattakia Portion of the Zone			
1973	138	5	143	210	8	218
1974	132	7	139	220	19	239
1975	189	9	198	262	14	276
1976	176	8	184	317	14	331
1977	152	5	157	266	12	278
			Tartous Portion of the Zone			
1973	39	3	42	60	8	68
1974	45	2	47	80	7	87
1975	41	2	43	66	5	71
1976	52	1	53	84	2	86
1977	44	1	45	54	2	56
			Lattakia-Tartous Zone			
1973	177	8	185	270	16	286
1974	177	9	186	300	26	326
1975	228	11	239	328	19	347
1976	228	9	237	401	16	417
1977	196	6	202	320	14	334

Source: Ministry of Tourism, TARTOUS AND LATTAKIA Offices.

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(Table B-42). In contrast to Damascus, which has international air service, arrivals at Lattakia come by land and to a limited extent by sea, while at Tartous arrivals are by land exclusively.[1/] The travel time is usually several hours (for example, Lattakia is about 350 kilometers from Damascus) and thus the foreign arrivals can be considered the equivalent of foreign tourists. Most of the foreign arrivals were from other Arab countries. The Lattakia portion accounted for about three-fourths of the foreign tourists, with the remainder in the Tartous portion.

The number of foreign arrivals grew at an annual rate of 14 per cent from the 1974 through 1976 period and then dropped off sharply in 1977 (Table B-42). The strife in Lebanon undoubtedly accounted for much of the drop, since this country is the greatest source of non-Syrian Arab tourism in the zone.

Although data are not available on the number of Syrian tourists in the Lattakia-Tartous zone of influence, an estimate has been made by the consultants based upon the national ratio of foreign tourists to Syrian tourists. This estimate indicates about 316,000 Syrian tourists for the zone of influence in 1977. This estimate, however, is conservative since neither it (nor the national ratio) reflects tourists (especially Syrians) who do not stay at hotels. Foreign tourist nights totalled 334,000 in 1977, down 20 per cent from 1976 and reflecting the Lebanese Civil War (Table B-42). Average length of stay per tourist for the zone of influence was 1.7 nights.

Visitors to museums and ancient monuments in the zone of influence totalled about 71,400 in 1975, but had dropped to about 47,700 in 1976 (Table B-43). Most of the decline was at the Arwad Citadel and to a lesser extent the Tartous Museum. For 1976, the number of these visitors represented about 9 per cent of the total number of tourists in the zone. Improvement of means of access to these historical sites and arrangements for Middle East tours to include these places should serve to enhance their value as rare and outstanding attractions, and thus to bring additional visitors to Syria and the coastal area.

The Lattakia-Tartous zone of influence is earmarked for special attention in Syria's tourism development plans. The major expansion is planned during 1980-1990, when the priority areas are to be developed. Thereafter, the marginal areas will be developed. However, the large increase in Syria's population (3.3 per cent per year) and in the populations of neighboring Arab

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1/ In 1976, 25,099 passengers disembarked and 12,952 embarked at the Port of Lattakia. This is the only port in Syria with passenger service. See Statistical Abstract, 1977, p. 317.

TABLE B-43

NUMBER OF VISITORS TO MUSEUMS AND ANCIENT MONUMENTS IN THE TARTOUS-LATTAKIA ZONE OF INFLUENCE, 1970 AND 1974-1976

Tourist Site	1970	1974	1975	1976
Tartous Museum	3,509	7,298	7,436	3,390
Markab Citadel	2,123	3,478	3,855	5,917
Ras Shamra (Ugarit)	5,662	13,696	23,089	21,930
Salah Aldin Citadel	-	2,992	3,843	4,397
Jableh Amphitheatre	397	1,265	567	1,122
Arwad Citadel	-	10,810	32,505	10,930
Zone Total	11,691	39,539	71,395	47,736

Source: Statistical Abstract, 1977, p. 595.

countries, together with a rise in family incomes, are expected to produce continuing demand pressure on tourism facilities in the zone. Further details of this development plan are presented in Section 5, PROJECTIONS OF THE ECONOMIC BASE.

4) Exports and Imports

a) Port Traffic in the Zone of Influence

Export and import general cargo traffic for the Ports of Tartous and Lattakia totaled 5.4 million tons in 1977 (Table B-24). This is about 700,000 tons greater than 1976 and nearly 2,000,000 tons greater than 1975. Relative shares of general cargo export and import tonnages for the two ports have changed as follows since 1970:

	1970	1971	1972	1973	1974	1975	1976	1977
	(percentage of total)							
Lattakia	81	69	73	62	59	49	47	40
Tartous	19	31	27	38	41	51	53	60

A very rapid growth in exports of phosphate and fuel oil have been major factors in the rising share of general cargo for the Port of Tartous (see Table B-46). In 1977, these two items alone accounted for 91 per cent of the general cargo exports from Tartous. General cargo imports for Tartous have also grown rapidly since 1970 with major increases being registered by such commodity groups as iron and metals, cereal grains, cement, and construction materials (Table B-47).

General cargo export tonnages for the Port of Lattakia, in contrast to those of Tartous, consist primarily of agricultural commodities with cotton lint, cottonseed cake and meal accounting for half of the export tonnage in 1977 (Table B-44). Since 1970, agricultural exports from Lattakia have fluctuated from a high of 512,000 tons in 1972 to a low of 131,000 tons in 1975. These variations are due primarily to barley and wheat production as affected by the amount of annual rainfall.

General cargo imports for the Port of Lattakia reached a high in 1976 of 1,920,000 tons and then dropped off about 6 per cent to 1,797,000 tons in 1977 (Table B-45). Among the major imports were feed grains and concentrates, iron and metals, machinery and tools, foodstuffs, sugar, chemical products and cement. These seven commodity groups accounted for about 75 per cent of the total imports in 1977.

For both ports, the rising trends in imports reflect the needs of the rapidly growing population for food, and the expansion of the economy under the national development plans, particularly for construction.

TABLE B-44

EXPORTS FROM THE PORT OF LATTAKIA, SAR, 1970-1977
(000 MT)

Commodity	1970	1971	1972	1973	1974	1975	1976	1977
Barley	175.1	-	7.5	5.1	-	0.2	14.8	31.2
Cotton (lint)	157.3	152.2	153.5	122.5	101.8	85.0	139.0	124.0
Cottonseed cake/meal	72.6	38.7	65.5	18.4	10.7	8.4	4.7	43.5
Groundnuts	2.5	3.4	3.0	4.6	1.3	1.7	2.4	2.2
Lentils & Vegetables	11.3	21.2	27.3	10.9	7.5	7.0	22.0	33.3
Tobacco	6.1	4.4	3.8	3.4	2.8	6.6	4.8	9.0
Wheat	-	-	214.1	93.6	-	-	-	-
Wool	4.1	6.5	8.1	5.6	3.2	1.5	2.5	3.9
Other Commodities	34.1	27.9	29.2	45.5	20.1	20.4	71.8	88.9
Total	465.5	254.3	512.0	309.6	147.4	130.8	262.0	336.0

Source: Lattakia Port Administration, 1978.

TABLE B-45

IMPORTS INTO THE PORT OF LATTAKIA, SAR, 1970-1977
(000 MT)

Commodities	1970	1971	1972	1973	1974	1975	1976	1977
Cement	19.7	39.5	5.2	1.5	101.1	123.0	269.1	126.2
Chemical products	195.5	195.5	84.9	107.0	120.5	151.8	121.3	138.3
Cloth & jute bags	17.9	6.8	115.4	7.0	6.4	10.3	14.5	6.4
Iron & metals	258.8	180.5	81.0	150.6	359.3	249.3	381.6	283.0
Lube oil & grease	26.8	27.5	6.1	26.5	27.0	65.5	36.2	36.8
Machinery & tools	68.0	62.3	90.8	84.7	101.8	176.4	223.0	175.1
Timber & wood products	110.0	87.6	96.2	95.2	144.4	61.3	80.7	110.5
Yarns & cloth	18.2	20.4	27.4	31.5	25.4	30.1	30.6	29.1
Cereals & feed concentrates	402.5	381.7	124.4	69.1	213.5	226.7	152.9	313.7
Foodstuffs	57.8	49.4	25.3	86.3	101.8	87.7	174.4	163.0
Rice	39.5	31.3	147.2	56.2	93.1	58.7	58.9	37.7
Sugar	141.7	172.2	56.3	117.7	126.6	64.0	120.2	144.0
Other commodities	118.7	124.4	271.7	154.5	197.6	217.8	256.9	233.0
Total	1,475.1	1,379.1	1,131.9	987.8	1,618.5	1,522.6	1,920.4	1,796.8

Source: Lattakia Port Administration, 1978.

TABLE B-46

EXPORTS FROM THE PORT OF TARTOUS, SAR, 1970-1977 1/
(000 MT)

Commodities	1970	1971	1972	1973	1974	1975	1976	1977
Alcohol	0.4	1.2	-	-	-	-	-	-
Asphalt	-	-	-	-	-	-	-	18.5
Fuel oil	49.0	57.3	5.0	2.2	0.4	279.4	290.6	444.1
Phosphate	-	-	60.6	227.7	286.4	201.4	318.8	523.2
Scrap iron	-	-	3.1	-	-	-	1.0	-
Sulfur	-	-	4.6	3.9	-	-	-	-
Vehicles	-	-	-	-	-	-	-	34.3
Cereal grains	-	-	-	4.6	-	-	-	12.0
Cotton	-	-	2.6	30.2	25.2	26.0	8.2	18.2
Leather	-	-	-	-	-	-	-	0.9
Live animals	1.5	-	0.3	1.5	-	0.1	-	-
Wool	-	-	-	-	-	-	5.6	3.3
Other commodities	3.9	9.7	1.9	10.8	17.5	8.4	21.2	12.4
Total	54.8	68.2	78.1	280.9	329.5	515.3	645.4	1,066.9

1/ Excludes crude petroleum.

Source: Tartous Port Administration, 1978.

TABLE B-47

IMPORTS INTO THE PORT OF TARTOUS, SAR, 1970-1977
(000 MT)

Commodities	1970	1971	1972	1973	1974	1975	1976	1977
Cement	44.2	90.9	23.8	1.0	78.7	169.2	405.8	292.7
Chemcial products	-	-	27.9	16.8	53.1	38.9	50.9	116.8
Construction materials	1.7	4.3	76.5	77.9	153.5	207.9	280.3	270.1
Iron & metals	62.7	55.4	64.2	68.2	125.8	204.7	327.1	470.4
Marble	-	-	-	-	-	-	18.7	23.4
Timber & products	45.4	30.9	26.0	70.8	83.6	79.4	196.9	116.4
Vehicles	-	-	3.6	10.6	33.9	95.5	70.4	39.0
Cereal grains	199.2	340.4	226.6	49.5	77.2	107.6	99.4	300.9
Foodstuffs	-	56.1	-	-	-	-	26.1	7.7
Rice	-	22.6	5.4	-	2.2	10.8	22.7	49.4
Sugar	43.2	63.5	62.8	92.6	91.9	94.7	68.8	112.7
Others	10.6	13.1	21.8	128.8	175.1	217.0	271.0	359.2
Total	407.0	677.2	538.6	516.2	874.8	1,224.7	1,838.1	2,158.7

Source: Tartous Port Administration, 1978.

TABLE B-48

COMPARISON OF TARTOUS AND LATTAKIA GENERAL CARGO EXPORTS AND IMPORTS WITH TOTAL SYRIAN GENERAL CARGO EXPORTS AND IMPORTS, 1970-1976
(000 MT)

Year	Syria1/	Lattakia	% of Syria	Tartous	% of Syria	Both Ports	% of Syria
			EXPORTS				
1970	653	465	71.2	55	8.4	520	79.6
1971	484	254	52.5	68	14.0	322	66.5
1972	934	512	54.8	78	8.4	590	63.2
1973	723	310	42.9	281	38.8	591	81.7
1974	793	147	18.5	330	41.7	477	60.2
1975	871	131	15.0	515	59.2	646	74.2
1976	1,249	262	21.0	645	51.6	907	72.6
			IMPORTS				
1970	2,277	1,475	64.8	407	17.9	1,882	82.7
1971	2,813	1,379	49.0	677	24.1	2,056	73.1
1972	2,144	1,132	52.8	539	25.1	1,671	77.9
1973	2,092	988	47.2	516	24.7	1,504	71.9
1974	3,511	1,618	46.1	875	24.9	2,493	71.0
1975	2,969	1,523	51.3	1,225	41.3	2,748	92.6
1976	4,400	1,920	43.6	1,838	41.8	3,758	85.4

1/ Excludes exports and imports of crude oil.

Source: Table B-24 of this report and Central Bureau of Statistics, Statistics of the Foreign Trade of Syria for the above years.

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Much of the general cargo export and import tonnage was hauled over all, or part of, the Tartous-Lattakia highway in 1976 and 1977. The composition and trends of this traffic are therefore of major interest in the current study. A note of caution needs to be added here, however, with regard to the substantial export tonnages of phosphate and fuel oil shipped from the Port of Tartous. With completion of the railroad, now being built from Mhine to Palmyra with connections to the Port of Tartous, phosphate exports presently hauled by truck to the port will be diverted to the railroad. This is scheduled for about July of 1980. Fuel oil exports are currently being delivered to the Port of Tartous by rail tankers and to a lesser extent by truck. With rehabilitation of the Homs-Akkari section of the Homs-Tartous railroad connection scheduled for completion in 1980, and with delivery of additional rail tankers, little if any fuel oil exports are expected to be carried from Homs to Tartous by truck tankers after 1980.

An additional source of truck traffic for the Tartous-Lattakia road will arise, however, from the new Banyas petroleum refinery scheduled to begin regular operation in January 1979. About half of its production will be consumed in the Tartous-Banyas-Lattakia region and will be delivered by truck.

The term "general cargo exports and imports" as used in this section refers to exports and imports from which movements of crude petroleum (imports into Banyas and exports from Tartous) have been excluded. These movements are entirely by pipeline, and thus are irrelevant to this particular highway study.

A comparison of Tartous and Lattakia general cargo export and import tonnages with the country as a whole show that for 1976 the two ports handled about 73 per cent of the total general cargo exports, and about 85 per cent of the general cargo imports (Table B-48). Lattakia's share of the country's general cargo exports has dropped from 71 per cent in 1970 to 21 per cent in 1976, while Tartous has increased its share from 8 per cent to 52 per cent over the same period (Table B-48). In terms of imports, however, the relative decline for Lattakia has been less. In 1970, it accounted for 65 per cent of the total general cargo imports, and in 1976 for about 44 per cent. Over the same period, Tartous increased its share of total imports from about 18 per cent to 42 per cent.

b) Land Traffic by Customs District

In 1976, about 342,000 tons of Syria's general cargo exports (27 per cent of the total) and approximately 642,000 tons of its general cargo about (15 per cent of the total) moved by land to or from foreign destinations

and origins.[1/] The major customs posts through which this export and import land traffic flows are Damascus, Deraa, Aleppo and Dabbousieh. The Lebanese land border crossings south of the zone of influence do not handle substantial volumes of exports and imports. The movements of exports and imports by land have fluctuated rather widely during the 1970-1976 period. Exports reached a high of about 344,000 tons in 1973 (about the same as 1976), while imports peaked in 1974 at about 1,018,000 tons. The annual average growth rate for exports was 17.1 per cent during the 1970-1976 period, while for imports it averaged 8.4 per cent over the same period.

5) Transit Traffic

a) General

Transit traffic by truck accounts for a very substantial tonnage movement over Syria's road network. In 1976 it totaled about 2,457,000 tons as shown in the tabulation below. Although the 1976 tonnage was down about a half million tons from the previous year, it still represents an increase of 38 per cent over the tonnage in 1972.

Year	1,000 Metric Tons
1972	1,776
1973	2,022
1974	3,006
1975	3,022
1976	2,457

Source: Syrian Customs Office and Statistical Abstract for appropriate years.

Data on truck transit movements by customs post show that the major movements were through Dabbousieh and Kameshli in northeast Syria on the Turkish frontier; Jdaydah, the frontier point on the Beirut-Damascus road; Bab Al Hawa, north of Aleppo on the Turkish frontier; and the Port of Lattakia (Table B-49). These five customs posts handled 81 per cent of the total transit movements in 1976. Since 1972, traffic at these customs posts has undergone some substantial changes. For example, transit traffic through Jdaydah ranged from 37 to 41 per cent of Syria's total transit from 1972 through 1975, and in 1976 had dropped to 16 per cent. The latter decrease reflected the Civil War in Lebanon, and is the major cause for the overall drop in total transit traffic in

1/ These estimates for land transport of general cargo exports and imports are based upon the difference between Syria's total tonnages of this traffic less the general cargo exports and imports for Tartous and Lattakia.

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TABLE B-49

TRANSIT MOVEMENT THROUGH SYRIA, BY CUSTOMS POST, 1972-1976[1/]
(In Thousands of Metric Tons)

Customs Post	1972	1973	1974	1975	1976
Damascus	61	30	55	41	25
Jdaydah	682	740	1,108	1,250	401
Serghaya	15	19	21	12	-
Dar'a	309	423	580	328	91
Abou Al Chamat	97	36	35	24	6
Aleppo	6	9	30	30	32
Bab Al Hawa	16	36	63	118	380
Midan Ekbes	21	25	55	25	20
Al Bukamal	18	47	5	14	6
Tal Kaujak	20	23	158	24	2
Kameshli	214	281	383	460	391
Homs	1	2	7	4	2
Dabbousieh	145	89	177	358	556
Akkari	32	15	29	19	1
Lattakia	108	169	255	274	256
Mafrak	5	4	7	4	4
Tartous	15	66	30	18	97
Others	11	8	8	19	187
Total	1,776	2,022	3,006	3,022	2,457

1/ Excluding the flows of crude oil by pipeline.

Source: Data from the Syrian Customs Office and Statistical Abstracts for appropriate years.

1976. The very rapid growth in transit traffic at Bab Al Hawa reflects the growing importance of Turkish and European movements to the Middle East. Kameshli transit traffic is primarily of Turkish origin, and has been growing rapidly since 1972. Transit traffic at Dabbousieh is largely of Cyprian and Lebanese origin, with the balance being of European origin. Transit traffic at Lattakia has more than doubled since 1972, and is primarily of Western European and American origin. Transit traffic for Lattakia will be discussed in greater detail in the following section.

b) For the Zone of Influence

International transit of goods moving through the zone of influence via the Ports of Tartous and Lattakia totaled about 353,000 tons in 1976, compared with 291,000 tons in 1975 and only 147,000 tons in 1977, as shown below:

International Transit Goods Through the Ports of Tartous and Lattakia, 1975-1977

(000 MT)

	1975	1976	1977
Port of Tartous	17.6	97.3	44.6
Port of Lattakia	273.5	256.1	102.7
Total	291.1	353.4	147.3

The very sharp fall-off in 1977 of transit goods movements from Lattakia was primarily due to decreases in tonnage destined for Iraq, Jordan and Saudi Arabia (Table B-50). Reference has been previously made in this report to the almost complete termination of trade between Syria and Iraq. In the case of Jordan and Saudi Arabia it is interesting to note that in 1976 tonnage movements to these countries via Lattakia were at a high for 1970-1971 and 1975-1977 except for Jordan in 1970.

The decline in the transit goods movements through the Port of Tartous for 1977 compared with 1976 was primarily due to a fall-off in the tonnage destined for Saudi Arabia. But once again as in the case of Lattakia, the 1976 transit goods movements from Saudi Arabia was unusually high for the four selected years shown in Table B-51. On an origin basis the countries showing the greatest declines from 1975 to 1977 for the Port of Lattakia were: Belgium, France, West Germany, Italy and Sweden (See Table B-52). For the Port of Tartous, transit goods movement in 1975 was hardly significant in the port's operation. The decline in 1977 tonnage over 1976 on an origin basis was well distributed through most of the European countries (See Table B-53).

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TABLE B-50

TRANSIT OF GOODS THROUGH PORT OF LATTAKIA BY MAJOR COUNTRIES OF DESTINATION, 1971 AND 1975-77
(000 MT)

Destination	1970	1971	1975	1976	1977
Jordan	124.8	53.9	31.8	54.5	20.2
India	-	-	1.1	-	-
Iraq	51.3	71.1	211.0	70.6	1.0
Iran	-	-	3.1	1.9	0.8
Kuwait	3.5	1.2	9.1	11.7	7.9
Lebanon	1/	1.6	2.9	25.7	29.1
Qatar	-	-	1.0	1.3	2.8
Saudi Arabia	0.9	1.0	12.9	88.4	40.0
Turkey	0.7	1.0	1/	-	0.2
Other	0.8	-	0.6	2.0	0.7
	182.0	129.8	273.5	256.1	102.7

1/ Less than 500 metric tons.

Source: Tabulations from the Central Bureau of Statistics.

TABLE B-51

TRANSIT OF GOODS THROUGH PORT OF TARTOUS BY MAJOR COUNTRIES OF DESTINATION, 1971 and 1975-77

Destination	1970	1971	1975	1976	1977
Egypt	-	-	1/	1.6	1.2
Jordan	35.1	11.3	2.0	1.1	0.4
Iraq	1.4	1.5	1/	-	1/
Kuwait	1/	1.0	4.1	9.4	4.5
Lebanon	-	-	1.0	13.0	11.7
Qatar	1/	1/	1/	1.9	1.6
Saudi Arabia	1/	1.8	9.6	68.0	24.2
Other	0.6	-	0.9	2.3	1.0
	37.1	15.6	17.6	97.3	44.6

1/ Less than 500 metric tons.
Source: Tabulations from the Central Bureau of Statistics.

TABLE B-52

TRANSIT OF GOODS THROUGH PORT OF LATTAKIA BY MAJOR COUNTRIES OF ORIGIN, 1971 AND 1975-77
(000 MT)

Origin	1971	1975	1976	1977
A. Europe				
Austria	5.8	1.0	6.1	0.6
Belgium	2.6	63.6	10.6	4.6
Bulgaria	4.7	1/	1/	1/
Czechoslovakia	3.1	1.1	16.2	0.6
Denmark	1.1	3.4	12.9	8.5
France	10.6	27.8	21.4	12.0
East Germany	1/	1.2	-	1/
West Germany	6.4	40.1	27.2	8.4
Greece	1/	7.0	24.2	5.9
Hungary	2.2	5.7	-	1.7
Holland	1.1	12.9	12.2	4.1
Italy	11.6	23.9	31.6	9.7
Poland	8.0	1.7	6.2	0.6
Romania	3.5	8.8	9.0	0.4
Spain	3.4	9.6	6.5	4.0
Sweden	8.0	14.1	4.5	2.2
Switzerland	1/	1/	1.1	3.9
United Kingdom	1/	15.0	14.3	8.8
Yugoslavia	2.4	1.8	2.3	0.4
USSR	26.3	8.3	-	1/
Sub-total	100.8	247.0	206.3	76.4
B. Other Countries				
Cyprus	1.0	1/	3.4	1.6
Egypt	21.7	2.3	9.8	1.3
Morocco	-	1/	1.4	1/
Turkey	1/	1.0	1.1	1/
Malagasy Rep.	-	-	2.9	1/
Canada	-	1.1	5.8	1/
USA	2.6	10.5	17.1	16.0
Sub-total	25.3	14.9	41.5	18.9
C. All Other	3.7	11.6	8.3	6.7
Total	129.8	273.5	256.1	102.7

1/ Less than 500 metric tons.

Source: Central Bureau of Statistics.

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TABLE B-53

TRANSIT OF GOODS THROUGH PORT OF TARTOUS BY MAJOR COUNTRIES OF ORIGIN, 1971 AND 1975-77
(000 MT)

Origin	1971	1975	1976	1977
A. Europe				
Austria	-	1/	4.4	1.3
Belgium	-	1/	-	1.8
Bulgaria	-	1/	1.3	0.1
Denmark	-	1/	-	0.1
France	2.5	3.6	3.3	5.7
East Germany	-	1/	-	-
West Germany	-	4.2	8.4	5.3
Greece	-	-	3.2	0.4
Holland	-	1/	2.6	2.2
Hungary	-	2.2	8.3	2.8
Italy	-	1.0	12.6	6.7
Poland	1/	1/	-	1/
Romania	-	1.3	13.2	2.7
Portugal	-	-	-	1/
Spain	-	1/	1.2	0.1
Sweden	1.3	1/	1.7	1.6
Switzerland	-	-	1.1	0.1
United Kingdom	1/	1/	7.9	4.6
Yugoslavia	-	1/	3.7	0.2
USSR	11.8	1/	-	2.2
Sub-total	15.6	13.6	72.9	37.9
B. Other Countries				
Brazil	-	1/	1.3	-
Cyprus	-	0.3	2.4	0.8
Egypt	-	1.2	1.5	0.6
Japan	-	1/	3.6	1.2
Lebanon	-	1/	1.6	0.1
USA	-	2.0	7.1	2.0
Sub-total		3.5	17.5	4.7
C. All Other	-	0.5	6.9	2.0
Total	15.6	17.6	97.3	44.6

1/ Less than 500 metric tons.

Source: Central Bureau of Statistics.

c) Roll-On/Roll-Off Traffic at the Ports of Lattakia and Tartous

A recent development in port traffic at both Lattakia and Tartous is that of imports and transit vehicles being delivered by roll-on/roll-off (ro/ro) ships.

For the Port of Lattakia, 92 ro/ro ships carrying about 80,000 tons of cargo were handled in 1976, and 121 such ships in 1977, with about 100,000 tons of cargo. (See Table B-54.) About 40 percent of the ro/ro tonnage in 1976 was transit with the balance for Syrian destinations, while in 1977, the transit percentage had dropped to 34 percent. (Table B-54.)

At the Port of Tartous, 247 ro/ro ships were reported for the year 1977 with vehicle tonnage of about 91,000 tons, while for the first four and one half months of 1978, 145 ro/ro ships had been received with a vehicle tonnage of about 24,000 tons. (See Tables B-55 and B-56.) Vehicle tonnage for this port refers to the weight of the cargo inside the trucks and trailers as well as the weight of empty vehicles such as cars, buses, chassis, etc., which are to be sold. About 64 percent of the ro/ro traffic at Tartous was transit in 1977, while for the early months of 1978, transit traffic represented about 50 percent of the total tonnage.

Since inception of the ro/ro service at Tartous, the port has handled from 36,000 to 43,500 vehicles annually, representing tonnages of about 91,000 to 111,000 as shown below:

Roll-On/Roll-Off Service Through the Port of Tartous

Year	Number of Vehicles	Number of Tons
1975	40,761	93,970
1976	43,524	110,891
1977	35,984	90,844

Source: Office of the Tartous Port Administrator.

Data compiled on port of orgin by country of the ro/ro ships received at Tartous during the first months of 1978, (January 2-May 19), show that of the 145 ships, 77 originated from Greek ports, 10 each from France, Germany, Italy, and the United States of America, 9 from Russia, 6 from Bulgaria, and the balance of 13 from Japan, Egypt, the United Kingdom and other countries of Europe.

TABLE B-54

Roll-On/Roll-Off Traffic Handled
at the Port of Lattakia, 1976 and 1977

	1976	1977
Number of Ro/Ro Ships	92	121
Type of Traffic:		
Transit		
No. of Containers 1/	2,112	2,155
No. of Trailers 2/	155	171
No. of Mobile Pieces 3/	265	95
Total Weight (Tons)	31,992	34,056
Syrian Destinations		
No. of Containers 1/	3,242	4,508
No. of Trailers 2/	331	375
No. of Mobile Pieces 3/	389	436
Total Weight (Tons)	48,300	65,613
Transit and Syrian Destination		
No. of Containers 1/	5,354	6,663
No. of Trailers 2/	486	546
No. of Mobile Pieces 3/	654	531
Total Weight (Tons)	80,292	99,669

1/ 20 foot containers with a tare weight (weight of empty container) of 2.2 tons and maximum cargo weight of 20 tons.

2/ Without tractors. Maximum weight of cargo equals 35 tons and tare weight of trailer equals 6 tons.

3/ Refers to vehicles or equipment moving on their own wheels such as buses, cement mixers, bulldozers, etc.

Source: Data provided by shipping agents through personal interviews at Lattakia, August, 1978.

TABLE B-55

Roll-On/Roll-Off Traffic Handled at the Port of Tartous, 1977[1/]

Month	Number of Ro/Ro Ships	Vehicles Imported into Syria		Vehicles for Transit through Syria		Total Vehicles		Total Number of Vehicles by Type[2/]			
		No.	Weight	No.	Weight	No.	Weight	Cars	Trucks	Buses	Chassis
January	30	1,539	2,548	2,176	13,000	3,715	15,548	1,572	61	413	1,669
February	13	428	1,485	581	3,797	1,009	5,282	419	132	-	458
March	20	1,338	2,956	1,017	5,142	2,355	8,098	1,558	194	-	603
April	19	2,984	3,393	1,100	5,329	4,084	8,722	3,316	37	-	714
May	20	2,261	2,107	1,278	7,525	3,539	9,632	2,575	-	-	964
June	21	1,207	2,631	998	7,216	2,205	9,847	1,005	409	-	791
July	32	3,077	5,212	1,303	6,414	4,380	11,626	3,152	105	-	1,123
August	16	1,699	2,308	400	2,667	2,099	4,975	1,728	-	-	371
September	13	904	950	252	931	1,156	1,881	1,051	-	-	105
October	20	3,749	4,081	1,452	3,525	5,201	7,606	4,935	-	-	266
November	22	2,322	2,014	439	1,147	2,761	3,161	2,694	13	-	54
December	21	2,881	3,162	599	1,304	3,480	4,466	3,381	-	64	35
Total	247	24,389	32,847	11,595	57,997	35,984	90,844	27,386	951	494	7,153

1/ Weight in metric tons.

2/ Chassis of trucks and buses.

Source: Port Administration of Tartous.

TABLE B-56

Roll-On/Roll-Off Traffic Handled at the Port of Tartous, 2 Jan.-19 May, 1978 1/

Month	Number of Ro/Ro Ships	Vehicles Imported into Syria		Vehicles for Transit through Syria		Total Vehicles	
		No.	Weight	No.	Weight	No.	Weight
January	17	1,224	1,668	569	1,141	1,793	2,809
February	29	694	1,793	788	2,388	1,482	4,181
March	41	825	2,222	1,434	3,557	2,259	5,779
April	30	901	2,877	1,120	2,769	2,021	5,646
May	28	1,105	3,429	749	2,168	1,854	5,597
Total 2/	145	4,749	11,989	4,660	12,023	9,409	24,012

1/ Weight in metric tons.

2/ 4½ months.

Source: Port Administration of Tartous.

d) Empty Vehicle Movements Through the Kassab Customs Post

A limited number of vehicles pass through the customs post near Kassab on the Syrian-Turkish frontier. The predominant movement is southbound and consists largely of empty used cars and trucks from Europe for resale in Lebanon and neighboring countries. They are thus in transit through Syria and to reach Lebanon and other countries to the south and southeast they travel over the Tartous-Lattakia road.

The northbound and southbound total vehicle movements for the three years 1975-1977 were as follows:

	Southbound	Northbound	Total
1975	21,128	5,257	26,385
1976	15,950	3,273	19,223
1977	18,036	4,524	22,560

Source: Kassab Customs Center.

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The overall trend for the short three-year period is downward, but this may be largely due to the fact that 1975 was a high year for used vehicle imports.

e) Comparative Economics of the Transit Traffic

Transit traffic through Syria from European and other industrial country origins to Middle East destinations moves by a variety of modes and routes.

Sea transport is provided by conventional freighters and roll-on/roll-off ships to the Ports of Lattakia and Tartous, with truck transportation beyond. The Northern Railways of Syria handles international transit traffic from European origins through participation with the national railways of Yugoslavia, Bulgaria, and Turkey. From Homs, (the present rail terminus) the rail shipments are then trucked by independent trucking companies to such destinations as Amman, Jordan, Riyadh, Saudi Arabia, Doha, Qatar, and Kuwait. A number of trucking companies also provide service for freight shipments from European origins to Middle East destinations. The shipments may originate from as far away as the British Isles, France, The Netherlands, etc., and move by road through Southeastern Europe and Turkey to Syria and beyond.

The shipments may move in standarized containers of 20, 30 or 40 feet in length; in conventional shipping containers of various sizes depending upon the contents of the merchandise; in roll-on/roll-off trucks; or as empty-wheeled vehicles or ro/ro equipment of various types (bulldozers, fork lift trucks, cement mixers, etc.). For example, in 1977 the Port of Lattakia received a total of 6,663 containers of which 2,155 were for transit and the balance were Syrian destinations. (Table B-54.) In the same year, the Port of Tartous received a total of 6,152 containers including transit and Syrian destinations. (Table B-57.) The numbers for each type of traffic, however, were not identified.

Precise comparisons of land and sea rates or even of land rates (rail and truck) are not possible because of the lack of common origin points, however, some general comparisons indicate that the sea transport rates for moving containers from Europe are substantially lower than the rail rates.

Rates on containers and trucks carried by sea from the Greek ports of Thessaloniki and Piraeus to Tartous range from about S.P. 4,800 to S.P. 5,300. (Tables B-58 and B-59.)

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TABLE B-57

Incoming Container Traffic at the
Port of Tartous by Month, 1977

Month	Ships	Number of Containers	Tons
January	11	670	9,166
February	12	882	10,557
March	15	739	7,975
April	12	499	5,604
May	15	614	8,798
June	15	628	7,497
July	17	699	8,080
August	14	368	4,772
September	11	310	4,060
October	14	273	3,604
November	14	273	4,078
December	12	197	2,538
Total	162	6,152	76,729

Source: Port Administration, Port of Tartous, 1978.

In contrast, rail rates on 40 foot containers from the Bulgarian-Turkish frontier to Aleppo are about S.P. 11,000 while from the same frontier to Homs, the rate is about S.P. 12,600. (Table B-60.) Although exact land and sea distances are not available, a close map study of the origin points indicate that the distances are quite comparable. And, in fact, the sea distance may be somewhat longer.

Other container rate quotations given in Table B-59 show that 40 foot containers may be shipped by sea from Marseille, France and La Spezia, Italy to Tartous for only S.P. 7,800, while the rates from Liverpool and Rotterdam to Tartous are only about S.P. 13,300, just slightly above the rail container rate from the Turkish-Bulgarian frontier to Homs.

Transit time for rail container freight from Europe to Aleppo is reported to average about 30 days, while from British, French and Italian ports, transit times for container ships to Lattakia and Tartous range from five to seven days. For Greek ports, the transit time is 48 to 60 hours.

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TABLE B-58

Freight Rates, Custom Clearance Charges and Road Taxes for Trucks Carried by Roll-On/Roll-Off Ships Between Thessaloniki, Greece and Port of Tartous, August, 1978

Trip	Freight Rate 1/	Applicable Rate in S.P. for Tractor Semi-Trailer (Overall Length-15.4M.) 2/
Thessaloniki-Tartous-Thessaloniki		
One way loaded and One way empty	U.S. $100/linear meter (including 1 driver)	6,006
	U.S. $55 for Co-Driver	214
Loaded truck on return trip	U.S. $40 extra per linear meter	2,402
Tartous-Thessaloniki		
Loaded truck	U.S. $70/linear meter	4,204
Empty truck	U.S. $40/linear meter	2,402
Thessaloniki-Tartous		
Loaded or empty	U.S. $80/linear meter	4,805

	Custom Clearance Charge and Road Taxes	
Greece	Drachmas 2,200/truck (including 1 driver)	226
	Drachmas 100 for Co-driver	11
Syria	U.S.$107 Clearance formalities per truck	417
	U.S.$110 Road tax for Syrian destinations	429
	U.S.$220 Road tax for transiting Syria	858

50 percent additional road tax for second trailer enroute.

1/ Above rates and conditions subject to change with or without notice.

2/ Exchange rates: 3.9 S.P. to U.S. $1.00 and .1025 S.P. to 1.00 Drachma. Rates effective August 8, 1978 as reported by the Commercial Bank of Syria, Lattakia, Syria.

Source: Private shipping agency in the City of Aleppo.

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TABLE B-59

Sea Transport Rates on Containers from Selected European Origins to the Port of Tartous

Origin	Rate for 2-20 ft. or 1-40 ft. Container	
	U.S.$	S.P. Equivalent[1/]
Liverpool and Rotterdam	3,400	13,260
Marseille, France and La Spezia, Italy	2,000	7,800
Trieste, Yugoslavia	2,200	8,580
Piraeus, Greece	1,350	5,265

1/ At exchange rate of 3.9 S.P. to U.S.$1.00.

Source: Private shipping agency in the City of Tartous.

In contrast to the sea transport rates, truck rates on shipments from European origins to Syria appear to be much closer to the level of the rail rates. For example, the rate for a 22-ton truck shipment by land from Frankfurt, Germany to Aleppo is quoted at U.S. $6,000 or S.P. 23,400. For a 15-ton shipment by rail from the Austrian-Yugoslavian border to Midan Ekbess (the Syrian-Turkish frontier, about 117 rail kilometers north of Aleppo), the rate is S.P. 15,144. Allowing for the difference in distance (Austrian-Yugoslavian frontier to Frankfurt, Germany, and Midan Ekbess to Aleppo) and the difference in weight, the equivalent rail cost would be at approximately the same level as the truck rate.

In terms of transit time, however, the trucks have a very definite advantage over the rails. Truck transit times from middle European origins to Aleppo range from 6 to 7 days compared with the above-cited rail transit times of about 30 days.

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TABLE B-60

Syrian Railroad International Transit Tariff Rates

ORIGIN	DESTINATION	RAILWAY	RATE Swiss Francs	RATE S.P. Equivalent[1]
A. Shipments of 15 tons, 3rd Class Merchandise[2]				
Zfalensgad, Austrain-Yugoslavian Frontier	Demetrograd, Yugoslavian-Bulgarian Frontier	Yugoslavian	601.5	1,364.80
Demetrograd, Yugoslavian-Bulgaria Frontier	Cabicola, Bulgarian-Turkish Frontier	Bulgarian	1,872.0	4,247.57
Cabicola, Bulgarian-Trukish Frontier	Midan-Ekbess, Turkish-Syrian Frontier	Turkish	4,201.0	9,532.07
Midan Ekbess, Turkish-Syrian Frontier	Homs, Syria	Syrian	1,072.0	2,432.37
		Total	7,746.5	17,576.81
B. Shipments of Forty Foot Containers - RATE PER CONTAINER				
Bulgarian-Turkish Frontier	Aleppo, Syria	Turkish & Syrian	4,905.0	11,129.44
Bulgarian-Turkish Frontier	Homs, Syria	Turkish & Syrian	5,555.0	12,604.30
Bulgarian-Turkish Frontier	Yaroubie, Syrian-Iraqi Frontier	Turkish & Syrian	6,148.0	13,949.81

1/ Syrian Pound equivalent converted at the rate of one Swiss Franc to 2.269 S.P., as quoted by the Commerical Bank of Syria, Lattakia, on August 8, 1978.

2/ Consists of merchandise such as machines, spare parts, metals, and other similar items.

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A substantial cost item in the truck transit rate is that of high transit taxes encountered in Turkey. Fuel taxes of U.S. $750 per truck levied by Turkish authorities were recently reported to have been increased by 50 percent. These taxes apply to all transit trucks with the exception of those with Bulgarian registration. The latter are reportedly exempt from the tax as the result of an agreement between the Bulgarian and Turkish Governments. Shipping agents in Syria anticipate that the substantial increase in the fuel tax will reduce the number of European origin trucks (excluding Bulgaria) transiting Syria.

Another problem encountered by truckers transiting Europe is that of the difference in the trucking regulations of the various countries. For example, Austria does not allow trucks on the highways on Sundays. This may pose a problem in scheduling for the truckers to insure that they are not in transit in that country on Sunday.

The truck rates for continuation of the transit shipments by land from the Ports of Lattakia and Tartous to typical Middle East destinations are shown in Table B-61 on a ton basis and a computed ton-kilometer basis. The rates are applicable to minimum loads of 13 tons. If the actual weight of the shipment is less than 13 tons, the full rate still applies. The rates quoted in Table B-61 are for regular shipments, as distinct from special rates applicable to heavy shipments. There are also provisions in the tariff covering penalty charges against the shipper for not using the truck when ordered, or for delay time. If these instances occur within Syria the charges range from S.P. 60 to S.P. 120 depending upon the size of truck. Charges are also assessed for delay times occurring outside of Syria with the amounts ranging from 10 to 20 Jordanian dinars or 100 to 200 Lebanese pounds, again depending upon truck size. There are also special charges (Syrian Passage Dues) imposed on non-Arab trucks, tractors and trailers passing through a Syrian port or land border for transit purposes or to Syrian destinations (Table B-62.) The charges, depending upon destination (transit or Syrian), range from S.P. 200 to S.P. 800 for loaded vehicles and from S.P. 40 to S.P. 160 for empty vehicles, with an additional charge for extra trailer. A limited number of exemptions from the charges are listed in the special tariff effective May 4, 1976.

The basic freight rates per ton-kilometer from Lattakia and Tartous to destinations in Jordan, Saudi Arabia, Kuwait and Qatar range from about S.P. 0.09 to S.P. 0.16 (Table B-61). The higher level of the rate scale reflects the shorter distances. This is in keeping with the concept that unit costs of motor carriers decline with increases in distance because of the distribution of terminal expense over a larger number of ton kilometers. The

TABLE B-61

International Transit Freight Rates From the Ports of Tartous and Lattakia to Representative Middle East Destinations
(Regular Truck Rates)

Destination	Route	Rate per Ton (S.L.) 1/		Distance (km) 2/		Rate per Ton-(km) (S.L.)	
		Lattakia	Tartous	Lattakia	Tartous	Lattakia	Tartous
Amman, Jordan	Homs-Damascus-Al-Mafraq-Amman	76.28	69.93	530	442	0.144	0.158
Aqaba, Jordan	Homs-Amman-Maan-Aqaba	114.43	101.71	870	782	0.130	0.132
Tabuk, Saudi Ar.	Homs-Amman-Tabuk	178.00	165.28	1,330	1,242	0.134	0.133
Median, Saudi Ar.	Homs-Amman-Tabuk-Medina	216.14	203.42	2,008	1,920	0.108	0.106
Mecca, Saudi Ar.	Homs-Tabuk-Medina-Mecca	241.57	228.85	2,408	2,320	0.100	0.986
Riyadh, Saudi Ar.	Homs-Al-Mafraq-Dammam-Alfarug-Riyadh (Tapline)	254.28	241.57	2,443	2,355	0.104	0.103
Dammam, Saudi Ar.	Homs-Al-Mafraq-Abu Hadriyah-Dammam (Tapline)	241.57	228.85	1,990	1,902	0.121	0.120
Jiddah, Saudi Ar.	Homs-Tabuk-Medina-Jiddah	228.85	216.14	2,401	2,313	0.095	0.093
Kuwait, Kuwait	Homs-Al-Mafraq-Abu Hadriyah-Kuwait (Tapline)	242.66	228.38	2,110	2,022	0.115	0.113
Doha, Qatar	Homs-Al-Mafraq-Dammam-Hofuf-Doha (Tapline)	254.28	241.57	2,361	2,273	0.108	0.106

continued

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TABLE B-61

International Transit Freight Rates From the Ports of Tartous and Lattakia to Representative Middle East Destinations
(Regular Trust Rates)

Destination	Route	Rate per Ton (S.L.) 1/		Distance (km) 2/		Rate per Ton km (S.L.)	
		Lattakia	Tartous	Lattakia	Tartous	Lattakia	Tartous
Abu Dhabi, U.A.E.	Homs-Al-Mafraq-Dammam-Hofuf-Abu Dhabi (Tapline)	499.59	485.32	2,800	2,712	0.178	0.179
Dubai, U.A.E.	Homs-Dammam-Abu Dhabi-Dubai (Tapline)	499.59	485.32	2,940	2,852	0.170	0.170
Basra, Iraq	Homs-Abu Alish-Amat Baghdad-Basra	211.30	199.56	1,663	1,575	0.127	0.127
Baghdad, Iraq	Aleppo-Abu Kamal-Baghdad	152.61	164.35	977	1,065	0.156	0.154
Baghdad, Iraq	Homs-Abu Alish-Amat-Baghdad	176.08	164.35	1,064	976	0.165	0.168
Tripoli, Lebanon	Coastal	36.85	30.27	153	65	0.241	0.466
Beirut, Lebanon	Coastal	46.06	42.11	243	155	0.189	0.272
Saida, Lebanon	Coastal	50.01	46.06	285	197	0.175	0.234

1/ Rates converted to Syrian Pounds at the following rates of exchange as quoted by the Commercial Bank of Syria, Lattakia, on August 8, 1978.

Lebanese pound	1.316	Jordanian dinar	12.714	Iraqi dinar	11.739
Kuwaiti dinar	14.274				

2/ Distances within Syria are taken from official sources. Distances outside Syria were computed by the consultant from a map of the Middle East showing kilometers between significant highway points, scale of 1:5,000,000, issued by Kummerly & Frey, Bern, Switzerland, 1977. Minimum load per truck is 13 tons.

Source: Rates are from official tariffs of May 8, 1977 as provided by the Lattakia Truck Office, Ministry of Transportation, August, 1978.

TABLE B-62

Syrian Passage Dues on Non-Arab Trailers Imposed by Virtue of Law No. 6 dated May 4, 1976
(In Syrian Pounds)

On Passage	Destination	On Each-- Truck Tractor & Trailer Tractor & Semi-Trailer		On Each-- Extra Trailer or Semi-Trailer Hauled By Arab Tractor	
		(Loaded)	(Empty)	(Loaded)	(Empty)
Through Syrian Port	Syria	400	80	200	40
Through Syrian Port	Transiting Syria	800	160	400	80
Through Syrian Land Border	Syria	200	40	100	20
Through Syrian Land Border	Transiting Syria	400	80	200	40

1. Exemption
   --Arab registered tractors and trailers.
   --Prior permit obtained from the Minister of Transport.
   --Carriage under conditions fixed by a decree to be issued by the Minister of Transport.
   --Foreign tractors and trailers not surpassing the customs zone of the entrance port of land post.
   --Trailers and tractors imported or exported empty to/from Syria or other countries.

2. Payment to be effected in foreign currency at the rates fixed each six months.

Source: Private Shipping Agency of Aleppo.

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TABLE B-63

Freight Rates for Shipping Containers From the Port of Lattakia to Middle East Destinations by Truck, 1978

Destination	Rate for 2 containers of 26 tons total (S.P.) 1/	Rate per Ton (S.P.)	Distance (km)	Rate per Ton-km
Amman, Jordan	2,300	88.46	530	0.167
Tabuk, Saudi Arabia	3,500	134.62	990	0.136
Dammam, Saudi Ar.	5,200	200.00	1,990	0.101
Jiddah, Saudi Ar.	5,200	200.00	2,401	0.083
Kuwait, Kuwait	5,200	200.00	2,110	0.095
Riyadh, Saudi Ar.	6,000	230.77	2,443	0.095
Doha, Qatar	6,000	230.77	2,361	0.098
Abu Dhabi, U.A.E.	10,000	384.62	2,800	0.137
Dubai, U.A.E.	10,000	384.62	2,940	0.131

1/ Includes return of empty containers to Lattakia. The minimum load per container is 13 tons. If the containers weigh less than 13 tons, the full rate still applies.

Source: Lattakia Truck Office, Ministry of Transportation, August, 1978.

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considerably higher ton-kilometer rates (in spite of the long distances) of S.P. 0.17 to S.P. 0.18 shown for Dubai and Abu Dhabi, United Arab Emirate reflects the use of about 450 kilometers of caravan tracks south and east of the Hofuf-Qatar road.

Freight rates on transit shipments to Lebanese destinations are much higher on a ton-kilometer basis than to other Middle East destinations shown in Table B-61. But again this is larger a reflection of the very short hauls involved, from 65 to 197 kilometers.

Freight rates on shipping containers hauled by truck from the Port of Lattakia to Middle East destinations average slightly lower on a ton-kilometer basis for the long hauls than the regular truck shipments rates quoted in Table B-61. (See Table B-63.) For example, the regular truck rate from Lattakia to Jiddah, Saudi Arabia is S.P. 0.095 per ton-kilometer, while the container rate (shipments of 2 containers of 26 tons total) averages S.P. 0.083 per ton-kilometer. The difference is even greater to Kuwait with the regular truck rate averaging S.P. 0.121 per ton-kilometer and the container rate averaging S.P. 0.095. Shipping containers are advantageous to the trucker in that the loading and unloading operation is much quicker than conventional shipments. They are also advantageous to both shippers and truckers since they greatly reduce the opportunity for pilferage.

Freight rates on shipping containers from the Port of Tartous to Middle East destinations would be only slightly different on a ton-kilometer basis than those shown in Table B-63 for the Port of Lattakia. (See Table B-61 for the small differences in ton-kilometer rates for the two ports based upon regular truck rates.)

Alternatives to transiting Syria do exist for goods moving from European, American or other western ports to the Middle East. The most important of these is by sea via the Meditterranean, the Suez Canal and the Red Sea to such ports as Aqaba, Jordan and Jiddah, Saudi Arabia, and on to the Arabian Gulf ports of Al Faw, Bandar - e - Shapur, Kuwait, Dammam, Bahrain, Doha, Abu Dhabi and Dubai. For a number of these ports, however, an additional lengthy land journey is required in order to reach such final destinations as Amman, Riyadh, Basra, Baghdad and Teheran as shown in the following tabulation:

Port	Major City	Road Distance (kms.)
Aquaba, Jordan	Amman, Jordan	340
Jiddah, Saudi Arabia	Riyadh, Saudi Arabia	1,063
Al Faw, Iraq	Basra, Iraq	170
Al Faw, Iraq	Baghdad, Iraq	939
Bandar-e-Shapur, Iran	Teheran, Iran	995

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Shipping agents report that the all-sea journey in conventional freighters from such ports as Marseille and La Spezia to the Arabian Gulf Ports of Kuwait and Qatar would average about 20 days, while the combination sea journey plus land transit via Syria would result in a time savings of four to five days. In the case of ro/ro ships, the all sea journey to these particular ports versus the combination sea and land transit via Syria is reported to require about the same number of days.

The sea journey from comparable origins to the Iraqi and Iranian Arabian Gulf ports would require about the same time span of 20 to 21 days for conventional freighters (16 to 17 days by ro/ro ships), in addition to the very long land hauls to the capital cities of between 900 and 1,000 kilometers. The land distance from the Ports of Lattakia and Tartous to Baghdad is just slightly more than that of the Iraquian Gulf port to Baghdad, while the time saving by land ranges from about 12 to 14 days (see Table B-61 for land distances).

To Teheran, Iran the land distance from Lattakia and Tartous would range from about 1,925 to 2,000 kilometers or about 1,000 kilometers farther than the land journey from the Iranian port of Bandar-e-Shapur. This difference, however, is far more than offset by the much longer sea journey to reach the Iranian port, representing a time differential of about 10 to 12 days.

Shipping agents report that for shipments to Iraq and Iran from European and other western origins, transiting via Syria is definitely cheaper because of the much shorter distances and transit time involved. The above examples confirm these reports.[1/]

Since 1977, however, all transit movements between Syria and Iraq have been stopped because of political differences between the two countries. This includes movements not only for Iraqi destinations but for other countries as well such as Iran, where the shipments would be transiting Syria and Iraq. With closure of their frontiers to Syria, another alternative route now being used for shipments to Iraq from Europe is by sea transport to the Turkish port of Mersin, and then by truck transport via the Kurd Highway to Baghdad. Shipping agents handling this traffic report that this alternative route is about $200 per truck (S.P. 780 for 2 containers of 26 tons) higher than the land routes through Syria via the Ports of Lattakia and Tartous.

[1/] These same agents report that shipments via Lattakia and Tartous with land transit to Amman, Jordan is cheaper than sea transport to the Port of Aqaba and land transport to Amman. Port charges at Aqaba and land transport beyond are reported to be very high.

6) Zone Domestic Imports

The tonnage of commodities requiring road transportation in the zone of influence, as determined in the preceding sections, has been related to the agricultural and industrial production occurring within the zone itself, and to commodities involved in foreign trade, whether as exports, imports or transit goods. In addition to these tonnages, there are also commodities which are produced or processed in other regions of Syria and are transported into the zone as domestic imports. Most of these domestic imports come into the zone from the major manufacturing cities of Damascus, Aleppo, Homs and Hama. In some cases, raw materials are imported through the ports of Tartous and Lattakia and trucked to the above manufacturing cities. Then, after processing, the finished goods are trucked into the zone of influence. The movement of these commodities is thus involved in the determination of transport tonnages on zone highways.

The zone's total domestic imports were estimated in 1976 as follows, in thousands of tons:

Petroleum products	750.0
Consumer goods	198.6
Manufacturing inputs	65.7
Agricultural inputs	10.0
	1,024.3

a) Petroleum Products

In 1976, no petroleum products were manufactured within the Tartous-Lattakia zone of influence. The zone's supply of gasoline, diesel fuel and other petroleum products was trucked largely from the refinery at Homs and from storage facilities at Banyas within the zone. The zone's annual consumption of these products in 1976 was estimated by the State Planning Commission at 15 per cent of Syria's total consumption of 5 million MT , or about 750,000 tons.

b) Consumer Goods

Various consumer products, such as processed foods, clothing, and durable consumer items are imported into the zone from the major manufacturing cities within Syria. No statistics are available on this type of trade, but tonnage estimates were made on the basis of per capita consumption data and zone population estimates. The major source of consumption data was per capita food estimates for Syria in 1975 as prepared by the FAO of the UN . These data

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were supplemented by expenditure data from Syria's 1971 Family Budget study. Per capita consumption of major food groups was as follows:

Food Groups	Per Capita Demand (kg/year)	Food Groups	Per Capita Demand (kg/year)
Cereals	170.0	Whole milk	24.0
Roots & tubers	14.2	Skimmed milk	6.3
Sugar products	30.8	Cheese	5.2
Pulses, nuts, seeds	21.9	Fats & oils	10.9
Vegetables	165.4	Spices	0.5
Fruits	172.1	Stimulants	0.6
Meats & offals	16.3	Alcoholic beverages	1.6
Eggs	4.0		
Fish	1.6	Total	645.4

With the total population of the zone estimated at 533,960 in 1976 (Table B-28), total food demand was about 344,600 MT. According to the Family Budget study, food accounted for about 76 per cent of total expenditures, and non-food items about 24 per cent. However, on a physical weight basis, it was estimated that non-food items would account for only about 15 per cent of all consumer items, or about 60,800 tons. In addition, it was estimated that about 60 per cent of the food products, chiefly vegetables and fruits, are produced within the zone or are imported from outside Syria. Thus the tonnage of domestic imports of food products into the zone was about 137,800 tons, and the zone's total domestic imports of food and non-food products was about 198,600 tons in 1976.

c) Manufacturing Inputs

Most inputs for the zone's manufacturing establishments were either locally produced or were imported from sources outside Syria. In the case of vegetable oil processing, however, about 16,000 tons of cottonseed was imported annually into the zone from Syria's cotton producing regions. Also, essentially all of the required cotton, wool and leather for the 49,700 tons of textiles, clothing and footwear manufactured in the zone was imported from other regions of Syria. Together these domestic imports for manufacturing totaled about 65,700 tons in 1976.

d) Agricultural Inputs

Fertilizer is used as an input chiefly for production of vegetables and citrus in the Tartous-Lattakia zone of influence. Based on the land area devoted to these crops, the tonnage of fertilizer imported from

domestic sources was about 4,030 tons in 1976. In addition, the 6,000 tons of timber cut on government lands in the Kassab region is trucked into the zone for use there or for further transport to Damascus.

5. PROJECTIONS OF THE ECONOMIC BASE

a. Introduction

The preceding section dealt with the development of the economic base of the zone of influence for the year 1976, with data being compiled and evaluated for the major economic sectors.

The emphasis in this section is on the projection of the 1976 economic base over the periods 1976-1983, 1984-1993 and 1994-2003. The first of these projection periods takes the economic base to the end of 1983 when construction of the Tartous-Lattakia expressway is proposed to be completed. The following twenty years cover the generally accepted period for analyzing the economic and technical feasibility of road projects.

In addition to projecting the major economic activities of the zone over the twenty-seven year period, the consultants have also analyzed and projected the growth of passenger traffic to the year 2003. Both the projected tonnages by economic sector and the passenger traffic were then converted to ADT's by type of vehicle for use in estimating the user savings attributable to the proposed road project.

b. Passenger Traffic

1) Projections of Normal Passenger Traffic

Average daily passenger traffic over the entire length of the Tartous-Lattakia highway totaled 1,357 vehicles in 1978 (see tabulation on following page). These data are from the Origin and Destination Survey conducted by the consultants in May, 1978.[1/] The ADT for the entire highway length is a weighted average by distance of ADT's of the three highway segments (Lattakia-Jebleh, Jebleh-Banyas, Banyas-Tartous) studied in the O & D Survey.

Historical trend data can serve as a valuable guide in projecting normal passenger traffic flows in a road corridor.[2/] Unfortunately such data are not available for the Tartous-Lattakia highway corridor. The only traffic counts made on the existing road, prior to the consultants' present study, were those developed in a study carried out by the Ministry of Communications in 1977. These data are too recent to be of assistance for projection purposes. In the absence of such data, one alternative is to seek historical trend data in the region from another road or roads with similar traffic characteristics. This step was pursued by the consultants, and historical traffic data were found to be available for the adjoining Homs-Tartous road segment as follows:

[1/] See Part C.2.e.

[2/] Normal traffic refers to that portion of the traffic which would continue to use the corridor with or without road improvements.

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	Annual Average Daily Traffic	
	1970	1977
Cars	1,045	1,985
Buses	146	277
Total	1,191	2,262

Source: Ministry of Communications.

The annual average growth rate on the Homs-Tartous road for cars and buses were each 9.6 percent for the 1970-1977 period.

In 1977, passenger traffic on the Homs-Tartous road represented about 50 percent of the total vehicular traffic. The same percentage was found by the consultants for the Tartous-Lattakia road in 1978 as shown below:

Annual Average Daily Traffic
Tartous-Lattakia Highway

	No.	% of Total
Cars	719	26.7
Taxis	405	15.0
Buses	233	8.7
Sub-total	1,357	50.4
Trucks	1,335	49.6
Total	2,692	100.0

One method of utilizing the historical traffic growth on the Homs-Tartous road as a means of traffic projections for the Tartous-Lattakia road is to relate the former to one or more bases of traffic generation. In this connection, the most obvious is population growth in the zone of influence. From 1960 to 1970, population in the Homs-Tartous zone of influence grew at an annual average rate of 2.9 percent as shown in the data below:

Population of the Homs-Tartous Zone of Influence

Mohafazats (in 000)	1960	1970
Homs	401.2	546.2
Tartous	240.8	302.1
Total	642.0	848.3

In the absence of census data later than 1970, the population in the Homs-Tartous zone of influence is assumed to have continued to grow at an annual average rate of at least 2.9 percent for the period 1970-1977.

The relationship of passenger traffic growth to population growth in the Homs-Tartous zone of influence for the 1970-1977 period is at a ratio of about 3.31 to 1.00:

$$\frac{\text{Annual Average Passenger Growth Rate of 9.6\%}}{\text{Annual Average Population Growth Rate of 2.9\%}} \text{ equals 3.31.}$$

The application of this ratio to the Tartous-Lattakia zone of influence would yield an annual average growth rate factor for normal passenger traffic of about 9.9 percent for the 1960-1976 period, and about 10.9 percent for the 1976-1983 period computed as follows:

Population of the Tartous-Lattakia Zone of Influence

Actual		Estimated		
1960	1970	1976	1977	1983
339,842	448,657	533,960	551,580	670,000

Annual Average Growth Rate:

1960-1970 equals 3.0 percent; 1971-1976 equals 3.0 percent; 1977-1983 equals 3.3 percent.

Estimated Annual Average Growth Factors for Normal Passenger Traffic in the Tartous-Lattakia Zone of Influence:

1960-1970, and 1971-1976 equals 9.9 percent (3.0% x 3.31).

1977-1983 equals 10.9 percent (3.3% x 3.31).

The projected increase in the population growth rate to 3.3 percent in the 1977-1983 period (the national level of population growth) reflects a substantial investment in the Tartous-Lattakia zone of influence during the Third Five-Year Plan (1976-1980). It is anticipated that the employment opportunities arising from this investment (discussed in Section B-4 and under the industry, agriculture and other headings in this section), will reduce the emigration from the zone and will attract workers and their families into the zone, resulting in a growth rate at, or above, the national level.

For the longer projected periods, 1984-1993 and 1994-2003, the consultant estimates annual average population growth rates for the Tartous-Lattakia zone of influence of 3.2 percent for the first ten years, and 3.1 percent for the second ten years. These slight declines are in recognition of the fact that the 3.3 percent growth rate for the country as a whole is high, and especially so when contemplating a twenty-year projection period and the possibility of pressure being put upon the standard of living from possible resource scarcities. Although it can be argued that the future population growth rates in this rapidly-developing zone of influence may well exceed the national average, the particular rates utilized here are, in the consultant's judgment, more reasonable.

In estimating the annual average passenger growth rates for the Tartous-Lattakia road over the twenty-year period, 1984-2003, the consultant has reduced the ratio of passenger traffic growth to population growth level of

1977-1983 to 2.95 for 1984-1993 and to 2.55 for 1994-2003. These reductions are based upon the premise that there has been, and will continue to be, a pent-up demand for passenger transport (especially by private automobiles) but that this demand will begin to slacken in future years as a higher percentage of the population is served.

An indication of this pent-up demand is shown by the increase in passenger vehicle registrations for the two mohafazats of Lattakia and Tartous during the period 1971-1976 (see tabulation following). In 1974, the SAR discontinued its import quotas on new vehicles, and substantially loosened up its import procedures.

Passenger Motor Vehicle Registrations in the Mohafazats of Lattakia and Tartous, 1971 and 1976

	1971	1976
Automobiles (including taxis)	1,964	4,116
Buses	97	331
Total	2,061	4,447

From the above, the annual average growth of all passenger vehicles equals 16.6 percent. The projected annual average normal passenger growth rates for the Tartous-Lattakia road are summarized below:

Period	Factor	Annual Average Population Growth Rate (%)	Annual Average Normal Passenger Growth Rates (%)
1977-1983	3.31	3.3	10.9
1984-1993	2.97	3.2	9.5
1994-2003	2.58	3.1	8.0

2) Allocation of Projected Normal Passenger Traffic by Vehicle Type

Allocation of the projected total normal passenger traffic for the Tartous-Lattakia road among private cars, taxis and buses is shown in Table B-64. In the allocation of auto traffic between private cars and taxis, the consultant estimates a substantially lower proportion of taxis in future years. This is because most of the present taxi traffic on the Tartous-Lattakia road relates to long-distance trips between Damascus-Homs-Tartous and Lattakia. These distances for taxis are not economically viable in the face of good bus transportation. Although taxis are competitive with private autos on economic grounds, the convenience of driving a private car outweighs economics of a taxi in the minds of car owners throughout the world. It is anticipated that as the number of car owners increase in Syria their behavior pattern, in terms of driving their own car versus using a taxi for long-distance travel, will be very similar to that of car owners in other countries.

TABLE B-64

ALLOCATION OF PROJECTED NORMAL PASSENGER TRAFFIC BY VEHICLE TYPES, 1983, 1993, 2003

Vehicle Type	1978 (May)		1983		1993		2003	
	ADT	Percentage Allocation	ADT[1/]	Percentage Allocation	ADT	Percentage Allocation	ADT	Percentage Allocation
Cars								
Private	719	53.0	1,283	54.5	3,269	58.0	7,100	65.6
Taxis	405	29.8	721	26.5	1,589	18.0	1,205	12.0
Sub-total	1,124	82.8	2,004	81.0	4,858	76.0	10,046	77.6
Annual Average Growth Rate	May 1978-1983 = 11.2%; 1984-1993 = 9.3%; 1994-2003 = 7.5%							
Buses	233	17.2	416	19.0	1,139	24.0	2,901	22.4
Annual Average Growth Rate	May 1978-1983 = 11.7%; 1984-1993 = 10.6%; 1994-2003 = 9.8%.							
Total Cars and Buses	1,357	100.0	2,420	100.0	5,997	100.0	12,947	100.0

1/ Based upon projected rate for 5.5 years.

be very similar to that of car owners in other countries.

The ADT for cars (private autos and taxis) is projected at annual average growth rates ranging from 11.7 percent for the 1978-1983 period to 9.8 percent for the 1994-2003 period. Bus transportation for the same periods show growth rates ranging from 11.7 percent down to 9.8 percent.

c. Agriculture

1) Methodology

a) Historical Rates and Weighting Factors

The annual average growth rates of agricultural production in the zone of influence for the periods 1970-1972 and 1974-1976 were used as the major basis for projections of marketable surplus for the zone from 1976 through 1983 (see Table B-39). The only exception was with the relatively small industrial crops group. The historical negative rate associated with this group was revised to a modest positive increase for the 1976-1983 period on the basis of target goals for the zone of influence as contained in the Fourth Five-Year Plan for major crops of this group, and on the basis of the opportunities for import substitution of some of these crops. (See Section B-4, Development Planning, and Appendix B Table 41).

Marketable surplus equaled 83 percent of total production in the zone in 1976. In making projections of marketable surplus over the twenty-year period, 1984-2003, the consultant estimated the effect of several major technical factors upon agricultural production and marketable surplus. These factors are:

(1) effective use of fertilizers (particularly superphosphate and nitrogen sources);

(2) adoption of improved varieties selected on the basis of actual field performance;

(3) adoption of improved cultural practices, such as timeliness of planting, suitable plant populations, exploitation of local opportunities for irrigation, etc.;

(4) use of soil treatment measures to improve soil structure, to supply nitrogen by means of leguminous green manures, and to improve soil drainage on soils that tend to become water-logged in winter; and

(5) use of pest control by suitable economic measures to minimize damage by insects, plant diseases, weeds, etc.

A weight was then assigned to each of the technical factors based on each factor's relative contribution to achievement of potential rates of

production and marketable surplus. The weights for the zone's four groups of crops were as follow:

Technical Factors	Vegetables	Fruits	Cereals	Industrial Crops
Use of fertilizers	19	20	19	21
Improved varieties	14	21	19	14
Improved cultural practices	29	21	19	30
Soil improvement	29	21	27	21
Pest control	9	17	16	14
Total Weighting of Factors [1/]	100	100	100	100

The weights were estimated on the basis of the type of natural resources that prevail in the zone. In the interest of conservative projections, no consideration was given for additional production arising from interaction among the categories of technical factors, although experience in other countries has shown such interaction to be significant.

Ranges of annual average rates were then estimated, by crop, for the potential growth over the 20-year period, 1984-2003. They are as follow: Vegetables 8.5 to 12.5 percent; fruit 4.5 to 7.5 percent; cereals 4.8 to 7.8 percent; and industrial crops 5.5 to 8.5 percent.

In livestock production projections two observations had significant influence. One was that the production increase recorded between the 1970-72 period and the 1974-76 period was very nominal. The second observation was that very little attention is being paid to the need for better livestock supplies, the need for better animal health programs, the effects of decentralization (so as to involve great numbers of small producers), and the inadequacy of access to livestock processing plants. In general there does not appear to be adequate economic incentive for farmers to expand into commercial levels of livestock production.

In consideration of the above mentioned technical factors the consultant has estimated the range of annual average growth rates to be 2.0 to 4.0 percent, with 3.0 percent as the mid-point.

Further details of potential for expanding agricultural production in the zone are given in Appendix B, Table 41.

[1/] No credit for interaction between technical factors.

b) Achievable Versus Potential Increases

An important factor affecting future increases in the zone's marketable surplus is the probable rate at which growers will adopt technological opportunities that become available to them. There is a traditional delay in rate of acceptance by the mass of small producers, who usually wish to be convinced that an innovation will bring economic rewards before they fully adopt it. On the basis of experience in both developing and developed countries, the consultant estimated that some 69 percent of the total potential marketable surplus would be achieved by 1993, while by 2003 the percentage would have risen to 80 percent (see Table B-65 following).

The growth rates are also influenced by assumptions of the extent to which government policies and programs will aid the agricultural sector. If such policies and programs prove to be unusually helpful to a large majority of producers, agricultural output will come closer to the potential level. On the other hand, constraints on the sector would tend to limit production to the readily achievable levels. From visits to agricultural producers and from discussions with various official agencies in the zone of influence (during the first half of 1978), the consultant gained generally optimistic impressions as to the status of support for the agricultural sector. Thus for the 1983 to 2003 period it was assumed that programs and policies would provide:

(1) An adequate economic return to the producer;
(2) Mapping of agricultural lands to identify suitable land uses, and needs for drainage and soil conservation practices;
(3) A dependable supply system to supply fertilizer and other farm production inputs;
(4) An adequate agricultural extension service;
(5) Establishment and operation of regional field research stations;
(6) Adequate agricultural marketing services including standards for establishing commodity grades, research on reducing loss in transit for perishables, and provision of centralized storage for non-perishable commodities; and
(7) Expansion of the quality and quantity of agricultural education at the secondary and university levels.

A major horticultural development project, which will have an important influence on future production, is currently underway in the zone of influence. This is an FAO-Syrian project for greatly increasing the output of

TABLE B-65

PROJECTIONS OF AGRICULTURAL MARKETABLE SURPLUS, BY COMMODITY GROUPS, ZONE OF INFLUENCE, 1976-2003

Commodity Group	1976	1983	Marketable Surplus 1993 Potential	1993 Achievable	2003 Potential	2003 Achievable
			(000 MT)			
Vegetables	241.8	679.3	2,476.7	1,708.4	4,983.5	3,976.9
Fruits	82.7	138.1	344.9	239.0	442.9	354.3
Cereals	44.9	80.0	188.1	130.4	271.5	217.2
Industrial Crops	22.1	24.5	70.4	48.8	94.8	75.8
Livestock & products	21.1	39.0	55.0	45.1	70.4	63.3
Total	422.6	960.9	3,135.1	2,172.7	5,863.1	4,690.5

TABLE B-66

ANNUAL AVERAGE GROWTH RATES OF PROJECTED AGRICULTURAL MARKETABLE SURPLUS, BY COMMODITY GROUPS, ZONE OF INFLUENCE, 1976-2003

Commodity Group	1976 1983	1984-1993 Potential	1984-1993 Achievable	1994-2003 Potential	1994-2003 Achievable	1984-2003 Potential	1984-2003 Achievable
				(Percentage)			
Vegetables	15.9	13.8	9.7	7.3	8.8	10.5	9.2
Fruits	7.6	9.6	5.6	2.5	4.0	6.0	4.8
Cereals	8.6	8.9	5.0	3.8	5.2	6.3	5.1
Industrial Crops	1.5	11.1	7.1	3.0	4.5	7.0	5.8
Livestock & products	3.3	3.5	1.4	2.5	3.4	3.0	2.5
Weighted Average	12.4	11.0	8.5	8.0	8.0	9.5	8.3

citrus fruit and winter vegetables. The program calls for the introduction and propagation of improved planting stock and for major increases in the area annually planted to citrus, along with development of extension and marketing services. Also, plastic greenhouses have been established to develop and expand intensive production of vegetables during the winter season.

2) Projections of Marketable Surplus

Agricultural marketable surplus for the Tartous-Lattakia zone of influence is projected as increasing from about 423,000 tons in 1976 to 961,000 tons in 1983 (see Table B-65). This is equivalent to an annual average growth rate of 12.4 percent, and is based upon the weighted average historical rate for four of the five commodity groups for the period 1970-1972 and 1974-1976 (see Table B-39). The fifth group, industrial crops, was projected at an annual average rate of 3.3 percent, compared with the historical rate of -1.0 percent. The projection takes into consideration the Fourth Five-Year Plans emphasis upon oil crops (including ground nuts) and tobacco in the zone, as well as long range possibilities for import substitution (see Appendix B, Table 41).

For the twenty-year projected period, 1984-2003, the marketable surplus potential was projected as rising to 3,135,000 MT by 1993 and to 5,863,000 tons by 2003. Achievable marketable surplus production, however, was forecast as 69 percent of the potential in 1993, or about 2,173,000 tons, and at 80 percent of the potential in 2003 -- about 4,690,000 tons (Table B-65). Annual average growth rates over the twenty-year period were 9.5 percent for the potential and 8.3 percent for the achievable (see Table B-66).

d. Industry

1) Methodology

Projections of the industry sector for the study zone are based upon the influences of the Third and Fourth Five-Year Development Plans, interviews with plant managers, and references to historical trend data for the national industrial sector. Unfortunately no industrial census has been taken in Syria, and overall production data on a homogeneous quantity basis (metric tons) do not exist. Some production data in physical units are published by the Central Bureau of Statistics for a limited number of main manufacturing industries, but because of the diverse units of output in which the data are reported, they are not additive. The only sources of historical trend data for industry are in the indices of industrial production which are published by the Central Bureau of Statistics, and in the national accounts which are published by the Central Bureau of Statistics and the Central Bank of Syria.

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