Chapter 9

Improvement Plan of Rolling stock, Workshop and Depot

Chapter 9 Improvement Plan of Rolling Stock, Workshop and Depot

9.1 Improvement concept for rolling stock, workshop and depot

(1) Rolling stock

Accompanying with the increase of the volume of transportation, operation plan of rolling stock will be as follows:

1) GESR is planning to introduce the diesel cars at 2002 for using the passenger trains. Accordingly, in the future, the diesel cars will be used for the passenger train mainly in the domestic transportation.

2) Locomotive will be used for freight trains, night passenger trains mainly in the domestic transportation and international passenger trains.

3) Shunting works in the industrial factories such as cement factories, cereal collection/ manufacturing factories, petroleum refinery factories etc. are operated by the locomotives. These locomotives will be also used for short distance traction of freight wagons between these factories and the nearest railway station.

4) Shunting work in the station, the LDE650 type locomotive will be used.

5) Shunting work in the port, the UNILOCK type locomotive will be used.

6) Passenger coaches are sleeping coach, restaurant coach, 1st class coach, 2 nd class coach and luggage car with partial mail room.

7) Roller bearing type wagons will be mainly used

8) In the driving cabs of locomotive and diesel car they are installed with the ATS (Automatic train stop) device.

① Main devices of ATS which are installed in the driving cabs are shown as follows:

(a) Pick-up coil on board

(b) On-board receiver

(c) Cab warning device

(d) Confirmatory button

(e) Return switch

② Performance of ATS is shown as follows :

In order for the driver to recognize that the front signal is indicating stop, the resonance coil which is installed between the rail, transmit that the front signal is indicating stop. This signal is received at the pick-up coil on board which is installed at the under frame of locomotive and diesel car. By this signal, the warning is radiated from the cab warning device which is installed in the driving cab for the driver. If the driver does not confirm within the 5 seconds from the radiation of the warning, emergency braking acts on automatically. And then, locomotive and diesel car stop at the stop signal.

(2) Workshop and depot

Accompanying with the increase of the numbers and type of rolling stock, workshop and depot will be improved as follows:

1) In Muslimia, modernized workshop will be constructed for locomotives, diesel cars and freight wagons. Locomotives and diesel cars will be repaired at the same workshop. In the locomotives and diesel cars workshop, foundry shop which make the brake block for the GESR rolling stock will be constructed.

2) The painting shop and final adjustment shop will be constructed in the Jubrin freight wagon workshop. The layout of workshop will be revised by integrating buildings for periodical maintenance/repair and building for temporary maintenance. In drawing up such revision and construction, new maintenance/repair machines and new testing equipments should be introduced for modernization.

3) In the future, accompanying with the increase of the freight wagons, new freight wagon workshop will be constructed.

4) Location of Aleppo locomotive depot will be changed at Jubrin and Muslimia dividedly. In drawing up the plan of change of location, new maintenance/repair machines and new testing equipments should be introduced for modernization.

5) Accompanying with the introduction of the diesel car, new maintenance/repair machines and new testing equipments for diesel cars will be introduced at the existing locomotive depots.

9.2 Necessary numbers of rolling stock and increase plan of rolling stock

(1) Accompanying with the increase of the volume of transportation, necessary numbers and increase plan of rolling stock are shown in Table 9.2.1.

Table 9.2.1 Necessary numbers and increase plan of rolling stock

Type		2005 year	2010 year	2015 year	2020 year
Locomotive	Necessary numbers	116	151	240	370
	Increase plan	50	35	119(19)	155(49)
Diesel car	Necessary numbers	55	85	195	290
	Increase plan	55	30	110	95
Passenger coach	Necessary numbers	190	190	140	140
	Increase plan	3	4	119	0
Freight wagon	Necessary numbers	5,000	7,500	10,800	18,000
	Increase plan	133	2,582	3,300	7,328

Note: Numbers in parentheses are for the included LED2800s which will be used for shunting after repair among the LDE2800 fleet not in use.

(2) Rolling stock plan of year wise and type wise are shown in the Appendix. 9.1.

Service life of rolling stock are shown as followings :

Type	Service lifes	Type	Service lifes
Locomotive	30 years	Passenger coach	50 years
Diesel car	30 years	Freight wagon	50 years

9.3 Improvement plan of workshop and depot

(1) Future inspection cycle and place

Existing inspection cycle and place are very complex because they are divided into many cases namely, by the every form of rolling stock type and by every country where rolling stock was manufactured. In the future, many new rolling stocks will be introduced. Therefore, future inspection cycle and place plan of rolling stocks will be shown in Table 9.3.1.

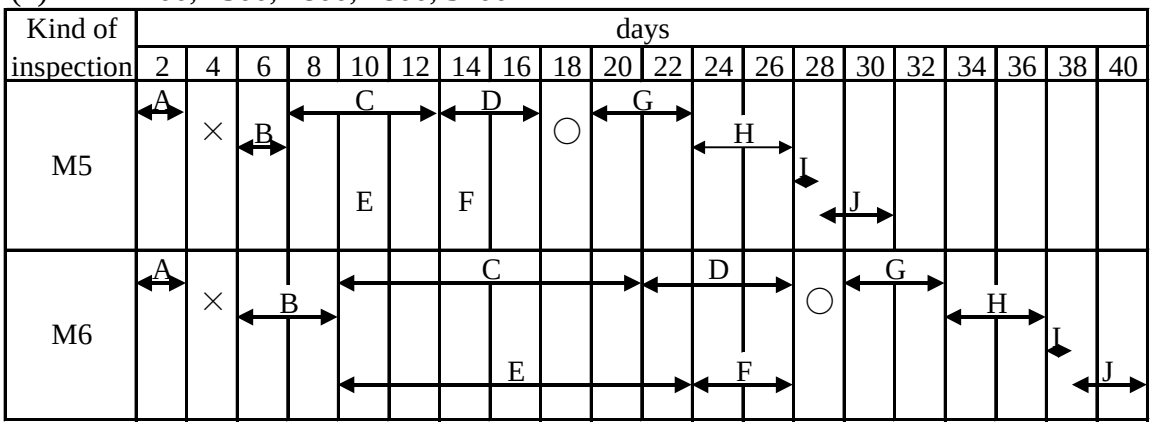
Table 9.3.1 Inspection cycle and place

Type	Form	Inspection cycle and place					
		M1	M2	M3	M4	M5	M6
Locomotive	LDE2800 LDE1800 LDE1500 LDE1200 LDE3200	Before used	3 days	3 months or 30,000 km	1.5 years or 150,000 km	3 years or 300,000 km	6 years or 600,000 km
		Depot	Depot	Depot	Depot	Workshop	Workshop
	LDE650	Before used	3 days	3 months	6 months	—	—
		Depot	Depot	Depot	Depot		
	UNILOCK	Before used	3 days	1 month	3 months	—	—
		Depot	Depot	Depot	Depot		
Diesel car	All form	D1	D2	D3	D4	D5	D6
		Before used	3 days	3 months or 50,000 km	1.5 years or 150,000 km	3 years or 300,000 km	6 years or 600,000 km
		Depot	Depot	Depot	Depot	Workshop	Workshop
Passenger coach	All form	T1	T2	T3			
		Before used	3 months	5 years	—	—	
		Depot	Depot	Workshop			
Freight wagon	All form	F1	F2	F3			
		Before used	3 months	6 years	—	—	
		Depot	Depot	Workshop			

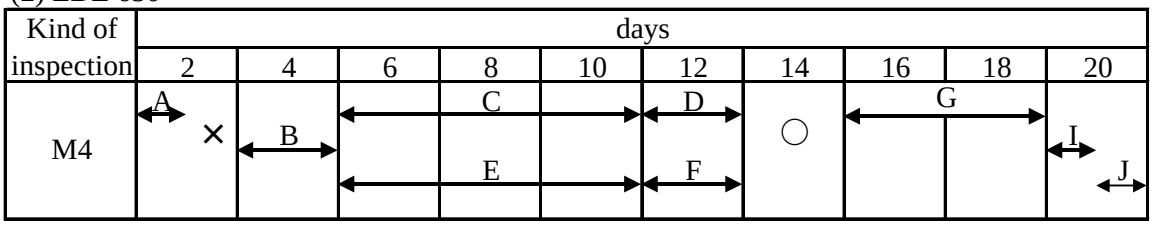
(2) Future standard process of periodical inspection

Rolling stock will be repaired in the modernized workshop and spare parts for rolling stock maintenance will be stored. Therefore, future standard process of periodical inspection can be shortened. Future standard process of periodical inspection are shown in Fig. 9.3.1, Fig. 9.3.2 and Fig. 9.3.3.

(1) LDE 1200, 1500, 1800, 2800, 3200

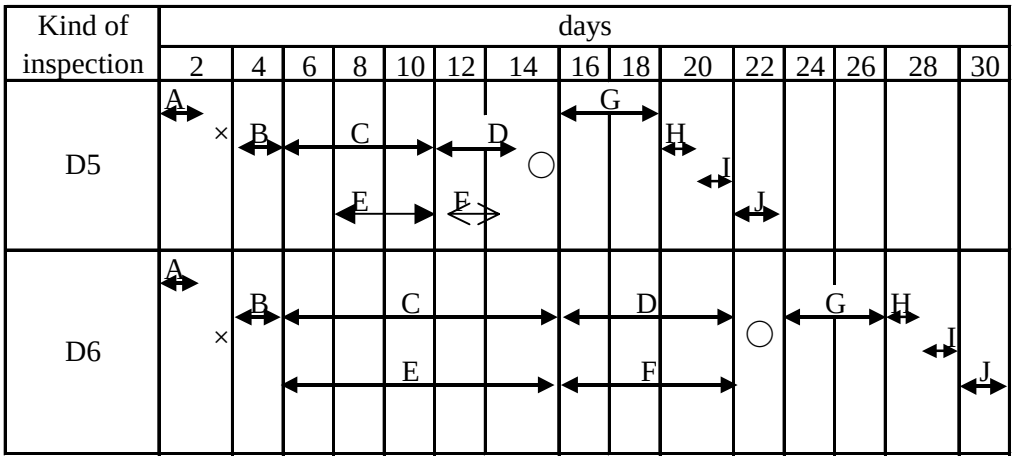


(2) LDE 650



A：Draw out the water and oil　B：Dismounting – Engine, cooling system, traction motor, wheel set　C：Body repair
D：Mounting – Engine, cooling system　E：Bogie frame repair　F：Bogie assembling – Traction motor, wheel set
G：Body painting　H：Performance test　I：Test running　J：Final adjusting　×：Body lifting　○：Body lowering

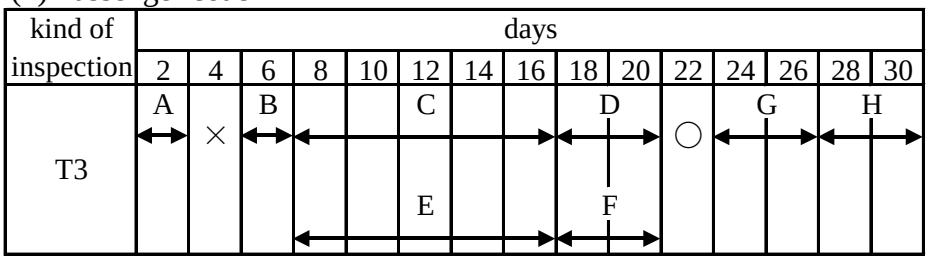
Fig. 9.3.1 Future standard process of periodical inspection for locomotive



A：Draw out the water and oil　B：Dismounting – Engine, cooling system, seat, air conditioning system　C：Body repair
D：Mounting – Engine, cooling system, air conditioning system, etc.　E：Bogie frame repair　F：Bogie assembling
G：Body painting　H：Performance test　I：Test running　J：Final adjusting　×：Body lifting　○：Body lowering

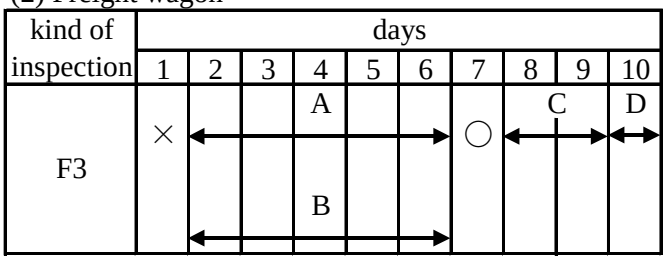
Fig. 9.3.2 Future standard process of periodical inspection for diesel car

(1) Passenger coach



A：Draw out the water　B：Dismounting – Seat, air conditioning system　C：Body repair
D：Mounting – Seat, air conditioning system　E：Bogie frame repair　F：Bogie assembling
G：Body painting　H：Performance test, final adjusting　×：Body lifting　○：Body lowering

(2) Freight wagon



A：Body repair　B：Bogie repair　C：Body paining
D：Performance test, final adjusting　×：Body lifting　○：Body lowering

Fig. 9.3.3 Future standard process of periodical inspection
for passenger coach and freight wagon

Table 9.3.2 Future standard process of periodical inspection

Type	Form	Kind of inspection	Necessary inspection days	Inspection place
Locomotive	LDE2800 LDE1800 LDE1500 LDE1200 LDE3200	M1	Before used	Depot
		M2	2 hours	Depot
		M3	1 day	Depot
		M4	10 days	Depot
		M5	30 days	Workshop
		M6	40 days	Workshop
	LDE650	M1	Before used	Depot
		M2	1 day	Depot
		M3	7 days	Depot
		M4	20 days	Depot
	UNILOK	M1	Before used	Depot
		M2	1 day	Depot
		M3	3 day	Depot
		M4	7 day	Depot
Diesel car	All form	D1	Before used	Depot
		D2	2 hours	Depot
		D3	1 day	Depot
		D4	7 days	Depot
		D5	22 days	Workshop
		D6	30 days	Workshop
Passenger coach	All form	T1	Before used	Depot
		T2	2 hours	Depot
		T3	30 days	Workshop
Freight wagon	All form	F1	Before used	Depot
		F2	1 hour	Depot
		F3	10 day	Workshop

(3) Yearly periodical inspection numbers of every kind of inspection

Based on the above necessary numbers of rolling stock (9.2 (1)), future inspection cycle and place (9.3 (1)) and future standard process of periodical inspection (9.3 (2)), yearly periodical inspection numbers are calculated as shown in Table 9.3.3.

Table 9.3.3 Yearly periodical inspection numbers

Type	Kind of inspection	Year	Numbers
Locomotive	M2	2005	15,166
		2010	19,366
		2015	26,556
		2020	38,556
	M3	2005	473
		2010	613
		2015	860
		2020	1,260
	M4	2005	55
		2010	72
		2015	104
		2020	154
	M5	2005	30
		2010	40
		2015	57
		2020	85
	M6	2005	26
		2010	34
		2015	48
		2020	70

Type	Kind of inspection	Year	Numbers
Diesel car	D2	2005	6,691
		2010	10,341
		2015	23,725
		2020	35,283
	D3	2005	129
		2010	199
		2015	455
		2020	677
	D4	2005	27
		2010	42
		2015	97
		2020	145
	D5	2005	14
		2010	21
		2015	49
		2020	72
	D6	2005	14
		2010	22
		2015	49
		2020	73

Type	Kind of inspection	Year	Numbers
Passenger coach	T2	2005	1,286
		2010	1,020
		2015	564
		2020	564
	T3	2005	70
		2010	56
		2015	32
		2020	32

Type	Kind of inspection	Year	Numbers
Freight wagon	F2	2005	19,600
		2010	28,991
		2015	41,641
		2020	69,241
	F3	2005	852
		2010	1,261
		2015	1,811
		2020	3,011

(4) Yearly number of rolling stock staying at the same time in every shop of the workshop

Based on future standard process of periodical inspection (9.3 (2)) and yearly periodical inspection number (9.3 (3)), yearly number of rolling stock staying at same time in every shop of workshop are calculated as shown in Table 9.3.4.

Table 9.3.4 Yearly numbers of rolling stock staying at the same time in every shop

Type	Shop name	Year	Numbers
Locomotive	Body shop	2005	6
		2010	6
		2015	8
		2020	11
	Painting shop	2005	2
		2010	2
		2015	2
		2020	3
	Performance shop	2005	3
		2010	3
		2015	3
		2020	4
	Final adjustment shop	2005	3
		2010	3
		2015	3
		2020	4
Diesel car	Body shop	2005	3
		2010	4
		2015	8
		2020	10
	Painting shop	2005	2
		2010	2
		2015	2
		2020	2
	Performance and final adjustment shop	2005	3
		2010	3
		2015	3
		2020	3

Type	Shop name	Year	Numbers
Passenger	Body shop	2005	6
		2010	5
		2015	3
		2020	3
	Painting	2005	1
		2010	1
		2015	1
		2020	1
	Performance	2005	2
		2010	2
		2015	2
		2020	2
Freight	Body shop	2005	24
		2010	36
		2015	51
		2020	84
	Painting shop	2005	6
		2010	9
		2015	13
		2020	21
	Performance and final adjustment shop	2005	5
		2010	8
		2015	11
		2020	18

(5) Example of schematic layout drawing of workshop

An example of schematic layout drawing of the modernized workshop is shown in Fig 9.3.4.

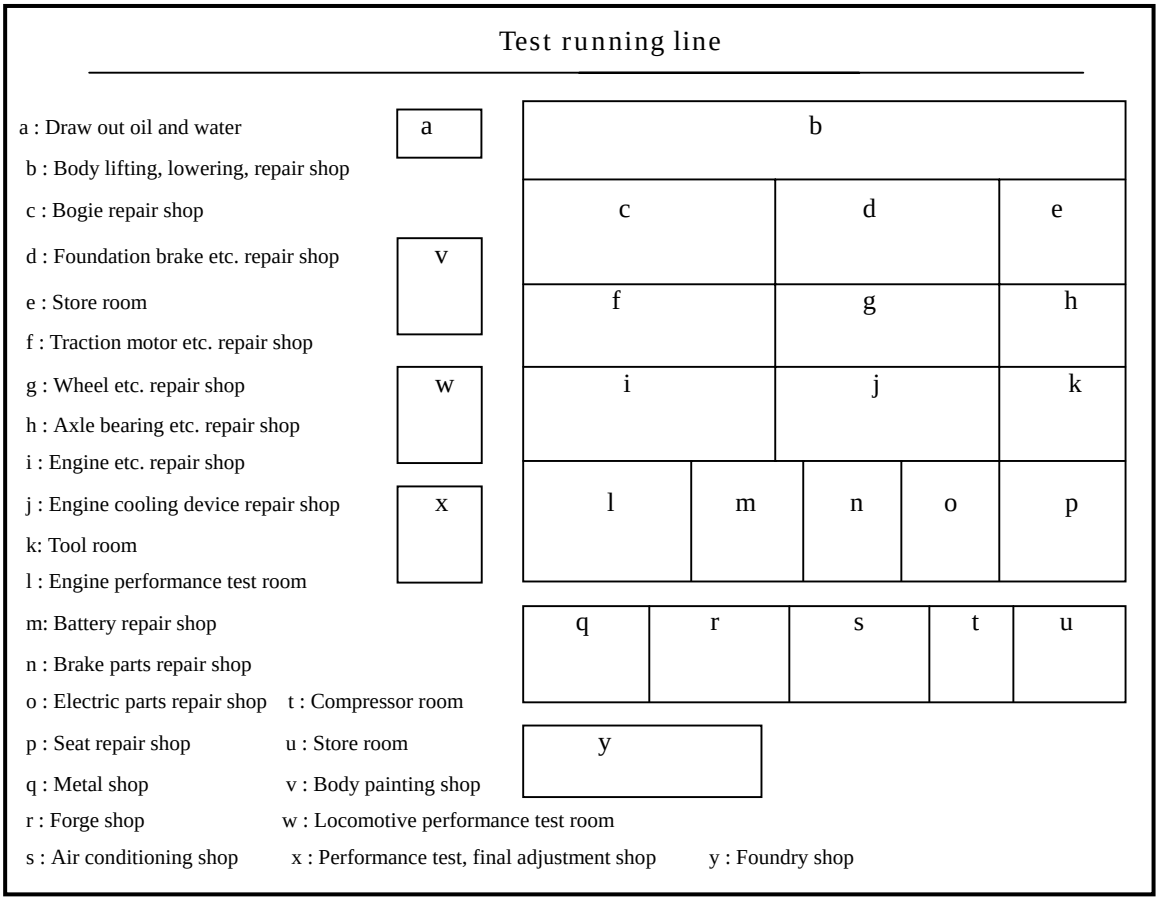


Fig. 9.3.4 Schematic layout drawing of locomotive and diesel car workshop (Example)

(6) Maintenance/repair machines and test equipments

Necessary main maintenance/repair main machines and main test equipments of every shop are shown in Appendix 9.3.

(7) Main inspection equipments/facilities for the diesel car in the depot

Main inspection equipments/facilities for the diesel car in the depot are shown in Table 9.3.5.

Table 9.3.5 Main inspection equipments/facilities for the diesel car in the depot

No.	Main inspection equipment/facilities
1	Inspection building
2	Inspection pit for underframe equipments
3	Inspection scaffold for roof top equipments
4	Dismount and mount device for underframe equipments
5	Lifting equipments for parts

9.4 Rolling stock maintenance system

(1) Rolling stock failure countermeasures.

1) It is necessary that causes of failure should be investigated and countermeasures are to be established and these things must be notified to the employees of rolling stock.

2) Effective rolling stock maintenance system should be established by transmitting details of temporary maintenance / repair carried out in depot to workshop.

(2) Education/training

1) It is necessary that employees should be trained so that employees can have the various maintenance ability.

2) Accompanying with the introduction of the diesel car, education of maintenance/repair and test method of the diesel car are necessary for staff, who maintain, repair and test of the diesel car of all locomotive and diesel car workshop and depots.
Contents of education are shown as followings:

① Outline of the diesel car.
② Engine, converter and cooling system of the diesel car.
③ Electric control system of the diesel car.
④ Brake system of the diesel car.
⑤ Bogie system of the diesel car.
⑥ Treatment method of accident time.

3) Accompanying with the introduction of the rolling stock new safety system, education of maintenance/repair and test methods of the rolling stock new safety system are necessary for staff who maintain, repair and test of the rolling stock new safety system, of all locomotive and diesel car workshop and depots.
Contents of education are shown as followings:

① Outline of the rolling stock new safety system.
② Treatment method of accident time.

4) When new rolling stock, new maintenance machines and new test equipments are introduced, staff of maintenance of rolling stock and staff of operation of machines and test equipments should go to the country where they are manufactured. They should learn the operation method and maintenance method of new rolling stock, new machines and new test equipments in these manufacturing factories.

In addition to the above, when new rolling stock arrive or new machines and test equipments are installed, supervisors for new rolling stock, new machines and new test equipments should be dispatched. They should instruct the operation method and maintenance method of rolling stock, new machines and new test equipments at the site.

(3) Spare parts control system

1) The stored place of spare parts should be controlled, so that effective rolling stock maintenance system could be established.

2) For effective rolling stock maintenance, the parts control system should be established, in which kinds and quantities of necessary parts will be controlled.

(4) Brake blocks for GESR should be manufactured in the new locomotive and diesel car workshop. It will contribute to the effective use of the rolling stock and the reduction of the expenses.

(5) Organization

1) The organization of existing locomotive depots will not be changed. Inspectors and maintenance men of the diesel car will be included in the each section of existing locomotive depots.

2) The organization of existing passenger coach and freight wagon depots will not be changed.

9.5 Staged improvement plan

(1) Rolling stock

Accompanying with the increase of the volume of transportation, necessary numbers and amounts of cost for rolling stock are shown in Table 9.5.1.

Table 9.5.1 Necessary amounts of cost for rolling stock (Unit: Million SP)

Type		2001-2005	2006-2010	2011-2015	2016-2020	Amounts of cost
Locomotive	Numbers	20	33	100*	106*	259
	Amounts	2,832	3,036	8,090	9,530	23,488
Diesel car	Numbers	55	30	110	95	226
	Amounts	2,530	1,380	5,060	4,370	13,340
Passenger coach	Numbers	3	4	119	0	126
	Amounts	96	128	3,444	0	3,668
Freight wagon	Numbers	133	2,582	3,300	7,328	13,343
	Amounts	269	3,318	4,191	9,685	17,463
Amount of cost	Numbers	211	2,649	3,565	7,529	13,954
	Amounts	5,727	7,862	20,785	23,585	57,959

Note: * The figures are decreased by the numbers in parentheses in Table 9.2.1.

(2) Workshop and depot

Accompanying with the increase of the numbers of rolling stock, necessary amounts of cost for workshop and depot are shown in Table 9.5.2 and detailed cost are shown in Appendix 9.4.

Table 9.5.2 Necessary amounts of cost for workshop and depot (Unit: Million SP)

Year	Content	Amounts of cost
2001 to 2005	1. Construction of locomotive & diesel car workshop	7,691.4
	2. Change of location of locomotive depot	1,000
	3. Construction of passenger coach workshop	3,600
	4. Equipment of diesel car depot	504
	5. Construction of locomotive depot	415
2006 to 2010	1. Construction of locomotive & diesel car workshop	743.5
	2. Modernization of freight wagon workshop	2,350
	3. Equipment of diesel car depot	504
	4. Modernization of locomotive depot	46
2011 to 2015	1. Construction of locomotive & diesel car workshop	16.6
	2. Construction of freight wagon workshop	4,600
	3. Equipment of diesel car depot	504
	4. Modernization of locomotive depot	46
2016 to 2020	1. Equipment of diesel car depot	504
	2. Modernization of locomotive depot	46

(3) Staged improvement plan

1) Rolling stock (Unit: Million SP)

Year	2001-2005	2006-2010	2011-2015	2016-2020	Amounts of cost
Amounts of investment for rolling stock	5,727	7,862	20,785	23,585	57,957

2) Workshop and depot (Unit: Million SP)

Year	2001-2005	2006-2010	2011-2015	2016-2020	Amounts of cost
Muslimia Loco. & DC Workshop & depot	9,610.4	1,293.5	566.6	550	12,020.5
Jublin P.C. Workshop	3,600				3,600
Jubrin & Muslimia F.C. Workshop		2,350	4,600		6,950
Amounts of cost	13,210.4	3,643.5	5,166.6	550	22,570.5

Chapter 10

Improvement Plan of Railway Civil Engineering Facility

Chapter 10 Improvement Plan of Railway Civil Engineering Facilities

10.1 Concept of Arrangement of Improvement Plan

Basic policy for track facility improvement is to keep maintain the current Russian standard of 3rd class lines and adopt 2nd class track standard depending on the section. As for adoption of new track materials for improvement, it is planned to use materials corresponding to UIC standard. Main specifications are as follows;

		Train	New Line	Existing Line
・ Design Train Speed (Maximum)	Alignment	Passenger	250km/h	130km/h
		Freight	140km/h	100km/h
	Track	Passenger	160km/h	120km/h
		Freight	120km/h	100km/h
・ Train Operating Speed (Max.)		Passenger	130km/h	130km/h
		Freight	100km/h	100km/h
・ Track Gauge			1,435mm	
・ Minimum Radius Curve			R=4,500m	R=600m
When required			R=600m	R=300m
・ Maximum Cant			150mm	
・ Maximum Slack			20mm	
・ Maximum Gradient			8.0‰	12.0‰
Where required			12.0‰	20.0‰
・ Design Load			UIC 702, Axle load 25ton	
・ Rail			UIC 60 (60.3kg/m)	
・ Sleeper			PC Sleeper(UIC B70),length 2,600mm No. of sleeper 1,540－1,667/km	
・ Fastening			Pandrol with elastic pad	
・ Track bed	Crushed stone, under sleeper more than		300mm	250mm
・ Turnout		Main Track	#14 or larger No.	#11
		Side Track	#9	#9
・ Line to line length	Between station		5.0m	
	Station yard		5.0－6.5m	
・ Track formation width		Single track	7.0－7.5m	
		Double track	12.0－12.5m	

In the first place, improvement of track shall be executed for each section and to secure the track capacity according to the traffic demand, construction of new signal station or double tracking will be executed. However, track maintenance condition of each section is poor and not adequate for train operation with the originally planned train speed although 20 - 30 years had already elapsed since the line had been opened for service. In order to upgrade the maintenance condition, track rehabilitation of all sections shall be made as far as practical at the beginning of line improvement plan.

The section of each project is as shown in Fig.10.1.1

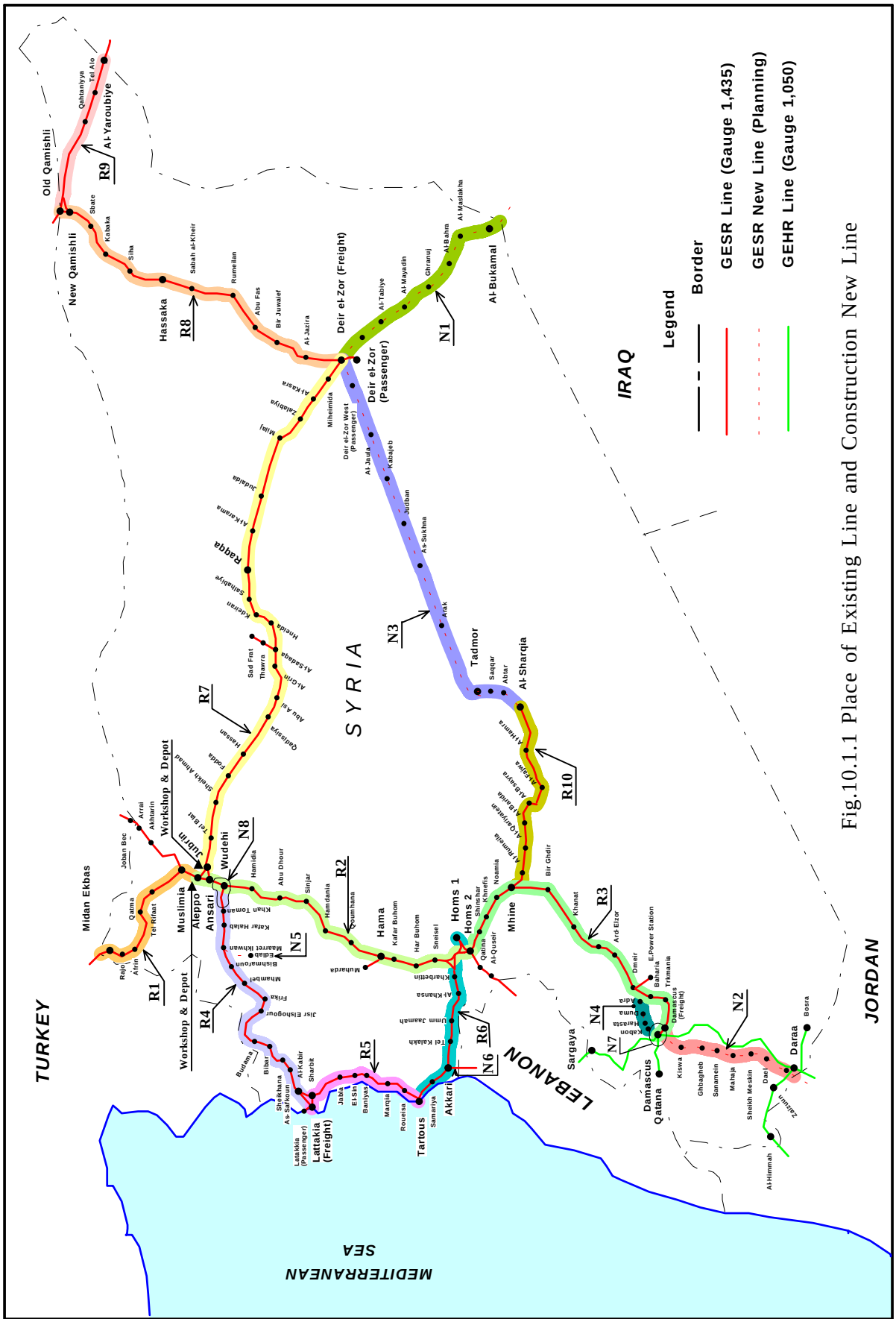


Fig.10.1.1 Place of Existing Line and Construction New Line

10.2 Track Facilities Improvement Plan

10.2.1 Track Capacity Strengthening Plan

To secure track capacity, signal stations should be installed between the present stations coping with the increase of number of trains. But in order to raise effectiveness, it is needed to divide the section between stations into 2 or 3 equal parts.

However, depending on track alignment, to install signal stations at equally spaced position between the current stations will be very difficult and the construction cost will become very high.

Consequently, in installing signal stations, it should be installed at places near to the roughly equally divided positions without altering the present alignment.

Design condition of signal station is ;

- Gradient : less than 3.0‰
- Curve Radius : more than 600m
- effective track length : more than 650m

and, if the above conditions are not satisfied, double tracking should be executed.

Improvement details of each section are as shown in Table 10.11. (Refer to Appendix 3.3.1, Appendix 10.1, 10.2)

Table 10.1.1 Improvement Plan of Each Line

No.	Line Name	Distance (km)	No. of Station	No. of New Signal Station	Double Tracking	Improvement of Alignment (km)
R1	Midan Ekbas ～Aleppo	133.2	7	—	—	80.0
R2	Aleppo～Homs	202.2	14	8(10)	37.0	—
R3	Homs～Damascus	202.6	13	7 (21)	112.4	—
R4	Aleppo～Lattakia	210.8	16	—	—	—
R5	Lattakia ～ Tartuos	79.0	7	—	—	—
R6	Tartous～Homs	102.0	7	2 (12)	45.9	39.4
R7	Aleppo～Deir el-Zor	323.0	21	8 (8)	—	—
R8	Deir el-Zor～Qamishli	217.5	11	—	—	—
R9	Qamishli～Al Yaroubiye	79.4	3	—	—	—
R10	Mihine～Al Sharqia	110.7	7	3 (6)	41.2	—
	Total	1,660.4	106	28 (57)	236.5	119.4

Note: Number in ( ) indicate number of necessary signal stations in case of single track (to correspond to the number of train until year 2020.)

(1) Signal Station

On the left and right side of the present track, track will be installed with track spacing of 5m with 650 meters of track effective length and will be connected to the present track with #11 turnout. Track usage direction is right-hand passage as principle and safety-siding is installed on head direction. Tracks laid on left and right side can be used as refuge line of pass-by train and existing track in the middle will be used as common passing track.

Standardized signal station is shown in Fig 10.2.1.

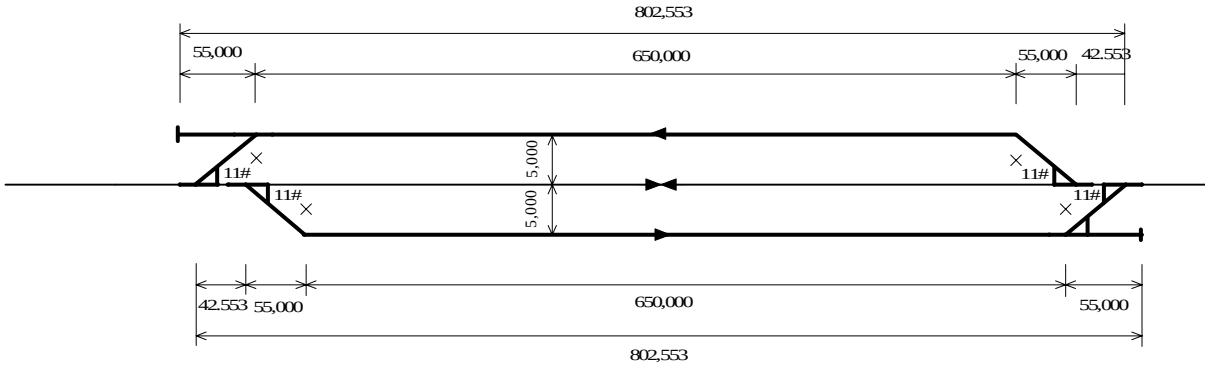


Fig 10.2.1 Standard Layout of Signal Station

(2) Double Tracking

In parallel with the present track between stations, the second track will be laid with 5.0m of track spacing. Considering right hand operation of road traffic and right side locomotive engineer's seat, right side passage train has been adopted in principle.

Standardized cross section of the double track is shown in Fig. 10.2.2.

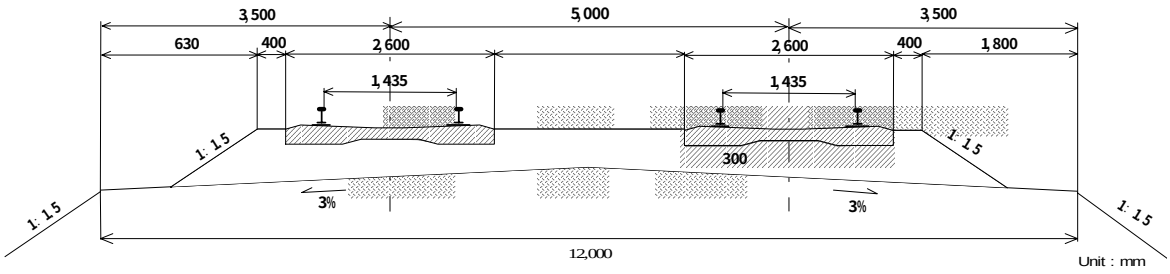


Fig 10.2.2 Cross section of Double Track (Straight Line)

10.2.2 Track Improvement

In order to grasp the present track condition, total track measuring of GESR should be performed and alignment control ledger should be prepared.

Alignment actually measured shall be compared with the original ones, post shall be installed and revision of alignment should be made according to this post.

(1) Rail

P 50 rail will be continued to be used in the same way as at present on main line and for Aleppo-Midan Ekbas and Qamishli- Al-Yaroubiye sections where 37kg/m or 43kg/m rail is used, these rails should be replaced by rail of more than 50kg/m.

(2) Fastening and Sleeper

Some of the plugs used for PC sleeper fastening are wooden made and many are not well functioned because of construction deteriorated due to their dryness and corrosion. Especially, at rail joint point, sleeper itself is deteriorated and will have to be replaced with new sleeper and with respect to fastening devices, replacement by coil spring is now under introduction.

Between Aleppo-Midan Ekbas and Qamishli- Al Yaroubiye, iron-sleepers are still remained and will be replaced with PC sleeper at the time when rails are to be exchanged.

(3) Turnout

At present, passing speed at turnouts is all restricted to 30-40 km/h regardless of straight side or branching side. In general, speed restriction are placed on branching side, but no restriction is placed on straight side. This speed restriction on straight side occurs because maintenance of turnouts and replacement of worn-out parts are not fully performed.

All track ballast at turnout section should be replaced to keep turnout surface plane precisely, and worn out parts, particularly the point rail, crossing and guard rail should be replaced to enable to release the speed restriction on straight line side.

(4) Roadbed

It was observed that many places on main track in railway station were covered by earth and sands.

For these places, whole replacement of ballast should be enforced to secure the formal ballast depth. And also at places between stations having the same conditions, whole replacement of ballast should be enforced.

Between Aleppo-Midan Ekbas and Qamishli-Al-Yaroubiye, ballast is not used below sleepers. At the same time of replacing the iron sleepers, full ballast spreading shall be done.

There are places where ballast are falling down on roadbed slope at embankment because of track formation shortage or increased ballast depth. At some places, even the sleeper-edges are exposed. Especially, at the outside of curved track, there are many such cases seen which may lead to stretch out of track. It is needed to expand the width of track formation, or placing ballast stopper (L type concrete block etc.) can secure the width of ballast of sleeper's edge. (Fig10.2.3)

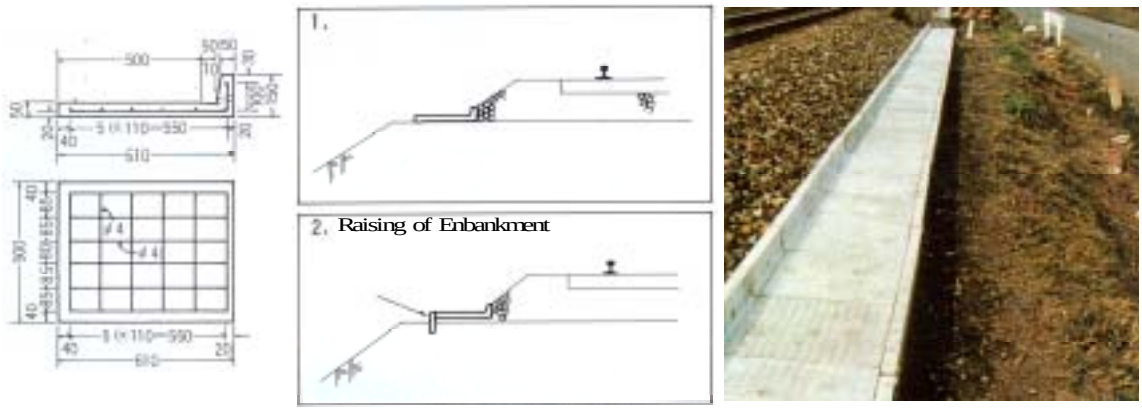


Fig.10.2.3 Ballast curb of L Type concrete block

10.2.3 Railway Level Crossing

There are many railway level crossings where crossing parts are all paved in the same way as the road and it is unable to execute track maintenance. It is, therefore, necessary to improve the level crossing portion as shown in Fig 10.2.4 so as to enable the maintenance.

There are places where the width of level crossing is narrower than road width. Enough width to accord with road traffic should be secured. (Refer to Appendix 10.3)

There are many places seen where inhabitants illegally cross the tracks causing tracks covered with earth and sands. These illegal railway crossings should be removed so as to enable railway to fully exhibit its function. If it is necessary, formal railway level crossing should be installed.

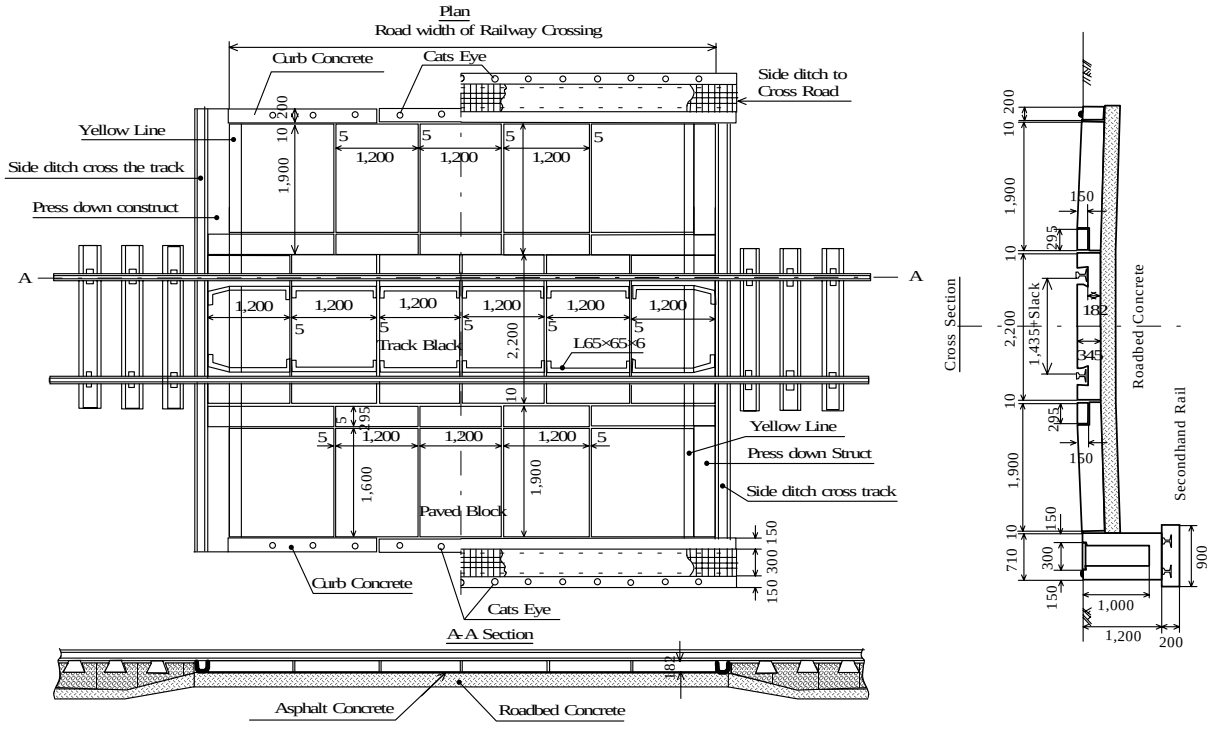


Fig.10.2.4 Railway Level Crossing

10.2.4 Structure

Structures, owing to the short years since construction, are at present fully functioning. Some

time later, however, chances are coming to need to make repairing because of the deterioration. Each structure must be checked on changed condition and check results should be recorded on control ledger.

Because of the weathering of track bed slope and consolidation depression of track formation, reduction of formation width is seen on embankment. As a result of re-ballasting for settlement of track formation, ballasts flow out from the slope. For the time-being, it is possible to keep the track ballast width by the means of the ballast-stop device. However, it is most desirable to keep the regular track formation width by expanding the roadbed width.

As for the bridges between Aleppo-Midan Ekbas and Qamishli-Al-Yaroubiye, they are open floor non-ballast type and those on the other lines are all closed floor ballasted bridges. Bridges with ballast are of narrow width and ballast flow out. It seems that formal ballast amount causes large dead-weight of closed floor type bridge, accordingly that the usage of PC sleepers are restricted. As a countermeasures, solid bed track may be introduced. There are many types of solid bed track. Elastically supported PC sleeper type as shown in Fig10.2.5 is recommendable.

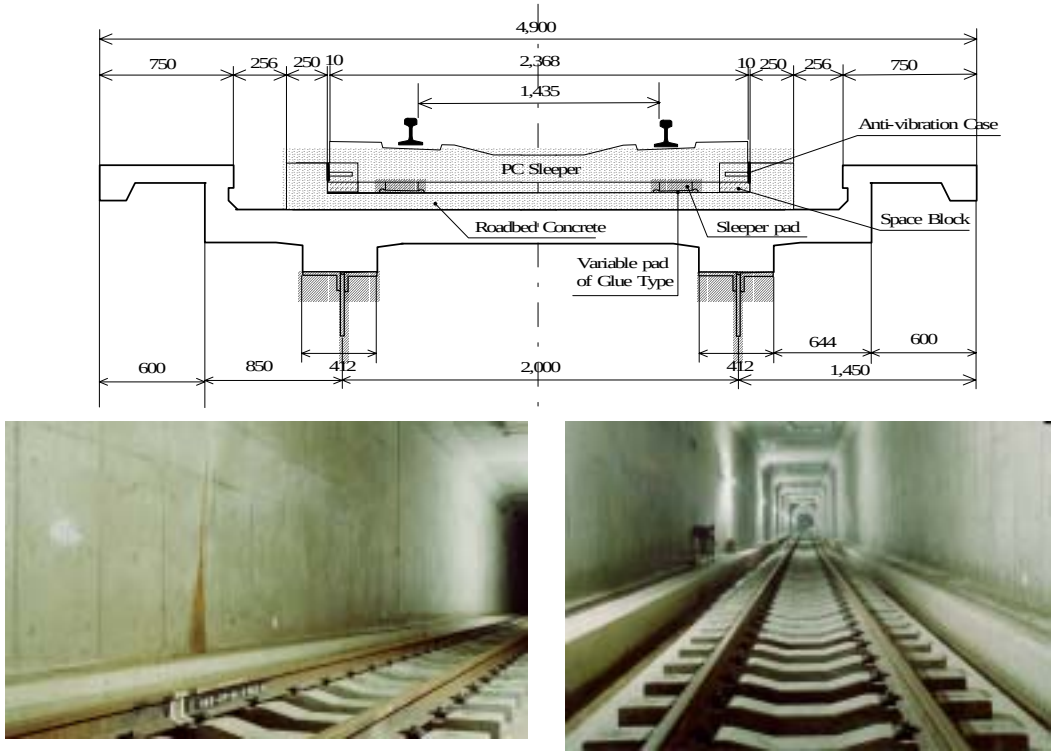


Fig.10.2.5 Elastically Supported PC Sleeper

10.2.5. Protection Facilities

(1) Sand Protection Measure

Cutting section is apt to become the place where drift sand is accumulated. Cutting slope should be made small. Also, in Syria, tree planting and cultivation of farm products are now promoted for sand protection. For implementing such measures, soil improvement along the line of sand protection section must be progressed. And also it is necessary to grasp meteorological information and to allocate track patrol staff in the sand drifting section.

(2) Fencing for Trespassing Railway Track

At the densely built-up section, tracks are partly used as living road. This is not only dangerous for human life but also disturbs train operation, and also destructs the well maintained track condition.

Protection fence should be installed to avoid the above adverse situations.

(3) In order to make clear the width of railway level crossing, fence using old rail should be installed.

10.2.6 Staged Improvement Plan

(1) Schedule

New installation of signal station and double tracking construction works should be planned so as to be completed by the time when track capacity increase is required.

Track improvement on the whole sections is so planned as to be completed in 5 years from the beginning of the Project.

Table 10.2.2 Table of Improvement Schedule

No.	Line Name	Schdule 2000 2005 2010 2015 2020	Railway Maintenance (km)	No. of New Signal Station	Double Tracking Length (km)	Improvement of Alinment (km)
R1	Midan Ekbas – Aleppo		133.2	—	—	80.0
R2	Aleppo – Homs		202.2	8	37.0	39.4
R3	Homs – Damascus		202.6	7	112.4	
R4	Aleppo – Lattakia		210.8	—	—	
R5	Lattakia – Tatous		79.0	—	—	
R6	Tartous – Homs		102.0	2	45.9	
R7	Aleppo – Deir el-Zor		323.0	8	—	
R8	Deir el-Zor – Qamishli		217.5	—	—	
R9	Qamishli – Al Yaroubiye		79.4	—	—	
R10	Mihine – Al Sharqia		110.7	3	41.2	
	Total		1,660.4	28	236.5	119.4

(2) Improvement Cost

Itemized improvement cost and investment schedule by lines is shown in Table 10.2.3.

Table 10.2.3 Cost and Investment Schedule

Unit : Million SP

Line	Item	2001-2005	2006-2010	2011-2015	2016-2020	Total
R1 Midan Ekbas-Aleppo	Land	478	0	0	0	478
	Roadbed	3,127	2,550	0	0	5,677
	Track	797	1,438	0	0	2,235
	Total	4,402	3,988	0	0	8,390
R2 Aleppo-Homs	Land	0	31	1	32	64
	Roadbed	0	430	23	233	686
	Track	936	685	255	812	2,688
	Total	936	1,146	279	1,077	3,438
R3 Homs-Damascus	Land	0	56	61	19	136
	Roadbed	0	367	425	132	924
	Track	964	1,205	1,442	429	4,040
	Total	964	1,628	1,928	580	5,100
R4 Aleppo-Lattakia	Land	0	0	0	0	0
	Roadbed	0	0	0	0	0
	Track	941	0	0	0	941
	Total	941	0	0	0	941
R5 Lattakia-Tartous	Land	0	0	0	0	0
	Roadbed	0	0	0	0	0
	Track	422	0	0	0	422
	Total	422	0	0	0	422
R6 Taltous-Homs	Land	0	107	117	3	227
	Roadbed	0	633	697	45	1,375
	Track	922	2,129	2,342	128	5,521
	Total	922	2,869	3,156	176	7,123
R7 Aleppo-Deir el-Zor	Land	0	0	3	7	10
	Roadbed	0	0	45	137	182
	Track	1,632	0	128	384	2,144
	Total	1,632	0	176	528	2,336
R8 Deir el-Zor-Qamishli	Land	0	0	0	0	0
	Roadbed	0	0	0	0	0
	Track	998	0	410	410	1,818
	Total	998	0	410	410	1,818
R9 Qamishli-Al-Yaroubiye	Land	0	0	0	0	0
	Roadbed	0	0	0	0	0
	Track	0	0	825	835	1,660
	Total	0	0	825	835	1,660
R10 Mihine-Al - Sharqia	Land	0	53	1	0	54
	Roadbed	0	346	23	0	369
	Track	531	1,137	64	0	1,732
	Total	531	1,536	88	0	2,155
Ground Total		11,748	11,167	6,862	3,606	33,383

(3) Others

Within 20 years, 912 km of new track will be constructed including 271 km of track addition of existing lines and 1660 km of existing track will be rehabilitated. Namely about 2572 km of track will be constructed or rehabilitated within 20 years. It means that about 129 km of track will be constructed or rehabilitated per year on an average.

In accordance with progress of rehabilitation of existing lines, used rails will be generated. Out of these used rails, undamaged ones can be used for improvement or construction of other branch lines or sidings such as Qatata Line, industrial sidings, etc., in order to save cost of rail.

10.3 Maintenance System

From 1907 to 1920, the railway from Turkish border to Iraq through Aleppo and Qamishli - Al Yaroubiye was constructed by the German technology.

Before this railway construction, Hijdas Railway was extended to the south but there were no railway network in the central part of Syria and from the latter part of 1960 until the latter part of 1980, the present network was constructed by the Russian technology.

For 30 years the Russian railway technology was brought up but after Russia's withdrawal, it is the time to establish the railway standard of Syrian Railways.

JICA Study Team have requested many information/data on survey at this time, and found out that there are facilities having multiple different kilometrages from the origin point. This will seriously disturb future track control and preparation of control ledger of each facility. Jubrin is already used as the origin point for train operational purpose, accordingly it is recommended that Jubrin should be also used as the origin point of kilometrage for track and structure maintenance.

10.3.1 Maintenance Organization

(1) Head Office, Each Railway Operating Division

The post exclusively handling track and structure control should be strengthened so as for the engineers in charge to be able to grasp the updated conditions of track and structures.

(2) Field Organization (track maintenance depot and track maintenance group)

Also within the field organization, engineers assigned exclusively for track and structure control must be strengthened in same way as in operating divisions, so as to grasp updated conditions of the site.

Track maintenance work is done by internal workers and one gang consisting of 9-12 workers is assigned for every 20-25km responsible section and there are 92 Gang Groups in total in GESR. Hereafter, maintenance volume will be increased according to the increasing number of train operations. Review on track maintenance work system is

necessary, so as to enable some work to be entrusted outside.

10.3.2 Arrangement of Various Regulations, Control Ledger and Maintenance Work Process

By Russian Railway's technical rules and regulations, railway construction and maintenance have been made up to now. However, in order to make railway transport more stable, rules, regulations and standard of Syrian Railways must be established.

(1) Rearrangement of various regulations

Official regulations can be divided into 3 items as follows:

- ・Rule To stipulate the minimum requirements of track and structure in order to secure the safety of railway transport. Therefore, the limit which was decided in this Rule can not be violated.
- ・Regulation Can be divided into Regulation and Standard rule.
  Regulation is established for new line construction, improvement and maintenance of rail way facilities.
  Standard rule is the rule for handling process of track and structure.
- ・Standard For every regulations, each working method, handling procedures are defined in detail.

(2) Rearrangement of Various Control Ledger

To grasp the up-dated condition, it is proposed to have numerical value control using statistics analysis of 5 items (rail gauge, track level, longitudinal level, alignment and track distortion) to show the track condition. (Appendix 10.4)

In addition to the above, kind of track material, historic data of track material, deterioration condition of track material and materials necessary to secure safety operation of train are the items to be arranged.

Also for structure control, in order to secure safety operation of train, completion drawing, design calculation paper and volume of material for every one by one item must be edited.

At present, track inspection/measuring car is introduced to grasp track conditions, but this inspection/measuring car has already been used for more than 10 several years. Measuring car with new measuring devices enabling compilation and analysis of the results of measuring should be introduced.

(3) Maintenance Work Process

On track maintenance, special and various kind of machines or measuring equipments are to be used. If these equipments are used wrongly, effective work or rightful data can not be obtained, also the precision of finishing become uneven. In order to keep maintain stable track, suitable control work method and inspection method making use of machine and equipment must be established.

10.3.3 Track Maintenance Machines/Equipment

(1) Track Maintenance Machine

As stated in Chapter 3, Syrian Railways possess various large size maintenance machines, however, most of them are superannuated. The large size machine maintenance group of the Track and Structures Department of the Head office possess 2 Multiple Tie Tampers, 2 Ballast Profiling Machines and 2 Ballast Consolidating Machines which are fully functioning. Those 3 Machines in 1 set are executing track maintenance for sections for GESR.

Each one set should be assigned to North, East and Central Transport Bureau, to carry out overall tamping on all the sections of GESR once a year.

(2) Measuring Equipment and Appliance

Track inspection/measuring car now in use was introduced in 1982, but measuring items are limited and it takes time for data processing. Therefore, one (1) new one is planned to be introduced for improvement of track control.

For each track maintenance depot, one set of measuring equipments (level, transit, distance meter) will be assigned to have standard post to be placed.

Track Gauge or Level measuring appliances which are essentially needed at site are the appliances to be used so frequently, and therefore, it is needed to be maintained by

checking and to keep ready for use. Those appliances which are not adjustable to use must be replaced.

10.3.4. Education and Training

Training Center is within Railway Academy, to make recruit education and rank-up training for staff who are to be engaged in field-work. Other than this, no particular Education/Training is now carried out. Along with the future increase of train operation and speed up operation, new technology for track maintenance will be introduced for maintaining safe track facilities.
To cope with such situations, appropriate education must be provided for staffs from organization concerned.

At present, there are many vacancies against full fixed strength staff in the head office as well as in the field organ. To cope with the increasing new lines, maintenance staff must be secured. Necessary condition of recruiting is different depending on working category. However, recruit is very difficult considering the current labor supply situations.

Considering the staffing situation of the entire state railway, it is thought that there may be some surplus staff in some railway fields and it is presumed possible to secure necessary staff after having transferring education and it is recommended to establish such transfer education.

10.4 Staged Construction Plan of New Lines

To build up a network with neighboring countries, i.e., Iraq and Jordan and also to develop a domestic network, new line construction plans as shown in the followings are underway.

10.4.1 Deir el-Zor-Al Bukamal (N1)

This is a route originated from Deir el-Zor to Baghdad (Iraq) through the left side bank of the Euphrates River, and then crossing the river to the right side bank at midway to the border of Al-Bukamal. The project include a plan to construct a branch line linking with a natural gas exploitation site form an en-route station Al-Tabiye. As of now, approximately 22km of roadbeds from Deir el-Zor are completed. The outline of the plan is as follows:

Length of Main Track :	145.0km
Length of Station Track :	30.5km
Length of Branch Line :	14.0 km
Total Track Length :	189.0km
Stations :	6 stations (Al-Tabiya, Al-Mayadin, Ghranji, Al-Bahra, Al-Maslakha and Al-Bukamal)
Track Structure Standard :	2^{nd} grade line (per Russian Railway)
	Passenger train -160km/h, freight train -120km/h.
	Axle load - 25 tons
	Annual net tonnage : 15-25 million tons

During 1980s, it was once planned as the 3^{rd} grade line according to Russian railway standards, but modified to the 2^{nd} grade line after a review. Since it is planned that the alignment standard in Iraq can accommodate trains with the maximum speed of 250km/h, a study for the review of an alignment suitable to the Iraq standard is underway.

10.4.2 Damascus – Darra (N2)

This is a route planned originating from Damascus along the Daraa line of Hedjaz Railway headed to the south via Darra to the border and reaches Amman (Jordan). The plan includes a branch line from an en-route station Sheikh Meskin to the east and reaching Sowaida. As of now, a little part of structures near Damascus is completed.

The outline of the plan is as follows:

Length of Main Track :	101.0km
Length of Station Track :	32.5km
Length of Branch Line :	51.0 km
Length of Station Track for Branch Line :	15.0 km
Total Track Length :	199.0km
Stations (Main Line) :	7 stations (Kiswa, Ghbagheb, Sanamein, Mahaja, Sheih Meskin, Dael and Darra)
Station(Branch Line) :	4 stations
Construction Cost:	7,353 million Syrian Pound
Track Structure Standard :	3rd Grade Line (per Russian Railway standard) Passenger train- 120km/h, freight train-100km/h. Axle load -25 tons Annual net tonnage : 8 to 15 million tons

This line was also once planned and designed during 1980s by Russian as well as Deir el-Zor – Al Bukamal line.

10.4.3 Al-Sharqia – Deir el-Zor (N3)

This is the extention of the current Mihine～Sharqia line constructed to transport phosphate ores exploited near Sharqia to the Tartous port. By extending and connecting the line to Deir el-Zor, this line becomes a shortcut from Qamishli and Deir el-Zor to Tartous and Damascus.

Since there are the Parmyla remains, which are one of the world heritages near Sharqia, this route would have a high potential in the future for tourist traffic. Partially from Sharqia to Tadmor, 3 stations with a track length of about 44.6km are under construction, however, not even a survey has yet commenced for the section between Tadmor and Dei el-Zor, the route length of which is about 194 km.

10.4.4 Others

Besides the above-mentioned 3 line sections, other new line constructions are planned for sections where domestic railway network is not enough. Also, to link developing industrial complex along the line to the nearest station, freight exclusive line is to be constructed.

Further study is necessary to identify the details of the need of construction. Table 10.4.1 shows these plans and their approximate length.

Table 10.4.1 Table of New Line Plan

No.	Section	Category	Length (km)	Remarks
N4	Adra – Kabon	New Line	23	
N5	Marret Ikhwan – Edlab	New Line	31	
N6	Akkari – Lebanon Border	Reconstruction	5	
N7	Kadam – Hejaz Station	New Line	4	
N8	West Entrance to Aleppo (＊)	Relocation	28	
S1	Muslimia – Industrial Zone	Construction to Industrial Zone	4	
S2	Adra – Industrial Zone	- ditto -	3	
S3	Noamis – Industrial Zone	- ditto -	17	
S4	Jisr Elshogour for Suger Beat Factory	- ditto -		
S5	Tel Alo – Al Rumilan for Croude Oil & Natural Gas	- ditto -		
S6	Hassaka – Shddadah for Crude Oil & Natural Gas	- ditto -		

(＊) There is a future plan to make Aleppo station as passenger-exclusive station.

10.4.5 Staged Construction Plan

(1) Schedule

New line construction already commenced by GESR will be kept advanced. And, as for construction of other new lines of which construction will be commenced from now, it should be synchronized with the commencement of commercial operation of traffic. Entire construction plan and route length, number of station are shown in Table 10.4.2.

Table 10.4.2 Construction Schedule of New Line

No.	Line Name	Schdule 2000	2005	2010	2015	2020	Railway Length (km)	Station (place)	Remarks
N1	Deir el-Zor - Al-Bukamal						145.0	6	
N2	Damascus - Daraa						152.0	7	
N3	Al Sharqia - Deir el-Zor						239.0	14 (9)	
N4	Adra - Kabon						23.0	3	
N5	Marret Ikhwan - Edlab						31.0		
N6	Akkari - Lebanon Border						5.0		
N7	Kadam - Hidjaz Station						4.0	1	
N8	West Entrance to Aleppo						28.0	1	
	Total						627.0	32	

Note : The figure in ( ) indicates GESR Plan.

(2) Construction Cost

Itemized construction cost and schedule by lines are shown in Table 10.4.3.

Table 10.4.3 Construction Cost of New Line

Unit : Million SP

Line	Item	2001-2005	2006-2010	2011-2015	2016-2020	Total
N1 Deir el-Zor-Al Bukamal	Land	518	0	0	0	518
	Roadbed	5,466	0	0	0	5,466
	Track	3,441	0	0	0	3,441
	Total	9,425	0	0	0	9,425
N2 Damascus-Daraa	Land	593	0	0	71	664
	Roadbed	6,258	0	0	674	6,932
	Track	3,939	0	0	503	4,442
	Total	10,790	0	0	1,248	12,038
N3 AlSharqia-Deir-el-Zor	Land	542	320	0	0	862
	Roadbed	4,840	4,305	0	0	9,145
	Track	2,378	3,678	0	0	6,056
	Total	7,760	8,303	0	0	16,063
N4 Adra-Kabon	Land	108	0	0	0	108
	Roadbed	1,134	0	0	0	1,134
	Track	713	0	0	0	713
	Total	1,955	0	0	0	1,955
N5 Marret Ikhwan-Edlab	Land	0	0	111	0	111
	Roadbed	0	0	1,169	0	1,169
	Track	0	0	735	0	735
	Total	0	0	2,015	0	2,015
N6 Akkari-Lebanon Border	Land	0	0	0	0	0
	Roadbed		0	0	0	0
	Track	110	0	0	0	110
	Total	110	0	0	0	110
N7 Kadam-Hidjaz Station	Land	135	25	0	0	160
	Roadbed	168	108	0	0	276
	Track	0	84	0	0	84
	Total	303	217	0	0	520
N8 West Entrance to Aleppo	Land	0	112	0	0	112
	Roadbed	0	1,121	0	0	1,121
	Track	0	926	0	0	926
	Total	0	2,159	0	0	2,159
Ground Total		30,343	10,679	2,015	1,248	44,285

(3) Others

Within 20 years, 912km of new track will be constructed including 271km of track addition of existing lines and 1,660km of existing track will be rehabilitated. namely about 2,572km will be constructed or rehabilitated within 20 years. It means that about 129km of track will be constructed or rehabilitated per year on an average.

In accordance with progress of rehabilitation of existing lines, used rails will be generated. Out of these used rails, undamaged ones can be used for improvement or construction of other branch lines or sidings such as Qatana Line, industrial sidings, etc., in order to save cost of rail.

Chapter 11

Improvement of Signal and Telecommunication System

Chapter11 Improvement of Signal and Telecommunication System

11.1 Basic Policy

Equipment and devices of signal and telecommunication systems at present are described in the Chapter 3.4.

The installation time of equipment and kind of equipment installed are different according to section.

Signal and telecommunication facilities can be largely classified into three categories：

(1) Lattakia – Aleppo - Qamishli (about 739km) sections were constructed around in 1971 with signal and telecommunication equipment of Type1;
(2) Tartous - Homs2 (about 102km) , Aleppo – Damascus (about 382km) and Mhine - Al-Sharqia (about 110km) sections were constructed around in 1982 with equipment of Type 2;
(3) In the sections of Aleppo - Midan Ekbas (about 117km), Qamishli - Al Yaroubiye (about 80km) and Lattakia – Tartous (about 86km), there is no particular signal and telecommunication equipment except radio equipment installed around in 1993 and decrepit bare wire lines.

Thus signal and telecommunication equipment and devices are different by section, in terms of the kind of equipment or in terms of the time of installation (elapsed year)

Accordingly, replacement time of signal and telecommunication equipment and devices is schemed considering the kind of equipment, time of installation (elapsed year) and time of improvement of the section.

Equipment and devices of signal and telecommunication to be installed in this plan are based on internationally recognized standards and well proven technologies.
They should be also selected carefully considering maintainability from various points.

In the installation of telecommunication cables and transmission system, there should be

considered the increase of computer terminals and communication lines due to the expansion of information systems in the GESR such as freight information system, ticket reservation and vending system and other management system in the future.

Centralized supervising system of equipment and devices should be introduced to detect function deterioration and failures of signal and telecommunication equipment and to decrease chances of the equipment failures and the time of recovery.

11.2 Improvement Plan of Signal Equipment and Devices

11.2.1 Blocking Equipment

The space interval method (method of operating trains with a certain spatial distance between the trains) is to be used for blocking system.

(1) Double track section

The indication of the signal is to be automatically controlled by the track circuits, which are installed continuously both in the station area and in the section between stations.

A number of signals are to be provided between stations to divide the section into small block sections.

(2) Single track section

A pair of traffic levers are to be provided between adjacent two stations.

These pair of traffic levers are operated only after mutual consultation and mutual operation between adjacent two stations, and are always set at either of up or down direction of train operation.

In the station area, continuous track circuits are to be provided, whereas in the section between adjacent stations, only short track circuits (CT, OT) are to be installed at the home signals to detect train going/coming in this report.

However, provided that track capacity of the particular sections become critical at the time of construction, continuous track circuits with intermediate block sections would be

considered even in the single track sections.
Rough comparison of axle counting system with track circuit is shown in Appendix 11-1.

11.2.2 Signals

Indication of color light signals is to be the same as the current system.

The planned speed of trains is to increase due to improvement of the track, level crossing, rolling stock, and others.

Accordingly, necessary visible distance of signal indication should be longer than the present one.

This should be taken into account at replacement of signals.
It is also necessary to examine introduction of color light signal of LED (Light Emitting Diode) with long life.

In the case of a light bulb, double filament bulb should be installed to decrease chance of entire failure of a signal bulb.

Detector of signal bulb failure is to be provided at the signal to inform its failure immediately to the CTC center/maintenance depot in charge.

In the single track sections, Distant signal is to be installed at the outside of the home signal for the purpose of repeating signal aspect in the same way as the current system.

11.2.3 Interlocking devices

Interlocking devices, which administer locking and interlocking of signals and switches in the stations, are to be installed in the stations where turnouts are provided.
Interlocking device to be installed is to be concentrated type.
The electronic interlocking devices (computerized interlocking systems) are to be used for all stations with turnouts.

The electronic interlocking device was developed as the interlocking device to succeed the relay interlocking devices.

It realizes the interlocking logic by computer software on micro- computer, and its safety is ensured by the technique of redundancy.

In this master plan, the electronic interlocking devices are to be installed in each station. However, thanks to the installation of optical fiber cable, concentrated installation of interlocking devices of several stations into one place becomes possible.

This plan will be finalized after considering maintenance method including trouble shooting and also making comparison of construction cost.

11.2.4 Level crossing protection devices

Level crossing protection devices (crossing alarm, crossing gate) are to be replaced at the time of signal and telecommunication section rehabilitation.

Number of accidents at the level crossing tends to increase due to increase of road traffic volume and high speed train operation.

So, level crossing protection devices are to be installed at the level crossings with no signal protection devices at present, after considering volume of road traffic, volume of railway traffic and the distance of unobstructed view from the road.

In addition to the crossing alarm and crossing gate, warning devices to the trains are to be provided to inform the obstacle to the drivers by using manipulator at the level crossing.
The train travel time is expected to be reduced after installation of these level crossing protection devices and the campaign for traffic safety to passersby and vehicle drivers.
The electronic level protection devices, which are gradually introduced, will be used after comparison of reliability, maintenance method, and the construction cost between the electronic type and the magnetic relay type.

11.2.5 ATS/ATP (Automatic Train Stop/Automatic Train protection)

ATS/ATP (Automatic Train Stop/Automatic Train protection) system is to be used in all the section lines of the GESR.

ATS/ATP (Automatic Train Stop/Automatic Train protection) system is to be installed to prevent train collisions, which occur when judgment and action of the driver are erroneous, by stopping a train automatically before it runs into block section indicating red signal.

And it is also to be used for the purpose of train speed restriction against the oversight of the sign on driver part in the section with speed limit such as the turnouts and curved section.

ATS/ATP (Automatic Train Stop/Automatic Train protection) system to be adopted in this master plan is comprised of the ground equipment transmitting the ground condition and the equipment provided on the cab to read the condition and to give a warning to a crew and apply an emergency brake, as required.

11.2.6 CTC (Centralized Train Control)

CTC system, in which the switches and signals of the remote stations are watched and controlled from the CTC center directly, is to be installed to control and supervise efficiently train operation of the section.

CTC central unit, control board (or control terminal), display board (or display), train number display devices and train diagram recorder are to be provided in the CTC center.

CTC station unit and supplementary control board (it is used in the case of CTC system failure) are to be installed in remote controlled stations.
Stations like Aleppo, having many signals and switches for train operation within station, are not to be controlled from the CTC center.

However indication of some signals, train existence and other necessary information are to be transmitted and displayed at the CTC center.(displayed station).
The five CTC centers (Aleppo, Lattakia, Homs, Damascus, Deir el-Zor) are to be constructed

in this master plan.

Fig 11.2.1 shows these five CTC centers and stations controlled from each CTC center. These five CTC centers are to be supervised from the master control center in Aleppo.

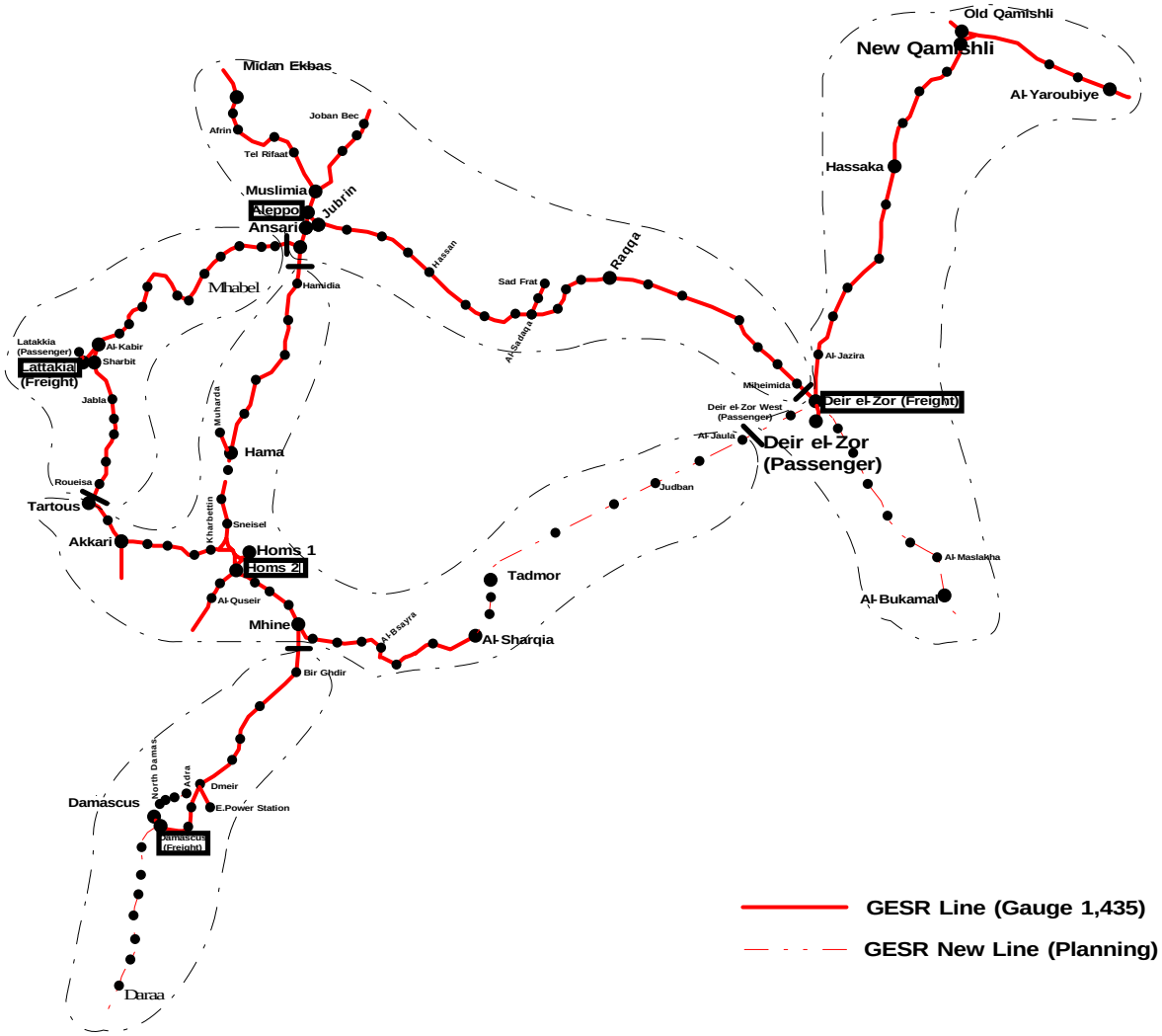


Fig 11.2.1 CTC center and Control Section

11.2.7 Centralized monitoring device

Signal and telecommunication equipment is playing an important role in the modernized railway operation and management.

If such equipment goes into failure and takes a long time for recovery, the train operation is

seriously affected.

Therefore, it is necessary to detect the deterioration of equipment and to replace or adjust the parts deteriorated before going into failure.

If detection of deterioration is difficult, it is inevitable to detect equipment failure and inform it immediately to the maintenance depot and repair it quickly.

For that purpose the centralized monitoring devices are to be provided in this master plan.

The centralized monitoring device is to detect and inform the deterioration of various signal and telecommunication equipment along the railway lines, or to detect failures of equipment and to inform it to the CTC center/maintenance depot to repair.

Signal bulb burnout, incorrect-lock of the electric switches, failure of level crossing protection devices, grounding of the cables, failure of power supply to the devices, and other signal and telecommunication equipment failures are detected and concentrated by this centralized monitoring device.

Information centralized through this device is utilized by computer terminal at the maintenance depot in charge.

11.3 Improvement plan of telecommunication equipment and devices

11.3.1 Telecommunication cable

Complex optical fiber cable (2Qcu24opt) is to be installed, or optical fiber cable and metallic cable to be installed under ground along all sections.
Telephone boxes, which are connected to the metallic lines of the complex optical fiber cable, are to be installed alongside the track.

Metallic lines in the cable are to be used for lines of the telephone box, lines of the centralized monitoring devices, lines of devices for detecting such disaster as falling rocks and sand pile.

Fiber cores are to be used for the train operation, management of personnel, maintenance of facilities and other basic communication network for the GESR.

Spare fiber cores could be utilized for the non-railway domestic telecommunication infrastructure of Syria.

11.3.2 Fiber optic transmission system

Multiplexer, demultiplexer and regenerator for the fiber optic transmission system are to be installed at every station.

STM-1 (155.52Mbps), interface name of SDH (Synchronous Digital Hierarchy), is to be used for the fiber optic transmission system in GESR.

SDH (Synchronous Digital Hierarchy) was standardized by CCITT (now ITU-T) in 1988.

11.3.3 Digital exchanger

Telephone network of the GESR is to be systematized by one numbering plan.
Digital telephone exchangers are to be installed in twelve stations.

(Aleppo, Lattakia, Homs, Mhine, Damascus, Deir el-Zor, Tartous, Jublin, Hama, Raqqa,

Hassaka and Qamishli)

11.3.4 Radio communication

Of the three radio communication links being used at present, radio communication link between the train driver and stationmaster in the station area (dispatching radio communication line) is to be extended to the CTC center.

The fiber optic transmission system is to be used to link between the radio base in the station and CTC center for dispatching radio communication line.
Communication link between adjacent stations is to be replaced by the fiber optic transmission system.
Therefore, radio frequencies which are used for the radio link between adjacent stations at present are to be utilized for the communications between maintenance employee (track, signal and telecommunication) working alongside the track and relevant station/depot, or to be used in the case of accident. (train drivers could carry this radio telephone set throughout their duty)

Radio communication link used in the station yard at present is to be continued after replacement of equipment and devices in this master plan.

11.3.5 Other systems

(1) Public address system

Public address systems are to be equipped in the major station for guiding passenger in the station.

(2) Central time system

Slave clocks are to be equipped in all the stations and time signal is to be delivered from the master clocks installed in the major station.

(3) Train destination indicators

Train destination indicators for guiding passenger are to be equipped in the major station.

(4) Closed circuit television system

In case of necessity, closed circuit television system is to be equipped for monitoring of entraining and detraining of passenger and for monitoring important locations by using optical fiber cores.

11.4 Maintenance organization

The purpose of the maintenance of the signal and telecommunication equipment and devices is to prevent failures of equipment and to repair their failures quickly in case of trouble.

11.4.1 Basic idea of maintenance

Basic idea of maintenance is to detect deterioration of equipment by inspection and to take restoration measures.

If failure occurs, maintenance workers are dispatched to the site promptly to make necessary repair.

Inspection of equipment is to be conducted at regular intervals and to get necessary data.
Such data as installation date, inspection date and data, date of failure, kind of failure and repaired result are to be accumulated for equipment by equipment.

These data are to be utilized for later inspection and restoration of later failure.

Equipment failure records are to be concentrated and major failure records are to be displayed in the CTC center for the quick restoration, and these concentrated failure and deterioration records are to be displayed or to be monitored by using terminals at the maintenance depot in charge.

11.4.2 Maintenance employees

Number of maintenance employees of the signal and telecommunication equipment and devices are to be increased, because new signal stations and level crossings with signal

protection devices will be introduced for improvement of the sections.

Number of maintenance employees is to be 615 by 2020 as shown in the Table 11.4.1**.**
Enhancement and continuity of maintenance technique, innovation of equipment and reshuffling of personnel are to be considered in recruiting new maintenance employees.

In addition to reshuffling of personnel from the train operation depot after training in the training center, it is necessary to recruit new graduates with much knowledge of electronics and computer software to maintain such equipment as electronic interlocking equipment and fiber optic terminals, which are to be newly installed.

Except engineers in the head office, these maintenance employees are to be stationed in the depot shown in the Fig 11.4.1.

Maintenance staff is to be collectively positioned so that they can be dispatched to any site in trouble within at least one hour from a depot in charge.

In general, maintenance is conducted centering on equipment inspection by the experts of respective field pooled in the depot concerned.
Maintenance engineers are to be stationed at depot so as someone in the depot can make restoration of any equipment in trouble.

Table 11.4.1 Number of Employees

	at present (2000)	I stage 2001～2005	II stage 2006～2010	IIIstage 2011～2015	IVstage 2016～2020
Number of increase					
Rehabilitation		23	23	2	0
New section		39	30	32	17
Number of increase(total)		62	53	34	17
Total Number of maintenance employee	450	512	565	598	615

*** New section: including new signal station and double track**

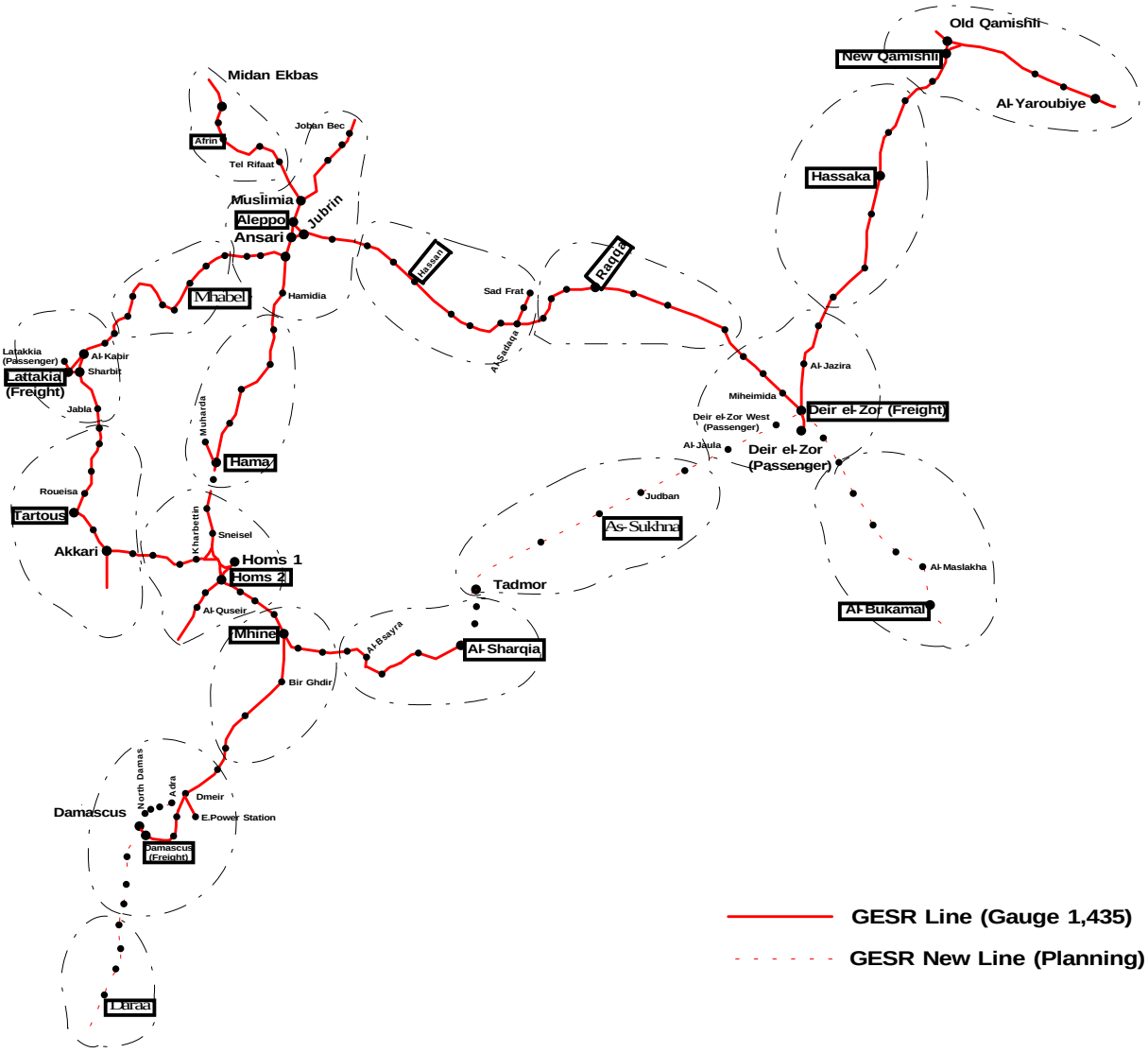


Fig 11.4.1 Maintenance depot and its covering area

11.5 Staged construction plan for signal and telecommunication equipment

Equipment conditions, construction date (elapsed years), rehabilitation and grade-up stage of the sections are considered.

Construction stage is divided into four stages in the same way as a whole master plan.

Construction volume of each stage is also considered.

Table 11.5.1 shows construction time, construction number of major equipment and construction cost of signal and telecommunication equipment and devices.

Table 11.5.1 Staged Construction Plan for Signal and Telecommunication (Including construction expense)

Project	No of station length(km)	Signal & Telecommunication at present	I stage 2001～2005	II stage 2006～2010	III stage 2011～2015	IV stage 2016～2020	Summary of Construction
Midan Ekbas～(Aleppo)	8	no signal equipment					(T)143,(S)169,(SW)90,(LCA)14,(LCG)3,(cable,20kv-line)120k,
	117	OHL(4)		616			(P/S)(STM)(Radio)(CTC)/cable of st.)8
(Aleppo)～Damascus	23	Type2					(T)502,(S)468,(SW)289,(LCA)50,(LCG)223,(cable,20kv-line)994k,
Aleppo,Ansari,Wudehi are not included	395	cable(7Q1.4mm)		1833	339(8st,54k)	225(5st,46k)	(P/S)(STM)(Radio)(CTC)/cable of st.)23,(PA)3,(PBX)3
Aleppo～Lattakia	13	Type1					(T)167,(S)253,(SW)183,(LCA)26,(LCG)10,(cable,20kv-line)208k,
	194	OHL(8)	892	17(15k)		103(3st)	(P/S)(STM)(Radio)(CTC)/cable of st.)13,(PA)2,(PBX)2
(Lattakia)～(Tartous)	5	no signal equipment					(T)149,(S)144,(SW)97,(LCA)27,(LCG)183,(cable,20kv-line)95k
	89	no wire line	472				(P/S)(STM)(Radio)(CTC)/cable of st.)5
Tartous～(Homs～Mhino)～Al Sharqia	15	Type2					(T)312,(S)326,(SW)190,(LCA)32,(LCG)15,(cable,20kv-line)211k,
	216	cable(7Q1.4mm)		1198(2st,79k)	88(1st,48k)	69(2st)	(P/S)(STM)(Radio)(CTC)/cable of st.)15,(PA)1,(PBX)1
(Aleppo)～Deir el-zor	20	Type1					(T)322,(S)293,(SW)195,(LCA)34,(LCG)6,(cable,20kv-line)347k,
	323	OHL(8)	1283		70(2st)	307(9st)	(P/S)(STM)(Radio)(CTC)/cable of st.)20,(PA)2,(PBX)3
(Deir el-zor)～Qamishli	7	Type1					(T)96,(S)88,(SW)78,(LCA)8,(LCG)6,(cable,20kv-line)216k,
	211	OHL(8)	531			139(4st)	(P/S)(STM)(Radio)(CTC)/cable of st.)7,(PA)2,(PBX)2
(Qamishli)～Al Yaroubiye	3	no signal equipment					(T)84,(S)43,(SW)24,(LCA)3,(LCG)1,(cable,20kv-line)78k
	76	no wire line			209		(P/S)(STM)(Radio)(CTC)/cable of st.)3
(Deir el-zor)～Al Bukamal	6						(T)128,(S)128,(SW)66,(LCA)10,(LCG)3,(cable,20kv-line)147k
	140		483				(P/S)(STM)(Radio)(CTC)/cable of st.)6
(Damascus)～Kiswa～Jordan Border	7						(T)144,(S)144,(SW)66,(LCA)10,(LCG)7,(cable,20kv-line)103k
	97		72(1ST)		408(6ST)		(P/S)(STM)(Radio)(CTC)/cable of st.)7
(Al Sharqia)～Tadmor～Deir el-zor	8						(T)88,(S)64,(SW)48,(LCA)16,(LCG)13,(cable,20kv-line)234k
	238			549	35(1st)	171(5st)	(P/S)(STM)(Radio)(CTC)/cable of st.)8
Adra～Kabon	4						(T)64,(S)64,(SW)66,(LCA)4,(LCG)3,(cable,20kv-line)24k
	24		241				(P/S)(STM)(Radio)(CTC)/cable of st.)4
(Maarret Ikhwan)～Edlab	1						(T)20,(S)20,(SW)16,(LCA)0,(LCG)0,(cable,20kv-line)31k
	31				80		(P/S)(STM)(Radio)(CTC)/cable of st.)1
(Akkari)～Lebanon Border	1						(T)20,(S)20,(SW)16,(LCA)0,(LCG)0,(cable,20kv-line)5k
	5		66				(P/S)(STM)(Radio)(CTC)/cable of st.)1
(Kadam)～Hidjaz station	1						(T)20,(S)20,(SW)16,(LCA)0,(LCG)0,(cable,20kv-line)4k
	4		67				(P/S)(STM)(Radio)(CTC)/cable of st.)1
West Entrance to Aleppo	2						(T)20,(S)20,(SW)16,(LCA)0,(LCG)0,(cable,20kv-line)14k
	14			94			(P/S)(STM)(Radio)(CTC)/cable of st.)2
Freight Information System	35						35terminals
					189		
Total			4107	4308	1406	1013	

(million sp)

rehabilitation
grade-up
( ) st:signal station
k :length of double track

(T)track circuit,(S)colour light signal,(SW)switch machin,
(LCA)crossing alarm,(LCG)crossing gate,(cable)fiber cable,
(PBX)pabx
(S/L)interlocking device,(P/S)power supply(STM)opt. Terminal
(Radio)radio base,(CTC)ctc unit(cable of st.)cable in station
and others

Chapter 12

Administration, Operation and Training Plan

Chapter 12 Administration, Operation and Training Plan

12.1 Organization and Number of Personnel

12.1.1 Organization

The organization of GESR is controlled under the administration consisting of the Director General, the Deputy-Director General and two committees (Executive Committee and Business Committee). The policy of the top management has been well filtered into each employee.

The organization of GESR consists of 17 Divisions in Headquarters and three Regional offices (Eastern, Central and Northern). Three Workshops of locomotive, passenger car and freight wagon are under Traction Division of Headquarters. Most of the Divisions in Headquarters are directly or indirectly handling business related to railway operation. Some of the railway companies in socialistic nations have so many unprofitable Divisions or Sections with no relation to their main line of business chiefly for welfare of their employees, but this does not apply to GESR. The organization of GESR may be kept as it is on the whole. It is appropriate to cover the network of GESR by three Regional Offices. The New lines built under the Master Plan should belong to any one of the Regional Offices. There is no need to establish a new Regional Office or divide the existing one into two. In future CTC System and Freight Information System are to be introduced. The Sections handling these systems should be under the Division controlling train operation in the Regional Offices.

The railway labor union of Syria is cooperative to the enterprise because it has a little bit different characteristics from unions in Western Europe and the United States. It can be deemed as one of the national organizations and some of the union leaders take part in administration and management as members of two committees. In implementing modernization and improvement of GESR, cooperation form labor union can be expected.

The number of employees in GESR seems to be excessive for its operation compared with railways in developed nations. Each section or division has no strong intention to cut the number of personnel and is satisfied only if the number of its members is under the fixed

quota of personnel for the section.

One of the reasons why the number of employees in GESR tends to become excessive is that its organization is divided into too small sections. In small sections there is advantage that the duties and responsibilities of each member are clear and the knowledge of business deepens, but there is also the fault that number of personnel to substitute the persons absent for day offs or illness increases. It should be considered that too small sections be integrated into a little bigger organizations and the personnel in the sections should become interchangeable in their works.

We presented the organization chart of Jublin Locomotive Workshop as an example of too small sections in Figures 7.1.1. (1)/(5) of Chapter 7, Volume III and suggested that the sections be integrated into the groups as large as possible in the new workshop.

12.1.2 Number of Personnel

(1) Car Inspection Workshops and Depots

Basic concepts on necessary number of employees are as follows.

1) Diesel cars are to be maintained and inspected at locomotive workshops and daily inspection and small repair are to be handled by passenger coach depots.

2) Table 12.1.1 shows personnel plan for car inspection workshops and depots in the master plan. Required number of employees is estimated based upon the number of inspected cars and the employees in 1999.

Table 12.1.1 Personnel Plan of Car Inspection Workshops and Depots

Organizations	Number of Employees				
	at Present	2005	2010	2015	2020
Locomotives and Diesel Cars					
Workshop	390	420	530	770	1,150
Lattakia Depot	55	40	40	40	40
Damascus Depot	35	30	30	40	40
Tartous Depot	50	40	40	40	45
Deriel-Zor Depot	50	40	40	40	40
Qamishili Depot	45	40	40	45	55
Aleppo Depot	360	230	290	425	540
Homs Depot	70	85	105	165	215
Sub-Total	1,055	925	1,115	1,565	2,125
Coaches and Wagons					
Passenger Coach Workshop	180	125	100	60	60
Wagon Workshop	150	150	220	315	520
Jubrin Depot	125	125	180	255	425
Aleppo Depot	140	60	50	30	35
Hama Depot	30	20	25	35	50
Homs Depot	95	60	75	95	155
Damascus Depot	20	15	20	25	40
Raqqa Depot	15	15	15	20	30
Deriel-Zor Depot	25	15	20	25	40
Hasaka Depot	10	10	15	15	20
Qamishili Depot	30	25	30	40	60
Lattakia Depot	50	35	45	60	95
Tartous Depot	110	60	85	2	190
Midan Ekbas Depot	15	15	15	115	30
Sub-Total	995	730	895	1,092	1,750
Grand Total	2,050	1,655	2,010	2,657	3,875

(2) Station Personnel and Train Crew

1) Number of Personnel Based upon the Current Standard

During the period of the project from 2001 to 2020, number of station personnel and train crew will increase considerably if the positioning of personnel is arranged based upon the current standard (Refer to Table 12.1.2)

Table 12.1.2 Number of Station Personnel and Train Crew
Estimated Based upon the Current Standard

	at Present	2005	2010	2015	2020
Driver	347	650	820	1,090	1,270
Assistant Driver	237	650	820	1,090	1,270
Sub-total	584	1,300	1,640	2,180	2,540
Station Personnel	1,500	1,500	1,500	1,500	1,500
Conductor	400	450	660	1,100	1,700
Sub-total	1,900	1,950	2,160	2,600	3,200
Total	2,484	3,250	3,800	4,780	5,740

Number of personnel at present has been calculated as follows.

a) Number of drivers and assistant drivers is according to the data presented by GESR
b) Number of station personnel has been assumed to be about 1,500 from the data of 1,665 Persons for GESR in UIC Statistics, 1996 version
c) Chief conductors belonging to Aleppo Station are 100 according to the records of GESR.

Total conductors have been estimated to be about 400 including those in other stations (Lattakia, Homs and Qamishili).

2) Plan of Number of Personnel in Future

To avoid the large increase of employees and to attain efficient and profitable management, some measures of reformation should be introduced.

The personnel plan for the coming 20 years (Table 12.1.3) have been drawn up upon the following conditions.

a) Assistant drivers are no more required to be on duty.
b) It is possible to abolish train operation handling at stations by introducing CTC system.
c) Chief conductors of freight trains are not necessary because their duty can be handled by locomotive drivers.

Table 12.1.3 Plan of Station Personnel and Train Crew

	at Present	2005	2010	2015	2020
Driver	347	650	820	1,090	1,270
Assistant Driver	237	0	0	0	0
Sub-total	584	650	820	1,090	1,270
Station Personnel	1,500	1,000	1,000	1,000	1,000
Conductor	400	400	400	450	670
Sub-total	1,900	1,400	1,400	1,450	1,670
Total	2,484	2,050	2,220	2,540	2,940

The basis of calculation is as follows.

a) Number of drivers per train km is as follows.

Taking the examples of railways in developed countries and JR Group companies in Japan into consideration, number of drivers per train km for GESR in future is assumed as follows.

0.06 in 2005, 0.05 in 2010, 0.03 in 2020

b) Number of assistant engine drivers

It is assumed to be nil considering the modernization of train operation system and the practice of Japan Railway.

c) Number of conductors per train km is as follows.

Taking the examples of railway companies in developed countries into consideration, number of conductors per train km for GESR in future is assumed to be 0.05.

On condition that conductors on freight trains are abolished, the number of employees per train km is assumed to be 0.016, the same figure as that in Japan which has already no conductors on board freight trains.

d) Station Personnel

In 2020 number of station personnel is assumed to be about 1,000 calculated on 0.031 persons per train km for the estimated train km in that year. The number of personnel per train km of 0.031 was adopted with reference to the station personnel in Japan (0.085 per train km) where CTC system has been already introduced and also with due consideration on station spacing distance in GESR. Numbers in 2005,

2010 and 2015 are estimated from the figure in 2020.

(3) Personnel for Track Maintenance

Number of track maintenance personnel per 1 km of route length in GESR at present is too many compared with JR Group Companies in Japan.

This is particularly remarkable in the number of middle and superior officers.

In future the route length of GESR will be extended by construction of new lines and double tracking of existing lines according to the Master Plan, but the present number of personnel will be enough for the maintenance of the whole extended tracks by 2020 by modernization of maintenance technology, utilization of new equipment for maintenance and introduction of outsourcing system of maintenance work.

(4) Personnel in Electrical Sector

As the results of replacement and improvement of signal and telecommunication equipment, number of personnel in electrical sector is assumed to increase as follows (Table 12.1.4).

Table 12.1.4 Plan of Personnel in Electrical Sector

	At Present	2005	2010	2015	2020
Number of Personnel	450	512	565	598	615

12.2 Personnel Plan

Table 12.2.1 shows the personnel plan of GESR under the Master Plan. In some divisions substantial cut of employees is under consideration to make GESR closer to modernized and efficient railway. Table 12.2.2 shows the increase and/or decrease of personnel. In 2005 and 2010 it is possible to handle increased volume of transport by less personnel than those working at present.

As it is not permitted by laws in Syria to dismiss the surplus employees, they should be absorbed as follows.

(1) Conversion to the Other Section after Training for New Type of Job

The sections requiring increase of personnel should accept as many employees as possible from other sections with surplus workers.

(2) Decrease of Personnel by Voluntary Resignation

The vacancy of positions by retirement or resignation with personal reasons should not be filled automatically.

(3) Transfer to the Related Business

It is important to start new related business within the company or establish subsidiaries for creating new jobs.

Table 12.2.1 Personnel Plan of GESR under the Master Plan Project

	At Present	2005	2010	2015	2020
Workshops & Depots	2,050	1,655	2,010	2,657	3,875
Drivers & Assistant Drivers	584	650	820	1,090	1,270
Station Personnel	1,500	1,000	1,000	1,000	1,000
Conductors	400	400	400	450	670
Track Maintenance	2,252	2,252	2,252	2,252	2,252
Electrical Sector	450	512	565	598	615
Total	7,236	6,469	7,047	8,047	9,682

Table 12.2.2 Increase and/or Decrease of Personnel Compared with the Number of Personnel at Present

	2005	2010	2015	2020
Workshops & Depots	△ 395	△ 40	607	1,825
Drivers & Assistant Drivers	66	236	506	686
Station Personnel	△ 500	△ 500	△ 500	△ 500
Conductors	0	0	50	270
Track Maintenance	0	0	0	0
Electrical Sector	62	115	148	165
Total	△ 767	△ 189	811	2,446

Table 12.2.3. Personnel Plan of Total Employees

	at Present	2005	2010	2015	2020
Total Number of Employees	10,778	10,011	10,589	11,589	13,224

12.3 Administration and Operating Cost

Administration and Operating Costs (excluding depreciation) consist of personnel and material costs and appropriate base unit is set for each item.
In this analysis material costs are further divided into the following three expense items.

(1) Lubricant & Fuel
(2) Maintenance Expenses
(3) Other Operating Cost

To find suitable base units, financial statements of GESR for the past three years have been analyzed and the results are shown in Table 12.3.1.

Table 12.3.1 Analysis of Administration and Operating Cost of GESR

Item＼Year	Unit	1997	1998	1999
Operating Cost				
Personnel Cost	'000 S.P.	814,721	892,285	905,956
Lubricant & Fuel	'000 S.P.	266,350	245,762	255,911
Maintenance Expenses (inc. Spare Parts)	'000 S.P.	178,906	130,201	187,228
Depreciation	'000 S.P.	67,604	67,604	74,876
Other Operating Costs	'000 S.P.	87,685	85,805	91,331
Operating Cost Total	'000 S.P.	1,415,266	1,421,657	1,515,302
Number of Employees		10,321	10,581	10,778
Car KM				
Passenger Car KM	'000 KM/Year	10,449	6,556	6,622
Freight Car KM	'000 KM/Year	66,371	62,499	63,608
Car KM Total	'000 KM/Year	76,820	69,055	70,230
Transport Volume				
Passenger Transport	'000,000 P.KM	292	181	187
Freight Transport	'000,000 Ton KM	1,439	1,430	1,577
Transport Volume Total	'000,000 P.Ton KM	1,731	1,611	1,764
Personnel Cost/Employee	'000 S.P./Person	78.9	84.3	84.1
Lubricant & Fuel/Car KM	S.P./Car KM	3.47	3.56	3.64
Maintenance Expenses/Car KM	S.P./Car KM	2.33	1.89	2.67
Other Operating Costs/Transport Volume	S.P./P.Ton.KM	0.051	0.053	0.052

Personnel cost per unit Number of Employees is set as base unit for estimating Personnel Cost. Lubricant & Fuel and Maintenance Expenses per Car KM is set as base unit for estimating these expenses, and Other Operating Costs per Transport Volume (Passenger Ton km) is set at base unit for estimation of Other Operating Costs. The results of the analysis show that base unit for each expense item is almost constant for these three years.

Therefore the following base units are used for calculation of Administration and Operating Cost in financial analysis (Table 12.3.2).

Table 12.3.2 Analysis of Administration and Operating Cost of GESR

(Unit: Syrian Pounds)

Expense Item	Base Unit	
Personnel Cost	84,500 ／person	(Number of Employees)
Lubricant & Fuel	3.65 ／km	(Car km)
Maintenance Expenses	2.70 ／km	(Car km)
Other Operating Costs	0.053 ／passenger.ton.km	(Transport Volume)

No adjustment for price hike is made between 1999 and 2001, because the latest available data show that the commodity price of Syria is stable for the past several years with some seasonal fluctuation (refer to Table 12.3.3)

Table 12.3.3 Price Index of Syria

(1995=100,Period Average)

Year	1992	1993	1994	1995	1996	1997	1998	1999
Wholesale Prices	75.5	81.9	93.5	100.0	103.2	105.8	105.2	
Consumer Prices	70.9	80.3	92.6	100.0	108.2	110.8	110.2	
Year	1996				1997			
Quarter	I	II	III	IV	I	II	III	IV
Wholesale Prices								
Consumer Prices	110.2	106.4	106.3	110.1	112.9	110.4	107.1	110.8
Year	1998				1999			
Quarter	I	II	III	IV	I	II	III	IV
Wholesale Prices								
Consumer Prices	113.9	105.9	107.1	110.8	110.8	104.5	105.3	

(IFS)

Base units except for personnel cost are assumed to go down gradually by equal difference to 70% in 2005 taking the effects of improvement and rationalization into consideration.

12.4 Education and Training

(1) Concept for Improvements

Middle Technical Institute of Railway for middle class staff and Training Center located in Aleppo are GESR's educational institutions, both of which are well equipped with facilities required for specific education and training. A competent division of GESR is involved and satisfactory results have been achieved. In order that GESR is developed as a modernized railway, education and training of their employees are indispensable. Therefore further improvement will be required. In particular, safety-oriented education as the basis in the transport business and a higher level of fundamental engineering that supports the former are essential.

(2) Overseas Training and dispatching of Engineers Abroad

To cope with ever-increasing high technology, overseas training intended for staff members of a leader level would be an effective step. Also, training conducted by suppliers from which new materials and equipments are procured and/or dispatching trainee to such suppliers is very effective. Some details of JICA's oversea training are given in Appendix 12.4.

(3) Enforcement of Conversion Education

In line with the advancement of transport improvement, unbalance of staff supply will occur depending on the type of job. In order to cope with such situation conversion training should be executed with due consideration on appropriate examination qualification.

(4) Introduction of Correspondence Course

A correspondence course should be introduced as a supplementary educational means to the Training Center. GESR has to bear a certain cost such as provision of teaching materials, its distribution, and evaluation of test results, etc. Trainees will receive a benefit to extend their job knowledge, and eventually they could achieve certain qualifications. Some details of correspondence course are given in Appendix 12.4.

(5) On-the-job Training

By carrying out organized on-the-job training, technology improvement and cooperation

spirit among the concerned staff can be promoted. Some details of on-the-job training are given in Appendix 12.4.

(6) Provision of Customer Service Division

Sales sector, in particular, who are to deal with customers directly, should receive a special training for service. A customer service program, therefore, should be added to the curriculum. When passengers have an opportunity to use GESR, ticket window at stations is the first meeting point. Therefore, if the service by staff were satisfactory, it would lead to a better image of the railway. Additional explanation is given in Appendix 12.4.

(7) Consciousness Education

In order to have common intentional consciousness over the entire organization of GESR, consciousness education should be enforced by the specialist.

1) Way of thinking

The management target of the enterprise must be established clearly in the first place. In order to foster such a company's custom as for each individual staff to behave so as to realize such target and also in order to establish the reliable enterprise on which not only customers but also the community have reliance, it is very important to upgrade the consciousness of company staff. In particular, in case of railway privatization which accompanies consciousness reform, the most complete consciousness reform of staff becomes inevitably necessary.

2) Enforcement method

In order to make staff have common recognition regarding the management target, not only to enforce the intensive lecture by different class and by specific lecturer but also to deepen the subject by discussion method are necessary. Further the enforcement guideline in class wise as well as group wise must be prepared to intend the realization.

(8) Facilities Improvement Plan

A list of facilities/equipments to be newly equipped with by Training Center and estimated necessary cost are given in Appendix 12.4.

Chapter 13

Business Improvement Plan

Chapter 13 Business Improvement Plan

13.1 Concept for Business Improvement

(1) Outlook of Business for Year of 2020

According to the demand forecast as described in Chapter 7, the business scale in the year 2020 will be as shown in Tablel3.1.l. The increase in passenger sales will be 6.26 to 11.06 times, while the increase in freight sales is expected to be 6.92 to 8.32 times over the year 1999.

Table 13.1.1 GESR Business Scale (Year of 2020)

Years	Distance	Passengers		Freight	
		Persons	Person-km	Tons	Tons-Km
	Km	000'persons	Million P-Km	000'Tons	millionton-km
1999(A)	1740	848	187	5445	1577
2020(B)	2381	5309	2068	37638	13120
ratio(B)/(A)%	137	626	1106	692	832

(2) Direction of Business improvement

It is necessary for GESR to make investments aggressively for the improvement of various railway fixed facilities and increasing rolling stock, in order to secure safety and punctuality of train operations. At the same time it is necessary to improve the following business aspects.

1) Changeover of Sales Posture

In view of current Sales business, a negative posture due to constant unreliable traffic status can be observed.

Especially in the Passenger Sales, little advertisement is made because only a few trains are running at present.

On the other hand however, there is an active move as seen in the new transport service to Iraq, therefore, it would be possible to attract customers through the development of new services.

Ii is a prerequisite that reliable train operations are guaranteed by way of necessary investments in new facilities and improvement of transport service.

2) Establishment of Sales Control System

In order to perform appropriate sales control precisely, a management system should be established, and at the same time, daily administrative data as indicated below should be orderly compiled and filed.

① No. of passengers boarding at each station, arriving/departing tonnage of freight and revenue at each station.

② Load factor of passenger trains and traction efficiency of freight trains by each major section.

③ Status of sales for reserved seat tickets by each train.

④ Ratio between the estimated required number of wagons and the number of wagons actually used.

⑤ Status of wagons deployed at each station.

3) Modernization of Sales Information Management

As an information management system in the GESR, computers have been partially introduced; however, on-line data processing is not performed.

In the future where the transport volume is expanded, computer terminals should be provided at each station and field sites to control the data in various fields comprehensively on on-line basis.

In this connection, the following should be promoted.

① Seat Reservation System

The system is required to cope with future increase in trains having reserved seats.

② Freight Information System

For automatic issuing of freight invoice and data processing for traffic information.

13.2 Improvements to Passenger Business

(1) Strategy for Improvements to Passenger Business

Since number of trains operated is very small and train delays arc frequent, sales promotion therefore cannot be made under such circumstances.

However, when number of trains operated is increased and transport service is promoted by securing train speed increase and reliable train operations through improving various facilities and increasing passenger coaches in the future, customers' increase could be obtained. In this context, the followings should be promoted.

1) Change over the past negative sales posture, develop sales activities for expansion of service.
2) Improve tariff, institution system to accord with customer's needs along with the increase of transport capacity.
3) To improve sales system for enabling railway to favorably compete with bus transport.

(2) Establishment of Sales Posture

1) Announcement of Train Time- Table

Train time- table is the merchandise of railway transport and to publicize the time-table is the origin of the railway business.

Customers make selection of suitable train by themselves by time- table and it will enable them to make trip plan.

In long future, comprehensive information of journey should be compiled in the time-table to bring up the image of GESR.

In this context, the followings should be promoted.

① Taking a chance of train schedule revision, make public the content of the revision through mass communication.
② Providing train time table at waiting rooms and post large-size time table at prominent places.
③ Publish information guidance such as sales guidance, fare table, kind of tickets and discounted tickets.

2) Improvement of Environment

Basic principle of transport service is to provide comfortable environment for customers including station facilities (waiting room, toilets) and passenger coach. Station building facilities and passenger coach of GESR are in acceptable level but it

is necessary to bring up their cleanliness and convenience.

To make such improvements, sense of reform among staffs concerned is necessary and it is hoped to provide complete guidance by on-the-job training.

(3) Improvement of Passenger Fare and the System

1) Passenger Fare

As described in Chapter 3, passenger fare of GESR is fixed cheap as public charges, and also with the consideration on competing with bus transport.

When the railway will be improved and reach a stage judged appropriately compatible with other transport means upon having investment and transport improvement, it is necessary to enforce the fare increase to meet the cost.

2) Dividing Base Fares and Service Charges

Passenger fares are classified into the base fare for a travel from a departure point to an arrival point and 'various service charges attributed to added values for express, reserved seat, and sleeping car.

The fare system adopted by GESR includes base fare and all related service charges combined. When train frequency will be increased and passengers will select multiple different classes of trains or miscellaneous service charges, the base fares and service charges must be divided.

Further, in order to enable passengers to buy a ticket for connecting trains, the control of ticket sales with computers will be needed.

Also in connection with this matter, a system to control the period of validity of tickets and disembarking at en route stations would be needed.

3) Issuing of Various Types of Tickets

When train frequency increased and users' needs diversified, various kinds of tickets will have to be issued to meet their needs.

Also, these tickets should be utilized as an effective advertisement means to lure more passengers.

The following are the major kinds of tickets.

① Round-trip tickets

② Commuter Pass

③ A book of tickets

④ Excursion tickets

⑤ Express, Limited-express tickets

⑥ First Class tickets

⑦ Sleeping car tickets

⑧ Reserved seat tickets

⑨ Commemorative tickets

(4) Development of Sightseeing Tour and Promotion of Group Tour

Syrian Arab Republic has rich sightseeing resources such as the Parmela remains. Dynamic sales activities are recommended by operating sightseeing trains connecting with such sites.

Also, by setting up package tours in association with bus/hotel business would be an asset in the future.

Group tour promotion with these products would be a step for those not using the rail service in their daily life to enhance their understanding on the railway.

(5) Connecting Service with Private Bus Operators

At present GESR does not have any inter line traffic service with bus operators, therefore, no bus service available to most of trains stations.

This fact may be due to the scarcity and instability in train operations.

In the future when more trains run reliably, connection with bus transport. as a feeder service at major stations would be required.

In that instance, it is desirable that close coordination be made between each party so that appropriate train diagrams could be prepared considering the bus connecting time for users convenience.

13.3 Improvements to Freight Business

(1) Strategy for Freight Business Improvements

Freight business plays a major role in the GESR. In line with future development of road network, more severe competition with road transport will be expected.

Accordingly it is essential to take a necessary measure such as up-dated and more efficient transport service to be more competitive with truck transport in order to obtain reliance from consignors. In this connection, the followings should be promoted

1) To maintain reliable transport service, regular train schedules must be established complying with traffic volume of each line, and in order to reduce transport time and to make clear arrival dates, designated connecting freight transport system should be promoted.

2) Strategic freight stations should be well developed and up-dated transport service such as container system should be promoted.

3) Expanding the use of exclusive sidings, promotion of consignor wagon ownership; preparation of standardized contract form should be promoted.

4) Facilities and equipment for loading/unloading at freight stations should be updated to cope with connection with truck transport.

(2) Improvement to Transport System

The current system by which a train is selected from a pre-arranged diagram for operations may be effective in terms of hauling efficiency of a train, however, it has caused a considerable train delay. This is a major cause of making stagnant the transport of general cargo.

To implement freight traffic as scheduled, stable traffic capacity must be secured and regular train schedules are required. Further, if transport time is reduced and consignees were informed of freight arrival dates clearly by the means that the shipment was made with a designated connecting freight transport system, it would be an effective means to attract more customers.

Also, if a regular train operation plan was prepared at least on the monthly basis, assignments of locomotive and train crew would be adequately planned.

(3) Modernization of Transport System (Container Traffic)

Inland freight depots are under expansion for conventional marine container traffic, however, a study should be made on a system for transporting the goods by GESR exclusive containers.

Container transport is advantageous because the goods can be easily transferred between train wagon and road trucks, and this system is in the mainstream within Japan Freight Railways.

As traffic expands in the future, when a demand for GESR exclusive containerized freight becomes higher, the GESR exclusive container system could be promoted.

(4) Promotion of Sales Policy

1) Promotion of Exclusive Sidings

The exclusive siding for Phosphorus Ore Public Corporation is a very important facility that is closely connected to the railway.

The new siding construction projects as shown in Table13.3.1 are being planned. As it can be seen from the Table, future forecasted railway traffic is not clear on some lines, or is too much large on other some line. Some sidings are, according to GESR, not economically feasible. Accordingly, when factory production plan and related railway traffic volume become clear in the future, feasibility studies should be carried out and construction of these sidings should be duly planned based on the results of feasibility study.

Table 13.3.1 The New Siding Construction Projects

No	Exclusive Siding	Route Length	Major Factory	Remark
1	Muslimia ~Industry Zone	4 km		Product plan and rail traffic are not clear
2	Adra ~Industry Zone	3Km		Ditto
3	Noamia ~Industry Zone	17Km	Chemical Textile	Very big railway freight traffic are being discussed among officers concerned, namely 1.6 million ton/y for the first 10years after completion of Industrial zone, and 4.8 million ton/y in further future. This volume of 4.8 million ton/y is almost 80% of the current GESR's whole freight traffic (6million ton/y). In dealing with such a big traffic volume, track doubling or instillation of new signaling stations,, purchase of many freight wagons must be planned along the transport route. Accordingly more careful study on future railway traffic must be carried out before deciding construction of exclusive railway siding.
4	Jirs Elshogour		Sugar Beet Factory	It is already existing. Ministry of Industry and GESR should discuss how to use it for railway transport.
5	Tel Alo ~Al Rumilan	22Km	Passengers Crude Oil Natural Gas Grains Fertilizer Goods for Animal	GESR informed JICA study team that they evaluated this siding as non-economic feasible. Accordingly Ministry of Industry should discuss the project with GESR, and if necessary, feasibility study should be carried out again.
6	Hassaka ~Shddadah		Crude oil Natural Gas	Ditto

2) Promotion of Consignor Wagon Owning System

Consignor wagon owning system has not been developed in GESR. As an effective means to increase wagons in the future, this system should be aggressively incorporated. As a target, in addition to fuel tank wagon, the following types of wagons should be considered for this system.

① Hopper wagon for phosphorous ore transport

② Hopper wagon for grain transport

③ Hopper wagon for cement transport

④ Tank wagon for chemical products

Any one of them is used frequently by exclusive sidings owning consignors. Accordingly these consignors should be persuaded to adopt consignor wagon owning system.

By use of these specialized consignor owning wagons, a comprehensive distribution cost including storage and loading/unloading could be saved.

3) Conclusion of comprehensive Contract

Comprehensive contract will conclude an agreement defining a certain fixed period for transport, minimum shipping tonnage, freight charge (discounted rate), and supplemental conditions.

Shipping as originally planned can be guaranteed to consignors while GESR could receive a benefit in securing a certain traffic volume and effective use of transport capacity.

GESR has so far exchanged a shipping plan with various corporations, but agreement of plan is not on contract basis and the plan has not often been executed. In the future, GESR should make an effort to conclude a contract under proper conditions in close coordination with consignors while stable transport is secured.

(5) Rate and the System

GESR's freight rates consist of five grades. (See Table 3.6.6) The 1st grade is 70% higher than 5th grade. Although there is no detailed data available regarding comparison between railway rate and truck rate, the rate by truck transport is less costly for a section between Qamishli and Damascus that is considerably distant. Therefore, an analysis for circumstantial conditions would be needed in revising the rates in the future. When the numbers of kinds of freight goods become increased very much some aspects of rate grading system of goods may not comply with the practical situations. It may be recommendable to study on abolition of rate grading system.

(6) Modernization of Freight Handling Facilities

1) Provision of Freight Depot at Strategic Location/s

Facilities should be selectively provided at a station or depot, which will be a strategic point for freight sales. In this connection the followings should be promoted.

① Layout of loading/unloading lines and spare sidings should be improved for efficiency.

② Provision and improvement of freight terminal platforms and roofs.

③ Pavements should be made to loading/unloading areas and passage, and sufficient space for the work with forklifts should be secured.

④ Appropriate equipment and handling machinery should be provided for freight

handling.

2) Modernization of Loading/Unloading System

By the introduction of palletized cargo, transfer of the cargo between wagons and trucks can be carried out within a short period of time by use of forklifts; thereby time and labor saving could be achieved.

Upon the introduction of palletized cargo system, it would be necessary to build up a comprehensive system to smoothly redistribute used pallets in which GESR, consignors and freight forwarders are involved.

In this connection, the following should be promoted.

① Standardization of Pallets.

② Pallets Pool System

③ Application of Discounted Rates for Pallets to be Returned

13.4 Freight Information System

Together with compiling daily sales management data, an on-line system should be incorporated by installing computer terminals at stations and on-site in the future.
Its outline is as follows:

(1) Sales Information

Freight Invoices are issued at each station, and data are summed, compiled and processed and necessary data classified by the following will be outputted:

Stations, each line, tonnage by commodities, freight charge, gross tonnage by each section, and ton-kilometers.

For the time being, only summation of data will be processed with computers.

(2) Transport Information

① Information of use of wagons and their deployment.

Estimated required number of wagons (Number of wagons estimated to be required for the following day).

Used wagons (Number of wagons used for the day).

Available wagons (Number of wagons available at fixed time point on the day)

Collect and input the above data with computer and output the data as instructive information.

② Train make-up stations and train control information

Train make-up details (composition, order of wagons etc) are inputted into computer terminal at a station where train is made up and compiled data are processed and the following data will be outputted.

No. of train operations, number of wagons coupled, output of traction efficiency, and output of necessary information to be exchanged between stations of train make-up.

(3) Train Sales System

A train will be specified between one terminal (Say A) and anther terminal (Say B), and will be announced to customers.

Customers will input their request for cargo to be coupled at stations at computer terminal at those stations, and these inputs will be centralized at central computer.

Specified train will be operated between A and B coupling request cargoes at intermediate stations.

In this way freight transport business will be carried out effectively.

Chapter 14

Investment Planning in Staged Development Plan

Chapter 14 Investment Planning in Staged Development Plan

14.1 Preconditions for Calculating the Amount of Investment

In principle, the amount of investment is calculated on the basis of the following preconditions.

(1) In calculating the amount of investment, the price as of June 2000 is applied, and factors related to future escalation are not considered.

(2) The currency conversion rate is :

US$1 =¥106 = SP 46, as of June 2000.

(3) The amount of investment is divided into the local currency portion and the foreign currency portion, and both are calculated in SP.

(4) As for the improvement and construction cost, the labor cost and material cost(including machine depreciation) are calculated for each construction work item.

(5) The labor cost is calculated in the local currency for each construction work item.

(6) In calculating the labor cost, material cost and so forth, the unit prices for each kind of work are based on the data supplied by the Syrian side. As for the unit prices for works which have not been conducted in Syria so far, new prices are established suitably by taking into consideration the actual results of construction works in Japan.

(7) As for the imported materials (including rolling stock) and so forth calculated in foreign currencies, CIF prices are applied by taking into consideration the actual results in the GESR.

(8) As the engineering fee, 5% of the improvement and construction cost is earmarked.

14.2 Investment Planning in the Staged Development Plan

The amount of investment by item of improvement and construction is as shown in Table 14.1.

The total amount of investment is SP 171,466 million. This is divided into the cost of about SP 41.8 billion (24.4%) for rehabilitation and modernization of existing lines; new line construction cost of about SP 46.5 billion (27.1%); improvement cost for rollingstock workshops of about SP 19.6 billion (11.4%); rolling stock cost of about SP 58.0 billion (33.8%); and engineering fee of about SP 5.4 billion (3.2%). The foreign currency portion is SP 104.9 billion (61%), and the domestic currency portion is SP 66.6 billion (39%).

The amount of investment for each project in the staged development plan excluding the engineering fee is as shown in Table 14.2. Specifically, the improvement and construction cost is about SP 64.6 billion (39%) for the 1st stage (short term 2001～2005); about SP36.4 billion (22%) for the 2nd stage (medium term 2006～2010); about SP 35.7 billion (21%) for the 3rd stage (long term 2011～2015); and about SP 29.5 billion (18%) for the 4th stage (long term 2016～2020).

Table 14.1 Investment Cost

Unit : million Sp

Item	Foreign Currency	Local Currency	Total	%
Rehabilitation, Modernization of Existing Line	23,028	18,769	41,797	24.4
New Line Construction	12,767	33,749	46,516	27.1
Workshop Improvement	14,250	5,350	19,600	11.4
Freight Information System	188	1	189	0.1
Sub Total	50,233	57,869	108,102	63.0
Rolling Stock	52,154	5,805	57,959	33.8
Engineering Fee (SubTotal * 5%)	2,512	2,893	5,405	3.2
Sub Total	54,666	8,698	63,364	37.0
Ground Total	104,899	66,567	171,466	100.0

Table 14.2 Schedule of Investment

Unit : Million SP

	Descriptions	Item	2001-2005	2006-2010	2011-2015	2016-2020	Total
Rehabilitation of Railways							
1	Midan Ekbas-Aleppo	Track & Structure	4,402	3,988	0	0	8,390
		Signal & Telecom	0	616	0	0	616
		Total	4,402	4,604	0	0	9,006
2	Aleppo-Damascus	Track & Structure	1,900	2,774	2,207	1,657	8,538
		Signal & Telecom	0	1,833	333	225	2,391
		Total	1,900	4,607	2,540	1,882	10,929
3	Aleppo-Lattakia	Track & Structure	941	0	0	0	941
		Signal & Telecom	892	17	0	103	1,012
		Total	1,833	17	0	103	1,953
4	Lattakia-Tartous	Track & Structure	422	0	0	0	422
		Signal & Telecom	472	0	0	0	472
		Total	894	0	0	0	894
5	Taltous-Homs	Track & Structure	922	2,869	3,156	176	7,123
		Signal & Telecom	0	674	48	69	791
		Total	922	3,543	3,204	245	7,914
6	Aleppo-Deir el-Zor	Track & Structure	1,632	0	176	528	2,336
		Signal & Telecom	1,283	0	70	307	1,660
		Total	2,915	0	246	835	3,996
7	Deir el-Zor-Qamishli	Track & Structure	998	0	410	410	1,818
		Signal & Telecom	531	0	0	138	669
		Total	1,529	0	410	548	2,487
8	Qamishli-Al-Yaroubiye	Track & Structure	0	0	825	835	1,660
		Signal & Telecom	0	0	203	0	203
		Total	0	0	1,028	835	1,863
9	Mihine-Al -Sharqia	Track & Structure	531	1,536	88	0	2,155
		Signal & Telecom	0	525	40	0	565
		Total	531	2,061	128	0	2,720
Sub Total			14,926	14,832	7,556	4,448	41,762
Construction of New Line							
1	Deir el-Zor-Al Bukamal	Track & Structure	9,425	0	0	0	9,425
		Signal & Telecom	483	0	0	0	483
		Total	9,908	0	0	0	9,908
2	Damascus-Jordan BorderDaraa	Track & Structure	10,790	0	0	1,248	12,038
		Signal & Telecom	72	0	408	0	480
		Total	10,862	0	408	1,248	12,518
3	AlSharqia-Deir-el-Zor	Track & Structure	7,760	8,303	0	0	16,063
		Signal & Telecom	0	549	35	171	755
		Total	7,760	8,852	35	171	16,818

	Descriptions	Item	2001-2005	2006-2010	2011-2015	2016-2020	Total
4	Adra-Kabon	Track & Structure	1,955	0	0	0	1,955
		Signal & Telecom	241	0	0	0	241
		Total	2,196	0	0	0	2,196
5	Marret Ibhwan-Edlab	Track & Structure	0	0	2,015	0	2,015
		Signal & Telecom	0	0	80	0	80
		Total	0	0	2,095	0	2,095
6	Akkari-Lebanon Border	Track & Structure	110	0	0	0	110
		Signal & Telecom	66	0	0	0	66
		Total	176	0	0	0	176
7	Kadam-Hidjaz Station	Track & Structure	303	217	0	0	520
		Signal & Telecom	67	0	0	0	67
		Total	370	217	0	0	587
8	West Entrance to Aleppo	Track & Structure	0	2,159	0	0	2,159
		Signal & Telecom	0	94	0	0	94
		Total	0	2,253	0	0	2,253
Sub Total			31,272	11,322	2,538	1,419	46,551
Workshop (Including Depot)							
Jubrin Loco. Workshop		Building	7,800	0	0	0	7,800
		Machine	1,250	0	0	0	1,250
		Total	9,050	0	0	0	9,050
Aleppo P.C. Workshop		Building	3,000	0	0	0	3,000
		Machine	600	0	0	0	600
		Total	3,600	0	0	0	3,600
Jubrin P.C. Worshop		Building	0	2,150	4,000	0	6,150
		Machine	0	200	600	0	800
		Total	0	2,350	4,600	0	6,950
Sub Total			12,650	2,350	4,600	0	19,600
Rolling Stock							
Locomotive & Diesel Car			5,362	4,416	13,150	13,900	36,828
Freight Wagon & Passenger Coach			365	3,446	7,635	9,685	21,131
		Total	5,727	7,862	20,785	23,585	57,959
Freight Information System							
Electoronic					189		189
		Total			189		189
Ground Total			64,575	36,366	35,668	29,452	166,061