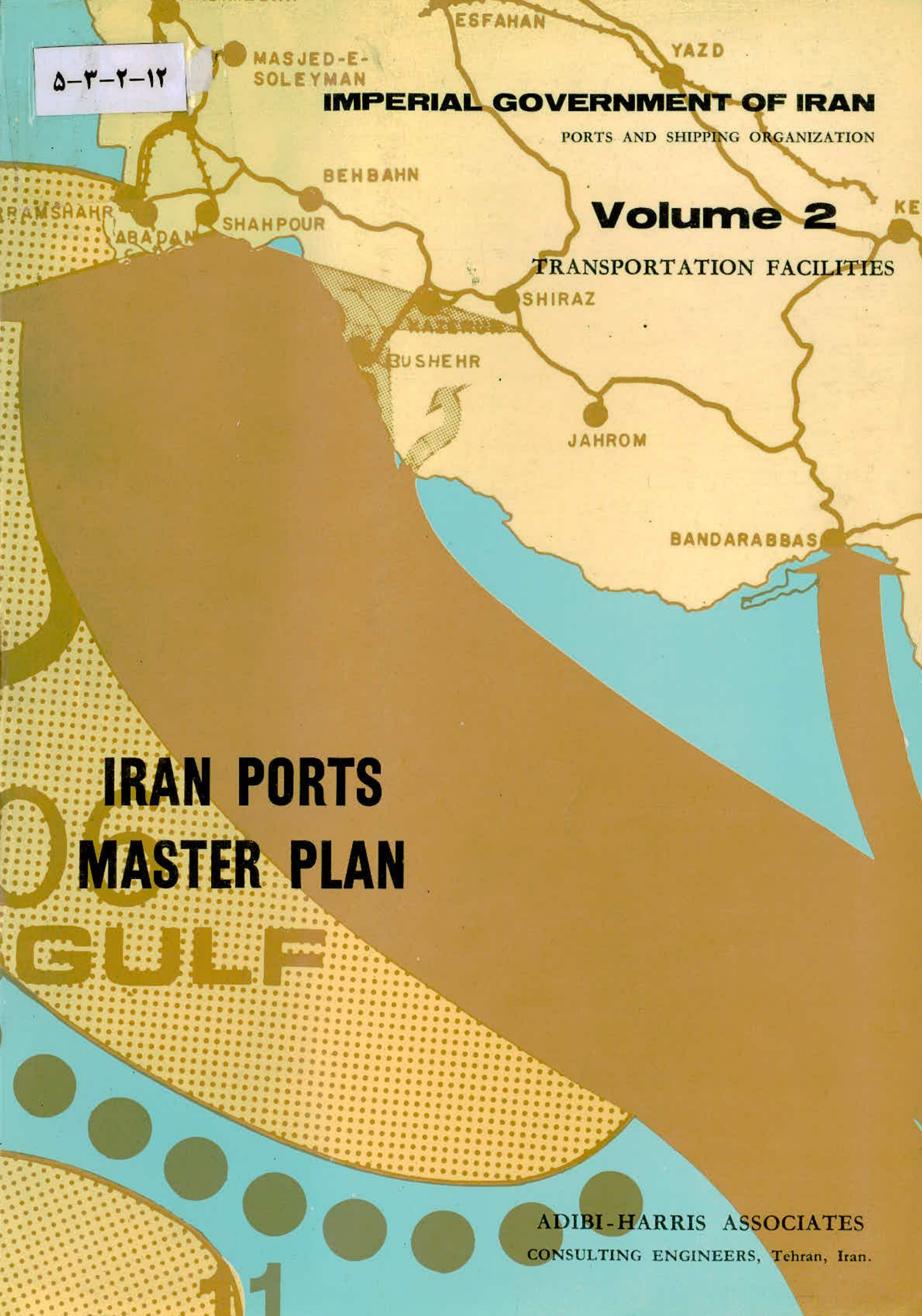
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IMPERIAL GOVERNMENT OF IRAN

PORTS AND SHIPPING ORGANIZATION

Volume 2

TRANSPORTATION FACILITIES

IRAN PORTS MASTER PLAN

ADIBI-HARRIS ASSOCIATES

CONSULTING ENGINEERS, Tehran, Iran.


CANAL ROUTE
PERS

IMPERIAL GOVERNMENT OF IRAN

21

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Volume 2

TRANSPORTATION FACILITIES

1974

ADIBI-HARRIS ASSOCIATES

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IRAN PORTS MASTER PLAN

FINAL REPORT

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SECTION 1

INTRODUCTION

1.1 THE GEOGRAPHY OF IRAN

Iran encompasses a large area of some 1,645,000 square kilometers, characterized by a concentration of population in the northern and western parts of the country and vast stretches of relatively unpopulated desert and near desert in the south and east. Approximately 57 percent of its over 31 million inhabitants live in rural areas and only 30 per cent reside in cities of 40,000 or more. The capital Tehran, with a population approaching four million, contains over 11% of the total population.

Geographically Iran consists of a triangular plateau bordered by formidable mountain ranges which restict access, especially between the Caspian Sea and Persian Gulf coastal area. This is described in more detail in Section 3.2.1.3. Because of the physical topography, inhabited areas are essentially islands, separated by considerable distances. Such distances and topography make transportation relatively costly.

1.2 PURPOSE OF VOLUME 2

The purpose of this volume is to examine the status of existing and planned transportation networks and to evaluate these systems for their adequancy in meeting the demands of future port traffic. Detailed analysis appears in the Master Plan Report Volumes for each major port.

1.3 CONTENTS OF VOLUME 2

This volume consists of three major sectors. The first treats the main two forms of domestic ground transportation: railroads and highways. The second treats other forms of domestic transportation : pipelines, aviation, fluvial transport and cabotage. The last section deals with international railroads, highways and waterborne transportation.

SECTION 2

SUMMARY AND CONCLUSIONS

2.1 IRANIAN STATE RAILWAYS

The Iranian railway network at present serves international cargo traffic at the ports of Khorramshahr and Bandar Shahpour and at the overland border crossings with the Soviet Union at Jolfa and Turkey at Razi. An extension from Kerman which will serve Bandar Abbas is planned, with completion expected by 1357. The rail network serves most of the major cities and developing industrial poles and thus can potentially play a major role in domestic transport of international cargoes. The network is illustrated in Figure 1.

The economic cost of rail freight transport is estimated to be 1.74 Rials/ton-km for general cargo, 1.31 Rials/ton-km for special cargo and 0.87 Rials/ton-km for bulk cargo.

In 1350 ISR lines transported small volumes of freight relative to their capacities with the exception of the line between Ahwaz and Arak. This is currently being operated at or near capacity and, unless improved, will be able to carry only a limited amount of additional port traffic northward from Bandar Shahpour. Priority for the improvement of this section should therefore be given. Figure 2 shows the estimated rail capacities versus utilization in 1350.

Future movements of international cargo, ore and steel products will significantly increase ISR freight haulage. Projections, presented in Table 3.20 for 1356 and 1361 and illustrated in Figure 3 for 1356, indicate that the following links of the ISR system will need improvements to accommodate projected demand.

- Tehran - Qom by 1356/57
- Arak - Dorud by 1356
- Dorud - Andimeshk as soon as possible
- Andimeshk - Ahwaz before 1356
- Ahwaz - Bandar Shahpour by 1356/57
- Qom - Kashan by 1357/58
- Kashan - Sagzi by 1357/58
- Sagzi - Esfahan after 1361
- Sagzi - Kerman by 1358
- Gole Gohar - Bandar Abbas by 1360/61. The presently planned single track line will have to be double track.

The above listed improvement projects will require considerable capital investment in ISR's infrastructure.

The organization and possible future role of ISR is currently being studied by the Prime Ministry's Transport Coordination Study and the industrial Management Organization.

2.2 NATIONAL ROAD TRANSPORT

The Iranian highway network at the beginning of the Fifth Development Plan (1352) consisted of 12,500 km of asphalt, 12,000 km of gravel and 17,500 km of feeder or dirt roads. The Fifth Development Plan contains project allocations for the completion of 3,620 km asphalt surface unfinished from the Fourth Plan, 2,900 km of asphalt roads to be begun and completed during the Fifth Plan, and 2,700 km of asphalt roads to be begun in Fifth Plan and completed in the Sixth Plan. There are also allocations for 7,500 km of new secondary roads to be completed during the Fifth Plan and 4,500 km to be completed in the Sixth Plan.

When the road projects of the Fifth Development Plan are completed, the network of asphalt highways will consist of 18,100 km of asphalt road plus 2,700 km to be completed in the Sixth Plan. All major ports will be connected to all major population centers, with the exception of a direct Kerman-Mashad connection. A Jolfa-Marand road connection exists which is currently gravel and not scheduled for improvement. The road networks are illustrated in Figures 4 and 5.

The highway network serving Bandar Abbas will be substantially improved. The road to Tehran will be fully paved and distance reduced from 1559 to 1289 km. The distance between Bandar Shahpour and Tehran is 1024 km. Thus the distance between the two ports and Tehran will be reduced from a 40% to a 23% difference. Other roads will provide more direct routes to the west of Shiraz and eastward to Bam and Zahedan.

A second major highway will serve Bandar Shahpour. This is the Ahwaz - Esfahan road, planned to connect to the existing Bandar Shahpour-Ahwaz road near Ramshir. It will not, however, be in operation before 1360. Road distance from Bandar Shahpour to Tehran via this road will, depending upon the final route selected, be slightly shorter than the existing route via Dorud. The new road will alter the "natural hinterlands" of the Persian Gulf ports by placing the Esfahan area in Bandar Shahpour's natural hinterland, at the expense of Bushehr.

The Chahbahar-Zahedan highway is being improved and asphalted, although this is not listed as a Fifth Development Plan project.

The Bushehr-Shiraz highway is scheduled for completion by the end of 1353.

1352 truck transport economic costs for an average ten ton truck have been calculated to be, in Rials per ton-km as shown in Table 2.1.

TABLE 2.1

TRUCK TRANSPORT ECONOMIC COSTS, RLS/TON

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	1.32	1.95	3.21
Rolling	1.50	2.18	3.52
Mountainous	1.54	2.64	3.84

Two-way highway capacities have been calculated to be, both in terms of equivalent light vehicles per day (ELV) and, assuming 50% of the traffic is trucking, in terms of million tons of cargo per year (MTY) as shown in Table 2.2.

TABLE 2.2

TWO-WAY HIGHWAY CAPACITIES MILL TON/YEAR

TERRAIN	Asphalt		Gravel		Earth	
	ELV	MTY	ELV	MTY	ELV	MTY
Flat	7,170	4.7	4,700	3.5	3,440	2.5
Rolling	5,770	2.4	3,440	1.4	2,350	1.0
Mountainous	10,140	2.2	6,020	1.3	3,670	0.8

Capacities of the highway network, in terms of million tons per year assuming 50% trucking, are illustrated in Figure 9.

The 1350 traffic on main highways is presented in Table 3.34 and illustrated in Figure 8. The highway from Khorramshahr/Bandar Shahpour between Andimeshk and Arak is currently over-crowded. This requires immediate improvement. In addition, the following sections of highway require immediate improvement:

- Tabriz vicinity
- Bandar Pahlavi - Rasht
- Shiraz vicinity
- Nain-Esfahan

Projections of highway traffic, including both port and domestic traffic, have been prepared and are presented in Tables 3.39 and 3.40 for 1356 and 1361. Figure 10 illustrates the projected highway traffic in 1356. The following roads will require improvements, in addition to those scheduled in the Fifth Development Plan,

by 1356

- Rasht - Qazvin
- Shahabad - Kermanshah
- Hamadan - Takestan

by 1361:

- Shiraz - Esfahan
- Tabriz - Qazvin

In the vicinity of Tehran, a thorough study of highway access is needed due to the scale and complexity of the traffic and road situation. A comprehensive study is therefore recommended.

The trucking industry should be organized to serve more effectively national needs, including the transport of international cargoes. Likewise domestic truck production targets should take port requirements into account.

2.3 OTHER DOMESTIC TRANSPORTATION

N.I.O.C.'s policy to build pipelines as soon as justified economically and to encourage use of natural gas as a substitute for fuel oil wherever possible minimizes the need to transport petroleum products by road and rail. The pipeline system is illustrated in Figure 11.

The volume of international freight transported by air and forecasts for the future indicate that aviation has an insignificant effect on the planning of Iran's ports.

Fluvial transport in Iran is limited to the Arvand Rud-Karun River system. Future developments will severely reduce or eliminate the present steel tonnage moving to Ahwaz by river, and no other major movements of cargo are expected to develop.

Cabotage by dhows is used for distribution of goods along the Persian Gulf coast. Although tonnage volumes are small, this is an effective means of distribution and is expected to continue to play a role in the future.

2.4 INTERNATIONAL TRANSPORTATION

The rail connection between Iran and Russia via Jolfa carried almost one million tons of international cargo in 1350. On the Iranian side cargoes are either transhippped by rail after a physical transfer of wagons, required due to change in gauge width, or by truck over the unpaved road to Marand. It is recommended that this road be paved. The planned electrification of the Jolfa-Tabriz rail line will increase capacity by 5-10%. This line capacity is expected to be adequate to 1366. Transhipment facilities, however, impose limitations and need improvement. The proposed second rail connection to Russia at Sarakhs will provide an alternative for some of the cargo at present passing through Jolfa.

The rail connection between Iran and Turkey at Razi was opened in 1350. Traffic has been developing at a fast rate. The 1352 haulage was at an annual level of about 180,000 tons. Significant growth is expected in the future. Plans to expand the ferry service at Lake Van in Turkey will result in capacity of about 1 million tons per year. There are plans to build a rail link around the lake when economically warranted.

Road transport of international cargo through Turkey is of fairly small magnitude at present, but is expected to play a more significant role in the future. This together with growing domestic traffic will require improvements of the Bazargan-Tabriz-Tehran highway in

the future, as mentioned in paragraph 2.2. Road transport between Iran and Afghanistan, Pakistan and Iraq consists of relatively small volumes, and no exceptional growth is anticipated.

Total world seaborne trade has been growing at an average annual rate of about 8%. Tonnage of oil and oil products has been growing at an even faster rate. In terms of tons, trade in the Persian Gulf is more than one fourth of total world seaborne trade. Persian Gulf oil shipments dominate Persian Gulf non-oil trade at a ratio of 100:1 tonnagewise whereas the comparable world ratio is 1:1.

The number of tankers outweighs the number of cargo ships in the Persian Gulf by a ratio of more than five to one.

Waterborne transport via the Caspian Sea serves trade between Iran and the USSR and also as an in-transit link between Iran and Europe. Traffic over the Caspian Sea is transported through the interior of Russia via rail or from/to the railhead ports of Baku and Makhachkala on the western shore of the Caspian Sea, Guryer on the north, and Krasnovodsk on the east, or via the Volga-Don and Volga-Baltic canal systems. The Volga-Don canal system operates a seven month season from early April through October, and the Volga-Baltic system operates a five month season from late April through September.

SECTION 3

DOMESTIC LAND TRANSPORTATION

3.1 IRANIAN STATE RAILWAYS

3.1.1 Introduction

The Iranian State Railway (ISR) is a government built, owned and operated rail system. Government cargo makes up a majority of its freight haulage. At present its organization and potential role in the national transport system are being studied both by the Prime Ministry's Transport Coordination Study and by the Industrial Management Organization.

3.1.2 The Railroad Network

The present network is a system of single track lines radiating from Tehran, with the exception of the line from Zahedan to the Pakistan border at Mirjaveh and the recently built line from Zarand to Esfahan and the Aryamehr Steel complex. A map of the network is shown in Figure 1.

3.1.2.1 Operational Divisions and Lines

The ISR railway network is composed of eleven operating divisions. Table 3.1 gives details of length of track and number of stations of each division. The operating lines are:

- South Line

The South Line and Ahwaz - Khorramshahr Line connect Tehran with Bandar Shahpour and Khorramshahr via Qom and Arak and were completed in 1317. The lengths of these lines are 928 km and 123 km respectively. They are the most heavily travelled trackage of the national system, carrying about 60% of the total freight. They are controlled by four divisions, namely Tehran, Lorestan, Arak and Southern. These divisions are at present the most sophisticated of the ISR system in terms of railway signalization and train operation.

- North Line

The North Line from Tehran to Gorgan is 497 km long linking Tehran with Bandar-e-Shah on the Caspian Sea and Gorgan. The line was completed in 1317 to Bandar-e-Shah and to Gorgan in 1338. This line is controlled by two divisions - Tehran with 200 km in length and North Division with 297 km.

- Tehran-Jolfa-Turkey Line

This line is composed of three operating divisions - Tehran, Northwest and Azarbaijan. The Tehran-Tabriz section via Qazvin, Zanjan and Maragheh was completed in 1337. The line from Tabriz to Jolfa meets the Caucasian Railway at the Russian frontier. It is 146 km long. A transfer and customs station is located at Jolfa for

passengers and cargo. A physical transfer is required since ISR operates on standard gauge of 1.435 m while the Russian gauge is 1.524 m.

The connection with the Turkish Railway at Razi was completed in 1350. This section is 222 km long and links the Iranian Railway with the railway network of Turkey and hence Europe. The Azarbaijan Division also provides rail service to Sharafkhaneh and Rahmanlu on Lake Rezaiyeh.

- Garmsar-Mashad Line

The length of this line is 811 km. It is operated under two divisions, the Northwest and Khorasan, comprising main line lengths of 478 km and 333 km respectively. The construction of the line was completed in 1336.

- Qom-Zahedan Line

This line is completed only from Qom to Zarand, a distance of 847 km and is under control of the Arak and Southeast Divisions. At Sagzi a line branches to Esfahan with an extension to the National Iranian Steel Corporation facilities to the southwest of the Esfahan. As part of the Bandar Abbas Line to be constructed, this line will be extended from Zarand to Kerman, a distance of 67 km. The proposed extension from Kerman to Zahedan constitutes a missing link in the Trans-Asian Railway network, ultimately to link Europe with Asia all the way to Singapore.

- Zahedan-Mirjaveh Line

This is the only broad gauge Pakistan gauge (1.676 m) sections of the ISR. The Pakistan Western Railway turned this section over to ISR for operations in 1348. The length of the line is 92 km.

TABLE 3.1

RAILWAY NETWORK AND DIVISIONS (1350)[1)]

DIVISION	TOTAL LINES (KM)	MAIN LINES (KM)	SIDE TRACK (KM)	SHUNTING	NUMBER OF STATIONS
Total Country	5224	4412	256	556	274
South	545	388	79	78	24
Lorestan	258	208	16	34	16
Arak	449	385	19	45	16
Tehran	673	527	49	97	26
North	336	297	14	25	26
Northeast	525	478	8	39	32
Khorasan	374	333	8	33	17
Northwest	507	465	7	35	25
Azarbaijan	448	336	30	82	30
Southeast	1017	903	26	88	60
Zahedan-Mirjaveh Line	92	92	0	9	2

1) Iranian State Railways

LEGEND

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

LEGEND

0 - 50%	
50-75%	
75-100%	
OVER 100%	

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IMPERIAL GOVERNMENT OF IRAN
MINISTRY OF FINANCE
PORTS & SHIPPING ORGANIZATION

AHA ADIBI-HARRIS ASSOCIATES
CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN
1350 ISR CAPACITY UTILIZATION

SCALE	DATE	FIGURE
GRAPHIC	APR. 1974	2

3.1.2.2 Planned Expansion and Improvements

The Fifth Development Plan includes the following projects for ISR:

New Line Construction

- The Zarand-Kerman-Bandar Abbas Line of 730 km; This is expected to receive highest priority;
- A Sari-Farahabad link of 30 km;

Also under consideration but not scheduled in the Fifth Plan are:

- A railway extension from Mashad to the Russian border either at Sarakh or Bajgiron. This would provide a shortened route for overland transit goods to the Eastern USSR and Japan ;
- A railway extension from Mashad to the Afghan border at Kalkale. Present level of trade with Afghanistan does not economically warrant this project in the foreseeable future ;
- A line between Esfahan and Azna on the South Line. Funds have been allocated for the study of this project ;
- The Kerman-Zahedan link, which would fill in the Iranian gap in the Trans-Asian Railway Network. Recent economic studies indicate that deferment until 1364 is warranted ;
- A line from Bushehr to Shiraz and connecting into the ISR network at Esfahan ;
- Double tracking of the South Line. It was recently announced that an agreement for Japanese technical assistance has been reached for this project ;
- A Persian Gulf coastal railroad, joining Bandar Shahpour to Bushehr and Bandar Abbas, eventually extending the entire coastal length.

Improvements of Existing Lines

The Fifth Development Plan includes projects for:

- Electrification of the Jolfa-Tabriz Line which is an unfinished project from the Fourth Plan ;
- Expansion of the Esfahan Steel Mill-Zarand Line by either dualization of track or by electrification ;
- Construction of overhead bridges in cities and towns on the old railway;
- Construction of a goods depot in Bandar Shahpour to increase capacity ;
- Construction of new customs houses outside Tehran and training of technical personnel .

Under consideration but not in the Fifth Plan:

- Switching yard north of Bandar Shahpour

3.1.2.3 Technical Data and Maintenance

The maximum permissible speed on ISR is 80 km/hr for passenger and 45 km/hr for freight trains. Maximum gradient on the main lines is 2.8% and the minimum radius is 220 m. All lines are single tracks with most sidings of about 500 m in length. Gauge width is 1.435 m with the exception of the Zahedan-Mirjaveh Line, which has a gauge width of 1.676 m.

The track is generally in acceptable condition. Due to recent reorganization of the track maintenance system and acquisition of mechanized equipment, an improved maintenance program is expected to result. The Fifth Development Plan provided ISR with allocations for this purpose.

3.1.3 ISR Operations

3.1.3.1 Organization and Administration

The Iranian State Railway was created by the Iranian Legislature in 1314, with an independent status and financial autonomy while under the general supervision of the Ministry of Roads. However, in the course of evolution, the ISR has become, in fact, a reflection of policy decisions made at higher levels with regard to capital expenditures, improvements, service rates, etc.

The organization of the ISR is shown in Table 3.2. The President with three Directors for Administration, Finance and Technical and the Technical Advisor to the President form the Board of Directors. This executive management body, through the Board of Directors, acts jointly with two advising groups; namely the Board of Supervisors and the High Technical Council. The Board of Directors in co-operation with Board of Supervisors mutually formulates administrative management decisions regarding policies and finance. The Board of Supervisors is composed of various officials designated by the Government. The High Technical Council is composed of five members and restricts itself solely to technical management of the railway.

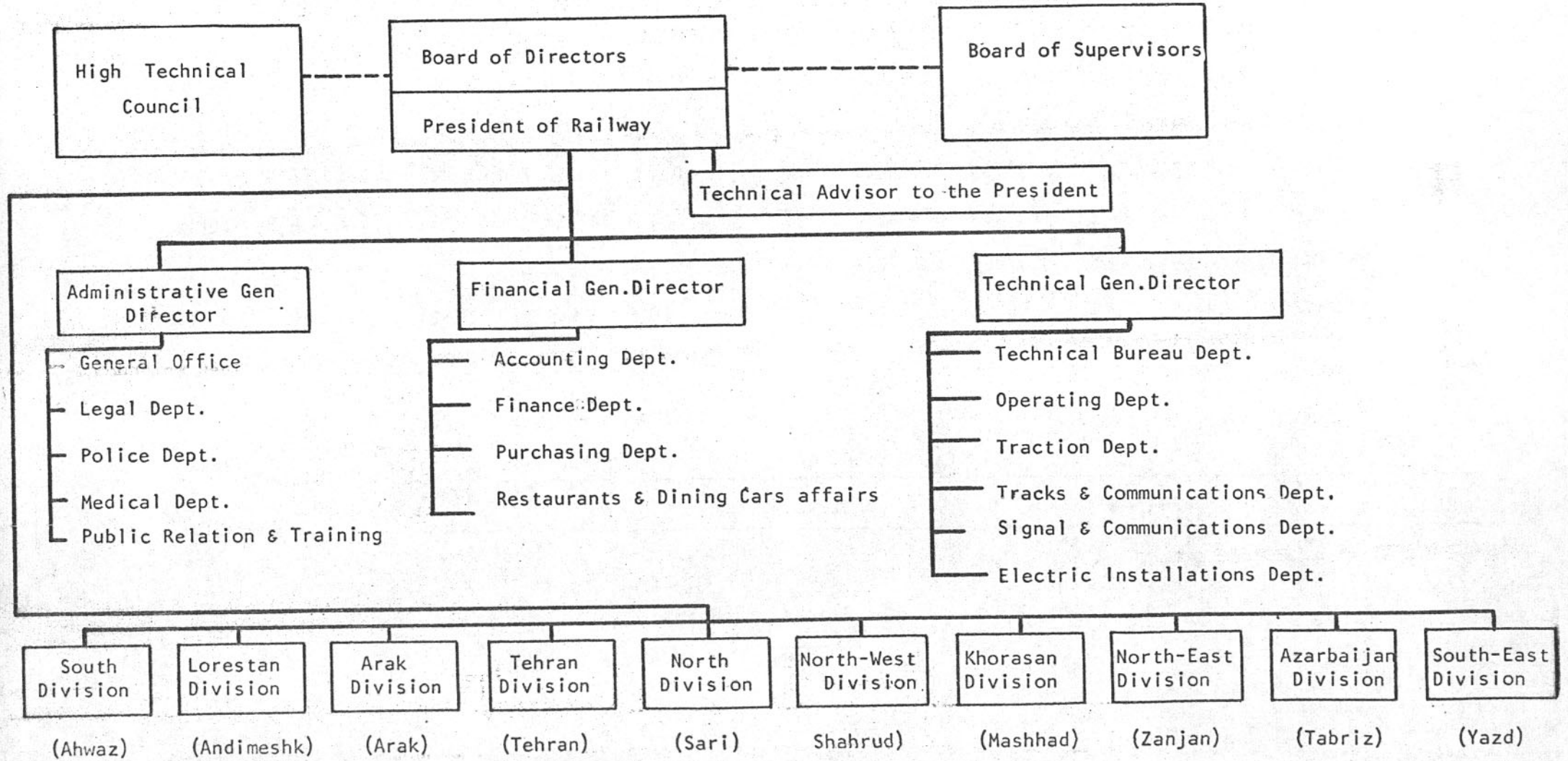
In addition to the Central Administration located in Tehran the ten divisions located throughout the railway system administer the operations of the various sections of the railway as shown in Table 3.2. A secondary management level directly responsible to the President of the Railway is thus created.

3.1.3.2 Passenger Traffic

In the year 1350 ISR carried 3,534,626 passengers, for a total of 1.79 billion passenger-km. Since 1346 the total number of passengers carried has increased by 725,790. As can be seen from Table 3.3, the peak of passenger service was in the year 1348 whereas the recent peak in passenger-km was 1349. This means that while the total number of passengers may have relatively decreased from 1348, the average distance travelled per passenger has correspondingly increased to give a significant increase in the total passenger-km travelled. Table 3.4 gives passenger-km by type of train.

TABLE 3.2

IRANIAN STATE RAILWAYS - ORGANIZATION CHART[1)]



1) Iranian State Railways.

TABLE 3.3

PASSENGER TRAFFIC 1345 TO 1350[1)]

YEAR	TOTAL PASSENGERS	INDEX (BASE YEAR 1335)	EXPRESS					LOCAL		
			1ST CLASS		2ND CLASS		3RD CLASS	1ST CLASS	2ND CLASS	3RD CLASS
			DE LUXE	ORDINARY	DE LUXE	ORDINARY				
1345	2,840,403	164.6	48,845	5,025	64,227	80,369	282,024	21,796	163,895	2,174,222
1346	2,808,836	162.8	80,248	3,923	3,949	133,921	332,436	5,164	168,203	2,080,992
1347	3,415,913	197.9	91.259	4,473	1,336	192,999	631,851	7,568	207,154	2,279,273
1348	3,736,301	216.5	112,350	0	0	274,130	699,857	657	186,005	2,463,302
1349	3,731,522	216.2	106,650	0	0	358,047	479,342	26,559	200,558	2,560,366
1350	3,534,626	204.8	127,461	0	0	472,241	244,678	32,221	171,330	2,486,695

1) Iranian State Railway

TABLE 3.4

PASSENGER-KM BY TYPE OF TRAIN[1)]
(Passenger-kmx1000)

YEAR	TOTAL PASSENGER-KMS	INDEX (BASE YEAR 1335)	EXPRESS							
			1ST CLASS		2ND CLASS		3RD CLASS	1ST CLASS	2ND CLASS	3RD CLASS
			DE LUXE	ORDINARY	DE LUXE	ORDINARY				
1345	1,160,501	262.5	35,813	4,329	42,547	63,707	189,371	17,060	99,711	707,963
1346	1,179,432	266.8	56,710	2,431	625	107,608	216,050	2,170	109,543	684,295
1347	1,456,058	329.3	49,431	6,757	441	136,320	342,599	3,773	111,897	804,840
1348	1,673,320	378.5	79,100	0	0	185,203	463,313	7,515	132,988	805,201
1349	1,800,020	407.1	91,834	0	0	281,192	390,061	15,388	123,702	897,843
1350	1,790,245	404.9	109,784	0	0	378,493	197,758	22,502	98,278	983,430

1) Iranian State Railways

3.1.3.3 Freight Tariffs

In the year 1350 the ISR transported some 5.4 million tons of freight for 3,006 million net tons-kms, as shown in Table 3.5. This results in an average haul of 553 kms. During the last ten years the net tonnage of freight transported by railway has increased by a factor of two, while passenger service increased by approximately 21%.

The transport of petroleum products has always been a major part of the total freight carried. The relative importance of the transport of petroleum products has been decreasing in recent years. Construction of petroleum product pipelines and consequent diversion of some portion of this tonnage will further reduce the relative significance of this commodity. Table 3.6 gives the breakdown of freight carried by ISR during the past six years.

As indicated in Table 3.7, the South Line and the Ahwaz-Khorramshahr Line account for more than 60% of the net freight carried in the year 1350, excluding the Tehran sector. These lines in the past have always carried a major portion of the net freight since they serve the oil production area, the main Persian Gulf Ports and several population centers. Their relative importance however, will decrease in the future owing to construction of product pipelines, refineries and the growth of imports and exports via road and rail connections with Russia and Turkey. Furthermore, the projected growth of Bandar Abbas as an import and export area for mineral products and general cargo, coupled with mining and steel producing activities in Bafgh and Esfahan regions, will result in an increasing importance of the Southeast Division.

3.1.3.4 Rolling Stock

At the end of 1350 ISR's fleet of rolling stock consisted of 287 locomotives, 432 passenger carriages and 7070 freight wagons. Of these 33 locomotives, 4 passenger carriages and 313 freight wagons were out of service. More detailed information is presented in Tables 3.8 and 3.9. Rolling stock in service requires routine maintenance and minor repairs. An estimated 10% of rolling stock in service is undergoing such maintenance at any given time.

ISR has recently placed orders for 53 diesel electric locomotives. With 3300 h.p. engines, these will be among the most powerful locomotives in the ISR system.

Locomotive kilometers for the year 1350 was 25.2 million km on main line and 22 million km for shunting, giving an average of 442 km per locomotive per day and 98 km per locomotive per day respectively. This is considered to be poor utilization of traction equipment.

Passenger and freight car usage during 1350 totalled 229.2 million km travelled, for an average of 88 km per wagon per day, indicating relatively low car-km per day utilization. However, in reviewing the above, it must be taken into consideration that some 14% of total freight wagons are not equipped with brakes. Accordingly, for braking and safety reasons locomotives are required

TABLE 3.5

LUGGAGE AND FREIGHT TRANSPORT[1)]
(BASE YEAR 1335)

YEAR	LUGGAGE				NET FREIGHT			
	WEIGHT (TON)	INDEX	TON--KILOMETER (THOUSAND)	INDEX	WEIGHT (THOUSAND TON)	INDEX	TON--KILOMETER	INDEX
1345	45,438	170.0	23,956	255.4	3,693	140.3	1,991	143.7
1346	47.709	178.5	25,787	275.0	3,546	134.7	1,938	139.9
1347	49,762	186.2	26,593	283.6	3,956	150.3	2,003	144.6
1348	49,138	183.9	30,724	327.6	4,158	158.0	2,145	154.8
1349	48,975	183.2	30,690	327.1	4,267	162.1	2,330	168.1
1350	52,602	196.8	33,209	353.9	5,431	206.3	3,006	216.9

1) Iranian State Railway.

TABLE 3.6

BREAKDOWN OF FREIGHT BY MAIN COMMODITIES [1]
(1,000 Tons)

YEAR	TOTAL	PETROLEUM	TYPE OF COMMODITY					
			MINERAL	AGRICULTURAL	FOODSTUFFS	INDUSTRIAL	ADMINISTRATIVE	OTHER
1346	3,546	1,671	149	139	383	219	- [2]	985
1347	3,956	1,766	188	259	338	269	478	658
1348	4,158	1,758	201	199	271	419	558	752
2349	4,267	1,608	236	362	186	385	605	884
1350	5,431	1,765	633	1,255	237	389	452	701

1) Iranian State Railways

2) Different commodity classification; "Administrative" is included in "Other".

TABLE 3.7

FREIGHT DISTRIBUTION BY AREA[1)]
(1,000 Tons)

YEAR	TOTAL	INDEX	RAILWAY DIVISIONS									
			SOUTH	LORES-TAN	ARAK	TEHRAN	NORTH	NORTH-EAST	KHORA-SAN	NORTH-WEST	AZAR-BAYE JAN	SOUTH EAST
1345	3,694	140.3	2,136	187	125	424	162	80	36	295	249	---
1346	3,546	134.7	1,872	212	73	349	184	93	59	336	368	---
1347	3,957	150.3	1,695	217	95	746	193	75	132	376	428	---
1348	4,158	157.9	1,671	243	124	874	159	76	152	328	533	---
1349	4,267	162.1	1,578	373	152	740	201	39	148	372	665	---
1350	5,431	206.3	2,926	268	101	659	186	61	116	382	374	356

1) Statistical Yearbooks Of The Iranian State Railway.

TABLE 3.8

TRACTION AND HEAVY EQUIPMENT (1350) 1)

DESCRIPTION	SITUATION AT THE END OF 1350			
	IN SERVICE	UNDER REPAIR	WAITING FOR SPARE PARTS AND OUT OF SERVICE	TOTAL
D.E.L. Series 60	65	6	-	71
D.E.L. Series 40	116	7	14	137
D.E.L. (Shuting) Series 90	31	1	1	33
D.L. Henshel Hydraulic Series 30	-	2	-	2
D.L. Dawnport	42	2	-	44
Cranes	64	4	10	78
Hoister	6	1	5	12
Snow Plows (Motor)	5	-	-	5
Snow Plows (Steam)	1	-	-	1
Snow Plow Wagones	4	-	-	4
Steam Generators	31	-	-	31

1) Iranian State Railways

D.E.L. = Diesel Electric Locomotive

D.L. = Diesel Locomotive

TABLE 3.9

ISR ROLLING STOCK [1]

PASSENGER CARRIAGES

TYPE OF CARRIAGE	PULLMAN	INSPECTION CARS		PASSENGER CARS CLASS							SNACK CARS	MAIL AND LUGGAGE CARS		CONVERTED TO CABOOSE, FIRST AID OR KITCHEN	TOTAL
				1		2		3		RESTUARANT CARS					
AGE		Old	New		Old	New	Old	New	Old	New		Old	New		
IN SERVICE	1	1	2	45	41	55	50	159	12	20	4	5	19	17	425
OUT OF SERVICE	-	-	-	-	-	-	3	-	-	-	-	-	1	-	4

FREIGHT WAGONS

TYPE OF WAGON	COVERED		LOW SIDED		HIGH SIDED		FLAT CARS		LOW BODY WAGONS	WIDE FLAT CARS	TANK CARS		REFRI-GERATOR WAGONS	DUMP WAGONS		CABOOSES	TOTAL
NO. AXLES	2	4	2	4	2	4	2	4	6	6	2	4	2	2	4	2	-
IN SERVICE	2010	720	595	112	628	672	119	349	6	60	79	982	15	187	200	23	6757
OUT OF SERVICE	56	5	61	11	45	-	56	20	-	-	3	27	-	28		1	313

1) Iranian State Railways.

on the average to pull freight trains at some 85% of their full capacity. Table 3.10 shows the breakdown of travelled kilometers for locomotives and rolling stock.

TABLE 3.10

BREAKDOWN OF DISTANCE TRAVELLED BY LOCOMOTIVES AND ROLLING STOCK [1)]

YEAR	DIESEL LOCOMOTIVE KILOMETERS			COACH AND FREIGHT KILOMETERS	
	PASSENGER	GOODS	SHUNTING	EMPTY	LOADING
1346	7,506,250	1,180,493	1,114,180	67,491,748	103,906,224
1347	7,623,793	11,248,065	1,109,598	62,472,596	125,392,266
1348	8,307,840	11,630,978	925,427	64,470,612	138,294,361
1349	8,089,395	15,023,164	894,049	65,503,955	162,056,692
1350	9,158,776	16,027,877	2,171,142	62,110,311	167,054,199

3.1.3.5 Repair Facilities

The ISR maintains one repair shop in Tehran, where all major repairs to both locomotives and passenger carriages are performed. Major repairs of freight wagons are carried out by the division shops and foundries as indicated on Table 3.11. ISR also maintains a number of posts in all divisions for the inspection and evaluation of transport equipment.

There is a general shortage of maintenance materials and in particular spare parts for locomotives.

3.1.3.6 Training

In 1345 ISR instituted a series of operational training courses in order to improve proficiency of the ISR staff in the various areas of railway operations. The training courses cover a wide range of expertise related to operation, maintenance and inspection.

3.1.4 Fare Rate Structure and Economic Costs

3.1.4.1 Passenger Fare Rates

The basic fare rates charged to passsengers on the ISR system has not changed since 1338 in relation to passenger-km travelled. Basically fares are established on the basis of speed, express

1) Iranian State Railways

or ordinary, train and comfort in terms of three basic levels, 1st, 2nd and 3rd class. In addition there are a passenger fare rates for special groups. fare rates are as follows:

	Express Train	Local Trains
1st class)	1.3 Rials	1.0 Rials
2nd class)per passenger-km	0.8 Rials	0.6 Rials
3rd class)	0.5 Rials	0.4 Rials

TABLE 3.11

REPAIR SHOPS AND INSPECTION POSTS [1)]

	REPAIRS SHOPS				FOUNDARY AND WORKSHOPS	INSPECTION POSTS FOR TRANSPORT EQUIPMENTS
	MAJOR		LIGHT			
	DIESEL	WAGON	DIESEL	WAGON		
South	-	1	1	1	1	4
Lorestan	-	-	-	2	1	3
Arak	-	1	-	2	1	3
Tehran & Central	1	1	1	1	1	3
North	-	1	-	2	1	6
North East	-	-	-	2	1	2
Khorasan	-	-	-	1	-	4
North West	-	-	-	1	1	4
Azarbaijan	-	1	1	1	1	5
South East	-	-	-	-	-	5
TOTAL	1	5	3	13	8	39

1) Iranian State Railways

3.1.4.2 Freight Rates

Freight rates are classified into seven groups, Class I through Class VII, as shown in Table 3.12. In addition to these basic freight rates, two specific types of rate reductions are available to shippers. One is imposed by governmental policy and the other intended to reflect a competitive commercial policy. Present examples of rate reductions for freight, as established by government policy are:

- Military goods-reduction of 75% ;
- Imported wheat-reduction of 25% ;
- Machinery for government workshops-reduction of 20% ;
- Export of ore-reduction of 55% ;

Commercial freight reductions are applicable for

- Volumes in excess of 10,000 tons ;
- Distance in excess of 300 km ;
- Certain type of commodities.

The cost of loading and unloading at railway stations can be done either by the shippers themselves or by ISR. If done by ISR the charges are as follows:

At Khorramshahr, Bandar Shahpour and Jolfa-
50 Rials/ton

At all other stations - 30 Rials/ton

TABLE 3.12

FREIGHT RATES PER TON-KM[1)]

CLASS RATE	RIALS	TYPICAL COMMODITIES
I	1.8	Electric tools and equip, textiles
II	1.6	Furniture, glass, wire, carpets
III	1.4	Plywood, paint, wool, nuts
IV	1.2	Rice, cotton, steel, crude oil & products
V	1.0	Timber, coal, asphalt, fertilizer
VI	0.8	Coke, zinc ore, lead ore, copper ore
VII	0.6	Water, coal, iron ore, chromite ore

1) Iranian State Railways.

3.1.4.3 Financial Situation of ISR

Table 3.13 presents some statistics on the overall financial situation of ISR. More detailed data, such as costs per ton-km, is generally unavailable. According to ISR letter No.23569 dated 22.12.1352 to P.S.O., such costs will not be available before the Industrial Management Organization has completed a cost study recently contracted for by ISR. The results of one study, conducted by the Indian Railway Team in 1351 based on 1349 data, are presented in Table 3.14.

TABLE 3.14

OVERALL ISR EXPENSES AND INCOME [1)]

	FREIGHT	PASSENGER
	(In Million Rials)	
Working expenses	2,339	1,555
Depreciation	355	188
Interest	549	314
Total expenses	3,243	2,058
Total earnings	2,998	918
Loss	- 245	-1,140

Total fully distributed cost of freight traffic was 1.39 Rials per ton-km against total earnings of 1.28 Rials per ton-km.

3.1.4.4 Freight Economic Costs

Since ISR pays no taxes and is reimbursed for customs, the above information can be used to obtain estimates of rail freight economic costs. The average cost of a unit of freight transport is

$\frac{1.39}{1.28}$ x tariff = 1.09 x tariff.

Reducing the seven ISR goods Classes to three cargo classifications and applying the 1.09 factor, estimated economic costs were obtained, as shown in Table 3.15.

TABLE 3.15

ESTIMATED RAIL FREIGHT ECONOMIC COSTS

ISR GOODS CLASS	ISR TARIFF	IPMP CARGO CLASSIFICATION	AVERAGE TARIFF	ESTIMATED ECONOMIC COST
			(Rials per ton-kilometer)	
First	1.80			
Second	1.60	General	1.60	1.74
Third	1.40			
Fourth	1.20	Special	1.20	1.31
Fifth	1.00			
Sixth	0.80	Bulk	0.80	0.87
Seventh	0.60			

1) Report on Introduction of Traffic Costing on Iranian State Railways, Indian Railway Team, 1351.

TABLE 3.13

TOTAL REVENUE OF THE IRANIAN STATE RAILWAYS BY SOURCE [1]

(MILLION RIALS: BASE YEAR FOR INDEX : 1335)

YEAR	TOTAL		PASSENGER		LUGGAGE		FREIGHT		MISCELLANEOUS	
	REVENUE	INDEX	REVENUE	INDEX	REVENUE	INDEX	REVENUE	INDEX	REVENUE	INDEX
1345	3,779	167.5	568	366.8	72	255.4	2,639	154.3	500	137.8
1346	3,387	150.1	576	371.5	77	275.0	2,175	127.2	559	154.1
1347	3,542	156.9	700	451.6	80	283.6	2,239	130.9	523	144.1
1348	3,905	173.0	850	548.3	92	327.6	2,504	146.4	537	147.8
1349	4,602	203.9	824	532.1	92	327.6	2,808	164.1	878	241.7
1350	6,128	271.5	830	536.0	100	356.1	3,979	232.5	1,220	335.8

1) Iranian State Railways.

3.1.5 Railroad Capacities and Utilization

3.1.5.1 General

In general, the capacity of any given railroad depends on the physical limitations of the railway and rolling stock, more specifically on the gradient and curvature of trackage, communication, locomotive power, rolling stock available, speed limitations, and the number and efficiency of the staff.

On a one-track line over which trains run in both direction, sidings are used to allow trains to bypass one another. As a result capacity of a given one-track line is basically determined by the longest time required to travel over any of the distances between two stations or two sidings that make up that line. This travel time depends on the combination of:

- The tractive capacity of the locomotive relative to the gross weight of the train and the resistance which it encounters;
- The gradient and curvature of the link ;
- Time for manoeuvering at sidings or stations, dependent on the layout of the sidings and the effectiveness of the railroad operating staff. This time is assumed to be 10 minutes.

The travel time determines the maximum number of trains which can be run over the line.

In addition, this maximum capacity is further restricted by the mixture of freight and passenger traffic. Since speed is important for passenger service, passenger trains are generally run at faster speeds and are given priority over freight traffic, causing freight trains to wait in sidings. For each passenger train that is run, the potential number of freight trains is reduced by a certain amount, dependent upon the relative speeds of the two types of service.

3.1.5.2 ISR Capacity Calculations

The methodology used to calculate ISR's one-track lines are those of the American Railway Engineer Association. [1] The calculations are based upon the following:

- Use of existing ISR locomotives ;
- Data on the gradient and curvature of ISR tracks ;
- Use of wagons with a gross weight of 40 metric tons and tare weight of 14 tons ;
- Use of trains of gross weight of 480 tons on the Garmsar-Gorgan and Sufian-Jolfa lines ;
- Use of trains of 2000 gross tons on the Zarand-Steel Mill line. Use of 4000 trains is being considered for the future ;
- Use of trains of 1000 tons gross weight on all other lines ;

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1) Manual for Railway Engineering, Vol.2, American Railway Engineering Association.

- The present level of passenger service .

For example, along the Qom-Ahwaz section of the South Line, the distance between the sidings at Shahzand and Nourabad is 19.3 km and the average gradient is 1.4%. A train of 1,000 tons gross weight pulled by a GT26CW locomotive can achieve a maximum speed of 34.2 km/hour when travelling up this grade.

This is taken as the average speed between the two sidings. Thus:

$$\text{Travel time} = \frac{19.3 \text{ km}}{34.2 \text{ km/hr}} = 0.56 \text{ hr} = 34 \text{ minutes}$$

$$\text{Manoeuvering time} = 10 \text{ minutes}$$

$$\text{Total transit time} = 44 \text{ minutes}$$

$$\frac{1440 \text{ minutes/day}}{44 \text{ minutes/train}} = 32.7 \text{ or } 32 \text{ trains/day}$$

The present level of passenger service is estimated to reduce this figure to 28 freight trains per day. Yearly freight capacity is therefore:

$$28 \frac{\text{trains}}{\text{day}} \times 650 \frac{\text{tons}}{\text{train}} \times 360 \frac{\text{days}}{\text{year}} = 6.6 \text{ million tons/year}$$

The results of these calculations, in terms of two-way capacities, are presented in Table 3.16. Since movements of trains and wagons in each direction on a branch line system as in Iran must be balanced, the capacity in each direction is estimated to be 50% of the two-way capacity. This relation does not hold for any future loop system.

3.1.5.3 Effect of Planned improvements on Capacity

Analysis of planned railroad improvements indicates the following increased in capacity over those given in Table 3.16.

- Electrification of line Tabriz-Jolfa line could reasonably improve capacity from five to ten percent. Modifications to length of by-passes and to coupling and braking of rolling stock could double the capacity of this line ;

- Electrification of the Zarand-Esfahan Steel Mill Line could result in a modest capacity increase of five to ten percent. Use of 4,000 tons trains will decrease the number of trains that can be run per day since their movements will be slower. Thus capacity will be somewhat less than double the capacity based on 2,000-tons trains: an estimated 32-36 million tons per year (MTY) from Sagzi to the Esfahan steel complex and 24-28 MTY from Sagzi to Zarand. Depending on the size of non-ore trains and on the mixture of ore and non-ore, actual capacity will be less ;

  A definite decision to double track the Sagzi-Esfahan line has already been made by ISR. Ore movements along this line are projected to increase from about 1.2 MTY in 1351 to 3.2 MTY in 1356, 8.0 MTY in 1361 and 20.0 MTY in 1366. Thus 1366 ore movements will require 20-2,000-ton trains or 10-4,000-ton trains per day per direction.

TABLE 3.16

RAILROAD CAPACITY CALCULATIONS

SECTION	TRAVEL TIME (MIN.)	MAX.NO. TRAINS	MAX.NO. FREIGHT TRAINS [1]	ESTIMATED TWO-WAY CAPACITY	ESTIMATED ONE-WAY CAPACITY
		Trains / Day		Million Tons/Year	
Razi-Sufian	38	38	36	8.5	4.2
Jolfa-Sufian	36	40	39	4.4	2.2
Sufian-Tehran	38	38	34	8.0	4.0
Tehran-Qom	36	40	34	8.0	4.0
Qom-Ahwaz	44	32	28	6.6	3.3
Ahwaz-Khorramshahr	30	48	44	10.4	5.2
Ahwaz-B.Shahpour	30	48	44	10.4	5.2
Qom-Sagzi	44	32	30	7.1	3.5
Sagzi-Steel Mill	30	48	46	21.0	10.5
Sagzi-Zarand	37	38	36	16.0	8.0
Tehran-Garmsar	36	40	36	8.5	4.2
Garmsar-Gorgan	34	42	40	4.6	2.3
Garmsar-Mashad	47	30	26	6.2	3.2

Shipment of steel ingots and imports from Bandar Abbas will require over 11-1,000-ton trains per day by 1361. The capacity of the Sagzi-Zarand-Esfahan line is 18-1,000 or 2,000-ton trains per direction per day. It therefore appears that this Sagzi-Zarand-Esfahan line will have to be doubled before 1366. ISR is currently studying requirements for this line.

In a double track system, the number of trains that can be run is determined by minimum safe headway between trains. If this is 20 minutes, 72 trains can be run per day in each direction. If each train carries a net weight of 1,400 tons, yearly capacity will be about 35 million tons each way. If trains of 2,800 net weight are used, yearly capacity will be almost 70 million tons per direction. The mixture of train sizes will reduce real capacity, but a doubled line will have adequate capacity beyond 1366. Further analysis is given in Volume 6.

1) Due to deductions for passenger service

- The Zarand-Kerman-Bandar Abbas extension is being designed with a maximum 0.5% grade, allowing use of trains of up to 10,000 gross tons. Due to coupling limitations use of 4,000 gross trains is being considered for the immediate future. Other movements will probably be by 1000 gross ton trains;

  Capacity is estimated to be on the order of 7.6 million tons per year, based on an estimated 32-1,000-ton trains per day. Use of 4,000-ton trains between Gole Gohar and Bandar Abbas will result in a capacity of about 22-26 MTY. Ore movements are expected to reach 1.1 MTY by 1356, 9.0 MTY by 1361 and 12.0 MTY by 1366. This will require 1 train per day in 1356, 4½-5 trains per day by 1361 and 6 trains per day by 1366. The remaining capacity based on use of 1,000-ton trains, is estimated to be at most 7.1, 5.1 and 4.7 million tons per year by 1356, 1361 and 1366 respectively. analysis is given in Volume 8 ;

- The proposed extension of the railway from Mashad to Sarakhs at the Russian frontier will, in conjunction with the construction and extension of the Russian railway from Tajan, represent a new service route and capacity for the Iranian State Railway. An estimated capacity of this extension is 9 million tons year, but its use will be limited by the capacity of the line to Mashad ;

- The proposed extension of the railway from Sari to Farahabad, will be limited by the capacity of the Garmsar-Gorgan line.

3.1.5.4 1350 Railroad Freight Traffic

Data on the tonnage of freight hauled in 1350 was received from ISR. It is presented in Table 3.17, mostly in the form of operating division to operating division. These have been assigned to the various sections of the ISR trackage, and the resulting information in the form of tonnage per direction per railroad section is presented in Table 3.18. It is illustrated in Figure 2.

Examiniation of this information indicates that on only one section of the ISR trackage is haulage approaching estimated capacity. That is the for northbound movements between Andimeshk and Dorud. Imports from Khorramshahr and Bandar Shahpour totalled 915,000 tons, and oil products from Khorramkouskh totalled 977,000 tons. This represents about 80% of the total northbound haulage of 2,370,000 tons from Ahwaz to Andimeshk. Note that southbound volume was well below capacity in 1350.

A recent report has stated that the South Line is in 1352 operating at capacity. [1] ISR has confirmed these findings.

3.1.5.5 ISR Traffic Projections

The data for 1350 ISR traffic served as a base for projections of haulage of non-port commodities. The shipments at each point of origin were assumed to increase in direct proportion with increase in value added in manufacturing for that city or region,[2] with the

1) Transport Coordination Study, Interim Report, 1352
2) Volume 1, Appendix 4.

LEGEND

IRAN BOUNDRY
OTHER BOUNDRY
ASPHALTED HIGHWAY
OTHER MAIN HIGHWAYS
LESSER ROADS
RAILWAYS
RAILWAYS UNDER CONSTR.
NAVIGABLE WATER
MAJOR PORT
MINOR PORT

CAPITAL
300,000 – 1,000,000
100,000 – 300,000
30,000 – 100,000
10,000 – 30,000
UNDER – 10,000
LAKES
SALT FLAT

LEGEND

EXISTING RAILWAY LINES
5 TH PLAN PROGRAM
ALTERNATIVES

طرح جامع بنادر ایران

IMPERIAL GOVERNMENT OF IRAN
MINISTRY OF FINANCE
PORTS & SHIPPING ORGANIZATION

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CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

IRANIAN RAILWAY SYSTEM
(1351 / 1356)

SCALE GRAPHIC	DATE MAY 1973	FIGURE 1

TABLE 3.17

1350 ISR FREIGHT HAULAGE [1]

ORIGIN	DESTINATION										
	SOUTH (1-5)	6	7	8	9	10	11	12	AZARBAIJAN (13-18)	19	TOTAL
1. Khorramshahr	58.2	3.9	9.8	219.0	0.8	0.4	5.8	1.7	1.2	-	300.8
2. Khorramkoushk	39.4	169.2	731.3	62.4	6.8	0.8	0.8	1.5	3.9	-	1,016.1
3. Bandar Shahpour	440.1	19.7	37.6	581.3	24.3	-	82.5	1.9	1.5	-	1,188.9
4. Ahwaz Harbour	2.7	7.1	31.2	16.2	1.2	-	4.7	16.2	16.1	-	95.4
5. Ahwaz Station	12.4	3.5	1.8	30.8	0.2	0.2	0.4	2.6	0.3	-	52.2
(1-5) SOUTH	552.8	203.4	811.7	909.7	33.3	1.4	94.2	23.9	23.0	-	2,653.4
6. Lorestan	128.5	91.1	22.0	29.8	0.8	-	2.6	0.1	-	2.5	277.4
7. Arak	45.5	1.1	10.7	11.6	0.6	1.5	-	-	1.1	3.1	75.2
8. Tehran	31.2	16.4	15.6	25.2	219.1	11.8	225.9	34.9	87.4	-	667.5
9. North	7.7	-	1.6	17.2	90.9	6.7	5.2	5.1	8.3	37.4	180.1
10. Northeast	-	2.3	3.4	8.7	3.6	17.5	8.7	-	5.4	12.0	61.6
11. Khorasan	31.9	-	-	47.5	-	-	2.1	-	0.1	-	81.6
12. Northwest	18.1	-	0.1	7.3	1.7	-	1.6	37.3	279.5	34.7	380.3
13. Marand	2.0	-	-	3.2	76.6	-	-	-	-	-	81.8
14. Tabriz	-	-	-	10.5	-	-	-	-	3.4	-	13.9
15. Soofian	-	-	-	60.6	60.9	-	-	-	-	-	121.5
16. Harzand	22.2	-	-	-	-	-	-	-	-	-	22.2
17. Zal	110.8	-	-	-	-	-	-	-	-	-	110.8
18. Jolfa	-	-	-	264.8	78.4	-	-	-	-	53.9	397.1
(13-18) Azarbaijan	35.0	-	-	339.1	215.9	-	-	-	3.4	53.9	747.3
19. Southeast	-	-	-	-	-	-	-	-	-	354.9	354.9
TOTAL	950.7	314.3	865.1	1396.1	565.9	38.9	340.3	101.3	458.7	444.6	5,479.3

1) Iranian State Railways. Includes minor quantities of passenger freight and ISR's own administrative movements.

TABLE 3.18

1350 ISR FREIGHT HAULAGE [1]

(Million Tons Per Year)

LINK	ESTIMATED CAPACITY (Two-way)	NORTHBOUND	SOUTH-BOUND	REMARKS
Tehran-Qom	8.0	1.14	.41	Adequate
Qom-Arak	6.6	1.14	.31	Adequate
Arak-Dorud	6.6	1.95	.29	Adequate
Dorud-Andimeshk	6.6	2.29	.44	Near capacity on northbound
Andimeshk-Ahwaz	6.6	2.37	.40	" " " "
Ahwaz-Khorramshahr	10.4	1.32	.16	Adequate
Ahwaz-Bandar Shahpour	10.4	1.19	.16	Adequate
Tehran-Garmsar	8.5	.81	.19	Adequate
Garmsar-Shahi	4.6	.48	.09	Adequate
Shahi-Gorgan	4.6	.52	.13	Adequate
Garmsar-Semnan	6.2	.36	.14	Adequate
Semnan-Mashhad	6.2	.34	.08	Adequate
Qom-Kashan	7.1	.14	-	Adequate
Kashan-Sagzi	7.1	.14	-	Adequate
Tehran-Zanjan	8.0	.21	.83	Adequate
Zanjan-Maragheh	8.0	.41	.74	Adequate
Maragheh-Tabriz	8.0	.40	.75	Adequate
Tabriz-Sufian	8.5	-	.74	Adequate
Sufian-Jolfa	4.4	-	.40 [2]	Adequate
Sufian-Razi	8.5	-	- [3]	Adequate

1) Based upon data from Iranian State Railways.
2) 1350 seems to have been an exceptionally low year for Jolfa rail. 1349: 601,413 tons; 1351: 820,629.
3) This link was opened in the second half of 1350 and carried only 6455 tons of imports and 721 tons of exports. Estimated haulage for 1352 is 180,000 tons imports and 26,000 tons exports.

exception of the three ports served or planned to be served by rail.

Rail transport of imports from Bandar Abbas and Bandar Shahpour was estimated, as described in Volume 5, Section 9. In addition, rail shipments of imports and exports to and from Turkey via Razi, and Russian via Jolfa, of steel products from the Esfahan and Bandar Abbas steel complexes and of steel ore and scrap were added. The assumed volume and distribution of these shipments are presented in Table 3.19. These movements were assigned to ISR trackage, and resulting tonnage per direction per section of track are shown in Table 3.20. The projections for 1356 are illustrated in Figure 3.

3.1.5.6 General Conclusions

Examination of the data in Table 3.20 suggests that the following sections of the ISR system will be over capacity:

- Tehran - Qom: northbound by 1356/57 ;
- Arak - Dorud: northbound before 1356;
- Dorud - Andimeshk: northbound before 1356;
- Ahwaz - Andimeshk: northbound before 1356;
- Ahwaz - Bandar Shahpour: northbound by 1356/57;[1)]
- Qom - Kashan: northbound by 1357/58;
- Kashan - Sagzi: northbound by 1357/58;
- Sagzi - Esfahan: southbound (westbound) after 1361;
- Sagzi - Kerman: northbound (westbound) by 1358/59;
- Gole Gohar - Bandar Abbas:southbound by 1360/61[2)].

Capacities of these sections can be expanded by constructing additional sidings, by use of heavier trains or by doubling the track. ISR is currently studying the alternatives for the Esfahan-Sagzi-Kerman trackage.

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1) For a detailed analysis, See Volume 6
2) For a detailed analysis, See Volume 8

TABLE 3.19

ASSUMED VOLUME AND DISTRIBUTION OF FUTURE ISR FREIGHT HAULAGE

(1000 Tons per year)

ORIGIN	DESTINATION	YEAR	
		1356	1361
BANDAR ABBAS:			
Imports	Southeast	230 (15%)	308 (15%)
	Tehran & Qom	783 (50%)	1,000 (50%)
	Arak	150 (10%)	200 (10%)
	North	150 (10%)	200 (10%)
	Khorasan	75 (5%)	100 (5%)
	Northwest & Azarbaijan	150 (10%)	200 (10%)
	Total	1,538 (100%)	2,008 (100%)
Exports	From Tehran	200	400
BANDAR SHAHPOUR:			
Imports [1]	South	1,118 (37.0%)	1,233 (37.0%)
	Lorestan	51 (1.7%)	55 (1.7%)
	Arak	96 (3.2%)	105 (3.2%)
	Tehran	1,447 (48.9%)	1,629 (48.9%)
	North	60 (2.0%)	68 (20%)
	Northeast & Khorasan	209 (6.9%)	231 (6.9%)
	Northwest & Azarbaijan	9 (0.3%)	10 (0.3%)
	Total	2,990 (100.0%)	3,331 (100.0%)
Exports	On basis of 1350 data and increase in value added in manufacturing.		
JOLFA:			
Imports [2]	Azarbaijan	75 (12.5%)	100 (12.5%)
	Tehran	325 (54.2%)	433 (54.1%)
	North	125 (20.8%)	158 (19.8%)
	Southeast	75 (12.5%)	109 (13.6%)
	Total	600 (100.0%)	800 (100.0%0

TABLE 3.19 (Cont'd)

ORIGIN	DESTINATION	YEAR			
RAZI:		1356		1361	
Imports	Azarbaijan & Northwest	50	(13%)	100	(14%)
	Tehran	250	(63%)	400	(58%)
	Arak	50	(13%)	100	(14%)
	Southeast	45	(11%)	100	(14%)
	Total	395	(100%)	700	(100%)
Exports	From Tehran	50		164	
ESFAHAN STEEL PRODUCTS	Southeast	200	(154%)	300	(9.4%)
	Qom	100	(7.7%)	200	(6.3%)
	Lorestan	-		100	(3.1%)
	Tehran	700	(53.8%)	1,500	(46.9%)
	North	100	(7.7%)	300	(9.4%)
	Northeast	-	-	100	(3.1 %)
	Khorasan	100	(7.7%)	200	(6.2 %)
	Northwest	-	-	200	(6.2 %)
	Azarbaijan	100	(7.7%)	300	(9.4 %)
	Total [3]	1,300	(100.0%)	3,200	(100.0%)
BANDAR ABBAS STEEL	Southeast	Not in operation		200	(40%)
	Tehran			300	(60%)
	Total [4]			500	(100%)
Ore and Scrap Movements					
Gole Gohar - Bandar Abbas : Ore pellets		1,125		9,000	
Bandar Shahpour - Ahwaz : "		1,125		6,000	
" : Scrap		150		600	
Zarand - Esfahan : Ore		3,200		8,000	
Tehran-Ahwaz : Scrap		150		600	
Tehran-Bandar Abbas : Scrap		-		150	

1) Same distribution as 1350 shipments from Bandar Shahpour
2) 1350 distribution was 67% Tehran, 20% North and 13% Southeast.
3) 300,000 tons in 1356 and 800,000 tons in 1361 are estimated to move by truck.
4) 500,000 tons are transported by truck and cabotage and 1,000,000 tons are exported.

TABLE 3.20

PROJECTED ISR FREIGHT HAULAGE
(Million Tons Per Year)

LINK	ESTIMATED CAPACITY (TWO-WAY)	1356 NORTH-BOUND	1356 SOUTH-BOUND	1361 NORTH-BOUND	1361 SOUTH-BOUND	REMARKS
Tehran-Qom	8.0	3.6	1.1	6.9	3.0	Will need expanded capacity by double track or use of heavier trains by 1356/57.
Qom-Arak	6.6	2.4	0.9	3.1	2.3	Adequate
Arak-Dorud	6.6	3.5	0.9	4.8	1.8	Needs improvement as soon as possible
Dorud-Andimeshk	6.6	3.7	1.0	5.1	2.2	" " " " " "
Andimeshk-Ahwaz	6.6	4.3	0.9	5.6	2.0	" " " " " "
Ahwaz-Khorramshahr	10.4	1.6	0.2	2.0	0.3	Adequate
Ahwaz-Bandar Shahpour	10.4	4.3	0.5	9.9	0.9	See Volume 6
Tehran-Garmsar	8.5	1.8	0.3	3.3	0.5	Adequate
Garmsar-Shahi	4.6	1.0	0.1	2.0	0.2	"
Shahi-Gorgan	4.6	1.1	0.2	2.0	0.4	"
Garmsar-Semnan	6.2	0.8	0.2	1.4	0.3	"
Semnan-Mashad	6.2	0.8	0.1	1.2	0.2	"
Qom-Kashan	7.1	2.5	0.4	4.9	1.0	Will need expanded capacity by 1358 or 1359
Kashan-Sagzi	7.1	2.5	0.4	4.9	1.0	" " " " " "
Tehran-Zanjan	8.0	0.8	1.5	1.7	3.4	Adequate, depending on Jolfa and Razi traffic growth
Zanjan-Maragheh	8.0	1.4	1.4	2.5	2.9	" " " " "
Maragheh-Tabriz	8.0	1.4	1.4	2.3	3.0	" " " " "
Tabriz-Sufian	8.0	0.2	1.5	0.4	2.5	Adequate
Sufian-Razi	8.5	0.2	0.6	0.2	0.9	"
Sufian-Jolfa	4.4	0.1	0.6	0.3	1.6	"
Sagzi-Esfahan	21.0	1.3	3.3	3.2	8.1	Adequate. Will need doubled track after 1361
Sagzi-Kerman	16.0	4.7	0.4	10.1	0.9	Will need doubled track by 1358/59
Kerman-Gole Gohar	7.6	1.5	0.3	2.5	0.6	Adequate
Gole Gohar-Bandar Abbas	7.6	1.5	1.4	2.5	9.6	Will need doubled track after 1361 See Volume 8.

LEGEND

IRAN BOUNDRY
OTHER BOUNDRY
ASPHALTED HIGHWAY
OTHER MAIN HIGHWAYS
LESSER ROADS
RAILWAYS
RAILWAYS UNDER CONSTR.
NAVIGABLE WATER
MAJOR PORT
MINOR PORT

CAPITAL
300,000 – 1,000,000
100,000 – 300,000
30,000 – 100,000
10,000 – 30,000
UNDER – 10,000
LAKES
SALT FLAT

LEGEND

0 - 50%
50-75%
75-100%
OVER 100%

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IRAN PORTS MASTER PLAN
PROJECTED 1356 ISR
CAPACITY UTILIZATION

SCALE GRAPHIC	DATE APR. 1974	FIGURE 3

3.2 NATIONAL ROAD TRANSPORT

3.2.1 The Highway System

3.2.1.1 Development of the Highway System

Iran is larger than Italy, Spain, France and Great Britian combined. About 80 percent of the land area consists of deserts and high mountains. The inhabited areas are essentially islands scattered through the countryside. Some 57 percent of the 31 million population reside in rural areas.

The pattern of economic activity makes long distance transportation important. Population and agricultural production are centered in the north, tapering off in a wide arc toward the south along the Iraq border. The main sea ports are on the Persian Gulf in the southwest and south. Thus imports and exports require transport over long distances. Minerals are extracted both in the northern and southern areas. Thus lead, chromite, iron, copper and coal require transport to both sea ports and inland destinations.

Modern road construction programmes started 1301. During the period 1301 to 1322 a number of new roads were constructed along with some of the ancient caravan routes which were turned into gravel roads. In total 24,000 km of gravel roads and 50 km of asphalted roads were completed during this period. During World War II road construction came to a halt. At the end of World War II the principal highways of Iran were:

- Khorramshahr to Tehran;
- Baghdad to Tehran;
- Tabriz via to Tehran to Mashhad;
- Tehran via Qom to Esfahan;
- Kashan to Yazd.

With Iran's First Development Plan starting in 1328 emphasis was given to the development of the country's communication system. About 11,500 km of roads were scheduled for development; however the programme was not completed in this period. The Second Seven-Year Plan which started in 1334 provided for the improvement and re-construction of 10,700 km roads of which about 6,000 km were carried out. During the Third Development Programme 1341-1346, 3,860 km of asphalt roads and 9070 km gravel roads were constructed. At the end of the Fourth Plan, 1346-1351, the length of secondary and feeder roads in operations totaled some 12,000 km, while the total length of asphalted roads in use was 12,500 km. This represents an approximate addition of 2,700 km of asphalt and 2,500 km of secondary and feeder roads during this period.

The planning, programming, construction and maintenance of highways are the responsibility of the Ministry of Roads. About 85% of these projected are studied and supervised by consultants. [1] Plan and Budget Organization must approve the programming of construction.

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1) Transport Coordination Study, Interim Report, 1352.

The Ministry of Cooperatives and Rural Affairs is responsible for secondary or rural roads.

3.2.1.2 Present and Planned Network

In 1351 the road network consisted of about 42,000 km. Some 12,500 km were asphalt, another 12,000 km gravel, and the remaining 17,500 km were either feeder or dirt roads or roads under construction.

The principal highway routes of Iran connect all the major population centers providing access to the principal ports on both the Persian Gulf and Caspian Sea. Further, all these routes are linked to the various foreign nations having a common frontier with Iran.

These principal routes, as described hereinafter, have been incorporated into the Asian Highway Network. For sake of clarity in defining the main arterial roads the Asian Highway designations have been used. Figure 4 presents the main arterial highways of Iran in 1356 with Fifth Development Plan improvements superimposed. Figure 5 presents highway improvements to be commenced in the Fifth Development Plan and completed in the Sixth.

- Asian Highway Route 1 (Tabriz - Tehran - Mashhad)

This route commences at the Turkish Frontier, Bazargan, and terminates in Cal Caleh, the frontier town on the Afghanistan border. It has a total length of two-lane paved roadway of 2,097 kilometers and connects the following principal population centers located along the upper northern regions of Iran; namely Tabriz, Zanjan, Takestan, Qazvin, Tehran, Sari, Gorgan, Bojnurd, Quchan and Mashhad.

- Asian Highway Route 83 (Tehran - Mashhad)

This section of highway provides an alternative route to Asian Highway Route 1, from Tehran to Mashhad. It follows an alignment south of the Alborz Mountains and connects the cities of Tehran and Mashhad with Semnan, Shahrood, Sabzewar and Nishabour. This two lane roadway is only partially paved. However, during the Fifth Development Plan, the entire 924 km are to be asphalt surfaced.

- Asian Highway Route 81 (Pahlavi - Khorramshahr)

This route, commencing at the port city of Bandar Pahlavi, runs in a north-south direction and terminates at the port of Khorramshahr.

From Khorramshahr a connecting roadway links the port cities of Abadan and Bandar Shahpour. The other principal cities linked by this road include Rasht, Qazvin, Takistan, Hamadan, Khorramabad, Malavi, Andimeshk and Ahwaz. The total length of this two lane. asphalted roadway is 1,241 kilometers. At Ahwaz connection is made with the road to Bandar Shahpour.

- Asian Highway Route 2 (Kermanshah - Tehran - Zahedan)

This route commences at the Iraqi frontier at Khosravi and proceeds in an easterly direction to Kermanshah, then to Tehran. From Tehran to Qom, Esfahan, Nain and thence to the Pakistan frontier crossing at Mirjaveh via Kerman. The principal municipalities lying along this route include Shahabad, Kermanshah, Hamadan, Saveh, Tehran, Qom, Esfahan, Nain, Yazd, Baghin, Kerman, Bam and Zahedan. The total

LEGEND

IRAN BOUNDRY
OTHER BOUNDRY
ASPHALTED HIGHWAY
OTHER MAIN HIGHWAYS
LESSER ROADS
RAILWAYS
RAILWAYS UNDER CONSTR.
NAVIGABLE WATER
MAJOR PORT
MINOR PORT

CAPITAL
300,000 – 1,000,000
100,000 – 300,000
50,000 – 100,000
10,000 – 50,000
UNDER – 10,000
LAKES
SALT FLAT

100 50 0 100 200 300 400

L E G E N D

MAJOR PAVED ROADS EXISTING AND CURRENTLY BEING COMPLETED

PAVED ROADS TO BE STARTED AND COMPLETED IN 5 TH. PLAN

MAJOR GRAVEL ROADS

MAJOR GRAVEL ROADS TO BE CONSTRUCTED

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IRAN PORTS MASTER PLAN
IRANIAN HIGHWAY SYSTEM
1351 – 1356

SCALE GRAPHIC	DATE FEB. 1974	FIGURE 4

LEGEND

IRAN BOUNDRY
OTHER BOUNDRY
ASPHALTED HIGHWAY
OTHER MAIN HIGHWAYS
LESSER ROADS
RAILWAYS
RAILWAYS UNDER CONSTR.
NAVIGABLE WATER
MAJOR PORT
MINOR PORT

CAPITAL
300,000 – 1,000,000
100,000 – 300,000
30,000 – 100,000
10,000 – 30,000
UNDER – 10,000
LAKES
SALT FLAT

LEGEND

ASPHALT ROADS BY END OF THE FIFTH PLAN

ASPHALT ROADS TO BE COMPLETED IN THE SIXTH PLAN

EXPRESSWAY (AUTO BAHN)

MAJOR GRAVEL ROADS

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IRAN PORTS MASTER PLAN
IRANIAN HIGHWAY SYSTEM
1351 – 1356 AND BEYOND

SCALE GRAPHIC	DATE FEB. 1974	FIGURE 5

length of this partially paved two-lane highway is 2,472 kilometers. The completion of the entire paving of this road is planned within the Fifth Development Plan.

- Asian Highway Route 78 (Mashhad - Zahedan)

This road connects Asian Route 1, at Shahtaghi, to Asian Route 2, in the vicinity of Zahedan. This route is presently only partially paved. However, this two-lane highway is to be completed in the Fifth Development Plan from Birjand to the north, a total distance of 406 kilometers. The southerly portion, totaling 482 kilometers, is to be reconstructed commencing in the Fifth Plan and completed in the Sixth Plan.

- Asian Highway Route 79 (Kerman - Bandar Abbas)

This important two-lane highway, commencing at Baghin, on Asian Route 2, connects with the cities of Sirjan and Bandar Abbas, a distance of 482 kilometers. This entire route is a paved highway.

- Asian Highway Route 84 (Esfahan - Shiraz - Bushehr)

This route was commenced prior to World War II, connecting the port of Bushehr with the Iranian hinterland. This facility is some 773 kilometers in length and is mostly paved. The cities of Kazerun, Shiraz and Shahreza lie in its path. During the Fifth Development Plan, work commenced during the Fourth Plan will be completed, thus providing Bushehr with a modern two-lane paved highway connecting with all principal arterial routes within Iran.

- Asian Highway Route 80 (Qom - Nain)

This section of highway, essentially commencing at the city of Qom and connecting with Asian Route 2 in the vicinity of Nain, a distance of 347 kilometers, is the most direct route to the city of Kerman and the port of Bandar Abbas for traffic eminating from points north of Qom. The Fifth Development Plan calls for the reconstruction and paving of this entire route. In recognition of the above, the present designations for Asian Routes 80 and 2 between these cities are planned to be reversed.

The Fifth Development Plan includes considerable improvements to the roads serving the main ports. Certain route relocations are called for to reduce total travel time. The important improvements are summarized below:

- Road access from Bandar Abbas to the interior will be substantially improved. A two lane highway between Sirjan and Anar will reduce travel distance between Bandar Abbas and Tehran from 1,559 km to 1,289 km. The reconstruction and asphalting of the section between Qom and Nain will further reduce travel time by about two hours. The planned new road from Kahgom to Shiraz will provide a more direct route to the Shiraz area. Finally, a highway will be completed to the east and north from Bandar Abbas via Rudan and Sabzavaran to the Kerman-Zahedan highway ;

- Bandar Shahpoùr will be provided with a major new access route to the interior but not before 1360 by means of a new road from Ramshir along the Bandar Shahpour - Ahwaz road to Esfahan. Another

planned highway will connect the Bandar Shahpour area to the Bushehr - Shiraz road. The Esfahan route will reduce the current Bandar Shahpour-Tehran road distance of 1,024 km to an estimated 980;

- Growing congestion around Tehran will be relieved by contruction of an expressway from Tehran and Qom, extension of the Karaj Expressway to Qazvin, and an improved highway from Tehran to Rudhen

- A fourth major Tehran-Caspian Sea highway will help relieve congestion on the existing highways. The fourth route via Zeerab and Shahi will be an alternative to the congested Tehran-Amol road. A new Caspian coastal road is also planned ;

The Fifth Development Plan's highway projects are listed in Tables 3.21 - 3.23. In summary, all major regions of the country will be linked with highways. The major exception is the absence of a Kerman - Mashhad highway. Not listed in the Fifth Plan but currently under construction is an asphalted highway between Chahbahar and Zahedan ;

The Fifth Development Plan is currently being reviewed and additional highway projects are under study. Under consideration are a new highway from Tehran to the Caspian Sea via Lashkarak with the possibility of creating a pair of one-way highways, extension of the Qom expressway to Esfahan, and a highway from Mashhad to Kerman or Yazd.

There are also allocations in the Fifth Development Plan for improving secondary and feeder roads by 7,500 km to be completed by 1356 and 4,500 km to be completed in the Sixth Development Plan. Under a new policy, secondary roads are to be paved with low grade asphalt. The total roads budget is presented in Table 3.24.

TABLE 3.24

SUMMARY OF ROAD PROGRAM OF FIFTH PLAN (1352-1356)[1)]

DESCRIPTION OF PROGRAM	CREDITS (Million Rials)
- Completion of projects started in the Fourth Plan	14,800
- Roads to be started and completed during the Fifth Plan	28,700
- Roads to be started during the Fifth Plan and to be completed in the Sixth Plan	9,000
- Studies, research and statistics	1,500
- General program of secondary roads	32,000
- Road maintenance	10,000
Total	96,000

1) Plan Organization, The Fifth Development Plan, 1351

TABLE 3.21

ROADS FROM FOURTH DEVELOPMENT PLAN, TO BE COMPLETED IN FIFTH DEVELOPMENT PLAN[1)]

NAME OF ROAD	LENGTH (km)	ALLOCATION (Million Rials)
A. MAJOR INTER-REGIONAL HIGHWAYS:		
- Tehran-Shahrood-Mashhad	570	1,070
- Pahlavi-Astara-Ardabil	225	620
- Tabriz-Ahar-Ardabil-Sarab-Bostanabad	400	1,200
- Kerman-Bam-Mirjaveh	600	1,200
- Saqez-Miandoab-Rezaiyeh-Khoy-Evoghlu	390	2,400
- Nain-Yazd	180	520
- Shiraz-Bushehr	100	1,650
- Shahabad-Ilam-Mehran	230	900
- Sanandaj-Hamadan	157	960
- Darzin-Sabzevaran	61	650
B. HIGHWAYS TO ACCOMMODATE INCREASING TRAFFIC:		
- Tehran-Qom (improvements of existing road)	140	150
- Karaj-Qazvin Freeway (first two lanes)	100	350
- Zeerab-Shahi	40	100
- Esfahan-Steel Plant Freeway	25	500
- Safety of Haraz and Chalus Roads	-	300
C. REGIONAL CONNECTORS AND CUT-OFFS:		
- Masjed-e-Soleiman-Shooshtar	42	330
- Saveh- Ravan	150	300
- Ahwaz-Darkhovin	120	1,200
- Kerman-Zarand	90	400

1) Plan Organization, The Fifth Development Plan for Iran, 1351.

TABLE 3.22

ROADS TO BE CONSTRUCTED IN FIFTH PLAN[1)]

NAME OF ROAD	LENGTH (Km)	ALLOCATION (Million Rials)
A. MAJOR INTER-REGIONAL HIGHWAYS:		
- Tabriz-Miandoab and Bonab-Maragheh	190	1,130
- Rafsanjan-Sarchesmeh-Khatonabad	100	800
- Rudan-Sabzevaran	173	1,500
- Nain-Kashan	227	1,280
- Completion of asphalt of Yazd-Kerman road	320	600
- Mashhad-Gonabad-Birjand	500	1,750
- Shiraz-Darab-Kahgom	430	2,100
B. HIGHWAYS TO ACCOMMODATE INCREASING TRAFFIC:		
- Tehran-Qom Freeway	130	3,600
- Karaj-Qazvin Freeway (second two lanes)	100	1,500
- Tehran-Gachsar and Karaj-Chalus	210	3,870
- Tehran-Rudehen-Damavand-Abali (two lane)	73	800
- Damavand-Firoozkooh-Zeerab	150	1,800
- Entrances and Bypasses for Tehran	100	1,500
- Ramsar-Sari (widening and bridges)	260	520
- Entrances and Bypasses for cities on major roads	250	2,500
C. REGIONAL CONNECTORS AND CUT-OFFS:		
- Sarbandar-Bandar Shahpour	12	120
- Sirjan-Shahre-Babak-Anar	200	1,250
- Incidental Works	-	1,250

1) Plan Organization, The Fifth Development Plan for Iran, 1351.

TABLE 3.23

ROADS TO BE INITIATED IN FIFTH PLAN AND COMPLETED IN SIXTH PLAN[1]

NAME OF ROAD	LENGTH (Km)	ALLOCATION (Million Rials) Total	Fifth Plan
A. MAJOR INTER-REGIONAL HIGHWAYS			
- Esfahan-Ahwaz	240	3,120	1,870
- Ahwaz-Shiraz to Bushehr Road	260	1,820	1,090
- Mianeh-Miandoab	200	2,000	1,000
- Mianeh-Foman	200	4,000	1,600
- Zahedan-Zabol-Birjand	445	1,560	250
B. HIGHWAYS TO ACCOMMODATE INCREASING TRAFFIC:			
- Esfahan-Azna (connecting Hamedan-Khorramabad Road)	310	1,550	465
- Caspian Sea Coastline Road	320	4,500	700
C. REGIONAL CONNECTORS AND CUT-OFFS:			
- Babolsar-Farahabad	50	500	300
- Ahwaz-Shooshtar-Dezful-Andimeshk	185	1,100	555
- Arak-Khomain-Golpayegan & Khomain-Mahalat	150	1,050	525
- Shahpasand-Chehel Dokhtar	85	510	205
- Ghochan-Bajgiran	80	800	240
- Meshginshahr-Parsabad	175	1,350	200

1) Plan Organization, The Fifth Development Plan for Iran, 1351.

3.2.1.3 The Highway Network and Natural Port Hinterlands

The Persian Gulf is separated from the interior of Iran by the Zagros-Makran Mountains, which run from the northwest to the southeast, come within 75 km of the Persian Gulf somewhat to the west of Bandar Shahpour and parallel the coast from there to the Pakistan border. Only in the west (Khuzistan) are there extensive lowlands adjacent to the coast. Yet even from this areas access to the central Iranian plateau must cross the mountains, which especially in the west are characterised by parallel ridges separated by deep valleys.

Thus access from the Persian Gulf to the Iranian plateau is severely restricted. Until fairly recently, the Ahwaz-Khorramabad road was the only modern highway connection. About five years ago, a second major highway to the Persian Gulf, from Baghin to Bandar Abbas, was completed. At present three more connections are under construction: Shiraz-Bushehr, Bandar Abbas-Sabzavaran and Chahbahar-Zahedan. The proposed Ahwaz-Esfahan road represents an additional connection for the future. As a result, only four coastal areas have (or will have) fairly direct highway access to the central plateau of Iran: the Khorramshahr-Bandar Shahpour area, Bushehr, Bandar Abbas and Chahbahar.

All goods traffic from the Persian Gulf area must be funneled through one of these corridors. It is appropriate to examine the existing and future "natural hinterlands" in terms of road distances of these access roads and hence the existing ports at their southern terminals. The upper Persian Gulf area lies closer to Tehran and most Iranian population centers and thus has a substantially bigger hinterland than Bushehr, Bandar Abbas and Chahbahar. Table 3.25 contains existing road distance from these ports to various interior cities and future distances assuming construction of the proposed Ahwaz - Esfahan highway, which will further increase Khorramshahr-Bandar Shahpour's hinterland at the expense of Bushehr and Bandar Abbas, and also of the construction of a paved Kerman-Mashhad highway, which would transfer the Mashhad area and Afghanistan to the Bandar Abbas hinterland at the expense of Khorramshahr-Bandar Shahpour. These are illustrated in Figures 6 and 7. Note that the differential between Tehran-Bandar Shahpour and Tehran-Bandar Abbas distances are effected only slightly.

3.2.1.4 Highway Design Standards

In accordance with the latest specifications of the Ministry of Roads, the design and alignment of all highway projects shall conform to the following standards where geographical and economic conditions permit:

- in flat terrain - 100 km per hour
- in rolling terrain - 80 km per hour
- in mountainous terrain - 65 km per hour

In general the design speed and maximum vertical gradients are established for three distinct classes of roads. Class I is highways and main roads. Class II is first class provincial roads. Class III is second class provincial roads.

LEGEND

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

100 50 0 100 200 300 401

U.S.S.R.

U. S. S. R.

TURKEY

IRAQ

DARYAY-E-MAZANDARAN
CASPIAN SEA

DASHT-E-KAVIR

DASHT-E-LUT

PERSIAN GULF

DARYAY-E-OMMAN
OMAN SEA

AFGHANISTAN

PAKISTAN

TEHRAN
MASHHAD
ESFAHAN
KERMANSHAH
HAMADAN
KHORRAMSHAHR
SHAHPOUR
BANDAR ABBAS
BIRJAND
ZAHEDAN
KERMAN
SHIRAZ
YAZD
TABRIZ
BAGHDAD
QATAR
OMAN
UNITED ARAB EMIRATES

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IMPERIAL GOVERNMENT OF IRAN
MINISTRY OF FINANCE
PORTS & SHIPPING ORGANIZATION

AHA ADIBI-HARRIS ASSOCIATES
CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

SOUTERN PORTS NATURAL HINTERLANDS
EXISTING SITUATION

SCALE	DATE	FIGURE
GRAPHIC	OCT. 73	6

LEGEND

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

Situation as it would be after completion of Ahwaz-Esfahan and Kerman-Meshed Roads

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IRAN PORTS MASTER PLAN

SOUTHERN PORTS NATURAL HINTERLANDS
HYPTHETICAL FUTURE SITUATION

SCALE GRAPHIC	DATE OCT. 73	FIGURE 7

TABLE 3.25

PERSIAN GULF PORT - INTERIOR ROAD DISTANCES

DISTANCE VIA EXISTING HIGHWAYS TO:[1]	BANDAR SHAHPOUR	BANDAR BUSHEHR	BANDAR ABBAS	CHAHBAHAR
Kermanshah	686	1,430	1,787	2,688 (G)
Tehran	1,024	1,202	1,559	2,372 (G)
Esfahan	908	768	1,125	2,026 (G)
Shiraz	1,399	277	1,616	2,517 (G)
Yazd	1,237	1,097	796	1,697 (G)
Kerman	1,601	1,461	492	1,333 (G)
Zahedan	468 (G)	2,028 (G)	1,059 (G)	766 (G)
Mashad	1,945	2,123	2,480	3,293 (G)
DISTANCE VIA EXISTING FUTURE HIGHWAY TO:[2]				
Kermanshah	686	1,101	1,600	2,688
Tehran	988	1,202	1,289	2,372
Esfahan	554	768	943	2,026
Shiraz	524	277	647	2,196
Yazd	883	1,097	614	1,697
Kerman	1,247	1,140	492	1,333
Zahedan	1,814	1,676	752	766
Mashad	1,887	2,059	1,411	1,719

1) Via "most paved" route, 1352. (G) indicates that a gravel road must be traversed.
2) Circa 1360. Assumes 5th Plan road projects ore implemented and a Kerman - Mashad road is paved.

TABLE 3.26

DESIGN SPEEDS AND MAXIMUM VERTICAL GRADES[1)]

CLASS OF ROADS	FLAT		ROLLING		MOUNTAINOUS		MOUNTAINOUS (EXCEPTIONS)	
	Des. Speed (km/hr)	Max. Grade %	Des. Speed (km/hr)	Max. Grade %	Des. Speed (km/hr)	Max. Grade %	Des. Speed (km/hr)	Max. Grade %
CLASS I	100	5	80	6	65	6	50	8
CLASS II	80	6	65	7	50	8	40	10
CLASS III	65	7	50	8	40	10	30	12

Widths of paved roadways in general are established in accordance with requirements given in Table 3.27. Shoulder width less than specified below is acceptable under certain conditions.

TABLE 3.27

ROAD WIDTHS[1)]

CLASS OF ROAD	WIDTH OF PAVEMENT (m)	SHOULDERS (m)	TOTAL WIDTH (m)
CLASS I	7.0	2.0	11.0
CLASS II	6.0	2.0	10.0
CLASS III	5.0	1.5	8.0

The following standards have been established for right-of-way by the Ministry of Roads.

- Main roads (highways) requiring further extensions to two plus two lanes - min. 45 m
- Provincial roads requiring further extension to two plus two lanes - min. 35 m
- Main roads (highways) requiring two lanes - min. 30 m
- Provincial roads requiring two lanes - min. 25 m
- Provincial roads not requiring two lanes - min. 15 m

Furthermore a capacity within the range of 400-700 vehicles per hour has been established as the design basis for two-lane roads. When the vehicles capacity of a particular road is considered to have exceeded these limits, a second two-lane carriage way should be planned for.

1) Ministry of Roads.

Standards regarding the installation of road signs and signals on Iranian highways reflect the adaptation to local conditions of the system generally known as the United Nations Uniform System of Road Signs and Signals.

Legislation has enacted various regulations relative to the operation, weight and size of vehicles authorized to travel within Iran. In general these regulations conform with those adopted at the International Geneva Conference in 1949. The weight of vehicles and axle load limitations are as follows:

- For single axles 8 tons, exceptionally 13 tons.
- For tandom axles 14 tons, exceptionally 20 tons (distance between the axles of 1 to 2 meters).

Regulations governing the dimensions of heavy vehicles on Iranian roadways are listed below:

- Max. width		- 2.5 m
- Max. height		- 4.0 m
- Max. length	- bi-axial vehicles	-10.0 m
	- bi-axial passenger vehicles	-11.0 m
	- 3 or more axles	-12.0 m
	- articulated vehicles	-14.0 m
	- trucks with one trailer	-18.0 m
	- trucks with two trailers	-22.0 m

Maximum length dimensions include total length of loading. The loading, which shall be arranged in accordance with the above dimensions, should be done in such a way as not to protrude more than 50 cms. from the front of the truck, bus or trailer and not more than 3 meters from the rear of truck, bus or trailer.

General design standards for the construction of roads which are based on the Swiss Norms are given in Table 3.28.

3.2.1.5 Road Maintenance

As mentioned previously, the MInistry of Raods is responsible for highway maintenance. The quality of maintenance in the past has been low, with available allocation per km well below U.S. standards [1]. Improvements in the activities are expected to result from anticipated reorganization of the government agencies dealing with transportation.

3.2.1.6 Finance and Taxation

Capital investments in the highway system are allocated from the P.B.O.'s budget and maintenance funds from the Government's general budget. There is no earmarking of the various taxes on vehicle ownership and use for highway purposes, but it appears that there is a balance between government revenues from transportation taxes and total annual outlays for construction and maintenance [1]. This rough

1) The Transport Sector: Iran, International Bank for Reconstruction and Development, 1970.

balance is expected to continue over the next few years.

The principal taxes are listed below:

- Import duties on vehicles	200% - 500% ad valorem
- Import duties on parts	40% ad valorem
- Gasoline tax	Rials 3.20 per liter
- Diesel oil tax	Rials 0.75 per liter
- Registration tax (when plates issued)	5% ad valorem (locally assembled vehicles); 10% ad valorem (imported vehicles)
- Renewal license plates (property tax)	Rials 140 per vehicle
- Automobile tax	Rials 150 per h.p. on new vehicles
- Various minor municipal charges	

Customs duties are collected by the customs authorities and paid to the Ministry of Finance. Fuel taxes are collected by the National Iranian Oil Company and paid to the Ministry of Finance after deduction of expenses. Automobile and registration taxes are collected by the Police and also handed to the Ministry of Finance.

TABLE 3.28

GENERAL DESIGN STANDARDS[1)]

DESIGN FACTOR		TYPE OF TERRAIN			
		Flat	Rolling	Mountainous	
Design Speed	km/hr	100	80	65	(50)
Radius of Curvature	normal (m)	700	270	120	(60)
	min (m)	500	240	100	
Radius of Vertical Curvature over Crests	min (m)	5,000	2,500	1,000	(800)
Radius of Vertical Curvature in Sags	min (m)	2,000	1,000	500	(400)
Grade	max. %	5	6	6	(8)
Sight Distance over Crests	min (m)	150	100	60	(40)

3.2.2 Trucking Industry and the National Vehicle Fleet

3.2.2.1 General Background

The trucking industry in Iran is characterized by a general freedom from regulation. There are no government restrictions on the number of trucking companies that may be established. A number of

1) Ministry of Roads

trucking office operators, also called freight agencies or "garages", hire the services of a large number of individually owned and operated trucks. There are 474 freight agencies in Iran and an estimated 50,000 trucks working in public transportation. The freight agencies and truck owners have formed two associations, which formed a "union" several years ago in order to organize the allocation of trucks to the freight agencies. Recently this role has been cancelled by the government on the Khorramshahr - Tehran axis [1].

Freight rates are set in each province by commissions made up of representatives of the Ministry of Economy, the Chamber of Commerce, the Governor, and trade associations of agencies and truck owners [1]. The rates charged by trucking establishments vary greatly with route, season and goods to be carried ranging from less than 0.5 Rials per ton-km to as high as 3.5 Rials per ton-km on unpaved roads during peak seasons. On the whole these rates seem to be low compared to European and international rates. The lower end of this range is below economic costs calculated by international standards (See Section 3.2.2.3) This can be attributed to low wages, long hours by drivers and the long average life of trucks in Iran, but there are also indications that investment in trucking has become uncompetitive, with a shortage of trucking vehicles in the country resulting.

3.2.2.2 Vehicle Fleet

The Ministry of Roads possesses some statistics on national vehicle registration, presented in Table 3.29. It is not known precisely how many of these registered vehicles are currently in operation.

Current figures are estimated to be 385,000 passenger cars, 103,000 trucks and 25,000 buses [1].

Industry sources[2] have estimated that in 1352 7,000 trucks were locally assembled and 1,000 imported.

At present four privately owned companies are locally assembling trucks for the Iranian market. Production targets are set by the Ministry of Economy and high tariffs are charged on imported vehicles.

Local assembly is expected to increase to about 24,000 per year by 1356, with 50-60% of them being "small" trucks.

Highway use is reflected in fuel consumption figures. Table 3.30 shows recent growth. Note that diesel fuel is used for stationary power sources, such as electricity generators and water pumps, and heavy vehicles such as buses and tractors, in addition to the truck fleet.

---

1) Transport Coordination Study, Interim Report, December 1973.
2) Khavar Truck Manufacturing Company.

TABLE 3.29

NATIONAL VEHICLE REGISTRATION[1)]

TYPE OF VEHICLES	YEAR					
	1341	1342	1343	1348	1349	1350
Diplomatic	1119	1353	1501	2500	2986	3268
Passenger Cars						
Private	76,508	89,659	102,937	207,820	228,044	249,261
Hire	21,525	23,810	30,407	6,543	8,321	9,390
Government	6,703	7,276	8,952	12,120	16,203	16,710
Sub-total	104,736	120,745	142,296	226,483	252,568	275,361
Buses						
Private	765	1,030	1,976	3,342	3,397	3,526
Hire	7,589	8,633	9,700	14,776	17,723	18,675
Government	563	809	809	394	401	401
Sub-total	8,917	10,472	12,485	18,512	21,521	22,602
Trucks						
Private	3,489	4,434	8,114	15,129	19,929	21,529
Hire	26,716	31,736	37,618	46,027	50,207	52,009
Government	235	316	316	3,377	3,380	4,747
Sub-total	30,440	36,486	46,048	64,533	73,516	78,285
Ambulances	240	349	371	337	337	337
Total	145,450	169,405	202,701	331,222	373,616	403,016

Based on these figures, the average annual growth rate was as follows:

Type of Vehicle	1343-50	1348-50
Passenger Cars	10%	10%
Trucks	8%	10%
Buses	9%	10½%

1) Ministry of Roads.

TABLE 3.30

CONSUMPTION OF GASOLINE AND DIESEL OIL [1]
(1,000 cu.m.)

YEAR	GASOLINE	% INCREASE	DIESEL OIL	% INCREASE
1345	800		1,881	
1346	854	7	2,185	12
1347	943	11	2,467	11
1348	1,068	11	2,654	11
1349	1,227	11	3.016	11

3.2.2.3 Truck Economic Operating Costs

Economic costs for trucking operations, based upon a standardized methodology for international use, were calculated using cost inputs from the current Iranian market. For use in the export/import model described in Volume 4 of this report, an average truck size of 10 tons was used and the following economic costs were interpolated, assuming a 70% utilization factor. The results of these calculations are presented in Rials per ton-km, in Table 3.31.

3.2.3 Highway Capacities and Utilization

3.2.3.1 Scope and Sources

For the purposes of this study an examination of the existing and planned domestic road system was undertaken. A complete analysis of Iran's highway network is beyond the scope of this study. Instead the examination concentrated on the roads which lead from the various ports to Tehran, the origin or destination of a major portion of transport movements.

Data on 1350 traffic counts were obtained from the Plan Organization's Development Economic Group. This information is not complete. The only other source of information, also for 1350, available is from the Prime Ministry's Transport Coordination Study. A comparison of these two sources revealed that they are in basic agreement for most links in the highway network.

3.2.3.2 Highway Capacity Calculations

Highway capacities were calculated using the methods adopted by the U.S. Highway Research Board [2]. Highway capacity depends on many factors, including width of the roadway, road surface, curvature and grades and hence passing sight distance and the mixture of light and heavy traffic. The U.S. methods establish five different levels of service, ranging from free flow to unstable flow with reduced speeds. The maximum volume that can be carried for a given level of service is the capacity or "service volume" for that level.

1) N.I.O.C.
2) Highway Capacity Manual, U.S. Highway Research Board, Special Report No. 87.

TABLE 3.31

TRUCK ECONOMIC OPERATING COSTS[2)]
(Rials per ton-km)

3.5 TON TRUCK

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	1.87	2.71	4.41
Rolling	2.13	3.05	4.85
Mountainous	2.65	3.76	5.31

15.0 TON TRUCK

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	.58	.88	1.51
Rolling	.65	.98	1.63
Mountainous	.82	1.17	1.79

10.0 TON TRUCK [2)]

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	1.32	1.95	3.21
Rolling	1.50	2.18	3.52
Mountainous	1.84	2.64	3.84

1) Jan de Weille, Quantification of Road User Costs World Bank Staff Occasional Paper, No. 2, 1970.
2) Interpolated, assuming a 70% load factor.

For the purpose of this study and its highway analysis, level "C" - where there is free flow but with speed and maneuverability closely restricted by higher traffic voloumes - was established as the criteria for highways in flat and rolling terrains. For highways in mountainous terrains, level "D" - more constricted, approaching unstable flow with lower operating speeds - was selected.

With the exception of the area around Tehran and Abadan-Khorramshahr, the Iranian highway system is composed of two-lane highways. A basic characteristic of traffic operation on two-lane highways is that distribution of traffic by direction has practically no effect on operating conditions, at any given total volume level. Therefore the capacity and service volumes are expressed in total vehicles per hour or day, VPH or VPD, regardless of directional distribution.

The U.S. capacity methodology establishes a theoretical capacities for given levels of service. For our purposes:

Flat, Rolling (Level C):	1,400 VPH
Mountainous (Level D):	1,700 VPH

These theoretical capacities are then reduced to account for limitations of roadbed and shoulder width and for a volume/capacity factor, related to passing sight distances, speed, and the surface/terrain combination. The following are the assumptions used in highway capacity calculations:

- Level of service "C" for flat and rolling terrains
  Level of service "D" for mountainous terrains;

- Asphalted roads assumed to be 7.0 m wide with a 0.5 m shoulder
  Gravel and earth roads assumed to be 6.5 m wide with no shoulders.
  These differ from the standards presented in Table 3.22 in an attempt to represent the existing situation;

- 50% availability of passing sight distance assumed for paved and gravel roads in flat and rolling terrains and no passing in mountainous terrains for all types of surface;

- A day is equivalent to 16 driving hours, i.e.

  16 VPH = VPD ;

- Adjustment for truck and width factors for earth and gravel roads assumed to be 0.75 ;

- Speed relationships:

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	70 km/hr	60	50
Rolling	60	50	40
Mountainous	50	40	30

Presented below are the resulting estimates of highway service volumes.

TABLE 3.32

TWO-LANE HIGHWAY CAPACITIES
(EQUIVALENT LIGHT VEHICLES PER DAY)

TERRAIN	SURFACE		
	Asphalt	Gravel	Earth
Flat	7,170	4,700	3,440
Rolling	5,770	3,440	2,350
Mountainous	10,140	6,020	3,670

These service volumes are in terms of light vehicles. Buses and trucks, being larger and less maneuverable, utilize more highway capacity than a passenger automobile. Thus it is necessary to convert buses and trucks into equivalent light vehicles by the factors shown in Table 3.33.

TABLE 3.33

AVERAGE GENERALIZED PASSENGER CAR EQUIVALENTS ON TWO-LANE HIGHWAYS [1)]

	TERRAIN		
	Level (Service level C)	Rolling (Service level C)	Mountainous (Service level D)
Trucks	2.5	5	12
Buses	2	4	6

Using these conversion factors and data on the 1350 Average Daily Traffic (ADT) from Plan Organization, the percentages of service volume being utilized on the main port-related roads were calculated. They are presented in Table 3.34 and in Figure 8.

For example, the highway between Tabriz and Bostonabad is asphalted and passes through terrain that is generally classified as rolling. Thus capacity is 5,770 equivalent light vehicles per day. In 1350 it carried an average daily traffic of about 1,015 light vehicles

1) Highway Capacity Manual, U.S. Highway Board, Special Report No. 87.

TABLE 3.34

1350 HIGHWAY UTILIZATION

HIGHWAY LINK	GENERALIZED SURF/TERRAIN	GENERALIZED 1350 AVERAGE DAILY TRAFFIC			ELV[2]	CAPACITY UTILIZATION (%)	REMARKS
		Light	Truck	Bus			
Jolfa-Marand	G/M	220	360	10	4,600	76	Gravel. No plans to asphalt
Bazargan-Marand	A/R	200	100	100	1,100	19	Adequate
Marand-Tabriz	A/R	1,300	750	150	5,650	98	Congestion near Tabriz; Need highway pass of Tabriz
Tabriz-Bostonabad	A/R	1,015	525	210	4,480	78	" " " "
Bostonabad-Mianeh	A/R	900	450	200	3,950	68	Adequate
Mianeh-Zanjan	A/R	900	450	220	4,030	70	Adequate
Zanjan-Qazvin	A/R	500	600	400	4,300	74	Adequate
Bandar Pahlavi-Rasht	A/F	6,000	600	350	8,200	114	Need expanded arterial Pahlavi-Rasht and bypass of Rasht
Rasht-Qazvin	A/R	1,000	500	200	4,300	75	Adequate
Caspian Road	A/F	3,000	400	100	4,200	59	Adequate. Plans for bypasses and bridge improvements in 5th Plan
Chalus-Karaj	A/M	500	200	35	3,100	31	Adequate, but not suitable for heavy truck traffic
Amol-Tehran	A/M	2,800	1,000	600	18,400	181	Congested. Plans for alternative Amol-Rudhen road and improved Tehran-Rudhen highway in 5th Plan
Khorramshahr-Ahwaz	A/F	900	850	90	3,205	45	Adequate
B. Shahpour-Ahwaz	A/F	1,000	750	30	2,935	41	Adequate. Indirect route
Ahwaz-Andimeshk	A/F	900	1,800	110	5,620	78	Adequate
Ahwaz-Shushtar-Andimeshk	G/F	400	130	10	745	16	Plan to asphalt in 5th Plan, to be completed in 6th Plan
Andimeshk-Dorud	A/M	600	900	100	12,000	118	Moderate congestion. Needs improvements such as tunnels and climbing lanes
Dorud-Arak	A/M	400	800	100	10,600	105	" " " " "
Arak-Qom Junct.	A/F	450	1,150	220	3,765	53	Adequate
Dorud-Esfahan	A/M	275	525	150	7,475	74	Adequate. Improvement plans in 5th Plan
Malavi-Shahabad	A/M	500	225	40	3,440	34	Adequate
Shahabad-Kermanshah	A/R	1,450	500	70	4,230	73	Adequate
Burujerd-Hamadan	A/M	550	500	100	7,150	71	Adequate
Kermanshah-Sanandaj	A/R	800	400	50	3,200	56	Adequate
Kermanshah-Hamadan	A/M	1,000	380	140	6,200	61	Adequate
Hamadan-Takestan	A/R	600	600	200	4,000	69	Plans for alternative Hamadan-Sanandaj road in 5th Plan
Qazvin-Karaj	A/F	4,106	1,584	1,031	10,128	141	Alternative autobahn planned in 5th Plan
Karaj-Tehran	A/F	5,007	2,093	1,715	13,670	191	Need study of overall Tehran access
Bushehr-Shiraz[3]	A/M	300	300	30	4,080	40	To be completed by end of 1353
Shiraz Vicinity	A/R	2,250	750	300	7,200	125	Need bypass, perhaps other improvements
Shiraz-Esfahan	A/R	600	400	200	3,000	52	Adequate
B.Abbas Vicinity	A/F	500	450	60	1,745	24	Adequate
B.Abbas - Nain	A/R	200	230	50	1,550	27	Adequate. Sirjan-Anar cutoff planned in 5th Plan
Yazd Vicinity	A/F	500	450	160	1,945	27	Adequate
Nain-Esfahan	A/R	1,250	1,200	250	7,750	134	Data may be in error. Needs further study
Nain-Kashan	A/R	240	165	40	1,225	21	Plans to asphalt in 5th Plan

..../..2

TABLE 3.34 (Contd)

HIGHWAY LINK	GENERALIZED SURF/TERRAIN	GENERALIZED 1350 AVERAGE DAILY TRAFFIC			ELV[2]	CAPACITY UTILIZATION	REMARKS
		Light	Truck	Bus			
Kashan-Qom	A/R	600	450	135	3,390	59	Adequate
Qom-Tehran	A/R	2,000	500	850	7,900	137	Qom freeway planned in 5th Plan Need study of overall Tehran access
Esfahan-Salafchekan	A/R	1,200	700	500	6,700	116	" " " " "
Salafchekan-Tehran	A/R	500	1,500	100	8,400	146	" " " " "
Kahgom-Shiraz	G/R	300	150	50	1,250	36	Plans to asphalt in 5th Plan

1) A = asphalt, G = gravel, E = earth, F = flat, R = rolling and M = mountainous

2) ELV = Equivalent Light Vehicles

3) Treated as if asphalted, although mountainous section still not completed.

LEGEND

IRAN BOUNDRY
OTHER BOUNDRY
ASPHALTED HIGHWAY
OTHER MAIN HIGHWAYS
LESSER ROADS
RAILWAYS
RAILWAYS UNDER CONSTR.
NAVIGABLE WATER
MAJOR PORT
MINOR PORT

CAPITAL
300,000 – 1,000,000
100,000 – 300,000
30,000 – 100,000
10,000 – 30,000
UNDER – 10,000
LAKES
SALT FLAT

LEGEND

LESS THAN 50% OF CAPACITY.
50 – 75% OF CAPACITY.
75 – 100 % OF CAPACITY.
OVER 100 % OF CAPACITY.

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CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

MAJOR HIGHWAY TRAFFIC
CAPACITY UTILIZATION, 1350

SCALE GRAPHIC	DATE FEB. 1974	FIGURE 8

525 trucks and 210 buses [1]. Converting this traffic into equivalent light vehicles:

Light:	1,015 x 1 =	1,015	
Truck:	525 x 5 =	2,625	
Bus:	210 x 4 =	840	
		4,480	Equivalent Light Vehicles

$\frac{4,480}{5,770} = 78\%$

Thus the highway carried about 78% of its service volume. When this figure reaches 100%, it does not mean that no more traffic can be accommodated. However additional traffic will begin to reduce the quality of accessibility along the road, perhaps with reduced speeds and occasional stoppage of traffic.

The results of these calculations suggest the following conclusions:

- The roads in the vicinity of Tabriz are near capacity. Improvements and a proper highway bypass of the city are recommended ;
- The Bandar Pahlavi - Rasht road is congested. The new Caspian Sea Coastal road should be designed to provide added capacity along this corridor and a bypass of Rasht should be incorporated. This part of the project should be given higher priority than the whole project, which is to begin in the 5th Plan and be completed in the 6th Plan ;
- The mountainous sections of the main access road from Bandar Shahpour between Andimeshk and Arak are congested. Immediate improvements should be made ;
- The roads in the vicinity of Shiraz are congested. Improvements and a proper highway bypass of the city are recommended ;
- The Nain - Esfahan road may be congested. The data, however, seems to be in error ;
- All of the roads leading to Tehran, except the Chalus road, are congested. The magnitude and complexity of this traffic require a thorough study of overall Tehran access to ascertain if the planned improvements, including extension of the Karaj freeway to Qazvin, construction of a Tehran-Qom freeway, and improvements of Tehran-Rudehen road and pavement of the Rudehen - Shahi road, are adequate. For example, extension of the Qom freeway to Esfahan may be advisable. Such a study could best be done by the Ministry of Roads, which is to be reorganized into the Ministry of Transport.

3.2.3.3 Tonnage Capacities

An alternative way of estimating highway capacities is to convert vehicles per day into tons of cargo per year. To do this it is necessary to assume the percentage traffic which is port-related trucking. This has been done based on two alternatives, namely 30%

1) Plan Organization, Development Economics Group. Prime Ministry data show comparable. Figures for average daily traffic: of 925 light and 875 heavy.

and 50% trucks. Furthermore, distribution of truck size was assumed to be 80% 10-ton trucks and 20% 15-ton trucks with a 70% load factor in each direction. This is equivalent to an overall average of 7.7 tons per truck. The percentage of buses is assumed to be 10%. 360 operating days per year are assumed.

For example, an asphalted highway in rolling terrain has been estimated to have a capacity of 5,770 vehicles per day, in terms of equivalent light vehicles. In rolling terrain, a truck is equivalent to 5 light vehicles and a bus to 4 light vehicles. Assuming 50% of the vehciles are trucks and 10% buses, the total number of vehicles V is:

$$(1)\ (.4V) + (5)\ (.5V) + (4)\ (.1V) = 5{,}770$$

$$3.3V = 5{,}770$$

$$V = 1{,}748$$

Thus the total number of vehicles is about 1,748. The number of trucks per day is $\frac{1}{2}V = 874$. Capacity equals:

$$874 \frac{\text{trucks}}{\text{day}} \times 7.7 \frac{\text{tons}}{\text{truck}} \times 360 \frac{\text{days}}{\text{year}} = 2.4 \text{ million tons/year}$$

The resulting capacities are presented in Table 3.35 and are illustrated in Figure 9.

TABLE 3.35

HIGHWAY TONNAGE CAPACITY
(TWO-WAY)

MILLION TONS PER YEAR

TERRAIN	SURFACE		
50% Truck	Asphalt	Gravel	Earth
Flat	4.7	3.5	2.5
Rolling	2.4	1.4	1.0
Mountainous	2.2	1.3	0.8

TERRAIN	SURFACE		
30% Truck	Asphalt	Gravel	Earth
Flat	3.8	2.5	1.8
Rolling	1.9	1.1	0.9
Mountainous	1.9	1.1	0.7

LEGEND

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

100 50 0 100 200 300 400

LEGEND

NUMBERS SHOW TONS / YEAR(000,000)

10 0 10

BAND SCALE TONS (000,000)

ASSUMPTION:

1-50% TRAFFIC IS TRUCKING.

2-AVERAGE TRUCK PAY LOAD IS 7.7 TONS.

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IRAN PORTS MASTER PLAN

IRANIAN HIGHWAY SYSTEM
CAPACITIES

SCALE GRAPHIC	DATE FEB. 1974	FIGURE 9

3.2.3.4 Traffic Projections

For the purpose of this study, it is necessary to evaluate the capacity and capability of existing and planned transport facilities to handle the transport of port cargoes. The existing and planned highway network and its capacity have already been treated in sections 3.2.1.2 and 3.2.3.2.

The highway network is not used exclusively for port cargo movements. Highway traffic can be classified into three major categories:

- light traffic ;
- truck traffic ;
- bus traffic .

Growth of all of these movements must be considered.

Light traffic consists of passenger automobilies, intercity taxis and minibuses and small pick-up trucks. The use of passenger automobilies for intercity travel in Iran has been rather limited, whereas the bus industry is well developed. However both the standard of living and automobile ownership are rising rapidly. A growth rate of the national automobile fleet of about 10-10½% per annum for 1343-50 has been previously noted. These automobiles are heavily concentrated in Tehran, and it is reasonable to expect a comparable growth of light traffic volumes on the highways in the vicinity of Tehran [1]. For areas more distant from the capital, a lower growth rate of 5% has been assumed.

Base traffic data is for 1350. An annual growth of 5% from 1350-1356 is equivalent to a total growth of 34%. For the eleven year period of 1350-1361 it is equivalent to 71%.

Truck traffic consists of both port-related and other movements. Recent growth of the truck registration has been about 10% per year. This does not account for trucks retired from service.

Since many of these trucks are used for local purposes and since rising standards probably will result in less usage per vehicle, a growth rate for non-port truck traffic of 6% per annum has been assumed. For a six year 1350-56 period, this is equivalent to a total growth of 42% and for an eleven year 1350-61 period, it is equivalent to 90%.

The national bus registration has also been growing at about 10% per year. The same growth of bus traffic of 6% per annum has been assumed.

These assumptions are summarized in Table 3.36.

---

1) The Caspian coastal road, the Rasht, Chalus and Haraz roads, the Qazvin-Tehran road, the Tehran-Qom road, and the Tehran- Salafchekan road.

TABLE 3.36

ASSUMED TRAFFIC GROWTH RATES

TYPE OF TRAFFIC	ANNUAL GROWTH RATE	6-YEAR GROWTH (1356)	11-YEAR GROWTH (1361)
Light: near Tehran	10%	77%	185%
Light: other	5%	34%	71%
Truck: non-port	6%	42%	90%
Bus	6%	42%	90%

The projection of port-related truck traffic has been based upon projections of port throughputs and an estimated modal split of imports between road and rail, as described in Section 8 of Volume 5. Estimated distribution of destinations of these cargoes including 1350 data, is presented in Table 3.37.

For each highway section, the 1350 data for light vehicle and bus volumes have been projected by the growth factors of Table 3.36. For truck volumes, the total was divided into port and non-port traffic. Non-port traffic was projected by the growth factor of Table 3.36 and the appropriate port traffic distributions of Table 3.37 were assigned to that link. For example, the Tabriz-Bostanabad link carried an estimated 200 truck movements per day related to Jolfa and Bazargan traffic in 1350. This is projected to 290 by 1356 and 387 by 1361. Light, non-port truck and bus volumes were increased by the factors of Table 3.36. As shown below, resulting 1356 utilization is 109% and 1361, 145%.

TABLE 3.38

SAMPLE TRAFFIC PROJECTIONS - TABRIZ-BOSTANABAD

	1350 ADT[1]	1350-56 INCREASED FACTOR	1356 ADT[1]	1350-61 INCREASED FACTOR	1361 ADT[1]
Light	1,015	1.34	1,360	1.71	1,736
Truck-port	200	Table 3.37[2]	290	Table 3.37[2]	387
Truck - non-port	325	1.42	462	1.90	618
Bus	210	1.42	298	1.90	399
ELV	4,480	-	6,312	-	8,357
% Capacity	78%	-	109	-	145

1) ADT Average Daily Traffic
2) Jolfa-Bazargan movements to Tehran must pass over the Tabriz-Bostonabad highway.

TABLE 3.37

ESTIMATED DISTRIBUTION OF TRUCK TRANSPORT OF INTERNATIONAL CARGOES

BORDER CROSSING	DESTINATION	TRUCK MOVEMENTS PER DAY[1] 1350	1356	1361	REMARKS
Bandar Shahpour/ Khorramshahr [2]	Khuzistan	300 (27.4%)	360 (30%)	440 (30%)	A decreasing proportion to Tehran and Esfahan is projected since Bandar Abbas and to a lesser extent Bushehr will increasingly serve these destinations.
	Kermanshah	50 (4.5%)	60 (5%)	100 (7%)	
	Sanandaj & north	50 (4.5%)	60 (5%)	100 (7%)	
	Esfahan & west	100 (9.0%)	100 (8%)	100 (7%)	
	Hamadan & north	50 (4.5%)	70 (5%)	100 (7%)	
	Arak	50 (4.5%)	50 (4%)	50 (3%)	
	Qom Tehran & north	500 (45.6%)	500 (42%)	580 (39%)	
	Total	1,100 (100.0%)	1,200 (100%)	1,470 (100%)	
Bushehr	Bushehr & coastal	5 (33%)	225 (70%)	250 (70%)	Having a limited hinterland, a majority of imports are locally destined.
	Shiraz	5 (33%)	60 (18%)	65 (18%)	
	North	5 (33%)	40 (12%)	45 (12%)	
	Total	15 (100%)	325 (100%)	360 (100%)	
Nowshahr	Tehran	40 (100%)	100 (100%)	82 (100%)	All movements are assigned to Tehran
Bandar Pahlavi	Gilan	40 (21%)	40 (20%)	50 (21%)	
	Tehran	150 (79%)	160 (80%)	185 (79%)	
	Total	190 (100%)	200 (100%)	235 (100%)	
Jolfa & Bazargan	Tabriz	32 (14%)	48 (14%)	63 (14%)	See Volume 4
	Tehran	200 (86%)	290 (86%)	387 (86%)	
	Total	232 (100%)	338 (100%)	450 (100%)	

		1,350	1356 A No Railroad	1356 B With Railroad	1361	
Bandar Abbas	Bandar Abbas	20 (11%)	150 (10%)	150 (30%)	160 (29%)	The railroad to Bandar Abbas, to be completed in 1357, will tend to divert long distance truck movements to Esfahan, Tehran and north.
	Kerman & Yazd	10 (5%)	80 (5%)	50 (10%)	50 (9%)	
	Esfahan & west	100 (56%)	400 (26%)	100 (20%)	150 (27%)	
	Qom Tehran & north	50 (28%)	880 (59%)	200 (40%)	200 (36%)	
	Total	180 (100%)	1510 (100%)	500 (100%)	560 (100%)	

1) To convert to million tons per year, divide by 660.
2) Assumes that railroad capacity is expanded

TABLE 3.19

1356 HIGHWAY UTILIZATION

HIGHWAY LINK	GENERALIZED SURF/TERRAIN[1]	GENERALIZED 1356 AVERAGE DAILY TRAFFIC			ELV[2]	CAPACITY UTILIZATION (%)	REMARKS
		Light	Truck	Bus			
Jolfa-Marand	G/M	299	485	14	6,203	103	Will need improvement. Should be asphalted
Bazargan-Marand	A/R	268	177	142	1,721	30	Adequate
Marand-Tabriz	A/R	1,742	1,074	213	7,969	138	Will need Tabriz bypass
Tabriz-Bostonabad	A/R	1,360	752	298	6,312	109	" " " " "
Bostonabad-Mianeh	A/R	1,206	645	284	5,567	96	Nearing congestion. Will need improment
Mianeh-Zanjan	A/R	1,206	645	312	5,679	98	" " " " "
Zanjan-Qazvin	A/R	670	958	568	7,232	125	" " Autobahn will relieve congestion
Pahlavi-Rasht	A/F	10,620	782	497	13,569	189	See Table 3.34
Rasht-Qazvin	A/R	1,770	657	284	6,191	107	Will need improvement. New Mianeh-Foaman road, to be completed in 6th Plan, will relieve some congestion
Caspian Road	A/F	5,310	611	142	7,122	99	Adequate. New Caspian coastal road will relieve congestion
Chalus-Karaj	A/M	885	341	50	5,277	52	Adequate. See Table 3.34
Amol-Tehran	A/M	4,956	1,477	852	27,792	274	See Table 3.34 Need study of overall Tehran access
Khorramshahr-Ahwaz	A/F	1,206	871	128	3,637	51	Adequate
Bandar Shahpour-Ahwaz	A/F	1,340	1,839	43	6,024	84	Adequate. Need direct route also serving new town
Ahwaz-Andimeshk	A/F	1,206	2,220	156	7,168	100	Adequate see below
Ahwaz-Shushtar-Andimeshk	G/F	536	185	14	1,027	22	Can serve as alternative to Ahwaz - Andimeshk road
Andimeshk-Dorud	A/M	804	1,004	142	13,704	135	Will need improvement
Dorud-Arak	A/M	536	904	142	12,236	120	" " "
Arak-Qom Junct.	A/F	603	1,423	312	4,785	66	Adequate
Dorud-Esfahan	A/M	369	743	213	10,563	104	Planned improvement in 5th Plan to be completed in 6th Plan
Malavi-Shahabad	A/M	720	303	57	4,768	47	Adequate
Shahabad-Kermanshah	A/R	1,943	693	99	5,804	101	New Shahabad-Ilam-Mehran will generate more traffic. Will need improvement
Burujerd-Hamadan	A/M	737	693	142	9,905	98	Adequate. Planned improvement in 5th Plan to be completed in 6th Plan
Kermanshah-Sanadaj	A/R	1,072	572	71	4,216	73	Adequate
Kermanshah-Hamadan	A/M	1,340	540	199	9,014	89	Adequate
Hamadan-Takestan	A/R	804	852	284	6,200	108	Will need improvement
Qazvin-Karaj	A/F	requires further study					
Karaj-Tehran	A/F	requires further study					
Bushehr-Shiraz	A/M	402	455	43	6,120	60	Adequate
Shiraz Vicinity	A/R	3,015	1,074	426	10,089	175	See Table 3.34
Shiraz-Esfahan	A/R	804	569	284	4,785	83	Adequate
B.Abbas Vicinity	A/F	670	912	85	3,120	44	Adequate
B.Abbas-Nain	A/R	268	464	71	3,014	52	Adequate. Sirjan-Anar cutoff will be available
Yazd Vicinity	A/F	670	776	227	3,064	43	Adequate
Nain-Esfahan	A/R	1,384	1,662	355	11,114	193	Base data may be in error. Completion of Nain-Kashan road will alter the flow
Nain-Kashan	A/R	322	363	57	2,365	41	Will actually carry more. Adequate

.../..2

TABLE 3.39 (Contd)

HIGHWAY LINK	GENERALIZED SURF/TERRAIN[1]	GENERALIZED 1356 AVERAGE DAILY TRAFFIC			ELV[2]	CAPACITY UTILIZATION	REMARKS
		Light	Truck	Bus			
Kashan-Qom	A/R	804	718	192	5,162	89	Will actually carry more. Adequate
Qom-Tehran	A/R	requires further study					
Esfahan-Salafchekan	A/R	"	"	"			
Salafchekan-Tehran	A/R	"	"	"			
Kahgom-Shiraz	A/R	402	213	71	1,751	30	Adequate

1) A = asphalt, G = gravel, F = flat, R = rolling, M = mountainous

2) ELV = Equivalent Light Vehicles

Notes: Assumes Kerman - Bandar Abbas railroad is built and Andimeshk - Dorud rail link capacity is increased.

TABLE 3.40

1361 HIGHWAY UTILIZATION

HIGHWAY LINK	GENERALIZED SURF/ TERRAIN	GENERALIZED 1361 AVERAGE DAILY TRAFFIC			ELV[1]	CAPACITY UTILIZATION (%)	REMARKS
		Light	Truck	Bus			
Jolfa - Marand	G/M	381	570	19	7,385	122	
Bazargan - Marand	A/R	342	313	190	2,667	46	
Marand - Tabriz	A/R	2,223	1,434	285	10,533	182	
Tabriz - Bostonabad	A/R	1,736	1,005	399	8,357	145	
Bostonabad - Mianeh	A/R	1,539	862	380	7,369	128	See Table 3.39
Mianeh - Zanjan	A/R	1,539	862	418	7,521	130	
Zanjan - Qazvin	A/R	855	1,147	760	9,630	169	
Pahlavi - Rasht	A/F	17,100	1,014	665	20,966	292	
Rasht - Qazvin	A/R	2,850	855	380	8,795	152	
Caspian Road	A/F	8,550	766	190	10,845	151	Alternative Caspian coastal road, to be completed in 6th Plan, will relieve congestion.
Chalus - Karaj	A/M	1,425	405	66	6,681	66	Adequate See Table 3.34
Amol - Tehran	A/M	7,980	1,925	1,140	37,920	373	See Table 3.39
Khorramshahr - Ahwaz	A/P	1,539	995	171	4,369	61	Adequate
B.Shahpour - Ahwaz	A/F	1,900	2,325	57	7,827	109	
Ahwaz - Andimeshk	A/F	1,539	2,930	209	9,282	129	
Ahwaz-Shushtar-Andimeshk	A/F	684	618	38	1,340	19	See Table 3.39
Andimeshk - Dorud	A/M	1,026	1,210	190	16,686	164	
Dorud - Arak	A/M	684	1,110	190	15,144	149	
Arak - Qom Junct.	A/F	770	1,815	418	6,144	85	Adequate
Dorud - Esfahan	A/M	523	958	285	13,729	135	Adequate See Table 3.39
Malavi - Shahabad	A/M	855	438	76	6,567	65	Adequate
Shahabad - Kermanshah	A/R	2,480	910	133	7,562	131	
Burujerd - Hamadan	A/M	941	910	190	13,001	128	See Table 3.39
Kermanshah - Sanandaj	A/R	1,368	765	95	5,573	97	Adequate
Kermanshah - Hamadan	A/M	1,710	722	266	11,970	118	Adequate. Slight congestion will be relieved by alternative Kermanshah-Sanandaj
Hamadan - Takestan	A/R	1,026	1,140	380	8,246	143	See Table 3.39
Qazvin - Karaj	A/F						Requires further study
Karaj - Tehran	A/R						Requires further study
Bushehr - Shiraz	A/M	513	592	57	8,019	79	Adequate
Shiraz Vicinity	A/R	3,848	1,432	570	13,288	230	See Table 3.39
Shiraz - Esfahan	A/R	1,026	761	380	6,351	110	Will need improvement
B.Abbas Vicinity	A/F	855	1,110	114	3,858	54	Adequate
B.Abbas - Nain	A/R	342	552	95	3,482	60	Adequate
Yazd Vicinity	A/F	855	970	304	3,888	54	Adequate
Nain - Esfahan	A/R	2,138	2,240	475	15,238	264	
Nain - Kashan	A/R	410	449	76	2,959	51	See Table 3.39
Kashan - Qom	A/R	1,026	930	257	6,704	116	
Qom - Tehran	A/R						Requires further study
Esfahan - Salafchekan	A/R						" " "
Salafchekan - Tehran	A/R						" " "
Kahgom - Shiraz	A/R	513	1,425	95	2,318	40	Adequate

Notes: 1) A = Asphalt, G = gravel, E = earth, F = flat, R = rolling and M = mountainous

2) ELV = Equivalent Light Vehicles

3) Assumes Bandar Abbas - Kerman railroad is built and Andimeshk - Dorud rail link capacity is increased

The results of these calculations for the main highway network are presented in Table 3.39 for 1356 and Table 3.40 in 1361. They are illustrated for 1356 in Figure 10.

3.2.3.5 General Conclusions

The traffic projections for 1356 are illustrated in Figure 10. In addition to the recommendations of Section 3.2.3.2 the following roads will require improvements by 1356:

- The Jolfa-Marand road should be paved;
- Rasht - Qazvin road;
- Shahabad - Kermanshah;
- Hamadan - Takestan .

In addition, the Shiraz-Esfahan and Tabriz-Qazvin roads will need improvements by 1361.

It should be cautioned that these projections have been done in a rather crude manner. A more thorough, comprehensive national transport planning process should be established in Iran.

3.3 MODAL COMPARISON

3.3.1 General

Since railroad and highway trucking are to a large part substitutible for one another, it is useful compare the two. In general, railroads have the advantage of lower line haul costs but the disadvantage of limited trackage. A truck has the flexibility of travelling over any reasonable roadway according to its own schedule. Thus it can provide door-to-door service on a flexible schedule. On the other hand a train is confined to the track system and can provide only station-to-station service. Thus shipment by rail often requires transfer and final delivery by truck, which involves extra costs which can offset rail's line-haul cost advantages.

3.3.2 Capital Costs

Rough estimates of the costs of construction of a railroad are the following:

TABLE 3.41

RAIL CAPITAL COSTS[1)]
(Million Rials per km)
(1352 prices)

TERRAIN	SINGLE TRACK	DOUBLE TRACK
Flat Terrain	5-6	10-11
Rolling Terrain	10-11	16-17
Mountainous Terrain	17-19	25-27
Swampy Flat Terrain	22-23	33-34

On the other hand, estimates of costs for construction of new, first class, asphalted highways are as follows:

TABLE 3.42

HIGHWAY CAPITAL COSTS[1)]
(Million Rials per km)
(1352 prices)

TERRAIN	TWO LANE	FOUR LANE
Flat Terrain	5-6	9-10
Rolling Terrain	8-9	12-13
Mountainous Terrain	15-18	25-28
Swampy Flat Terrain	23-24	39-40

1) Adibi Harris Associates. Assumptions:
- Flat terrain: 100% fill; 100% soil (sand and gravel); no transport of material, average cut or fill - 1.2 m for road, 2.0 m for railroad.
- Rolling Terrain: 60% fill, 40% cut; 30% rock, 70% soil; no transport of material; average cut or fill - 2.5 m for road, 4.0 m for railroad.
- Mountainous terrain: 40% fill, 60% cut; 70% rock, 30% soil, no transport material; average cut or fill - 4.0m for road, 6.0 m for railroad.
- Swampy terrain: extra cost over flat terrain is due to cost of transport of material, assumed to be 35 km; height of 3.0m for road, 4.0 m for railroad.

L E G E N D

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

100 50 0 100 200 300 400

L E G E N D

LESS THAN 50% OF CAPACITY.

50 - 75% OF CAPACITY.

75 - 100 % OF CAPACITY.

OVER 100% OF CAPACITY.

REQUIRES FURTHER STUDY

U.S.S.R.

U. S. S. R.

DARYAY-E-MAZANDARAN (CASPIAN SEA)

DASHT-E-KAVIR (DESERT)

DASHT-E-LUT (DESERT)

KHALIJ-E-FARS (PERSIAN GULF)

DARYAY-E-OMMAN (OMAN SEA)

طرح جامع بنادر ایران

IMPERIAL GOVERNMENT OF IRAN
MINISTRY OF FINANCE
PORTS & SHIPPING ORGANIZATION

AHA **ADIBI-HARRIS ASSOCIATES**
CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

MAJOR HIGHWAY TRAFFIC
PROJECTED CAPACITY UTILIZAION 1356

SCALE GRAPHIC	DATE FEB. 1974	FIGURE 10

3.3.3 Capacity

Based upon the ISR capacity calculations, it can be said that the capacity of a single-line generally ranges between 5-10 million tons/year, with great increases possible if necessary steps are taken. If 50% of the capacity of asphalt highway is used for trucking, the tonnage capacities based upon the methods used in section 3.2.3.2 are:

Flat Terrain	4.7 million tons/yr.
Rolling Terrain	2.4 million tons/yr.
Mountainous Terrain	2.2 million tons/yr.

It is important to note that a highway's overall capacity will be limited by those sections with smallest capacities. For example, a mountainous section of a highway will become a "bottle neck" for the freer flat sections.

3.3.4 Over-all Costs

An example of detailed analysis and modal comparison is available for the proposed Bandar Abbas-Kerman line. Two alternatives were compared:

Alternative A: No railroad is built. The existing highway is improved to meet projected demand.

Alternative B. A rail is built.

The results, presented in Table 3.43, are indicative of the high capital costs of rail investment with resulting lower operating costs for certain kinds of movements, in this case, long distance ore movements.

3.3.5 Enviromental Costs

On the whole, railroad operations involve fewer accidents than trucking and are less disruptive of the urban areas through which they pass in terms of noise, air pollution and traffic accidents.

TABLE 3.43

INTERMODAL COMPARISON KERMAN-BANDAR ABBAS TRANSPORT COSTS[1)]
(Million Rials)

YEAR 1357	ALTERNATIVE A	ALTERNATIVE B		
	Road	Road	Rail	Total
Annualized capital costs	191 (15 %)	0	596	596 (58%)
Maintenance costs	37 (3 %)	0	52	52 (5%)
Operating costs	1,018 (82 %)	20	357	378 (37%)
Total	1,246 (100 %)			1,026 (100%)

YEAR 1370	ALTERNATIVE A	ALTERNATIVE B		
	Road	Road	Rail	Total
Annualized Capital costs	192 (8%)	0	596	596 (44%)
Maintenance costs	59 (3%)	0	52	52 (4%)
Operating costs	2,307 (89%)	59	640	699 (52%)
Total	2,558 (100%)			1,347 (100%)

1) Pre-Feasibility Study for Railways: Iran-Kampsax Consultants, 1351

SECTION 4

OTHER DOMESTIC TRANSPORTATION SYSTEMS

4.1 PIPELINES

4.1.1. Background

Crude and liquid bulk petroleum products for export are not included within the scope of this study, hence the pipeline network to serve this trade is not included in this discussion, except if shipping traffic is affected. Internal consumption of petroleum however must be served by the domestic transportation system. The extent of pipeline transportation system and the extent of pipeline transport, now existing and planned for the future, is significant because of the potential reduction in demand which may be made on other surface modes and the resultant releasing of capacities for other types of commodities.

Shown below is the domestic distribution of oil movements by the various modes over recent years, excluding collecting lines in the oil fields.

TABLE 4.1

INTERNAL DISTRIBUTION OF OIL BY TRANSPORT MODE [1)]
(Million Ton-Km)

Year	1345	1346	1347	1348	1349
Road Tankers	943	1,033	1,126	1,293	1,455
Rail Tank Wagons	1,180	943	882	856	777
Sea & River Tankers	40	49	65	87	94
Pipelines	3,139	4,217	5,286	5,835	6,312
Total	5,302	6,242	7,359	8,071	8,638

These figures are total volumes which include crude for domestic refineries, fuel oil, petrol, diesel oil, and kerosene. Obviously, therefore, not all of these volumes could be moved by pipeline, even if a more extensive network existed. The discussions which follow will identify certain areas where pipeline transport is feasible and is being planned, and where the capacities thus freed for other use are particularly important for transport requirements of the port sites being considered in this study.

4.1.2. Refineries in Iran

Total refinery capacity in Iran is currently approximately 32.5 million tons per year with refineries in Abadan, Masjed-e-Suleiman, Tehran and Kermanshah. In keeping with government policy to

1) National Iranian Oil Company

locate refineries close to energy generating centers, the Tehran refinery is scheduled to be increased from 5 million tons/year to 10 millions/year. A new refinery has just been dedicated in Shiraz and others are planned near Behshahr and Tabriz. A new topping plant has recently been commissioned at Lavan Island. These installations are planned to satisfy the rapidly growing internal market reflected in Table 4.2 below.

TABLE 4.2

INTERNAL PETROLEUM PRODUCTS CONSUMPTION[1)]
(Million Tons Per Year)

ACTUAL			FORECAST	
1348	1349	1351	1356	1361
8.2	8.9	11.4	21	33

Negotiations are being conducted with foreign countries for the construction of large export refineries. It may be expected that one 25 millions tons per year refinery will be completed during the Fifth Plan and two export refineries of this size will be completed during the Sixth Plan.

4.1.3. Oil Pipelines

Oil Pipelines - Existing

There are close to 4,000 km of oil pipelines in Iran. Those of greatest importance to this study are given below. See Figure 11.

- The 20/16 inch crude line from Ahwaz to Tehran. 750 km in length and with a capacity of 5 million tons per year;
- The oil products line from Ahwaz to Tehran with a capacity of 4 million tons per year. Branch lines serve Esfahan, Mashad and Bandar Pahlavi.

Oil Pipelines - Proposed

- A crude line from Tehran to near Tabriz, 650 km in length, 14" diameter;
- A 30/26 inch crude line with 10 million tons per year capacity from Ahwaz to Tehran. This line would complement the existing 20/16 inch line which will continue to be used for crude ;
- A crude line from Tehran to near Behshahr ;
- A product line from near Behshahr to Nowshahr;
- A product line from near Tabriz to Rezaiyeh ;
- A product line from Masjed-i-Suleiman to Kerman.

1) National Iranian Oil Company

L E G E N D

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
NAVIGABLE WATER		SALT FLAT	
MAJOR PORT			
MINOR PORT			

100 50 0 100 700 300 400

L E G E N D

REFINERIES
EXISTING
PLANNED
(EACH DIVISION = 2 MIL. TONS/YR)

CRUDE LINES
EXISTING
PLANNED

PUMP STATION OR CONSUMPTION TAKE – OFF

PRODUCT LINES
EXISTING
PLANNED

GAS LINES
EXISTING

طرح جامع بنادر ایران

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AHA ADIBI-HARRIS ASSOCIATES
CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

PIPELINE SYSTEM

SCALE NONE	DATE FEB. 1974	FIGURE II

4.1.4. Natural Gas and Gas Pipelines

It is government policy to encourage the use of gas as a substitute for fuel oil wherever possible. Source may be natural gas fields or gas which is a joint product of oil production. Fuel oil, not easily be transported by pipeline in Iran, hence is moved by rail or roads with a resultant higher cost fuel than gas.

The Trans-Iranian Gas Pipeline is a 40 inch line 1,066 km in length with a capacity of 28.3 million cu.m. per day of gas for export to Russia at Astara west of the Caspian Sea on the Russian Border. Additional pumping booster stations are now being installed. Capacity will then be increased to 46.7 million cu.m. per day. The capacity in excess of that required for export will be available for internal use within Iran through 680 km of branch pipeline feeding gas to Shiraz, Isfahan, Lashan, Qom and Tehran. Studies have now been initiated by the authorities for the building of gas storage facilities in a number of major consumption centers to build up local reserves. The line has no direct significance on the port study.

A second line for supplying domestic demand is also under study. A vast new gas field has been discovered at Sarakhs 180 km east of Mashad near the Soviet/Afghan border. The field has not been fully tested, but is said to have reserves of 0.5 trillion cubic meters of gas. The NIGC is considering the construction of a 16 inch pipeline from the Sarakhs field to Mashad to replace fuel oil now being received from Tehran or the Persian Gulf and to increase sales to Russia.

4.1.5. Trans-Iranian Oil Pipeline

The Turkish and Iranian national oil companies have formed a joint petroleum transport authority to build a 1,700 km pipeline between the two nations. A 42 inch line is planned with an ultimate capacity of 50 million tons per year. The line would connect the oil fields in the south with the Turkish port of Iskanderun.

As an international project this proposed line would have no sigificance to this ports study. However, if branch lines were to be constructed to serve Tabriz, it could serve to relieve the demand on crude transport via Tehran.

The principle effect of this line would be to reduce the number of ships (tankers) in the Persian Gulf in general and passing south of Quoin Island in particular. This shipping lane may well be overcrowded, requiring some ships to take the longer, more expensive route north of Quoin Island.

4.2. AVIATION

4.2.1 Background

Domestic air service in Iran is provided exlusively by Iran Air (Iran National Airlines) with a network currently operating some 60 flights per week to 17 areas throughout the country. Iran Air

also operates all oil industry flights, as well as Haj Flights to Mecca and other special charters.

Iran Air operates internationally and dominates the market for originating passengers. Additionally scheduled foreign service is provided by 23 foreign carriers so that air service is available to the major cities of the world.

All of Iran Air's domestic and international flights use jet aircraft, although a small number of piston-engined aircraft are operated for cargo flights and stand-by service.

4.2.2. Facilities

4.2.2.1 Airports

Iran had 24 fully equipped airports throughout the country at the beginning of 1352. Airports in Iran are generally classified in three categories:

- International Airports: Mehrabad (Tehran), Abadan, Shiraz and Bandar Abbas.

- Class I Airports: Tabriz, Esfahan, Mashad, Rasht, Rezaiyeh, Kerman, Yazd, Zahedan, Hamadan, Kermanshah, Sanandaj, Ahwaz, Ramsar, Babolsar, Bushehr and Bandar Lengeh.

- Class II Airports: Kharg, Gachsaran, Masjed-e-Soleiman, Chalus.

There are also small airports around some small cities and also in some Persian Gulf islands for special visits, but these airports have not yet been fully equipped and completed. The Department of Civil Aviation has plans to develop 50 small airports throughout the country.

4.2.2.2 Operational Facilities

Most of the Class 1 airports were completed during the Fourth Plan, although construction had been started during the Third Plan period. Original plans did not, however, include the communication and navigational aids necessary to make the airport system fully viable. A contract has subsequently been let to furnish communications, navigation aids, fire and safety equipment necessary to meet current International Civil Aviation Organization (ICAO) standards at all of the airports included in the Plan. To cover this contract, scheduled for completion during the Fifth Plan period, necessary funds were appropriated in the Fifth Plan.

4.2.2.3 Meteorological Facilities

In 1351 there were seven meteorological stations in the country, with an additional 600 rain-gauge stations, 370 climatological stations, 44 synoptic stations, and 8 upper air stations. A receiving station which automatically picks up continuous photo-services from weather satellites when in orbit over Iran and neighbouring countries started functioning at Mehrabad International Airport in 1350. This is the third receiver of its kind in the world, and Iran is the only country in this region so equipped.

4.2.2.4 Aircraft Service Facilities

An assembly and service facility was constructed and operation initiated in 1351 at Mehrabad International Airport, and when completed in 1352 will be the best equipped facility of its kind in Western Asia. When fully commissioned this facility will offer engine over-haul and service to neighbouring countries and international aviation in general. An assembly plant will initially assemble small aircraft and at a later date larger jet aircraft.

4.2.2.5 Passenger Traffic

The size of the country, the distances between major centers, and a terrain which makes surface transport difficult to build and costly to maintain, all have contributed to the rapid growth of passenger travel by air. In 1349 N.I.A.C. reported a total of 612, 787 arriving and 613,278 departing passengers in domestic services in contrast to 338,161 arrivals and 338,826 departures only four years earlier in 1345 as shown in Table 4.3. A review of statistics for the individual airports shows that, will the exception of Tabriz where volumes remained constant, cities which also had rail passenger service experienced the same growth pattern as those without it. This would indicate that passenger rail service in Iran, as in many other countries, is losing out to air travel. Figure 12 shows the domestic air network.

4.2.2.6 Air Cargo/Freight Service

Air cargo/air freight service is provided by Iran Air. However, as such transport is inherently expensive, volumes are relatively small. Delivery of perishable goods to market to avoid shutdowns or costly delays are types of shipments which give air cargo movements an importance which is greater than relative volume figures would suggest. Increasing industrialization around the port areas being proposed will intensify the importance of air cargo services.

During the period from 1345 to 1348 air cargo movements at Mehrabad increased by 103% from 1,279 tons to some 2,597 tons. During the same period mail increased from 93 tons to 123 tons as shown in Table 4.4.

4.2.3 International Air Services

4.2.3.1 International Airports

As indicated in Section 4.2.2.1 Iran's international airports are currently Mehrabad, Abadan, Shiraz and Bandar Abbas. Construction has been commenced for a new international airport at Esfahan with the intention of making this an international gateway during the period of the 5th Development Plan. A new and larger airport is also scheduled to replace the existing Mehrabad facility, with completion expected around 1357.

4.2.3.2 International Passenger Traffic

Iran Air and 23 foreign airlines provide international service from the airports listed above. Numbers of departing passengers carried more than tripled in the 5 year period from 1345 - 1349, as is shown in the tabulation below:

TABLE 4.3

DOMESTIC PASSENGER TRAFFIC [1]

	1345		1346		1347		1348		1349	
	ARRIVAL	DE-PARTURE	ARRIVAL	DE-PARTURE	ARRIVAL	DE-PARTURE	ARRIVAL	DE-PARTURE	ARRIVAL	DE-PARTURE
TOTAL	338,161	338,826	396,436	396,212	444,304	443,356	519,117	518,644	612,787	613,278
Tehran	129,588	127,351	155,685	154,649	185,611	182,947	217,533	215,263	267,801	260,613
Abadan	48,395	47,947	55,178	53,216	60,344	59,899	65,066	64,526	64,992	665,277
Esfahan	226,285	26,545	30,816	30,712	37,825	38,350	40,241	42,180	48,732	51,841
Shiraz	46,083	43,657	52,426	50,831	52,323	51,116	59,273	57,525	67,432	66.088
Mashhad	25,871	27,250	33,331	33,344	34,951	34,947	45,400	43,746	55,549	57,507
Tabriz	22,996	24,081	23,277	24,046	22,918	23,081	22,311	22,461	22,510	22.700
Ahwaz	4,375	4,446	6,313	6,669	8,105	8,664	9,560	9,968	12,868	13,278
Kerman	2,491	2,211	4,264	3,695	6,621	6,272	8,907	8,797	11,786	11,632
Zahedan	4,093	4,496	4,904	5,426	5,925	6,643	6,833	7,734	9,436	10,698
Kharg	6,565	7,108	7,210	7,496	9,240	8,172	13,671	13,482	12,618	12,051
Bushehr	10,651	11,939	11,737	12,816	7,967	8,844	10,049	10,899	11,864	13,172
Gachsaran	896	790	873	793	-	-	-	-	-	-
Hamadan	120	102	160	124	92	73	-	-	-	-
Sanandaj	153	127	167	148	128	134	-	-	-	-
Kermanshah	277	220	258	237	282	231	-	-	-	-
Bandar-e-Langeh	3,057	3,835	3,395	4,572	3,577	4,620	3,705	4,869	2,620	3,582
Bandar-e-Abbas	5,865	6,400	6,416	7,438	6,517	7,178	7,982	7,825	9,998	10,135
Chalus	180	167	-	-	-	-	-	-	-	-
Babolsar	220	154	-	-	-	-	-	-	-	-
Rezaiyeh	-	-	-	-	1,878	2,185	5,531	5,962	6,660	7,009
Rasht	-	-	-	-	-	-	1,132	1,488	2,058	2,179
Ramsar	-	-	-	-	-	-	1,299	1,285	2,896	2,306
Yazd	-	-	-	-	-	-	624	631	2,967	3,210

1) National Iranian Airway Corporation

L E G E N D

IRAN BOUNDRY		CAPITAL	
OTHER BOUNDRY		300,000 – 1,000,000	
ASPHALTED HIGHWAY		100,000 – 300,000	
OTHER MAIN HIGHWAYS		30,000 – 100,000	
LESSER ROADS		10,000 – 30,000	
RAILWAYS		UNDER – 10,000	
RAILWAYS UNDER CONSTR.		LAKES	
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CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

DOMESTIC AIR NETWORK

SCALE NONE	DATE FEB. 1974	FIGURE 12

1349 - 290,275
1348 - 181,003
1347 - 153,516
1346 - 121,963
1345 - 95,481

Iran Air carried some 30% of the total in 1349, double the number of passengers carried by the most heavily patronized of the foreign carriers.

4.2.3.3 Air Cargo

Statistics covering international air cargo movements were available only for Mehrabad Airport, and these data are shown in Table 4.4. It will be noted that growth rates for cargo movements have not increased at the rate shown above for passenger movements.

4.2.4 Administration

4.2.4.1 Organizational Responsibility

Administrative control of airports is centralized under one authority, the Directorate General of Civil Aviation (DGCA). The Ministry of Finance budget covers operating expenditure, and the PBO, capital expenditure. Expenditures on joint-use civil and military airfields such as Tehran's Mehrabad Airport are all borne by the civil budget and not charged to the military.

4.2.4.2 Revenues

The main sources of revenue are landing and lighting fees and a passenger airport tax. Landing and lighting fees are billed by DGCA to the customer who pays direct to the Ministry of Finance. The airport tax and revenue from rent and restaurant profits are collected by DGCA and passed on to the Ministry of Finance, with a part of the latter income being channelled into the Pahlavi Social Foundation.

Revenue from all baggage handling is collected by Iran Air, which also bears the expenditures involved. No throughput fee is received by DGCA for aviation fuel, which is all handled by the National Iranian Oil Company (NIOC). No landing fees are collected from Iran Air or the military, who are important users of some air fields.

4.3 FLUVIAL TRANSPORT

Aside from the Arvand Rud, which has been improved to admit ocean vessels to Khorramshahr, only the Karun River has served for fluvial transport in Iran.

4.3.1 Fluvial System

The Karun fluvial transport system extends from Khorramshahr, where ocean vessels can discharge directly into lighters, to the practical head of navigation just below Ahwaz. There the lighters are discharged directly to manufacturing plants on the river bank. Fluvial transport is economical for certain commodities but distances, time and other factors may favor alternative modes, such as trucking or railroad. In case of Karun river the distance Khorramshahr to Ahwaz is

TABLE 4.4

AIR CARGO AND MAIL TRANSPORTED VIA MEHRABAD [1]

YEAR	CARGO (TONS)						MAIL (TONS)					
	INCOMING			OUTGOING			INCOMING			OUTGOING		
	TOTAL	LOCAL	INTER-NATIONAL	TOTAL	LOCAL	INTER-NATIONAL	TOTAL	LOCAL	INTER-NATIONAL	TOTAL	LOCAL	INTER-NATIONAL
1345	6,871	205	6,666	5,114	1,074	4,040	362	29	333	259	64	195
1346	6,747	623	6,124	5,072	1,252	3,820	427	36	391	239	64	173
1347	7,466	576	6,890	5,191	1,552	3,639	525	48	477	264	63	201
1348	7,524	692	6,832	5,462	1,906	3,557	739	63	676	267	60	207

1) National Iranian Airway Corporation

approximately 200 km by river and only 130 km by highway.

4.3.2 Navigation

A review of the Karun River shows that it is navigable by vessels of 0.6 m draft throughout the year and of 1.5 m draft when the river is in spate. Between Khorramshahr and Ahwaz the river varies in width from 200 to 500 meters but the navigable channel is very narrow in places.

Current velocities are normally about 2 knots, but during the flood season these increase to from 4 to 6 knots. The river is subject to tidal influence and this is felt as far as Ali-Ibn-Al-Husains tomb 55 km above Khorramshahr.

4.3.3 Facilities

At the lower end of the river within the old port of Khorramshahr numerous small waterfront facilities in the form of wharfs and jetties are available. The river is also used for lighterage anchorages at this point. From Khorramshahr up river until the steel plants below Ahwaz, the river is virtually devoid of waterfront facilities. Near the steel mills just below Ahwaz improved landing facilities are at present under construction to serve these industries.

4.3.4 Operations

About 10 km south of Ahwaz there are two steel rolling plants, the Shahriar Industries Rolling Mill and the Ahwaz Rolling and Pipe Mill.

The Karoon Company, a barging company operating throughout the upper Persian Gulf as far as Basra, barges about 140,000 tons of steel billets and blooms to these plants each year. The up-river passage requires 3 days, whilst the return to Khorramshahr can be accomplished in one day. Movement of vessels can only be undertaken during daylight hours, as night navigational aids are not available on the river. The tug takes a barge on each side at an average of 800 tons per trip and 90 trip per year.

In the future the present barging operations on the river will be drastically affected when the construction of the proposed steel port at Bandar Shahpour is complete. It can be foreseen that the existing traffic in billets and blooms will be suplanted by the supply of steel pellets from Bandar Abbas to the new steel manufacturing plant at Ahwaz.

The route for this cargo through Bandar Shahpour has advantages over that via Khorramshahr and the Karun River in that bulk carriers of greater draft and tonnage can reach Bandar Shahpour than can be accomodated on the Arvand Rud. Furthermore Bandar Shahpour unlike Khorramshahr is not burdened by high dredging and pilotage dues. If follows that greater tonnage can be moved through Bandar Shahpour and hence to Ahwaz via rail or possibly canal at a lower cost than can be achieved via Khorramshahr.

The overall effect of these considerations will be to severely reduce, or even to eliminate the present steel tonnages moving on the Karun River.

It seems unlikely that other bulk cargo commodities will be generated in the future to replace the lost tonnages on the river. If these develop it will be more economic to move them over the same route to Ahwaz as the steel products.

4.4 CABOTAGE

Cabotage has been an important part of Iran's internal trade for centuries and will certainly so continue until a coastal highway is constructed. Even then due to the length of the coastline cabotage will be of importance.

4.4.1 Network

At present no less than 64 ports serve Iran's cabotage trade. These include the major foreign trade ports such as Khorramshahr, down to the smallest of coastal villages. Each is recognized officially as a port of entry and exit with a customs station. The large ports, Khorramshahr, Bandar Abbas and Abadan and the more important small ports namely Bushehr, Lavan, Kharg and Chahbahar had a cabotage throughput of 230,000 tons in 1346. The remaining 57 small ports recorded a total of 28,000 tons of cabotage in the same year. These ports also had 50,000 tons of foreign trade. By 1350 the foreign trade of these small ports grew to 72,700 tons. It is anticipated that cabotage grew at a similar rate.

The widely known Persian Gulf dhow fills most of the need for small scale general cargo transport along the coast, and the largest dhows venture several thousand kilometers from home. About 2000 dhows are registered in Iran, and they constitute about 70 percent of the dhow fleet in the entire Persian Gulf. They provide a transport "system" that may not be efficient, but is simple and effective. Many are also engaged in fishing. The dhow is usually individually or family owned.

4.4.2 Facilities

Shore facilities will be inventoried in some detail in Volume 3. These facilities often consist of nothing more than a strip of beach, as protected as possible, similar to that on which the dhows are often built. At such locations lighterage is the most convenient loading and unloading method.

Dhows range in size from approximately 8 to 10 m length and five ton capacity, to over 30 m and 250 ton capacity. Often lateenrigged with a single forward raking mast, they rarely use sails now since most are now diesel engine powered. Many are built on the south coast beaches. They are made in Iran except for the teak imported from India or Zanzibar. The smaller dhows work particularly the coastal trade where they can best manage without port facilities. Other work in the trans-Gulf trade and the largest operate in the entire Arabian Sea and along the coast to Africa and India.

Small steel hulled coasters also visit the ports of the Persian Gulf. Some are tankers delivering pertroleum products from Mahshahr to Persian Gulf states and to other Iranian ports. About 150 barges are also in service for lightering around Khorramshahr and for coastal traffic.

4.4.3 Operations

Dhows are not fitted with radio receivers, therefore have no means of communication with the mainland. Furthermore, there are only a few sheltered harbours along the coastline where they can take refuge from storms. They operate along the coast in search for cargo and often make voyages with little or no cargo on board.

4.4.4 Minor Ports Development

The development of the minor Persian Gulf ports is treated in Volume 11 of this report.

SECTION 5

INTERNATIONAL TRANSPORTATION

5.1 INTERNATIONAL RAILROADS

5.1.1 Trans-Asian Railway Network

In the interest of facilitating international railway transport, about ten years ago the ECAFE nations started to sponsor the development of a Trans-Asian Railway Network. The ultimate aim is to develop a railway network connecting Istanbul to Singapore, a distance of some 14,000 km.

At this time the missing links in this network total a distance of approximately 1920 km comprising some 1400 km between Bangladesh and Thailand via Doharzari, Prome, Rangoon, Mae Sod and Suphanburi. The balance is a 560 km railway link in Iran, between Kerman and Zahedan as shown on Figure 13.

It is anticipated that this project will also serve to connect landlocked countries with main ports in neighbouring territories by extending several of the existing railways into such countries as Afghanistan, Laos and Nepal. Furthermore, it should give momentum to the modernization and rehabilitation of the existing railway systems in the respective countries. Another important aspect of the proposed railway network is railway ferry service between Ceylon and India, across the Brahmaputra to Bangladesh and between Penang in Malaysia and Sumatra in Indonesia.

The implementation of these programs will make it possible for railways in Asia to be linked to those in Western Europe and the U.S.S.R. It should be noted that Iran has in 1350 been linked with Europe via Turkey.

5.1.2 European and Russian Railway Connections

Both Western Europe and Russia have extensive and efficient railway networks for the transportation of passengers and freight. With the completion of Iranian links to both the Russian and Turkish railway systems, significant volume flows of general cargo trade have immediately materialized. Through Jolfa at the Russian frontier, the transfer of some 915,800 tons of cargo was realized during the year 1350. See Table 5.1.

TABLE 5.1

TRANSFER OF PASSENGER AND CARGO AT JOLFA[1)]

DESCRIPTION	Y E A R						
	1351	1350	1349	1348	1347	1346	1345
COMING IN :							
No. of wagons	-	36,287	41,022	33,899	29,928	25,123	15,983
Freight (Tons)	790,265	827,305	904,598	743,338	658,537	624,617	359,444
No. of Passengers	-	606	703	1,033	1,168	-	-
GOING OUT :							
No. of wagons	-	4,974	3,791	2,919	2,374	1,186	550
Freight (Tons)	127,294	88,531	72,561	85,516	51,422	49,084	15,369
No. of Passengers	-	674	1,659	2,281	2,281	-	-

TABLE 5.2

IMPORTS VIA JOLFA [2)]

(Tons)

YEAR	TOTAL IMPORTS	CARGO SHIPPED BY ISR	PERCENTAGE BY ISR	TOTAL EXPORTS
1348	743,338	484,649	65%	85,516
1349	904,598	601,413	66%	72,561
1350	827,305) 1,617,570 [3)]	337,509) 1,158,138 [3)]	72%	88,531
1351	790,265)	820,629)		127,294

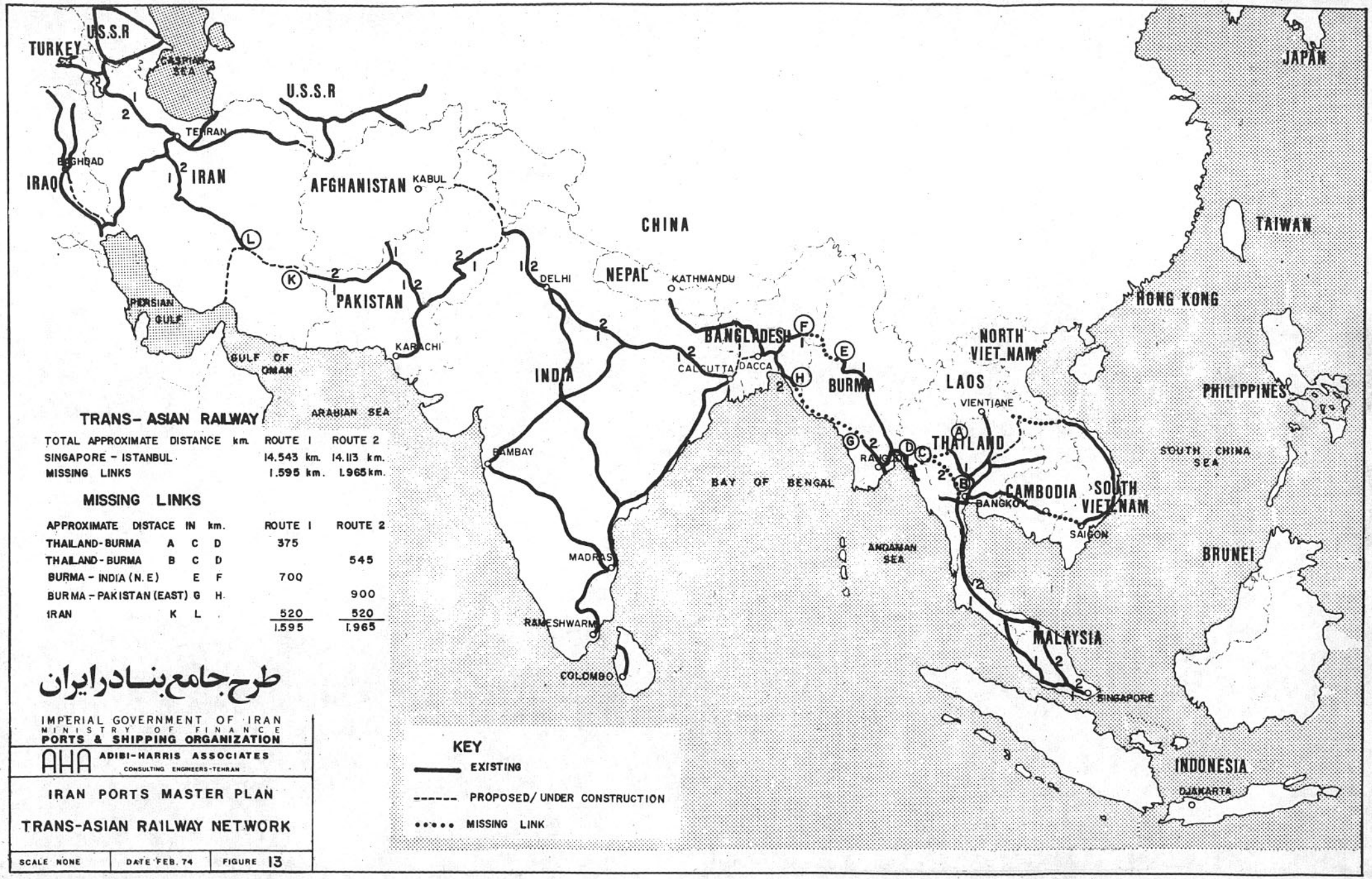
1) Iranian State Railways

Much of this cargo moves by truck over the gravel road from Jolfa to Marand, where it connects to the main asphalted highway to Tabriz and Tehran.

2) Iranian State Railways

Data on ISR shipment of exports is not available.

3) The apparent inconsistency in 1351 data was explained to be due to cargo shipped to Jolfa in 1350 but transhipped inland after storage in customs. As a result, 1350 and 1351 data are combined.



TRANS- ASIAN RAILWAY

TOTAL APPROXIMATE DISTANCE km.	ROUTE 1	ROUTE 2
SINGAPORE – ISTANBUL	14.543 km.	14.113 km.
MISSING LINKS	1.595 km.	1.965 km.

MISSING LINKS

APPROXIMATE DISTACE IN km.				ROUTE 1	ROUTE 2
THAILAND-BURMA	A	C	D	375	
THAILAND-BURMA	B	C	D		545
BURMA – INDIA (N.E)		E	F	700	
BURMA – PAKISTAN (EAST)	G	H			900
IRAN	K	L		520	520
				1.595	1.965

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IRAN PORTS MASTER PLAN

TRANS-ASIAN RAILWAY NETWORK

SCALE NONE	DATE FEB. 74	FIGURE 13

KEY

EXISTING

PROPOSED/ UNDER CONSTRUCTION

MISSING LINK

These figures conflict with recent railway officials' statements which have appeared in the newspapers, claiming that only 30% of the goods through Jolfa are shipped by ISR and 70% by truck. The same officials claim a railway capacity of 5,000 - 7,000 tons per day and indicate a shortage of trucks. The road from Jolfa to Marand, where traffic joins Asian Highway Route 1, is a gravel road. There are no plans for improving it in the 5th Development Plan, although projections developed in the Section 3.2.3.4 indicate that asphalting is justifiable. There are plans to electrify the Jolfa-Sufian rail line. Rail capacity appears adequate for projected volume. Transhipment facilities as well as a shortage of trucks appear to impose limitations on throughput.

The link between ISR and Turkish railway via Razi began operations during the second half of 1350, carrying only 7,200 tons during that period. These operations are developing at a satisfactory rate. Below are statistics for 1973.

TABLE 5.3

1973 PASSENGER AND CARGO TRAFFIC AT THE TURKISH FRONTIER[1)]

MONTH	TONS OF IMPORTED CARGO	TONS OF EXPORTED CARGO	NO. PASSENGERS ENTERING IRAN	NO. PASSENGERS EXITING IRAN
January	8,674	106	412	461
February	8,722	902	466	422
March	10,982	1,759	365	619
April	17,687	1,224	416	592
May	18,507	2,187	330	703
June	13,283	2,462	528	820
July	16,258	1,494	976	862
August	9,127	697	969	936
EIGHT MONTH TOTAL	103,240	10,831	4,462	5,414
PRORATED ANNUAL TOTAL	155,000	16,250	6,690	8,200

A continued rapid growth of this traffic is anticipated for the future. The ferry service accross Lake Van in Eastern Turkey has a capacity limitation of 500,000 tons per year. However, two more ferries are being built which will double the capacity, and a rail link around the lake is planned.

A container rail service between Iran and Japan via the Trans-Siberian Railway was initiated in the later part of 1351. This service produces savings in transportation and insurance costs. It also provides fast transit time and is capable of accomodating both 20 and 40 foot containers. The proposed railway extension to Sarakhs on the Russian Frontier will reduce the transit and cost for this service.

1) Iranian State Railways.

5.1.3 International Transportation Concepts

The railway distances from a number of Western European cities to Lahore, Pakistan as shown in Table 5.4 indicate distance ratios in order of 1 to 3 of land route versus the African sea route. Similarly land route distances versus the Suez Canal sea route indicate a land route advantage of approximately 1.2 to 1.7. Figure 14 shows the Euro-Indo Railway System. It, therefore, can be said that railways may be competitive for the transportation of general cargo between Europe and Iran as well as the Indian Subcontinent. The complete overland route may be operational in about 10 years.

TABLE 5.4

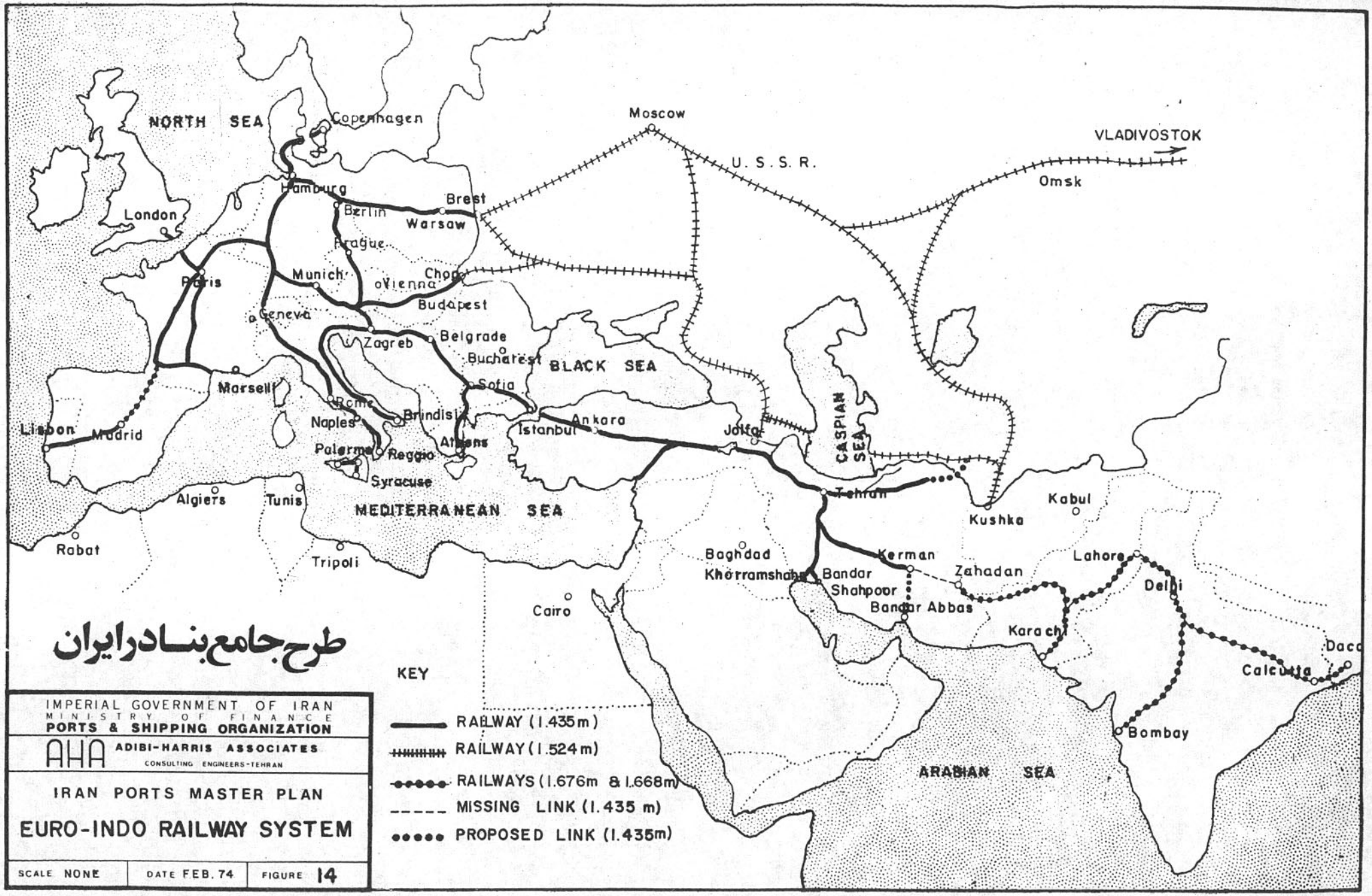
DISTANCES BY RAIL AND SEA BETWEEN
LAHORE AND SELECTED EUROPEAN COUNTRIES

COUNTRY	ENTRY PORT (SEA ROUTE)	RAIL VIA USSR	RAIL VIA TURKEY	SEA VIA AFRICA	SEA VIA SUEZ
		In km			
West Germany	Hamburg	8,798	9,083	24,300	13,938
Denmark	Copenhagen	8,898	9,457	25,795	15,038
Italy	Geneva	8,876	8,286	23,745	10,438
USSR	Odessa	4,188	-(1)	24,392	9,838
Yugoslavia	Rijeka	8,365	7,268	24,845	10,360

5.1.4 Tariffs

For the study representative freight rates were collected for the regional origins and destinations. These rates are detailed in Volume IV, Appendix 2.

1) Via Jolfa



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EURO-INDO RAILWAY SYSTEM

SCALE NONE	DATE FEB. 74	FIGURE 14

5.1.5 System Capacities

- Russian Connections

ISR connects to the Russian broad gauge line at Jolfa where Iran has a transhipment station to the electrified Russian Railway system. The estimated capacity of this line is 10 million tons per year. It is presently limited by the actual transhipment terminal facilities and the capacity of the Jolfa - Tehran line.

The proposed new link into the Russian Railway system at Sarakhs will provide additional rail capacity. The capacity limitations of this line will however also largely depend on the transhipment facilities and the track capacity of the Iranian line.

- Turkish Connection

The basic capacity of this connection is controlled by the railway ferry across Lake Van. The present capacity is some 500,000 tons per year. This capacity is planned to be increased by 100% by providing two additional ferries.

- Pakistan Connection

This connection is not scheduled for construction within the next ten years. Once built the basic capacity is estimated to be of the order of at least 5 million tons per year. Again transhipment or bogie changes will be necessary due to the existing broad gauge system of the Pakistan Railways.

5.2 INTERNATIONAL HIGHWAYS

5.2.1 Euro-Asian Highway Network

During the past two decades a comprehensive international highway network has been constructed, connecting various countries, industrial and commercial centers. This development has contributed to the increase of both domestic and international trade within and outside of Europe and Asia. Due to the development of containers and TIR trailers, competitive international truck transportation systems became established. This system provides fast and efficient service for long distance transportation coupled with flexibility to respond to changing trade loads and patterns.

The two main routes, A-1 and A-2 of the Trans-Asian Highway Network, shown in Figure 15, reflect a total length of some 24,000 km planned within ECAFE nations. Approximately 22,000 km of these priority roads were completed by the year 1350. Of the balance some 490 km of roads exist, however below the minimum standards established by ECAFE for the Trans-Asian Highway Network. The remaining major missing links are located in very difficult terrain within the countries of Nepal and Burma.

Principal highway routes are shown of Figure 16.

5.2.2 International Connections

5.2.2.1 Turkish Connections

Iran has one principal highway connection with Turkey, namely Asian Highway Route No.1 via Bazargan, which has a customs station at the frontier. The traffic across this point is growing rapidly. In 1969 there were some 11,100 crossings and in 1970, 15,600, out of which approximately 30% were trucks[1]. In 1971 international trucking volumes crossing at Bazargan were estimated at 60,000 tons of exports from Iran and 75,000 tons of imports to Iran.[2] This route is expected to be of increasing significance in the future. The present road's capacity should be adequate for several million tons of cargo per year.

A second, minor connection to Turkey is from Rezaiyeh via Sero which also has a customs station. The indirect connection with Iran due to the position of Lake Rezaiyeh preclude any major role for this crossing.

5.2.2.2 Afghanistan Connections

Afghanistan is reached from Iran by a recently asphalted portion of the Asian Highway Route No.1 from Mashad to the frontier town of Taybat, where Iranian frontier and customs facilities are located. In 1350 there were no imports from Afghanistan to Iran and only 16,500 tons of exports. In 1351 some 24,300 tons of export cargo entered Afghanistan from Iran while some 3,300 tons entered into Iran.[3]

5.2.2.3 Iraq Connections

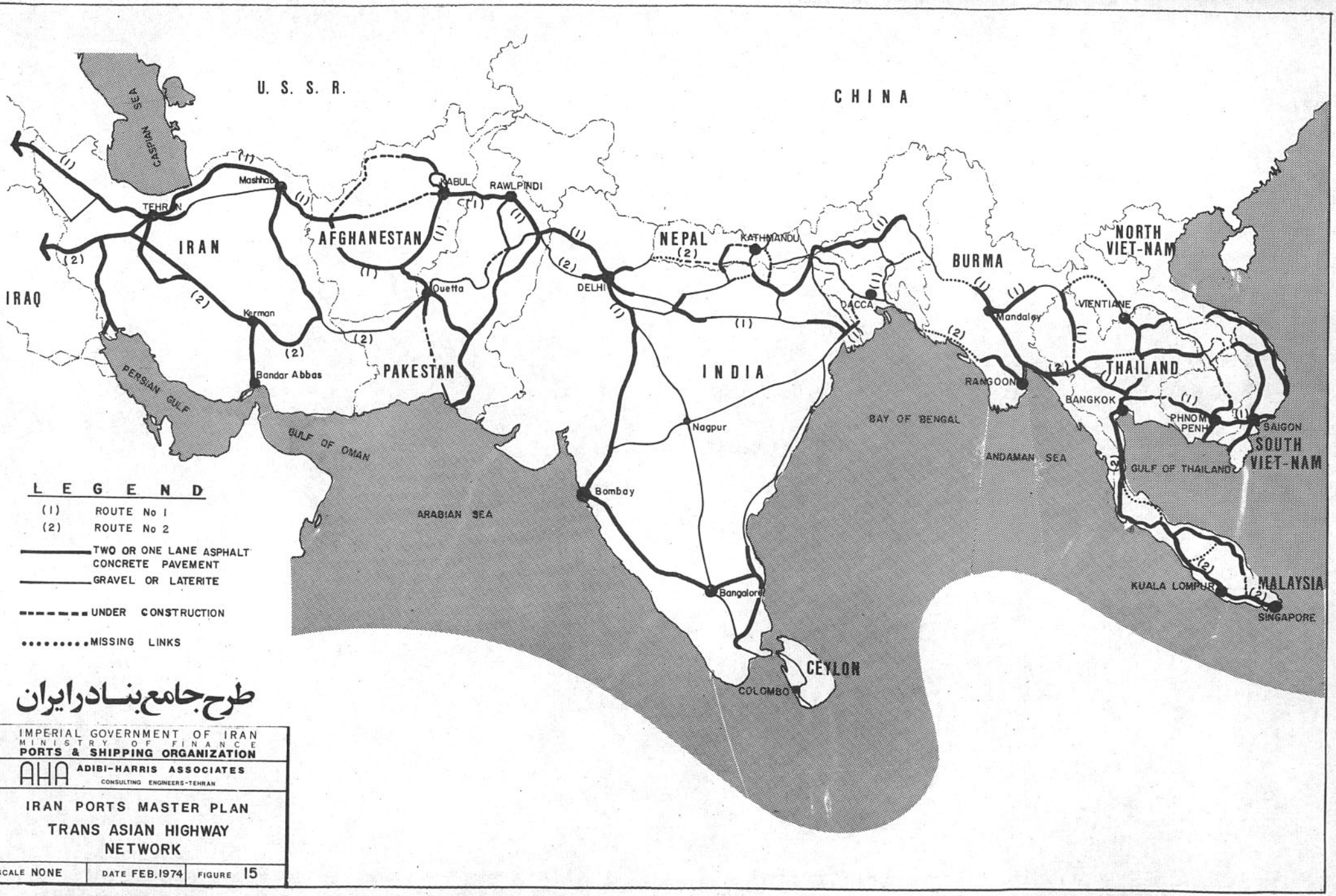
Iran has one international highway crossing with the country of Iraq, located at Khosravi, on Asian Route No.2. Although there was a fast growth of traffic at this crossing up to 1347 at present essentially no commerce exists with Iraq. However, the frontier as such is open, and some passenger and bus vehicles still utilized this crossing during 1351.

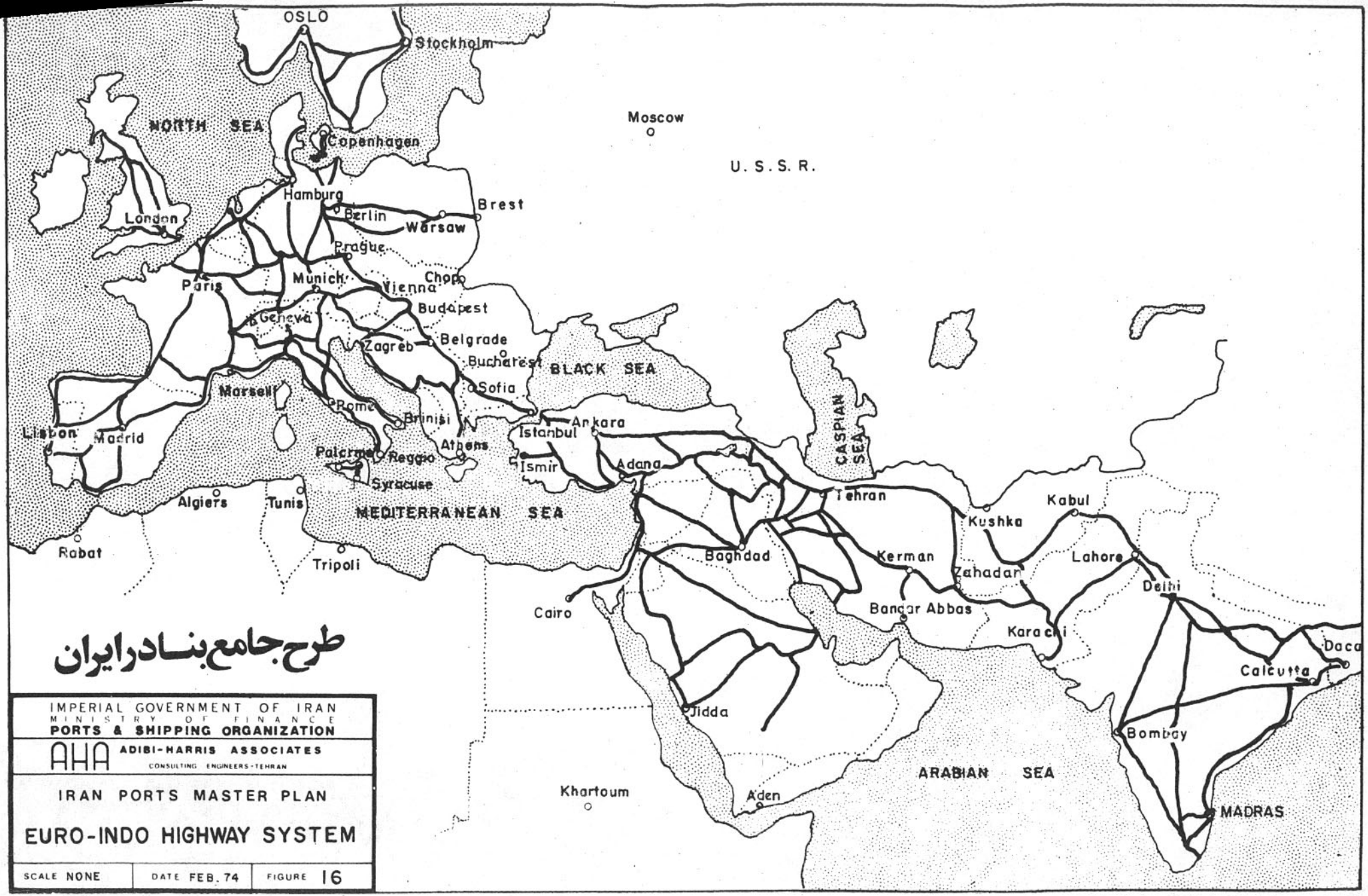
5.2.2.4 Pakistan Connections

An international highway crossing exists between Iran and Pakistan at the town of Mirjaveh, located at the frontier and on Asian Highway Route No.2. This gravel roadway is currently being paved as part of the Kerman-Zahedan road. In 1350 Iran exported a total of 1800 tons to Pakistan and imported a total of 14,900 tons. Figures for 1351 are 3,800 and 20,400 tons respectively.[4] It is estimated that the majority of these volumes move by sea or rail road (to Zahedan). Hence the highway connection plays an insignificant role. Completion of the Kerman-Zahedan highway is expected to increase its importance.

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1) Pilot Survey for the Development of, and Prospects for, International Traffic in Iran (U.N.D.P. Project, 1972).
2) International Road Transport Syndicate.
3) Iranian Customs, Foreign Trade Statistics.
4) Iranian Customs, Foreign Trade Statistics.


U. S. S. R.
CHINA
CASPIAN SEA
IRAN
AFGHANESTAN
NEPAL
BURMA
NORTH VIET-NAM
IRAQ
PAKESTAN
INDIA
THAILAND
SOUTH VIET-NAM
MALAYSIA
CEYLON
PERSIAN GULF
GULF OF OMAN
ARABIAN SEA
BAY OF BENGAL
ANDAMAN SEA
GULF OF THAILAND
Mashhad
TEHRAN
KABUL
RAWLPINDI
KATHMANDU
Quetta
DELHI
DACCA
Mandalay
VIENTIANE
Kerman
Bandar Abbas
RANGOON
BANGKOK
PHNOM PENH
SAIGON
Nagpur
Bombay
Bangalore
COLOMBO
KUALA LOMPUR
SINGAPORE
LEGEND
(1) ROUTE No 1
(2) ROUTE No 2
TWO OR ONE LANE ASPHALT CONCRETE PAVEMENT
GRAVEL OR LATERITE
UNDER CONSTRUCTION
MISSING LINKS
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TRANS ASIAN HIGHWAY NETWORK
SCALE NONE
DATE FEB. 1974
FIGURE 15



طرح جامع بنادر ایران

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IRAN PORTS MASTER PLAN

EURO-INDO HIGHWAY SYSTEM

SCALE NONE	DATE FEB. 74	FIGURE 16

5.2.2.5 Russian Connections

No effective vehicular transport facilities exist between Iran and Russia. Consequently, no international road traffic exists. Owing to a difference in rail gauge, all rail traffic to and from Russia must be unloaded and reloaded at Jolfa. On the Iranian side much of this cargo moves by truck over the gravel road from Jolfa to the main highway at Marand.

5.2.3 International Road Transport and Trucking Industry

Iran is well served by a growing number of foreign and national trucking firms engaged in international overland transport, principally in service between Iran and the Western European nations. As Iran has recently become a member of International Road Union (IRU) it is presumed that important and significant benefits will be realized by the Iranian international trucking industry arising from TIR certifications in terms of reduced operating expenses and travel times.

A major factor responsible for foreign handling of imports destined for Iran is the relatively low number of Iranian trucks which meet the specified international standards.

The following worldwide countries are members of I.R.U. and are authorized thereby to issue T.I.R. certificates governing transport of goods for both import and export:

Albania, Austria, Belgium, Bulgaria, Czechoslavakia, Denmark, Finland, France, West Germany, East Germany, Greece, Hungary, Iran, Ireland, Israel, Italy, Japan, Luxemburg, Netherlands, Norway, Portugal, Romania, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States of America and Yugoslavia.

Detailed information on international trucking tariffs appears in Volume 4.

5.3 WORLD AND PERSIAN GULF WATERBORNE TRAFFIC

5.3.1 World Seaborne Trade

World total seaborne trade in terms of tons moved has more than doubled in the last 10 years. The average percentage growth per year has been about 8%. The tonnage of crude oil and oil products has been increasing slightly faster than the total trade.

Ten years ago oil and oil products constituted about 40% of the total. At the present time oil and oil products account for about one half of the total tonnage. Table 5.5 shows the development of seaborne trade in tons for the last 10 years.

TABLE 5.5

WORLD SEABORNE TRADE[1)]

1342 (1963) TO 1352 (1973)

(Million Tons Per Year)

YEAR	TOTAL TRADE ESTIMATE	CRUDE OIL	OIL PRODUCTS	IRON ORE	COAL	GRAIN	OTHER CARGO ESTIMATE
1963	1,350	424	158	107	64	59	538
1964	1,510	482	170	134	60	71	593
1965	1,640	552	175	152	59	70	632
1966	1,770	607	195	153	61	76	678
1967	1,860	672	193	164	67	68	696
1968	2,040	768	207	188	73	65	739
1969	2,240	871	209	214	83	60	803
1970	2,480	995	245	247	101	73	819
1971	2,580	1,068	247	250	94	76	845
1972	2,750	1,179	254	247	96	89	885
1973Est.	3,040	1,310	275	285	107	99	964

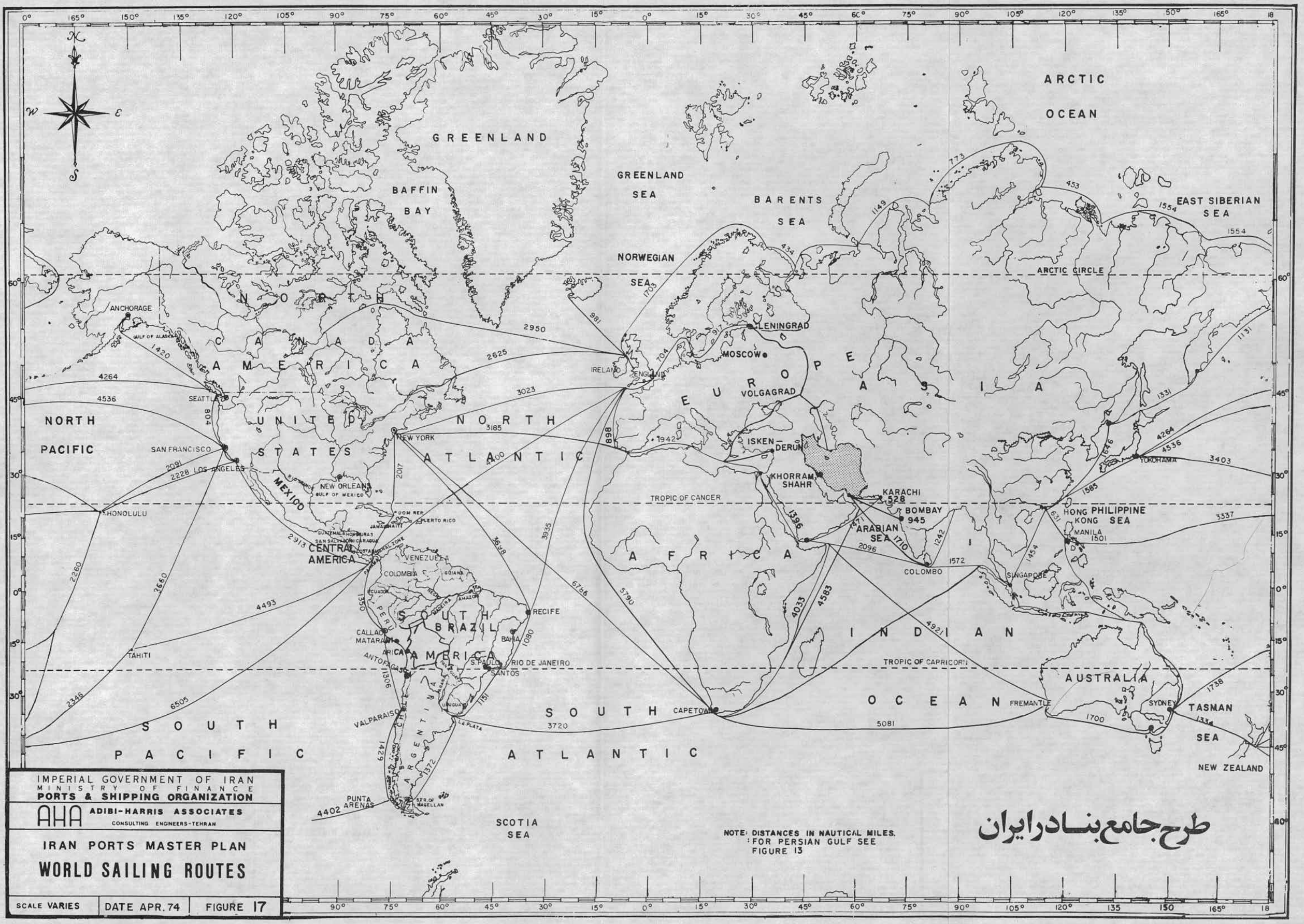
Notes: Estimates for 1352 (1973) are based on statistics for the nine first month of the most important countries plus estimates for the rest of the year as regards the specified commodities. Total trade estimates and other cargo estimates for 1973 are based on world trade growth as indicated by official sources.

World seaborne trade in terms of ton-miles has increased faster than the tonnage, reflecting the increasing sailing distances. The three main underlying factors for the increase in ton-miles are :

- The increase in overall shipments from the Persian Gulf;
- The decline in shipments from North Africa;
- The rising need for long distance oil imports into the United States.

When evaluating the future needs of seaborne trades, these factors are important. Other factors, although many in numbers, appear relatively insignificant. An examination of the major sailing routes of the world shown on Figure 17 explains why the above mentioned are the important factors. Table 5.6 shows the development of seaborne trade in ton miles for the last 10 years.[1)]

1) Fearnley & Egers Chartering Company Ltd., Oslo, Norway, Review 1973.



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WORLD SAILING ROUTES

SCALE VARIES	DATE APR. 74	FIGURE 17

NOTE: DISTANCES IN NAUTICAL MILES.
FOR PERSIAN GULF SEE FIGURE 13

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TABLE 5.6

WORLD SEABORNE TRADE [1)]

1342 (1963) TO 1352 (1973)

(Billion Ton-Miles)

YEAR	TOTAL TRADE ESTIMATE	CRUDE OIL	OIL PRODUCTS	IRON ORE	COAL	GRAIN	OTHER CARGO ESTIMATE
1963	4,704	1,850	600	348	202	304	1,400
1964	5,353	2,150	620	456	199	378	1,550
1965	5,849	2,480	640	527	216	383	1,600
1966	6,228	2,629	700	575	226	408	1,700
1967	7,230	3,400	730	651	269	380	1,800
1968	8,372	4,197	750	775	310	340	2,000
1969	9,347	4,853	760	919	385	307	2,150
1970	10,654	5,597	890	1,093	481	393	2,200
1971	11,695	6,220	900	1,185	434	406	2,250
1972Est.	13,072	7,670	950	1,156	442	454	2,400
1973Est.	14,800	8,750	1,020	1,330	495	505	2,700

5.3.2 Persian Gulf Seaborne Trade

The composition of the seaborne trade in the Persian Gulf is dramatically different from the composition of the world seaborne trade. In the world seaborne trade, the ratio between oil and other cargoes by tons is about 1:1 at the present time. In the Persian Gulf trade the ratio between oil and other cargoes is about 100:1. In 1351 about 750 million tons of oil moved out of the Persian Gulf. The other cargo movements including grain in the area, in and out, were about 7.5 million tons. Although the tankers, on the average, currently are about 10 times the size of other cargo ships, the number of tankers still outweighs the number of cargo ships by a ratio of more than five to one. This means that tankers dominate the Persian Gulf trade not only in tonnage, but also in number. Although tanker sizes are increasing the historical trend, as well as the forecast for the future, that oil trade increases faster than other cargo trade, the dominance of tankers in number of ships in the Persian Gulf will continue for at least the next decade. It is interesting to note that the seaborne trade in tons in the Persian Gulf is more than one fourth of total world seaborne trade in tons, but as mentioned, most of this tonnage is oil. As a matter of fact, the 750 million tons of oil in 1351 is more than half of the total world seaborne oil trade in tons.

1) Fearnley & Egers Chartering Company Ltd., Oslo, Norway, Review 1973.

The major international commercial non-oil sailing routes in the Persian Gulf are shown in Figure 18. At the present time the Khorramshahr - Bandar Shahpour port complex accounts for more than one half of the total non-oil commercial traffic in the Persian Gulf.

5.3.3. Ship Operations in the Persian Gulf

As mentioned in the previous paragraph, tankers dominate the Persian Gulf trade. They also enjoy the best operational climate with respect to port facilities. The oil terminals are generally well equipped. Waiting time is relatively small and loading time is short, with modern equipment resulting in quick turnarounds. This is desirable from an operational viewpoint. Part of the reason for short loading times, of course, must be attributed to the homogenous bulk cargo (oil).

The non-oil cargo ship operators using the non-oil ports which are the subject of this study, do not enjoy a similarly good operational climate. Persian Gulf non-oil ports generally are ill equipped, have unskilled labour and are most often too small for the quantities of cargo moving through, resulting in slow cargo handling and long waiting times for berths. About two weeks waiting time is typical for several Persian Gulf ports. This results in port surcharges which increase the cost of imported goods.

Most of the ships employed in the non-oil Persian Gulf trade are general cargo ships with an average size of about 8,000 DWT. Some relatively small (about 20,000 - 30,000 DWT) bulk carriers are employed, principally in the shipping of grain. Container ships and other specialized carriers are almost non-existent in the Persian Gulf trade at the present time.

All of the countries surrounding the Persian Gulf are oil exporting and developing countries. Oil income is used for developing their industries, including building of refineries and petrochemical plants. These facilities require heavy equipment, all of which must be imported. Ports' gear generally cannot unload such equipment, and it therefore has to be unloaded by ships' gear. As a consequence there are relatively more heavy lift ships used in the Persian Gulf trade than elsewhere in the world. These specialized ships charge higher tariffs than conventional ships, rates varying from case to case. Otherwise tariffs to the Persian Gulf ports in general are well established through various conference rates.

5.3.4 Tariffs to Iranian Ports

Ships tariffs vary depending upon the commodity moved. The tariffs also are a function of whether the commodity is charged per weight unit or measurement unit. Average tariff rates for various commodities and foreign origins and destinations are given in Volume 4, Appendix 2.

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PERSIAN GULF SAILING REUTES

SCALE NONE	DATE FEB. 1974	FIGURE 18

IRAQ
KUWAIT
SAUDI ARABIA
QATAR
UNITED ARAB EMIRATES
OMAN
AFGHANESTAN
PAKESTAN

DEZFUL
ESFAHAN
SHAHREZA
YAZD
AHWAZ
KHORRAMSHAHR
BASRAH
ABADAN
SHAHPOUR
MAHSHAHR
UMM QASR
DEYLAM
FAO
KHOR AL AMAYA
SHIRAZ
KUWAIT
MINA AL AHMADI
MINA ABDULLA
CYRUS TERMINAL
KHARG IS.
DARIUS TERMINAL
BUSHEHR
MINA SAUD
NEUTRAL ZONE
RAS AL KHAFJI
JAHROM
RAS AL MISHAB
BAM
BANDAR ABBAS
SEA IS.
RAS TANURA
AD DAMMAN
LAVAN
LANGEH
QUOIN IS.
SITRA
BAHREYN
JASK
CHAHBAHAR
HALUL IS
DOHA
SHARJEH
DUBAY
DAS IS.
UMM SAID
ABU DHABI
JEBEL DANA
SAIH-EL MALIH
MUSCAT

TO/FROM KARACHI
TO/FROM BOMBAY
TO/FROM FAR EAST & AUSTRAL/ASIA
TO/FROM AROUND THE CAPE N. AMERICA, S. AMERICA
TO/FROM E. AFRICA, WEST EUROPE
AFRICA

COMMERCIAL PORTS
OIL TERMINALS

100 KM. 50 0 100 200

48° 50° 52° 54° 56° 58° 60° 62°
32° 30° 28° 26° 24°

5.4 CASPIAN SEA TRAFFIC

Caspian Sea transport is unusual, if not unique. The Caspian is a Russian sea, insofar as transport is concerned, but it also serves as a link between Europe and Iran.

5.4.1 Sailing Routes

Russia's vast distances and severe winters lead to the favouring of rail over highway transport, thus Caspian ports are found at the railhead cities of Baku and Makhachkala on the western shore, Guryer on the north, and Krasnovodsk on the east.

Astrakhan, on the Volga delta, is also a railhead, but is more significant as the entrance to the Volga-Don and the Volga-Baltic canal systems, see Figure 19. Only Baku-Pahlavi and Baku-Nowshahr routes are of year-around use to Iran. The northern Caspian is quite shallow, and the fresh water inflow of the Volga freezes sufficiently to stop navigation. The canals leading off from Volgarod are ice-bound in any case. The Volga-Don canal remains open about 7 months from early April through October while Volga-Baltic route has only a 5 month season late April through September. During the winter months shipments are rail routed to Baku, for transhipment to Pahlavi or Nowshahr.

The Volga-Don canal is limited to about 3000 DWT vessels, with maximum length of 135 meters, beam of 16.15 meters, and 3.3 meter draft. In some years due to low water only smaller vessels can operate. The Volga-Baltic is reported to accomodate over four meter draft. On the Caspian, as from Baku to Iran, vessels are limited to around 4,000 tons, mostly by available draft in the Caspian ports served. Nowshahr for instance cannot take the larger vessels fully loaded.

Another canal of potential interest to Iran is also in the construction stage. Work continues on approximately 100 km required to complete a Rhine-Danube canal. Connecting into the Black Sea, this route to Iran would also be subject to the same icebound winters as the existing Volga-Don canal with which it would form a link. It is not expected to be completed for at least five years and will be limited to vessels of 80 m length, 9½ m draft, which is somewhat less than the Volga-Don canal.

5.4.2 Operations

The Caspian Sea serves as a link between Iran and the USSR for trade between the two countries and also as an in-transit link between Iran and Europe and the north continental ports. However, the USSR also extensively uses her railway, via Jolfa, to serve the same trades. A single tariff covers all combinations of the Europe-Iran operation and all modes are represented by Iran-Soviet Joint Stock Private Forwarding Company (IRSOT) in Tehran. The canal service is managed by the Foreign Shipping Department of the Ministry of River Fleet of the Russian Federation in Moscow.

The journey from Rotterdam, Antwerp, Bremen, Hull etc. to Pahlavi takes between 22-30 days via the Volga-Baltic. The season begin about 1st May and there are on the average 2 arrivals per week in Pahlavi.

Throughout the year, Russian vessels operate between Baku and Pahlavi. Some also call at Nowshahr. These arrive at a rate of about four per week. In 1350 a total of 285 vessels called at Pahlavi.

Vessels used on the canal run are of four types with characteristics as in Table 5.7.

TABLE 5.7

VOLGA - BALTIC CANAL FLEET

DETAILS	SHIP CLASS			
	BALTISKY*	SORMOVSKY*	MORSKOI	LADOGA*
NRT	938	1,420	913	826
DWT	2,140	2,935	1,810	1,968
Draught (m)	3.50	3.50	3.30	3.5-4.0
Holds	3	4	3	2
Hold Capacities m^3	3,190-3,470	4,300	2,900	2,615

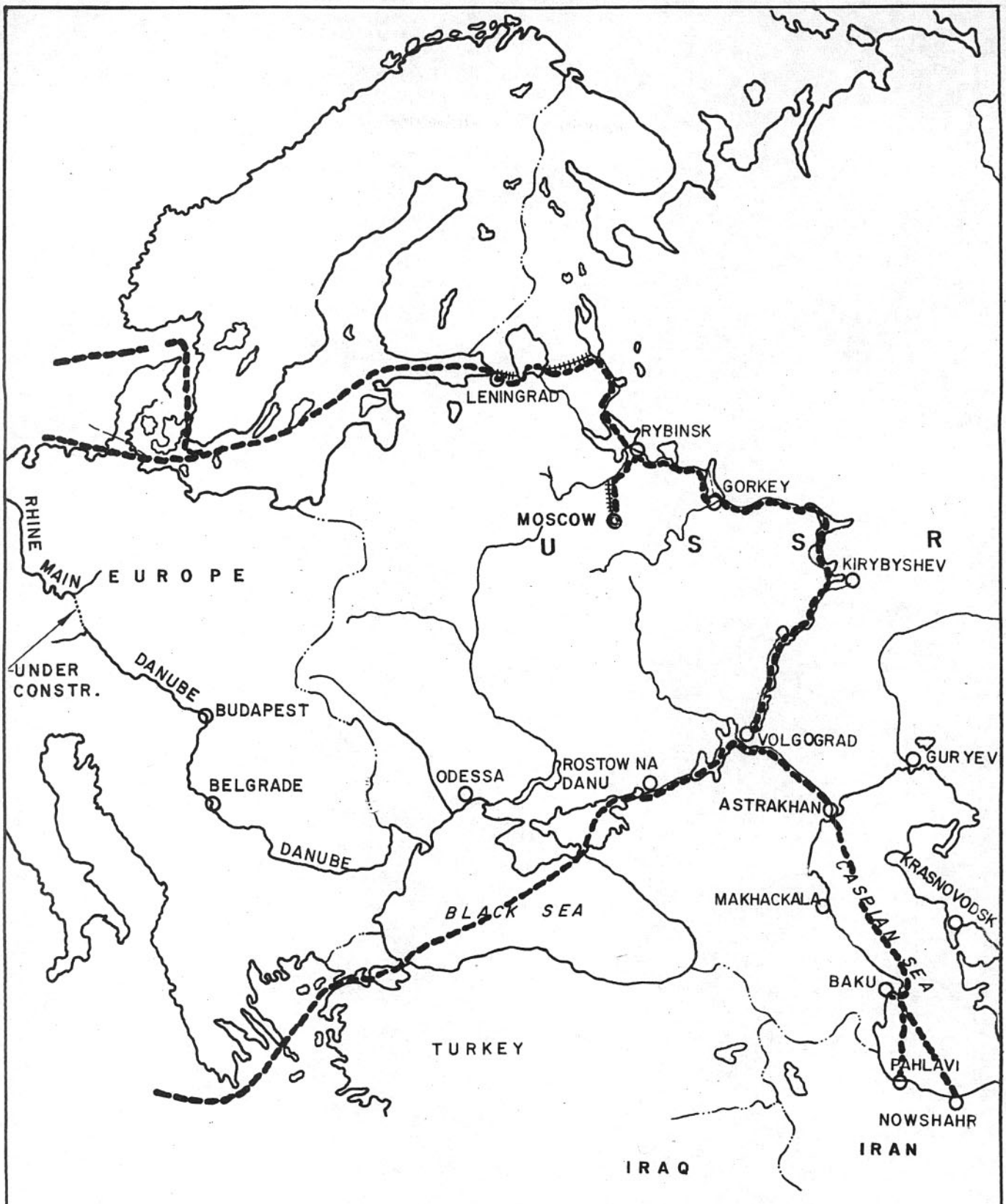
* Not equipped with winches, derricks or cranes.

On the Baku-Pahlavi-Nowshahr 3,000 to 4,000 ton vessels are more common. The largest is the Kaspar, of 4,016 DWT, with a length of 120 m., beam of 15 m and draft of 4.20 m. It has been confirmed with IRSOT and their principals in Moscow that no larger general cargo vessels are planned for use on the Caspian Sea.

5.4.3 Tariffs

A single in-transit tariff, issued by IRSOT, covers Jolfa, Pahlavi or Nowshahr to or from USSR border points at Khob on the Czechoslovakia-German border, or the continental ports of Hamburg, Rotterdam, Antwerp or Bremen. The shipper has the option of routing via Jolfa or Iran's Caspian Sea ports, but the remaining routing is at IRSOT's option.

During the months when the canals are closed, the tariff rates are increased by about 11 percent. However, the rates are set basically to compete with the ocean routes around Africa. Detailed information is presented in Volume 4, Appendix 2.



طرح جامع بنادر ایران

500Km. 0 500 1000 Km

L E G E N D

RIVERS

CANALS

NAVIGATION ROUTE

IMPERIAL GOVERNMENT OF IRAN
MINISTRY OF FINANCE
PORTS & SHIPPING ORGANIZATION

AHA ADIBI-HARRIS ASSOCIATES
CONSULTING ENGINEERS-TEHRAN

IRAN PORTS MASTER PLAN

CASPIAN SEA SAILING ROUTES

SCALE GRAPHIC | DATE FEB. 74 | FIGURE 19

APPENDICES BY OTHERS

TO VOLUME 6

NO.	TITLE	DESCRIPTION	COMPANY
1.	Property Survey - Bandar Shahpour	5 sheets	NCC
2.	Soil Investigation for Bandar Shahpour project	1 Report	PEYJOU
3.	"	11 Report	"
4.	"	111 Report	"
5.	Survey of Sea Conditions and Hydrographic Surveys in Persian Gulf and Caspian Sea Site: Bandar Shahpour	Report	CESCO, B.V.
6.	Hydrualic Studies for Port Development in Iran Site: Bandar Shahpour	Report	DHL

TO VOLUME 7

NO.	TITLE	DESCRIPTION	COMPANY
1.	Property Survey - Bandar Bushehr	3 sheets	NCC
2.	Survey of Sea Conditions and Hydrographic Surveys in Persian Gulf and Caspian Sea Site: Bandar Bushehr	Report	CESCO, B.V.

TO VOLUME 8

NO.	TITLE	DESCRIPTION	COMPANY
1.	Survey of Sea Conditions and Hydrographic Surveys in Persian Gulf and Caspian Sea Site: Bandar Abbas	Report	CESCO, B.V.
2.	Soils Investigation Bandar Abbas and Minor Ports Persian Gulf and Sea of Oman	Report	CESCO, B.V.

NO.	TITLE	DESCRIPTION	COMPANY
3.	Annex 1: Borings and Laboratory Test Results Bandar Abbas	Report	CESCO, B.V.
4.	Hydraulic Studies for Port Development in Iran Site: Bandar Abbas	Report	DHL
5.	Land Survey Port of Bandar Abbas and Adjacent Areas for Port Development	Drawings	RASSAD
TO VOLUME 9			
1.	Hydrographic and Land Surveys in Persian Gulf and Sea of Oman	Report	GECIMA/POSFORD, PAVRY
2.	Survey Drawings (for above)	11 sheets	GECIMA/POSFORD PAVRY
3.	Results of Soil Investigation Vol. 1 Minor Ports Persian Gulf and Sea of Oman (See also Appendix No. 2 of Vol. 8)	Report	MRTSL
TO VOLUME 10			
1.	Property Survey - Bandar Khorramshahr	Drawings	NCC
TO VOLUME 11			
1.	Hydrographic and Land Surveys Minor Persian Gulf Ports (also see Appendix Nos.1 & 2 Vol. 9)	7 Sheets	NGO
2.	Results of Soil Investigation Vol. II Minor Ports Persian Gulf and Sea of Oman (See also Appendices No.2 of Vol. 8 and No.3 of Vol.9)	Report	MRTSL
TO VOLUME 12			
1.	Property Survey - Bandar Pahlavi	Drawings	NCC
2.	Survey of Sea Conditions and Hydrographic Surveys in Persian Gulf and Caspian Sea Site: Bandar Pahlavi	Report	CESCO, B.V.

NO.	TITLE	DESCRIPTION	COMPANY
3.	Hydraulic Studies for Port Development in Iran Site: Bandar Pahlavi	Report	DHL
4.	Property Survey - Bandar Nowshahr	4 sheets	NCC
5.	Survey of Sea Conditions and Hydrographic Surveys in Persian Gulf and Caspian Sea Site: Bandar Nowshahr	Report	CESCO, B.V.
6.	Hydraulic Studies for Port Development in Iran Site: Bandar Nowshahr	Report	DHL

TO VOLUME 13

1.	Soil Investigation Report for Golmankhaneh Port of Lake Rezaiyeh	Report	MRTSL
2.	Report on Hydrographic Survey of Lake Rezaiyeh May - July 1973	Report	RASSAD
3.	Survey Drawings for Hydrographic Survey of Lake Rezaiyeh	17 Sheets	RASSAD

IRAN PORTS MASTER PLAN

LIST OF ABBREVIATIONS USED IN THE TEXT AND ON DRAWINGS

1. COMPANIES & ORGANIZATIONS

P O	:Plan Organisation
P B O	:Plan and Budget Organization
P S O	:Ports and Shipping Organization
R C D	:Regional Cooperation for Development (Iran, Pakistan and Turkey)
N I O C	:National Iranian Oil Company
O O C	:Oil Operating Company (Private Company) (Formerly: Iranian Oil Exploration and Producing Co.)
I P A C	:Iran Pan American Oil Company
I O R C	:Iranian Oil Refining Company
I S R	:Iranian State Railway
I C A O	:International Civil Aviation Organization
N I A C	:National Iranian Airways Corporation
I R U	:International Road Union
T I R	:Transport International Routiere
IRN	:IRAN
I R S O T	:Iran Soviet Joint Stock Private Forwarding Co.
I S C	:Iran Statistical Centre
ARYA	:ARYA National Shipping Line
I R A L C O	:Iran Aluminium Company
N C C	:National Cartographic Centre
N G O	:National Geographic Centre
M R T S L	:Ministry of Roads Technical & Soils Laboratory
D H L	:Delft Hydraulics Laboratory
A H A	:Adibi Harris Associates, Consulting Engineers
A D L	:Arthur D. Little, Consultants
U N	:United Nations.
I B R D	:International Bank for Reconstruction and Development (World Bank)
I D A	:International Development Association
A S C E	:American Society of Civil Engineers
M E N A S	:Middle East Navigation Aids Service

E C A F E	:Economic Commission for Asia and the Far East

2. NAUTICAL TERMS

L.L.W.	:Lowest Low Water
H.L.W.	:Highest Low Water
M.S.L.	:Mean Sea Level
L.H.W.	:Lowest High Water
H.H.W.	:Highest High Water
L.W.S.	:Low Water Springs
L.A.T.	:Lowest Astronomical Tide
H.A.T.	:Highest Astronomical Tide
M.L.L.W.	:Mean Lowest Low Water
M.H.L.W.	:Mean Highest Low Water
M.H.W.N.	:Mean High Water Neaps
M.L.H.W.	:Mean Lowest High Water
M.H.H.W.	:Mean Highest High Water

3. MISCELLANEOUS

ELEV (EL)	:Elevation
B/L	:Bill of Lading
L P G	:Liquid Petroleum Gas
L N G	:Liquid Natural Gas
G M T	:Greenwich Mean Time ($3\frac{1}{2}$ hours earlier than Iran Mean Time)
G R T	:Gross Register Tonnage (entire internal cubic capacity of ship in terms of 100 cu. ft.)
N R T	:Net Register Tonnage (Gross tonnage minus space provided for crew, machinery engine room, fuel etc.).
D W T	:Deadweight (cargo weight, including bunker)
Displacement	:Weight of water displaced by the vessel
E	:East
W	:West
N	:North
S	:South
NE	:North East

4. OTHER ABBREVIATIONS

N.A.	:Not Available/Not Applicable
C.P.T.	:Commercial Profit Tax
G.N.P.	:Gross National Product
G.D.P.	:Gross Domestic Product