Chapter 2

Transport Condition

Chapter 2 Transport Conditions

2.1 Overall Transport Network

Syria's transportation infrastructure includes road, railway, air and pipeline networks. These are shown in Figure 2.1.1.

Figure 2.1.1 Basic National Transportation Infrastructure Networks

In terms of the domestic transportation the road network is the most widely spread and therefore utilized transport mode (refer to Table 2.1.1).

Table 2.1.1 Transport Volume by Mode (1999, inter-governorate traffic only)

Transport mode	Passenger (pax・km)	Freight (ton・km)
Road transport (estimated)	34,136,101	51,509,883
Railway	573,351	4,477,920
Air	Very small amount	Very small amount
Marine	No domestic marine transport	No domestic marine transport
Pipeline	—	Exclusively for crude oil and natural gas

Figure 2.1.2 shows the 1999 traffic modal shares in Syria for both freight and passenger. Road and rail modes shares are nearly 100% and the share of air transport mode is very low for both freight and passenger.

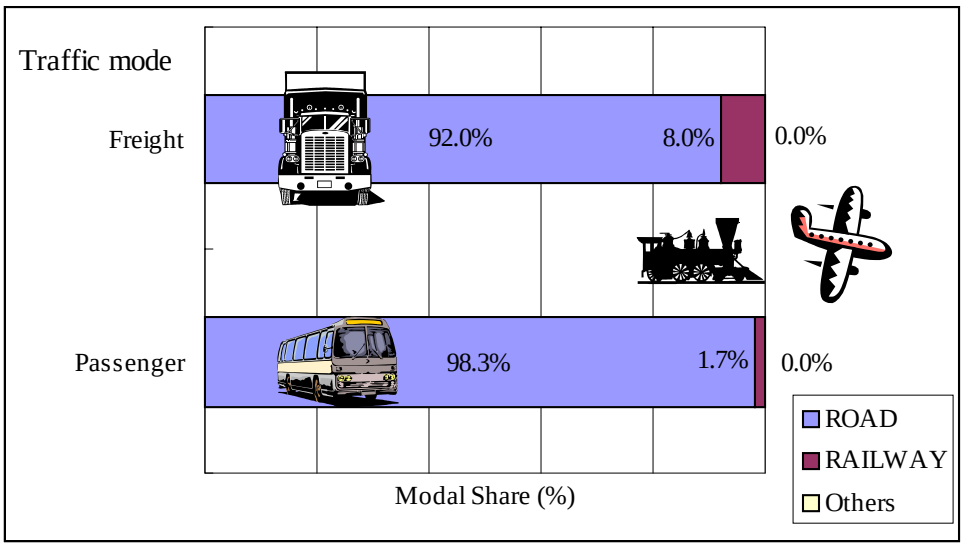

Figure 2.1.2 Traffic Modal Share in Syria

2.2 Road Network in Syrian Arab Republic

(1) Institutional Setup

The road network is classified into four (4) categories as follows:

⇒ Highways (4-lane Expressways)

⇒ Central Roads (2-lane Expressways)

⇒ Main Roads (Primary Roads)

⇒ Secondary Roads (Secondary Roads)

The Ministry of Construction and Development is responsible for the first two categories and the Ministry of Local Government is responsible for the last two. The road network by road category is shown in Figure 2.2.1.

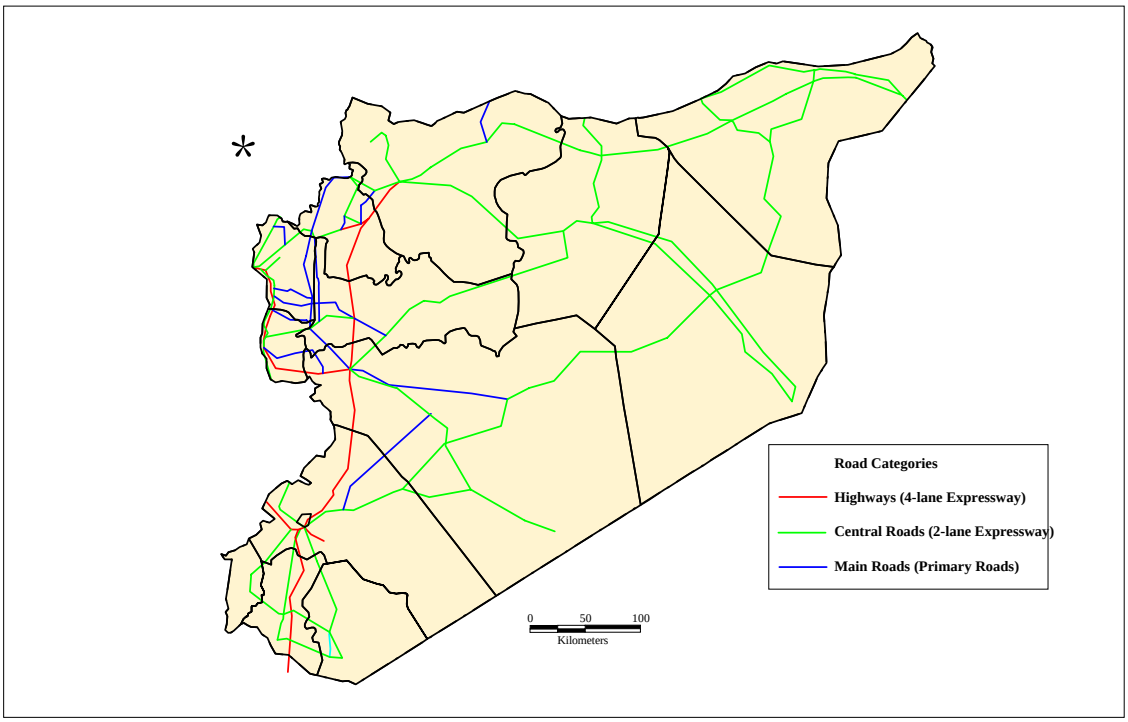

Figure 2.2.1 Road Network

(2) Road Network length classification

The road network is shown in Table 2.2.1.

Table 2.2.1 Road Network Length (unit Km)

Year	Asphalt roads	Non-asphalt paved roads	Level roads	Total
1970	8,096	1,500	2,091	11,687
1975	10,740	1,500	2,364	14,604
1980	12,969	4,172	2,678	19,819
1985	20,372	5,467	2,197	28,396
1990	23,779	7,305	2,129	33,213
1994	26,993	8,384	2,098	37,475
1995	27,769	9,327	2,237	39,333
1996	28,665	9,430	2,404	40,499
1997	29,215	9,585	2,651	41,451
1998	30,059	9,503	2,230	41,792

As the figures show the total road network length has increased in the last twenty years almost fourfold, while the share of unpaved earth roads of the total has decreased from 18% in 1970 to 5% in 1998.

(3) Road Network Conditions

Since 1994 the Ministry of Construction and Development has, in cooperation with the

UNDP introduced a Highway Maintenance and Inspection System (HMIS). HMIS is used to identify the priority road sections for maintenance and depends on site surveys, manual traffic counts and automated traffic counts in some sections, as its input data.

The 1998 report on required maintenance works, issued by the Ministry of Construction and Development, covers a total length of 6,348.40 kilometers of roads (highways with median are counted twice for each direction) divided into 74 road sections. The IRI (International Roughness Index) for each section is estimated, and based on which the maintenance conditions are evaluated. There are four evaluation categories based on the World Bank HDM III computer analysis system as explained in Table 2.2.2.

Table 2.2.2 Maintenance Condition Category

IRI	Category	Conditions
IRI < =4	Good	Road surface is level and even without surface deformation or depressions.
4 < IRI <= 7	Fair	Road surface has a smooth and shiny appearance with no visible stones. In hot, dry weather the surface is soft and tacky.
7 <= IRI< 9	Poor	Fretting-ravelling occurs in areas of the road surface where a loss of bitumen binder results in exposure of the stone aggregates with many loose stones which have worked free of the bitumen.
9<=IRI	Very poor	A disintegrated road surface in which the bitumen binder is almost completely gone. The pavement surface has many loose stones of various sizes and looks like a gravel road with a few small areas of bitumen remaining.

These data show that none of the surveyed road sections can be classified under “Good” category. “Fair” is 38%, “Poor” is 42%, and “Very Poor” is 20% (refer to Figure 2.2.2). Obviously there is a need to increase road maintenance and the funds provided for this activity. The same report estimates that USD 142 million is required to upgrade the road network to the “Good” category.

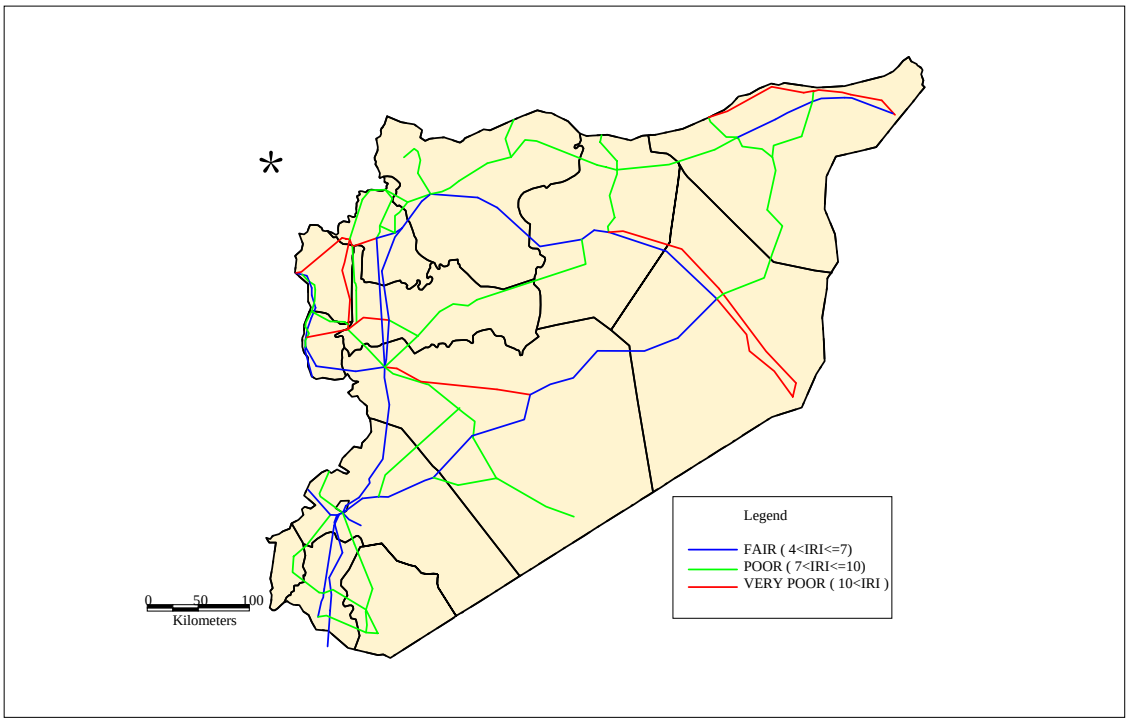

Figure 2.2.2 Road Network Pavement Conditions

(4) Traffic Volumes

Traffic volumes for the three years of 1995 to 1997 are shown in Table 2.2.3.

Table 2.2.3 Traffic Volumes (average daily vehicles, both directions)

Road name	1995	1996	1997	Average growth (%)
1. Homs – Damascus	18,648	19,130	19,819	3.06
2. Homs – Tartous – Lattakia	13,071	14,451	17,107	13.96
3. Homs – Hama – Aleppo	14,719	14,947	15,085	1.22
4. Damascus – Jordanian border	6,434	8,763	9,657	18.39
5. Damascus – Lebanese border	7,845	11,563	12,397	19.68
6. Aleppo – Manbej – Al-Yaroubiye	3,664	5,574	6,200	22.75
7. Damascus – Tadmor – Hassaka	3,835	4,500	5,005	13.00
8. Lattakia – Jisr Elshogour – Ariha	5,279	5,970	6,532	10.49

Source: World Bank Sector Report, February 1999

Traffic volumes are around 20,000 ADT on the Damascus – Homs four lanes highway. The large growth rates in some road sections are mainly due to strengthening of Syria's international commercial activity. The highest growth rates are shown in roads 4, 5, and 6, which connect Syria with Jordan, Lebanon and Iraq respectively. Road no. 2 connecting the two major seaports of Lattakia and Tartous has also shown a high growth rate. In terms of available road capacity, these traffic volumes do not represent a high demand, which

cannot be absorbed by the available capacity supply.

Figures 2.2.3 and 2.2.4 show the daily traffic volume for passenger vehicles and freight vehicles respectively based on the surveys implemented in 2000 by the Study team and the survey data collected from the Ministry of Communications.

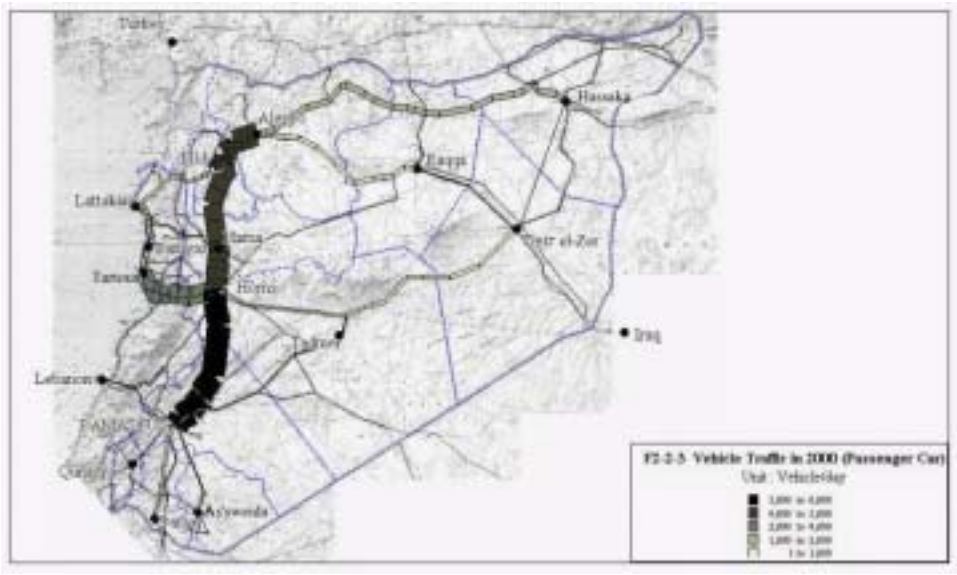

Figure 2.2.3 Road Traffic Volume (Daily, Passenger vehicle)

There are 5,000 passenger vehicles daily along the Homs – Damascus link that is the largest traffic volume link. The Homs – Aleppo link and Homs – Tartous – Lattakia link also have heavy passenger traffic of 2,000 to 5,000 daily.

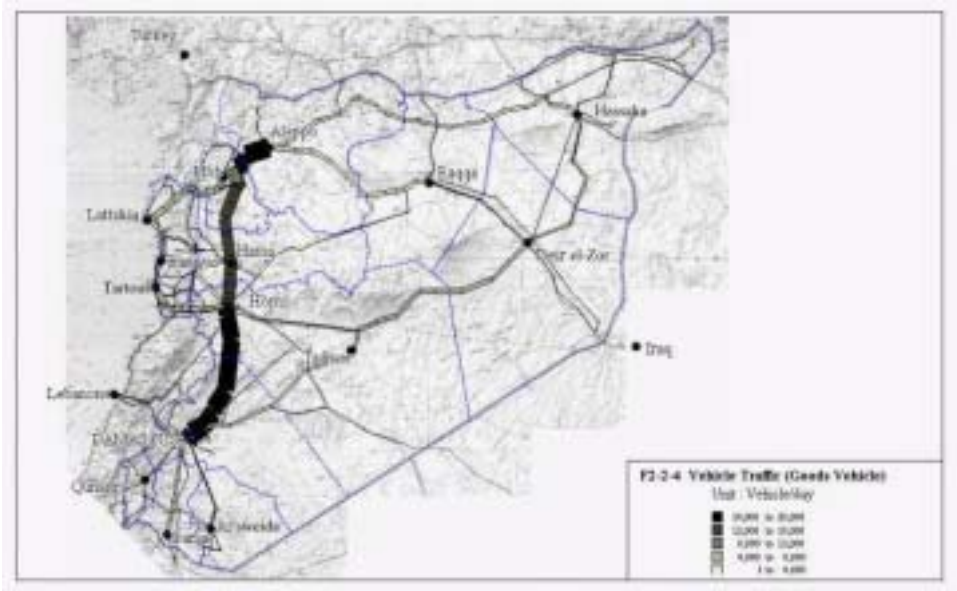

Figure 2.2.4 Road Traffic Volume (Daily, Freight vehicles)

Numbers of vehicles transporting goods are on average 4 times the number of those transporting passengers on most of the links. The largest number of freight trucks was observed along Aleppo – Homs – Damascus at 16,000 to 20,000 vehicles. The large transport demand of crude oil and other goods between Aleppo and Lattakia and between Homs and Tartous account for the high traffic volumes observed there.

(5) New Road Projects

The ministry is considering a number of road projects as follows:

1) Aleppo – Raqqa Road widening to four lanes through construction of a new road parallel to the existing one.
2) Damascus Outer Ring Road
3) Hassya – Al Qusair – Talkalakh new road to bypass Homs city for the Damascus – Tartous – Lattakia traffic.
4) Raqqa – Deir el-Zor – Al-Bukamal new road construction
5) Five new maintenance centers

2.3 Railway Network

The Syrian railway network is shown in Figure 2.3.1. This network serves the national land use structure in Syria, which was described in Chapter 1. From this network over 100 branch lines eminate to serve factories and silos.

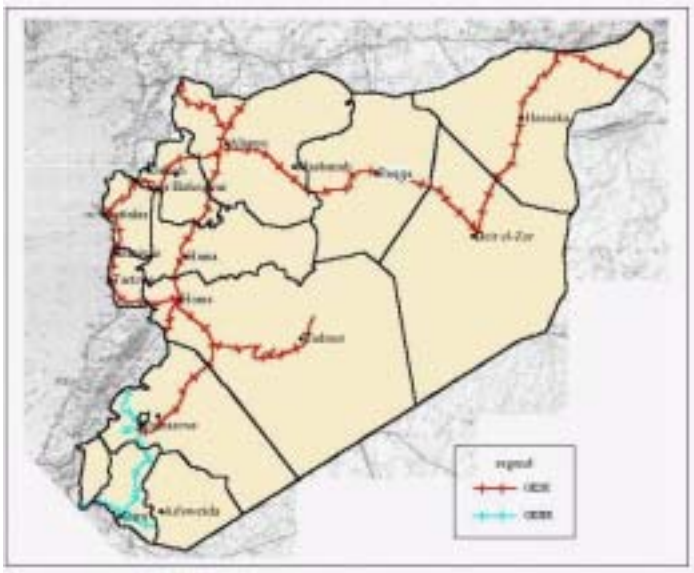

Figure 2.3.1 Railway Network

2.3.1 General Establishment of Syrian Railways (GESR)

(1) Summary

The main lines are as shown in the figure and described below;

1) The north-south route crossing the Syrian-Turkish border and traveling through Aleppo, Hama and Homs to reach Damascus. This route passes through the heavily populated areas of Syria.

2) The west-east route starting from Lattakia, passing through Aleppo, continuing along Euphrates River to Deir el-Zor, then to Qamishli and crossing into Turkey. This route serves Syria's cultivable areas transporting many agricultural products.

3) The Coastal route connects to the north-south route traveling from Lattakia, through Tartous at Homs. Lattakia and Tartous are the first and second seaports in Syria respectively and in terms of foreign trade together account for 65% of total imports entering the country and 15% of the total exports (both in weight base). This line has a large potential in connecting the high population density areas of Damascus and Aleppo with the important seaports serving foreign trade.

4) The route from Homs to Tadmor. This line transports the phosphate ore extracted from the Tadmor area to Tartous.

GESR classifies 47 stations as main stations or the stations where branch lines start. GESR has over 100 branch lines. These lines mostly connect with grain silos, phosphate mines and petroleum products production facilities.

(2) Operation Indicators in 1999

The operation indicators for 1999 are given in Table 2.3.1.

Table 2.3.1 Operation indicators in 1999

Unit	Plan	Actual	Actual (%)
A. Transported Passengers and Freight			
Passenger number (1,000 persons)	676.6	755.7	111%
Freight (1,000 tons)	4,167.5	4,605.1	110%
B. Investment Plan			
Investment amount	SP 1,875 M	SP 1,125 M	60%

These indicators show that GESR appears satisfied with its operation in 1999. However there were some difficulties facing their operation. These were mainly the reduction in production of phosphates, and the lack of scheduling for transport of most freight commodities. In case of passengers transport strong competition has developed from private sector bus and taxi operators.

(3) New Projects considered by GESR

In 1995 two studies were made by GESR for construction of two new lines; the first linking Deir el-Zor with Al-Bukamal on the Iraqi border and the second linking Damascus to the Jordanian border through Daraa and parallel to the existing Hidjaz line. Table 2.3.2 summarizes the two projects briefly as noted in the study reports.

Table 2.3.2 Two New Projects proposed by GESR

Item	Deir el-Zor – Al-Bukamal	Damascus – Daraa
1. Total length including branch lines (km)	189.5	201
2. Number of Stations	8	7
3. Construction cost estimate (1995)	SP 6,764 M	SP 7,353 M
4. Present project status	45 km of earthwork already completed. Work proceeds, as funds are made available.	Russian design prepared in 1987. 30% of required earthwork completed. Presently no funds to proceed.

Interestingly both projects have international significance as they link Syria with its neighboring countries.

2.3.2 General Establishment for Hidjaz Railways (GEHR)

(1) Summary

Hidjaz railway has in the past played an important religious role in transporting the Moslem pilgrims to the holy cities in Saudi Arabia for the annual “Haj” pilgrimage. The Hidjaz railway links the three Arab countries of Syria, Jordan and Saudi Arabia. At present

there are only 340 kilometers of GEHR tracks and the operation frequencies are extremely low. Furthermore the section located in Saudi Arabia is not operated. The section in Jordan is operated at low frequency in the same manner as that in Syria.

(2) Network facilities

The GEHR network can be classified into five lines as shown in Figure 2.3.2. There are 38 stations serving this network and the average distance between the stations is 12 kilometers on 4 of the 5 lines. In the case of Damascus – Qattana the stations are more closely spaced (at average 5-kilometer distances).

(3) Operation Indicators

The operation indicators for the GEHR are reproduced in Table 2.3.3.

Table 2.3.3 Operation Indicators for GEHR

Year	Passenger	Freight (ton)	Tourist/ private trips	Rail revenue (SP)	Share of Tot. revenue (%)	Expenditure
1994	13,641	2,291	0	3,601,470	5%	35,644,682
1995	62,930	600	6	10,856,484	15%	45,428,411
1996	78,922	1,691	33	5,432,702	4%	63,634,843
1997	85,333	2,350	33	7,741,898	4%	83,129,171

Obviously the GEHR makes very little profit from its rail transport operations and most of its revenues are from leasing its real estate properties. The passengers are categorized into commuters and those tourists or holidaymakers in order to improve the services for commuters.

(4) Improvement Plans for GEHR

⇒ In 1975 the three related countries formed a committee to investigate how to rehabilitate the Hidjaz railway line once more.

⇒ In 1977 the committee decided to reconstruct the Hidjaz line as a wide gauge line

⇒ In 1979 a German consulting company was selected to prepare the feasibility study for the proposed project

⇒ In 1980 the German company completed its F/S and the results of the study were adopted by each of the three countries for execution of their own portions of the project by themselves. The German study recommended that the new line be laid along the route of the existing narrow-gauge tracks.

⇒ Syria in 1982 commissioned a British consultant to prepare the plans for the rehabilitation of the historic Hidjaz central station.

⇒ In 1983 Syria asked the Former Soviet Union to include the improvement project for GEHR network within its territory in the Soviet Union's assistance program to Syria. Accordingly some improvement projects were implemented.

Figure 2.3.2 GEHR Network (Syria, Jordan and Saudi Arabia)

(5) Hidjaz Railway conditions in Jordan

As explained earlier the Hidjaz railway crosses the Syrian-Jordanian border and extends into Jordan. Therefore it is recommendable to understand the operation conditions of the Jordanian section of the Hidjaz railway as well. Along this section about 100 trips are operated annually (these are mostly twice per week traveling between Amman and Damascus) transporting a total of about 2,000 passengers. A simple division would indicate that there are about 10 passengers per trip. In 1999 the passenger number was relatively high, as shown in Table 2.3.4 with an average of 64 passengers per trip.

Table 2.3.4 Operation Indicators of Jordan section of Hidjaz Railways

	1994	1995	1996	1997	1998	1999
Number of Passenger Trains	105	105	105	101	101	90
Number of Passengers	3,136	2,259	2,248	2,533	1,622	5,791
Number of Freight trains	192	59	177	184	133	110

Source: Jordanian Railways

In addition to these trips the Jordanian Railways operates tourist train trips to Damascus on a charter basis. These are not included in the table. The maximum speeds of the trains are 50 km/hr. Scheduled trains run round trips twice a week between Amman and Damascus. Schedule of freight trains is not fixed depending on demand. On average 2 trips a week are also made.

There is a preliminary plan to upgrade the line to the borders with Syria but there is no study available to the Study team. It has been reported however that a feasibility study is in progress.

2.4 Pipeline Transport

(1) Operator

The Syrian Storage and Petroleum Products Distribution Company was established in 1974 as one of the company's belonging to the Ministry of Petroleum and Natural Resources. This company is responsible for the construction and operation of pipelines and storage facilities for petroleum products transport and distribution. The sales of this company in 1998 reached 7.5 million tons of petroleum products and its revenue for that year was SP 33.9 billion.

This company transports its products from two refineries located at Homs and Baniyas to storage tanks located in five regions: South, Middle, Coastal, Northern and Eastern regions. For this transport the company mainly depends on pipelines, and for a minor portion on railway when the pipeline service does not reach the region. Road transport is limited to the northeastern region of Raqqa, Hassaka and Deir el-Zor.

(2) Pipeline Facilities

The pipeline facilities under the disposal of the company are shown in Table 2.4.1. The related storage facilities reached a storing capacity of 293 m^3 with 16 tanks. The existing pipeline network is considered to have sufficient capacity to transport crude oil and natural gas up to the year 2020. The network is described in Table 2.4.1.

Table 2.4.1 Pipeline Facilities

Line name	Length (km)	Daily pumping capacity (m3)
A. MAIN LINES		
1) Homs – Adra (1) (ϕ 6")	167.02	2,200
2) Homs – Adra (2) (ϕ 12")	167.30	7,200
3) Homs – Aleppo (ϕ 6")	183.35	2,200
4) Baniyas – Lattakia (ϕ 6")	44.22	1,560
5) Baniyas – Homs (ϕ 6")	122.80	1,368
6) Baniyas – Homs (ϕ 6")	122.80	18,000
Sub-total	807.49	
B. BRANCH LINES		
1) Branch Rahiba from Adra (2) (ϕ 6")	4.57	NA
2) Branch Dmeir from Adra (2) (ϕ 6")	4.95	NA
3) Baniyas – Anazza (ϕ 6")	5.22	NA
4) Boukka – Rail station (ϕ 12")	2 x 2.10	NA
5) Rail station – Hassaka (ϕ 6")	2 x 4.40	NA
6) Al Aish (ϕ 6")	6.00	NA
7) Khan Al Assal (ϕ 6")	5.00	NA
8) Wadi Al Ain (ϕ 6")	0.50	NA
Sub-total	39.24	
Total	846.73	

2.5 Air and Marine Transport

(1) Air Transport

There are five commercial airports in Syria: Damascus, Aleppo, Lattakia, Deir el-Zor, and Qamishli. The domestic flights and their frequecncies using these airports are explained in Table 2.5.1.

Table 2.5.1 Commercial Domestic Flights

Service routes	Frequency
Damascus – Aleppo	Weekly 24 round trips
Damascus – Deir el-Zor	Weekly 2 round trips
Damascus – Lattakia	Weekly 1 round trip
Damascus – Qamishli	Weekly 3 round trips

(2) Marine Transport

There are three seaports serving Syria in Lattakia, Tartous and Baniyas. Both Lattakia and Tartous are trading ports serving containers, general commodities and bulk commodities. Baniyas port serves crude oil transport. These seaports transport imports and exports and there are no domestic sea routes. There is also no inland canal transport.

2.6 International Railway Network

2.6.1 Background

Syria and its neighboring Middle East countries have been engaged in constructive discussions, within the framework of DGMO organization, to link their railway systems and introduce smoother rail transport amongst these countries. DGMO refers to the General Directors of Railways in Middle Eastern countries.

The members of DGMO include Syria, Iran, Turkey, Egypt, Iraq, Lebanon, Jordan and Saudi Arabia. Other Arab Gulf states, Central Asian countries, Pakistan, Afghanistan and India are not members of DGMO, but in future their railway network will be integrated with DGMO railway network after the latter's railway network itself will be adequately developed.
UIC generally attends the meeting as an able adviser and provides useful suggestions to DGMO based on its rich experiences in integration of European railways.

The latest DGMO meeting was held in Aleppo in July 2000. The Study Team was invited to attend the meeting and this section is prepared on the basis of discussions held at that time.

2.6.2 Syrian Outlook

GESR emphasized the importance of developing its railway system in order to serve interna-

tional rail transport during the meeting. GESR outlined its development strategy in that connection along 5 main axes.

1) Istanbul (Turkey)- Midan Ikbes/Aleppo－Damascus/Daraa(Syria)－ Amman-Aqaba (Jordan)
2) Tehran – El Razi (Iran) – Malatia –Istanbul (Turkey)
3) Tehran – Arak – Khasafy (Iran) – Baghdad (Iraq) – Albou Kamal – Deir el Zour – Aleppo – Midan Ikbas (Syria)－Istanbul (Turkey), or Aleppo～ Damascus

4a) Tehran－Kharem Shaher (Iran)－Basra－Baghdad (Iraq)

4b) Tehran－Khasafy－Mosul－Syria

5) Adana－Nassibbein (Turkey)－Yaaroubia (Syria)－Mosul (Iraq)

During the DGMO meeting GESR outlined the development strategy it has prepared in order to support these 5 axes. The development strategy within Syria are explained as follows:

(axis 1) Rehabilitation of Midan Ikbes－Aleppo section and construction of standard gauge line along Damascus – Derra – Nassib section

(axis 3) Rehabilitation of Aleppo – Deir el Zor section and construction of Deir el Zor – Al Boukamal section.

(axis 1 or 3)

Construction of a new electric traction line between Aleppo and Damascus.

2.6.3. Future Prospective of the International Railway Network surrounding Syria

It is important to note that DGMO countries are recognizing significant role which the development of international railway network plays in promoting intra-and inter-regional socio-economic development.

In order to promote intra-and inter-regional railway network development, much efforts are also put on bilateral cooperation besides multilateral discussion in DGMO meeting.

This is evident by the continuous bilateral discussions between GESR and its Iraqi counterpart and restoration of scheduled rail service between the two countries. GESR is also constructively engaging its Turkish counterpart as well as the Iranian counterpart on bilateral basis. Discussions are also proceeding with Jordanian Hijaz railways. Obviously Syria's geographic position and realization of the importance of international railway development are two important factors in realizing the development goal.

More concrete measures remain to be taken; such as outlining of the rail development plans in each country and coordination of these plans. GESR has taken an important step forward by explaining its own plans and also requesting the regional countries to explain theirs, in general and concerning specific problem sections.

The development of the Middle East international railway system can plan a role in improving the livelihood of the peoples there and promoting beneficial coexistence.

Chapter 3

Current Situation and Major Issues of GESR

Chapter 3 Current Situation and Issues of GESR

3.1 Transport

3.1.1 Outline of train operating line

(1) Train operating line

	Line Name	Section	Distance (km)	Remarks
1	Jubrin- Midan Ekbas	Jubrin – Midan Ekbas	133.2	
2	Jubrin- Damasucus	Jubrin – Damascus	401.9	
3	Muslimiyya-Arrai	Muslimiyya-Arrai	85.9	Out of service
4	Jubrin –Lattakia- Homs 1	Jubrin –Lattakia Lattakia- Lattakia Port Lattakia- Tartous Tartous- Tartous Port Tartous- Homs 1	204.9 5.9 85.9 4.0 95.3	
5	Jubrin- Qamishli- Al Yaroubiye	Jubrin- Deir el-Zor (passenger) Deir el-Zor- Old Qamishli New Qamishli-Al Yaroubiye	323.0 198.6 79.5	
6	Mhine- Al Sharqia	Mhine- Al Sharqia	110.7	

(2) Train maximum speed and speed limit at curved track and turnout

1) Maximum speed

Passenger Train	100 km/h
Freight Train (general)	80 km/h
Freight Train (oil tank)	70 km/h
Freight Train (Gas tank)	60 km/h

2) Speed limit at curved track

Radius of curvature	Passenger Train km/h	Freight Train (general)km/h	Freight Train (oil tank) km/h	Freight Train (gas tank) km/h
300=	80	80	70	60
301～400	80	80	70	60
401～500	85	80	70	60
501=<	100	80	70	60

3) Speed limit at turnout

Main line Turnout 11#

Siding Turnout 9#

The speed limit is 70 km/h imposed for main line straight side while 40 km/h for curved side, however, the speed limit of 40 km/h is imposed on all the points regardless of straight side or curved side due to defective track maintenance.

In addition, the speed limit is 30 km/h on the point that have been fixed on the sleepers with dog spikes at closed stations so that engine driver can confirm safe running can be ensured.

(3) Closed stations are listed as follows:

Aleppo through Qamishli	13 stations among	34 stations
Aleppo through Midan Ekbas	1 station among	8 stations
Aleppo through Dmascus	1 stations among	26 stations
Aleppo through Lattakia through Homs	3 stations among	32 stations
Muslimia through Arrai	2 stations among	3 stations
	(On this line-section, service is suspended)	
Mhine through Al-Sharqia	2 stations among	7 stations

Among a total of 102 stations, 22 stations are closed due to no needs.

(3) Types of trains and train formation

1) Passenger Train (Express)

(a) Operation section and operation time

	Train No.	Section				Schedule Time	Distance	Schedule Speed	Remarks
		Departure		Arrival					
		Station	Time	Station	Time				
1	30	Aleppo	0:30	Damascus	6:25	5:55	395.6	66.8	
	35	Damascus	16:05	Aleppo	21:35	5:30	395.6	71.9	
2	255	Aleppo	23:30	Qamishli	6:59	7:29	546.9	73.1	
	256	Qamishli	22:45	Aleppo	6:30	7:45	546.9	70.5	
3	44	Aleppo	5:48	Lattakia	8:29	2:41	198.6	74.0	In Summer
	49	Lattakia	21:00	Aleppo	23:48	2:48	198.6	70.9	
4	242	Aleppo	7:00	Lattakia	9:59	2:59	198.6	66.7	
	243	Lattakia	6:45	Aleppo	9:51	3:06	198.6	64.1	
5	246	Aleppo	15:35	Lattakia	18:40	3:05	198.6	64.4	
	245	Lattakia	15:30	Aleppo	18:30	3:00	198.6	66.2	
6	23	Damascus	15:00	Lattakia	20:40	5:40	380.8	67.2	The day before holiday
	22	Lattakia	23:30	Damascus	5:12	5:42	380.8	66.8	Holiday
7	65	Damascus	5:13	Midan Ekbas (Istanbul)	13:40	8:27	512.2	60.6	Tuesday
	66	(Istanbul) Midan Ekbas	11:40	Damascus	20:06	8:26	512.2	60.7	Monday
8	663	Aleppo	14:45	Midan Ekbas	17:56	3:11	116.6	36.6	
	660	Midan Ekbas	6:40	Aleppo	9:28	2:48	116.6	41.6	
9	53	Aleppo	22:00	Al Yaroubiya (Mosru)	6:36	8:36	630.0	73.7	2000/8/12 ～ Saturday
	52	Al Yaroubiya (Mosru)	23:45	Aleppo	8:28	8:43	630.0	72.3	2000/8/12 ～ Friday

Passenger train diagrams shown in Fig 3.1.1

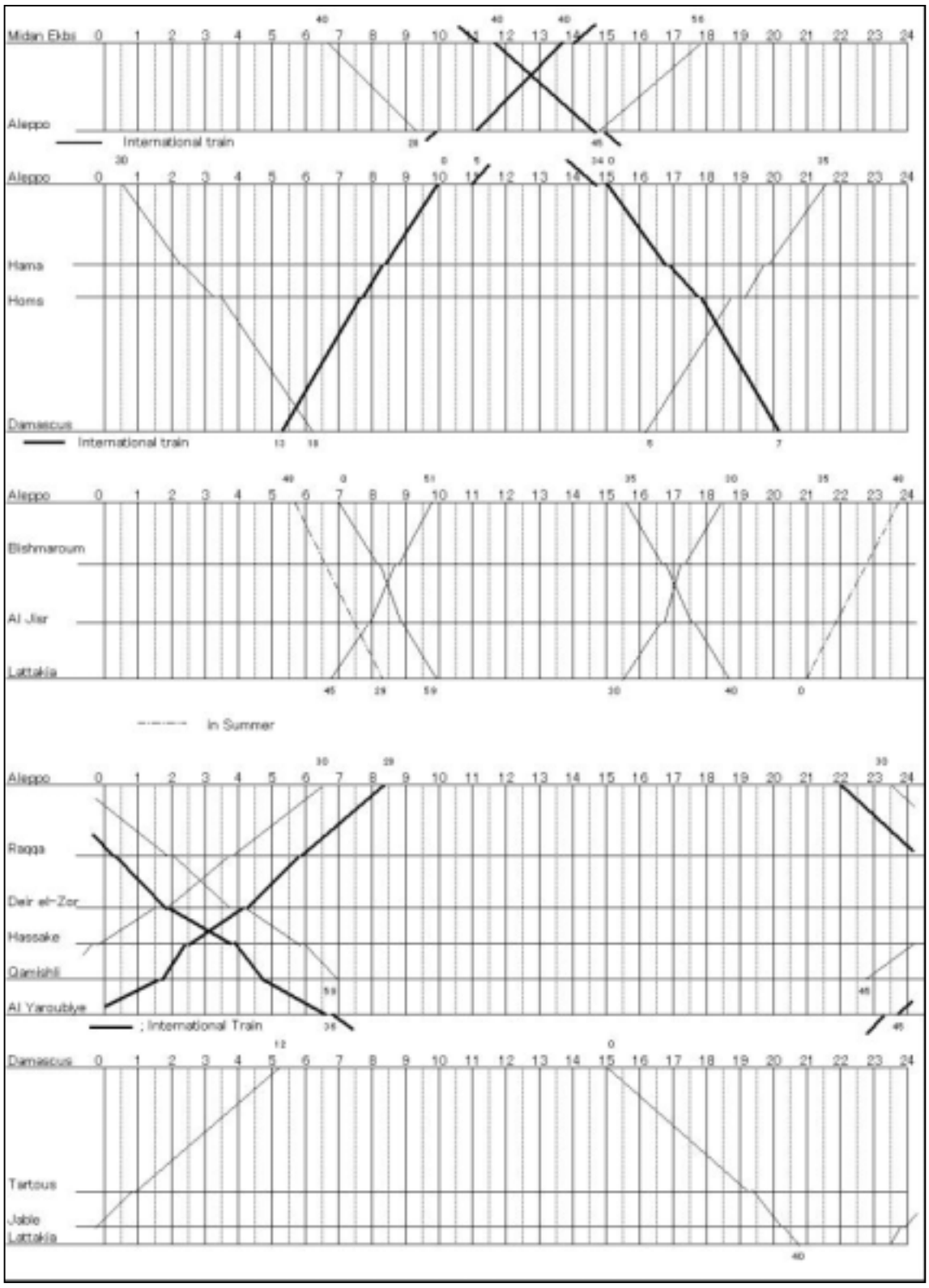

Fig 3.1.1 Passenger train diagrams

(b) Formation of Passenger Train

・Aleppo-Damascus,

1	2	3	4	5	6	7
Baggage car	2nd Class seat	Dinning car	1st Class seat	1st Class seat	1st Class seat	Sleeping car

Wed. Thu. Fri. Sat.; 2nd Class Car ×2

・Aleppo- Qamishli

1	2	3	4	5	6
Baggage car	2nd Class seat	2nd Class seat	1st Class seat	1st Class seat	Sleeping car

・Aleppo- Lattakia

1	2	3	4	5	6	
2nd Class seat	2nd Class seat	Dinning car	1st Class seat	1st Class seat	1st Class seat	Thu.Fri.Sat:; 1st class car ×4

1	2	3	4	5	6	
1st Class seat	1st Class seat	1st Class seat	1st Class seat	1st Class seat	1st Class seat	In Summer

・Damascus- Lattakia

1	2	3	4
1st Class seat	1st Class seat	2nd Class seat	2nd Class seat

・Damascus-Midan Ekbas(Istanbul)

1	2
1st Class seat	Sleeping Car

・Aleppo- Midan Ekbas

1	2	
2nd class seat	2nd class seat	Freight car

・Aleppo- Al Yaroubiye(Moslu)

1	2	3	4
Baggage car	Sleeping Car	Sleeping Car	Power Car

(c) Passenger train route

Passenger train operation route is shown in Fig3.1.2.

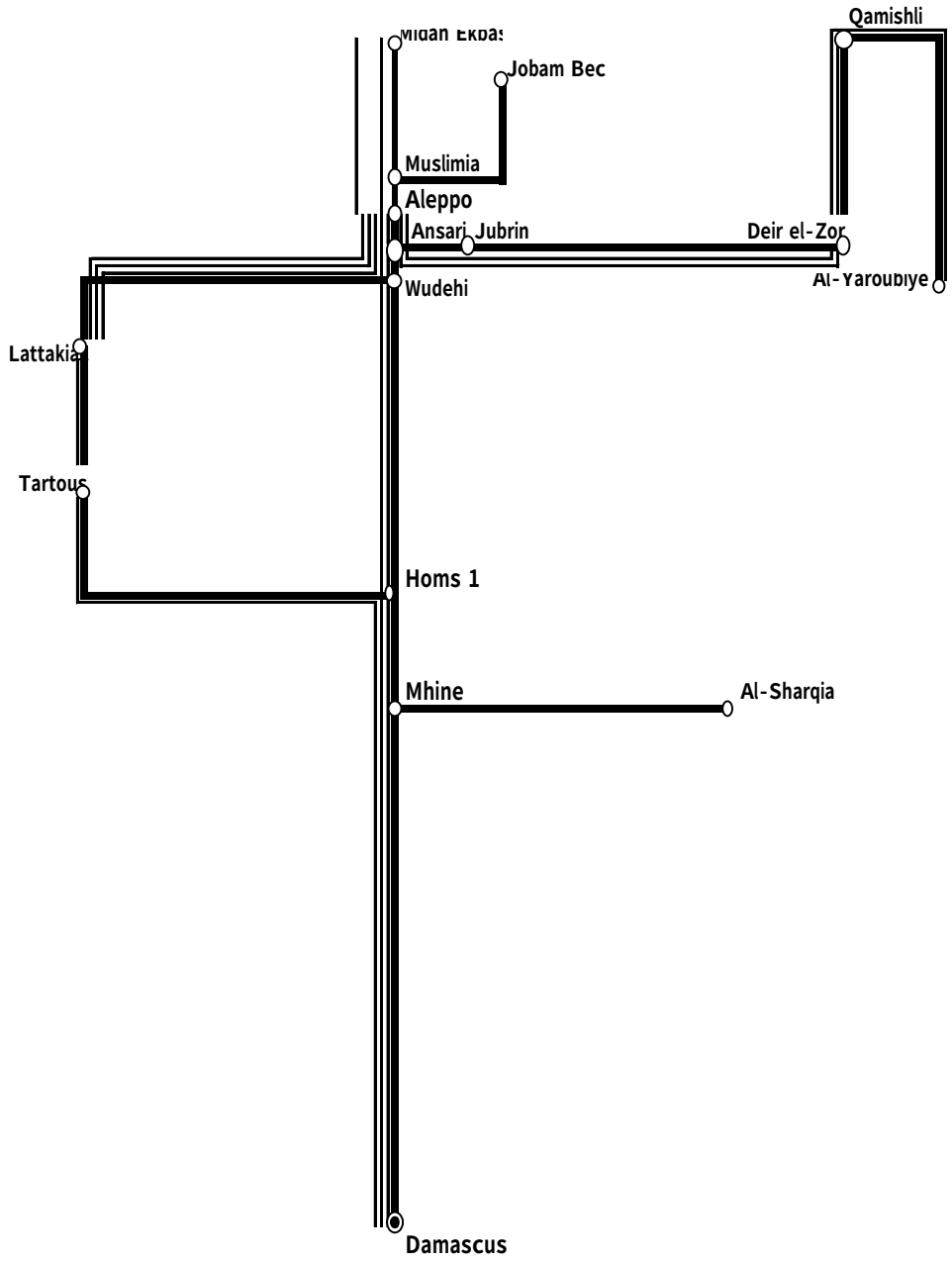

Fig 3.1.2 Passenger train operation route

2) Freight Train

GESR mainly handles freight traffic; in terms of train kilometer it is more than four times greater than those of passenger trains, and in terms of train frequency 13 times greater.

Based on the information collected until 8:00 a.m. in the previous morning, only required number of freight trains are to be selected for operations from diagrams fully set up to the line capacity beforehand. Roughly 2 to 5 round-trip trains are operated on each line.

(a) Formation and Hauling Weight

① Exclusive freight trains for phosphate transport 16 wagons 1400 ton

② Other trains 2000ton～1400ton～300ton

Tractive fore coefficient is about 60%, averaging ① and ② above.

(b) Freight train operation route

Freight train operation route is shown in Fig 3.1.3.

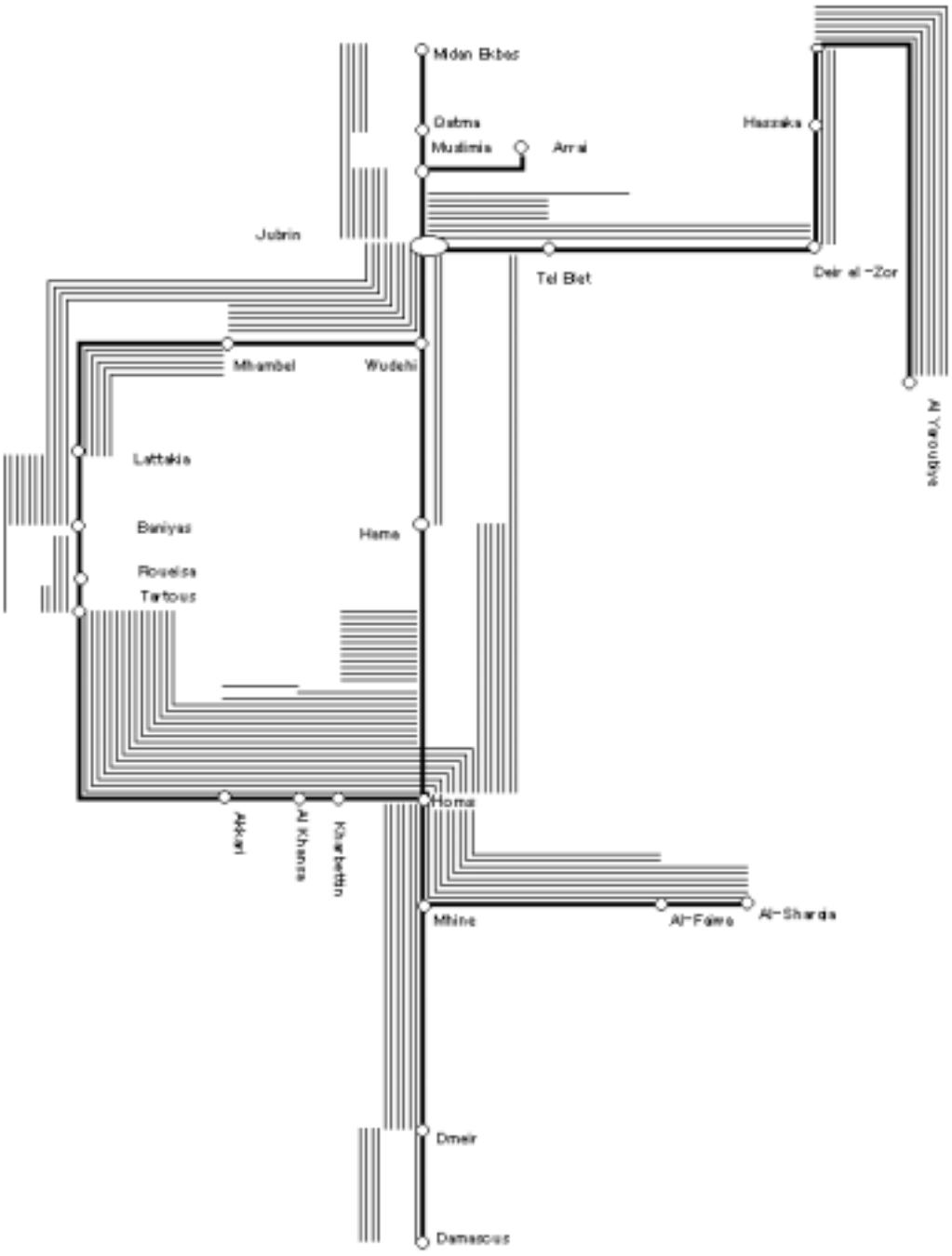

Fig 3.1.3 Freight train route

(4) Frequency of passenger trains and freight trains for each line section

Table 3.1.1 Number of train for each line section (Peak day)

↓						Station Name	↑						↑ ↓
Total	Freight	Mixed	Passenger				Passenger			Mixed	Freight	Total	Grand Total
			Express	Other	Total	Midan Ekbas	Total	Other	Express				
7	5	1	1		1	Muslimia	1		1	1	5	7	14
10	8	1	1		1	Aleppo	1		1	1	8	10	20
11	6		5		5	Aleppo	5		5		6	11	22
5	2		3		3	Wudehi	3		3		2	5	10
8	7		1		1	Lattakia	1		1		7	8	16
10	9		1		1	Tartous	1		1		9	10	20
10	9		1		1	Akkari	1		1		9	10	20
						Homs							
11	6		5		5	Aleppo	5		5		6	11	22
6	4		2		2	Wudehi	2		2		4	6	12
6	4		2		2	Hama	2		2		4	6	12
16	13		3		3	Homs	3		3		13	16	32
8	5		3		3	Mhine	3		3		5	8	16
						Damascus							
6	4		2		2	Aleppo	2		2		4	6	12
5	3		2		2	Raqqa	2		2		3	5	10
4	2		2		2	Deir el-Zor	2		2		2	4	8
4	2		2		2	Hassake	2		2		2	4	8
6	5		1		1	Nusaibin	1		1		5	6	12
						Al-Yaroubiye							
8	8		0		0	Mhine	0				8	8	16
						Al-Sharqia							

(5) Hauling locomotive and hauling capacity

Hauling capacity tables for passenger trains and freight trains are shown in Table 3.1.2

Table 3.1.2 Hauling capacity

Section		Loco. Type	Max. Gradient ‰	Hauling Capacity (ton)		Remarks
				Passenger Train	Fright Train	
Qamishli ～Aleppo	Qamishli～Al-Yaroubiye	1800		500	1100	
	Qamishli～Deir el-Zor	2800	8	500	2000	
		1800		350	1300	
	Deir el –Zor～Aleppo	2800	6	500	2000	
		1800		350	1300	
Aleppo ～ Midan Ekbas	Qatma → Aleppo	1800	9	450	1350	
	Aleppo → Qatma	1800	10	450	800	
	Qatma→Midan Ekbas	1800	20	250	250	
	Midan Ekbas→ Qatma	1800	25	200	300	
Aleppo ～ Tartous	Aleppo～Mhambel	2800	8	450	2000	
		1800		350	1300	
	Mhambel～Lattakia	2800	12	450	1400	
		1800		350	800	
	Lattakia～Tartous	2800	12	450	1400	
		1800		350	900	
Tartous ～ Homs	Tartous～Akkari	2800	12	350	1400	
		1800		150	800	
	Akkari→Al-Khansa	2800	20	350	800	
		1800		150	350	
	Al-Khansa→Akkari	2800	12	350	1400	
		1800		150	700	
	Al-Khansa～Homs	2800	12	350	1400	
		1800		150	700	
Aleppo ～ Damascus	Aleppo～Homs	2800	12	500	1400	
		1800		250	800	
	Homs→Hama	2800	12	500	1700	
		1800		250	1300	
	Homs～Damascus	2800	12	500	1400	
		1800		250	800	
Homs ～ Al-Sharqia	Homs～Al-Sharqia	2800	12		1400	
		1800			800	

(6) Operating schedule of locomotive

1) There in no specific operating schedule table for locomotive. Locomotive operation is programmed as pair train operation in principle. When necessary, locomotive is operated in coordination with train dispatcher.

Average loco-km par day is 184km (80 locomotives are in use). Average locomotives running time per day is 12 hours.

2) Locomotives operation rang

a) Homs Depot

Originating from Homs, the following three directions :

Homs～Damascus

Homs～Al Sherqia

Homs～Tartous～Baniyas

b) Aleppo Depot

Originating from Aleppo, the following 4 directions :

Aleppo～Homs（Passenger train ; Aleppo～Damascus）

Aleppo～Midan Ekbas

Aleppo～Qamishli

Aleppo～Lattakia～Tartous

3.1.2 Record of train operation

(1) Number of train, Train Km and Car km

Number of train, Train Km and Car km in 1995～1999 are shown in Table 3.1.3

Table 3.1.3 Number of train, Train Km and Car km

(a)Year total

Year	Number of train		Train operating Km		Car km		
	Passenger train	Freight train	Passenger train km	Freight train km	Passenger car km	Freight car km	Locomotive km
1995	7,478	36,967	2,357,538	3,803,668	13,680,617	57,925,963	6,356,573
1996	7,469	37,089	2,356,489	3,880,647	13,857,961	55,781,008	6,418,603
1997	4,999	42,652	1,717,545	4,214,253	10,449,323	66,370,922	6,240,232
1998	3,127	40,763	1,063,030	4,146,038	6,556,215	62,498,581	4,863,401
1999	3,135	41,094	1,069,982	4,180,494	6,621,777	63,608,029	5,390,009

(b) 1day average

Year	Number of train		Train operating Km		Car km		
	Passenger train	Freight train	Passenger train km	Freight train km	Passenger car km	Freight car km	Locomotive km
1995	20.5	101.3	6,459.0	10,421.0	37,481.1	158,701.3	17,415.3
1996	20.5	101.6	6,456.1	10,631.9	37,967.0	152,824.7	17,585.2
1997	13.7	116.9	4,705.6	11,545.9	28,628.3	181,838.1	17,096.5
1998	8.6	111.7	2,912.4	11,359.0	17,962.2	171,229.0	13,324.4
1999	8.6	112.6	2,931.5	11,453.4	18,141.9	174,268.6	14,767.1

(2) Transport fluctuation

1) Passenger

As for passenger traffic fluctuation, traffic is high in summer and reaches to 180% of annual average during July through September, however falls down to 60% in winter during December through February.

Passenger fluctuation are shown in Table 3.1.4 and Fig 3.1.4

Table 3.1.4 Passenger fluctuation in season

Number of boarding passenger at main station(1999)

	1	2	3	4	5	6	7	8	9	10	11	12	Total	Yearly Average
Aleppo	24,051	16,359	24,551	23,571	21,368	27,971	38,148	41,097	35,569	21,234	17,142	14,941	307,012	
Hama	701	630	651	790	679	565	694	689	702	662	534	515	7,812	
Homs	1,159	801	933	905	890	747	1,011	1,024	1,079	928	819	806	11,102	
Damascus	3,087	2,200	3,089	2,514	2,291	2,527	3,624	3,831	3,376	3,003	2,475	2,104	34,121	
Tartous	348	229	169	110	194	207	270	334	294	326	262	172	2,917	
Lattakia	18,606	12,365	21,051	18,399	17,863	23,906	30,760	32,485	28,885	19,163	15,226	12,530	251,241	
Ragga	853	576	800	693	675	728	707	923	2,773	652	474	472	10,326	
Deir el-Zor	1,306	730	1,370	1,195	1,125	973	1,309	1,686	4,157	1,120	814	702	16,487	
Hassakia	1,644	1,866	1,462	1,299	1,217	1,102	1,213	11,076	4,411	1,142	1,063	1,215	28,710	
Qamishli	2,017	1,306	1,976	2,271	1,542	1,275	1,510	11,382	1,731	1,446	1,319	1,093	28,866	
Total	53,782	37,062	56,052	51,747	47,844	60,003	80,246	104,527	82,877	49,676	40,128	34,550	698,596	58,216
Fluctuation	92.4	63.7	96.3	88.9	82.2	103.1	137.8	179.5	142.5	85.3	68.9	59.3		100.0

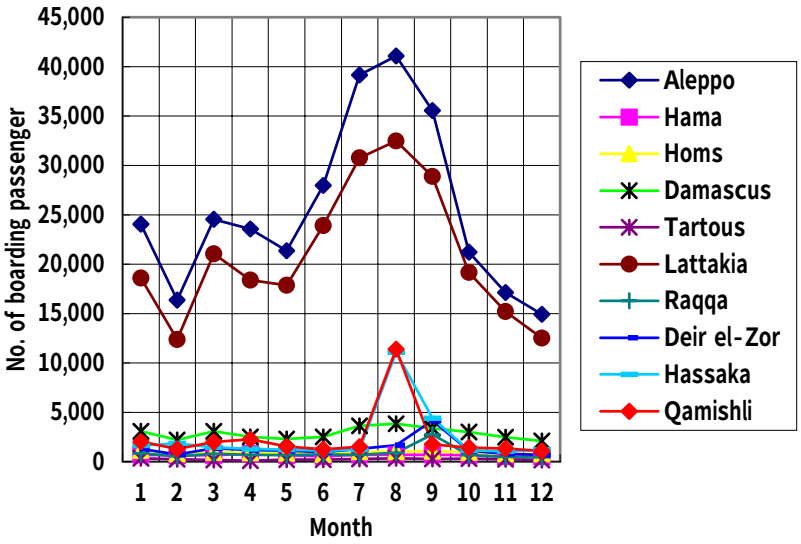

Fig 3.1.4 Passenger fluctuation (1999)

2) Freight

Actual record of freight transport volume by month are shown in table 3.1.5 and Fig 3.1.5

Table 3.1.5 Transport volume fluctuation

1999

Month	Freight Transport Ton	Fluctuation Ratio %
1	408,992	90.1
2	410,813	90.5
3	479,674	105.7
4	446,027	98.3
5	448,087	98.8
6	418,124	92.2
7	457,384	100.8
8	508,520	112.1
9	516,348	113.8
10	511,084	112.6
11	380,270	83.8
12	459,422	101.3
Total	5,444,745	
Avarage	453,729	100

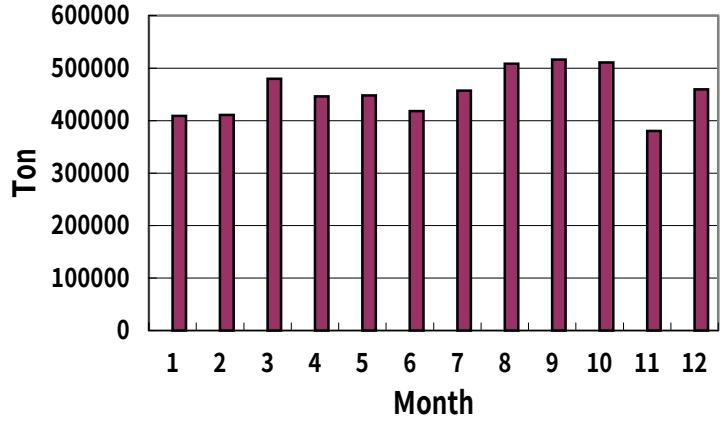

Fig 3.1.5 Freight transport fluctuation (1999)

(3) Load factor

1) Passenger train

Passenger load factor by train are shown in Table 3.1.6.

Table 3.1.6 Passenger load factor by train in 1999

	Train No.	Origin		Destination		1	2	3	4	5	6	7	8	9	10	11	12	Average
1999	30	Aleppo	0:30	Damascus	6:16	86	80	84	81	76	69	84	89	86	79	70	73	79.6
	35	Damascus	16:05	Aleppo	21:35	34	26	36	30	34	34	46	42	39	41	34	35	36.1
	242	Aleppo	7:00	Lattakia	9:59	37	30	47	52	50	60	69	78	74	53	32	26	50.7
	246	Aleppo	15:35	Lattakia	18:40	59	38	66	74	60	80	81	84	81	63	51	24	63.4
	243	Lattakia	6:45	Aleppo	9:51	45	27	46	45	44	52	56	63	72	51	37	31	47.6
	245	Lattakia	15:30	Aleppo	18:30	60	48	67	71	65	73	67	77	76	56	55	42	63.1
	255	Aleppo	23:30	Qamishli	6:57	36	29	36	36	26	30	29	31	33	28	25	20	30.3
	256	Qamishli	22:45	Aleppo	6:30	37	27	34	19	27	25	17	35	33	27	21	23	27.1
	23	Damascus	15:00	Lattakia	20:40	3	1	8	3	4	5	15	19	16	5	6	4	7.4
	22	Lattakia	23:30	Damascus	5:12	17	20	18	15	17	16	17	22	43	25	17	14	20.1
	44	Aleppo	5:48	Lattakia	8:29						59	97	105	106				91.8
	49	Lattakia	21:00	Aleppo	23:48						44	77	86	80				71.6
	Average					41.4	32.6	44.8	42.6	40.5	45.6	54.6	60.9	61.6	42.8	34.8	29.2	49.1

The annual average is 49.1% in 1999; high in summer while low in winter.

In terms of type of train, the average of night trains between Aleppo and Damascus is 80% throughout the year, but it is contrarily about 30% for daytime trains

Between Aleppo and Qamishli, only a night train is operated and the loading factor is around 30%, and that of night trains between Damascus and Lattakia is somewhat 20%, the loading factor of daytime operations even in summer is about 10% and that is less

than 10% in winter.

The loading factor of trains running between Aleppo and Lattakia is high on average. In particular, trains are crowded in summer.

2) Freight Train

Result at 1999/7

Month/day	7/1	7/2	7/3	7/4	7/5
Number of Train	29	50	36	50	54
Total hauling weight (ton)	24,527	39,410	27,653	39,995	43,921
Load factor %	70.8	62.3	55.7	57.0	64.2

Some train having hauling capacity of 2000～1400～300 ton haul train with load factor of 100, however, on average, load factor is about 60%.

(4) Train delays and cancellations

1) Train delays

Both passenger trains and freight trains are always delayed. Most of the delays are caused by poor maintenance of locomotives, degraded track condition and signal breakdown.

(a) Delays classified by causes during March 21 through March 30 1999

Number of delayed trains 640

Average number of delayed train per day 64

Total delayed time: 2,126.3 hours

2,101.2 hours (99 % of total) due to Cause of Delay 1, 2 and 3 as below.

Average delayed hour per train: 3.3 hours

Classification of Delay Cause:

1. Delay of locomotives starting from of depot
2. Waiting the arrival of scheduled locomotives

   2,101.2 Hours (99%)

   } 1～3
3. Break down of track signal and locomotive
4. Waiting other trains
5. Waiting for formation for freight car

6. Waiting arrival of freight goods
7. Late boarding of group passengers

(b) Circumstances of Passenger Train Delays

Delay Records between Aleppo and Lattakia during August 21 through August 28 in1999 are shown in Table 3.1.7.

Although the delayed time is small for departure, all the trains arrive delayed at terminal stations. The delay per train par day averaged over the eight days reaches to 20～50 minutes.

Table 3.1.7 Train delays record

Train No.	Station	Dp. Ar	Schedule Time	Delay time (minute)								
				21	22	23	24	25	26	27	28	Average
243	Lattakia	Dp	6:45	0	0	0	7	0	0	0	0	0.8
	Aleppo	Ar	9:51	38	39	42	43	24	24	39	39	36.0
49	Lattakia	Dp	21:00	0	0	20	0	0	10	0	0	3.8
	Aleppo	Ar	23:48	27	0	63	4	7	32	2	32	20.9
245	Lattakia	Dp	15:30	0	0	0	0	0	0	0	0	0
	Aleppo	Ar	18:30	35	65	35	94	85	16	24	45	49.9
44	Aleppo	Dp	5:48	7	0	7	0	0	0	0	0	2.1
	Lattakia	Ar	8:29	16	26	21	26	21	16	26	46	24.8
242	Aleppo	Dp	7:00	5	0	5	0	0	0	5	0	1.9
	Lattakia	Ar	9:59	36	46	41	46	37	76	26	36	38.5
246	Aleppo	Dp	15:35	0	0	0	0	0	0	0	0	0
	Lattakia	Ar	18:40	25	28	25	30	105	65	20	40	42.3

Most of the delay causes are: stop once and slowdown of train for long period of construction work of new station, breakdown of track and signal and power-shortage of locomotive (type 2800 was schedule to be used but type 1800 is used instead of by broken type 2800)

2) Train Cancellation

The number of trains cancelled between March 21 through March 31, 1999: 112

Average per day: 11.2

Causes of train cancellations are broken down as follows:

1. Due to no payload: 34
2. Lack of locomotive: 32
3. Others 46

(5) Accidents

Number of Accidents in 1996～1999 is classified as shown Table 3.1.8

Table 3.1.8 Number of accidents (1996～1999)

	1996	1997	1998	1999	Remarks
Derailment	70	64	46	54	
Breaking of Turnout&signal	50	38	34	34	
Collision with other rolling stock within stationyard	8	10	11	6	
Other(Broken Track, Fire, Escape)	15	24	19	22	
Collision of Vehicles	52	39	30	31	at level crossing
Hitting Person	29	26	21	20	
Hitting Animal	4	5	3	5	
Total(A)	228	206	164	172	
Number of Train(B)	44,558	47,651	43,890	44,229	
Train km(C)	6,237,136	5,931,798	5,209,068	5,250,476	
Accident Rate(D=A/B×1000)	5.1	4.3	3.7	3.9	
Accident Rate(E=A/C*1,000,000)	36.6	34.7	31.5	32.8	

The break down of accidents in 1999 classified by causes is as Table 3.1.9.

Table 3.1.9 Accidents by cause in 1999

	Mishandling by staff member	Defective track condition	Rolling stock break down	Rolling stock erroneously manufactured	Phosphate piled up on rail	Natural disasters	Trespassing in front of train	Entrance in railway track	Other	Total
Derailment	32	12	2	1	2	5				54
Breaking of Turnout or signal	30	1	2		1					34
Collision with other rolling stock within station year									6	6
Other	3	3	3						13	22
Collision of vehicle	6						25			31
Hitting person								20		20
Hitting animal								5		5
Total	71	16	7	1	3	5	25	25	19	172

The break down of accident at level crossing is as shown in Table 3.1.10.

Table 3.1.10 Number of accident at level crossing (break down)

	1996	1997	1998	1999	Remark
Crossing by GESR Setting	3	4	2	3	Number of crossing 412 at 1999
Crossing by unlawful setting	49	35	28	28	Number of crossing 126 at 1999
Total	52	39	30	31	

3.1.3 Signal System

GESR provided with 2 types of signal system as follows, Russian type – token less system - which has no track circuit in station yard nor track between station, arrival and departure of train is checked by short track circuit installed at entrance and exit of station, multi-color light home and departure signal which is interlocked with locally controlled turnouts, and German type - electric relay interlock system which has track circuit in the station yard and electrically driven turnouts.

As for another, a system which has no signal but the certificate to approve of operation issued by station masters over wireless communication, is applied. This no-signal system is used in the sections between Aleppo – Lattakia, Qamishli – Al-Yaroubie and Aleppo – Midan Ekbas where number of train operation per day is small.

3.1.4 Train Dispatching Systems

Dispatchers' offices are located at Aleppo and Homs with 2 dispatchers each on 3-shift system for 24 hours covering all sections except Old Qamishili～Al Yaroubiye and Sharbit～Al Roueisa. Train dispatcher records actual diagrams through reported telephone by each station, and control, trains with telephone communications. Although locomotives are equipped with radios, communication with dispatchers is not possible, but is possible with station master.

Dispatcher work area are as flow

① Homs

1 Homs ～Sharqia～Damascus

2 Homs～Tartous

2 Homs～Aleppo(Wudehi)

② Aleppo

3 Aleppo ～Deir el-Zor～Qamishli

4 Aleppo ～Lattakia

4 Aleppo ～Midan Ekbas

3.1.5 Line capacity

There is an allowance for line capacity at present. Line capacity is as shown in Table 3.1.11.

Table 3.1.11 Line capacity at present

Section	Line capacity (Max. No. trains)	Current number of train
Midan Ekbas-Muslimia	36	16
Muslimia- Aleppo	65	22
Aleppo- Wudehi	80	22
Wudehi- Lattakia	36	10
Lattakia- Tartous	68	16
Tartous-Akkari	62	20
Akkari- Homs	63	20
Wudehi-Hama	49	12
Hama-Homs	84	12
Homs-Mhine	72	32
Mhine-Damascus	60	14
Aleepo-Raqqa	42	10
Raqqa-Deir el Zor	59	8
Deir el Zor-Hassaka	55	6
Hassaka- Qamishili	75	6
Qamishili-Al-Yaroubiye	30	2
Mhine-Al Sharqia	34	16

3.1.6 Train Crew

(1) Crew members aboard a train consist of the following:

Passenger train
- Driver (1)
- Assistant Driver (1)
- Train Master (1)
  - Conductor (4)
  - Electrical (1)
  - Baggage Conductor (1)
  - Sleeping Car Conductor (1)

Total: 10

Freight train
- Driver (1)
- Assistant Driver (1)
- Train Master (1)

Total 3

Driver and assistant driver and technical attendant belong to depot and the other crew members belong to main stations

(2) Appointments and Vocational Training for Locomotive Crew

1) Standards for Appointments

Assistant Driver:

Qualification: Graduates from Junior High School or above and age under 30 years old.

Those graduated from elementary school having experience in the maintenance/repair of locomotive at Depot Workshop for more than 3 years.

Training: Training is conducted aboard locomotives within the distance less than 10,000 km, and is also held at Training Center.

Driver:

Qualification: Those having job knowledge in repairing locomotive with high technical skill; having experience as an Assistant Driver for more than 150,000 km distance. (Those graduated from high school or technical high school – 100,000 km and those graduated from Railway Training School or from Mechanical/Electrical Engineering Department of University – 25,000 km)

Training: Training is conducted at Training Center.

2) Number of driver and assistant driver

Number of driver and assistant driver by depots and center are as shown in Table 3.12.

Table 3.12 Number of driver and assistant driver by depot and center

Depot & Center	Driver	As. Driver	Total
Aleppo	149	37	186
Midan Akbas	5	4	9
Lattakia	19	25	44
Muhambel	4	8	12
Homs	48	48	96
Hama	15	22	37
Damascus	8	7	15
Tartus	46	51	97
Qamishili	35	24	59
Deir el Zor	14	8	22
Al Raqqa	4	3	7
Total	347	237	584

3.1.7 Issues in G.E.S.R

(1) Ensure safety of train operation

① Rehabilitation and modernization of signal/telecommunication

Rehabilitation of existing signal equipment

Provision of modernized signal equipment for all lines.

Modernization of telecommunication equipment

② Rehabilitation of rolling stock

Rehabilitation of existing locomotive, passenger coaches and wagons, etc.

③ Enhancement of vocational training

Periodic training for crew members during duty hours

(2) Ensure just on time of train operation

① Prevention of train delays

- Setting up adequate train time schedules
- Minimization of speed restrictions at level crossing, turnout, bridge, etc.
- Rehabilitation of existing operating equipment (rolling stock, signaling, telecommunication etc)
- Analysis of train delay cause and exclusion of the delay cause

Train delay must be minimized as far as possible.

Currently, train delay, both for passenger and freight train, is like a matter of course, no precise anticipation can be made on train arrivals.

Then, customer will flee from the railway and rely on other transportation mode. Not only that, it is hard to ensure the safety of track maintenance staff without precise anticipation of train operation.

It is required that GESR should keep the promised item to the client that “train departs on scheduled time and arrives at scheduled time.”

As a matter of course, failure and defect of locomotive, track and signal which mainly cause train delay should be firstly minimized. Not only that, to set up train operation diagram, which is matching with practical train operation condition, such as characteristics of rolling stock, weight of train, line condition and train operation regulations, are necessary applying theoretical simulation.

Furthermore, it is necessary to make the effort not to change original train operating conditions as far as possible and, at the same time, period of speed restriction, and change of operating route for long period due to rehabilitation/modernization should be limited in short period with a fully worked-out plan.

To grasp the exact situations of train delay should be stipulated as the responsibility of train dispatcher, and the system to search the cause of train delay and to make up the countermeasure is essential.

Also it is important that keeping of punctual train operation are, in case of delay, recovering operation by train driver should be stipulated.

To carry a watch and train operation time table is essential for train driver. Train driver should operate train properly comparing watch and time table.

(3) Prevention of train accident

According to GESR, number of train accident per number of trains is decreased but if evaluate based on train kilometer, the frequency of accident is very high. 37～33 accidents in million train kilometer which is more than 30 times in Japan having, 0.9

accidents in million train kilometer (Statistics of 1997).

The system that studied on cause of accident and establishes its countermeasure such as establishment of a committee for “prevention of accident”, is necessary and mistakes are to be covered by hardware as far as possible on the premises premising that “every human being makes mistake”.

For an example, mechanization of blocking for train safety, ATS for prevention of collision and of speed restriction violation, and installation of interlocking system for prevention of miss handling of turnout are useful.

(4) Modernization of train operating management

To control train operation, to grasp the exact location of train is essential. As the current system which relies on the train passing report from station master is not able to obtain real time situation of train, train operation control by modernized automatic device is required.

For an example, CTC (automatic train diagram recorder, train location indicating panel, central control system of signal and turnout), wireless communication system between dispatcher and train crew can be adopted.

By adoption of CTC, not only strengthening of train operation management but also extensive rationalization of station staff can be obtained.

① Systemization of train dispatching work

Modernization of train dispatching equipment i.e. automatic train monitor, automatic train diagram records, radio communication with crew members, etc.

② Computerized for traffic information

Train operating km, car km, train delay, etc.

(5) Others

① Improvements of freight transport system

The current freight train operation is neither intentional, nor with any plans. As the

result, nobody knows arriving time of train at the destination.

Then railway loses the attraction of client. At the same time, application plan of hauling locomotive nor working schedule of crew cannot be decided.

The freight transportation should be so planned as to state clearly the arriving time of goods to consignor similar to passenger transportation.

To realize this freight transportation system, the current system that the dispatcher selects a freight train on the previous day, is to be changed to new system that fixes a freight train based on yearly freight transportation plan and relay the loaded wagon from one freight train to others to ease to trace the movement of consigned goods.

- Provision of a through-train system and public announcements of definite schedule (dates and times)
- Setting up a periodic freight train diagram

② Service Improvements to Passengers and Consignors

- Increase in train frequency
- Public announcement of definite schedule (dates and times)
- Prevention of train delays and setting-up a system for explanation to and relief measures for passengers and consignors when train delayed and cancellation
- Increase in train speeds using lightweight passenger coaches
- Provision of a train diagram to ensure train connection at junctions including GEHR line

Increase the number of passenger train is required. Looking from the frequent service of bus which is parallel running along the railway line, this requirement is understandable.
It is ideal that whenever you go to station, train is waiting. But at least it is required that one train is to be operated every 2 hours during daytime. Short formation train with high frequency service is more attractive and more easy to utilize than 1～2 train operation in daytime with big formation.

Publication of train time table induces more passenger, and at the same time railway is bound by public as a contract.

Since beautiful and clean station and passenger coach gives reliability to user, station and passenger coach should be clean and beautiful. Cleaning of station should be a duty of station staff, cleaning of station yard and track surface should be carried out positively.

Current status of dirty window glass of passenger coach which is prevent the visibility through it, betray the expectation of passenger and furthermore, it can be said that train operation with broken window glass passenger coach is regarded as train operation without proper repair.

Watch at station is a symbol of punctual train operation and should work punctually, then reliability of public is obtainable.

③ Education and training

Needless to say well prepared education before employment is important, furthermore, strengthening of on-the-job training after employment and establishment of reeducation on surplus staff who will be reassigned to different job are necessary.

The training against abnormal state and periodical repeating education and training of operation regulation should be a part of a job in the working cycle thus normal operation and prevention of accident can be ensured.

To secure number of staff to cope with increased transportation demand in future, training system which is free from school career, is required to obtain smooth transference from the office considered having surplus staff to the other in the shortage of staff.

3.2 Rolling stock and workshop

3.2.1 Current situation of rolling stock

Type of locomotives are electric diesel type. The main generator of locomotives which are used since 1972 is the direct current generator and the traction motors are actuated the direct current. The main generator of locomotives which are imported from France in 1999 is the alternating current generator and the traction motors are actuated by the alternating current.
Passenger coaches mainly used are 1st class, 2nd class, restaurant car etc., which are imported from East Germany since 1982.
Freight wagons in use are tank wagon, wagon for cereal, wagon for phosphate, wagon for cement, covered wagon, flat wagon etc.
Main particulars of rolling stocks of GESR are shown in Table 3.2.1.

Table 3.2.1. Main particulars of rolling stock

1. Locomotive

Type	Country where manufactured	Out put (HP)	Max Speed (km/m)	Axle weight (t)	Electric method	Manufactured year
LDE 3200	France	3,200	120	20	AC – AC	1999
LDE 2800	Russia	2,800	100~120	20	DC – DC	1974~1984
LDE 1800	U.S.A.	1,800	110	15	DC – DC	1976
LDE 1500	Cezcho	1500	90	20	DC – DC	1985
LDE 1200	Russia	1200	100	20	DC – DC	1972
LDE 650	France	650	60	15	DC – DC	1968
UNILOK	West Germany	60	24	2	—	1976

2. Passenger coach

Type	Country where manufactured	Empty car weight (t)	Seat capacity	Max length (m)	Max width (m)	Max height (m)	Manufactured year
AP (1st class)	East Germany	42.0	54	26.4	2.824	4.05	1982
BH (2nd class)	East Germany	42.0	102	26.4	2.824	4.05	1983
BM (2nd class)	East Germany	44.0	80	26.4	2.824	4.05	1982
WR(Restaurant car)	East Germany	18.0	42	26.4	2.824	4.05	1983
DPOST (luggage+engine)	East Germany	—	—	26.4	2.824	4.05	1982

3. Freight wagon

Type	Country where manufactured	Empty car weight (t)	Loaded car weight (t)	Max length (m)	Max width (m)	Max height (m)	Manufactured year
Tank wagon (Zaes)	Iran	23	58	13.2	—	4.27	1994
Cereal wagon (Tagpps)	Iran	22	58	15.44	3.06	4.265	1999
Phosphate wagon (Talls)	Bulgaria	28	45	14.42	3.1	4.26	1992
Cement wagon (Uacs)	Poland	24.5	50	14.04	3.1	4.334	1978

(1) Locomotive

Current number of locomotives on the books, available for use and under repair etc. as of June 200 are showed in Table 3.2.2.

Table 3.2.2 Current number of locomotive (2000 June)

Type	Country where manufactured	Number of the books	Number available for use	Number under repair etc.
LDE2800 (old)	Russia	29	0	29
LDE2800 (new)	Russia	77	22	55
LDE1800	U.S.A.	26	20	6
LDE1500	Czecho.	25	20	5
LDE1200	Russia	11	9	2
LDE650	France	9	9	0
UNILOCK	West Germany	6	5	1
Total		183	85	98

1) LDE2800 and LDE1800 are used for traction of both passenger and freight train.
2) LDE1500 and LDE1200 are used as shunting locomotive in the industrial factories such as cement factories, cereal collection/manufacturing factories, petroleum refinery factories etc. They are also used for short distance traction of freight wagons between these factories and the nearest railway station.
3) LDE650 is used for shunting work of passenger and freight train in the station.
4) UNILOCK is used for shunting work in the port etc.
5) Main accidents of locomotive in 1999 are shown in Table 3.2.3.

Table 3.2.3 Main accidents of locomotive (1999)

No.	Main accident contents
1	Engine accident
2	Bogie accident
3	Brake accident
4	Main generator accident
5	Traction motor accident
6	Auxiliary generator accident
7	Engine cooling water system accident
8	Electric parts and electric circuit accident

(2) Passenger coach

Current numbers of passenger coaches on the books, available for use and under repair etc. as of June 2000 are shown in Table 3.2.4.

Table 3.2.4 Current number of passenger coach (2000 June)

Type	Country where manufactured	Number on the books	Number available for use	Number under repair etc.
ACM	Rumania	10	5	5
AM, AP	Rumania, East Germany	101	100	1
BM, BHM, BH, BP	Rumania, Poland, East Germany	239	238	1
BRM	Rumania	10	4	6
DPEM, DPOST etc.	Rumania, Poland	30	25	5
ABM	East Germany	14	0	14
BM	East Germany	9	0	9
WR	East Germany	19	19	0
Special saloon car	East Germany	3	3	0
Sleeping car	East Germany	44	42	2
Total		479	436	43

ACP : 1st class + sleeping coach
AM, ABM, AP : 1st class coach
BM, BHM, BH, BP : 2nd class coach
BRM : 2nd class coach equipped with buffet
DPEM, DPOST etc. : luggage car with partial mail room
WR : Restaurant car

1) 14 cars of ABM and 9 cars of BM both manufactured in East Germany are not used at present due to deterioration because of very long usage since 1971.

2) Main accidents of passenger coach in 1999 are shown in Table 3.2.5.

Table 3.2.5 Main accidents of passenger coach (1999)

No.	Main accident contents
1	Bogie accidents
2	Hand brake accidents
3	Coupler accidents
4	Electric parts and electric circuit accidents

(3) Freight wagons

Current numbers of freight wagons on the books, available for use and under repair etc. as of April 2000 are shown in Table 3.2.6.

Table 3.2.6 Current number of freight wagon (2000 April)

Type	Country where manufactured	Number on the books	Number available for use	Number under repair etc.
Flat wagon	Russia, Poland, East Germany	2,159	2,104	55
Covered wagon	East Germany, Sweden	940	880	60
Tank wagon	Russia, Poland, France, Czecho. Rumania, Iran	1,638	1,511	127
Wagon for phosphate	Bulgaria, Poland	323	312	11
Total		5,060	4,807	253

1) 347 out of 940 covered wagons are old plain bearing type freight wagons used since 1955～1975.

2) Main accidents of freight wagon in 1999 are shown in Table 3.2.7.

Table 3.2.7 Main accidents of freight wagon (1999)

No.	Main accident contents
1	Bogie accidents
2	Hand brake accidents
3	Brake accidents
4	Coupler accidents

3.2.2 Current situation of workshop and depot of locomotive

(1) Workshop and depot

Workshop is located in Jubrin (Jubrin workshop) and depots are located in Aleppo (Aleppo depot) and in Homs (Homs depot) etc.

(1)-1 Jubrin workshop

In Jubrin workshop, about 390 staff are carrying out the works as the followings:

① Periodical maintenance / repair of M4-M6 for LDE2800 type, M5-M9 for LDE1800 type, M6 for LDE1500 type and M4-M6 for LDE1200 type.

② Temporary large scale maintenance/repair of engine, traction motor, compressor etc. of all type of LDE.

1) In Jubrin workshop, it takes about 2.5 months for periodical maintenance/repair for M6

of LDE2800, about 2.5 months for M8 of LDE1800 and about 2 months for M6 of LDE1500.

2) Shops of Jubrin workshop are divided as follows:

① Shop for periodical maintenance/repair of body, bogie, engine of LDE2800, LDE1500, LDE1200.

② Shop for periodical maintenance/repair of body, bogie, engine of LDE1800.

③ Shop for wheel set, traction motor, compressor etc. of all type of LDE.

④ Shop for temporary maintenance/repair of all type of LDE.

3) Numbers of temporary maintenance/repair of locomotive at Jubrin workshop in 1999 are shown in Table 3.2.8.

Table 3.2.8 Numbers of temporary maintenance/repair of locomotive at Jubrin workshop (1999)

Contents of temporary maintenance / repair	D	E	M	Total
LDE2800	26	30	27	83
LDE1800	44	54	21	119
LDE1500	2	31	26	59
LDE1200	28	17	13	58
Total	100	132	87	319

D : Engine relation
E : Main generator, Traction motor, Electric circuit relation
M : Compressor, Bogie, Brake relation

(1)-2 Aleppo depot

In Aleppo depot, about 360 staffs are carrying out the works as the followings:

① Periodical maintenance/repair of M1-M3 of LDE2800 and LDE1200 type, M1-M4 of LDE1800 type, M1-M5 of LDE1500 type and M1-M6 of LDE650 type.

② Small scale temporary maintenance/repair of engine, traction motor, compressor etc. of all type of LDE.

(1)-3 Homs depot

In Homs depot, about 70 staffs are carrying out the works as the followings:

① Periodical maintenance/repair of M1-M3 of LDE2800 type, M1-M4 of LDE1800 type, M1-M3 of LDE1500 type, M1-M3 of LDE1200 type and M1 of LDE650 type.

② Small scale temporary maintenance/repair of engine, traction motor, compressor etc. of all type of LDE.

(2) Workshop and depot for passenger coach

Workshop is located in Aleppo (Aleppo workshop) and depots are located in Aleppo (Aleppo depot), in Qamishli (Qamishli depot), in Lattakia (Lattakia depot) and in Damascus (Damascus depot) etc. Aleppo depot is the large one.

(2)-1 Aleppo workshop

In Aleppo workshop, about 180 staff are carrying out the works as the followings:

① Periodical maintenance/repair of T1-T6 of all types of coaches.

② Temporary large scale maintenance/repair of wheel tread cutting, changing of spring of bogie etc. of all types of coaches.

1) In Aleppo workshop, it takes about 1.5 months for periodical maintenance/repair of T6.
2) In the workshop, there are body and bogie shop, machine-processing shop, wood working shop, electrical parts/air brake and seat shop etc.
3) In Aleppo workshop, brake blocks are manufactured which are used for all locomotives in GESR.
4) Numbers of temporary maintenance/repair of passenger coach at Aleppo workshop in 1999 are shown in Table 3.2.9.

Table 3.2.9 Numbers of temporary maintenance/repair of passenger coach at Aleppo workshop (1999)

Contents of temporary maintenance / repair	Bogie relation	Air-conditioning relation	Battery relation	Electric circuit relation	Accident relation
All type	39	8	6	3	2

(2)-2 Aleppo depot

In Aleppo depot, about 140 staffs are carrying out the works as the followings :

① Daily inspection of all types of passenger coaches.

② Temporary small scale maintenance/repair of cooling water apparatus, broadcasting apparatus and printed circuit board etc.

(3) Workshop and depot for freight wagon

Workshop is located in Jubrin (Jubrin workshop) and depots are located in Jubrin (Jubrin depot), in Aleppo (Aleppo depot), in Lattakia (Lattakia depot), in Midan Ekbas (Midan Ekbas depot), in Homs (Homs depot), in Tartous (Tartous depot), in Damascus (Damascus depot), in Hama (Hama depot), in Deir-Zor (Deir-Zor depot), in Raqqa (Raqqa depot), in Hassaka (Hassaha depot) and in Qamishli (Qamishli depot). Major depots are Jubrin, Homs and Lattakia depot.

(3)-1 Jubrin workshop

In Jubrin workshop, about 150 staffs are carrying out the workers as the followings:

① Periodical (every 3 ~ 15 years) maintenance/repair of all types wagons.

② Temporary large scale maintenance/repair such as repair of wagons damaged by collision, wheel tread cutting etc.

1) In Jubrin workshop, it takes 1 week for overhaul at maximum.
2) In Jubrin workshop, there are body and bogie shop, machine-processing shop, wheel shop, wood working shop, air brake and spring shop, tank inspection shop for tank wagon for natural gas etc.
3) Numbers of temporary maintenance/repair of freight wagon at Jubrin workshop in 1999 are shown in Table 3.2.10.

Table 3.2.10 Numbers of temporary maintenance/repair of freight wagon at Jubrin workshop (1999)

Contents of temporary maintenance / repair	Body relation	Bogie relation	Brake relation	Tank relation	Collision relation	Derailment relation
All type	192	298	13	37	2	9

(3)-2 Jubrin depot

In Jubrin depot, about 125 staff are carrying out the works as the followings:

① Daily inspection of all types of wagons.

② Temporary maintenance/repair such as replacement of brake block etc.

(3)-3 Homs depot

In Homs depot, about 95 staffs are carrying out the works as the followings:

① Daily inspection of all types of wagons.

② Temporary maintenance/repair such as replacement of wheel set and brake block etc.

(3)-4 Lattakia depot

In Lattakia depot, about 50 staffs are carrying out the works as follows:

① Daily inspection of all types of wagons.

② Temporary maintenance/repair such as replacement of brake block etc.

3.2.3 Current situation of maintenance system of rolling stock and workshop

(1) Organization

Current situation of maintenance organization is shown in the Fig. 3.2.1.

Workshops are directly controlled by the head office of GESR. Depots are controlled by the each improvement department.

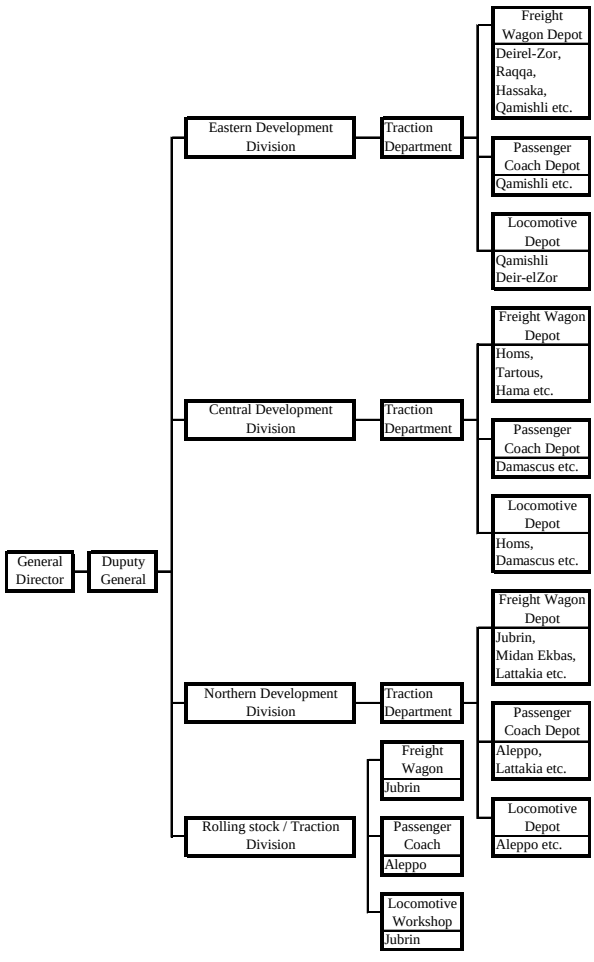

Fig.3.2.1 Maintenance Organization

(2) Inspection cycle and place

Current situation of inspection cycle and place of rolling stocks are shown in Table 3.2.11.

Table 3.2.11 Inspection cycle and place

1. Locomotive

Type of inspection	M1	M2	M3	M4	M5	M6	M7	M8	M9
LDE2800 (old)	After every operation	5,000km	25,000km	100,000km	200,000km	600,000km	-	-	-
Place of Inspection	Depot	Depot	Depot	Workshop	Workshop	Workshop			
LDE2800 (new)	After every operation	5,000km	25,000km	200,000km	400,000km	900,000 km	-	-	-
Place of Inspection	Depot	Depot	Depot	Workshop	Workshop	Workshop			
LDE1800	After every operation	8,000km	25,000km	50,000km	200,000km	400,000 km	800,000 km	1,200,000 km	1,600,000 km
Place of Inspection	Depot	Depot	Depot	Depot	Workshop	Workshop	Workshop	Workshop	Workshop
LDE1500	After every operation	15 days	3 months	1 year or 75,000km～100,000km	2 years or 150,000km～200,000km	6 years or 500,000 km	-	-	-
Place of Inspection	Depot	Depot	Depot	Depot	Depot	Workshop			
LDE1200	After every operation	15 days	3 months	1 year or 100,000km	2 years or 200,000km	6 years or 600,000 km	-	-	-
Place of Inspection	Depot	Depot	Depot	Workshop	Workshop	Workshop			
LDE650	After every operation	15 days	3 months	6 months	-	-	-	-	-
Place of Inspection	Depot	Depot	Depot	Depot					
UNILOK	After every operation	1 month	3 months	-	--	-	-	-	-
Place of Inspection	Depot	Depot	Depot						

2. Passenger

Type of inspection	Inspection	Periodical maintenance	T1	T2	T3	T4	T5	T6
East Germany	After every operation	9 months 70,000km～100,000km	2 years or 400,000km	4years or 800,000km	6 years or 1,200,000km	8 years or 1,600,000km	10 years or 2,000,000km	12 years or 2,400,000km
Place of Inspection	Depot	Depot	Workshop	Workshop	Workshop	Workshop	Workshop	Workshop
Poland, Rumania	After every operation	9 months or 70,000km～100,000km	3 years or 300,000km	6 years or 600,000km	9 years or 900,000km	-	-	12 years or 1,200,000km
Place of Inspection	Depot	Depot	Depot	Workshop	Workshop			Workshop

3. Freight wagon

Type of inspection	Inspection cycle	Place of inspection
-	after every operation	Depot
Semi-overhaul	3 year, 4 year, 5 year	Workshop
Overhaul	6 year, 8 year, 9 year, 12 year, 15 year	Workshop

(3) Number of periodical inspection

Number of periodical inspection of rolling stocks during 1999 are in Table 3.2.12.

Table 3.2.12 Number of periodical inspection (1999)

1. Locomotive

Type	Location	Form	Kind of inspection and inspection number								
			M1	M2	M3	M4	M5	M6	M7	M8	M9
Locomotive	Jubrin Workshop	LED2800	-	-	-	3	9	6	-	-	-
		LED1800	-	-	-	-	0	0	8	0	0
		LED1500	-	-	-	-	-	3	-	-	-
		LED1200	-	-	-	0	0	7	-	-	-
		LED650	-	-	-	-	-	-	-	-	-
	Aleppo Depot	LED2800	3,274	233	74	-	-	-	-	-	-
		LED1800	3,211	109	48	0	-	-	-	-	-
		LED1500	1,944	68	21	0	0	-	-	-	-
		LED1200	658	27	3	-	-	-	-	-	-
		LED650	532	58	8	0	-	-	-	-	-
	Homs Depot	LED2800	2,101	183	51	-	-	-	-	-	-
		LED1800	876	0	0	0	-	-	-	-	-
		LED1500	885	27	10	0	0	-	-	-	-
		LED1200	177	0	0	-	-	-	-	-	-
		LED650	155	0	0	0	-	-	-	-	-

2. Passenger

Type	Location	Form	Kind of inspection and inspection number					
			T1	T2	T3	T4	T5	T6
Passenger Coach	Aleppo Workshop	East Germany	15	11	13	8	3	22
		Poland	4	1	0	-	-	4
		Rumania	0	3	3	-	-	2

3. Freight wagon

Type	Location	Form	Kind of inspection and inspection number							
			3 years	4 years	5 years	6 years	8 years	9 years	12 years	15 years
Freight Wagon	Jubrin Workshop	All type	79	157	20	177	5	34	3	91

3.2.4 Current major issues and improvement

(1) Rolling stock

1) Common

① Wheel tread cutting and replacement of wheel are frequently carrying out for the bad quality of brake block. Accordingly, quality control of brake block must be improved urgently.

2) Locomotive

① Number of LDE2800 under repair shares almost 80% of the total number of LDE2800 on the books. This is because repair is suspended due to shortage of spare parts of engine etc. Accordingly it is very necessary to procure spare parts of engine, traction motor and other various spare parts for LDE2800.

② It is also necessary to procure spare parts of engine, traction motor and other various spare parts for LDE1800, LDE1500 and LDE1200.

③ 30 number of LDE3200 are planned to be imported from France. In the future, passenger and freight train will be mainly hauled by this type locomotives.

3) Passenger coaches

① 70% of total number of passenger coaches under repair are in the state of suspended repair due to the shortage of spare parts of major components such as battery (including battery charging circuit devices), air brake, accommodation and other necessary spare parts for all type of passenger coaches. Accordingly, it is necessary to procure adequate number of spare parts of battery (including battery charging circuit devices), air brake, accommodation and other necessary spare parts for all type of passenger coaches.

② As one kind of rolling stock accident, the hand brake was forgotten to open. Accordingly, it is necessary to take measure to meet hand brake as not forgotten to open.

4) Freight wagon

① 80% of total number of wagon under repair are the ones damaged by collisions etc. Accordingly, it is necessary to prevent collision of wagons which often occur during shunting work or formation of train.

② As one kind of rolling stock accident, the hand brake was forgotten to open. Accordingly, it is necessary to take measure to meet hand brake as not forgotten to open.

③ Old plain bearing type wagons should be replaced by roller bearing type wagons.

(2) Workshop and depot

1) Workshop

① Jubrin locomotive workshop

a. The reasons why it takes rather long time for periodical maintenance/repair is that there is the shortage of spare parts for major equipment such as engine, traction motor etc.

b. Workshop is very narrow and the machineries for maintenance/repair are old aged and the various testing equipments are in shortage. Accordingly, modern locomotive workshop should be constructed. In drawing up such construction, installation of new machines/repair machines and new testing equipments should be include for the booked locomotive of GESR.

c. The foundry shop to manufacture the brake block should be constructed in this

workshop.

② Aleppo passenger coach workshop

a. The reason why it takes long time for periodical maintenance/repair in the workshop is that there is a shortage of spare parts of major components such as bogie, air-conditioned system.

b. Aleppo passenger coach workshop was constructed about 100 years ago and the machineries for maintenance/repair are old aged and the various testing equipments are in shortage. Accordingly, modern passenger coach workshop should be constructed. In drawing up such construction, installation of new machine/repair machines and new testing equipments should be included for the booked passenger coach of GESR.

③ Jubrin freight wagon workdhop

a. The reason why it takes very long time for periodical maintenance/repair in the workshop is that there is a shortage of spare parts of major components such as bogie.

b. It is necessary to revise the layout of workshop by integrating buildings for periodical maintenance/repair and building for temporary maintenance and painting shop and final adjustment shop etc. should be constructed. In drawing up such revision and construction, installation of new machine/repair machines and new testing equipments should be included for the books freight wagon of GESR for modernization.

2) Depot

① Aleppo locomotive depot

a. Buildings and machineries are all very old. For example building were constructed about 100 years ago and turn-table was also installed about 100 years ago. Accordingly, in drawing up change of location, installation of new machine/repair machines and new testing equipments should be included for modernization.

b. Effective locomotive maintenance system should be established by transmitting content of temporary maintenance/repair should be carried out.

c. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

② Homs locomotive depot

a. Buildings and machineries are all very old. For example buildings were constructed about 100 years ago. New machines/repair machines and new testing equipments should be included for modernization.

b. Effective locomotive maintenance system should be established by transmitting content of temporary maintenance/repair.

c. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

③ Aleppo passenger coach depot

a. Effective passeger coach maintenance system should be established by transmitting content of temporary maintenance/repair should be carried out.

b. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

④ Jubrin freight wagon depot

a. Effective freight wagon maintenance system should be established by transmitting content of temporary maintenance/repair.

b. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

⑤ Homs freight wagon depot

a. Effective freight wagon maintenance system should be established by transmitting content of temporary maintenance/repair.

b. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

⑥ Lattakia freight wagon depot

a. Effective freight wagon maintenance system should be established by transmitting content of temporary maintenance/repair.

b. For the temporary maintenance/repair which could be reliably and speedily implemented, adequate number of spare parts should be provided.

3.2.5 Education/training

(1) Education/training in the training center

Education/training requested by the head office are being carried out for the railways employees to master technical know-how at the training center as shown in Table 3.2.13.

Table 3.2.13 Details of education for rolling stock

Course	Experience	Graduation	Weeks	Hours
Upgrading of chief of workshop	5 to 10 years	High school	9	252
Upgrading of locomotive maintenance	1 to 5 years	High school	13	360
Upgrading of passenger coach maintenance	1 to 5 years	High school	9	252
Upgrading of freight coach maintenance	1 to 5 years	High school	13	252
Upgrading of freight coach inspection	1 to 3 years	High school	9	248

(2) On the job training at job sites

On-the-job trainings are not carried out at job sites to learn the technical know-how periodically.

3.3 Permanent Way Facilities

3.3.1 Track Standards

(1) Track Standards

Syrian Railways (GESR) are divided into two parts, namely a route in northern region of Syria constructed at the end of the Ottoman Empire and another route expanded by Russian railway engineering during the age between 1960s and 1970s. The railway has been unified as a third-grade track of Russian Standard (annual tonnage of 8 million tons to 15 million tons). Major characteristics are as follows:

Maximum Design Speed:	Passenger train – 120 km/h, Freight train – 100 km/h
Track Gauge:	1,435 mm (Standard Gauge)
Minimum Radius of Curve:	R = 600 m (R = 300 m where required)
Maximum Cant:	150 mm
Maximum Slack:	20 mm
Maximum Gradient:	G = 12.0‰ (25‰ where required)
Design Load:	Russian Railway Standard Load (S12 load)(12ton/m) Axle load 25 tons (See Fig. 3.3.1)
Rail:	P50
Sleeper:	PC Sleeper L=2,420, 1,600-1,840/km, St. 1,440/km
Fastening:	K2, Kb, RN, Nabra
Ballast:	250mm (Ballast) + 100mm (Sand) (Under Sleeper)
Turnout:	Main Line 11#, Sub Line 9#
Construction Gauge:	As shown in Fig. 3.3.2
Railway Track Cross Sectional Dimensions:	As shown in Fig. 3.3.3

(Note: In the case of improvement, UIC standard for track shall be used.)

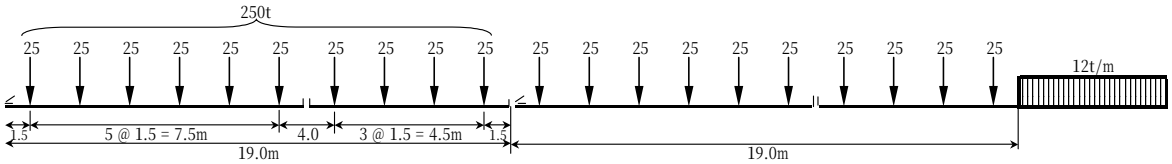

Fig.3.3.1 Standard Load

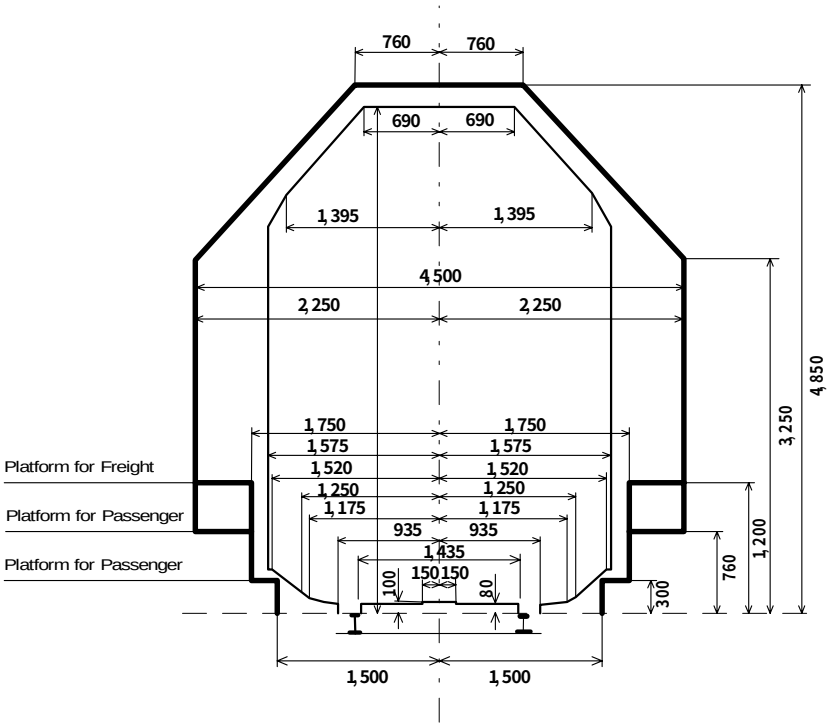

Fig.3.3.2 Construction Gauge

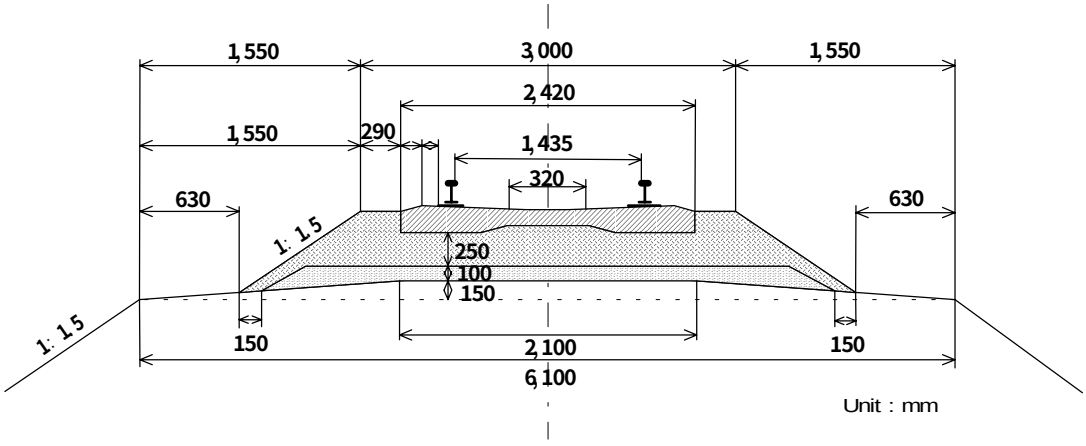

Fig.3.3.3 Railway Track Cross Section Dimension

3.3.2 Railway Alignment

The alignment is as shown in Fig. 3.3.4. The route crossing over mountain ridges consists of small radius of curves with steep gradients.

While, the alignment of the section crossing desert regions consists of large radius of curves with moderate gradients.

The summary of curves and gradients of respective lines is as shown in Table 3.3.1 and Table 3.3.2 (Appendix 3.1.1) GESR's routes comprise a route between Midan Ekbas and Aleppo, and a route between Old Qamishli and Al Yaroubiye, both constructed during the age of the Ottoman Empire. Other inland routes were expanded and constructed since 1970s as the third-grade line per Russian Standard. Future expansion of these routes is under planning.

Although the alignment is provided partially with small radius of curves (200 to 400 m, the length of 17.6km) and steep gradients (20 to 25‰, the length of 40.8 km) over a mountain range, the alignment of the routes of the whole network is generally mild.

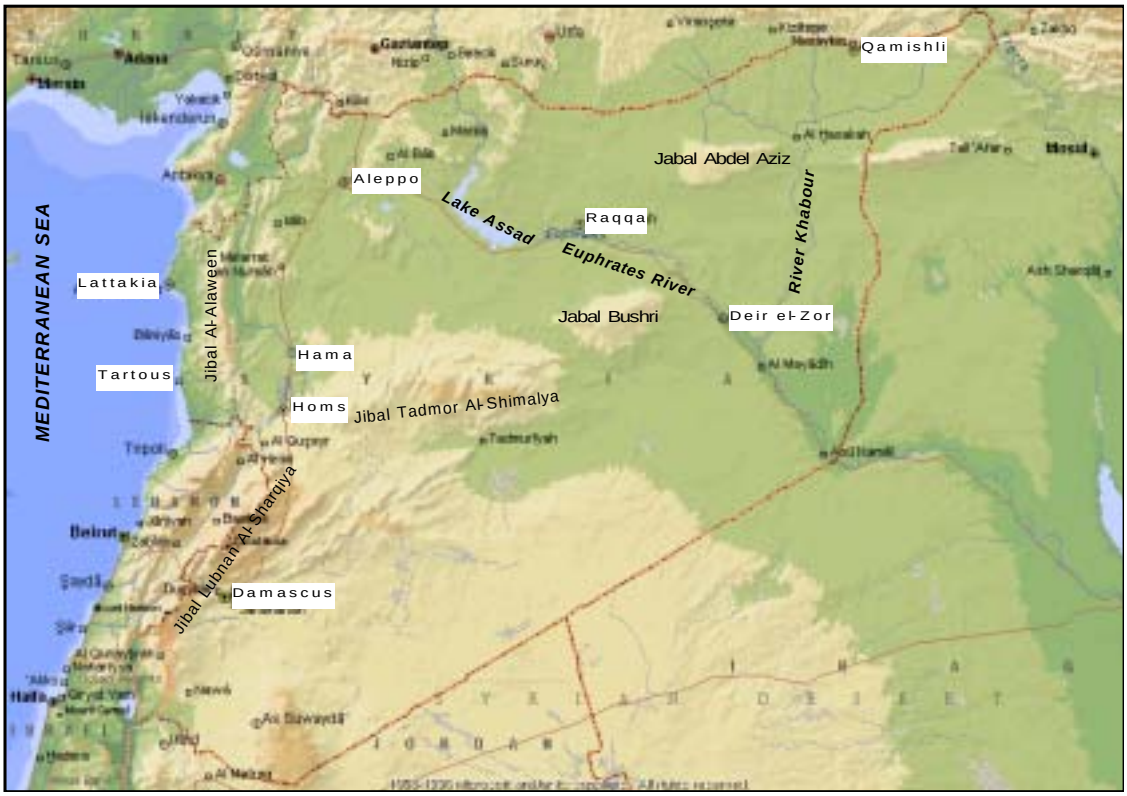

Fig.3.3.4(1) Topographical Map

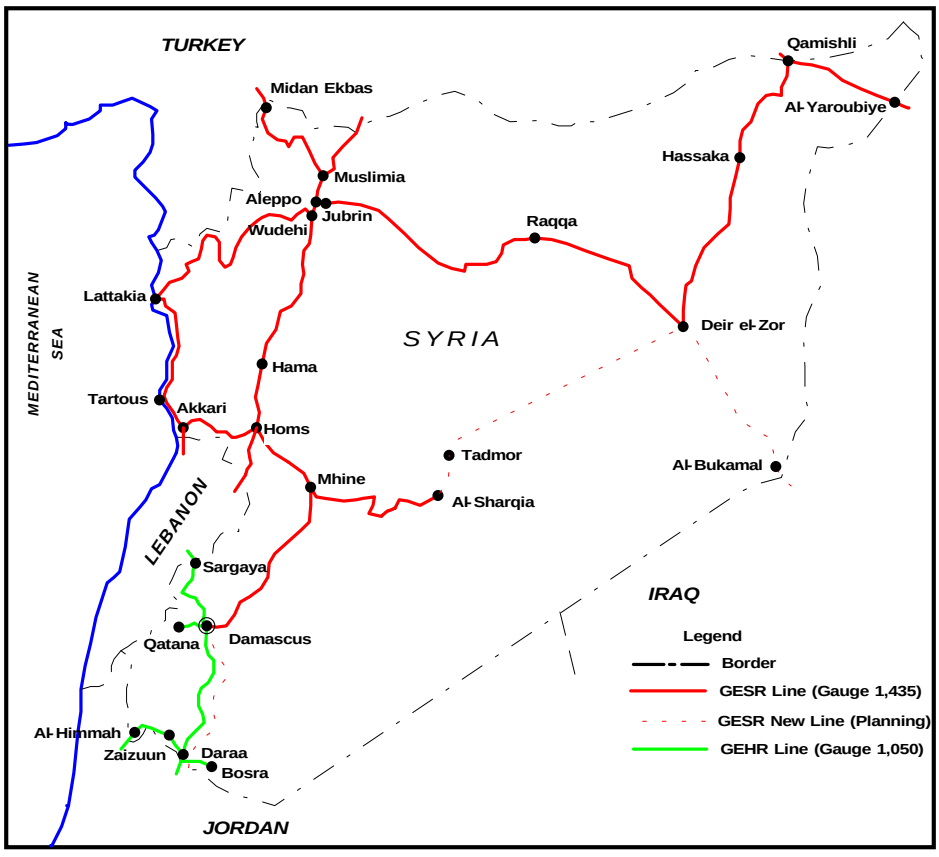

Fig.3.3.4(2) Syrian Railway Network

Table 3.3.1 Table of Curve

Curve	Jublin - Homs 2			Homs 1 - Damascus			Homs 1 - Tartous -Al-Kabil			Lattkia - Wdehi			Jublin - Old Qamishli		
	Length			Length			Length			Length			Length		
R (m)	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.
200≦R＜300							67	0.1	1						
300≦R＜400				1,123	2.5	3	16,092	21.5	43						
400≦R＜500	4,932	10.1	12	942	2.1	2	5,353	7.2	18	38,103	55.3	100	100	0.2	1
500≦R＜600	2,100	4.3	6	1,690	3.8	2	2,471	3.3	6	7,455	10.8	19	810	1.5	1
600≦R＜700	12,480	25.5	25	8,553	19.3	13	18,349	24.5	40	6,479	9.4	21	16,944	30.7	42
700≦R＜800							1,179	1.6	2	130	0.2	1			
800≦R＜900	9,063	18.5	11	6,337	14.3	9	5,171	6.9	13	2,225	3.2	7	4,266	7.7	10
900≦R＜1000							276	0.4	1						
1000≦R＜1100	3,541	7.2	6	1,865	4.2	6	3,213	4.3	8	5,287	7.7	12	16,665	30.2	35
1100≦R＜1200															
1200≦R＜1300	7,712	15.7	16	12,140	27.4	21	11,558	15.5	25	549	0.8	1	3,079	5.6	6
1300≦R＜1400															
1400≦R＜1500															
1500≦R＜1600	950	1.9	2	1,488	3.4	2	3,438	4.6	6	4,974	7.2	9	2,038	3.7	3
1600≦R＜1700															
1700≦R＜1800															
1800≦R＜1900	1,365	2.8	1				1,008	1.3	2				343	0.6	1
1900≦R＜2000															
2000≦R＜3000	6,071	12.4	12	7,528	17.0	16	6,360	8.5	15	1,385	2.0	4	4,296	7.8	10
3000≦R＜4000	220	0.4	1	2,611	5.9	5	77	0.1	1	416	0.6	1	5,273	9.6	14
4000≦R＜5000	573	1.2	1				160	0.2	2				183	0.3	1
5000≦R										1,952	2.8	3	1,187	2.2	4
Curve Total	49,007	100.0	93	44,277	100.0	79	74,772	100.0	183	68,955	100.0	178	55,184	100.0	128
Straight	153,596	75.8		155,458	77.8		112,644	60.1		113,338	62.2		484,901	89.8	
Curve	49,007	24.2		44,277	22.2		74,772	39.9		68,955	37.8		55,184	10.2	
Total	202,603			199,735			187,416			182,293			540,085		

Curve	Aleppo - Midan Ekbas			Mhine - Al-Sharqia			Old Qamishli - Al-Yaroubiye			Total		
	Length			Length			Length			Length		
R (m)	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.
200≦R＜300										67	0.0	1
300≦R＜400				350	0.9	1				17,565	4.6	47
400≦R＜500	18,285	36.9	68							67,715	17.6	201
500≦R＜600	14,460	29.2	46	570	1.5	1	240	4.0	1	29,796	7.7	82
600≦R＜700	2,010	4.1	8	17,840	47.4	27				82,655	21.5	176
700≦R＜800										1,309	0.3	3
800≦R＜900	4,500	9.1	15	2,910	7.7	6				34,472	8.9	71
900≦R＜1000										276	0.1	1
1000≦R＜1100	6,770	13.7	19	2,630	7.0	3	1,165	19.5	4	41,136	10.7	93
1100≦R＜1200										0	0.0	0
1200≦R＜1300				11,150	29.6	21				46,188	12.0	90
1300≦R＜1400										0	0.0	0
1400≦R＜1500										0	0.0	0
1500≦R＜1600	1,300	2.6	1							14,188	3.7	23
1600≦R＜1700										0	0.0	0
1700≦R＜1800	780	1.6	1							780	0.2	1
1800≦R＜1900										2,716	0.7	4
1900≦R＜2000										0	0.0	0
2000≦R＜3000	1,320	2.7	1	1,880	5.0	7	4,517	75.6	14	33,357	8.7	79
3000≦R＜4000	80	0.2	1	280	0.7	1				8,957	2.3	24
4000≦R＜5000										916	0.2	4
5000≦R							53	0.9	1	3,192	0.8	8
Curve Total	49,505	100.0	160	37,610	100.0	67	5,975	100.0	20	385,285	100.0	908
Straight	67,145	57.6		73,162	66.0		75,268	92.6		1,235,512	76.2	
Curve	49,505	42.4		37,610	34.0		5,975	7.4		385,285	23.8	
Total	116,650			110,772			81,243			1,620,797		

Note :

Exclude
Muslimia - Joban Bec
Exclusive Line
Short-cut Line

Table 3.3.2 Table of Gradient

Gradient	Jublin - Homs 2			Homs 1 - Damascus			Homs 1 - Tartous - Al-Kabil			Lattkia - Wdehi			Jublin - Old Qamishli		
	Length			Length			Length			Length			Length		
(‰)	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.
0≦G<1	40,675	20.1	65	31,491	15.8	52	42,913	22.9	87	35,375	19.4	56	193,445	35.8	196
1≦G<2	19,437	9.6	27	21,490	10.8	37	6,508	3.5	17	9,285	5.1	16	58,821	10.9	76
2≦G<3	7,615	3.8	19	22,098	11.1	46	14,786	7.9	31	7,816	4.3	15	68,138	12.6	80
3≦G<4	12,706	6.3	24	15,260	7.6	25	9,248	4.9	24	8,333	4.6	17	35,697	6.6	45
4≦G<5	9,767	4.8	17	14,770	7.4	25	7,762	4.1	25	6,177	3.4	15	28,250	5.2	35
5≦G<6	11,337	5.6	25	9,405	4.7	19	7,756	4.1	27	7,785	4.3	16	62,350	11.5	72
6≦G<7	15,415	7.6	29	9,760	4.9	24	7,243	3.9	19	16,213	8.9	24	72,323	13.4	81
7≦G<8	4,613	2.3	11	6,830	3.4	15	2,425	1.3	7	8,110	4.4	18	6,281	1.2	9
8≦G<9	8,760	4.3	16	12,630	6.3	28	4,266	2.3	11	8,335	4.6	14	14,780	2.7	14
9≦G<10	4,750	2.3	9	3,594	1.8	8	6,987	3.7	15	3,430	1.9	9			
10≦G<11	8,720	4.3	22	8,662	4.3	17	11,024	5.9	24	40,170	22.0	60			
11≦G<12	24,843	12.3	44	16,795	8.4	34	18,319	9.8	45	15,870	8.7	32			
12≦G<13	33,965	16.8	48	26,950	13.5	40	23,574	12.6	50	14,584	8.0	34			
13≦G<14							869	0.5	3						
14≦G<15							641	0.3	3						
15≦G<16							624	0.3	2	810	0.4	1			
16≦G<17							323	0.2	1						
17≦G<18							639	0.3	2						
18≦G<19							2,250	1.2	2						
19≦G<20							200	0.1	1						
20≦G<21							19,059	10.2	11						
21≦G<22															
22≦G<23															
23≦G<24															
24≦G<25															
25≦G<26															
Total	202,603	100.0	356	199,735	100.0	370	187,416	100.0	407	182,293	100.0	327	540,085	100.0	608

Gradient	Aleppo - Midan Ekbas			Mhine - Al-Sharqia			Old Qamishli - Al-Yaroubiye			Total		
	Length			Length			Length			Length		
(‰)	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.	(m)	(%)	No.
0≦G<1	24,267	20.8	28	13,762	12.4	27	30,468	37.5	39	412,396	25.4	550
1≦G<2	1,920	1.6	3	5,252	4.7	9	10,990	13.5	12	133,703	8.2	197
2≦G<3	7,286	6.2	9	5,965	5.4	13	8,055	9.9	11	141,759	8.7	224
3≦G<4	3,085	2.6	4	5,590	5.0	15	4,050	5.0	5	93,969	5.8	159
4≦G<5	2,900	2.5	5	8,857	8.0	20	7,180	8.8	8	85,663	5.3	150
5≦G<6	9,257	7.9	10	3,400	3.1	8	3,650	4.5	5	114,940	7.1	182
6≦G<7	6,060	5.2	6	5,310	4.8	13	7,350	9.0	5	139,674	8.6	201
7≦G<8	2,220	1.9	3	2,450	2.2	4	2,400	3.0	2	35,329	2.2	69
8≦G<9	2,055	1.8	3	5,350	4.8	13	6,300	7.8	5	62,476	3.9	104
9≦G<10	2,180	1.9	4	1,836	1.7	5				22,777	1.4	50
10≦G<11	14,592	12.5	6	6,050	5.5	9				89,218	5.5	138
11≦G<12	901	0.8	1	23,475	21.2	39				100,203	6.2	195
12≦G<13				23,475	21.2	31	800	1.0	1	123,348	7.6	204
13≦G<14	3,824	3.3	4							4,693	0.3	7
14≦G<15	930	0.8	1							1,571	0.1	4
15≦G<16	1,162	1.0	2							2,596	0.2	5
16≦G<17	3,098	2.7	2							3,421	0.2	3
17≦G<18	1,600	1.4	2							2,239	0.1	4
18≦G<19	4,199	3.6	3							6,449	0.4	5
19≦G<20	3,412	2.9	3							3,612	0.2	4
20≦G<21	3,290	2.8	1							22,349	1.4	12
21≦G<22	525	0.5	1							525	0.0	1
22≦G<23	4,717	4.0	3							4,717	0.3	3
23≦G<24	5,727	4.9	7							5,727	0.4	7
24≦G<25	1,000	0.9	1							1,000	0.1	1
25≦G<26	6,443	5.5	4							6,443	0.4	4
Total	116,650	100.0	116	110,772	100.0	206	81,243	100.0	93	1,620,797	100.0	2483

Note :
Exclude
Muslimia - Joban Bec
Exclusive Line
Short-cut Line

3.3.3 Status Quo of Permanent Way Facilities

Major facilities of permanent way are as follows:

Railway Route Length	1,792km (1,540km)
Number of Track	Single Track
Number of Station	102 Stations
Number of Curve & Length	(888places, 379km)
Number of Gradient & Length	(2,390places, 1,158km)
Number of Bridge & Length	602, 21.8km
Number of Tunnel & Length	12, 7.5km

Note : The figures ( ) exclude Muslimia – Joban Bec, Exclusive Line, Short-cut Line

(1) Track

1) Rails and Switches

The rails laid over the line section constructed since 1970s are of P50 (50 kg/m) as defined per Russian Standards and its unit length is 25 m. (Fig.3.3.5) Over the route between Aleppo and Midan Ekbas and the route between Old Qamishli and Al Yaroubiye constructed during Ottoman Empire, P43 rails (43 kg/m) have been laid, and these rails have not been replaced since the time of rail installation unless the rails are damaged due to accident/s or other factors.

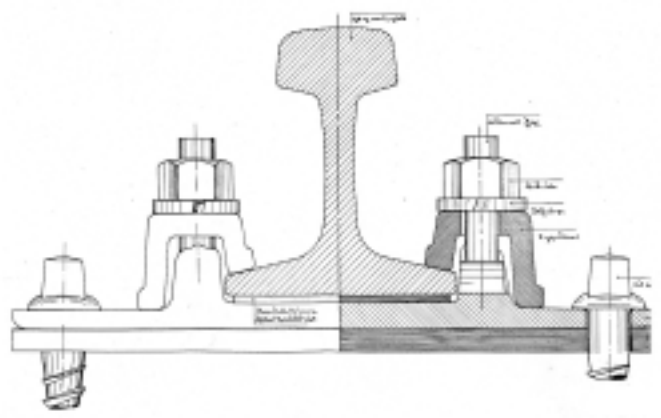

Fig.3.3.5 Rail and Fastening

Switch # 11 per Russian standard with P50 rails have been installed on main line while switch #9 with the same type of rails installed on sidings. (Fig.3.3.6)

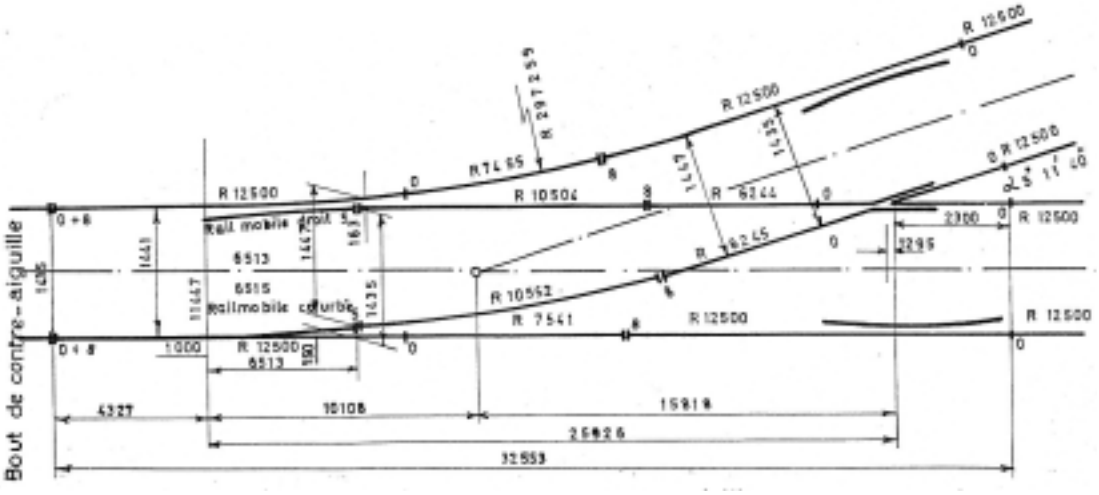

Fig.3.3.6 (1) Switch #11

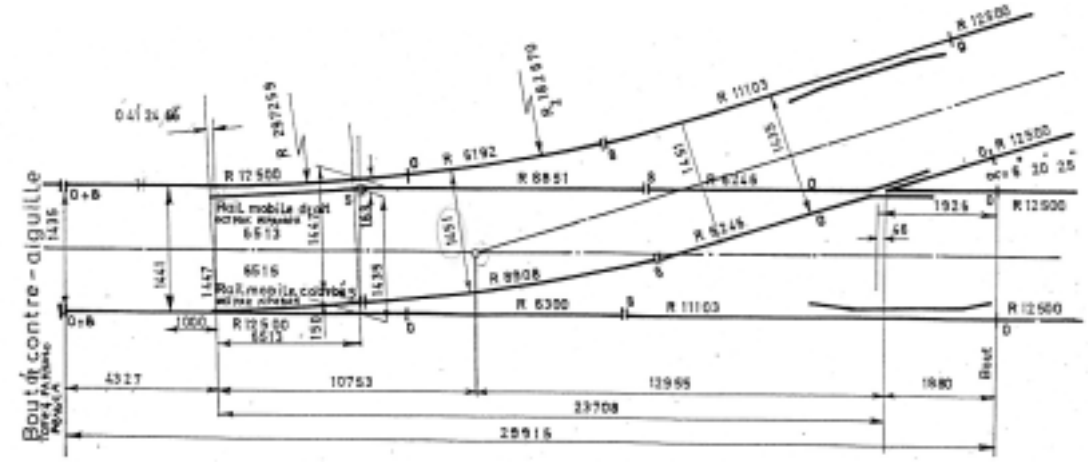

Fig.3.3.6 (2) Switch #9

Photo 3.3.1 Switch

2) Sleepers and Fastenings

Over the route constructed since 1970s, concrete sleepers have been placed. For rail fastenings, GESR initially adopted Russian Standard K2 tie plates. However, due to aging, initial wooden tie plugs are no longer suitable for secure tightening of bolts, therefore, replaced with plastic tie plugs. Since then, French made Rn and Russian Standard K6 have been adopted. Since a suitable type of fastening device to meet the GESR's requirements has not been determined yet, an alternative-fastening device is under study.

Photo 3.3.2 Concrete Sleeper and Wooden Tie Plug

Concrete sleepers are being manufactured by General Company for the construction of Syrian Railways; its capacity is 200,000 units/year, which is sufficient for the supply.

3) Ballast

Over the route constructed since 1970s, crush stone ballast have been placed, except earth fill roadbed on the route constructed prior to 1970s.

(2) Maintenance Condition

1) Track

The condition of track maintenance is generally good, however, compaction of ballast at rail joints is not sufficient. Rolling stock is subject to pitching (up-and-down movement) when passing over the joints. Between Mhine and Al Sharqia, sleepers at rail joints were replaced together with carrying out proper track maintenance. Since then the condition has been rectified. It is recommended to do the similar maintenance work in other sections. Since rail fastening bolts for concrete sleepers have not been properly tightened,

sleepers are not fastened rail at rail joint side at numerous locations. Also, rail pads are lost due to vibrations at many places. Track maintenance has been carried out with large track maintenance machinery; however, large irregularities in alignment and level were observed (due to lack of standards and criteria for track maintenance). As mentioned in 2) below, ballast outside the end of sleeper is in sufficient at many places because of falling down of ballast due to in sufficient width of roadbed. This results in occurring of irregularity of alignment.

As the maintenance of switches has not been properly carried out, speed restrictions have been imposed over straight track. In some locations, a large gap is seen between tie plates and tongue rail on which tongue rail is laid, thus the whole of switch is not properly leveled. Wooden sleepers for switches are not adequately placed, as there are gaps between dog spikes and tie plates. There are allegedly accidents occurred due to insufficient maintenance of switches, however, no records of the cause of accidents was made available to the JICA Study Team.

2) Roadbed

Over the line section constructed after 1970s, in particular on embankments, sufficient roadbed width has not been secured and there are observed many places where ballast is falling down from the end of sleepers to the slope of embankments. Provided that width of shoulders is secured, an allowance of about 60 cm should be available at both sides, however not available due to increased ballast depth under sleeper bottom and failure of slope shoulder.

Photo 3.3.3 Slope of Embankment

An area of approximately 40 km in length including Jawaief station between Al Jazira

and Abu Fas was heavily damaged by sandstorms; railway tracks are frequently buried during the transition of seasons (from dry season to rainy season, vice versa). About one meter depth of sands are piled up in a day or so, thus the Railway is struggling for a countermeasure. Especially in cut sections, such an adverse effect is evident. Although various steps are taken to solve this problem by cutting off the surface of cut sections, or planting trees in the surroundings, yet, no decisive measure is found so far.

Photo 3.3.4 Sandstorm

3) Railway Markers

Kilometer posts are generally installed at designated locations but 100m posts and 500m posts are installed on limited section. Gradient posts are partially installed, however, almost every one of them is illegible. Markers indicating the beginning of curve and the end of curve are rarely installed. These markers are criteria for track maintenance and are essential for train operations as well.

4) Level Crossings

Level crossings and adjacent tracks are not properly maintained causing large vibrations upon train passing. In terms of structure, pavement and others at roadside are well maintained while railway side is not capable of maintenance freely. Also, level crossing width is narrower than the road width at numerous locations thus affecting adversely the passing through the road. In addition, there are a number of private level crossings built by surrounding inhabitants, which have impaired train operations.

5) Others

At some line section where farm products are cultivated, ballast between sleepers was

removed for installation of water pipes for irrigation at many locations.

3.3.4 Railway Structures (Appendix 3.3.2)

Bridges, tunnels and structures crossing the railway are as shown in Table 3.3.3.

Table 3.3.3 Railway Structure

	Station to Station	Bridge		Tunnel	Drain	Remarks
		Concrete	Metal			
1	Lattakia – Tartous	23			167	
2	Tartous – Akkari	13			9	
3	Akkari – Homs 2	21			98	
4	Homs 2 – Sneisel	4			14	
5	Sneisel – Abu Dhour	37			69	
6	Abu Dhour – Wudehi	27			23	
7	Wudehi – Aleppo	16			42	
8	Wudehi – Lattkia	89	14	8 (Concrete)	154	
9	Homs 1 – Mhine	24			27	
10	Mhine – Al-Shrqia	64			200	
11	Mhine – Damascus	109			177	
12	Aleppo – Midan Ekbas		13	4 (Stone)	237	
13	Jubrin – Al-Sadaqa	21			56	
14	Al-Sadaqa – Al-Karama	19			56	
15	Al-Karama – Bir Juwaief	21			147	
16	Bir Juwaief – Old Qamishli	32			139	
17	Nusaibin – Al-Yaroubiye	6	8		55	
Total		567	35	12	1,670	

(1) Bridges

All bridges located between Aleppo and Midan Ekbas and those between Nusaibin and Al Yaroubiye as built during the end of the Ottoman Empire are erected with steel girders. As for steel girders, 3-span continuous deck truss, and through truss with a span of 74 m or spans of 21 to 50 m have been constructed. The bridges were designed with a 17-ton axle load by German technology during the aforesaid age, which have now caused a problem to introduce large traction force locomotives.

Photo 3.3.5 Haradara Bridge

The bridges on the lines section constructed after 1970s have been designed with a 25-ton axle load with concrete girders with a variety of spans of 3.0 to 34.2 m; composite girders with varying spans of 16.5 to 34.2 m have been used at mountain regions crossing deep gorges.

Although the concrete girders are aged more than 20 to 30 years, most of them are relatively in a good condition. Although main reinforcing bars are partially exposed due to a shortage of minimum concrete cover during the construction, and cracks were observed along the main reinforcements, these failures are not susceptible to a rapid malfunction to the bridges. The designed function of bridges can be sustained by making periodic remedies under a cautious planning.

(2) Tunnels

A total of 12 tunnels consisting of four between Aleppo and Midan Ekbas and eight between Wudehi and Lattakia have been driven. The former tunnels are constructed of stone masonry while the latter constructed of concrete. The breakdown is as shown in Table 3.3.4.

Table 3.3.4 Table of Tunnel

	Station to Station	Km - km	Length (m)	Quality	Remarks
	Lattakia Line				
1	Jisr Elshogour — Budama	134 - 135	1,101.51	Concrete	
2	Jisr Elshogour — Budama	137 - 138	625.80	Concrete	
3	Budama — Bibar	147 - 149	1,862.90	Concrete	
4	Bibar — Sheikhana	151 - 151	296.00	Concrete	
5	Bibar — Sheikhana	161 - 161	291.50	Concrete	
6	Bibar — Sheikhana	161 - 161	206.00	Concrete	
7	Bibar — Sheikhana	162 - 163	495.00	Concrete	
8	Sheikhana — Al-Kabir	177 - 179	1,600.00	Concrete	
	Sub Total		6,478.71		
	Midan Ekbas Line				
1	Midan Ekbas — Rajo	557 - 557	130.00	Stone	R=400
2	Midan Ekbas — Rajo	563 - 563	165.00	Stone	R=400
3	Midan Ekbas — Rajo	565 - 565	540.00	Stone	R=400
4	Afrin — Qatma	606 - 606	235.00	Stone	R=400
	Sub Total		1,070.00		
	Grand Total		7,548.71		

3.3.5 Track Maintenance

(1) Standards and Criteria

Track maintenance has been carried out according to Russian Standards. Regarding respective items, evaluations are made dividing into five different ranks, and where it exceeded “Rank 3”, maintenance has to be carried out.

Various items are shown in Table 3.3.5 (1) and (2).

Table 3.3.5 (1) Gauge

(Unit : mm)

Rank	Gauge (−)		Gauge (+)			
	1435	1445	1435 R≧350	1445 349≧R≧300	1450 R≦299	1455
1	1 – 4	1 – 4	1 – 8	1 – 8	1 – 8	1 – 6
2	5 – 6	5 – 10	9 – 11	9 – 11	8 – 11	—
3	7 – 8	11 – 12	12 – 16	11 – 16	—	—
4	9 – 10	13 – 14	16 – 26	—	—	—
5	Over 10	Over 14	Over 26	Over 16	Over 11	Over 6

Table 3.3.5 (2) Longitudinal Level, Torsion, Cross Level and Alignment

(Unit : mm)

Rank	Longitudinal Level (*)	Torsion (**)	Cross Level	Alignment (*)
1	1 – 10	1 – 8	1 – 6	1 – 3
2	11 – 15	9 – 12	7 – 12	4 – 5
3	16 – 20	13 – 16	13 – 16	6 – 7
4	21 – 25	17 – 20	17 – 20	8 – 9
5	26 – 35	21 – 30	21 – 25	10 – 17
	Over 35	Over 30	Over 25	Over 17

Note: (*) over 20m chord (**) 5m interval

(2) Maintenance of Way System

Maintenance of way system is composed of 1 Bureau, 7 Departments, 18 Divisions at Headquarter in Aleppo, while 3 regional Bureaus i.e., (North, East and Central Bureau), 10 Maintenance of Way Offices under regional Bureaus, and 32 sub-districts with 92 gangs along the line are responsible for the maintenance of way.

The number of regular staff is 224 in the headquarters, 92 in the regional bureaus, and 2,920 in the maintenance of way offices totaling to 3,236. The responsible range of respective gangs is extended to 20 to 25 km, and 9 to 12 gangers are deployed at each location. Gangers and watchmen are deployed at 92 locations and its total number is 1,016.

(3) Maintenance Material Volume

An annual average volume and quantities of materials used for maintenance per 1 km of track length classified by type are as shown in Table 3.3.6.

Table 3.3.6 Annual Quantity of Material Used for Maintenance

Description	No. Per Track 1 km
Steel Sleeper	2
Concrete Sleeper	5
Wood Sleeper	50
Rubber pad with Steel plate	10
Fishplate	6
Fastening Bolt & Nut for Sleeper	40
Fastening	3

The annual volume of ballast and sand used for maintenance on whole network is 35,000 m^3 and 9,000 m^3 respectively.

(4) Maintenance of Way Machinery and Equipment

2 self-propelled track geometry cars are on hand, however, one of them is outdated and merely used for the transport of gangers. The other one runs through the entire line inspecting the track geometry once every six months. The results of inspections and measurements are notified to respective depots for the planning of maintenance of way. However, statistical analyses are not conducted of those data gained by the track geometry-recording car for the management of respective track conditions.

Although large heavy-duty machinery is allocated for maintenance of way, those introduced at the onset of construction in 1970s are now deteriorated thus not useful any more. Existing machinery controlled by the headquarters is organized into a mechanized gang and actively performing the required work at strategic points.

Large heavy-duty machinery and equipment and tools provided at respective mechanized gangs are shown in Table 3.3.7 and Table 3.3.8.

Table 3.3.7 Table of Track Maintenance Machines

Description		Type	Quantity	Starting Date for Usage	Installation Place
1	Lifting, leveling, lining, & tamping machine (Multiple Tie Tamper with lining)	07-32 (Plasser)	1	1974	Deir Ezzor
2	Ballast profiling machine	USP-3000C (Plasser)	1	1974	Homs
3	Ballast consolidating machine	VDM-800 (Plasser)	1	Description	Kamishli
4	Track Recording machine	PV-6 (Matisa)	1	1974	Homs
5	Lining & leveling machine (Multiple tie tamper)	AL-250 (Plasser)	1	1970	Kamishli
6	Lifting, leveling, lining, & tamping machine (Multiple Tie Tamper with lining)	07-32 (Plasser)	1	1979	Director
7	Ballast profiling machine	PBR-103 (Plasser)	1	1979	Kamishli
8	Ballast consolidating machine	VDM-800 (Plasser)	1	1979	Director
9	Track crane (25ton)	KDE-235 (Russia)	2	1979	Homs Deir Ezzor
10	Track crane (16ton)	KDE-163 (Russia)	2	1979	Aleppo Lattskia
11	Trolley equipped with crane	Domelli (Italy)	3	1981	Tartus Homa Aleppo
12	Trolley equipped with crane	Glismac (Italy)	5	1983	Jubrin Lattakia Homs Damascus Der Ezzor
13	Trolley equipped with crane	Agimo (Russia)	5	1970	Lattakia Homs Hama Rakka Kamishli
14	Sand removal machine	SRM (Plasser)	1	1982	Deir Ezzor
15	Ballast cleaning machine (Ballast Cleaner)	RM76-HR205 (Plasser)	1	1982	Director
16	Tamping machine (Tie Tamper)	Minima II (Plasser)	6	1982	Hama Aleppo Deir Ezzor Homs Rakka Kamishli
17	Lifting, leveling, lining, & tamping machine for switch (Multiple Tie Tamper with lining)	07-275 (Plasser)	1	1982	Director
18	Track evaluating machine (Track Recording Car)	EM-80 (Plasser)	1	1982	Director
19	Lifting, leveling, lining, & tamping machine (Multiple Tie Tamper with lining)	08-32 (Plasser)	2	1996	Director
20	Ballast profiling machine	SSP-203 (Plasser)	2	1996	Director
21	Ballast consolidating machine	VDM-1000 (Plasser)	2	1996	Director
22	Trolley equipped with crane	OBW-10R (Plasser)	1	196	Director
23	Screw wrench machine	SW1000	3	1997	Aleppo Homs Kamishli
24	Sleeper replacer	11CX-RR (France)	3	1998	Aleppo Homs Kamishli

Table 3.3.8 Table of Track Maintenance Tools

No.	Description	No.	Description
1	Track maintenance Trolley	13	Track measurement device
2	Track trolley trailer	14	Track gauge adjuster
3	Electric generating set with distributing box	15	Optic measurement device (transit and level)
4	Hydraulic aligner	16	Ballast fork
5	Rail expansion gap expander	17	Tamping pick
6	Hydraulic rail straighten	18	End open spanner (36x37)
7	Rail electric saw (cutter)	19	Hammer (different weights)
8	Track electric tamper	20	Shovel
9	Lifting jack	21	Manual saw
10	Rail electric drill	22	Rail grinder
11	Portable telephone	23	Manual sleeper screw wrench
12	Coach screwing machine		

3.3.6 Education/Training

(1) Education/training in Railway Academy

Education/training requested by the headquarters are being carried out for the railways employees to enable them to master technical know-how at the training center of the Railway Academy as described in Table 3.3.9.

Table 3.3.9 Details of Education for Railway Facilities

Courses	Educational Background	Experience in years	Course Duration	Remarks (Purpose)
Gangers	4 to 6 years	—	17 weeks	Newcomers
Upgrading of Gangers	6 to 9 years	1 to 5 years	9 weeks	Retraining
Maintenance Vehicle Drivers	Ditto	2 to 5 years	9 weeks	Promotion
Foremen	Ditto	—	43 weeks	Promotion
Upgrading of Foremen	Ditto	1 to 5 years	13 weeks	Retraining
Upgrading of Gang Chiefs	12 years	1 to 5 years	13 weeks	Promotion
Upgrading of Gate Keepers	3 to 5 years	1to 5 years	4.5 weeks	Promotion

Educations/training is not conducted for new technology and for the case when new machinery introduced. There is also a problem in recruiting qualified engineers capable of giving lectures in the training center.

(2) On-the-Job Training at Job Sites

Allegedly, on-the-job trainings are not carried out at job sites to learn the technical know-how for track maintenance.

3.3.7 Securing Safe and Stable Transport

Existing facilities and provisions are the same as those under which trains (passenger 120 km/h and freight 100 km/h) were operated during the initial age after construction. Since satisfactory maintenance of way has not been carried out, speed restrictions are inevitably imposed on some section. Problems to be solved in the future to resume design speeds and to maintain safe and stable train operation are as described below:

(1) Urgent Matters

1) Remedy to the low rail joints

Replacement of sleepers where rail fastening is not possible, straightening of rails, placing sufficient volume of ballast and compacting with a tie-tamper to prevent up-and-down movements (vertical movement) and at locations where ballast is consolidated, replacement with new ones.

2) Rectification of Switches

Ballast of switches on the main line are consolidated and the level is not even. All the ballast should be replaced, securing designed ballast depth and then compacted properly. Replace damaged and defective parts of the switch with new ones, securing designed dimensions of each part.

3) Maintenance of Level Crossing and Securing Safety

Almost no maintenance is carried out for the track at level crossings, ballast under the sleepers is consolidated and maintenance standards are not complied with. In an extreme case, the alignment at both sides of level crossing is inappropriate. Removing all the pavements of level crossings, replacing all the ballast, the structure should be altered to a type so as not to receive all the road traffic loads directly upon the track skeleton at level crossings.

All the trains passing through level crossing reduce the train speeds in Syria. It should be

noted that trains in advanced countries run through level crossings at normal speeds.

A decisive legislative rule should be applied to the passing of motor vehicles at level crossings; on the other hand, the Railway side should take necessary measures required for the legislation such as provision of necessary warning signs and marking for the protection of accidents.

(2) Improvements of Maintenance of Way

1) Modernized Control of Track Geometry

The entire track geometry is inspected with a track-recording car once every 6 months. Based on the results, maintenance of way is carried out, however, the results of the inspections are not fully utilized. Since no indication is made to the control limits line for respective items to be measured, failures exceeding slightly the limits are presumably overlooked, although a large irregularity could be easily detected. A system should be established to control statistical values by which the most recent results of measurements could be readily compared with the previous measurements.

2) Preparations of Track Management Log

Although profiles were available to the Study Team under this survey, those are the data used at the time of construction stage; depending on the locations, several different kinds of drawings were furnished. It was difficult for the Study Team to understand which drawing was appropriate one for existing condition.

When the Study Team surveyed the work carried out by mechanized gang at site, the maintenance was carried out targeting at the good maintenance level of the nearby track, therefore the maintenance standard level was varied depending on the locations.

It is necessary to establish an absolute standard by which track maintenance should be performed. It seemed that the original alignment as constructed was not maintained due to placing of additional ballast for remedy. Surveying should be carried for the entire route, setting up a new alignment, recorded on the log, and then maintenance should be carried out based on the standard values on the log.

3) Setting up Track Maintenance Plan

A survey was made to the maintenance plan throughout the year for track and related facilities. It revealed that only maintenance was aimed at defects and failures without indicating any intentional annual plan for the work.

This fact is probably due to the limited number of workers i.e. 10 or so allocated for a work range (average track length of 30 km). Under such a condition, maintenance as planned cannot be possible except for only urgent remedies as required.

Although large machinery is deployed at each line maintenance depot, it is assumed that they are not fully capable of meeting the requirements because of aging. It is necessary to reorganize the system with incorporating new heavy-duty machinery together with deploying a larger mechanized gang to enable them to perform intended maintenance work. In connection with this step, on-the-job training especially for chiefs of gangs should be thoroughly made and line maintenance work should be standardized.

Since track conditions considerably vary depending on the district, Superintendent of Track Maintenance Depot who controls the district should be given an authority.

4) Preparations of Civil Engineering Structures Log

Most of the structures are aged more than 20 to 30 years. These structures will be further deteriorated rapidly in the near future, thus an increase in repairs is most likely.

Especially in concrete structures, large cracks and separation of concrete exposing reinforcing bars were observed. It is recommended that current conditions of respective types of structures be logged in for the control as soon as possible.

Regarding earth-fill structures and embankments in particular, roadbed width is insufficient at numerous locations. As an extreme case, ballast fell out of the end of sleepers over embankment slope.

3.4 Signal and telecommunication system

3.4.1 Signal system (the present situation)

The GESR operates its signal system in the railway lines except the section Qamishli to Al-Yaroubiye, Sharbit to Roueisa and Muslimia to Midan Ekbas.

The color lights speed signal system is adopted as the standard signal system in the GESR.

The signals are classified according to the usage as Home Signal ,Starting Signal ,Crossing Signal ,Track Signal ,Distant Signal ,Shunting Signal ,Humping Signal, Shut Signal and Repeated Signal. (Based on the Signal System in GESR)

Signal equipment and devices to constitute the GESR signal system are divided into two main types.

Type1

This type1 of signal equipment and devices were installed at the end of 1969,and has been used since 1971 for the section between Lattakia and Allepo,Allepo and Qamishli. (Fig 3.4.1)

This type adopts a blocking system between stations. Track circuits (DC) are installed only at the entrance/exit of the stations.

The direction of train operation is decided between neighboring station masters using block equipments through telecommunication lines. (Tokenless blocking system)

Employee in charge handles switch manually by using a key (control key) and set it into the device in the switch-man house at the station.

These devices are connected to the block equipment and interlocked. (Dispersion interlocking)

The station master is able to indicate the signal after confirming the train direction with related neighboring station master through block equipments and switch-man setting control key correctly.

In this type, the signal relay, track relay and power supply devices are installed near to the signals and track circuits.

In the major stations having complicated track layout such as Allepo and Jubrin, the track circuits (AC) are installed for all the tracks in the station area , besides for the track at the entrance/exit of the station , and the switches are handled and checked by the switch machine

(DC 160V) remotely from the center of the station even in this type1 .

Fig 3.4.1 Signal devices of Type 1

Type 2

This type of signal equipment and devices were installed at the beginning of 1980,and has been used since 1982 for the section between Hamidia and Damascus (F), Homs and Tartous, Mhin and Al-Sharqui.

Tarous, Mhine and Al-Shaqia.

This type also adopts a blocking system between stations.

The track circuits (AC) are installed for all the tracks in the station area , besides for the track at the entrance/exit of the station , and the switches are handled and checked by the switch machine (AC380V) remotely from the station master's room .

The station master is able to indicate the signal after switching key correctly on the control board and confirming the train direction with related neighboring station through block equipment. (Tokenless blocking system)　(Centralized Interlocking)

In the type2, main signal equipment and devices such as signal relay and track relay are

installed in the centralized signal house in the stations.

Fig.3.4.2 Control board of Type 2

The Table 3.4.1 shows the summary of signal equipment of the GESR.

Table 3.4.1 Summary of Signal Equipment of the GESR

Equipment	Kind	Lattakia Qamishli	(Allepo) Midan Ekbas	Tartous (Homs)	(Mhine) Al-Sharqia	(Aleppo)* Damascus	(Lattakia) (Tartous)	(Qamishli) Al-Yaroubiye
	Line length (km)	740	117	96	110	395	99	51
		Type1	no signal	**Type2**	**Type2**	**Type2**	no signal	no signal
(number of equipment)			equipment				equipment	equipment
Corour light signal		624		184	103	452		
Track circuit	AC	184		164	112	480		
	DC	196						
Interlocking	R.I. Concentrated	5		8	4	22		
	C.K. Dispersion	34						
Switch	Power,remote(DC)	171						
	(AC)			115	60	277		
	manual,local	285						
Signal Equipment		1		1	14	4		
at Level crossing								

*except Ansari Wudehi

3.4.2 Telecommunication System (the present situation)

Telecommunication equipment of GESR is installed along all their railway lines.

Type1

As for telecommunication wired line, 8 lines of over head bare wire are installed and used in the section between Lattakia and Allepo, Aleppo and Qamishli, 4 lines of over head bare wire are installed in the section between Allepo and Midan Ekbas. (Bare Wire Section)
These lines were constructed at the end of the1969 and have been used since 1970.

Type2

Telecommunication cables (7Q1.4mm) are buried in the ground along the section between Aleppo and Damascus (F), Tartous and Homs ,Mhine and Al-sharqia. (Cable Section)
These cable lines were constructed at the early 1980's and have been used since 1982.

Type3

There is no telecommunication wired line in the section between Qamishli and Al-Yaroubiye, Lattakia and Tartous. (No Wire Section)

These telecommunication wired lines are dedicated to the train operation control such as the blocking lines between stations, dispatching order lines from the Allepo, etc.
In the section (**Type1)**, necessary communications among stations, depots and managing place like head office are limited, and quality of communications is not stable.
In the section (**Type2)**, necessary communications among the head office, stations, dispatcher center and maintenance depots are smooth, and quality of communications is stable by using carrier system.

The PABX (Private Automatic Branch eXchange) systems are prepared in the necessary stations such as Allepo, Tartous and other major station.
However PABX systems in the section (**Type1)** are not connected to each other due to the shortage of communication lines, contrary PABX systems in the section (**Type2)** are networked with each other.

The radio communication systems have been constructed using frequency band of 400MHz

since 1993 for the local communication links between the neighboring stations, station and train crew.

These radio communication systems are used in the all section of the GESR except one part of the Al-Sharqia line (will be equipped in this year).

For yard operation, movable radios of 415MHz band are used.

The long radio communication link is not installed for the railway communication.

The Table 3.4.2 shows the summary of the telecommunication equipment of the GESR.

Table 3.4.2 Summary of Telecommunication Equipment of the GESR

Equipment	Kind	Lattakia Qamishli	(Allepo) Midan Ekbas	Tartous (Homs)	(Mhine) Al-Sharqia	(Aleppo) Damascus	(Lattakia) (Tartous)	(Qamishli) Al-Yaroubiye
	Line length (km	740	117	96	110	395	99	51
		Type1	Type1	Type2	Type2	Type2	Type3	Type3
O.H.bare wire	8lines	740						
(km)	4lines		117					
Cable	7Q1.4mm			96	110	395		
PABXwithout network	without network	7						
	with network	1		2	1	4		
Carrier Terminal (set)				1		3		
Radio	Base Station	33	6	9	1	25	6	3
	Relay Station	8				3		
Dispatcher line		○ D1andD2	○ D1	○ D3	○ D4	○ D4	×	×
Block line		○	×	○	○	○	×	×
Station to Station line		○	×	○	○	○	×	×
Operator to Station line		○	×				×	×
Communication line		○	×	○	○	○	×	×
for mentenance engineer								
						*except Ansari Wudehi		

3.4.3 Electrical Power Supply

The electrical power is supplied to almost all stations for the activating lights of the station, signal and telecommunication equipment or devices by either of the following three types of method.

Moreover for the case of power off, battery back up systems are prepared in signal and telecommunication system. The diesel generator is also provided in the major stations.

Type1

The 20KV lines of the electric power company are led to the transformer in the station.

Type 2

The 20KV lines of the GESR diverged from the 20KV lines of the electric power company are led to the transformer in the station.

Type3

The 20KV lines of the GESR from the substation of the electric power company are installed along the railway line and led to the transformer in the each station.

These lines have been constructed by degrees since 1976.

The Table 3.4.3 shows the summary of the power supply of the GESR.

Table 3.4.3 Summary of Power Supply Devices of the GESR

transformer capasity		Lattakia Qamishli	(Allepo) Midan Ekbas	Tartous (Homs)	(Mhine) Al-Sharqia	(Aleppo) Damascus	(Lattakia) (Tartous)	(Qamishli) Al-Yaroubiye
Line length (km)		740	117	96	110	395	99	51
(number of statioos)								
100KVA and the less	Type1	26						
	Type2	1						
	Type3	8		6	5	14		
200KVA-400KVA	Type1	4				1		
	Type2							
	Type3			1	1	5		
500KVA-1800KVA	Type1	2		1		1		
	Type2							
	Type3	1		1		2		

*except Ansari Wudehi

3.4.4 Maintenance system (the present situation)

The Table 3.4.4 shows the number of electrical engineer stationed along the railway lines. The equipment and devices are maintained by electrical engineer stationed in the Table 3.4.4.

Table 3.4.4 Number of Electrical Engineer in the GESR

			Signal		Telecommunication		Electrical		Diesel Generater	
		Enginer	Technical assistant	worker	Technical assistant	worker	Technical assistant	worker	Technical assistant	worker
Division	Depot									
Head Office		13								
Aleppo		4								
	Maarret Ikhwan		2	3	5	2				
	Kafar Halab		1	3						
	Ansari		12	3	2		1	2		
	Aleppo		16	4	11	7	15	13	7	5
	Tel Rifaat				3	1				
	Qatma				2	4			1	1
	Jubrin		7	3	6	1	1	2		
	Sheikh Ahmad							1		
Lattakia		8								
	Lattakia		7	3	4	2	3	5		
	Sheikhana							2		
	Budama			1	1	3				
	Jisr Elshogour		2			2				2
	Mhambel		4		3	2	1			
	Bishmaroun		2	2	4		2			1
	Jabla				1	1		2		
Homs		4								
	Tel Kalakh							1		
	Al-Khanse				1			1		
	Homs		7	8	6	7	7	6		
	Kaarbettir						1			
	Mhine						1	2		
Damascus		8								
	Damascus(F)		7	3	3	2	1	1		
	Damascus(p)				5					
Hama		1								
	Hama		6	1	4	3	7			
	Qoumhane		1							
	Kafar Buhom		2							
	Sneisel		1		1		1			
	Abu Dhour			1	1			1		
Tartous		9								
	Baniyas				1	1	1	1		
	Tartous		6	2	6		4	1		
	Akkari						1			
Qamishli		4								
	Al-Sadaqa				1					
	Hneida		1							
	Raqqa		3	1	1	2	1	1		
	Deir el-Zor		3	4	2	3	3			
	Hassaka		3	2	2	3	3	1		
	Qamishli		5	4	4	5	2	4	2	

Table 3.4.5 shows training courses for electrical engineer provided in the training center of the GESR.

Training for technical assistant and workers are conducted systematically in the training center of the GESR in Allepo.

Table 3.4.5 Training Course of Electrical Engineer provided in the training center of the GESR

Training Course	qualification		weeks	hours
	experience	graduation		
signal				
worker levelup course1	1-5years	junior high school	5	136
worker levelup course2	1-5years	junior high school/high scool	17	476
technical assistant qualification course	1-5years	railway school	17	472
technical assistant levelup course	1-5years	high school	26	728
telecommunication				
worker levelup course1	1-5years	junior high school	6	136
worker levelup course2	1-5years	junior high school/high scool	17	476
technical assistant levelup course	1-5years	high school	13	364
electric				
worker levelup course1	1-5years	junior high school/high scool	9	252
technical assistant levelup course	1-5years	high school	17	476

3.5 Operation, Management and Financial Standings

3.5.1 Management Form

GESR is an independent enterprise, but its capital is almost paid-up by Syrian Government and the Government has the right to appoint the Director General. GESR has not been granted subsidy from the Government to make up for the deficit, but the necessary funds for the projects with the approval of the Government are supplied with no interest. As a result, there is no problem of cash flow for GESR. As a matter of fact, this means that GESR has a feature similar to one of the Government Organizations. The restructuring of management such as separation of account, division of business and privatization has not been studied or planned at present though some of them may be possible in future.

3.5.2 Financial Standings

(1) Accounting System

Syria has the general accounting rule established by the Government. By this rule, each accounting item is given its own code number and both GESR and GEHR are handling accounting business according to the same rule. It partly has a little bit different provision from general rule in Japan. For example, the products manufactured not for selling outward but for own use are included in the amount of sales, but roughly speaking it is not considered that there is a big problem in the rule in view of the general accounting principle.

(2) The Scale of Management

GESR almost concentrates on railway business. More than 90 % of its total revenue comes from transport.

The records as from 1995 show that GESR has been overwhelmingly devoted to freight transport. The transport volume of passengers is less than 10 % of the whole. Decrease of the number of passengers is particularly significant from 1997 in which the number of passenger train operation was cut drastically. In 1998 and 1999, the transport volume did not reach half of 1995 and the share to total transport was also only less than 5%. As a result, total transport volume for these 5 years remained almost on the same level although freight transport increased about 20% during the same period (Please refer to Table 3.5.1).

The records in 1990 shows that passenger transport was 4,050 thousand persons (1,140 million person/km) and freight was 5,240 thousand ton (1,265 million ton/km). That means the transport volume of GESR has followed the tendency toward the sharp decrease of passengers and the mild increase of cargo for nearly 10 years.

Table 3.5.1 Volume & Revenue of Transportation (GESR)

ITEM	UNIT	1995	1996	1997	1998	1999
VOLUME						
NUMBER OF PASSENGERS	THOUSAND PERSONS	1,752	1,602	1,132	804	848
INDEX	1995=100	100	91	65	46	48
TRANSPORTED KM (PASSENGERS)	MILLION PASSENGER·KM	492	452	292	181	187
INDEX	1995=100	100	92	59	37	38
TRANSPORTED FREIGHT	THOUSAND TONS	4,318	4,653	4,937	4,981	5,445
INDEX	1995=100	100	108	114	115	126
TRANSPORTED KM (FREIGHT)	MILLION TON·KM	1,285	1,364	1,439	1,430	1,577
INDEX	1995=100	100	106	112	111	123
TOTAL	MILLION PASSENGER／TON·KM	1,777	1,816	1,731	1,611	1,764
INDEX	1995=100	100	102	97	91	99
REVENUE						
PASSENGER		86,420	80,844	52,585	32,640	32,851
INDEX	1995=100	100	94	61	38	38
SHARE	%	8.2%	6.9%	4.0%	2.4%	2.3%
FREIGHT		969,050	1,099,255	1,277,407	1,341,565	1,398,848
INDEX	1995=100	100	113	132	138	144
SHARE	%	91.8%	93.1%	96.0%	97.6%	97.7%
TOTAL		1,055,471	1,180,099	1,329,992	1,374,206	1,431,698
INDEX	1995=100	100	112	126	130	136
SHARE	%	100.0%	100.0%	100.0%	100.0%	100.0%

(3) Profit and Loss Status

Financial results of GESR recorded deficit every year from 1978 to 1996 and total loss amounted to 1,784 million pounds (Table 3.5.2), but then the situation changed.

Table 3.5.2 Accumulated Loss of GESR

(UNIT: SYRIAN POUND)

CODE	YEAR	AMOUNT
17901	1978	14,335,122
17902	1979	10,816,163
17903	1980	35,238,190
17904	1981	7,196,718
17905	1982	14,706,477
17906	1983	66,234,041
17907	1984	50,282,959
17908	1985	10,430,056
17909	1986	57,231,244
17910	1987	91,027,375
17911	1988	49,161,772
17912	1989	73,806,577
17913	1990	122,825,808
17914	1991	119,734,015
17915	1992	46,845,585
17916	1993	145,170,692
17917	1994	254,155,103
17918	1995	274,884,805
17919	1996	339,852,893
TOTAL		1,783,935,595

In 1997 revenue and expenditure were balanced and GESR recorded profitable results for two successive years in 1998 and 1999. According to GESR the reason why the profit and loss situation was improved is drastic cut of unprofitable passenger transport

operation. In 1998 liberalization policy of importing and operating buses was introduced. As a result, bus transportation has become active and it has become easier for GESR to reduce the number of passenger trains. On the other hands increase of freight charge for 15% from October 12, 1996 (original draft for 28% up was curtailed by the Government) also contributed to the improvement of profit and loss status.

It is certain that rate of operating cost on operating revenue of GESR was improved remarkably from 1997 onwards, but it is still not enough to get operating profit. Besides total personnel cost has been increasing during this period and decrease of operating cost has mainly depended on cost of equipment, materials and others (Table 3.5.3). One of the reasons why GESR could gain final profit is increase of interest earned and dividend from subsidiary in non-operating revenue (Table 3.5.4).

GESR has only one subsidiary established in 1995 by dividing its division of railway construction and maintenance. It produces and sells electric light poles and construction materials as well as being engaged in GESR's railway construction and maintenance. In principle all profit of the subsidiary is to be paid to GESR as dividend.

Table 3.5.3 Rate of Operating Cost on Operating Revenue

(UNIT: THOUSAND SYRIAN POUNDS)

ITEM	1995	1996	1997	1998	1999
OPERATING REVENUE (A)	1,059,131	1,188,330	1,334,243	1,410,551	1,466,004
INDEX (1995=100)	100	112	126	133	138
OPERATING COST (B)	1,353,391	1,568,406	1,415,265	1,421,657	1,515,301
INDEX (1995=100)	100	116	105	105	112
PERSONELL COST	744,353	813,529	814,721	892,285	905,956
INDEX (1995=100)	100	109	109	120	122
OTHERS	609,038	754,877	600,544	529,372	609,345
INDEX (1995=100)	100	124	99	87	100
RATE (B／A)	127.8%	132.0%	106.1%	100.8%	103.4%

Table 3.5.4 Dividend & Interest in Non-operating Revenue

(UNIT: THOUSAND SYRIAN POUNDS)

ITEM	1995	1996	1997	1998	1999
DIVIDEND FROM SUBSIDIARY	0	15,070	35,120	17,230	24,384
INTEREST EARNED	3,393	1,054	2,883	15,595	34,954
BANK DEPOSIT	280,803	320,403	1,087,381	2,314,121	2,583,527
FUNDS BY MOF	4,570,332	5,560,152	7,184,803	9,618,427	7,914,890

On the other hands necessary funds are supplied from the national budget to the projects approved by the Government and such funds remain in the hands of GESR till payment is made to manufacturers of rolling stock or construction companies. For the past few years GESR was permitted to buy new type of locomotives from France and has received much money from the Government for payment of the purchase price. However, the delivery of

the locomotives and the payment of the price were delayed because a lot of troubles happened. As a result much of the funds received from the Government remained in the bank account of GESR and are bearing interest.

Of these two factors increasing non-operating revenue, dividend from subsidiary will be expected to some extent as far as its management goes well, but the interest on deposit is only temporary. Ironically it was the results of the situation unfavorable to GESR and will not be obtained in future constantly. To continue profitable basis of GESR's financial standings, it is very important to make the work of the transport division more efficient by resolving the troubles with the new type of French locomotives and putting them into operation as soon as possible. Increase of profit in the transport division must cover interest revenue for the past few years.

(4) Indices for Management Analysis

From Balance Sheets and Profit & Loss Statements of GESR several indices for profitability, safety and productivity are calculated and the results are shown in Table 3.5.5. Before calculation, Balance Sheets were revised.

Table 3.5.5 Indices for Management Analysis

ITEM	1995	1996	1997	1998	1999
INDEX FOR PROFITABILITY					
RATE OF RETURN ON TOTAL ASSETS (%)	-3.2%	-3.8%	0.0%	0.1%	0.3%
RATE OF RETURN ON EQUITY (%)	-12.2%	-18.9%	0.0%	0.7%	1.1%
RATE ON RETURN ON OPERATING REVENUE (%)	-26.0%	-28.6%	0.0%	1.0%	4.1%
TURNOVER OF OPERATING REVENUE ON TOTAL ASSETS	0.12	0.13	0.10	0.08	0.08
INDEX FOR PRODUCTIVITY					
TRANSPORT REVENUE PER EMPLOYEE (THOUSAND)	105.3	116.6	128.9	129.9	132.8
PASSENGER／TON･KM PER EMPLOYEE (THOUSAND)	177.3	179.4	167.7	152.3	163.7
INDEX FOR SAFETY					
RATE OF EQUITY ON TOTAL ASSETS (%)	26.3%	19.9%	13.2%	10.0%	30.4%

As for indices for profitability, rates of return improved from the bottom in 1996, but only turnover of operating revenue on total assets was at low level and is gradually deteriorating. It is because GESR has so many Fixed Assets still not in work though payment of the purchase price has been made partially or totally (Fixed Assets in Progress). This means that GESR cannot fully utilize its assets for acquiring revenue. In 1998 amount of Fixed Assets in Progress (not in work) was especially big and was more than usual Fixed Assets because new type of locomotive purchased from France could not start operation. This is really an extraordinary situation. (Table 3.5.6)

Table 3.5.6 Fixed Assets & Fixed Assets in Progress

(UNIT: THOUSAND SYRIAN POUNDS)

ITEM	1995	1996	1997	1998	1999
FIXED ASSETS	5,688,406	6,730,743	6,679,887	6,679,812	9,785,897
FIXED ASSETS AFTER DEPRECIATION	4,801,653 71.5%	5,667,681 76.9%	5,549,221 49.4%	5,481,542 38.8%	8,512,751 69.1%
FIXED ASSETS IN PROGRESS	1,914,347 28.5%	1,705,185 23.1%	5,694,061 50.6%	8,663,660 61.2%	3,804,497 30.9%
TOTAL	6,716,000 100%	7,372,866 100%	11,243,282 100%	14,145,202 100%	12,317,248 100%

Increase of Fixed Assets in Progress is to some extent inevitable for Syria. GESR must import most of its rolling stock and machinery from overseas. After payment of the purchase price long shipping period is required. However, it is undesirable to have troubles with knockdown, adjustment and trial after arrival of equipments and to waste so may days. For that purpose, GESR should review conditions of the contracts and request technical assistance of the manufacturers for the earliest possible operation of equipments in addition to improvement of payment conditions.

As for indices for productivity, transport revenue is increasing, but transport volume is decreasing per employee. During the period, transport volume remained almost at the same level, but the number of staff members has been expanding year by year As it is difficult to fire an employee, once hired, it should be restrained to employ a person not in proportion to increase of transport volume.

Rate of equity on total assets as index for safety went down every year until 1998, but in 1999 the new stocks for 3,373 Million Pounds were issued and fully paid-up by the Government. The rate was also remarkably up. So far Syrian Government has made sufficient financial assistance to GESR by providing with funds bearing no interest from the national budget, but the capital increase is highly appreciated because it strengthens the basis of GESR's management and makes the Government support to GESR clearer (Refer to Table 3.5.7).

Table 3.5.7 Paid-up Capital of GESR

(UNIT: SYRIAN POUNDS)

YEAR	1998	1999
MINISTRY OF FINANCE	3,201,356,067 89.3%	6,574,356,067 94.5%
OTHERS	383,643,933 10.7%	383,643,933 5.5%
TOTAL	3,585,000,000 100%	6,958,000,000 100%

(5) Break Even Point Analysis

Break Even Point is the point at which the sales (revenue) and the total cost used to

acquire the sales are the same. In other words it is the amount of sales being just able to collect the expenditure. Any enterprise can get profit only by selling more than the Break Even Point. Rate of Break Even Point on sales is called Break Even Point Ratio. The lower this Ratio is, the higher the profitability of the enterprise. Such a company is able to get over the change of economic situations like depression.

To calculate Break Even Point all expenditures must be classified into two. One is fixed cost and the other is variable cost. The former must be paid irrespective of the amount of sales and the latter varies in proportion to the sales. Break Even Point is obtained by following formula.

$$X = F / (1 - V / R)$$

X = Break Even Point

F = Fixed Cost

V = Variable Cost

R = Revenue (Sales)

By this formula we can know the followings. In order to lower Break Even Point and to make the profitable enterprise, it is necessary to cut fixed cost or to cut down the rate of variable cost on revenue.

However, it is not so easy task to break down all expenditures into fixed cost and variable cost. Usually it is said that depreciation, personnel cost, tax and interest paid are typical fixed costs, but there is another theory that out of personnel cost overtime pay and payment by piecework system should be included in variable cost. Allowance for depreciation is said to be the most typical fixed cost because a certain amount must be earmarked every year even if the operating rate of the equipments goes down, but it is not always certain because investment of facilities is needed in case that the management scale expands substantially. In a word the difference between fixed and variable costs is valid only within a certain relatively short period or within a certain operating rate.

In this Report, all expenditures are classified into fixed and variable costs according to the rule adopted by NEEDS (Comprehensive Economic Data Bank System of Japan Economic Journal, one of the biggest daily economic newspapers in Japan) and then Revenue of Break Even Point and Break Even Point Ratio are calculated.

1) Fixed Costs: Personnel Cost, Depreciation, Tax, Interest Paid etc. (Interest and Dividend Received are to be deducted as negative fixed cost)
2) Variable Costs: Commodity Tax and Value Added Tax, Materials, Lubricant,

Electricity and Water (in addition to these items purchasing cost of merchandise and sales commissions are important variable costs in case of trading companies)

In Table 3.5.8 are shown Break Even Point Ratios of GESR from 1995 to 1999 calculated according to the above-mentioned preconditions and those of 14 major Japanese private railway companies for the periods from March 1995 to March 1999 released from NEEDS. Break Even Point of GESR was improved on and after 1997, but the level is still as high as almost the amount of Revenue and Break Even Point Ratios stand at around 100%. Break Even Points of Japanese private railway companies are a little bit lower, but is still over 90%. They are higher than those of other industries in Japan.

Table 3.5.8 Break Even Point Analysis of GESR

(UNIT: THOUSAND SYRIAN POUNDS, %)

ITEM	1995	1996	1997	1998	1999
OPERATING REVENUE	1,059,131	1,188,330	1,334,243	1,410,551	1,466,004
REVENUE ON BREAK EVEN POINT	1,457,654	1,682,261	1,389,199	1,382,848	1,453,167
BREAK EVEN POINT RATIO	137.6%	141.6%	104.1%	98.0%	99.1%
OPERATING PROFIT AFTER INTEREST RECEIVED &PAID	△ 290,867	△ 363,952	△ 43,020	21,719	10,040
MARGINAL PROFIT	773,020	875,618	1,044,459	1,105,867	1,146,581
MARGINAL PROFIT RATIO	73.0%	73.7%	78.3%	78.4%	78.2%
RATE OF TOTAL VARIABLE COSTS ON REVENUE	27.0%	26.3%	21.7%	21.6%	21.8%
RATE OF TOTAL FIXED COSTS ON REVENUE	100.4%	104.3%	81.5%	76.9%	77.5%
TOTAL VARIABLE COSTS	286,111	312,712	289,784	304,684	319,423
SALES TAX & VALUE ADDED TAX	4,081	3,363	2,540	3,360	4,207
MATERIALS	3,661	8,231	4,251	36,345	34,305
LUBRICANT, ELECTRICITY & WATER	278,369	301,118	282,993	264,979	280,911
TOTAL FIXED COSTS	1,063,887	1,239,570	1,087,479	1,084,148	1,136,541
PERSONNEL COST	744,353	813,529	814,721	892,285	905,956
DEPRECIATION	74,620	67,604	67,604	67,604	74,876
TAXES & LEVIES	0	0	0	0	0
INTEREST PAID	1	0	2,080	0	0
INTEREST & DIVIDEND EARNED (△)	△ 3,393	△ 16,124	△ 38,003	△ 32,825	△ 59,338
OTHERS	248,306	374,561	241,077	157,084	215,047
14 MAIN JAPANESE PRIVATE RAILWAY COMPANIES	March 1995	March 1996	March 1997	March 1998	March 1999
BREAK EVEN POINT RATIO	96.7%	96.1%	93.7%	94.6%	94.1%

As for the future prospects of GESR's Break Even Points, the situations do not allow much room for optimism. There are so many factors increasing fixed costs. Personnel cost is going up year by year. High level of interest revenue is based on the temporary cause and will not be expected in the not-too distant future. When the new type of French-made locomotives goes into full operation, sharp increase of depreciation is inevitable.

3.5.3 Organization and Personnel Arrangement

(1) Top Management

GESR is administrated under the Director General appointed by the Government with assistance of the Deputy-Director General. There are two Committees. One is Executive Committee responsible for drafting management plans and the other is Business Committee checking whether the plan has been executed as decided every three months. Members of the two committees are as follows.

Executive Committee

The members of Business Committee

Chairman of the Baath Party in GESR

Model Workers (maximum 5 persons)

Business Committee

Director General

Deputy-Director General

Manager of Financial Division

Manager of Planning and Statistics Division

One of the Managers of Technical Divisions

Two representatives of the Labor Union

(2) Labor Union

Syrian labor unions have a little bit different characteristics from those in Western Europe and the United States. They should be deemed one of the national organizations. Their nationwide organization is General Union of Workers under which is Union of Transport Workers. In each city there is Union of Railway Workers too, a subordinate organization to which the Director Generals and all other employees of the railway companies in the city belong as members. Workers take part in management of any enterprise by sending representatives of their union into Executive Committees. Workers are also able to appeal to the union to solve any of their problems. The unions have no right to go on strike, but companies have no right to dismiss the union members.

(3) Organization

GESR consists of Headquarters and three regional offices. Headquarters are divided into 17 divisions. The organization chart is as follows (Fig. 3.5.1).

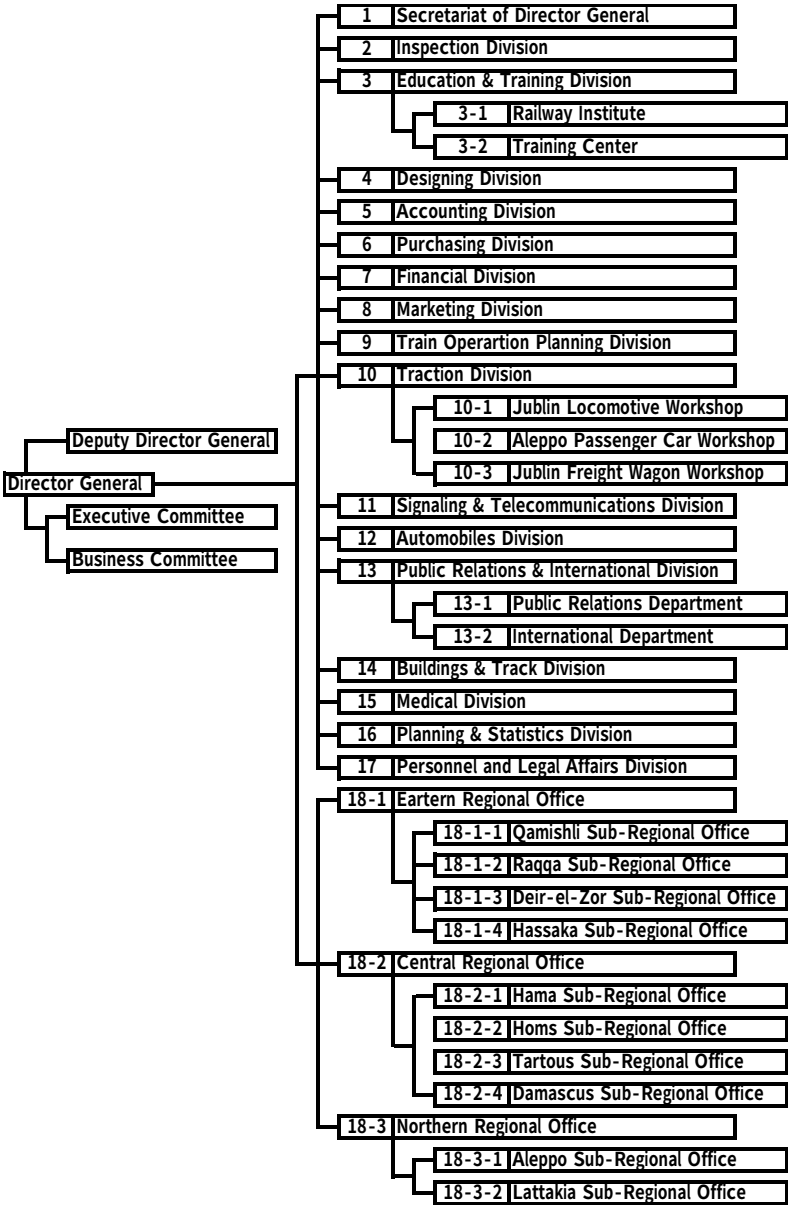

Fig. 3.5.1 Organization Chart of GESR

(4) Number of Employees

Table 3.5.9 shows the number of employees of GESR from 1995. During this period the transport volume of GESR remained almost at the same level, but the total number of employees increased about 10%. Three regional offices added employees at the higher rate than Headquarters.

Number of employees in regional offices at this stage is in Table 3.5.10. It is reported that

there remains no past records. There is a big difference of numbers for each regional office between Table 3.5.9 and 3.5.10. According to the explanation it is difficult to catch the correct figure because of frequent fluctuation of temporary workers. In classifying the staff members, ranks of wage or status (from 1st to 5th rank) are regarded more important than specialty. Engineers are broken down only as 1st or 2nd class.

Table 3.5.9 Number of employees (GESR)

DIVISION		1995	1996	1997	1998	1999	2000
1	Secretariat of Director General	79	85	83	85	85	87
14	Buildings & Track Division	142	146	150	153	150	152
17	Personnel & Legal Affarirs Division	64	59	65	65	64	63
9	Train Operation Planning Division	103	104	104	104	104	104
11	Signaling & Telecommunications Division	172	172	167	162	159	158
4	Designing Division	53	55	57	59	56	57
2	Inspection Division	9	9	9	10	9	9
13-1	Public Relations Department	62	49	47	55	59	59
10	Traction Division	760	683	731	803	893	886
3-1	Railway Institute	19	20	19	19	23	23
12	Automobiles Division	119	107	106	100	109	118
8	Marketing Division	27	26	27	28	22	19
13-2	International Department	9	8	7	8	8	8
6、7	Financial Division & Purchasing Division	249	235	241	240	247	243
5	Accounting Division	76	76	78	81	80	80
3-2	Training Center	108	106	114	119	119	122
15	Medical Division	22	21	21	20	21	22
16	Planning & Statistics Division	27	20	17	17	14	12
18-1	Eastern Regional Office	1,349	1,377	1,421	1,464	1,493	1,521
18-2	Central Regional Office	3,013	3,077	3,203	3,268	3,338	3,463
18-3	Northern Regional Office	3,559	3,687	3,654	3,721	3,725	3,794
TOTAL		10,021	10,122	10,321	10,581	10,778	11,000

Table 3.5.10 Number of Employees (GESR Regional Offices)

	1st Class	2nd Class	3rd Class	4th Class	5th Class	TOTAL
Qamishli	12	81	65	196	28	382
Raqqa	1	29	22	109	24	185
Deir el-Zor	5	69	28	301	45	448
Hassaka	12	56	35	218	30	351
EASTERN REGIONAL OFFICE TOTAL	30	235	150	824	127	1,366
Hama	22	179	23	198	18	440
Homs	63	345	97	559	65	1,129
Tartous	75	420	112	327	73	1,007
Damascus	49	97	35	218	30	429
CENTRAL REGIONAL OFFICE TOTAL	209	1,041	267	1,302	186	3,005
Aleppo	29	709	219	844	122	1,923
Lattakia	68	374	94	578	86	1,200
NORTHERN REGIONAL OFFICE TOTAL	97	1,083	313	1,422	208	3,123
GRAND TOTAL	336	2,359	730	3,548	521	7,494

Under these circumstances, requests for replenishing the shortage of staff members have been presented from some of the divisions and regional offices. If these requests are

complied with easily, it may come to more expansion of personnel. As it is difficult to dismiss the person once hired, it must be careful with increase of employees by recruiting. For that purpose strict control of personnel is required and number of employees in each section classified by their specialties must be recorded.

3.5.4 Present Situation and Problems of Personnel Positioning

(1) Car Inspection Workshops and Depots

Table 3.5.11 shows the rough number of employees in car inspection workshops and depots in June 2000. Compared with the present volume of work, these workshops and depots seem to be overstaffed. In the personnel plan of the project, increase of employees should be kept as low as possible.

(2) Station Personnel and Train Crew

1) Station Personnel

Judging from the number of trains, work volume and so forth, there is some room of capacity in the number of station personnel working at present in respect of both passenger and freight transport.

2) Train Crew

As for the train crew, it is necessary to increase the number of personnel in accordance with the number of trains and train-km. In this connection, the present work systems of train crew will be reviewed as follows.

a) Abolition of Assistant Engine Drivers

At present, there are 347 engine drivers and 237 totaling 584 persons. In diesel locomotive operation, it is considered that the engine driver alone can sufficiently take such actions as the confirmation of situation ahead of the train and identification of signal indications. Therefore, the abolition of assistant engine drivers will be studied in the future, taking into consideration the progress of personnel training for job change and so forth.

b) Passenger Train Crew

At present, the crew in charge of passenger service consists of four or five persons per train, including a chief conductor who administers the entire operation of the train. The contents of work of the crew will be reviewed in the future.

c) Freight Train Crew

The abolition of the crew in charge of freight consignor service will be studied.

Table 3.5.11 Rough Number of Employees in Car Inspection Workshops and Depots

(as of June 2000)

Organizations	Number of Employees
1. Locomotive	
Jublin Locomotive Workshop	390
Aleppo Locomotive Depot	250
Homs Locomotive Depot	100
Sub-Total	740
2. Coach	
Aleppo Passenger Coach Workshop	180
Aleppo Passenger Coach Depot	130
Lattakia Passenger Coach Depot	5
Damascus Passenger Coach Depot	5
Qamishili Passenger Coach Depot	5
Sub-Total	325
3. Wagon	
Jublin Freight Wagon Workshop	150
Jublin Freight Wagon Depot	100
Homs Freight Wagon Depot	70
Lattakia Freight Wagon Depot	100
Midan Ebbas Freight Wagon Depot	5
Tartous Freight Wagon Depot	5
Damascus Freight Wagon Depot	5
Hama Freight Wagon Depot	5
Deriel-Zor Freight Wagon Depot	5
Raqqa Freight Wagon Depot	5
Hassaka Freight Wagon Depot	5
Al-Yaroubixe Freight Wagon Depot	5
Qamishili Freight Wagon Depot	5
Aleppo Freight Wagon Depot	5
Sub-Total	470
Grand Total	1,535

(3) Personnel for Track Maintenance

Organization of track maintenance consists of headquarters, 3 bureaus (regional offices), 10 sections, 9 sub-sections and 92 teams and covers track maintenance and improvement work for about 1,740 km and building of new lines. Personnel arrangement is shown in Table 3.5.12.

Table 3.5.12 Personnel Positioning for Track Maintenance

Items		Number of Personnel		
		Fixed	Existed	＋or－
Head Quarters (Aleppo)	Track & Structure Department	224	158	－66
North Bureau (Aleppo)	T. & S. Division	42	28	－14
	Aleppo Section	388	271	－117
	Lattakia Section	611	537	－74
	Jubrin Section	194	85	－109
	Total	1,235	921	－314
East Bureau (Kamishli)	T. & S. Division	25	11	－14
	Kamishli Section	278	201	－77
	Deir el-Zor Section	199	142	－57
	Rakka Section	168	81	－87
	Total	670	435	－235
Central Bureau (Homs)	T. & S. Division	25	11	－14
	Homs Section	398	272	－126
	Hama Section	230	164	－66
	Tartuos Section	237	181	－56
	Damascus Section	217	110	－107
	Total	1,107	738	－369
Ground Total		3,236	2,252	－984

Number of personnel existed at present is far below the fixed number in every division or section, but the existed personnel for track maintenance is about 1.3 persons per 1 km of route length and the number of workers in field organizations is 0.6 per 1 km. This means that the number of middle and superior officers is too many compared with the workers.(in whole JR Group Companies, personnel for track maintenance is 1.1 per 1 km, of which the number of workers is 0.9).

Large size machinery for track maintenance was introduced with the expansion of the network, but it has become too old and the net operating ratio is also going down because it has not been replaced with new one smoothly. Under these circumstances, it is impossible to keep the tracks in satisfactory condition.

Now GESR is promoting improvement of the network and extension of the route length. In that process, it must be avoided just to fill the vacancy and to increase the number of personnel. It is preferable that the present number of personnel should be kept by modernization of track maintenance technology and introduction of equipment for maintenance with high efficiency.

In order to modernize track maintenance technology, it is necessary to enrich the education for acquiring technology, to reform the lowest unit of the organization and to reshuffle the

personnel. It is also important to adopt outsourcing system of maintenance work willingly.

(4) Personnel in Electrical sector

The number of maintenance personnel for electric facilities is 450 at present, consisting of 51 managerial persons (engineers), 146 maintenance persons for signal facilities (technical assistants and workers), 131 maintenance persons for telecommunication facilities (technical assistants and workers), 103 maintenance persons for electric power facilities (technical assistants and workers), and other 19 persons (technical assistants and workers). The present number of maintenance persons is adequate if the present situation of electric facilities is kept as it is.

However, to meet the increase in facilities, qualitative changes in facilities and so forth, it is necessary to continuously consider the employment, positioning, and training of young electrical engineers. In connection with these measures, a future task is how to cope with new technologies and inherit the technical power accumulated so far.

It is essential to utilize the limited number of maintenance personnel by pooling them. In this case, it is necessary to reconsider the number and kinds of the personnel to be pooled as well as the places where they should be pooled. Usually preventive measures are systematically taken against failure of facilities. It is then necessary to study the methods of detecting failure and install adequate detectors. These detectors should be installed in the way that enables appropriate maintenance personnel to visit the site concerned and restore the facilities. Furthermore, how to reinforce the technical power of maintenance personnel in coordination with new introduction of electric facilities is a task in the future. At the same time, it should be aimed to dynamically carry out transpositions of maintenance personnel depending upon the need.

As for the head office, it is essential to grasp the actual situation and problems of field organizations and facilities more in detail than at the present to take suitable countermeasures when necessary. It is also advisable to promote personnel exchanges in such ways as assigning employees with experience of maintenance at field organizations to headquarters (or regional offices).

3.5.5 Education and Training

(1) Outline of Educational institutions

GESR’s Middle-class Technical Institute of Railway and Education/Training Center are provided in Aleppo where various facilities and sidings are fully furnished.

① Middle-class Technical institute of Railway

Established, in 1974, under the control, by Ministry of Transport and Ministry of High-Education, high school graduates who passed common examination are allowed to enter the Institute.

The number of students is around 100 depending on the needs of GESR. The period of education is two years, and given a qualification as assistant engineer as graduated.

There are four courses, i.e., rolling stock, transport, facilities and signal/ telecommunications inc hiding on-the-job training for one month.

In addition to a principal, a vice-principal; four chiefs and four responsible teachers, lecturers are dispatched by GESR.

② Education/Training Center

Established in 1987 by the request from GESR for the purpose of level-up education their staff, training for new comers. As a special course, rolling stock, operations facilities, signal and telecommunications courses provided where practical education and training are being carried, out. On-the-job training is carried out at respective special workshops and training sidings.

Also, computer course and foreign language (English) course are provided.

The responsible staff of GESR plans training curriculums and periods.

As stated above, so far about 2,000 employees have graduated from, the Institute, while about 3,200 employees have completed at the Training Center.

However, lecturer, especially expert engineers are short, and training facilities are becoming out-of-date.

(2) Improvement to Education/Training

① For upgrading the skills of employees in supervisory level, more overseas training should be conducted in the country where new materials purchased.

② For smooth deployment/reassignment of employees, training for other specialties

should be carried out regardless of trainee's qualification.

③ For expansion of a range in education/training, a correspondence course system should be incorporated.

④ Organized on-the-job training should be carried out.

⑤ A curriculum for customer services should be the training program.

3.6 Business

(1) Outline of Business

The GESR's track records in 1999 was 848,000 passengers, 187 million passenger-kilometers, 5,445,000 tons of freight, and 1,577 million ton-kilometers. A total of revenue of 1,431. million Syria pound (equivalent to US $ 31 .1 million or Japanese Yen 3,298 million) was achieved with both of passenger and freight traffic.

The GESR's traffic volume as shown in Fig. 3.6.1, turned out to be lower since the investment law revised in 1991, in particular, passenger traffic has considerably decreased, affected by enhanced road network; development of motor vehicle i.e. sedans and buses.

On the other hand, freight traffic comprised of phosphorus ore, fuels, grains and others has steadily increased.

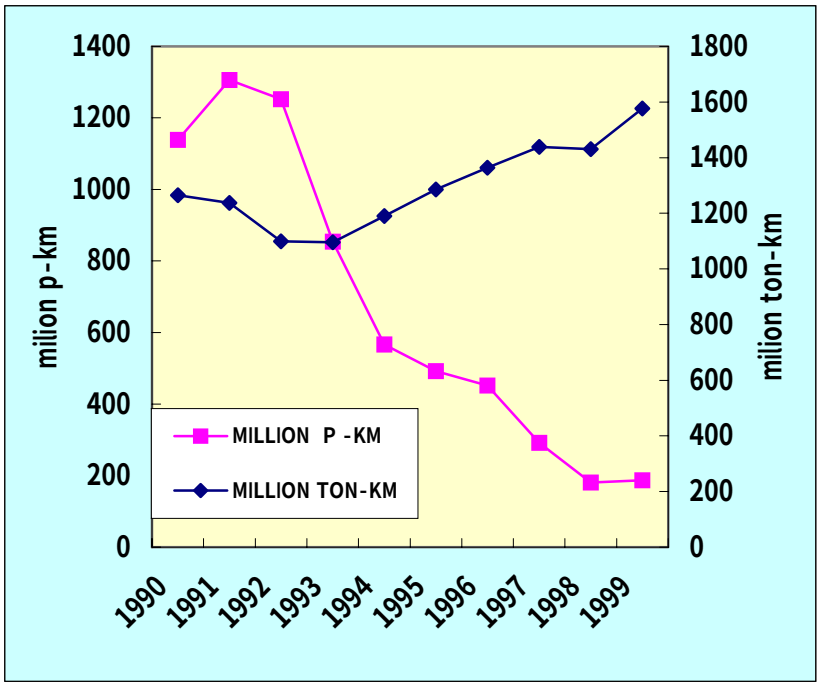

Fig 3.6.1 Volume of Transportation (GESR)

(2) Passenger

1) Outlines of Passenger Trains

Three round-trips between Aleppo and Lattakia

(One round-trip during the summer with express train)

One round-trip between Aleppo - Damascus (Articulated with a sleeping car)

One round-trip between Aleppo - Qarnishli (Articulated with a sleeping car)

One round-trip between Aleppo – Midan Ekbas (Passenger/freight Mixed train)

One round-trip between Damascus and Lattakia (Departure fromDamascus on the day before holidays and departure from Lattakia on holidays)

Also, an international train is being operated 'between Damascus and Istanbul of Turkey; another train, between Aleppo and Mosle of Iraq is operated since August this year. (Both trains operated once a week).

All trains are hauled by locomotive.

2) Outline of System

① Tickets

As for tickets, there is no independent fare established for express ticket and sleeping car, the ticket is inclusive of related services. Type of ticket is limited, therefore, tickets such as round-trip ticket, a book of tickets and excursion tickets are not sold.

Ticket vending machines are installed at major stations. At Deir el-Zor and Qamishli remote from town centers, ticket sales offices are provided in the town, however, not controlled with computer- The locations where the vending machines installed are shown in Table 3.6.1.

Table 3.6.1 Station for Ticket vending machines

Aleppo	Damascus(GEHR)	Damascus(Kadam)	Homs(1)	Hama
AbuDhour	Bishmaroun	Jisr Elshogour		
Lattakia	Tartous	Raqqa	Deir el-Zor(p) (town)	
Hassaka	Qamishli (town)			

② Fare Computation System

The GESR raised the fare by 10% in August 1993. Current fares between major

stations are as shown in Table 3.6.2. The fares are classified by 1st Class, 2nd Class, Adult, Children, Discounted and Sleeping Car, tickets subject to discount are as shown in Appendix 3.6.1. The children fare is applicable to those between 4 years and 10 years old.

Table 3.6.2 Passenger Fares

(Unit: S.P)

sleeping car			discount		child		Adult		
child	adult	1_{ST}	2nd	1_{ST}	2nd	1_{ST}	2nd	1_{ST}	
0	0	0	29	48	18	27	36	54	LAT-ALP
0	0	0	36	53	23	34	45	67	exp-lat-alp
165	325	580	45	68	29	43	57	85	DAM-ALP
90	175	290	25	36	16	23	31	45	HOM-ALP
65	125	210	18	37	12	17	23	34	HAM-ALP
115	225	380	31	46	20	29	39	57	DAM-HAM
35	65	100	8	12	5	8	10	15	HOM-HAM
90	180	310	25	38	16	24	32	47	DAM-HOM
175	350	595	71	106	44	66	88	132	KAM-ALP
150	300	510	62	92	39	58	77	115	HAS-ALP
115	225	375	47	70	29	44	58	87	DZR-ALP
70	140	230	30	44	19	28	37	55	RAQ-ALP
115	225	380	47	70	30	44	59	88	KAM-RAQ
90	180	295	37	56	24	35	47	70	HAS-RAQ
55	105	155	21	31	13	19	26	38	DZR-RAQ
80	155	250	32	47	20	29	39	58	KAM-DZR
55	105	165	21	33	14	20	27	39	HAS-DZR
35	70	105	13	19	8	12	16	23	KAM-HAS
0	0	0	48	72	30	45	60	90	LAT-DAM
0	0	0	36	54	23	34	45	67	TAR-DAM
0	0	0	29	43	18	27	36	54	LAT-HOM
0	0	0	16	24	10	15	20	30	TAR-HOM
0	0	0	16	23	10	14	19	28	LAT-TAR
0	0	0	18	27	12	17	23	34	MID-ALP

The GESR's fare computation system is based on the distance to travel that considered the services offered. On the other hand, it has been, established taking into account competition with bus transport. A comparative table for fares of major lines is shown in the following Table3.6.3

Table 3.6.3 Fare Comparison with Bus Service

(Unit: SP)

Section		Distans(km)	1st	2nd	Bus
Damascus	Aleppo	418	85	57	100
	Hama	256	57	39	55
	Tartous	302	67	45	70
	Lattakia	390	90	60	90
Aleppo	Lattakia	221	(67) 54	(45) 36	50
	Deirel-Zor	339	87	58	85
	Qamishli	547	132	88	120
	Hama	162	34	23	40
	Homs	218	50	45	31

Aleppo-Lattakia ( )=ExpressFare

The 2nd Class fare of each line is much lower to compare with that of bus service, while, the 1st Class fare of some lines is somewhat higher. Also, the line between Damascus and Aleppo for instance, which has been exposed to severe competition with bus service, has a large gap between the fares.

3) Present Condition of Passenger Traffic

① The total of passengers carried by each line is as shown in Table 3.6.4 the traffic between Aleppo and Lattakia accounts for approximately 70% of the whole. On this line, three round-trips have been set 'up including express trains during the summer; the load factor floats between about 60 to 70% which is the most important line in terms of passenger traffic.

Other lines except for night trains running between Aleppo and Damascus with an 80%-load factor, have experienced in considerably lower load factors.

Table 3.6.4 Number of Passenger by Section

(unit :persons)

Section		1995	1996	1997	1998	1999	Share
Aleppo	Qamishli	435,572	369,574	181,165	91,924	118,030	14
Aleppo	Damascus	274,528	228,214	187,444	137,663	141,783	17
Aleppo	Lattakia	705,018	704,922	606,689	543,477	565,835	68
Lattakia	Damascus	137,107	127,446	62,944	9,824	7,557	1
Total		1,552,225	1,430,156	1,038,242	782,888	833,205	100

② Number of Passengers Boarded at Major Stations

The number of passengers boarded at major stations is as shown in Table 3.6.5. Even the. capital city Damascus has a record of passengers less than 100, such a phenomenon implies the road transport is much superior to the rail service.

Table 3.6.5 Number of Passengers by Major Station (per day)

(unit: persons)

	1994	1995	1996	1997	1998	1999
ALEPPO	1454	1280	1215	982	847	568
HAMA	85	56	46	39	21	21
HOMS	166	117	102	67	34	31
DAMASCUS	679	641	522	249	89	95
TARTOUS	46	43	45	35	10	8
LATTAKIA	1112	1079	1041	809	693	688
RAQQA	135	109	102	57	21	28
DEIR EL-ZOR	280	244	212	111	38	45
HASSAKA	439	370	320	131	41	78
QAMISHLI	429	353	303	130	52	79
TOTAL	**4825**	**4292**	**3908**	**2610**	**1846**	**1641**

(3) Freight

1) Outline of Freight Business

The GESR's freight revenue account for 96% of the gross revenue that has become the principal axis in the railway business. However, looking at its details, most of them consist of state policy-oriented commodities such as phosphorous ore, fuels, grains, etc., thus general freight sales are stagnant under tough competition with truck transport. In addition to the current traffic route to Turkey via Midan Ekbas, another international route towards Iraq via Al-Yaroubiye commenced since July this year; its future Wend is noticeable.

① Outline of Freight Trains

Except for exclusive freight trains for phosphorous ore, a freight train required for operation is selected from that pre-scheduled diagram. An operational plan is determined in the afternoon of the day before the train departure considering various conditions, i.e., stations where train formation is made up, the condition of major station and shipping plan.

In terms of operational condition for each line, the line between Mihine and Horns is the busiest one on which phosphorous ore trains make 13 round-trips.

② Utilization method of Wagons

The GESR currently owns about 5,000 wagons, of which excluding phosphorous ore wagons are commonly used. Some stations have been reserved for storage of

exclusive wagons to carry respective types of commodities; empty wagons arc normally deadheaded. Also, freight dispatchers at Aleppo and Homs give deadheading instructions.

③ Customs Clearance

Customs clearance procedures vary depending on the type of commodities, and freight is handled at Aleppo or Damascus where boarder-station, port and bonded warehouses are located. At Midan Ekbas located at Turkish boarder, only paperwork is allegedly processed for customs declarations.

2) Outline of the System

① Freight Invoice

Upon receiving freight from consignors, freight invoice is issued. The crew aboard the train conveys the invoice to arrival stations. The invoice is forwarded to the Finance office from the arrival station then screening and computation is made.

Major items to be filled in on the invoice are as follows:

a) Departing/arriving stations, time and date, train number, date of receiving/ delivery.
b) Name of consignor, consignee and addresses.
c) Kind of shipping freight, volume and cover
d) Wagon number.
e) Shipping charges and taxes.

② Freight Fare

The GESR raised the fare by 15% in October 1996. There are five grades as shown in Table 3.6.6. Phosphorous ore that is main Freight is classified as 4th grade while fuels are 3rd grade.

Table 3.6.6 Freight Fare

(Unit: S.P/Ton)

5	4	3	2	1	class-km
49	56	60	72	87	40
87	97	107	127	150	100
143	165	183	217	251	200
202	233	257	302	349	300
258	296	325	385	447	400
316	362	397	467	544	500
370	425	466	550	636	600
426	487	534	632	731	700
480	549	604	713	825	800
534	610	672	793	919	900
587	672	740	874	1012	1000
641	734	808	956	1101	1100
693	795	874	1032	1195	1200

③ Exclusive Sidings

Exclusive sidings for Phosphorous Ore Corporation, Grains Corporation and Oil Refinery Corporation have exceeded 100 lines, which are major consignors closely connected to the railway. However, some problems as a reduction in the use of Sidings, absorption of upkeep cost and others have arisen.

④ Privately owned Wagon

Although there is a system for privately owned wagons, but it is not well developed.

3) Present Condition of Freight

The track records of freight classified, by commodities are as shown in Table 3.6.7, and phosphorous ore and fuels account for about 70% of the total. The center of distribution is based at Homs district, from where phosphorous ore and fuels are shipped to inland. Also, grains traffic with adequate types of wagons from inland regions to harbors, Aleppo and Damascus districts has become efficient.

In regard to containerized traffic, inland freight depots have been provided at Aleppo and Damascus for future expansion of the business.

Table 3.6.7 Freight Volume (1995~1999)

(Unit: Ton)

	1995	1996	1997	1998	1999	share
Phosphorus Ore	1187043	1644166	1835584	1888683	1527779	28
Black Fuel	1162346	1065476	1254600	1358452	1993492	37
White Fuel	391819	368451	471654	513738	548520	10
Cement Bulk	63505	53920	55480	43800	41440	1
Cement packed	334589	321596	283034	200382	287378	5
Lumber & Iron	45307	73517	89356	106883	97984	2
Cereal Bulk	447485	490744	407871	346571	479831	9
Cereal Packed	60009	71525	43362	3601		
Fertilizer	21567	34439	8159			
Gas	71843	90878	92312	115071	118344	2
Wheat	30199	11030	1450			
Raw suger		654				
Equipment	71292	107560	117001	113419	104550	2
Special Goods	14915	14551	21533	18469	15152	
Sand	241800	91100	11850			
Construction Material	64879	96830	60246	63300	78413	1
Import	86036	110447	103433	75517	110405	2
Export	23133	4391	77501	129817	39703	1
Other Goods		1686	2492	3459	1754	
Total	4317767	4652961	4936918	4981162	5444745	100

(4) Connection with other transport sectors

It is extremely important in the rail transport service to maintain close connection with other transport sectors to offer convenient and secure services to passengers and shippers who utilize multiple number of transport means.

In the case of GESR in particular, there is no substantial connection with GESR for both passenger/freight as the train frequency between GESR and GEHIR is extremely limited; and track gauges of the two operators are different.

Nevertheless, if the two railways made improvements in terms of traffic increase and upgraded facilities, then traffic demand would increase in the future, adequate measures would be required in terms of train diagrams and various related systems.

As to the passenger services further, connection at major stations with road transport (bus/taxi, etc.), and furnishing and maintaining adequate loading/unloading facilities at strategic freight depots would be required.

(5) Current Problem Areas and Direction for Improvements

1) Improvements to Passenger Business

① Changeover of Sales Stance

a. Publication of Timetables and Various Sales Promotion

Since train frequency is less, timetables and sales brochures/pamphlets are not seen at station premises. A basic posture, as the passenger sales should be established.

b. Furnishing of Upgraded Station Facilities (Environmental Conditions)

Adequate station facilities (waiting rooms and toilets) should be furnished and kept clean always; interior and exterior of passenger coach should be cleaned to maintain neat appearance.

② Punctuality and Increase in Train Frequency

Safety and punctuality, which are the basis of rail services, should be secured, and trains frequency should be increased on certain lines.

③ Improvements to Sales System

Standardized products should be developed; dynamic sales promotion should be made for group tours.

④ Improvements to Customer Service Manners

Station employees working at ticket barriers, those at ticket windows, and train conductors, who are directly involved in the passenger services should be given thoroughly a practical knowledge for customer services, thereby, an attractive railways image could be infused into the public.

2) Improvements to freight Business

① The current system by which, a train is selected from the pre-scheduled diagram should be altered to a system by which all trains are regularly scheduled for operations. Further, the speeds for shipping should be increased, and dates and times

of arrivals should be clarified by operating a train for pre-designated shipment connection.

② Modernization of Transport System

a) As a next phase, a strategic freight depot should be maintained orderly to handle containerized freight.

b) Provisions should be made for inland depots to cope with marine container.

③ Modernization of Freight Loading/Unloading System

Palletized freight and forklift should be incorporated.

④ Promotion of Private Wagon System

A system should be established for private wagon owners who use exclusive sidings. (Control of funds for manufacturing new wagons)

⑤ Modernization of Automatic Data Processing

Adequate measures with computers should be taken to control the following:
Shipping information
Online train control information, and Issuing freight invoice

⑥ Services to New Consignors

Since it is a precondition that head-office's approval required for shipments by new consignors, processing of paperwork should be simplified by entrusting station masters with a guarantee system for a certain type of commodity.