Chapter 5

Transportation Plan

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5.1 Concept on transportation plan

To secure safety is essential item for all transport industries. At the same time, improvement of efficiency is required, as well.

Transportation plan for modernization of GESR should be set up, bearing in mind securing of safety and improvement of efficiency, so that railway could cope with the requirement of users and fully display its role.

5.2 Fundamental premises for setting up transportation plan

Transportation plan is set up as follows based on the above mentioned concept.

(1) Project sections and maximum speed

The operating speed limit by section is set as shown in Table 5.1.

Table 5.1 Section and speed limit

Section	Distance (Km)	Maximum Speed (km/h)		Remarks
		Passenger Train	Freight Train	
Tartous～Homs	102.0	130 (100)	100	
Homs～Mhine	63.7	130 (100)	100	
Mhine～Al-Sharqia	110.8	130 (100)	100	
Total	276.5			

Note: The figure in ( ) is the Maximum speed for Passenger Train tracted by DEL

(2) Operation security system

As for train operation security system which is a fundamental requirement of train operation, an automatic blocking system on double track section is adopted.

On single track section, track circuit is fully installed within the station, and on the track between stations, the detecting track circuit is installed on both ends of station to detect arriving and departing of train in order to secure blocking between stations.

The multi-color right signal currently used is applied for home and departure signal, and home signal is equipped with distant signal. Train operation side is on the right side. Train

is equipped with automatic train stop (ATS) system.

(3) Traction system

As for traction system, diesel engine is adopted, and electrification which requires big investment will not be used. Overnight sleeper train and some day time passenger train (only up to 2010) are hauled by diesel electric locomotive (DEL).

Regarding day time train, DEL traction passenger coach train and Diesel car train are co-used by 2010, but after 2010, all day time passenger train is by small formation of diesel railcar (DC) train to perform frequent service.

(4) Kind of train

Kind of train is passenger train and freight train, and passenger train is consisted of express train and local train. Part of express passenger train will be sleeper train.

Freight train is planned as a kind of through train stopping only at principal stations.

(5) Train formation

1) Passenger train

Referring to the result of future cross sectional transportation demand, the formation of sleeper train is 9～11 coaches and daytime operating passenger coach train is 4 coaches, while, DC train is 2～5 cars considering frequent service.

2) Freight train

The single headed operation is the principle of freight train and hauling capacity is 1800 tons by French new DEL (3200 type), with 70% of hauling efficiency and 60% of loading factor.

With respect to train operation between Akkari and Al-Khansa, three alternative methods will be compared:

① single DEL traction (950 ton traction force) on 20‰ new track constructed in parallel with existing track.

② double DEL traction (1800 ton traction force) on 20‰ new track constructed in parallel with existing track.

③ single DEL traction (1800 ton traction force) on 12‰ new track constructed separately from the existing track route.

(6) Train operation

1) In case of passenger train, usually two men crew, driver and conductor, is planned on a train except sleeping train. In case of sleeping train, servicing staff is to be assigned in addition to two men crew.
2) On freight train, only driver is assigned but no conductor.

(7) Rolling stock and its characteristics

The aged rolling stock are to be phased out. The day time passenger train is formed by only DC with possible maximum speed of 130km/h to increase availability. The formation of sleeper train is consisted of sleeping coach and 1st class seating car, dining car and baggage car.

Day time passenger train is not coupled with dining car nor baggage car but consist of seating car.

As for locomotive, only French 3200 type locomotive will be used.

(8) Riding factor and hauling factor

1) Riding factor

The riding factor of passenger train is premised as 70%.

Seating capacity of 1st class coach is 60 and 2nd class, 80, while the capacity of sleeping car is 22.

2) Hauling factor

Based on the actual result, hauling factor of freight car is to be 70%, and loading weight is 60% of hauling capacity.

3) Fluctuation of transportation

Based on the actual result, seasonal fluctuation of train is to be 110% for both passenger and freight.

(9) Transportation management system

1) Management system

To manage all trains in whole railway system safely and efficiently, CTC should be adopted.

CTC (Centralized Traffic Control) is for grasping real time correct status of train

operation which is collected from station, and also for remotely controlling turnout in the station.

Therefore, CTC center should be provided with CTC central processor, mimic panel to show train location and train number, central control device which control turnout and signal and train diagram automatic recorder. Besides, auxiliary control panel should be provided at each station to control turnout and signal individually in necessary case.

CTC center is installed at Homs.

2) Information transmission system

Information transmission between station masters, between station master and train driver, and among station master, train driver and train dispatcher, is important for train operation. Therefore, wireless telephone or exclusive telephone for communication between station masters, and wireless telephone for communication of dispatcher, station master and train driver are required.

3) ATS

To secure safety of train operation, ATS should be provided all over the railway system.

(10) Transportation Demand

1) Total Transportation Volume of Syrian railways

Table 5.2 indicates transportation volume of Syrian Railways in total prepared by Master Plan.

Table 5.2 Estimated transportation volume (per day)

	1999	**2005**	**2010**	**2015**	**2020**
Passenger	2,323	**4,500**	**6,941**	**10,938**	**16,044**
Passenger-Km	512,329	**1,462,004**	**2,453,481**	**3,808,481**	**5,510,119**
Ton	14,918	**25,035**	**40,566**	**72,669**	**121,612**
Ton-km	4,320,548	**7,161,118**	**11,899,969**	**21,272,642**	**35,909,406**

2) Transportation volume of the section under Feasibility Study

The section of Tartous～Homs～Mhine～Al-Sharqia is originated by Tartous which handles major portions of import and export goods and terminated at Al-Sharqia which has a mine of phosphate rock and its production volume is equivalent to one third of freight traffic of Syrian Railways and the section of Homs～Mhine is located at center of the north to south trunk line.

Transportation volume is indicated in Table 5.3. Transportation volume on the section share 40～50% in terms of number of passenger, 10～15% in terms of passenger-km, 60% in terms of ton, and 30～40% in terms of ton-km, compared with total transportation volume of Syrian Railways.

Table 5.3 Estimated transportation volume in section of Tartous～Homs～Mhine～Al-Sharqia (per day)

	1999	**2005**	**2010**	**2015**	**2020**
Passenger	390	**1,660**	**3,200**	**5,578**	**6,768**
Passenger-Km	40,393	**157,888**	**364,512**	**583,139**	**733,923**
Ton	8,139	**15,142**	**26,500**	**44,250**	**71,212**
Ton-km	1,665,845	**2,751,711**	**4,921,746**	**7,337,964**	**10,957,060**

3) Cross sectional transportation volume

(a) Passenger transportation volume

One way passenger traffic volume between stations per day is indicated in Table 5.4.

Table 5.4 Daily one way passenger traffic volume between stations

Year / Section	2005	2010	2015	2020
Tartous～Samariyan	315	563	803	1,175
Samariyan～Akkari	315	563	803	1,175
Akkari～Tel Kalakh	315	566	804	1,176
Tel Kalakh～UmmJaamah	315	566	804	1,176
UmmJaamah～Al Kansa	315	566	804	1,176
Al Kansa～Khrbettin	315	566	804	1,176
Khrbettin～Homs 1	315	566	804	1,176
Homs1～Homs2	723	1,134	2,086	2,349
Homs2～Shinshar	723	1,134	2,086	2,349
Shinshar～Khnefis	723	1,134	2,086	2,349
Khnefis～Noamia	723	1,134	2,086	2,349
Noamia～Mhine	723	1,134	2,086	2,349
Mhine～AlRumeila		415	608	683
AlRumeila～AlQariyatein		415	608	683
AlQariyatein～AlBarida		415	608	683
AlBarida～AlBasayra		415	608	683
AlBasayra～Alfajwa		415	608	683
Alfajwa～AlHamra		415	608	683
AlHamra～AlSharqia		415	608	683

(Unit: passenger/Day)

(b) Freight transportation volume

Table 5.5 indicates one way transportation volume between stations per day.

Table 5.5 Daily freight transportation volume between stations (Unit: tons)

	2005		2010		2015		2020	
	↓	↑	↓	↑	↓	↑	↓	↑
Tartous～Samariyan	6951	5991	11995	8979	17871	12713	26988	17945
Samariyan～Akkari	6951	5991	11995	8979	17871	12713	26988	17945
Akkari～Tel Kalakh	6951	5991	12004	8976	17890	12718	27031	17958
Tel Kalakh～UmmJaamah	6951	5991	12004	8976	17890	12718	27031	17958
UmmJaamah～Al Kansa	6951	5991	12004	8976	17890	12718	27031	17958
Al Kansa～Khrbettin	6951	5991	12004	8976	17890	12718	27031	17958
Khrbettin～Homs 2	6951	5991	12004	8976	17890	12718	27031	17958
Homs2～Shinshar	4266	6763	9352	10539	17362	15163	29299	21974
Shinshar～Khnefis	4266	6763	9352	10537	17366	15152	29312	21955
Khnefis～Noamia	4266	6762	9352	10537	17366	15152	29312	21955
Noamia～Mhine	4266	6762	9352	10537	17366	15152	29312	21955
Mhine～AlRumeila	81	5826	2937	9173	5387	11661	9511	15008
AlRumeila～AlQariyatein	81	5791	2950	9103	5414	11512	9566	14731
AlQariyatein～AlBarida	81	5791	2950	9103	5414	11512	9566	14731
AlBarida～AlBasayra	81	5791	2950	9103	5414	11512	9566	14731
AlBasayra～Alfajwa	81	5791	2950	9103	5414	11512	9566	14731
Alfajwa～AlHamra	81	3991	2950	7303	5414	9712	9566	12931
AlHamra～AlSharqia	81	3991	2950	7303	5414	9712	9566	12931

5.3 Selection of hauling system for Alternative A

(1) Hauling system

The freight train hauling system between Akkari～Al-Khansa with gradient of 20‰ should be decided by single headed locomotive hauling system or by double headed hauling system, considering required number of locomotive, number of locomotive driver, track capacity, train handling system, travel time.

Alternative A-1 Single headed with 3200 type locomotive, hauling 950tons

Alternative A-2 Double headed with 3200 type locomotive, hauling 1,800tons

On the sections other than Akkari～Al-Khansa section, single headed 3200 type locomotive is planned to haul 1,800 tons.

Those are illustrated in Fig.5.1.

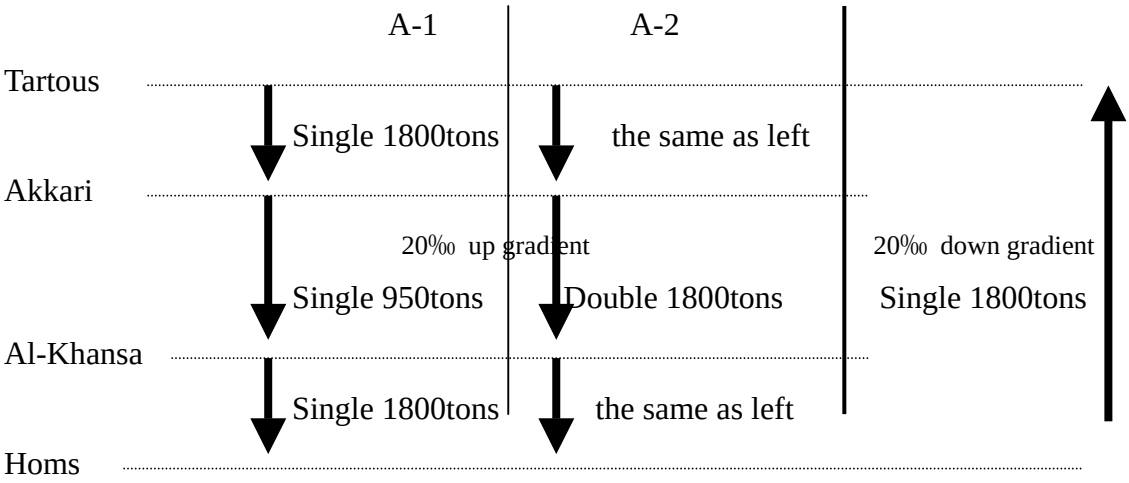


Fig. 5.1 Hauling system

Due to the weakness of screw coupler, in case of double headed operation, boosting locomotive should be coupled at the end of train to push the train. If the screw coupler could be replaced by automatic coupler which has enough strength, two locomotive can be coupled each other at the foremost of train to haul the train.

(2) Comparison

The evaluation of Alternative A-1 and A-2 is made as shown in Table 5.6 by the stand point of required number of locomotive, number of train crew, number of train, travel time and train handling system.

Table 5.6 Evaluation

	A-1	A-2
Necessary number of Locomotive	◯	◯
Necessary number of Driver	◯	◯
Number of Train	△	◯
Travel time	△	◯
Train handling	▲	△

◯: No difference △: Somewhat inferior ▲: inferior

1) Necessary number of locomotive

Necessary number of locomotive is not different in either case of single headed operation or double headed operation.

At the steep gradient section, in case of double headed operation, required number of locomotive per train is twice as much as single headed operation. But even on

descending operation, boosting locomotive should be operated to Akkari as dead head operation. Consequently, the same number of locomotive for ascending and descending operation is required.

In case of single headed operation, one train should be divided into two trains to climb up, thus number of locomotive is the same as double headed operation. For descending operation, locomotive should be transported to Akkari as dead head operation.

2) Necessary number of locomotive driver

Necessary number of locomotive driver is not different in either case of single headed operation or double head operation by the same reason as shown in comparison of number of locomotive.

In case of double headed operation, boosting locomotive is coupled rearmost of train, thus locomotive driver of boosting locomotive cannot be deleted.

3) Number of train

In case of double headed operation, less number of train is required for transportation than that for single headed operation.

The total number of train (up and down) in this section per day is indicated in Table 5.7.

Table 5.7 Total number of train per day (Two ways)

	A-1	A-2
2005	58	48
2010	92	74
2015	130	104
2020	190	150

Therefore, in case of single headed operation, the shortage of track capacity comes earlier than double headed operation, and the number of section which needs track addition is two for single headed operation on year 2005, but not necessary for double headed operation. Number of section which needs track addition is indicated in Table 5.8.

Table 5.8 Number of section which needs track addition

	A-1	A-2
2005	2	0
2010	5	5
2015	5	5
2020	6	6

4) Travel time

Shorter travel time (including running time, handling time) is obtainable by double headed operation than single head operation between Akkari and Al-Khansa, as indicated in Table 5.9. The train running time between stations is regarded as not different by single headed operation or double headed.

As for single headed operation, at Akkari station, the train with 1,800tons load should be divided into two trains to climb up gradient, and at Al-Khansa, the divided trains should be coupled. Accordingly, the waiting time for following train, shunting time and coupling time are required, resulting in handling time of about 35 minutes.

As for double headed operation, at Akkari station, the booster locomotive should be coupled at the rearmost of train and uncoupled at Al-khansa, resulting in handling time of about 10 minutes. The Alternative A-2 is advantageous over A-1 with respect to travel time.

Table 5.9 Train handling time

(Unit; Minute)

	Alternative A-1			Alternative A-2	
	Train handling time			Booster at rearmost	
	Dividing	Waiting	Coupling	Coupling	Uncoupling
Akkari	5			5	
Al-Khansa		15	15		5
Total	35			10	

(3) Evaluation

According to the above studies, the double headed operation is advantageous over the single headed operation. Therefore, Alternative A-2 will be chosen and defined as Alternative A in the Feasibility Study.

5.4 Train operation plan of Alternative A

5.4.1 Train operation plan

(1) Passenger train operation plan

1) Premises

(a) The long distance night train is to be a locomotive hauled passenger train and others, diesel railcar train, basically. For the transition to year 2010, some passenger trains are to be by locomotive hauled train.

(b) The maximum operating speed of loco-hauled train is 100km/h while diesel railcar train, 130km/h.

(c) To calculate the train transportation capacity, following assumptions are applied.

Seating capacity of passenger coach and diesel car: 60 passengers for first class, 80 passengers for second class, 22 passengers for sleeping coach.

Loading factor: 70%

Rate of seasonal fluctuation: 10%

2) Basic composition of train formation

(a) Night sleeping car train

Sleeper Train

1	2	3	4	5	6	7	8	9	10	11
Baggage Car	Sleeping car	Sleeping car	Sleeping car	Sleeping car	Sleeping car	Dining car	1st class seating car	1st class seating car	1st class seating car	1st class seating car

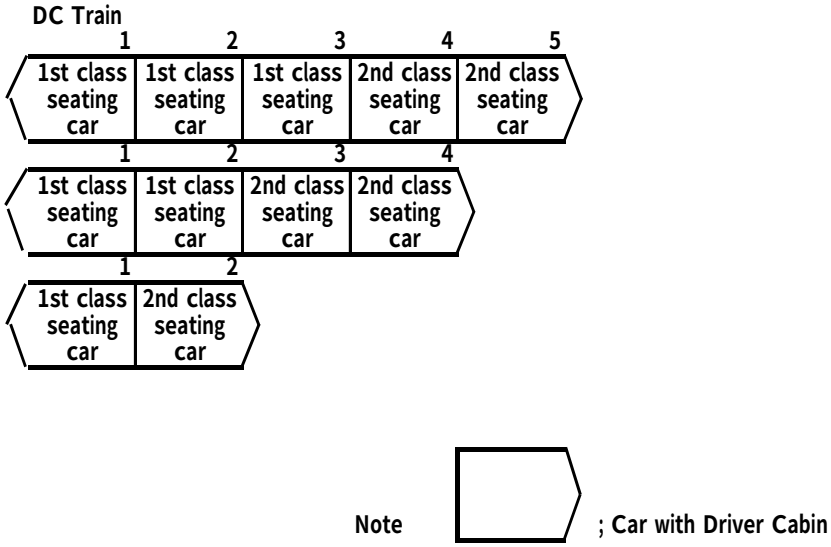
1	2	3	4	5	6	7	8	9
Baggage Car	Sleeping car	Sleeping car	Sleeping car	Sleeping car	Dining car	1st class seating car	1st class seating car	1st class seating car

(b) Daytime passenger train

1	2	3	4
1st class seating car	1st class seating car	2nd class seating car	2nd class seating car

1	2
1st class seating car	2nd class seating car

(c) Diesel railcar train



3) Designed transportation capacity

Table 5.10 indicates kind of train, number of train, formation of train by section of the line.

Table 5.10 Kind of train and number of train, and coaches in the train formation

Year	Train Type / Section	Passenger Coach Train									Diesel Car Train				Total Number of Train
		Sleeping Train					Day time Train				Day time Train				
	Formation (Class)	No. of Car/Train				Number of Train	No. of Car/Train			Number of Train	No. of Car/Train			Number of Train	
		Sleep.	1St	Othe	Total		1St	2nd	Total		1St	2nd	Total		
2005	Tartous ～Homs1	4	3	2	9	2	2	2	4	2	1	1	2	4	8
	Homs1～Mhine	4	3	2	9	6				0	2	2	4	6	12
	Mhine～ Al Shrqia					0				0					0
	Formation (Class)	No. of Car/Train				Number of Train	No. of Car/Train			Number of Train	No. of Car/Train			Number of Train	Total No. of
		Sleep.	1St	Othe	Total		1St	2nd	Total		1St	2nd	Total		
2010	Tartous ～Homs1	4	3	2	9	2	2	2	4	2	1	1	2	4	8
	Homs1～Mhine	4	3	2	9	4					2	2	4	8	12
	Mhine～ Al Shrqia	4	3	2	9	2	2	2	4	2					4
	Formation (Class)	No. of Car/Train				Number of Train	No. of Car/Train			Number of Train	No. of Car/Train			Number of Train	Total No. of
		Sleep.	1St	Othe	Total		1St	2nd	Total		1St	2nd	Total		
2015	Tartous ～Homs1	5	4	2	11	2					2	2	4	8	10
	Homs1～Mhine	5	4	2	11	4					3	2	5	16	20
	Mhine～ Al Shrqia	5	4	2	11	2					3	2	5	4	6
	Formation (Class)	No. of Car/Train				Number of Train	No. of Car/Train			Number of Train	No. of Car/Train			Number of Train	Total No. of
		Sleep.	1St	Othe	Total		1St	2nd	Total		1St	2nd	Total		
2020	Tartous ～Homs1	5	4	2	11	2					3	2	5	10	12
	Homs1～Mhine	5	4	2	11	4					3	2	5	20	24
	Mhine～ Al Shrqia	5	4	2	11	2					3	2	5	4	6

(A) Operation plan for year 2005

(a) Sleeping car train

The current train operating status is to be continued - operating section and number of train - (one round trip train in the section between Aleppo～Damascus, Lattakia～

Damascus, Deil El Zor～Damascus）. The formation is 9 coaches to cope with demand.

(b) Daytime passenger train

One round trip of loco-hauled passenger train with 4 coaches formation is planned on the section of Tartous～Homs1.

(c) Diesel railcar train

Two round trip trains with 2 coaches formation is planned on the section of Tartous～Homs1 and three round trip trains with 4 coaches formation on the section of Homs1～Mhine. Three round tripe trains between Homs1～ Mhine are nothing but passing trains between Damascus～Tartous and Aleppo～Damascus.

(B) Operation plan for year 2010

(a) Sleeping car train

One train, Qamishili～Damascus via Aleppo, is planned to change the train route to Qamishili～Tadmor～Al-Shrqia～Mhine, making use of new line between Deir el Zor ～Tadmor.

Other sleeping car trains are as the same as 2005.

(b) Daytime passenger coach train

One round trip train on the section of Deir El Zor～Homs via Tadmor～Al-Shrqia～Mhine is planned. Others are the same as year 2005.

(c) Diesel railcar train

To cope with increased transportation demand, one train, Aleppo～Damascus via Homs～Mhine is planned.

(C) Operation plan for year 2015

(a) Sleeping car train

Train operation plan is the same as year 2010.

(b) Daytime passenger train

The passenger coach train is replaced by diesel railcar train. Furthermore, the train formation will be enlarged adding car, and number of trains increased to cope with increase of transportation demand.

(D) Operation plan for year 2020

(a) Sleeping car train

The operation plan of sleeping car train is the same as year 2010.

(b) Diesel railcar train

To cope with transportation demand, formation of train is to be enlarged, and number of train increased.

4) Travel time

Travel time is calculated based on diesel railcar train for an example.

Table 5.11 indicates travel time and scheduled speed.

Table 5.11 Travel time and scheduled speed

	Section distance	Travel time DC Exp	Scheduled speed	Remark
Tartous Homs	102.0 km	1:17:00	83.8km/h	Non stop
Homs Mhine	67.8 km	0:40:00	101.7km/h	Non stop
Mhine AlSharqia	110.8 km	1:10:00	95.0km/h	Non stop

・Maximum speed: 130km/h

・Speed restriction on curved track:

Apply the stipulation of Syrian Railways (80 km/h on the radius of curve of 400m)

・Speed restriction of straight side of turnout: 100km/h

・Speed restriction on down gradient:

Apply the stipulation of JR（110km/h on 20‰ down gradient）

・Applied performance and traction force of JR limited express diesel railcar, (type 118, 3960PS, 319tons 7 cars formation)

Target of scheduled speed was 100 km/h, however, due to 21 km of mountainous section between Tartous～Homs, having many sharp curved tracks of 300m or 400m radius, restricting train operation speed to 80km/h, targeted scheduled speed operation is hardly obtained in Tartous～Homs section.

Meanwhile, if the renovated railcars with special construction (car with pendulum body) are employed, which is able to operate with higher operating speed (+20km/h～+30km/h above the normal speed) on curved section, the scheduled speed of near 100 km/h is obtainable in this section.

(2) Freight train operation plan

1) Premises

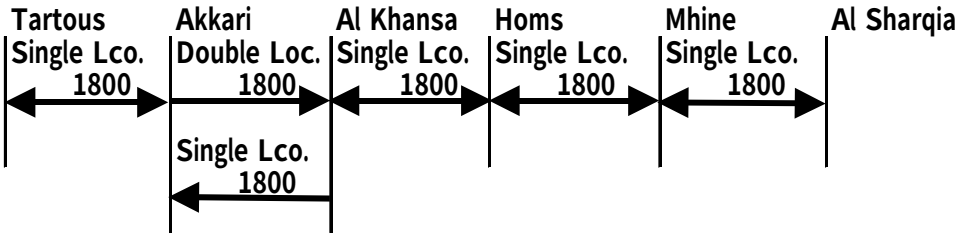
Applying following assumptions and based on cross sectional traffic demand, required number of train is calculated.

Fluctuation rate of transportation: 10%

Hauling efficiency: 70%

Actual load factor: 60%

2) Hauling weight（tons）



The train with 1800 tons load is hauled by double headed 3200 type locomotive on up gradient section between Akkari～Al-Khansa (+20‰), while down gradient of the same section and other section is by single headed with 3200 type locomotive.

3) Designed transportation capacity

Table 5.12 indicates kind of train and number of train. The number of train includes dead head train.

Table 5.12 Kind of train and number of train (two ways/day)

Year \ Item / Section			Number of FreightTrain			Dead head Loc. Train	Total
			Phosphate	Other	Total		
2005	Tartous ～Homs1	Tartous ～Akkari	10	20	30		30
		Akkari～Al-Khansa	10	20	30	10	40
		Al-Khansa～Homs2	10	20	30		30
	Homs1～Mhine		12	14	26		26
	Mhine～ Al Shrqia	Mhine～Al Fajwa	12	2	14		14
		Al Fajwa～ Al Shrqia	10	2	12		12
2010	Tartous ～Homs1	Tartous ～Akkari	12	36	48		48
		Akkari～Al-Khansa	12	36	48	18	66
		Al-Khansa～Homs2	12	36	48		48
	Homs1～Mhine		14	28	42		42
	Mhine～ Al Shrqia	Mhine～Al Fajwa	14	10	24		24
		Al Fajwa～ Al Shrqia	12	10	22		22
2015	Tartous ～Homs1	Tartous ～Akkari	16	52	68		68
		Akkari～Al-Khansa	16	52	68	26	94
		Al-Khansa～Homs2	16	52	68		68
	Homs1～Mhine		16	52	68		68
	Mhine～ Al Shrqia	Mhine～Al Fajwa	16	16	32		32
		Al Fajwa～ Al Shrqia	14	16	30		30
2020	Tartous ～Homs1	Tartous ～Akkari	18	80	98		98
		Akkari～Al-Khansa	18	80	98	40	138
		Al-Khansa～Homs2	18	80	98		98
	Homs1～Mhine		18	86	104		104
	Mhine～ Al Shrqia	Mhine～Al Fajwa	18	44	62		62
		Al Fajwa～ Al Shrqia	16	44	60		60

The train transporting phosphate is to be an exclusive train of phosphate, while others are to be ordinary freight trains.

5.4.2 Train kilometer and car kilometer

Table 5.13 indicates train kilometer and car kilometer per day.

Table 5.13 Train kilometer and car kilometer (per day)

	1999	2005	2010	2015	2020
Passenger Train Km	170.7	1,632.4	2,028.4	3,030.0	3,288.8
Freight Train Km	3,466.9	6,701.2	11,074.0	16,075.8	25,348.8
Total Train km	3,637.6	8,333.6	13,102.4	19,105.8	28,637.6
PC Car km	22,512.1	6,275.8	7,685.2	7,642.8	7,642.8
DC Car Km	0.0	2,408.8	3,782.4	10,820.0	12,970.0
FC Car Km	52,696.9	101,858.2	168,324.8	244,352.2	385,301.8
DEL Km(for Passenger Train)		897.8	1,191.1	764.3	764.3
DEL Km(for Freight Train)		7,808.0	12,967.5	18,818.8	29,630.5
DEL Km (Total)	3,734.3	8,945.9	14,158.5	19,583.1	30,394.8

Remarks : Figures in 1999 is calculated based on the passenger-kilometer and ton-kilometer

5.4.3 Track capacity

The track capacity and planned number of train by year are indicated in Table 5.14(1)～5.14(4).

Track capacity is calculated based on 10% higher average speed against current average operating speed and 70% as for the track utilization factor and 2.5 minutes for train handling time at stations, as a rule.

Table 5.14 (1) Track capacity (2005)

			2005			Track Capacity
			Number of Passenger Train	Number of Freight Train	Total	
Tartous ～ Homs	Tartous	Samariane	8	30	38	75
	Samariane	Akkari	8	30	38	43.3
	Akkari	Tel Kaslakha	8	40	48	59.2
	Tel Kaslakha	Umm Jaamh	8	40	48	55.6
	Umm Jaamh	Al Khanse	8	40	48	45.4
	Al Khanse	Khar bettin	8	30	38	58.6
	Khar bettin	5km	8	30	38	64.1
	5km	Homs 2	16	52	68	64.1
Homs～ Mhine	Homs 1	Homs 2	12	0	12	153.9
	Homs 2	Shinshar	12	26	38	60.4
	Shinshar	Khnefist	12	26	38	59.3
	Khnefist	Noamie	12	26	38	50.9
	Noamie	Mhine	12	26	38	62.5
Mhine ～Al Sharqia	Mhine	Al Rumeila	0	14	14	30.4
	Al Rumeila	Al Qariyatein	0	14	14	30.4
	Al Qariyateir	Al Baridia	0	14	14	26.5
	Al Baridia	Al Bsayra	0	14	14	26.5
	Al Bsayra	Al Fajiwa	0	14	14	63
	Al Fajiwa	Al Hamra	0	10	10	24
	Al Hamra	Al Shrqia	0	10	10	24

The track capacity of all section on year 2005 is good enough for required number of train operation, but if exceeded, its extent will be very slight.

Table 5.14 (2) Track capacity (2010)

			2010			Track Capacity
			Number of Passenger Train	Number of Freight Train	Total	
Tartous ～ Homs	Tartous	Samariane	8	48	56	75
	Samariane	Akkari	8	48	56	43.3
	Akkari	Tel Kaslakha	8	66	74	59.2
	Tel Kaslakha	Umm Jaamh	8	66	74	55.6
	Umm Jaamh	Al Khanse	8	66	74	45.4
	Al Khanse	Khar bettin	8	48	56	58.6
	Khar bettin	5km	8	48	56	64.1
	5km	Homs 2	18	74	92	64.1
Homs～ Mhine	Homs 1	Homs 2	12	0	12	153.9
	Homs 2	Shinshar	12	42	54	60.4
	Shinshar	Khnefist	12	42	54	59.3
	Khnefist	Noamie	12	42	54	50.9
	Noamie	Mhine	12	42	54	62.5
Mhine ～Al Sharqia	Mhine	Al rumeila	4	24	28	30.4
	Al rumeila	Al Qariyatein	4	24	28	30.4
	Al Qariyateir	Al Baridia	4	24	28	26.5
	Al Baridia	Al Bsayra	4	24	28	26.5
	Al Bsayra	Al Fajiwa	4	24	28	63
	Al Fajiwa	Al Hamra	4	20	24	24
	Al Hamra	Al Shrqia	4	20	24	24

The track capacity of following section, Samarian～Akkari～Al-Khanse and 5km Point～Homs, is not enough. There are some other sections where the track capacity is slightly short.

Table 5.14(3) Track capacity (2015)

			2015			Track Capacity
			Number of Passenger Train	Number of Freight Train	Total	
Tartous ～ Homs	Tartous	Samariane	10	68	78	75
	Samariane	Akkari	10	68	78	43.3
	Akkari	Tel Kaslakha	10	94	104	59.2
	Tel Kaslakha	Umm Jaamh	10	94	104	55.6
	Umm Jaamh	Al Khanse	10	94	104	45.4
	Al Khanse	Khar bettin	10	68	78	58.6
	Khar bettin	5km	10	68	78	64.1
	5km	Homs 2	26	102	128	64.1
Homs～ Mhine	Homs 1	Homs 2	20	68	88	153.9
	Homs 2	Shinshar	20	68	88	60.4
	Shinshar	Khnefist	20	68	88	59.3
	Khnefist	Noamie	20	68	88	50.9
	Noamie	Mhine	20	68	88	62.5
Mhine ～Al Sharqia	Mhine	Al rumeila	6	32	38	30.4
	Al rumeila	Al Qariyatein	6	32	38	30.4
	Al Qariyateir	Al Baridia	6	32	38	26.5
	Al Baridia	Al Bsayra	6	32	38	26.5
	Al Bsayra	Al Fajiwa	6	32	38	63
	Al Fajiwa	Al Hamra	6	28	34	24
	Al Hamra	Al Shrqia	6	28	34	24

The track capacity is short for the most of sections on 2015 for train operation plan.

Table 5.14(3) Track capacity (2020)

			2020			Track Capacity
			Number of Passenger Train	Number of Freight Train	Total	
Tartous ～ Homs	Tartous	Samariane	10	98	108	75
	Samariane	Akkari	10	98	108	43.3
	Akkari	Tel Kaslakha	10	138	148	59.2
	Tel Kaslakha	Umm Jaamh	10	138	148	55.6
	Umm Jaamh	Al Khanse	10	138	148	45.4
	Al Khanse	Khar bettin	10	98	108	58.6
	Khar bettin	5km	10	98	108	64.1
	5km	Homs 2	30	160	190	64.1
Homs～ Mhine	Homs 1	Homs 2	24	104	128	153.9
	Homs 2	Shinshar	24	104	128	60.4
	Shinshar	Khnefist	24	104	128	59.3
	Khnefist	Noamie	24	104	128	50.9
	Noamie	Mhine	24	104	128	62.5
Mhine ～Al Sharqia	Mhine	Al rumeila	6	62	68	30.4
	Al rumeila	Al Qariyatein	6	62	68	30.4
	Al Qariyateir	Al Baridia	6	62	68	26.5
	Al Baridia	Al Bsayra	6	62	68	26.5
	Al Bsayra	Al Fajiwa	6	62	68	63
	Al Fajiwa	Al Hamra	6	54	60	24
	Al Hamra	Al Shrqia	6	54	60	24

On year 2020, the track capacity is not enough for the train operation plan on all the sections.

5.4.4 Necessary number of rolling stock

(1) Way of calculation

Train kilometer is calculated by number of train and operating distance, car kilometer is calculated by number of cars in the train formation and train kilometer. Daily car kilometer is running distance of car per day. Required number of rolling stock is calculated from dividing car-km by daily car-km.

Premised daily car kilometer is as follows:

Passenger coach : 400km

Diesel railcar : 400km

Locomotive : 450km

20% for maintenance, repair and reserve (in case of passenger coach, 50% considering temporary group tourist reserve) are added to get necessary number of vehicle.

But, the sections consisting the Project line between Tartous and Al-Sharqia are

respectively a part of the other operating route sections and no vehicles operate exclusively limited to these sections, therefore, number of rolling stock for these sections is calculated by the method of proportional allotment of total number of rolling stock of Syrian Railways applying car kilometer.

(2) Necessary number of car per kind of rolling stock

Table 5.15 indicates necessary number of car by kind of rolling stock

Table 5.15 Necessary number of car by kind of rolling stock

	2005	2010	2015	2020
PC	25	30	25	25
DC	8	15	35	40
DL	26	42	58	89

5.5 Train operation plan of Alternative B

5.5.1 Train operation plan

(1) Passenger train operation plan

1) Premises

The sectional transportation volume, train formation, designed transportation capacity, number of train by kind of train, and train operating line system are the same as 5.4 “Train operation plan of Alternative A”.

2) Track usage

The down train uses existing track (-20‰), while up train, newly built track (+12‰) apart from existing line.

(2) Freight train operation plan

1) Premises

The rate of transportation fluctuation, hauling efficiency and actual load rate are the same as 5.4 “ Train operation plan of Alternative A”.

2) Hauling tonnage : 1,800tons by single 3200 type locomotive

3) Track usage

The down train uses existing track (-20‰), while up train, new track (+12‰).

4) Designed transportation capacity

Designed transportation capacity is the same as Alternative A. However, Alternative B adopts single headed locomotive train, there is no dead head train.

Table 5.16 indicates kind of train and number of train per day.

Table 5.16 Kind of train and number of train per day

Year \ Item / Section			Number of FreightTrain			Dead head Loc. Train	Total
			Phosphate	Other	Total		
2005	Tartous ～Homs2	Tartous ～Akkari	10	20	30		30
		Akkari～Al-Khansa	10	20	30	0	30
		Al-Khansa～Homs2	10	20	30		30
	Homs2～Mhine		12	14	26		26
	Mhine～ Al Shrqia	Mhine～Al Fajwa	12	2	14		14
		Al Fajwa～ Al Shrqia	10	2	12		12
2010	Tartous ～Homs2	Tartous ～Akkari	12	36	48		48
		Akkari～Al-Khansa	12	36	48	0	48
		Al-Khansa～Homs2	12	36	48		48
	Homs2～Mhine		14	28	42		42
	Mhine～ Al Shrqia	Mhine～Al Fajwa	14	10	24		24
		Al Fajwa～ Al Shrqia	12	10	22		22
2015	Tartous ～Homs2	Tartous ～Akkari	16	52	68		68
		Akkari～Al-Khansa	16	52	68	0	68
		Al-Khansa～Homs2	16	52	68		68
	Homs2～Mhine		16	52	68		68
	Mhine～ Al Shrqia	Mhine～Al Fajwa	16	16	32		32
		Al Fajwa～ Al Shrqia	14	16	30		30
2020	Tartous ～Homs2	Tartous ～Akkari	18	80	98		98
		Akkari～Al-Khansa	18	80	98	0	98
		Al-Khansa～Homs2	18	80	98		98
	Homs2～Mhine		18	86	104		104
	Mhine～ Al Shrqia	Mhine～Al Fajwa	18	44	62		62
		Al Fajwa～ Al Shrqia	16	44	60		60

No dead head operation of locomotive, but designed transportation capacity is the same as the case of Alternative A.

5.5.2 Train kilometer and car kilometer

Table 5.17 indicates train kilometer and car kilometer per day.

Table 5.17 Train kilometer and car kilometer (per day)

	2005	2010	2015	2020
Passenger Train Km	1,711.8	2,107.8	3,129.3	3,388.1
Freight Train Km	6,899.7	11,312.2	16,393.4	25,706.1
Total Train km	8,611.5	13,420.0	19,522.7	29,094.2
PC Car km	6,533.9	7,943.3	7,943.3	7,861.2
DC Car Km	2,488.2	3,941.2	11,137.6	13,367.0
FC Car Km	104,875.4	171,945.4	249,179.7	390,732.7
DEL Km(for Passenger Train)	941.5	1,234.8	786.1	786.1
DEL Km(for Freight Train)	7,589.7	12,443.4	18,032.7	28,276.7
DEL Km (Total)	8,531.2	13,678.2	18,818.9	29,062.8

Compared with the Alternative A plan, the track length is extended as about 1.3 times. Consequently, train kilometer, passenger car and diesel railcar kilometer are enlarged, meanwhile the locomotive kilometer becomes shorter as the cancellation of double headed operation even with the extension of operation track length.

5.5.3 Necessary number of rolling stock

(1) Premises

The same premises as Alternative A plan are adopted.

(2) Necessary number of vehicles by the type

Table 5.18 indicates necessary number of car by kind of rolling stock

Table 5.18 Necessary number of car by kind of rolling stock

	2005	2010	2015	2020
PC	25	30	25	25
DC	8	15	35	40
DEL	23	37	51	78

5.5.4 Travel time

In case of trains on up track between Tartous～Homs, the express diesel railcar train needs 1 hour 16 minutes, which is almost equal with the case of Alternative A plan while the freight train requires 2 hours 45 minutes, 50 minutes extended compared with Alternative A. This means that travel time of Alternative B case requires 40 minutes more than that of Alternative A even after subtracting 10 minutes for coupling and dividing of boosting locomotive for Alternative A.

5.6 Comparison of Alternative A and B

Alternative A - parallel track addition - and Alternative B - track addition by newly built track apart from existing line - are compared regarding items of the number of trains, track capacity, travel time, necessary number of rolling stock and train handling. Table 5.19 indicates comparison results.

(1) Train kilometer

As track length of Alternative B is extended, Alternative B has longer train kilometer than Alternative A.

(2) Car kilometer

Due to longer track length, car kilometer of PC, DC and FC in case of Alternative B are larger than that of Alternative A. While, locomotive kilometer of Alternative B is shorter than that of Alternative A due to single headed operation.

(3) Number of trains

Due to dead head locomotive operation, number of train of Alternative A is larger than that of Alternative B in the section of Akkari～Al-Khansa.

(4) Travel time

Comparison of train travel time of up train on the section of Tartous～Homs is resulting that diesel railcar train has not big difference, while in case of freight train, Alternative B require 40 minutes more than Alternative A. (See Appendix 5.1, 5.2)

(5) Number of rolling stock

In case of PC and DC, the same number is required for Alternative A and Alternative B in every year, while in case of locomotive, due to the existence of boosting locomotive, Alternative A requires more locomotive than Alternative B in every year. On year 2020, Alternative A needs 11 locomotives more than Alternative B.

(6) Locomotive driver

More drivers are needed on Alternative A than Alternative B due to the boosting

locomotive and in the year 2020, 20 drivers more are needed on Alternative A than Alternative B.

(7) Train handling

Boosting locomotive is necessary to push the train at rearmost for Alternative A plan for freight trains excluding the train with empty wagons exclusive for Phosphate,. Boosting locomotive should be coupled at Akkari and uncoupled at Al-Khansa, then dead head operated to Akkari. Thus, Alternative A requires more work of train handling compared with Alternative B.

Table 5.19 Comparison Alternative A and Alternative B

			A	B	B-A	Remarks
Train kilometer	2005		8,333.6	8,611.5	277.9	
	2010		13,102.4	13,420.0	317.6	
	2015		19,105.8	19,522.7	416.8	
	2020		28,637.6	29,094.2	456.5	
Car kilometer	2005	PC	6,275.8	6,533.9	258.1	
		DC	2,408.8	2,488.2	79.4	
		FC	101,858.2	104,875.4	3,017.2	
		DL	9,404.6	8,531.2	-873.4	
	2010	PC	7,685.2	7,943.3	258.1	
		DC	3,782.4	3,941.2	158.8	
		FC	168,324.8	171,945.4	3,620.6	
		DL	15,416.2	13,678.2	-1,738.1	
	2015	PC	7,642.8	7,861.2	218.4	
		DC	10,820.0	11,137.6	317.6	
		FC	244,352.2	249,179.7	4,827.5	
		DL	21,399.8	18,818.9	-2,580.9	
	2020	PC	7,642.8	7,861.2	218.3	
		DC	12,970.0	13,367.0	397.0	
		FC	385,301.8	390,732.7	5,431.0	
		DL	33,189.6	29,062.8	-4,126.8	
Number of trains(at Peak section)	2005		48	38	-10.0	Akkari～ Al Khans
	2010		74	56	-18.0	
	2015		104	78	-26.0	
	2020		148	110	-38.0	
Travel time(UP Train)(Trtous～ Homs)	Passenger T		1:17:00	1:16:00	-1:00	Freight A is included 10 minute of coupling and uncoupling time for assistant locomotive
	Freight T.		2:05:00	2:45:00	40:00	
Number of Rolling stock	2005	PC	25	25	0	
		DC	8	8	0	
		DL	25	23	-2	
	2010	PC	30	30	0	
		DC	15	15	0	
		DL	40	37	-3	
	2015	PC	25	25	0	
		DC	35	35	0	
		DL	55	51	-4	
	2020	PC	25	25	0	
		DC	40	40	0	
		DL	86	78	-8	
Locomotive driver	2005		180	170	-10	
	2010		240	230	-10	
	2015		290	275	-15	
	2020		330	310	-20	
Assistant locomotive			Need	No need		

(8) Overall comparison

In views of comparison of the above items, Alternative B is advantages to Alternative A from the view points of train operation aspects.

Chapter 6

Plan of Rolling stock and Depot

Chapter 6 Plan of Rolling stock and Depot

6.1 Basic plan of rolling stock

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

(1) In the future, the diesel cars will be used for the passenger train mainly in the domestic transportation. (Up to 2010, daytime passenger coach train tracted by DEL will be partly used.)

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

(3) For performing the frequent service of domestic passenger transportation, DC trains composed of 1～5 cars are operated.

(4) Some of DC have the driving cabs at the both end or one side. Types of DCs are 1st class and 2nd class.

(5) Passenger trains for domestic night and international operation are composed of 3～5 numbers of ACM or sleeping car, 3-4 numbers of AM or AP, 1 (one) of WR and 1 (one) DPOST type.

(6) In the driving cabs of locomotive and diesel car, the ATS (Automatic train stop) devices are installed.

6.2 Basic plan of depots

Basic plan of depots are shown as follows :

(1) At Tartous and Homs depot, repair and inspection are done for cars to be operated not only in the sections between Tartous, Homs and Al Sharqia but also in other sections. (for ex.

the section between Aleppo and Damascus, the one between Damascus and Lattakia).

(2) According to the increase of numbers and type of rolling stock, depots will be improved as follows :

① According to the increase of the locomotive hauling trains, new Homs locomotive depot will be constructed.

② According to the introduction of the diesel cars, new maintenance / repair machines and testing equipments for diesel cars will be introduced at the existing Tartous and Homs locomotive depots.

③ According to the introduction of automatic train stop (ATS) device on the locomotive and the diesel cars at the driving cab, new maintenance/repair machines and testing equipments will be introduced at the existing Tartous and Homs locomotive depots.

④ As the use of LDE2800 will be continued in the future, the turn tables which are installed in the Tartous locomotive depot and Homs locomotive depot are replaced, because these turn tables are very old.

6.3 Comparison of alternatives of railway transport between Akkari and Al Khansa

For the case of improvement alternative A, number of locomotive increases by 3 to 11 compared with alternative B. But yearly periodical inspection numbers of locomotive at the Tartous and Homs locomotive depots are almost the same for both alternatives.

6.4 Places of periodical inspection of rolling stock

Kinds of periodical inspection of rolling stock which are carried out at the Tartous depot and Homs depot, are shown as follows :

(1) Locomotive

Depot name	M1	M2	M3	M4
Tartous	○	○	○	○
Homs	○	○	○	○

(2) Diesel car

Depot name	D1	D2	D3	D4
Tartous	○	○	○	○
Homs	○	○	○	○

(3) Passenger coach and Freight wagon

Depot name	Passenger coach	Freight wagon
Tartous	○	○
Homs	○	○

6.5 Yearly numbers of periodical inspection of rolling stock

Yearly numbers of periodical inspection of rolling stock which are carried out at the Tartous depot and Homs depot, are estimated by the following formula and shown as follows :

$$A = (B \div C) - D$$

A: Number of rolling stock to be periodically inspected per year

B: Number of rolling stock in charge of the depot

C: Inspection cycle

D: Number of rolling stock to be periodically inspected at the higher grade per year

(1) Locomotive

Depot name	Type of inspection	Year	Numbers
Tartous	M2	2005	607
		2010	755
		2015	1,062
		2020	1,542
	M3	2005	19
		2010	25
		2015	34
		2020	50
	M4	2005	2
		2010	3
		2015	4
		2020	6
Homs	M2	2005	3,943
		2010	5,035
		2015	6,904
		2020	10,024
	M3	2005	122
		2010	159
		2015	224
		2020	328
	M4	2005	14
		2010	19
		2015	27
		2020	40

(2) Diesel car

Depot name	Type of inspection	Year	Numbers
Tartous	D2	2005	268
		2010	414
		2015	949
		2020	1,411
	D3	2005	5
		2010	8
		2015	18
		2020	27
	D4	2005	1
		2010	2
		2015	4
		2020	6
Homs	D2	2005	1,740
		2010	2,689
		2015	6,169
		2020	9,174
	D3	2005	34
		2010	52
		2015	118
		2020	176
	D4	2005	7
		2010	11
		2015	25
		2020	38

(3) Passenger coach

Depot name	Type of inspection	Year	Numbers
Tartous	T2	2005	179
		2010	143
		2015	79
		2020	79
Homs	T2	2005	51
		2010	41
		2015	23
		2020	23

(4) Freight wagon

Depot name	Type of inspection	Year	Numbers
Tartous	F2	2005	2,744
		2010	4,059
		2015	5,830
		2020	9,694
Homs	F2	2005	3,332
		2010	4,928
		2015	7,079
		2020	11,771

6.6 Numbers of rolling stock staying at the same time

Numbers of rolling stock staying simultaneously at the Tartous depot or Homs depot, are estimated by the following formula and shown as follows :

・M3, M4 for DL and D3, D4 for DC

$E = (F \times G) \div H$

E: Number of rolling stock staying at the same time for the periodical inspection

F: Number of rolling stock to be periodically inspected per year

G: Number of days necessary to the periodical inspection

H: Number of working days per year

・M2 (DL), D2 (DC), T2 (PC), F2 (FC)

$I = J \div K \div L$

I: Number of rolling stock staying at the same time for the periodical inspection

J: Number of rolling stock to be periodically inspected per year

K: Ditto per day

L: Number of working days per year

(1) Locomotive

Depot name	Type of inspection	Year	Numbers
Tartous	M2	2005	1
		2010	1
		2015	1
		2020	1
	M3	2005	1
		2010	1
		2015	1
		2020	1
	M4	2005	1
		2010	1
		2015	1
		2020	1
Homs	M2	2005	2
		2010	3
		2015	4
		2020	5
	M3	2005	1
		2010	1
		2015	1
		2020	1
	M4	2005	1
		2010	1
		2015	1
		2020	2

(2) Diesel car

Depot name	Type of inspection	Year	Numbers
Tartous	D2	2005	1
		2010	1
		2015	1
		2020	1
	D3	2005	1
		2010	1
		2015	1
		2020	1
	D4	2005	1
		2010	1
		2015	1
		2020	1
Homs	D2	2005	1
		2010	2
		2015	3
		2020	5
	D3	2005	1
		2010	1
		2015	1
		2020	1
	D4	2005	1
		2010	1
		2015	1
		2020	2

(3) Passenger coach

Depot name	Type of inspection	Year	Numbers
Tartous	T2	2005	1
		2010	1
		2015	1
		2020	1
Homs	T2	2005	1
		2010	1
		2015	1
		2020	1

(4) Freight wagon

Depot name	Type of inspection	Year	Numbers
Tartous	F2	2005	1
		2010	2
		2015	2
		2020	3
Homs	F2	2005	1
		2010	1
		2015	2
		2020	3

6.7 Improvement plan of depots

Improvement plan of depots are shown as follows:

(1) Locomotive and diesel car depots

1) Tartous locomotive depot

Accompanying the introduction of the new locomotive like LDE3200 and LDE3500 and accompanying with the introduction of the diesel cars, fullness of spare parts should be carried out.

Adequate supply of spare parts of automatic train stop (ATS) device should be carried out.

The very old turn table is installed in Tartous locomotive depot. GESR is planning to continue the use of the LDE2800 type locomotive in the future. The modern turn table should be introduced.

The diesel cars will be introduced at 2002 year. Accompanying with the introduction of the diesel cars, new maintenance/repair machines and new testing equipments for diesel cars will be introduced in the Tartous locomotive depot.

Main inspection equipments/facilities for diesel cars in the depot are shown as follows:

No.	Main inspection equipments / 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

2) Homs locomotive depot

Accompanying the increase of the numbers of periodical inspection of locomotive, GESR has a plan that Homs locomotive depot will be constructed newly. New Homs depot is a large scale depot and the modern machines and equipments for repairing and inspection of the locomotive are introduced.

Accompanying the introduction of the new locomotive like LDE3200 and LDE3500 and accompanying with the introduction of the diesel cars, fullness of spare parts should be carried out.

Adequate supply of spare parts of automatic train stop (ATS) device should be carried out.

The very old turn table is installed in Homs locomotive depot. GESR is planning to continue the use of the LDE2800 type locomotive in the future. The modern turn table should be introduced.

The diesel cars will be introduced at 2002 year. Accompanying with the introduction of the diesel cars, new maintenance/repair machines and new testing equipments for diesel cars will be introduced in the Homs locomotive depot.

Main inspection equipments/facilities for diesel cars in the depot are shown as follows:

No.	Main inspection equipments / 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

(2) Passenger coach and freight wagon depot

1) Tartous passenger coach and freight wagon depot

For effective operation of passenger coach and freight wagon, adequate supply of spare parts should be carried out.

Maintenance of repair machines and testing equipments should be carried out completely.

2) Homs passenger coach and freight wagon depot

For effective operation of passenger coach and freight wagon, adequate supply of spare parts should be carried out.

Maintenance of repair machines and testing equipments should be carried out completely.

6.8 Organization of locomotive/diesel car depot and passenger coach/freight wagon depot

According to the increase of the maintenance / inspection numbers of rolling stock, organization and staff of each depots will be as follows :

(1) Locomotive / diesel car depot

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

Number of staff of Tartous locomotive / diesel car depot and Homs locomotive/diesel car depot of every year are shown as follows:

Name of depot	Number of staff				
	2001 Jan.	2005	2010	2015	2020
Tartous locomotive / diesel car depot	50	40	40	40	45
Homs locomotive / diesel car depot	70	85	105	165	215

(2) Passenger coach/freight wagon depot

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

Number of staff of Tartous passenger coach/freight wagon depot and Homs passenger coach/freight wagon depot of every year are shown as follows:

Name of depot	Number of staff				
	2001 Jan.	2005	2010	2015	2020
Tartous passenger coach / freight wagon depot	110	60	85	115	190
Homs passenger coach / freight wagon depot	95	60	75	95	155

6.9 Staged improvement plan and cost

Staged improvement plan and cost are shown as follows:

(Unit : Million SP)

Year	2001-2005	2006-2010	2011-2015	2016-2020	Amount of cost
Construction of locomotive depot	415				415
Equipment of diesel car depot	288	288			576
Modernization of locomotive depot		46			46

6.10 Education

Contents of education of staff for maintenance/repair and test of rolling stock at the depots are shown as follows:

(1) Accompanying the introduction of the diesel cars, education of maintenance/ repair method and test method of the diesel car are necessitated for staff of Homs locomotive/ diesel car depot and Tartous locomotive/diesel car depot.

Contents of education are shown as follows:

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 at accident time.

(2) Accompanying the introduction of the new locomotive, education of maintenance/repair method and test method of new locomotive are necessitated for staff of Homs locomotive/diesel car depot and Tartous locomotive/diesel car depot.

Contents of education are shown as follows:

1) Outline of the new locomotive.
2) Electric control system of the new locomotive.
3) Brake system of the new locomotive.
4) Treatment method at accident time.

(3) Accompanying the introduction of the automatic train stop (ATS) device, education of maintenance/repair method and test method of the automatic train stop device are necessitated for staff at Homs locomotive/diesel car depot and Tartous locomotive/diesel car depot.

Contents of education are shown as follows:

1) Outline of the automatic train stop device.
2) Treatment method at accident time.

(4) When new maintenance machines and new test equipments are installed in the depots, education of the operation method, maintenance method and treatment method of accident time are necessitated for operator.

Chapter 7

Track Facilities Improvement

Chapter 7 Track Facilities Improvement

7.1 Concept of Track Facilities Improvement Plan

Although the basic policy of track facilities improvement is established based on 3rd class track of Russia, now it is decided to introduce UIC standard for future improvement or new construction of railways. As a consequence, the Project sections to be improved will be based on UIC standard, however, there are places inevitably to use partly the existing track alignment and track structures. Main specification for the Project sections is as follows;

- Design Speed DEL Passenger Train ----------120km/h
  (Operating maximum speed----100km/h)
  DC Passenger Train ------130km/h
  Freight Train ----------100km/h
- Maximum Radius of Curve R=600m (for standard alignment excluding station yard)
  R=300 – 400m (inevitable case in existing alignment)
- Maximum Cant 150mm
- Maximum Slack 20mm
- Maximum Gradient 12‰
  20‰ (Akkari – Al Khansa section :
  Double tracking in parallel with existing track)
- Design Load UIC 702, Axle load 25ton
- Rail UIC 60 (60.3kg/m)
  (New track and rehabilitation of existing track)
- Sleeper PC Sleeper (UIC B70) L=2.600m, 1,540 – 1,667/km
  (New track and rehabilitation of existing track)
- Fastening Pandrol with elastic pad
  (New track and rehabilitation of existing track)
- Ballast Crushed Stone, 300mm (Under Sleeper) (New track)
  250mm (Under Sleeper) (Rehabilitation of existing track)
- Turnout Main Line 11#, Sub Line 9#

- Center to center distance between adjacent tracks

  between station 5.0m, station yard 5.0 – 12.5m
- Track formation width Single Track 7.0– 7.5m Double Track 12.0 – 12.5m

In order to secure the safety of train operation after double tracking, the usage of each track of every station will be fixed. Consequently, the usage of platform will be by direction method and if necessary, the new platform will be installed.

7.2 Track Capacity Strengthening Plan

Master Plan and Feasibility Study indicate that the passenger and freight demand are forecasted to increase between Tartous ~ Homs ~Mhine to Al-Sharqia during the year 2001 to 2020, and the track capacity will become insufficient.

In order to increase the track capacity of single track section, it is possible to operate 120 trains/day by installing one or two new signal stations in between stations and in case the number of train exceeds beyond the capacity increased by installing signal stations or the ground configuration does not allow to build signal stations, double tracking would become necessary.

In between Akkari and Al-Khansa (39.4km), there is a continuous section of about 24km with grade of 20‰, which is more than 12‰, the largest gradient stipulated in Syria railways, and will hinder the train operation.

The route to connect Akkari and Al-Khansa with the maximum grade of 12‰ will be studied.
(See Fig.7.2)

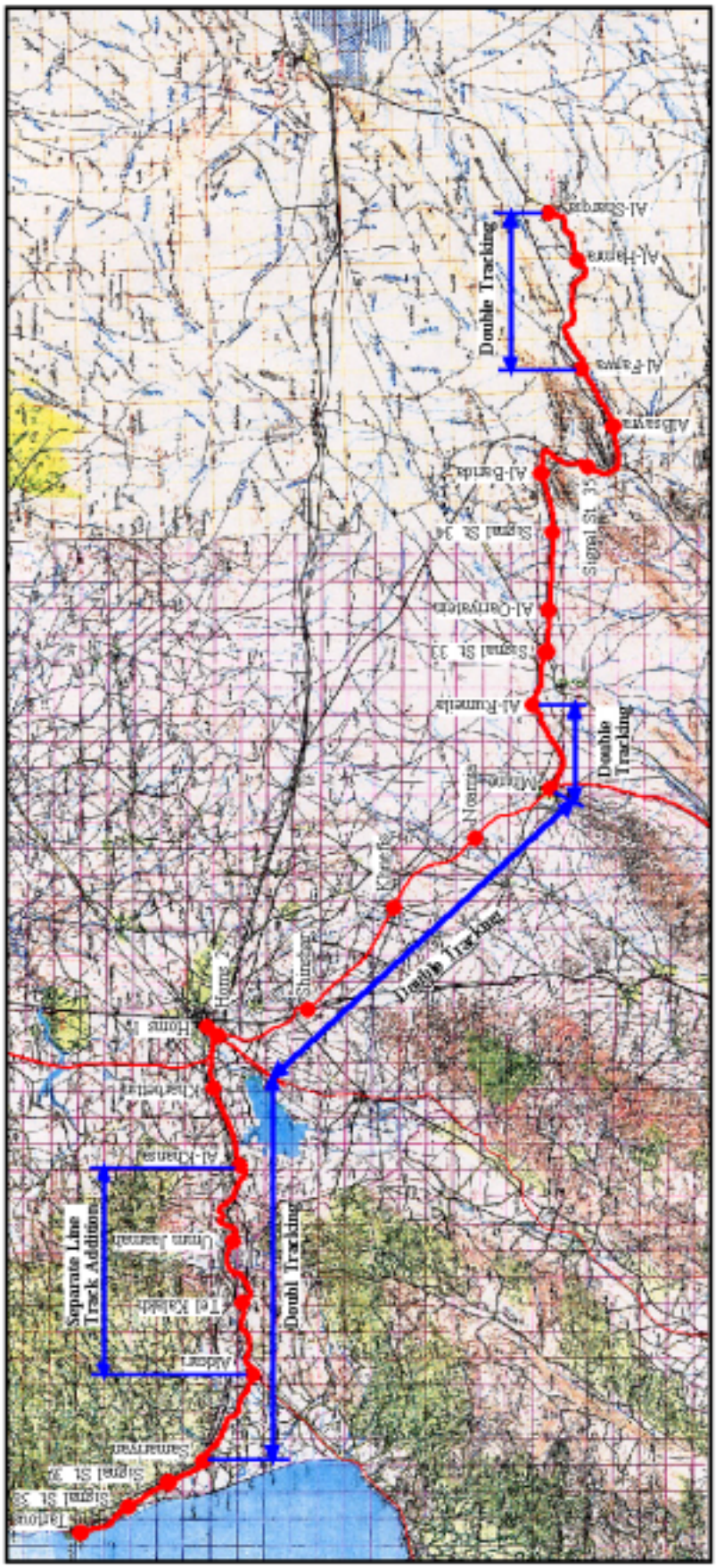


Fig.7.2 Track Capacity Strengthening Plan

7.2.1 Tartous – Homs (102k216m)

Signal stations to be built following the traffic increase or the necessary timing of double tracking construction are summarized in Table 7.2.1.

Table 7.2.1 Improvement Plan between Tartous and Homs 1

Station Name	km	Distance (St. to St.)	State of Line	Year of Improvement	Remarks
Tartous	102,216	4,711			
Signal St. A	97,505	6,275	New Station	2010	
Signal St. B	91,230	5,223	New Station	2010	
Samariyan	86,007	21,960			
			Double Tracking	2010	No suitable place for signal station
Akkari	64,047	10,964			
			Double Tracking	2010	No suitable place for signal station
Tel Kalakh	53,083	12,782			
			Double Tracking	2010	No suitable place for signal station
Umm Jaamah	40,301	15,687			
			Double Tracking	2010	No suitable place for signal station
Al-Khansa	24,614	16,162			
			Double Tracking	2015	No suitable place for signal station
Kharbettin	8,452	2,669			
5 km	5,783	5,783	D. Tracking	2010	Junction Point
Homs 1	0				

Note: km=Existing km

(1) Tartous – Samariyan

In between these stations, install two (2) signal stations and at signal station A, install 4 stabling sidings to detain those cars waiting for loading at Tartous station so as not to disturb the increasing arrival and departure trains.

Rough sketch of track layout of signal station A, signal station B and Samariyan station yard are shown in Fig.7.2.1 – Fig.7.2.3.

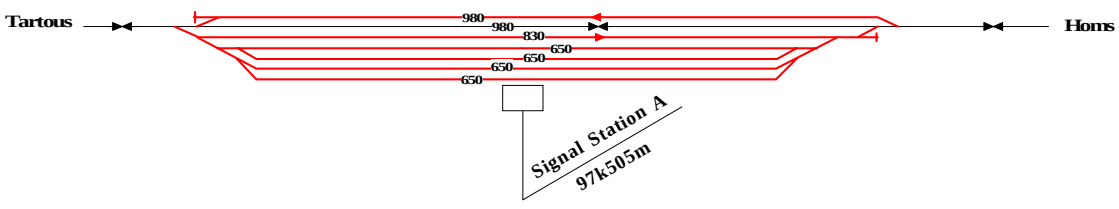


Fig. 7.2.1 Station Yard Track Layout of Signal Station A

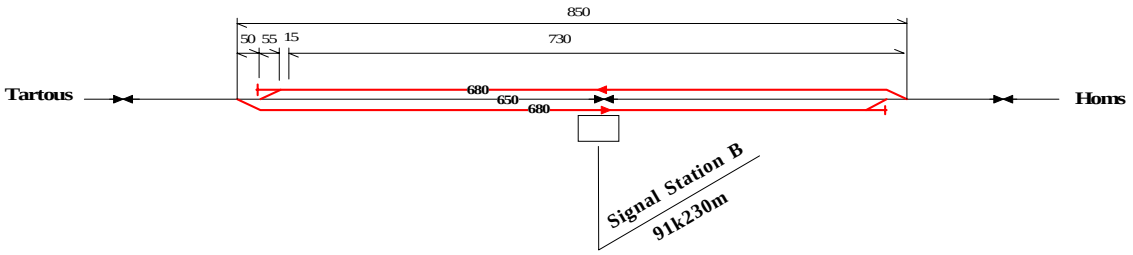


Fig. 7.2.2 Station Yard Track Layout of Signal Station B

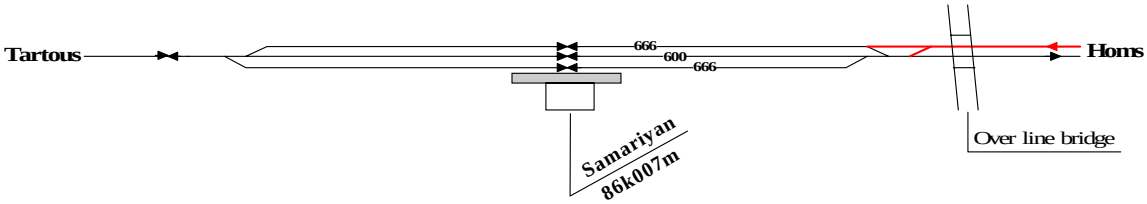


Fig. 7.2.3 Station Yard Track Layout of Samariyan Station

(2) Samariyan – Akkari

In between these stations, in order to operate increasing trains, 2 signal stations are needed, however, locations at 78k687m and 71k367m, where the section between stations can be divided into three (3) equal parts, do not have suitable alignment standard to place station (grade should be less than 3‰, curvature of radius be over R=600m), therefore double tracking along the existing track is to be installed. In between these stations, there are 2 overbridges, therefore, in order to secure proper width, it is needed to rebuild them.

(3) Akkari – Al-Khansa (Alternative A)

From Akkari station of altitude 60m to Al-Kansa station of altitude 520m, there are, en route, station Tel-Kalakh of mountain area and Umm Jaamah station located in a basin area. This section has the continued length of 39.4km going up the height of 460m in one breath. In this section, in addition to the current 2 stations, 6 new signal stations are necessary, however, because of the alignment reason, double tracking will be enforced by laying one (1) additional track along the existing track. As there are two places to cross with highway, between Umm Jaamah – Al-Khansa, rebuilding of grade separation at these places is necessary. At present, freight trains are operated by splitting into two trains hauled by one locomotive,however,in order to meet the traffic increase, two locomotives will be provided without dropping the hauling capacity. For this arrangement, at Akkari

and Al-Khansa station, locomotive refuge track will be built.

Track layout alterations at each station after double tracking will be shown in Fig.7.2.4 - Fig.7.2.7.

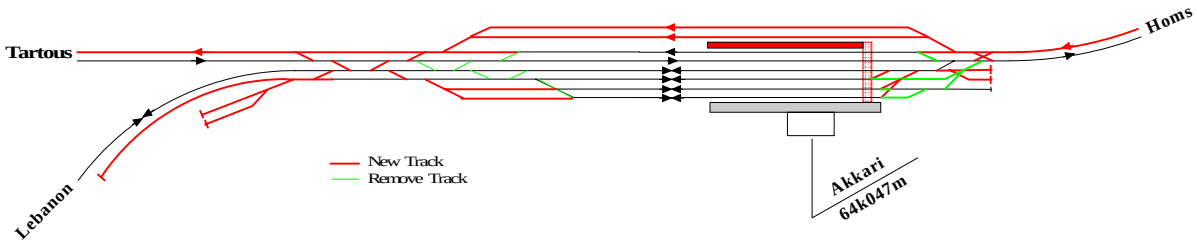


Fig. 7.2.4 Sketch of Akkari station track layout

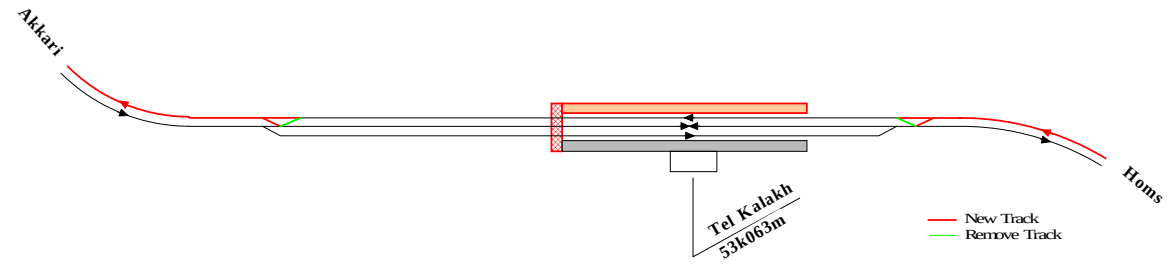


Fig. 7.2.5 Sketch of Tel Kalaakh station track layout

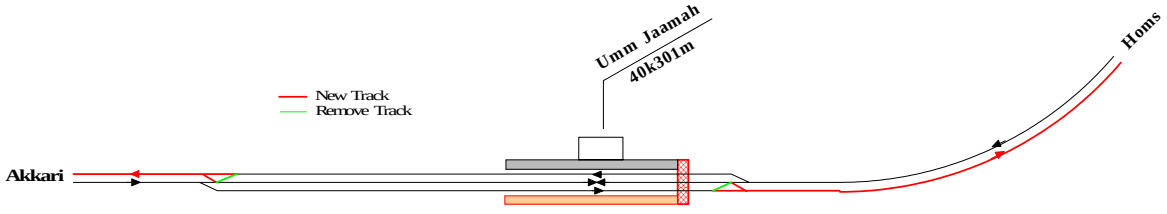


Fig. 7.2.6 Sketch of Umm Jaamah station track layout

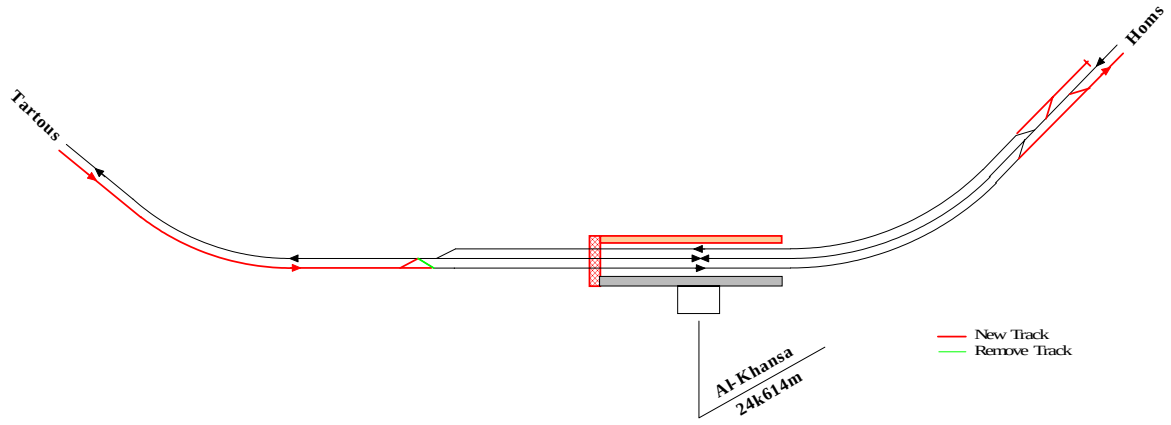


Fig. 7.2.7 Sketch of Al-Khansa station track layout

(4) Al-Khansa – Kharbettin

For this section, 2 signal stations are becoming necessary. However, the route goes through large plateau after finishing mountain range, and there are many ups and downs along the route. Therefore, there are no suitable places dividing the section into three (3) to install signal stations. Accordingly, double tracking will be enforced by placing one (1) track in parallel with existing track.

(5) Kharbettin – Homs 1 (Homs 2)

There are 2 branch points in this section. One is so-called 5km point, the other is 2km point.

5km point is the joining point from Aleppo direction and 2km point is the branch point for Damascus direction and Homs 1 direction. Especially, 5km point would be the joining point for double track, therefore, grade separation will be made.

With respect to 2km point, on the other hand, Homs 1 direction is only for passenger train service, therefore, Damascus (Homs 2) direction will become the main route.

Improved track layout of Kharbettin station is shown in Fig.7.2.8. Sketch of improvement between Kharbettin – Homs 1, Homs 2, is shown in Fig.7.2.9.

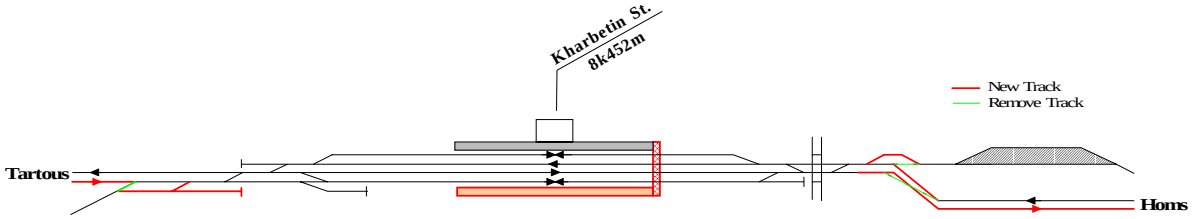


Fig. 7.2.8 Sketch of Kharbettin station track layout

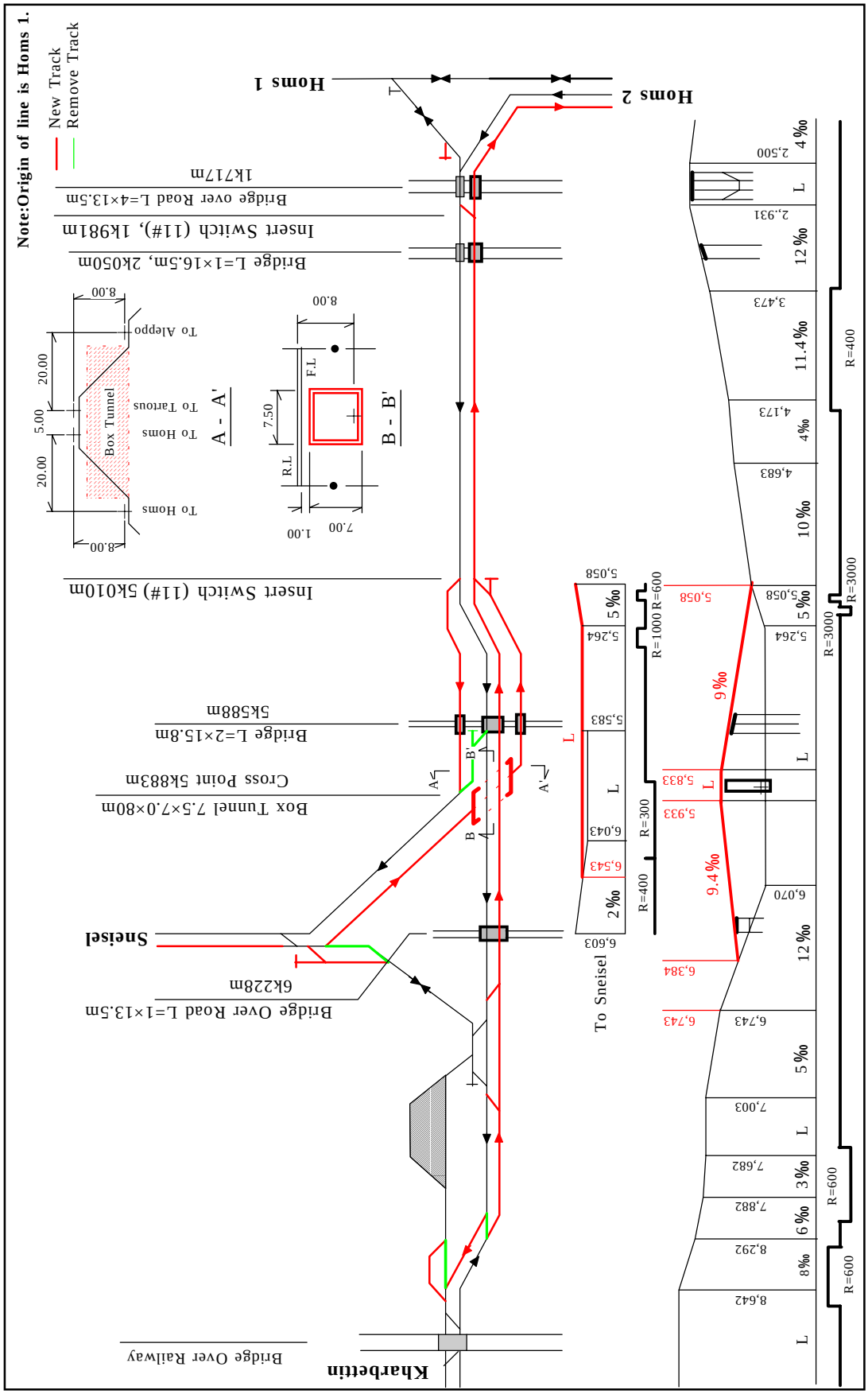


Fig.7.2.9 Sketch of Improvement of the Area near 5km point

7.2.2 Between Homs 2 – Mhine

The necessary timing of construction of double tracking or signal stations to cope with the traffic increase of this section, is summarized in Table 7.2.2.

Table 7.2.2 Improvement Plan between Homs 1 and Mhine

Station Name	km	Distance (St. to St.)	State of Line	Year of Improvement	Remarks
Homs 1 (P)	0				
Homs 2 (F)	4,120	4,120			
			Double Tracking	2015	No suitable place for signal stations
Shinshar	18,299	14,179			
			Double Tracking	2015	No suitable place for signal stations
Khnefis	31,856	13,557			
			Double Tracking	2010	No suitable place for signal stations
Noamia	52,956	21,100			
			Double Tracking	2015	No suitable place for signal stations
Mhine	67,793	14,837			

(1) Homs 1 – Homs 2 – Shinshar

Homs 1 is an exclusive passenger station and the scale of facilities is fully provided. Homs 2 is a freight station for which an extra one main track is to be laid along with double tracking of main line so as to enable to handle passengers by providing “island type” platform.

Between Homs 2 and Shinshar, 2 signal stations are needed, however, since there are no places having alignment to satisfy the signal station installment conditions, double tracking is enforced by adding 1 more track in parallel with the existing track.

Sketches of Homs 2 and Shinshar station improvement track layout are shown in Fig.7.2.10, Fig7.2.11.

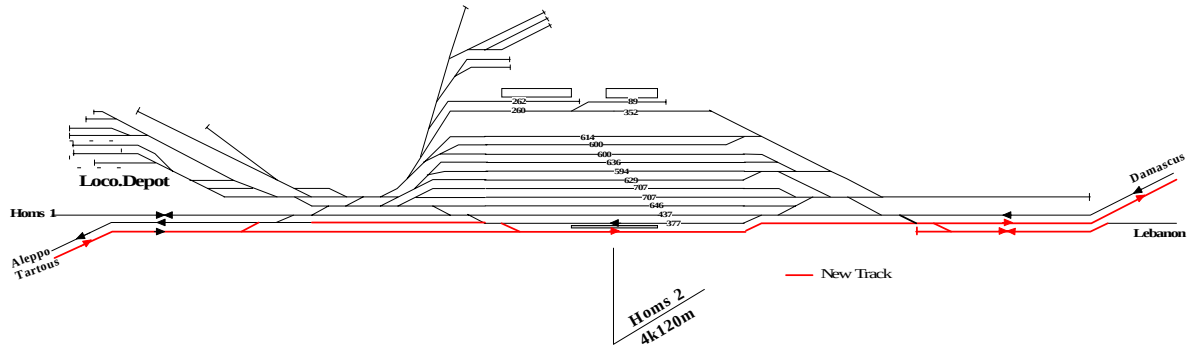


Fig.7.2.10 Sketch of Homs 2 station improvement track layout

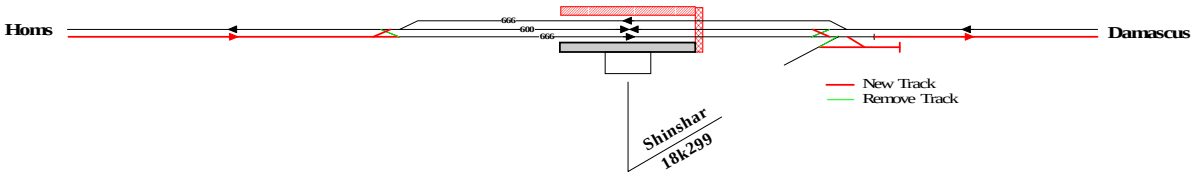


Fig.7.2.11 Sketch of Shinshar station improvement track layout

(2) Shinshar – Khhnefis – Noamia – Mhine

Between Shinshar and Khnefis and between Noamia and Mhine, 2 signal stations are needed respectively, and between Khnefis and Naomia, 3 signal stations are needed. However, none of these sections have the suitable places to install signal stations, therefore, double tracking will be enforced by placing extra track along the existing track. In order to secure the safety of train operation after double tracking, the usage of each track of every station will be fixed. Sketches of improvement of track layout at each station are shown in Fig.7.2.12 – Fig. 7.2.14.

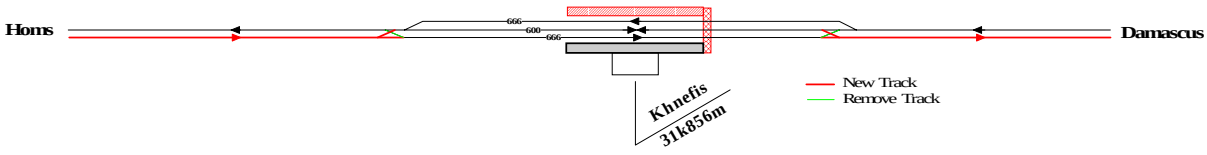


Fig.7.2.12 Sketch of Khnefis station improvement track layout

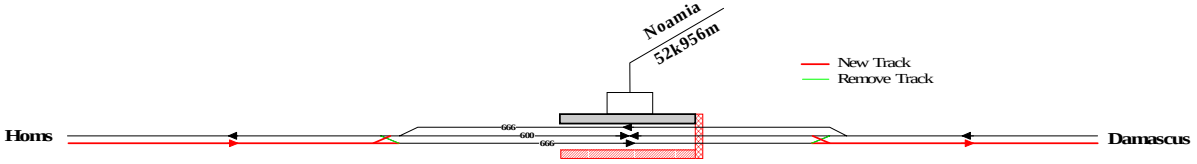


Fig.7.2.13 Sketch of Noamia station improvement track layout

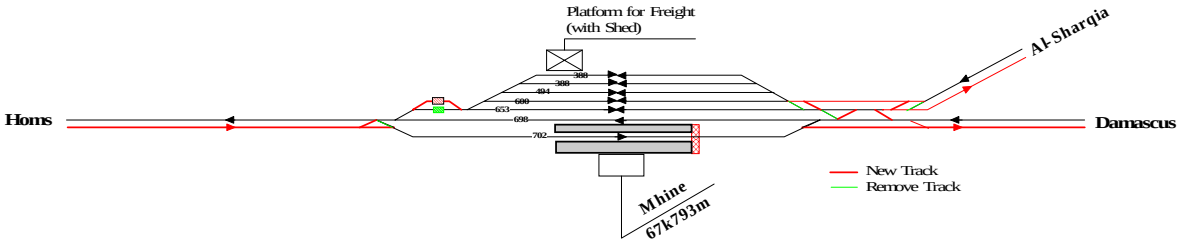


Fig.7.2.14 Sketch of Mhine station improvement track layout

7.2.3 Mhine – Al-Sharqia

The necessary timing of construction of double tracking or signal stations to cope with the traffic increase is summarized in Table 7.2.3.

Table 7.2.3 Improvement Plan between Mhine and Al-Sharqia

Station Name	km	Distance (St. to St.)	State of Line	Year of Improvement	Remarks
Mhine	0				
			Double Tracking	2020	No suitable place for signal station
Al-Rumeila	12,150	12,150			
Signal St. C	20,700	8,550	New Station	2020	
Al-Qariyatein	25,914	5,214			
Signal St. D	37,514	11,600	New Station	2020	
Al-Barida	47,814	10,300			
Signal St. E	56,000	8,186	New Station	2020	
Al-Bsayra	66,572	10,572			
Al-Fajwa	81,772	15,200			
			Double Tracking	2010	No suitable place for signal station
(Al-Hamra)	98,072	16,300			
			Double Tracking	2010	No suitable place for signal station
Al-Sharqia	110,772	12,700			

(1) Mhine – Al-Rumelia

In this section, there is a need to install one signal station, however, no place is found where alignment is enough to satisfy the installing standard of signal station, therefore, double tracking is to be enforced by laying extra new track along existing track. Track layout alteration of Al-Rumelia station is shown in Fig.7.2.15.

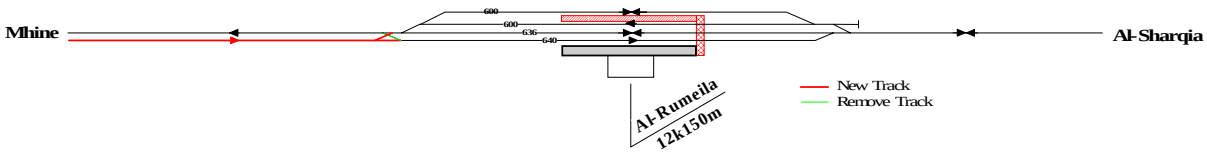


Fig. 7.2.15 Sketch of Al-Rumeila station improvement track layout

(2) Al-Rumeila – Al-Qariyatin -Al-Barida – Al-Bsayra

In each section, there is a place with suitable alignment respectively where a section can be divided into 2 sub-sections, therefore, one signal station shall be installed in each section. Track layout of signal station is to use the existing track as middle track for train passing-by for both direction, and to install the refuge tracks of 650m on each side.

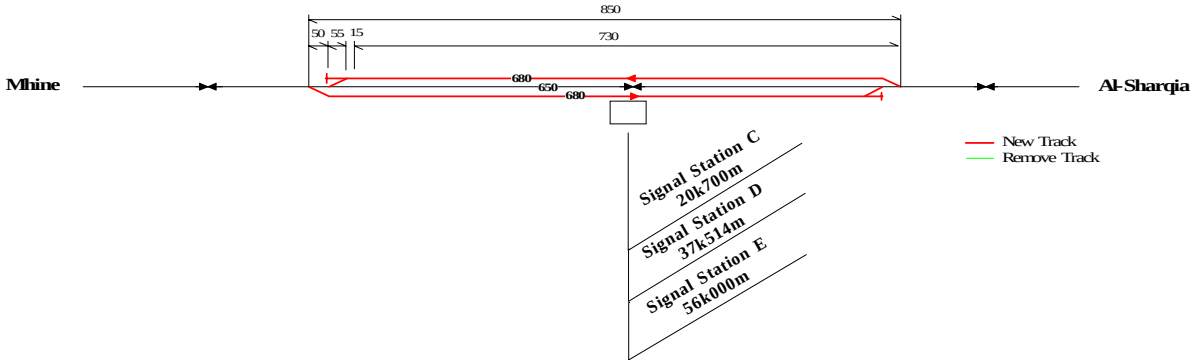


Fig.7.2.16 Sketch of Signal station track layout

(3) Al-Fajwa – Al-Hamra – Al-Sharqia

In each section, one signal station is necessary to be installed respectively, however, since there are no suitable places to install signal station, double tracking will be enforced by laying a new track in parallel with existing track. With respect to Al-Hamra station, only site is secured, however, there are no station facilities provided.

Sketches of improved track layout for Al-Fajwa station and Al-Sharqia station are shown in Fig.7.2.17 and Fig. 7.2.18.

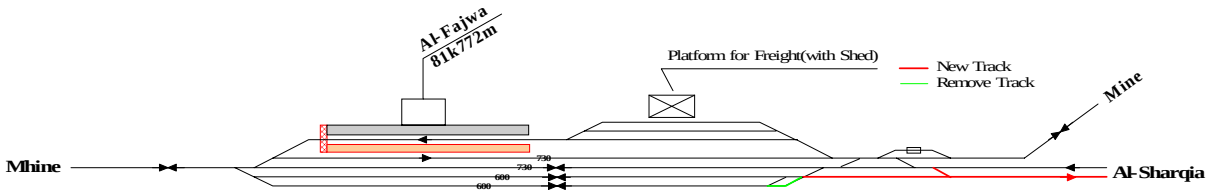


Fig.7.2.17 Sketch of Al-Fajwa station improvement track layout

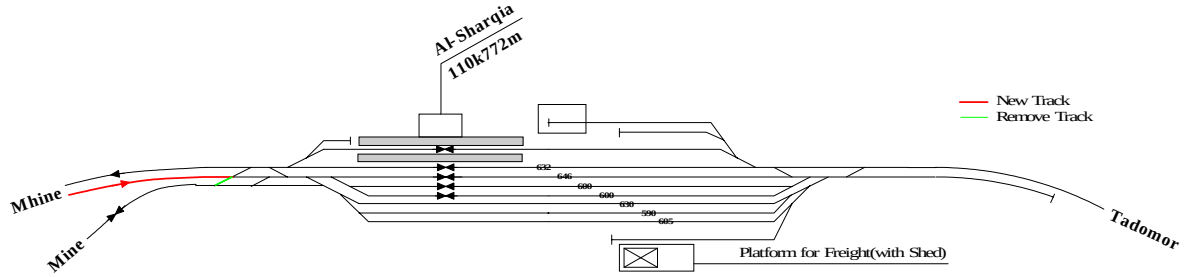


Fig. 7.2.18 Sketch Al-Sharqia station improvement track layout

7.2.4 Track Addition of Separate Route between Akkari – Al-Khansa (Alternative B)

At this section climbing steepest grade is 20‰. The freight train is split at Akkari and operation is made by reducing the hauling load. In order to make operation without reducing the hauling capacity, it is needed to have the grade less than 12‰. As the track capacity will become short in between the year 2010 – 2015, installation of signal station or double tracking will be necessary. Because installation of signal station is difficult due to line site condition, double tracking will be implemented. In double tracking, the present track will be used as going down track only and a new track of improved alignment with 12‰ will be exclusively used as climbing up train.

The present track length between Akkari – Al-khansa is 39km 433m, however, with new route, its length will be 49km386m, thus 10km extension. At Tel Kalakh, it is difficult to build additional track next to the present station and the station for Homs direction will be installed 2 km away. As for Umm Jaamah station, it is possible to build additional track near to the present track and the station improvement track layout plan will be the same as the other station improvement track layout accompanying with the double tracking.

Outline plan and profile are shown in Fig.7.2.19 and Fig.7.2.20.

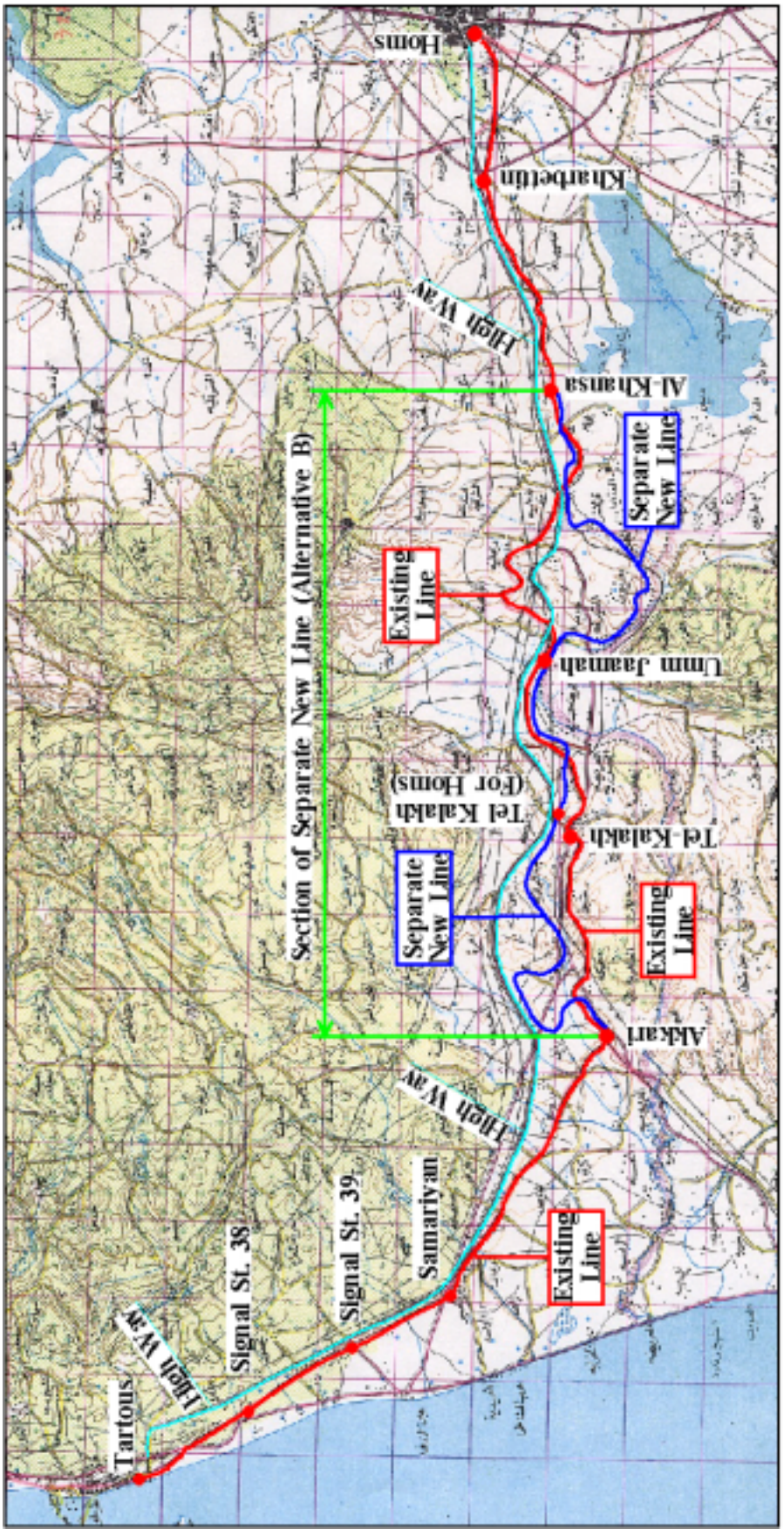


Fig.7.2.19 Outlined Plan

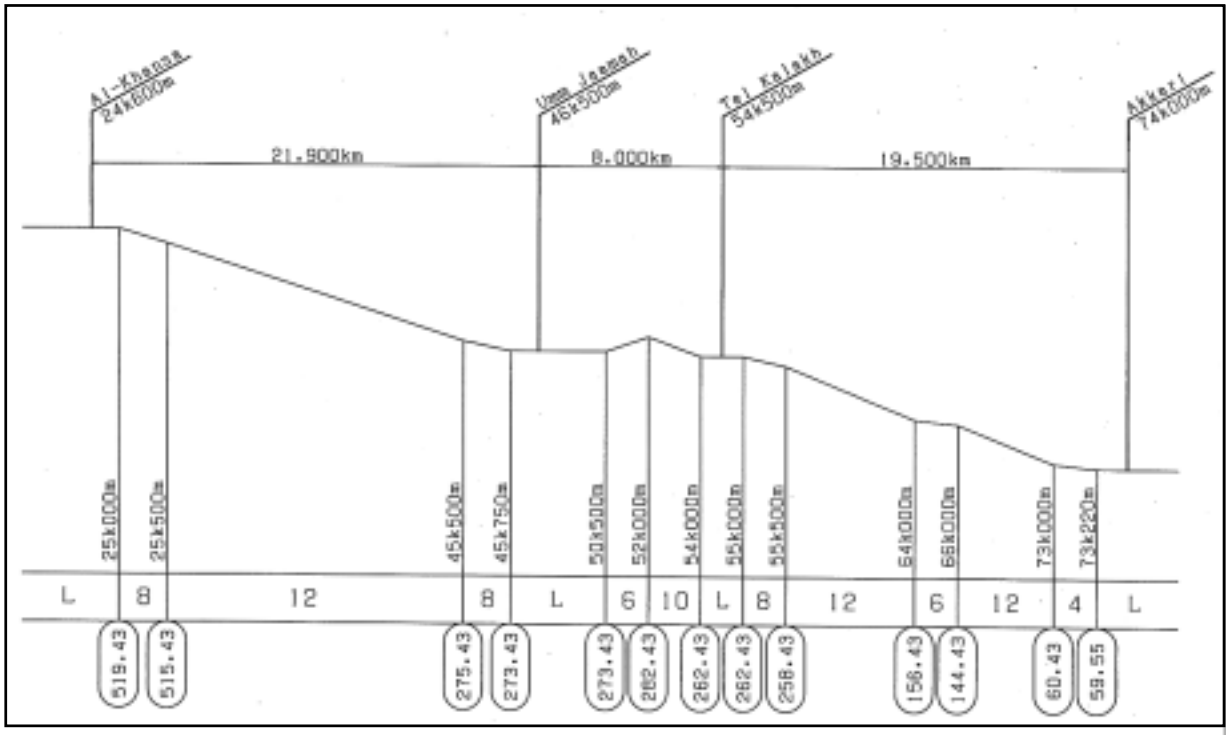


Fig.7.2.20 Outline profile of separate line

Sketch of track layout of Tel Kalakh station towards Homs is shown in Fig.7.2.21.

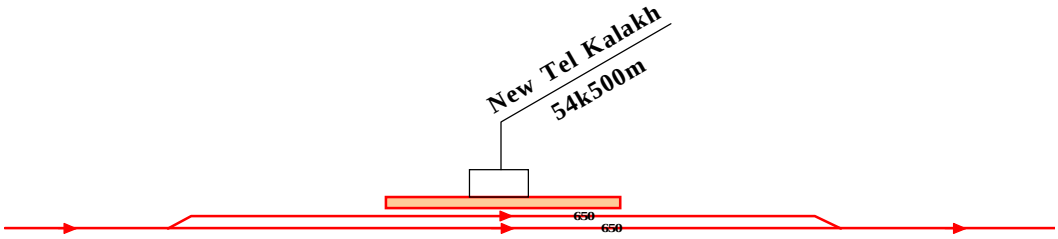


Fig.7.2.21 Sketch of track layout of Tel Kalakh station

7.2.5 Transport improvement plan between Tartous – Homs – Mhine – Al-Sharqia

(1) Alternative A

To make double tracking by laying one new track in parallel with the existing track. The train will be hauled by double locomotives. This is called Alternative A.

(2) Alternative B

To make double track by adding second track on separate route having improved grade between Akkari – Al-khansa. The train will be hauled by one locomotive. This is called as Alternative B.

7.3 Preliminary Design

Basic concept of permanent way specification and structures in Feasibility Study section (Tartous –Homs – Mhine – Al-Sharqia) is as described below.
Specification for track for Alternaqtive B between Akkari to Al Khansa is as shown in 7.3.3.

7.3.1 Track Structures

- Radius of Curvature: Minimum Radius of Curvature: 300m (same as existing line)
- Grade: Maximum Gradient: 20/1,000 (same as existing line)
- Formation Width : 3.05m from track center line
- Track Spacing : 5. 0m
- Bridge : Reinforced concrete of girder type structure
- Culvert : Reinforced concrete of box type rigid formation
- Transverse Pipe : Reinforced concrete pipe
- Number of sleeper for track :

  Straight track or more than 1,200m radius of curve : 1600/km

  less than 1,200m radius of curve : 1,840/km

7.3.2 Station and Signal Station

- Grade : Existing station is the same as the present condition

  New signal station should have level track in principle.
- Track Effective Length : 650m
- Track Center Distance : Existing station : the same as present condition

  Newly built track : 5.5m
- Turnout : 1/11 (for side track 1/9)
- Number of sleeper for track : 1,600/km (side track 1,440/km)

7.3.3 Design Specification of Separate Route (Alternative B)

Design specification on alternative B between Akkari and Al-Khansa is as follows.

(1) Track Structure

- Radius of Curvature : Minimum radius of curvature: 600m
- Gradient : Maximum grade 12/1,000
- Formation Width : 3.05m from track center line
- Track Spacing : 5.0m
- Bridge : Deck steel truss girder and reinforced concrete girder structure
- Culvert : Reinforced concrete box rigid structure
- Transverse Pipe : Reinforced concrete pipe
- Number of Sleeper : Straight track and radius of curve more than 1.200m : 1,600/km
  Radius of curve less than 1,200m : 1,840/km

(2) Station (Tel Kalakh, Umm Jaamah)

- Gradient : Level
- Effective Track Length : 650m
- Number of Track : 2 tracks
- Track Spacing : 5.5m
- Turnout : 1/11
- Number of Sleeper : 1.600/km
- Passenger Platform : Width 2.0m, Length 200m

7.3.4 Outline of Design

(1) Tartous – Homs

1) Tartous – Samariyan

Signal stations No.38 and No.39 will be installed.

Among these, at signal station No.38, 4 tracks for freight wagons stabling will be built side by side.

Track effective length will be 650m and track spacing distance will be 5.5m. Turnout at main track will be 1/11, and at stabling track, 1/9.

2) Samariyan – Akkari

Facing to Akkari from Samariyan side, track will be added on left side.

In this section, there are 2 over-line road bridges and for both of them railway track is running at the center span of 3 spans.

Over-line road bridge on Akkari side needs rebuilding.

Regarding over-line road bridge on Samariyan side, there is a possibility to lay 1 more track between abutment and pier subject to the examination by detail drawing. At this time, rebuilding of 2 over-line road bridges are planned. Also there are bridges with many number of clear spans scattered, it is needed to widen the track spacing considering the economy and easiness of construction at these places.

3) Akkari – Tel Kalakh – Umm Jaaamah (Alternative A)

Facing to Tel Kalakh from Akkari side, track addition will be made on the left hand side.

2 tracks will be additionally laid at Akkari station and large scale track layout change will be made.

Also, at both sides of Akkari station, 2 stable tracks each will be installed for auxiliary locomotive to be used between Akkari and Al-Khansa.

Track curvature, gradient and structures in section between stations will be of the same specifications and structure type as the existing track.

Near by Akkari station where private houses are approaching in close with tracks, it will be planned to build gravity type retaining wall.

4) Tel Kalakh – Umm Jaamah (Alternative A)

Tracks will be added on left side facing Umm Jaamah from Tel Kalakh side. At near by station, where private houses approach in close, gravity type retaining wall will be planned.

Over-line road bridge at near by Tel Kalakh station, the pier span is about 9.6m, therefore, it is possible to avoid the rebuilding of bridge by studying the plane alignment of track in detail.

Design specification and structure type of facilities will be the same as the existing line.

5) Umm Jaamah – Al-Khansa (Alternative A)

Tracks will be added on the right side of the route facing to Al-Khansa from Umm Jaamah.

In this section, railway line crosses the high-way obliquely at 2 places, namely at near by Umm Jaamah station and 5 km away from Al-Khansa. At both places, the railway

goes through under the high-way and both tunnels are of single track type.

To avoid the disturbance to the existing tunnel, and to secure the easiness of the construction, it is needed to provide enough attention to make the distance between the existing tunnel and a new tunnel as large as possible in detail design of the track alignment.

The tunnel newly built is planned with the reinforced concrete box rigid frame structure of 5m inner width and 7m inner height.

6) Al-Khansa – Kharbettin

Track will be added on the right side facing to Kharbettin from Al Khansa.

At Al-Khansa station, drill track for auxiliary locomotive from Akkari will be newly built.

Design specification of track and structure type of facilities will be planned as the same as the existing line.

In the section between Old Kharbettin –Kharbettin which is now disused, the old road bed can possibly be used for double tracking.

7) Kharbettin – Homs2

Track is to be added on the right hand side facing to Homs from Kharbettin.

Under the over-line road bridge near by Kharbettin station, only double track space is available. That is why it is planned to use the industry private track going into Kharbettin station from the petroleum factory as an additional main line track.

This plan is effective one because the usage frequency of private track is low and the rebuilding of the over-line road bridge can be avoided.

It is needed, however, to change branching point of industry line and to replace a part of track.

Tartous – Homs line joins with Aleppo –Damascus line at about 5km point from Homs. At present, either of these lines are single track lines, and therefore, there is no problem to make connection at grade.

However, after completion of double tracking between Kharbettin – Homs 2 and between Sneisel and Homs 2, train operation on level crossing will cause bottleneck on operation planning and operational safety.

In order to grade up the operational planning and operational safety, it is planned to make connection by the grade-separation accompanying with the improvement project

of this occasion.

Connecting track will be laid as the same height with existing track, and Tartous – Homs line will cross over the connecting line.

For this plan, raising 2 tracks including additional new track, new construction of tunnels at crossing portion, rebuilding existing bridge and grade separation of level crossings are necessary.

8) Akkari-Al-Khansa (Alternative B)

Alternative B between Akkari – Al-Khansa is planned to improve the maximum grade 20/1,000 into 12/1,000 and the minimum radius of curve 300m to 600m, consequently the track length is increased by app. 10km compared with the existing line.

In particular in selecting the separate route at near by Akkari station, the altitude of track will be raised by making detour at the flat land north of station, and the route will run towards hilly area.

In case of double track operation using separate line and existing line, it is more logical to use new separate line towards Homs for going up grade and to use existing line for going down towards Tartous.

Outline examination was made by the survey data of 1997 offered by GESR, and it is deemed necessary to adopt the elevated structure for new line viewing from the facts that consideration must be made for reduction of required land size at flat area and also for the landscape. Elevated structure includes long bridge of 700m.

Also, to keep the right side train operation on double track section, it is planned to install a new separate line on station building side (south side) of Akkari station.

To realize such plan, alignment of existing line will be shifted to the point where existing line and new line can make grade separation and the shifted existing line will go under the separate line and be connected again with the original alignment.

(2) Homs – Mhine

1) Homs 2 – Shinshar

Add a track on the right side of the existing track towards Hom2 – Shinshar.

Tracks from Homs for Lebanon should be moved partially.

2) Shinshar – Khnefis – Noamia – Mhine

On each section, tracks are to be added on right side of existing track. At the time of

detail design stage, it should be studied to enlarge the track spacing in consideration of easiness of construction of new bridge beside the existing bridge.

For three (3) stations of Shinshar, Khnefis and Noamia, it is planned to install passenger passage way to cross passenger platform and tracks.

(3) Mhine – Al-Sharqia

1) Mhine – Al-Rumeila

At Mhine station, track will be added on the left side towards Al-Rumelia so that it will not affect the main track for the direction to Damascus. From the point where track separates from Damascus main track, new track will be added on right side of existing track until Al-Rumeila.

2) Al-Rumeila –Al-Qariyatein – Al-Barida –Al-Bsayra

Signal station No.33 between Al-Rumeila – Al-Qariyatein, signal station No.34 between Al-Qariyatein – Al-Barida, and Signal station No.35 between Al-Barida – Al-Bsayra will be newly built. Number of track at signal station is 3 tracks, track effective length is 650m. To select the location of signal station, it is selected, in principle, at near the middle point of both stations and also track in the station should be level.

However there are few places to satisfy the level conditions over the whole track effective length, therefore some tracks have gradient of 5/1,000.

3) Al-Fajwa – Al-Hamra – Al-Sharqia

On all these sections, track will be added on right side of existing track.

At Al-Fajwa, passenger platform and passenger passage way will be installed.

At Al-Hamra, because the existing station’s track is single, only 1 track will be added like in the case of intermediate section and no other track like refuge track is not provided.

Al-Sharqia , only a part of track layout on Mhine direction and a part of industry track siding will be changed, and no large scale track layout change is done.

7.3.5 Construction Quantity

Outlined design quantity of each section are shown in Table 7.3.1 – Table 7.3.3

Table 7.3.1. Between Tartous and Homs

Items	Unit	Alternative A								Alternative B
		Tartous ～ Samariyan		Samariyan ～ Akkari	Akkari ～ Tel Kalakh	Tel Kalakh ～ Umm Jaamah	Umm Jaamah ～ Al-Khansa	Al-Khansa ～ Kharbettin	Kharbettin ～ Homs2	Akkari ～ Al-Khansa
		Signal St.38	Signal St.39							
Land	m²	36,000	16,000	108,000	55,000	64,000	78,000	61,000	82,000	1,470,000
Building compensation	Type								1	1
Enbankment	m³	36,000	14,000	168,000	87,000	158,000	135,000	94,000	296,000	6,990,000
Cutting	m³	35,000	9,000	81,000	31,000	32,000	169,000	62,000	1,000	4,860,000
Crossing pipe	m	60		70	5	30	5		45	320
Concrete	m³	150	190	370	3,280	3,230	850	190	3,920	3,990
Reinforced concrete	m³	150	160	220	500	330	780	200	2,410	12,700
Bridge	m			447	11	311	161	107	253	482
Improve over line bridge	place			2						
Tunnel crossing with highway	place						2			
Remove bridge	m								63	
Deck type truss bridge	m									700
Girder type viaduct	m									5,000
Newly install track	km	5.1	1.7	21.7	16.2	12.6	15.7	16.4	14	49.4
Newly install turnout	set	14	6	2	26	4	4	8	15	6
S.C. new install	set				1					
Car stopper newly install	set	2	2		5			1	5	2
Remove track	km	0.1	0.1		1.2				3.7	
Remove turnout	set			1	16	2	2	1	5	
emove car-stopper	set				1				2	
New install crossing	place			16	4	8	4	12	6	8
Station building	ridge	1	1							2
Fence	m	2,100	2,100							4,200
Passenger platform etc.	m²			440	680	440	440	440	450	800

Table 7.3.2 Table of Quantity between Homs and Mhine

Items	Unit	Homs2 ～ Shinshar	Shinshar ～ Khnefis	Khnefis ～ Noamia	Noamia ～ Mhine
Land	m²	71,000	68,000	106,000	74,000
Embankment	m³	127,000	39,000	116,000	88,000
Cutting	m³	1,300	32,000	33,000	23,000
Crossing pipe	m	10	5	60	20
Concrete	m³	30	20	250	110
Reinforce concrete	m³			70	50
Bridge	m	96	36	263	249
New track	km	15.2	13.6	21.1	14.8
New turnout	set	7	6	4	11
Install car-stopper	set	1	1		
Remove turnout	set	1	4	2	5
Remove car-stopper	set	3	1		
Install railway crossing	place	4	8	14	6
Passenger platform etc.	m²		440	440	440

Table 7.3.3 Table of Quantity between Mhine and Al-Sharqia

Item	Unit	Mhine ～ Al-Rumeila	Al-Rumeila ～ Al-Qariyatein Signal St. 33	Al-Qariyatein ～ Al-Barida Signal St. 34	Al-Barida ～ Al-Bsayra Signal St. 35	Al-Fajwa ～ Al-Hamra	Al-Hamra ～ Al-Sharqia
Land	㎡	61,000	16,000	16,000	16,000	82,000	64,000
Embankment	m^3	101,000	25,000	25,000	35,000	197,000	96,000
Cutting	m^3	36,000				63,000	51,000
Crossing pipe	m	85	30	20		65	75
Concrete	m^3	560	90	60	140	880	710
Reinforce concrete	m^3	350			135	620	470
Bridge	m	12			18	99	18
New track	㎞	12.2	1.7	1.7	1.7	16.3	12.7
New turnout	set	2	6	6	6	4	1
Install car-stopper	set		2	2	2		
Remove track	㎞		0.1	0.1	0.1		
Remove turnout	set	1				1	2
Install railway crossing	place	4					
Station Building	ridge		1	1	1		
Fence	m		2,100	2,100	2,100		
Passenger platform etc.	㎡	430				450	

7.4 Work Execution Plan

Grand total length of feasibility study route is approximately 276 km.
Track addition and new installation of signal station are planned to be established in parallel to existing track in principle. However, between Akkari – Al-Khansa, it is studied to lay separate route as Alternative B.

For these sections, particular examination of execution method and of execution sequence are necessary for the following two (2) places;

- At the grade separation around 5km point near by Homs.
- At the crossing point of new and old track near by Akkari in case of Alternative B.

7.4.1 Execution Plan near 5km Point from Homs

It is planned to raise existing Tartous – Homs line and to make grade separation crossing with connecting line to be additionally installed.
At raising section, there are bridge and level crossing of existing line. It is needed to rebuild those facilities.
To rebuild these facilities, the temporary line execution method will be adopted. By this method, it is intended to secure the safe train operation and grade up the execution characteristics.
Execution sequence is as follows and Fig.7.4.1 shows the detailed sequence.

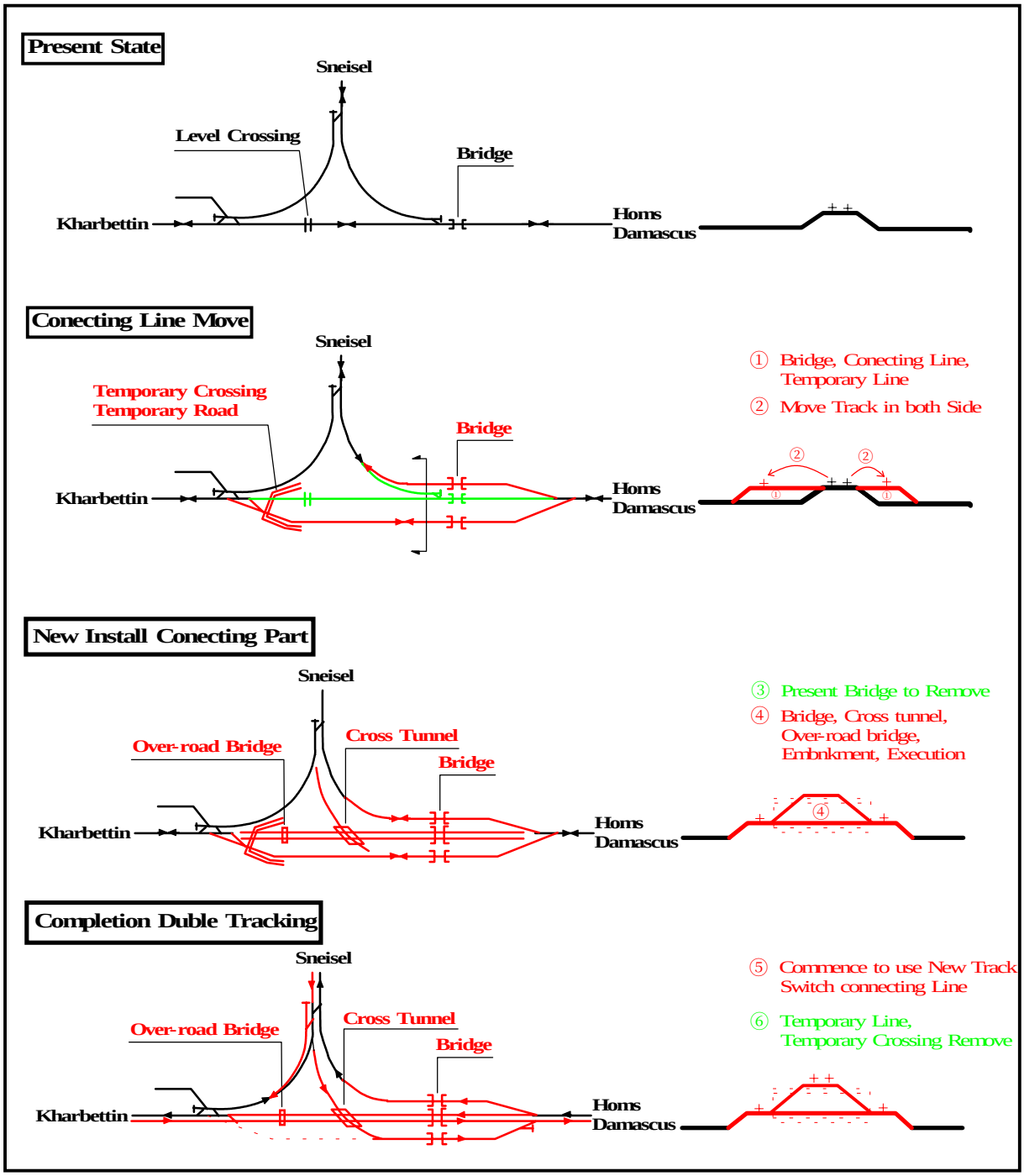


Fig.7.4.1 Homs 5km Execution Sequence

(1) At the specified locations of out side of existing lines, install new connecting lines which will be used in future. The new connecting line on the right hand side of Tartous – Homs line will be extended as temporary line to Tartous direction.

(2) The existing Tartous – Homs line and the connecting line will be switched to the newly

built outside lines.

After switching the track, the existing bridge (5k588m) will be removed, and double track bridge, the crossing tunnel of connecting line and raising the embankment will then be executed.

As for the grade separation of the existing level crossing of (6k228m), road will be switched to the temporary road after building temporary level crossing and temporary road. After switching the road, existing level crossing will be removed and the new double over-road bridge will be newly installed.

(3) At the same time as already raised Tartous – Homs line will be recovered, new connecting line will be used. At this moment, track facilities capable to accord with future transport plan will be completed.

(4) The road near by over road bridge will be lowered and the road alignment will be recovered. After recovery of road alignment, temporary level crossing, temporary road and temporary line at Tartous side will be removed.

7.4.2 Execution Plan near by Akkari of Alternative B.

Plan of alternative B of Akkari –Al-Khansa is to make grade separation crossing between the separate line and existing line and to make right-side train operation by the method of temporal track construction.

Construction work at crossing place of separate line should be executed together with the relocated part of tack before existing track will be switched to relocated part of track. Construction sequence including the separate track route are explained as below.

(1) Together with the construction of separate route, relocating part of track of existing line will be constructed.

(2) After switching the existing track to relocated part of track, which goes under the separate route track, relocated track will be offered for use.

(3) At the place of existing track near by Akkari station which has been switched to relocated part of track separate route facilities will be constructed.

(4) After the completion of the entire separate route, both separate and existing route will be used as up and down tracks.

7.5 Outline of Construction Cost

In the section between Akkari and Al-Khansa, there are Alternative A plan to install additional track along with existing line and Alternative B plan to install the separate single track having good alignment.

Estimated total cost for the section between Tartous and Al Sharqia including Alternative A is calculated as approximately 7,734 Million Syrian Pound in total, and that including Alternative B calculated as about 11,483 Million Syrian Pound.

Regarding the cost limited to Akkari – Al-Khansa section only, the cost for Alternative A is approximately 1,523 Million Syrian Pound and for Alternative B is calculated at approximately 5,272 Million Syrian Pound. Therefore the cost for Alternative B is more expensive by approximately 3,749 Million Syrian Pound than Alternative A.

Each section-wise estimated construction cost is shown in Table 7.5.1 – Table 7.5.3.

Table 7.5.1 Cost between Tartous and Homs

Unit: 1,000S.P.

Items	Alternative A(Akkari - Al-Khansa)								Alternative B
	Tartous ～ Samariyan		Samariyan ～ Akkari	Akkari ～ Tel Kalakh	Tel Kalakh ～ Umm Jaamah	Umm Jaamah ～ Al-Khansa	Al-Khansa ～ Kharbettin	Kharbettin ～ Homs2	Akkari ～ Al-Khansa
	Signal St. 38	Signal St. 39							
Land	8,640	3,840	25,992	10,972	8,362	7,840	7,502	18,774	213,960
Roadbed	24,128	8,344	91,055	57,311	87,673	107,446	59,757	134,015	1,723,551
Bridge	1,075	1,625	134,805	7,164	81,130	195,870	28,615	90,625	2,333,600
Track	127,151	46,185	416,840	385,077	256,527	316,536	329,818	303,271	962,149
Station	19,006	19,006	308	476	308	308	308	315	38,740
Total	180,000	79,000	669,000	461,000	434,000	628,000	426,000	547,000	5,272,000

Table 7.5.2 Cost between Homs and Mhine

Unit: 1,000S.P

Items	Homs2 ～ Shinshar	Shinshar ～ Khnefis	Khnefis ～ Noamia	Noamia ～ Mhine
Land	11,360	10,848	3,536	2,226
Roadbed	55,002	25,833	59,656	44,014
Bridge	24,000	9,000	66,450	62,725
Track	305,638	269,011	406,050	306,727
Station	0	308	308	308
Total	396,000	315,000	536,000	416,000

Table 7.5.3 Cost between Mhine and Al-Sharqia

Unit: 1,000S.P

Items	Mhine ～ Al-Rumeila	Al-Rumeila ～ Al-Qariyatein Signal St. 33	Al-Qariyatein ～ Al-Barida Signal St. 34	Al-Barida ～ Al-Bsayra Signal St. 35	Al-Fajwa ～ Al-Hamra	Al-Hamra ～ Al-Sharqia
Land	1,824	480	480	480	2,445	1,905
Roadbed	55,937	11,329	11,329	17,529	101,756	57,252
Bridge	6,220	0	0	5,800	30,990	9,105
Track	235,718	46,185	46,185	46,185	324,494	251,738
Station	301	19,006	19,006	19,006	315	0
Total	300,000	77,000	77,000	89,000	460,000	320,000