

**ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC**

# **Development of The Trans-Asian Railway**

**TRANS-ASIAN RAILWAY IN THE  
NORTH-SOUTH CORRIDOR  
NORTHERN EUROPE TO THE PERSIAN GULF**



**UNITED NATIONS**

**ST/ESCAP/2182**

This publication was prepared with financial support by the Government of Germany through GTZ German Technical Cooperation.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

This publication has been issued without formal editing.

# CONTENTS

	<b>Page</b>
CHAPTER 1 INTRODUCTION	1
CHAPTER 2 POSSIBLE TRANSPORT ROUTES BETWEEN NORTHERN EUROPE AND THE PERSIAN GULF	7
2.1 Denomination of routes	7
2.2 The Caucasus route	7
2.2.1 Route alignment and technical characteristics	7
2.2.1.1 Caucasus route in Finland	7
2.2.1.2 Caucasus route in the Russian Federation	9
2.2.1.3 Caucasus route in Azerbaijan	9
2.2.1.4 Caucasus route in Armenia	12
2.2.1.5 Caucasus route in the Islamic Republic of Iran	12
2.2.2 Route alignment and technical characteristics	15
2.3 The Central Asian route	15
2.3.1 Route alignment and technical characteristics	15
2.3.1.1 Central Asian route in Finland	16
2.3.1.2 Central Asian route in the Russian Federation	16
2.3.1.3 Central Asian route in Kazakhstan	16
2.3.1.4 Central Asian route in Uzbekistan	18
2.3.1.5 Central Asian route in Turkmenistan	18
2.3.1.6 Central Asian route in the Islamic Republic of Iran	21
2.3.2 Route alignment and technical characteristics	21
2.4 The Caspian Sea route	23
2.4.1 Route alignment and technical characteristics	23
2.4.1.1 Caspian Sea route in Finland	23
2.4.1.2 Caspian Sea route in the Russian Federation	23
2.4.1.3 Caspian Sea route in the Islamic Republic of Iran	24
2.5 Possible future route developments along the corridor	25
2.5.1 The Caucasus route	25
2.5.2 The Central Asian route	26
2.6 Continuation of the corridor in South / South-East Asia	27
2.6.1 Corridor connections with countries in South Asia	27
2.6.1.1 Closing the 'Kerman - Zahedan' gap	27
2.6.1.2 Corridor continuation in Pakistan	29
2.6.1.3 Corridor continuation in India	30
2.6.2 Corridor connections with countries in South-East Asia	31
2.6.2.1 Rail link in Singapore and Malaysia	31
2.6.2.2 Rail link in Thailand	33
2.7 Continuation of the corridor in Europe	33
2.8 Conclusion	36
CHAPTER 3 TECHNICAL REQUIREMENTS	37
3.1 Structure gauge and loading gauge	37
3.2 Axle-load	42
3.3 Commercial speeds	45

	<b>Page</b>
CHAPTER 4 OPERATIONAL REQUIREMENTS	49
4.1 Compatibility of rolling stock	49
4.2 Compatibility of train assembly and load scheduling practices	51
4.3 The break-of-gauge issue	52
4.3.1 The break-of-gauge problem in the Corridor	52
4.3.2 Description of technical solutions to the break-of-gauge problem	53
4.3.3 Advantages vs disadvantages of different solutions	55
4.3.4 Capital costs	57
CHAPTER 5 COMMERCIAL REQUIREMENTS	59
5.1 Business environment of container traffic	60
5.2 Transit times	61
5.2.1 Estimates of sea transit times	61
5.2.2 Estimates of rail or rail-cum-sea transit times	62
5.2.2.1 Estimates of all-rail transit times	63
5.2.2.2 Estimates of land-cum-sea transit times	63
5.3 Tariffs	66
5.3.1 Outline of tariff setting methods applied by railways in the corridor	67
5.3.2 Modern approach to tariff setting	69
5.4 Reliability / Punctuality / Frequency of service	72
5.5 Other aspects of service level	73
5.5.1 Security of cargo	73
5.5.2 Information to customers	75
5.6 General conclusion	79
CHAPTER 6 FACILITATION OF CROSS-BORDER MOVEMENTS OF CARGO	81
6.1 International transit agreements and conventions	81
6.1.1 Work of ESCAP	81
6.1.2 Work of the Organization of Economic Cooperation	85
6.2 Transit facilitation	86
6.3 International rail transit agreements	87
6.4 International agreements and conventions	87
6.5 Railway adoption of EDI systems	88
CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS	89
7.1 TAR network designation	89
7.2 Fundamental role and operational priorities	90
7.3 Completing the network	91
7.4 Traffic information and forecasting system enhancement	91
7.5 Identifying and achieving targets for competitive rail service	91
7.6 Recommended minimum technical standards	92
7.7 Specific container handling needs	93
7.8 Facilitation measures for cross border traffic	93
7.9 TAR network development needs	94

## **LIST OF MAPS**

	<b>Page</b>
Map 1	Proposed Trans-Asian Railway Routes 3
Map 2	Routes of Trans-Asian Railway in North-South Corridor 5
Map 3	North-South Corridor in Finland 8
Map 4	North-South Corridor in the Russian Federation (West of the Urals) 10
Map 5	North-South Corridor in Azerbaijan 11
Map 6	North-South Corridor in Armenia 13
Map 7	North-South Corridor in the Islamic Republic of Iran 14
Map 8	North-South Corridor in Kazakhstan 17
Map 9	North-South Corridor in Uzbekistan 19
Map 10	North-South Corridor in Turkmenistan 20
Map 11	Corridor continuation in South Asia 28
Map 12	Corridor continuation in South-East Asia 32
Map 13	European Railway Networks 34
Map 14	European Road Networks 35

## **LIST OF TABLES**

Table 3.1	Dimensions of most commonly used ISO and non-ISO containers 39
Table 5.1	Estimates of all-rail transit times from Helsinki to Tehran, Bandar Abbas, Lahore and New Delhi 64
Table 5.2	Estimates of land-cum-sea transit times from Helsinki to Tehran, Lahore, New Delhi and Bangkok 65

## **LIST OF ANNEXES**

Annex 1	ESCAP Resolution 48/11 and Table of Accession 95
Annex 2	Inter-Governmental Agreement on International North-South Transport Corridor 97

## **- Chapter 1 -**

### **Introduction**

---

One main feature of economic development in the last decade of the 20<sup>th</sup> century has been the globalisation of markets which brought with it increased demand for the unhindered movement of people, goods and services. In this new environment, transport has become both an economic resource and a servant of economic activity. However, increased demand for mobility can only be satisfied if two important conditions are met. One is the provision of safe and reliable international transport routes and networks. The other is the efficient management of the infrastructure including the 'software aspects' of transport relating to the necessary harmonisation of the documents required as well as their speedy and unadulterated transmission between the parties involved.

The overall competitiveness in a global economy is impaired when transport services are inadequate, with the poorer, peripheral regions often paying the highest penalties in as much as they are kept away from the mainstream of economic activities with related consequences on their social development. This has encouraged the physical development of routes/networks, either through the provision of new infrastructure or a process of upgrading existing national and international infrastructures, so that they can accommodate the increase in traffic volumes.

Wider recognition of the above, combined with improved political stability in most parts of the Asian continent, has made possible the expression of a common desire by the countries concerned to make greater efforts towards bringing closer together hitherto fragmented national networks to form regional and sub-regional transport systems.

Acknowledging the benefits that economic globalization, if properly engineered and conducted, could have for the economic and social development of the countries of the region, ESCAP identified the development and strengthening of intra- and inter-regional transport and communication linkages as a major objective of phase II (1992-1996) of the Transport and Communications Decade for Asia and the Pacific. In this context ESCAP, in 1992, initiated the integrated Asian Land Transport Infrastructure Development (ALTID) project comprising the Trans-Asian Railway (TAR) and Asian Highway (AH) projects as well as facilitation of land transport. ESCAP also adopted resolution 48/11 of 23 April 1992 on road and rail transport modes in relation to facilitation measures.

In view of its practical importance, the ALTID project formed a priority component of the New Delhi Action Plan on Infrastructure Development in Asia and the Pacific (1997-2006) launched by the Ministerial Conference on Infrastructure held in New Delhi in October 1996. Renewed support to the ALTID project was also expressed by the 55<sup>th</sup> Commission of ESCAP held in Bangkok in April 1999. The Commission renewed the mandate of the

secretariat to continue and, whenever possible, speed up the implementation of the ALTID project, thus giving new impetus to ESCAP resolution 52/9 of 24 April 1996 on Intra-Asia and Asia-Europe land-bridges which laid emphasis on concrete actions towards the development of reliable and efficient Intra-Asia and Asia-Europe transport linkages to facilitate international and bilateral trade and tourism.

With this mandate, the Transport, Communications, Tourism and Infrastructure Development Division of ESCAP developed the ALTID project implementation strategy featuring a step-by-step approach. Accordingly, a series of studies were conducted aimed at defining a network of road and rail linkages of sub-regional, regional and international importance. More specifically, in the field of railways, an important feasibility study was completed in 1996 on the Trans-Asian Railway Northern Corridor of Asia-Europe transport links, namely a study on connecting the rail networks of China, Kazakhstan, Mongolia, the Russian Federation and the Korean Peninsula. Also in 1996, another study was completed on the development of the Trans-Asian Railway in the Indo-China and ASEAN sub-region. Additionally, in 1999, a study on the development of the Trans-Asian Railway in the Southern Corridor of Asia-Europe routes was completed with a view to connecting Thailand and Yunnan province of China with Turkey as well as Europe and Central Asia through Myanmar, Bangladesh, India, Pakistan and the Islamic Republic of Iran. Nepal and Sri Lanka also took part in the study.

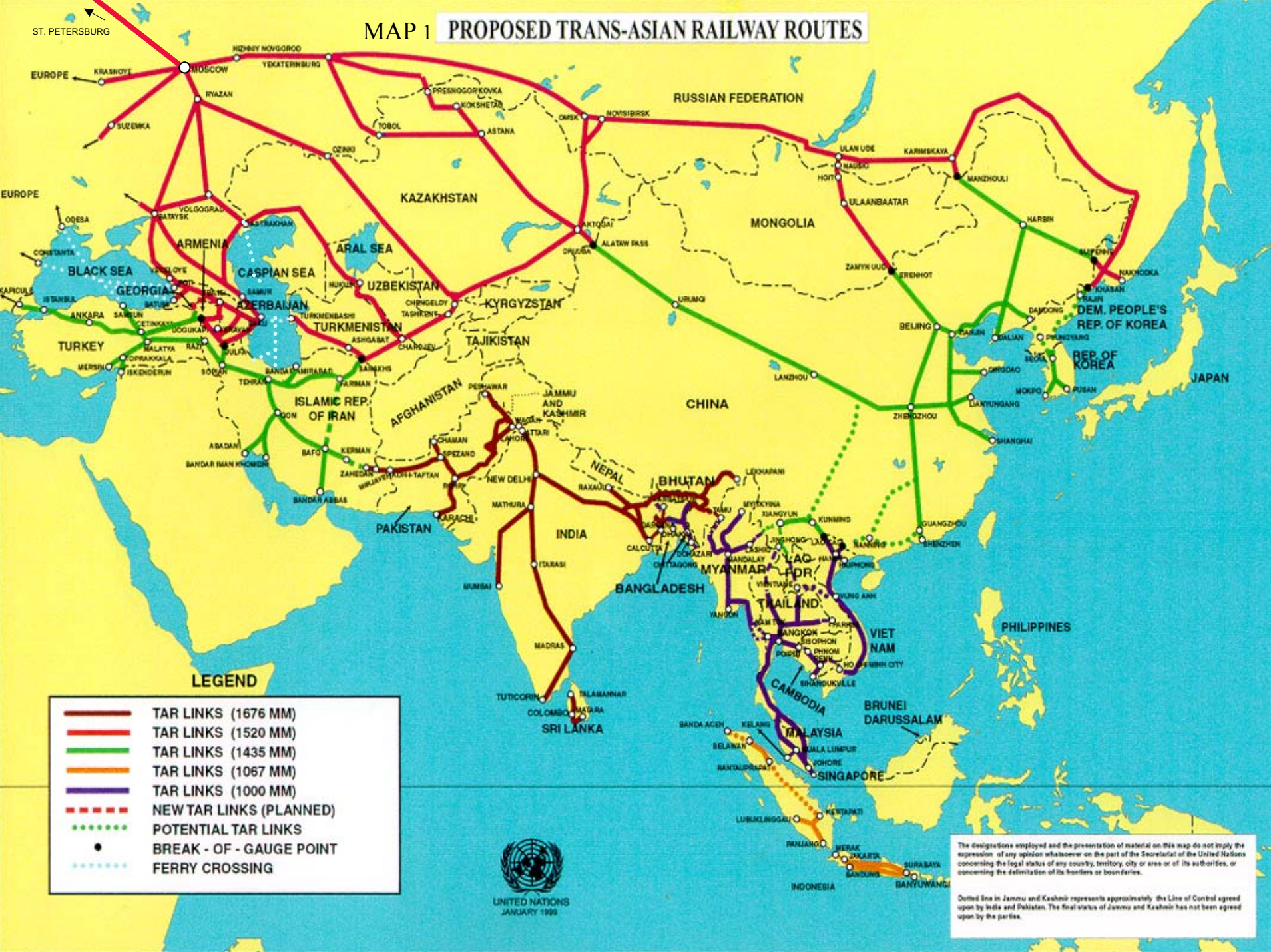
The links forming the Trans-Asian Railway network were identified by the participating countries in accordance with the following criteria:

- (a) capital to capital links (for international transport);
- (b) connections to main industrial and agricultural centres (links to important origin and destination points);
- (c) connections to major sea and river ports (integration of land and sea transport networks);
- (d) connections to major container terminals and depots (integration of rail and road networks).

The overall TAR network defined on the basis of these principles is illustrated in Map 1.



## MAP 1 PROPOSED TRANS-ASIAN RAILWAY ROUTES





With the above studies completed in close cooperation with the countries concerned, the picture of a Trans-Asian Railway network started to appear covering North-East, South-East, South and South-East Asia with linkages between these subregions. At the same time, connections with the European transport systems were also considered with a view to developing, whenever possible, landbridge operations between the two continents, as well as linkages giving to landlocked countries access to the main ports in both Asia and Europe.

However, to complete the TAR network, and to act upon the recommendation of the 56<sup>th</sup> session of the Commission, one study still needed to be accomplished, namely : a study on development of “Trans-Asian Railway in the north-south corridor : Northern Europe - Russian Federation - Central Asia - Persian Gulf” in order to establish the feasibility of rail container transport as a possible alternative to shipping between Northern Europe (Scandinavian countries) and the Persian Gulf to serve such regions as the Caucasus region, the Central Asian countries and countries of South Asia such as India and Pakistan with possible shipping connections from these countries to countries in South-East Asia. On the basis of the TAR criteria described above, three routes were identified within this corridor, as shown in Map 2.

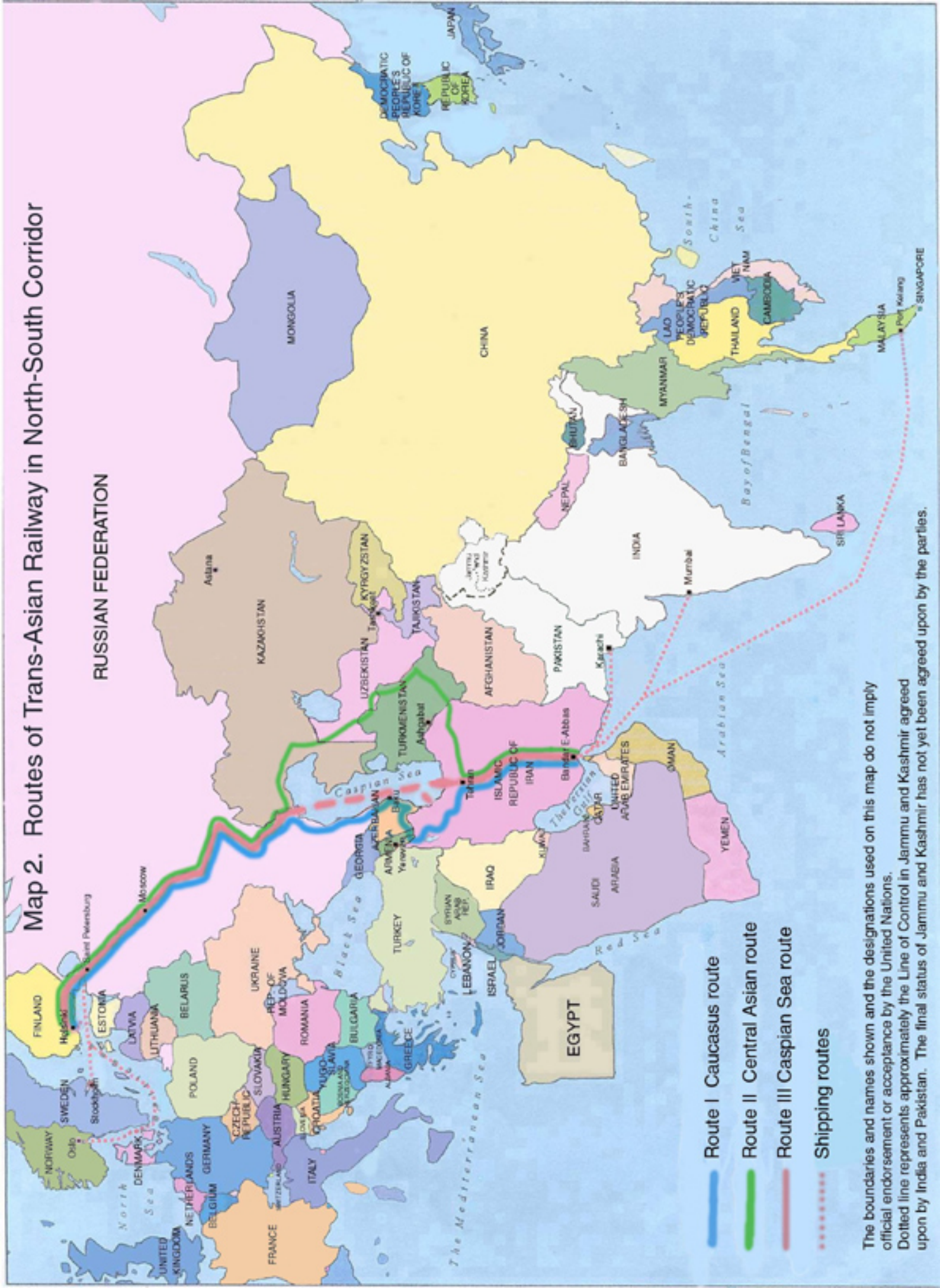
The principle objectives of the study are to identify :

- all feasible rail and land-cum-sea routes forming part of a network of routes connecting Northern Europe with the Persian Gulf through the Caucasus region, Central Asia and/or the Caspian sea;
- the characteristics of these routes in terms of their lengths and the transit times they can reasonably offer, having due regard to average operating speeds as well as typical dwell times at border stations and transshipment points; and
- the possible presence of operational restrictions which might impede the smooth flow of goods along the routes.

It is hoped that the study will provide a useful source of reference for future planning by the respective governments, as well as concerned international institutions/agencies in their efforts to put in place international transport corridors able to (i) provide business with fast and efficient transport services at competitive costs, (ii) reduce congestion and pollution by channeling increasing volumes of freight traffic onto rail and/or combined transport networks, and (iii) establish stronger connections between the main economically active regions on the European and Asian continents. It must be observed that the study did not deal with traffic forecasts. This is due to the fact that an early investigation led to the realization that many countries in the corridor only had fragmentary data that were not sufficient to usefully support any relevant analysis. Furthermore, in view of the fact that the identification of the routes in the corridor still is at a preliminary stage, data which would have been provided, could have become irrelevant very quickly and, in any case, would have had to be re-assessed later on to take into consideration the volatility of the international situation.

The report consists of six main chapters. Chapter 2 describes the routes in each country with an evaluation of distances in relation with existing or planned line sections, and reviews future infrastructure development in the corridor. It also looks at corridor

Map 2. Routes of Trans-Asian Railway in North-South Corridor



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

continuation in South and South-East Asia. Chapter 3 deals with technical requirements relevant to the development of container traffic in the corridor, namely: structure gauge, axle load and commercial speed. Chapter 4 deals with important basic operational requirements such as rolling stock compatibility, compatibility of train assembly and scheduling practices, and solution to the break-of-gauge issue. Chapter 5 outlines commercial requirements that need to be addressed if the railways concerned are to attract traffic to the corridor. Chapter 6 deals with traffic facilitation and Chapter 7 presents a number of recommendations on initial steps to be taken to develop the corridor.

\*      \*

     \*

## **- Chapter 2 -**

### **Possible Transport Routes Between Northern Europe and the Persian Gulf**

---

#### **2.1 Denomination of routes**

Three main transport routes were identified between Northern Europe and the Persian Gulf. Although origin and destination remain the same, the routing differs by the countries that each route will transit and by the combination of modes that would be used to carry cargo from one end to the other. These routes, which are illustrated in Map 2, have been defined as follows:

- Route I, the Caucasus route,
- Route II, the Central Asian route, and
- Route III, the Caspian Sea route.

The present chapter reviews all three core routes connecting Finland and the northern part of the Russian Federation with the Persian Gulf, and looks at connections with the transport networks currently in existence between these two ends and other transport networks in Northern Europe and South / South-east Asia.

In the present configuration of the infrastructure all three routes have two common sections. *In the north* a common section of 2,800 kilometres connects Helsinki (Finland) with Aksarayevskaya station (Russian Federation). At Aksarayevskaya, the routes junction off in different directions to go to the Islamic Republic of Iran through (i) Armenia and Azerbaijan, (ii) Central Asian Republics, or (iii) ports of the Caspian Sea.

Meanwhile, *in the south* a common section of around 1,450 kilometres located on the Iranian Islamic Republic Railways (RAI) connects Tehran with the port of Bandar Abbas.

#### **2.2 The Caucasus route**

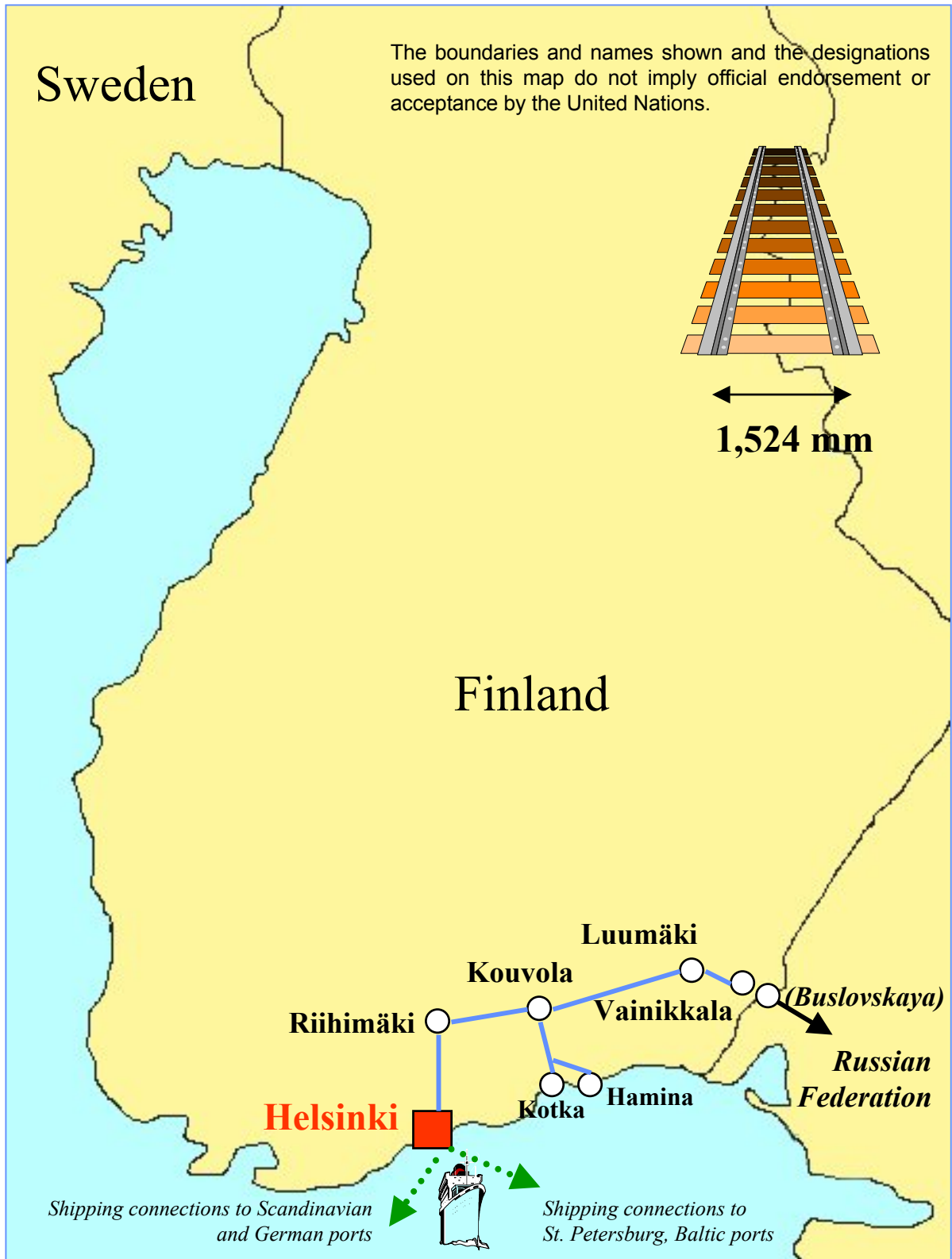
##### **2.2.1 Route alignment and technical characteristics**

The Caucasus route connects Finland with the Islamic Republic of Iran through the territories of Armenia, Azerbaijan and the Russian Federation. Details of the route in each country is given hereafter in a north to south order.

##### ***2.2.1.1 Caucasus route in Finland***

In Finland, the route originates in the port of Helsinki and goes to Vainikkala (283 km), the border station between the Finnish Rail Administration (RHK) and Russian Railways (RZhD) (Map 3).

### *Map 3. North-South Corridor in Finland*





The Helsinki - Vainikkala link is double-track to Luumäki (250 km) and single track thereafter to Vainikkala (33 km). The entire link is electrified. The maximum operating speed is 100 km/h for freight trains and 120-160 km/h for passenger trains. The track gauge is 1,524 mm.

***Finnish Rail Administration (RHK)***

Route length : 5,836 km  
Track gauge : 1,524 mm  
Electrification : 2,234 km (38.3%)  
25kV 50Hz

***Source : Jane's World Railways – 2000-2001***

### ***2.2.1.2 Caucasus route in the Russian Federation***

From Finland the route connects with the railways of the Russian Federation (RZhD) at Buslovskaya. From there it goes 3,221 km to Samur at the border between the Russian Federation and Azerbaijan. It travels through Saint Petersburg, Bologoye, Moscow, Kochetkovka, Rtishevo, Saratov, Volgograd and Aksarayskaya, as illustrated in Map 4.

***Russian Railways (RZhD)***

Route length : 87,000 km  
Track gauge : 1,520 mm  
(1,067 mm on Sakhalin Isl.)  
Double track : 37,000 km (42.5%)  
Electrification : 40,000 km (46%)

***Source : Consultant Report (2001)***

With the exception of the Volgograd - Verhny Baskunchak section (214 km) and some portions of the Saratov to Petrov Val and Verhny Baskunchak to Aksarayskaya sections, the Buslovskaya - Aksarayskaya section is double-track. It is electrified over 52% of the distance. The maximum operating speed is 90 km/h for freight trains and 120-160 km/h for passenger trains.

413 kilometres, i.e. 58%, of the 708-km long Aksarayskaya - Samur section is single track (between Trusovo and Karlan Yurt) and the section is only partly electrified. The maximum operating speed is 80 km/h for freight trains and 100 km/h for passenger trains.

Track gauge on Russian Railways is 1,520 mm.<sup>1</sup>

### ***2.2.1.3 Caucasus route in Azerbaijan***

Shortly after Samur the route joins Azerbaijan's rail system (AZR) at Yalama and continues to Baku and Osmanly Novaya where it junctions southward to Astara and westward to Djulfa as shown in Map 5. From Yalama the distance to Osmanly Novaya is 320 kilometres. From Osmanly Novaya, the southward junction to Astara is 183 kilometres, while the westward junction to Djulfa is 352 kilometres, including the 50 km section going through the territory of Armenia. After exiting the territory of Armenia, the line section to Djulfa covers a distance of around 70 km through Azerbaijan's Autonomous Republic of Nakhchivan.

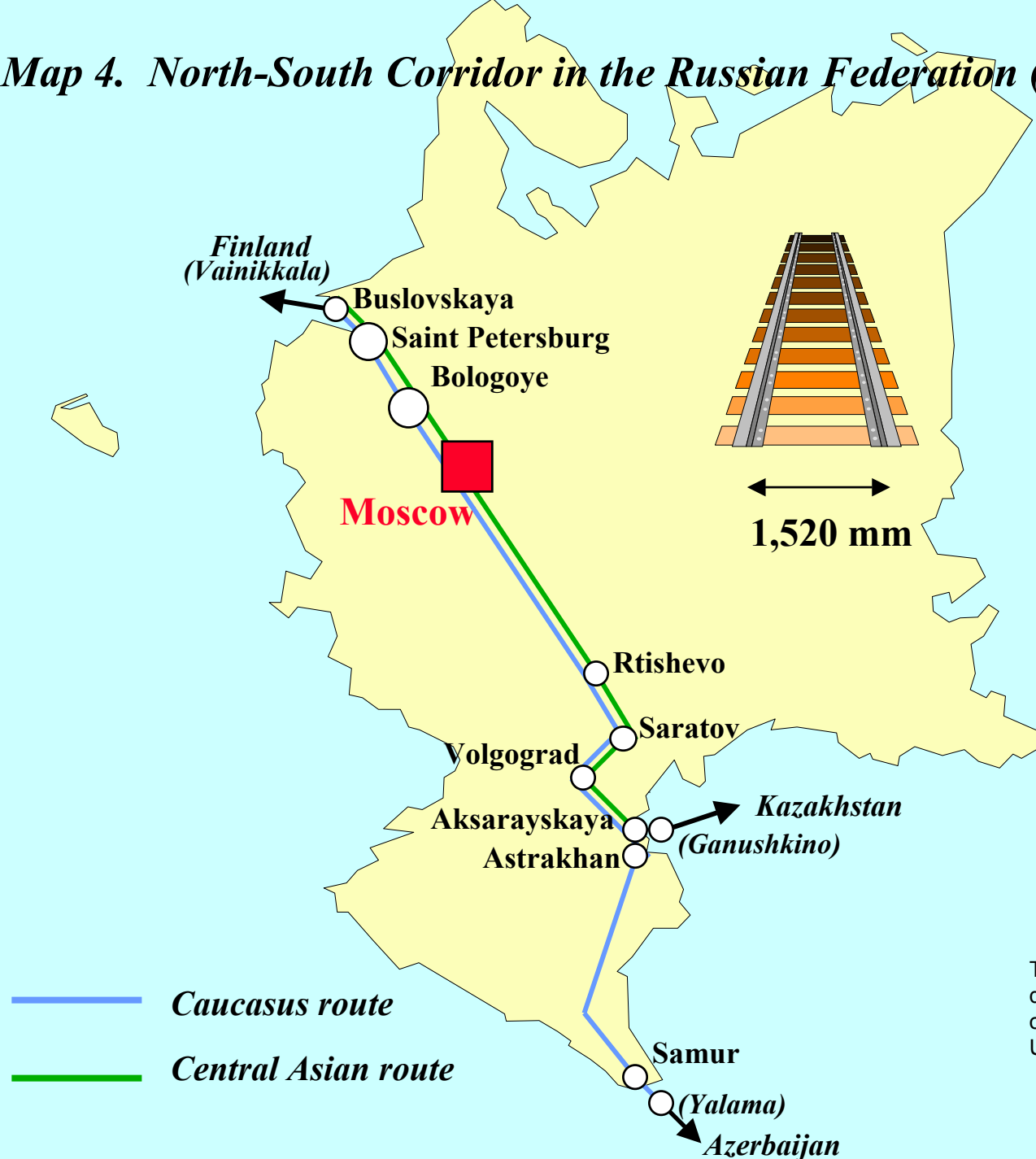
***Azerbaijani Railways (AZR)***

Route length : 2,122 km  
Track gauge : 1,520 mm  
Electrification : 1,278 km (60.3%)  
3 kV DC

***Source : Jane's World Railways – 2000-2001***

<sup>1</sup> With the exception of the railway links on the island of Sakhalin where the 890 km of trackage were originally developed in compliance with the Japanese track gauge standard of 1,067 mm.

**Map 4. North-South Corridor in the Russian Federation (West of the Urals)**



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



## Map 5. North-South Corridor in Azerbaijan



With the exception of the 3-km long section between Ali and Bayramli-Post 51, the Yalama - Osmanly Novaya section is almost entirely double-track. It is electrified and equipped with automatic interlocking and centralized dispatching systems.

Meanwhile, the 183-km long southward junction to Astara and the 352-km long junction to Djulfa are both single track and non-electrified. Both are equipped with automatic interlocking and centralized dispatching systems.

#### **2.2.1.4 Caucasus route in Armenia**

Due to the territorial distribution in the Caucasus region among countries that gained independence after the collapse of the Soviet Union, the Osmanly Novaya - Djulfa section transits Armenia's rail system over a distance of about 50 kilometres between Niuvedi and Kartsivan, as shown in Map 6.

##### **Armenian Railways**

Route length : 852 km  
Track gauge : 1,520 mm  
Electrification : 779 km (91.4%)  
3 kV DC

**Source : Jane's World Railways – 2000-2001**

This section is single track, not electrified and given that little traffic, if any, has been reported in recent years, its operating condition is questionable.

#### **2.2.1.5 Caucasus route in the Islamic Republic of Iran**

At Djulfa the route connects with the Iranian Islamic Republic Railways (RAI). This connecting point also marks the only break-of-gauge point along the route between the AZR 1,520 mm track gauge and the RAI 1,435 mm track gauge. From Djulfa, the Caucasus route covers a distance of 882 km to Tehran through Tabriz, Maragheh, Zanzan and Qazvin. From Tehran it goes south to the port of Bandar Abbas over another 1,443 km passing through Qom, Meybod and Bafq, as illustrated in Map 7.

##### **Iranian Islamic Republic Railways (RAI)**

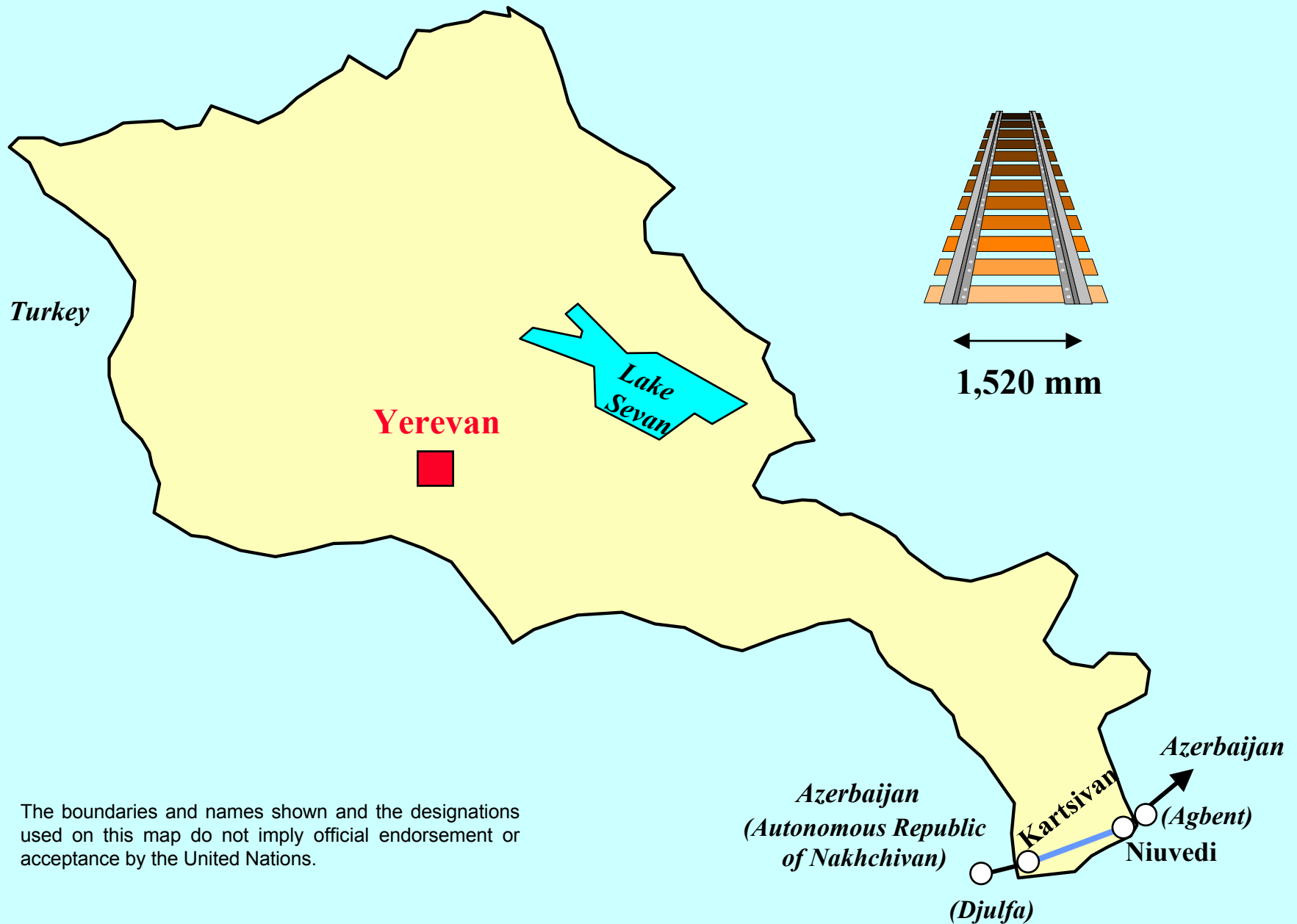
Route length : 5,995 km  
Track gauge : 1,435 mm  
(1,676 mm over 94 km)  
Electrification : 146 km (2.4%)  
25 kV 50 Hz

**Source : Jane's World Railways – 2000-2001**

The Djulfa - Tehran and Tehran - Bandar Abbas sections are both single track. The 146 km section between Djulfa and Tabriz is to date the only electrified line-section on the railways of the Iranian Islamic Republic Railways (RAI). The 2,179 km between Tabriz and Bandar Abbas are diesel-operated.

The maximum operating speed is 60 km/h for freight trains and 120 km/h for passenger trains.

*Map 6. North-South Corridor in Armenia*



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

## Map 7. North-South Corridor in the Islamic Republic of Iran



## 2.2.2 Route alignment and technical characteristics

The above description lead to the following configuration for the Caucasus Route.

Origin :	Helsinki (Finland)
Destination :	Bandar Abbas (Islamic Republic of Iran)

Total length :	<b>6,501 km</b> of which :	283 km in Finland (1,524 mm track gauge)
		3,221 km in Russian Federation (1,520 mm track gauge)
		622 km in Azerbaijan (1,520 mm track gauge)
		50 km in Armenia (1,520 mm track gauge)
		2,325 km in Islamic Rep. of Iran (1,435 mm track gauge)

Number of Border Crossings :	5	Finland – Russian Federation Russian Federation – Azerbaijan Azerbaijan – Armenia Armenia – Azerbaijan (AR of Nakhchivan) Azerbaijan (AR of Nakhchivan) – Islamic Republic of Iran
------------------------------	---	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Number of Break-of-gauge points:	1	Azerbaijan (AR of Nakhchivan) – Islamic Republic of Iran
----------------------------------	---	----------------------------------------------------------

Double-track :	3,046 km (47%)
Single-track :	3,455 km (53%)
Electrification :	2,360 km (36.3%)

## 2.3 The Central Asian route

### 2.3.1 Route alignment and technical characteristics

The Central Asian route connects Finland with the Islamic Republic of Iran through the territories of Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan. Detailed of the route in each country is given hereafter in a north to south order.

### ***2.3.1.1 Central Asian route in Finland***

In Finland, the route originates in the port of Helsinki and goes to Vainikkala (283 km), the border station between the Finnish Rail Administration (RHK) and Russian Railways (RZhD).

The Helsinki - Vainikkala link is double-track to Luumäki (250 km) and single track thereafter to Vainikkala (33 km). The entire link is electrified. The maximum operating speed is 100 km/h for freight trains and 120-160 km/h for passenger trains. The track gauge is 1,524 mm.

### ***2.3.1.2 Central Asian route in the Russian Federation***

From Finland the route connects with the railways of the Russian Federation (RZhD) at Buslovskaya. From there it covers a distance of 2,513 km to Aksarayskaya through Saint Petersburg, Bologoye, Moscow, Kochetkovka, Rtishevo, Saratov and Volgograd (see above, Map 4).

With the exception of the Volgograd - Verhny Baskunchak section (214 km) and some portions of the Saratov to Petrov Val and Verhny Baskunchak to Aksarayskaya sections, the Buslovskaya - Aksarayskaya section is double-track. It is electrified over 52% of the distance. The maximum operating speed is 90 km/h for freight trains and 120-160 km/h for passenger trains.

At Aksarayskaya the route junctions off eastward and covers around 85 km to connect with the railways of Kazakhstan at Ganushkino.

### ***2.3.1.3 Central Asian route in Kazakhstan***

In Kazakhstan, the Central Asian route covers a relatively short section of 815 kilometres from the border between Kazakhstan and the Russian Federation to the border between Kazakhstan and Uzbekistan. From Ganushkino (near the border between Kazakhstan and the Russian Federation), the route goes through Makat and Beyneu, respectively 368 km and 668 km from Ganushkino, and travels further south to the Kazakh-Uzbek border over around 90 km, as illustrated in Map 8.

#### ***Kazakhstan Railways***

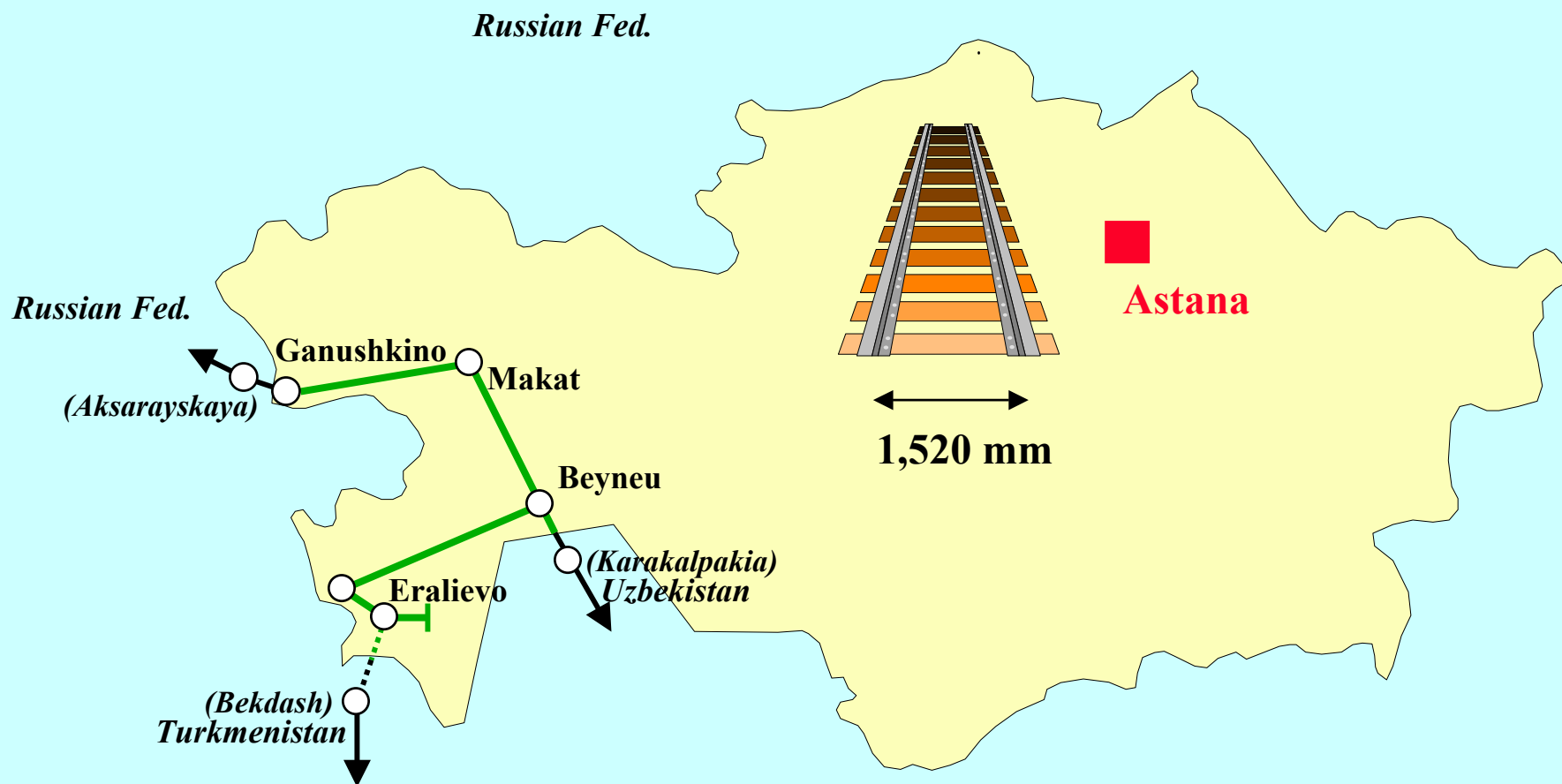
Route length : 13,700 km  
Track gauge : 1,520 mm  
Double track : 5,100 km (37%)  
Electrification : 3,700 km (27%)

***Source : Consultant Report (2001)***

The link is entirely single track and operated under diesel traction. Depending on the line section, the maximum operating speed on Kazakhstan Railways is 60 to 80 km/h for freight trains and 60 to 100 km/h for passenger trains.

At Beyneu a single track, diesel-operated line section goes westward to Eralievo over a distance of around 480 kilometres. From there, a possibility could exist in the future to connect with the railways of Turkmenistan. This, however, would necessitate the construction of a 230 km-long line section connecting Eralievo (Kazakhstan) with Bekdash (Turkmenistan).

## Map 8. North-South Corridor in Kazakhstan



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



#### **2.3.1.4 Central Asian route in Uzbekistan**

Exiting the territory of Kazakhstan, the Central Asian route connects with Uzbekistan Railway at Karakalpakia (100 km south of Beyneu station in Kazakhstan) from where the route continues south to Pitnyak over a distance of 593 kilometres. However, only 521 km of this distance is on Uzbekistan Railways, i.e. the 409 km-long section between Karakalpakia and Taxiatah, and the 112 km-long section between Station '449-km' and Pitnyak. The 72 km-long section between Taxiatah and Station '449-km' is located in Turkmenistan. The entire section – including the section passing through Turkmenistan – is single track and diesel-operated. This link is shown in Map 9.

##### **Uzbekistan Railway**

Route length : 3,600 km  
Track gauge : 1,520 mm  
Single track : 3,150 km (90%)  
Electrification : 230 km (6.6%)

**Source : Consultant Report (2001)**

After the break-up of the Soviet Union, it is understood that the joint inter-operability of the line section from Karakalpakia (Uzbekistan) to Chardjou (Turkmenistan) could pose some operational problems between the two countries due to the number of new border crossings along the line resulting from their new status as independent states. This line was then the only rail section linking Tashkent, the capital city of Uzbekistan, to the country's north-west region. In 1993, the Uzbek authorities began construction of a 342-km long section linking Uchkuduk and Nukuss in order to be able to reach Karakalpakia by rail without transiting the territory of Turkmenistan. The inauguration of the Uchkuduk-Nukuss section in February 2001 creates another possibility of routing cargo through Central Asian countries.

This new line section now makes it possible to route cargo from Karakalpakia to Khodchadavlet, the border point between Uzbekistan and Turkmenistan (see Map 9), through Nukuss, Uchkuduk, Navoi and Bukhara. The distance between Karakalpakia and Khodchadavlet is around 1,250 kilometres. The entire section is single track and diesel operated. Beyond Khodchadavlet, the route continues to join the railways of Turkmenistan shortly before Chardjou.

#### **2.3.1.5 Central Asian route in Turkmenistan**

Exiting the territory of Uzbekistan, the Central Asian route connects with Turkmenistan State Railway at Taxiatah from where the route continues south to Chardjou, Mary and Sarakhs at the border with the Islamic Republic of Iran over a distance of 1,002 kilometres. However, only 890 km of this distance is on Turkmenistan State Railway, i.e. the 72 km-long section between Taxiatah and Station '449-km' and the 818 km-long section between Gazodjak and Sarakhs. The 112 km-long section between Station '449-km' and Pitnyak is located in Uzbekistan. The entire section – including the section passing through Uzbekistan – is single track and diesel-operated. This link is shown in Map 10.

##### **Turkmenistan State Railway**

Route length : 2,500 km  
Track gauge : 1,520 mm  
Single track : 2,460 km (98%)  
Diesel operation only

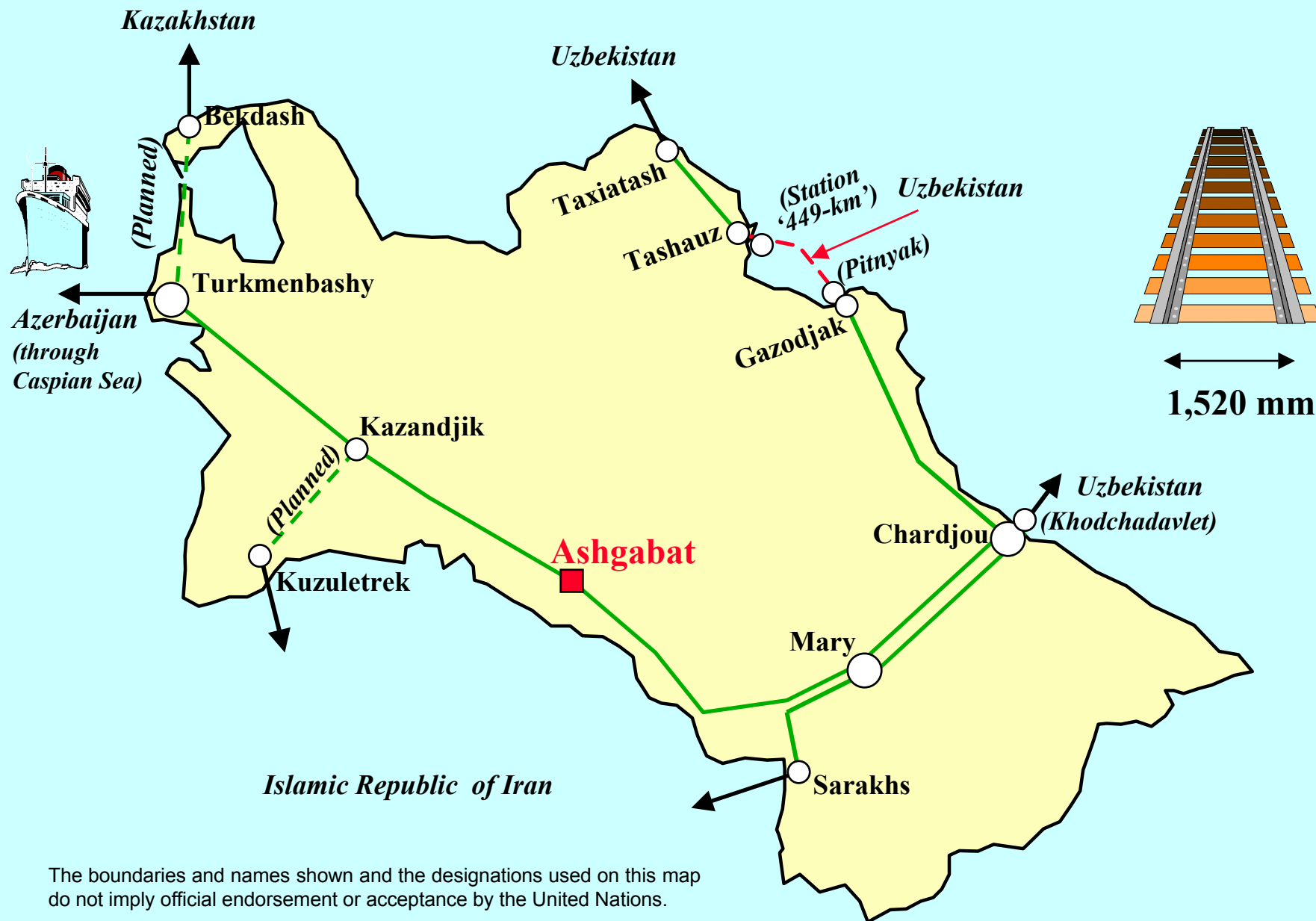
**Source : Consultant Report (2001)**

## Map 9. North-South Corridor in Uzbekistan



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

## Map 10. North-South Corridor in Turkmenistan



### **2.3.1.6 Central Asian route in the Islamic Republic of Iran**

After Sarakhs the Central Asian route leaves Turkmenistan and connects with the Iranian Islamic Republic Railways (RAI) through the 120-km long Sarakhs-Mashad section commissioned in May 1996. With this section in place, movements by rail between the landlocked countries of Central Asia and a port on the Persian Gulf, i.e. Bandar Abbas, became possible, albeit with a break-of-gauge between the rail systems of Central Asian countries (track gauge of 1,520 mm) and the rail system of the Islamic Republic of Iran (track gauge of 1,435 mm).

From Mashad the route continues over 926 kilometres to Tehran through Azadvar, Sharood and Garmsar (see above, Map 7). From Tehran, the route continues south to Bandar Abbas through Qom, Meybod and Bafq over a distance of 1,443 kilometres. The sections Sarakhs-Mashad-Tehran and Tehran-Bandar Abbas are both single track and diesel-operated. The maximum operating speed is 60 km/h for freight trains and 120 km/h for passenger trains.

Regarding traffic originating in Central Asia with Bandar Abbas for final destination, it must be noted that the Government of the Islamic Republic of Iran is currently constructing a 756-km long, double-track section between Mashad and Bafq. When work is completed (expectedly in 2005), traffic from Central Asia to Bandar Abbas could bypass Tehran and the overall distance to Bandar Abbas will be 1,000 kilometres shorter than the current route through Tehran.

### **2.3.2 Route alignment and technical characteristics**

The above description lead to the following route configuration for the Central Asian Route.

#### ***Through Taxiataash***

Origin :	Helsinki (Finland)
Destination :	Bandar Abbas (Islamic Republic of Iran)

Total length :	<b>7,549 km<sup>(1)</sup></b> of which :	283 km in Finland (1,524 mm track gauge)
		2,539 km in Russian Federation (1,520 mm track gauge)
		815 km in Kazakhstan (1,520 mm track gauge)
		533 km in Uzbekistan (1,520 mm track gauge)
		890 km in Turkmenistan (1,520 mm track gauge)
		2,489 km <sup>(2)</sup> in the Islamic Republic of Iran (1,435 mm track gauge)

(1) 6,549 km after commissioning of the Mashad – Bafq section.

(2) 1,489 km after commissioning of the Mashad – Bafq section.

Number of Border Crossings :	7	Finland – Russian Federation Russian Federation – Kazakhstan Kazakhstan – Uzbekistan Uzbekistan – Turkmenistan Turkmenistan – Uzbekistan Uzbekistan – Turkmenistan Turkmenistan – Islamic Republic of Iran
Number of Break-of-gauge points:	1	Turkmenistan – Islamic Republic of Iran
Double-track :	2,438 km (32%)	
Single-track :	5,111 km (68%)	
Electrification :	1,598 km (21.1%)	

***Through Nukuss***

Origin :	Helsinki (Finland)
Destination :	Bandar Abbas (Islamic Republic of Iran)

Total length :	<b>7,885 km<sup>(3)</sup></b> of which :	283 km in Finland (1,524 mm track gauge)
		2,539 km in Russian Federation (1,520 mm track gauge)
		815 km in Kazakhstan (1,520 mm track gauge)
		1,250 km in Uzbekistan (1,520 mm track gauge)
		509 km in Turkmenistan (1,520 mm track gauge)
		2,489 km <sup>(4)</sup> in the Islamic Republic of Iran (1,435 mm track gauge)

**(3) 6,885 km after commissioning of the Mashad – Bafq section.**

**(4) 1,489 km after commissioning of the Mashad – Bafq section.**

Number of Border Crossings :	5	Finland – Russian Federation Russian Federation – Kazakhstan Kazakhstan – Uzbekistan Uzbekistan – Turkmenistan Turkmenistan – Islamic Republic of Iran
Number of Break-of-gauge points:	1	Turkmenistan – Islamic Republic of Iran

Double-track :	2,438 km (31%)
Single-track :	5,447 km (69%)
Electrification :	1,598 km (20%)

## 2.4 The Caspian Sea route

### 2.4.1 Route alignment and technical characteristics

The Caspian Sea route connects Finland with the Islamic Republic of Iran through the Russian Federation and the Caspian Sea. Shipping services across the Caspian Sea which are of relevance to the route are between the Russian port of Astrakhan and the ports of Bandar-E-Anzali and Noshahr, the Islamic Republic of Iran's two main Caspian Sea ports. In 1998, Bandar-E-Anzali and Noshahr handled 1.6 and 0.83 million tonnes of cargo respectively. Container traffic is also predominantly routed through Bandar-E-Anzali which handled 1,121 TEU in 1998 against 485 TEU handled in Noshahr.

Given the cumbersome process of having to use ice-breakers to secure port operation at Astrakhan during winter, the Government of the Russian Federation has started the development of a year-round-operation port at Olya. A first development phase has already been completed and ferry services are already regularly operated between Olya, Turkmenbashi and Bandar-E-Anzali. From Astrakhan, shipping distances across the Caspian Sea are 1,200 kilometres to Bandar-E-Anzali and 1,400 kilometres to Noshahr.

#### *2.4.1.1 Caspian Sea route in Finland*

In Finland, the route originates in the port of Helsinki and goes to Vainikkala (283 km), the border station between the Finnish Rail Administration (RHK) and Russian Railways (RZhD).

The Helsinki - Vainikkala link is double-track to Luumäki (250 km) and single track thereafter to Vainikkala (33 km). The entire link is electrified. The maximum operating speed is 100 km/h for freight trains and 120-160 km/h for passenger trains.

#### *2.4.1.2 Caspian Sea route in the Russian Federation*

From Finland the route connects with the railways of the Russian Federation (RZhD) at Buslovskaya from where it covers a distance of 2,513 km to Aksarayskaya through Saint Petersburg, Bologoye, Moscow, Kochetkovka, Rtishevo, Saratov and Volgograd. From Aksarayskaya, the route continues over 49 kilometres to the port of Astrakhan, Russia's main port on the Caspian Sea (see above, Map 4).

With the exception of the Volgograd - Verhny Baskunchak section (214 km) and some portions of the Saratov to Petrov Val and Verhny Baskunchak to Aksarayskaya

sections, the Buslovskaya - Aksarayskaya - Astrakhan section is double-track. It is electrified over 52% of the distance. The maximum operating speed is 90 km/h for freight trains and 120-160 km/h for passenger trains.


#### ***2.4.1.3 Caspian Sea route in the Islamic Republic of Iran***

From the above-mentioned Iranian ports on the Caspian Sea, there is no rail connection to the main lines of the Iranian Islamic Republic Railways. Only Bandar-E-Anzali stands a chance of being rail-connected in the future as it is located on the Astara-Qazvin section that the Iranian Islamic Republic Railways has put down for construction on its general development plan.<sup>2</sup> In the present configuration of the infrastructure, road movements are necessary between the ports and the nearest railheads, i.e. Qazvin for the port of Bandar-E-Anzali (around 210 km) and Tehran for the port of Noshahr (around 250 km).

From Tehran, the route then continues to Bandar Abbas through Qom, Meybod and Bafq over a distance of 1,443 kilometres. All sections are single track and diesel-operated. All future sections look to be also single-track and diesel-operated. The maximum operating speed is 60 km/h for freight trains and 120 km/h for passenger trains.

Pending the provision of the necessary line sections connecting the Iranian ports on the Caspian Sea with the nearest railheads, the Caspian Sea route is more likely to be a rail-cum-sea-cum-road route in the foreseeable future, provided it can compete at all with the above-described Caucasus and Central Asian routes for traffic originating in Northern Europe to final destinations in the Islamic Republic of Iran and South or South-East Asia. In this respect, putting in place efficient interfaces between the various modes will be crucial.

The above description leads to the following route configuration for the Central Asian Route:

Origin :	Helsinki (Finland)	
Destination :	Bandar Abbas (Islamic Republic of Iran)	
Total length :	<b>5,842 km</b> <i>through Bandar-E-Anzali</i>	<b>5,938 km</b> <i>through Noshahr</i>
	283 km in Finland (1,524 mm track gauge)	283 km in Finland (1,524 mm track gauge)
	2,562 km in Russian Federation (1,520 mm track gauge)	2,562 km in Russian Federation (1,520 mm track gauge)
	<i>1,200 km through Caspian Sea</i>	<i>1,400 km through Caspian Sea</i>

<sup>2</sup> It must be noted that the port of Bandar-E-Torkman is another Iranian port on the Caspian Sea and one which is already rail-connected. The port is located on the Tehran – Gorgan main line, about 450 km from Tehran in a northeasterly direction. The overall rail distance between Tehran and Gorgan is 496 km. However, this port has not been mentioned in connection with the corridor study in the Country Report for the Islamic Republic of Iran.



	1,797 km in Islamic Rep. of Iran, incl.: - 210 km by road (Bandar-E-Anzali to Qazvin), and - 1,587 km by rail (Qazvin to Bandar Abbas - 1,435 mm track gauge)	1,693 km in Islamic Rep. of Iran, incl.: - 250 km by road (Noshahr to Tehran), and - 1,443 km by rail (Tehran to Bandar Abbas- 1,435 mm track gauge)
For rail portion of the route:	- Double track : 2,812 km - Single track : 1,587 km - Electrification : 1,563 km	- Double track : 2,812 km - Single track : 1,443 km - Electrification : 1,563 km
Number of Border Crossings :	2	Finland – Russian Federation Russian Federation – Islamic Republic of Iran
Change of transport mode:	- Rail to Ship : Russian ports - Ship to Road : Iranian ports - Road to Rail : Qazvin or Tehran (although it is likely that once loaded on trucks in the Iranian ports, cargo will travel all the way to Bandar Abbas by road).	

## 2.5 Possible future route developments along the corridor

### 2.5.1 The Caucasus route

As previously mentioned (2.2.1.3), the Caucasus route offers a through-rail linkage between Finland and Azerbaijan through the Russian Federation connecting Helsinki (Finland) with Astara (Azerbaijan) at the border between Azerbaijan and the Islamic Republic of Iran. However, after Astara there is currently no cross-border continuation on the Iranian Islamic Republic Railways. Providing such continuation would necessitate the construction of a 366-km long rail section between Astara and Qazvin on the current main line connecting Tehran to Djulfa. The link has second priority (first priority being the completion of the ongoing construction work on the Mashad-Bafq section – see above, point 2.3.1.6) in the railway development plan of the Islamic Republic of Iran and budget has already been appropriated although no definite time frame was indicated in the course of the study. The current planning is for a single track, diesel-operated section.

When the link is in place, the Caucasus route through Astara would be 5,960 kilometres (as compared with 6,501 kilometres through Djulfa) out of which 3,032 kilometres would be double track (51%) and 2,149 kilometres (36%) would be electrified. There would still be a break-of-gauge point between the Azerbaijani network (with a track gauge of 1,520 mm) and the Iranian Islamic Republic Railways (with a track gauge of 1,435 mm). However, there would only be three border crossings (against five on the route through Djulfa) as there would be no transit through the territory of Armenia.

The short distance advantage between the route via Djulfa and the route via Astara, i.e. 541 km, may seem not significant enough to justify the investment on purely financial

reasons. However, a detailed assessment of infrastructure conditions in the southern part of Armenia and Azerbaijan and a review of the level of performance of cross-border operations through Djulfa may also reveal a need for substantial investment to improve operation there too. A cost/benefit analysis may then tip the balance in favour of constructing the Astara-Qazvin section rather than on restoring operation through Djulfa.

Regarding operation through Djulfa, the sharp decrease in traffic which affected the railways of all the former Soviet republics and political tensions between Armenia and Azerbaijan in the early 1990's have dramatically decreased traffic to Djulfa through the territory of Armenia. The situation is such that when the authorities of the Islamic Republic of Iran were developing the Sarakhs-Mashad link to open up their rail system to Central Asian Republics (May 1996), the bogie-changing equipment was transferred from Djulfa to Sarakhs with no definite plan to restore it.<sup>3</sup> In 2000, the daily number of loaded wagons crossing from the Islamic Republic of Iran into Azerbaijan's Autonomous Republic of Nakhichevan totalled eight, down from 300 before the start of hostilities between Armenia and Azerbaijan. Although no clear indication was given in the course of the study, this suggests that little transshipment takes place, and then only by manual means or light machinery.

## **2.5.2 The Central Asian route**

As previously indicated, the main link in Kazakhstan is the 668-km long Ganushkino-Makat-Beyneu line section. From Beyneu, the route goes either to the border between Kazakhstan and Uzbekistan, or goes to Eralievo (point 2.3.1.3). At Eralievo, a possibility exists to have in future a shorter route going to the Islamic Republic of Iran directly through Turkmenistan. However, such a route would necessitate the construction of :

- (i) a *circa* 230-km long line section between Eralievo (Kazakhstan) and Bekdash (Turkmenistan),
- (ii) a *circa* 240-km long section between Bekdash and Turkmenbashi (in Turkmenistan),
- (iii) a *circa* 225 km-long section between Kazandjik and Kuzuletrek (in Turkmenistan), and
- (iv) a *circa* 90 km-long section between Kuzuletrek (in Turkmenistan) and Gorgan (Islamic Republic of Iran).

If all of the above links were provided, the Central Asian route would be around 7,000 km (as compared with 7,593 km using the existing route through Turkmenistan and Uzbekistan) out of which 2,438 kilometres would be double track (35%) and 1,598 kilometres (23%) would be electrified.

There would still be a break-of-gauge point between Turkmenistan State Railways (with a track gauge of 1,520 mm) and the Iranian Islamic Republic Railways (with a track gauge of 1,435 mm). However, there would only be four border crossings (against 7 on the route through Chardjou) as there would be no transit through the territory of Uzbekistan. Here again, it can be reasonably assumed that operating conditions (i.e. train speeds, loading

---

<sup>3</sup> Country Report for the Islamic Republic of Iran.

gauges, etc.) will remain identical to those on the rest of the networks of both the Islamic Republic of Iran and Turkmenistan, with the exception of the axle-load of 25 tonnes that RAI wants to introduce on all future links. At this point in time, however, it is understood that the authorities in the Islamic Republic of Iran give higher priority to the Astara - Qazvin link.<sup>4</sup>

Only constructing the 230-km long line section between Eralievo (Kazakhstan) and Bekdash (Turkmenistan), and the 240-km long section between Bekdash and Turkmenbashy would still allow connection with the Iranian Islamic Republic Railways through Sarakhs. From Turkmenbashy the route would then continue 894 kilometres to Sarakhs via Ashgabat and Tedjen on a single track, diesel-operated section. However, this would be the longest possible route with a total distance of around 7,900 kilometres and, in view of this fact, will not be further considered in the study, especially for the calculation of transit times in the corridor (Chapter 5).

## **2.6 Continuation of the corridor in South / South-East Asia**

Ultimately, the corridor could also serve the transportation of cargo destined for countries in South Asia, particularly India and Pakistan, and South-East Asia. Connections to countries in South Asia could be by rail or shipping, while in practical terms, destinations in South-East Asian countries would only be reached by shipping services with possible use of rail for the ultimate leg of the journey from the main ports, such as Singapore or Port Kelang (Malaysia) to destinations in Malaysia and Thailand.

In the long-term future, other countries in South-East Asia (Cambodia, Lao People's Democratic Republic, Myanmar, Viet Nam) and Yunan province of China could also be served once their rail systems have been interconnected. The recent feasibility study carried out by the Association of South-East Asian Nations (ASEAN) on the Singapore-Kunming Rail Link project has recommended connecting the railways of the concerned countries. However, finding the necessary financial resources to put all the required links in place will take time.

### **2.6.1 Corridor connections with countries in South Asia**

#### ***2.6.1.1 Closing the 'Kerman - Zahedan' gap***

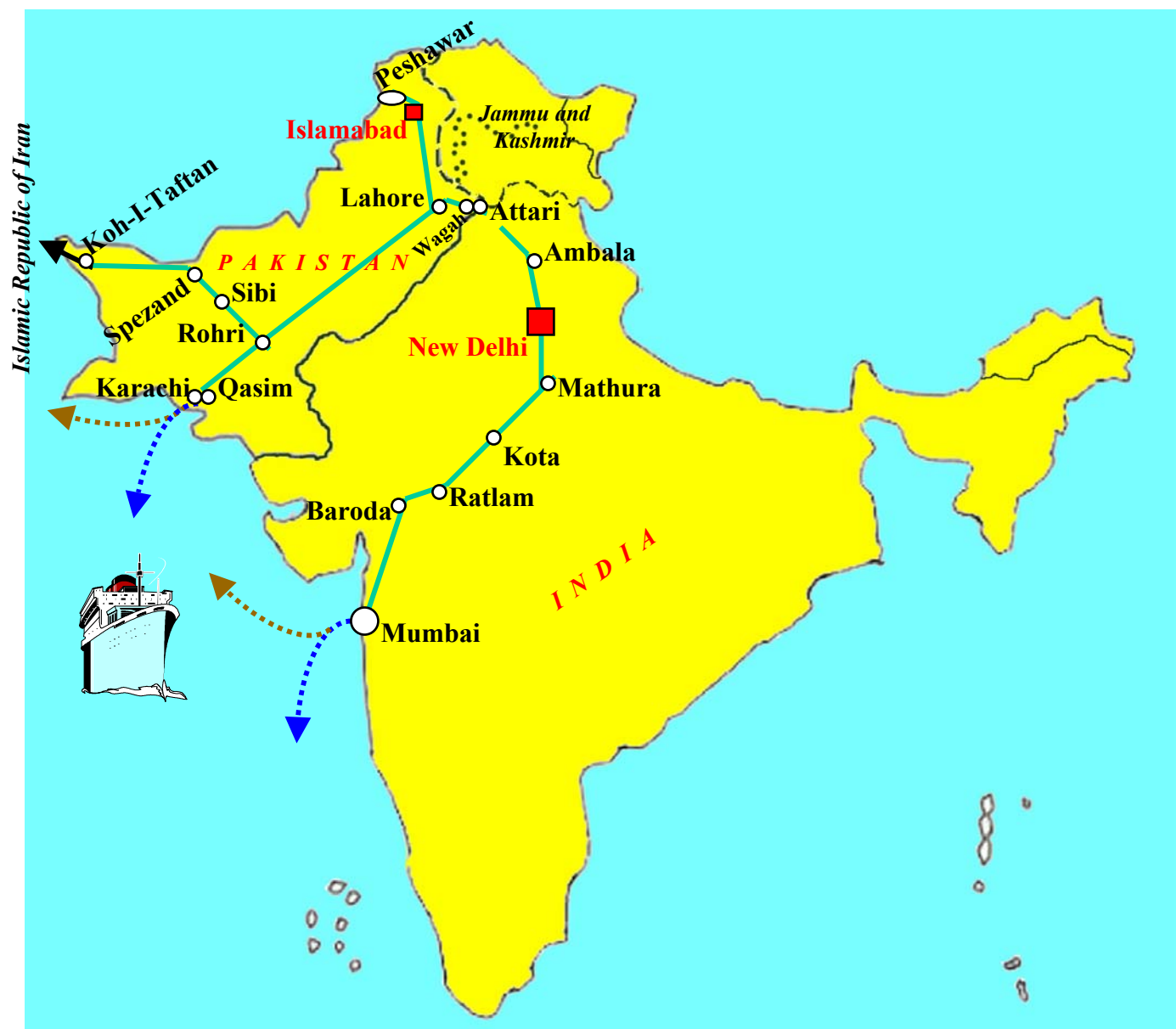
India and Pakistan are two countries in South Asia with a realistic chance of being served directly by rail through the corridor, although this should only be envisaged as a long term prospect (see Map 11). However, in the present configuration of rail infrastructure in the region, this would mean completing construction of the single track, non-electrified 539 km section of 1,435 mm gauge linking Kerman and Zahedan in the Islamic Republic of Iran for which work is currently underway. When this new line is commissioned, and pending the re-construction of a new Zahedan-Mirjaveh section to 1,435 mm gauge, in conformity with the rest of the Iranian rail system, transshipment facilities will be provided at Zahedan. Once standard gauge extends to Mirjaveh, the break-of-gauge point will be at the border between the two countries.

---

<sup>4</sup> Indeed, the Country Report for the Islamic Republic of Iran does not mention construction of the link although it does mention Gorgan as a planned border station with Turkmenistan.

## Map 11. Corridor continuation in South Asia

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.



..... Shipping connections to Bandar Abbas / Europe

..... Shipping connections to South-East Asia

Currently, the gap existing between the railheads at Zahedan and Kerman is bridged by road transport, although it is understood that comparatively little traffic is generated west of Zahedan.

From Kerman, a line runs in a northwesterly direction to Bafq, which is the junction station for the trunk line running south to the port of Bandar Abbas. As Bafq will also become the junction station for the new line under construction that will provide a direct link with Central Asia, completion of the Kerman-Zahedan line could also permit direct movements by rail between places in Central Asia with final destination in Pakistan or India.

#### ***The Zahedan – Mirjaveh line***

Interestingly, Pakistan's rail system extends into the territory of the Islamic Republic of Iran through a broad gauge (1,676 mm) line which runs over 92-km from Mirjaveh, at the border between the Islamic Republic of Iran and Pakistan, to Zahedan. This broad gauge line is owned and maintained by the Iranian Islamic Republic Railways, which also staffs the stations and administers freight handling operations under contract. Meanwhile, Pakistan Railways is responsible for the supply of motive power and rolling stock, as well as for train operations on the line. Between the border and Zahedan, the only station of any significant size is located at Mirjaveh, 8 km from Koh-i-Taftan. The line is maintained in operable condition, although the track is unballasted throughout and passes through flat, sandy terrain. It is the intention of the Iranian Islamic Republic Railways to reconstruct this line on a formation running parallel to the existing alignment, but to 1,435 mm gauge, in conformity with the rest of the system. This would result in creation of a break-of-gauge at the border with Pakistan.<sup>5</sup>

***Source : ESCAP study "Development of the Trans-Asian Railway : Trans-Asian Railway in the Southern Corridor of Asia-Europe Routes", New York, 1999, p.17, and information provided by the Iranian Islamic Republic Railways during ESCAP mission to Tehran in May 1998.***

#### ***2.6.1.2 Corridor continuation in Pakistan***

On Pakistan Railways, two main lines would continue the corridor (Map 11). One would be the 1,730 km line which follows a west to east alignment connecting Koh-I-Taftan at the border with the Islamic Republic of Iran to Wagah at the border with India through Rohri and Lahore. At Lahore, the line continues either northward, or eastward. The northward connection goes to Islamabad, Pakistan's capital city, and its twin city, Rawalpindi (around 290 km from Lahore) and Peshawar, the capital city of the Northwest Frontier Province (462 km from Lahore). The eastward connection goes to Wagah at the border with India. The other line branches off at Rohri to travel south to Pakistan's main ports at Karachi and Qasim over a distance of 480 km.

#### ***Pakistan Railways***

Route length: 7,718 km / 445 km  
Track gauge: 1,676 mm / 1,000 mm  
Electrification: 293 km of 1,676 mm at 25kV 50Hz AC

***Source: Jane's World Railways – 2000-2001***

<sup>5</sup> ESCAP study "Development of the Trans-Asian Railway : Trans-Asian Railway in the Southern Corridor of Asia-Europe Routes", New York, 1999, p.17, and information provided by the Iranian Islamic Republic Railways during ESCAP mission to Tehran in May 1998.

The overall line between Koh-I-Taftan and Wagah comprises 1,021 km of non-electrified single track line, 245 km of electrified single track line, 423 km of non-electrified double track line, and 41 km of electrified double track line. Its 462 km extension to Islamabad and Peshawar is a non-electrified single-track with the exception of short double track sections between Lahore and Shahdara (7 km) and between Chaklala and Golra Sharif (19 km). Meanwhile, the 480 km line from Rohri to Karachi and Qasim is non-electrified and double-tracked over its entire length.

### **2.6.1.3 Corridor continuation in India**

Given the land mass of India and its extensive rail system, it would be impossible within the scope of this study to review all possible major destinations in India. In view of the TAR corridor criteria stipulating that designated routes should be, among others, capital-to-capital links and connections to major sea ports, New Delhi has been selected as the core destination to illustrate the potential of the corridor to serve India, either directly by rail through Pakistan, or using shipping services between Bandar Abbas and Mumbai with rail connection from there to New Delhi.

From New Delhi, the Indian Railway network, with its impressive 63,000 route-km (44,000 of which on broad gauge), radiates in all directions to serve all of India's major cities and provincial towns. Indeed, the Container Corporation of India Limited (CONCOR) has substantially developed rail container transport across India since the company started operating in November 1989 (see box below).

As shown in Map 11, there are two alternatives to the corridor continuation in India. The first – and existing – alternative is to use shipping services between Bandar Abbas and the two main ports serving Mumbai, i.e. Mumbai Port or Jawaharlal Nehru, which handle over 60% of India's container traffic, and from there continue by rail to inland destinations in India. The Mumbai - New Delhi line covers a distance of 1,510 km of 1,676 mm gauge and is multiple tracked and electrified throughout. It passes through important commercial centres such as Mathura, Kota, Ratlam, Baroda and Mumbai.

The other alternative, which is dependent on the completion of the Kerman-Zahedan line (point 2.6.1.1. above), is to direct cargo to Mirjaveh and then on through Pakistan Railways to connect with India's rail system at Attari at the border between India and Pakistan.

From Attari, the line goes in a southerly direction to New Delhi through Amritsar, Jalandhar, Ludhiana and Ambala. It covers a distance of 470 km and is entirely broad gauged (1,676 mm). It must be noted that this line provides the sole effective land transport connection with Pakistan, although reportedly there is currently only a limited exchange of freight and passenger traffic between the Indian border station of Attari and the Pakistani border station of Wagah.

#### **Indian Railway**

Route length:	62,809 km
Track gauge:	44,216 km of 1,676 mm 15,178 km of 1,000 mm 3,415 km of 762 mm and 610 mm
Electrification:	14,415 km of 1,676 mm At 25kV 50Hz AC 429 km of 1,676 mm at 1.5kV DC 165 km of 1,000 mm at 25kV 50Hz AC

**Source: Jane's World Railways – 2000-2001**

### ***Container Corporation of India Limited***

In India, the Container Corporation of India Limited (CONCOR) was set up with the prime objective of developing modern multimodal transport logistics and infrastructure. With only 600 employees CONCOR has increased its volumes of container traffic tenfold in slightly over ten years of existence, i.e. from 74,890 TEUs in 1990 to 802,000 TEUs in 1999, and developed a network of 31 export-import (exim) container terminals and 9 domestic container terminals across India against seven Inland Container Depot operated by Indian Railways in 1989. Capitalising on its past successes and with growth forecast of 80 per cent and 65 per cent in its TEU volumes in international and domestic traffic respectively over the period 1999-2000 to 2002-03, CONCOR has been able to secure a US\$ 94 million loan from the World Bank to acquire 3,800 high-speed flat wagons for 100 km/h operation. Meanwhile, CONCOR is planning to increase its number of (exim) terminals to 50 by 2002-03.

**Source:** CONCOR Website, <[www.concorindia.com](http://www.concorindia.com)>

## **2.6.2 Corridor connections with countries in South-East Asia**

In the current configuration of rail infrastructure in South-East Asia, there are only two physical connections between the railways of the countries of the region, namely between Singapore and Malaysia and between Malaysia and Thailand. If one is to extend the geographical definition of South-East Asia to the southern provinces of China, there is also a rail connection between Viet Nam and China.

All other countries in South-East Asia operating a railway network are not connected either due to their geographic characteristic as island countries (e.g. Indonesia and the Philippines), or to the absence of a rail connection between their rail system and those of their neighbouring countries. Thus, Thailand has currently no rail connection with either Cambodia or Myanmar, and there is no connection between Cambodia and Viet Nam. Lao PDR, meanwhile, has no rail system although the authorities are planning the development of rail linkages under the framework of the Singapore Kunming Rail Link project aimed at creating an ASEAN subregional rail network providing additional connection with the railways of China at Kunming. The existing, as well as missing, connections between these railways are shown in Map 12.

In view of the above, only one main link is currently of direct interest to the North-South corridor, i.e. the Singapore-Malaysia-Thailand connection which could carry traffic from the two main ports in the area, i.e. Singapore and Port Kelang (Malaysia).

### ***2.6.2.1 Rail link in Singapore and Malaysia***

The link most likely to carry cargo from the ports of Singapore or Port Kelang up to destinations in Malaysia or Thailand is the line connecting Singapore in the south with the Malaysia/Thailand border station of Padang Besar in the north, over a distance of 919 km. This link comprises the West Coast mainline of Malaysia's rail operating company (KTMB) and the Kedah

#### ***Keretapi Tanah Melayu Berhad (KTMB)***

Route length: 2,227 km  
Track gauge: 1,000 mm  
Electrification: 150 km at 25kV 50Hz AC

**Source:** ASEAN Railways brochure – 2001



# Map 12. Corridor continuation in South-East Asia

The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.



branchline running from Butterworth to Pedang Besar. In addition to providing a through rail connection between Bangkok and Singapore, the West Coast mainline serves major container traffic generating centres such as Johor Bahru, the federal capital Kuala Lumpur and the adjacent key industrial complexes of the Klang Valley, Ipoh and Taiping. The link is conveniently connected by short branchlines to the major container handling seaports of Peninsula Malaysia - Port Pasir Gudang (Johor), Port Kelang and Penang Port – and is the backbone for the container landbridge operation launched jointly in 1999 by KTMB and the State Railway of Thailand between Port Kelang and Bang Sue ICD near Bangkok. Finally, with funding from the Government of Malaysia, work is under way to construct a 31.5 km single track line linking the new port at Tanjung Pelepas with Pelabauhan, near Johor Bharu, with completion scheduled in 2002.

With the exception of the 102 km section between Rawang and Seremban, which is double tracked, and a 3 km section of triple track between Kuala Lumpur Station and the junction with the Port Kelang line, the entire west coast system is single tracked. However, extensive work is now underway to double track, electrify and re-signal the 175 km section between Rawang and Ipoh.

Within Singapore, the West Coast Mainline comprises a single track of 23.5 km, from Keranji/Woodlands on Johor Strait to the main Singapore Station on Keppel Road. A 4 km branchline off the West Coast Mainline to Jurong is no longer operated.

It must be noted that an alternative route provides a connection between Singapore and the rail system of Thailand. This is the Malaysian East Coast mainline, which branches off the West Coast mainline at Gemas (222 km by rail north of Singapore) and runs in a northeasterly direction to connect with the railways of Thailand at Hat Yai junction. While the West Coast mainline is preferred in view of its alignment through major traffic generating centres, this link, which is marginally shorter than the West Coast mainline (958 vs. 965 km), has provided, and will in future continue to provide, back-up capacity for the West Coast mainline.

#### ***2.6.2.2 Rail link in Thailand***

In Thailand the line to be considered is the extension of the above-described West Coast mainline in Malaysia over the 982 km distance from the Thailand/Malaysia border station of Padang Besar to the main SRT Freight Handling Terminal of Bang Sue in Bangkok.

##### ***State Railway of Thailand (SRT)***

Route length: 4,043 km  
Track gauge: 1,000 mm  
Diesel operation only

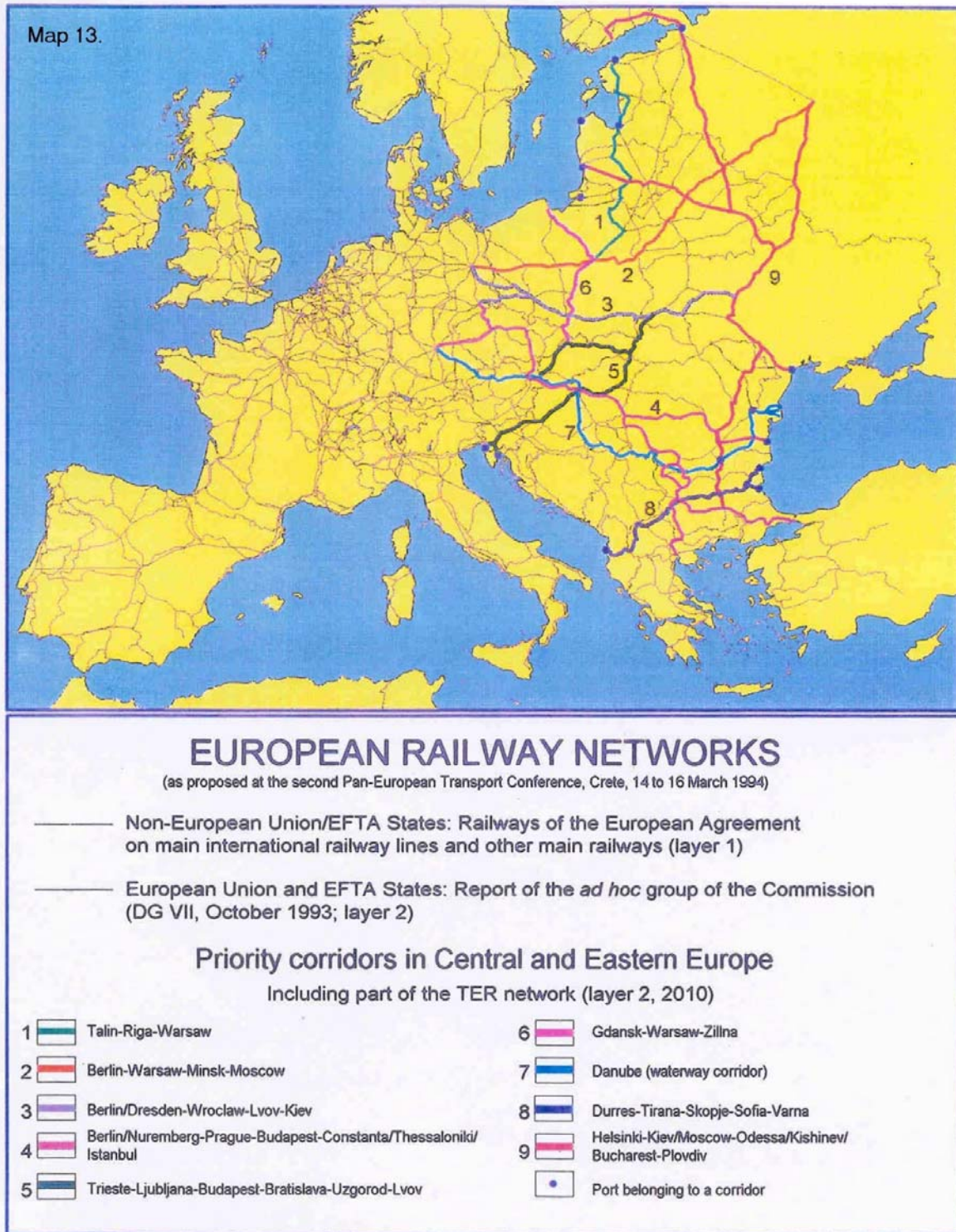
***Source: ASEAN Railways brochure – 2001***

From Bangkok, the Thai rail system extends in all directions to serve the country's main cities as well as the new deep-sea container port at Laem Chabang, located on the Gulf of Thailand. The entire rail system of Thailand is single track and non-electrified.

## **2.7 Continuation of the corridor in Europe**

Although the main scope of the study is to look at the corridor with Northern Europe (i.e. Finland) as origin, it is likely that efficient operation could also attract cargo from/to Central and Eastern Europe which could travel by either rail or road to/from the main

Map 13.



Source: Second Pan-European Transport Conference, Crete, 14-16 March 1994



Map 14.



Source: Second Pan-European Transport Conference, Crete, 14-16 March 1994

container terminals along the corridor, and more specifically to/from terminals in the Moscow area, which could become a major international hub.

Although a number of international organizations have defined related projects, the present study reproduces here the planned European rail and road network earmarked for development by year 2010 with an aim to facilitate the intra-Europe movements of people and goods, including combined transport (Maps 13 and 14 above).

Although the scope of the study does not allow the exploration of technical details, the availability of such networks already illustrates the possibility for the North-South corridor to attract cargo originating in or destined to a wide range of consumer centers and industrial areas in Europe, the Middle East, South and South-East Asia.

## **2.8 Conclusion**

The above shows that, at this point in time, the infrastructure already in place in the countries concerned already constitutes the backbone for a rail corridor connecting Northern Europe (with Helsinki as the reference point of origin) with ports in the Persian Gulf (with Bandar Abbas as the reference destination port).

These corridors would all have a distinctive distance advantage over the existing shipping route. The Helsinki to Bandar Abbas distance by sea is of around 7,217 nautical miles, i.e. 13,366 km. In other words, the existing – or future – land routes described above would nearly halve that distance.

However, leaving aside all other considerations relating to such crucial issues as service level, tariffs and transit times to attract traffic to the corridor (more on this in Chapter 5), in order to capitalise on the corridor's obvious distance advantage, the countries concerned would have to define a set of common technical standards and commit the necessary financial resources to implement them so that there is as much end-to-end uniformity as possible on all the routes in the corridor. While it must be accepted that break-of-gauge points will remain, sufficient resources should be allocated to ensure the least possible level of impediment to smooth operation.

At this point in time, the only existing continuous 'all-rail' operation between Helsinki and Bandar Abbas is via the Central Asian route through the Russian Federation, Kazakhstan, Uzbekistan and Turkmenistan, be it the 7,549-km long route via Taxiataash, or the 7,885-km long route via Nukuss.

The Caspian Sea route is, the shortest of all routes in the corridor. However, current port infrastructure as well as planned developments will have to be studied in detail if one is to make a realistic assessment of the capability of this route to be an effective alternative to the other routes between Northern Europe and the Persian Gulf.

\*      \*

\*

## - Chapter 3 -

### Technical Requirements

---

A primary requirement for the routes in the corridor is that they should in future permit the conveyance of containers of all types and sizes being used in international trade. Such conveyance should be free of technical obstacles from one rail system to another and from one mode to another.

The practical implications of this requirement are that:

1. The limiting dimensions of structures throughout this network should be sufficient to allow unrestricted passage of wagons conveying the highest and widest containers used in international trade - i.e. the ***structure gauge*** adopted for the network should provide adequate clearance for such containers carried at normal running speeds;
2. The maximum allowable ***axle loads*** throughout this network should be sufficient to allow conveyance of such containers in trainloads of economic size and configuration. In practice, this would mean that axle loads would need to be sufficient for the conveyance on a single wagon of the equivalent of two (and in some cases three) twenty foot containers loaded up to or near their maximum payload or for the operation of locomotives of adequate power rating<sup>1</sup>;
3. The maximum allowable line speeds throughout the network must be consistent with the realization of ***commercial speeds*** which are competitive with those of alternative transport modes (bearing in mind that maximum line speed is only one of the factors influencing commercial speed, other important ones being operational and border crossing stopping times, signalling system performance, infrastructure condition, and motive power and rolling stock condition and performances).

This chapter provides an assessment of these technical requirements and the extent to which they are met on the networks in the corridor.

#### 3.1 Structure gauge and loading gauge

The *structure gauge* sets dimensions within which no outside structure may protrude and prescribes minimum height and width distances between structures and track centre.

The *loading gauge* sets dimensions beyond which no part of the cargo may protrude. These are maximum dimensions in relation to the track centre. The loading gauge thus

---

<sup>1</sup> In the majority of cases, it is likely to be the axle loading of locomotives, rather than that of the container wagons, which will provide the overall axle load constraint for the system.

prescribes the maximum width and height of a wagon or of a cargo, i.e. a container, secured on a wagon.

However, in practice, the above-mentioned definitions are applied with due consideration given to basic principles of physics regarding vehicles in movement, most notably in curves where the central part of a vehicle tends to be pushed inwards and the end and corner parts of the vehicle tend to be pushed outwards. This is particularly important when commercial requirements lead to the development of faster rolling stock.

Usually, the width imposed by the loading gauge is not a constraint for the transportation of containers. Problems arise with the height measured from the top of the rail to the top of the load. While the centre part of the load does not normally constitute a problem, the top outside edges do, as the standard loading gauge does not have a rectangular top section but a slanting shape. This is crucial in the case of containers as (a) containers have a cubic shape which tend to occupy a large volume of the loading gauge and (b) containers are getting bigger.

To allow for vertical and lateral movement of wagons due to track irregularities or vehicle dynamics on curved track sections, a clearance of about 40 cm between the outside dimensions of wagons and their loading and the inside dimensions of structures typically has to be allowed.

The use of low profile wagons (i.e. wagons with wheels of small diameter or with dropped centre sections) can sometimes be used to overcome structure constraints without the need to expand the inside dimensions of structures, thereby avoiding expensive investments.

The dimensions and physical weight of ISO and non-ISO containers most commonly used in international movements are shown in Table 3.1. To determine the readiness of the Trans-Asian Railway to provide efficient container movements throughout its various components, it is therefore imperative to assess the extent to which each individual railway system along the North-South corridor can accommodate the most widely used ISO and non-ISO containers.

#### **(i) Assessment of the structure and loading gauge situation in Armenia, Azerbaijan, Kazakhstan, Russian Federation, Turkmenistan, Uzbekistan**

Until the break-up of the former Soviet Union, the railways of these countries formed part of the then Soviet Railways. In other words, their design standards are those which were developed and enforced in the days of the Soviet Union and are therefore common to all.

These technical standards were often more generous than those adopted by most other European and Asian railways and there is currently no restriction on the railways of these countries (now forming the Commonwealth of Independent States, or CIS) to the movement of ISO and non-ISO containers.

#### **(ii) Assessment of the structure and loading gauge situation in Finland**

The loading gauge standard adopted by Finnish Railways are such that the Finnish Railway component of the corridor, i.e. the line section between Helsinki and Vainikalla, at

the border between Finland and the Russian Federation, can accommodate both ISO and non-ISO containers.

**Table 3.1 Dimensions of most commonly used ISO and non-ISO containers**

Freight container designation	External height			External width			External length			Maximum gross weight (tonnes)
	ft	in	mm	ft	in	mm	ft	in	mm	
<b>ISO</b>										
1 A	8	00	2,438	8	00	2,438	40	00	12,192	30
1 AA	8	06	2,591	8	00	2,438	40	00	12,192	30
1 B	8	00	2,438	8	00	2,438	30	00	9,125	25
1 BB	8	06	2,591	8	00	2,438	30	00	9,125	25
1 C	8	00	2,438	8	00	2,438	20	00	6,058	20
1 CC	8	06	2,591	8	00	2,438	20	00	6,058	20
1 D	8	00	2,438	8	00	2,438	10	00	2,991	10
<b>Non-ISO</b>										
(1)	9	06	2,896	8	00	2,435	48	00	14,630	35
(1)	9	06	2,896	8	00	2,435	45	00	13,716	35
(1)	9	06	2,896	8	00	2,435	40	00	12,192	35
(1)	9	06	2,896	8	00	2,435	20	00	6,058	35
(2)	9	06	2,896	8	06	2,591	53	00	16,150	35
(2)	9	06	2,896	8	06	2,591	48	00	14,630	35
(2)	9	06	2,896	8	06	2,591	45	00	13,716	35

*(1) High cubes*

*(2) Super high cubes*

### **(iii) Assessment of the structure and loading gauge situation in the Islamic Republic of Iran**

The structure and vehicle gauge applicable to all 1,435 mm gauge lines in the Islamic Republic of Iran indicates that super high cube containers would certainly, and that high cube containers would probably, infringe the structure gauge, if carried on standard flat wagons, while ISO containers of 8ft 6in height would infringe the vehicle gauge of the network. However, the latter may be carried since there would be greater than 40 cm clearance between the outside dimensions of the wagon with its container load and the inside dimensions of structures.

On the railway system of the Islamic Republic of Iran, the most critical structure limitations are to be found between Tehran and Djulfa, more precisely between Tehran and Tabriz, where mountainous terrain has required extensive tunnelling. It is understood that there are a number of tunnels in the section Km 427.6 - Km 497.25 (distances measured from Tehran), ranging in length from 537 to 1,726 metres.

In view of the important role of the Islamic Republic of Iran in offering transit to the Persian Gulf to a number of countries, most significantly to the landlocked countries of Central Asia, it can be assumed that when traffic justifies such investments, palliative



measures, such as the adoption of low-floor rolling-stock, will be adopted by the Iranian Islamic Republic Railways.

#### **(iv) Assessment of structure and loading gauge situation in South Asia**

##### ***India***

For the purpose of an earlier ESCAP study<sup>2</sup>, Indian Railway, in its Country Report, indicated that all nominated TAR links in India – among which the Attari - New Delhi and New Delhi - Mumbai sections of the north-south corridor in India – conform with the structure and vehicle gauge standards specified for the TAR network. Restrictions applying to the dimensions of vehicles (and their loads, as applicable) throughout the Indian Railway network were given as follows (with the assumption that these restrictions apply in respect only of the broad gauge, i.e. 1,676 mm, network):

- Maximum width	3,250 mm (10ft 8ins)
- Maximum height above rail level at track centre	4,140 mm (13ft 7ins)
- Maximum height above rail level	3,530 mm (11 ft 7ins)

While both high cube and super high cube containers would infringe this vehicle gauge if carried on standard height (1,000 mm) wagons, they are classified as «over dimensional consignments» and are permitted to move, but at a maximum speed of 75 km per hour.

##### ***Pakistan***

According to the same study<sup>3</sup>, structure dimensions impose restrictions on the movement of super high cube containers at only two locations on the routes which continue the corridor on Pakistan Railways. They are as follows:

- a tunnel at Km 263 between Spezand and Sibi provides clearance of only 29 cm between the inner tunnel wall and the top corners of super high cube containers loaded on wagons of 1200 mm height. In this case, the vehicle gauge infringement is 5.1 cm, and
- a tunnel at Km 1608 between High Attock City and Peshawar restricts the clearance available for super high cube containers loaded on wagons of 1200 mm height to 36.8 cm. In this case, the vehicle gauge infringement is 6.3 cm.

It should be noted, however, that these restrictions appear with the use of 1,200 mm high wagons, when in fact the floor height of the standard BKF container flat wagons in use in Pakistan is only 1,105 mm. Use of lower profile wagons would in both cases allow passage of high profile containers with only minimal speed restrictions.

---

<sup>2</sup> “Development of the Trans-Asian Railway: Trans-Asian Railway in the southern corridor of Asia-Europe routes”, New York, 1999, p. 82.

<sup>3</sup> Op. Cit. p. 83.

## **(v) Assessment of structure and loading gauge situation in South-East Asia**

### ***Malaysia and Singapore***

ISO standard containers of a height of 8 ft and 8 ft 6 in fit within the KTM structure gauge, even when mounted on standard container flat wagons of 1,010 mm floor height. In the case of 8 ft high containers, the clearance between the shoulder of the container and the structure gauge limit is about 37 cm, while in the case of 8 ft 6 in high containers, clearance is about 25 cm. ISO containers of both height dimensions are regularly transported between Port Kelang (Malaysia) and Bangkok (Thailand) under the framework of the container landbridge launched by the railways of the two countries in July 1999, so that the actual structure dimensions along this main line clearly pose no obstacle to the through movement of these containers.

Meanwhile, non-ISO containers of 9ft 6 in height infringe the KTM structure gauge when mounted on standard container flat wagons. If such containers could be conveyed on low level wagons with a floor height of 700 mm, a clearance of 21 cm would be available, which on some parts of the network is likely to be too small a margin for safe operation. Alternatively, conveyance of such containers on low level well-type wagons would provide clearance of 37 cm between the shoulders of containers and the inside surfaces of structures. This is sufficient for safe operation.

In Malaysia, four tunnels prohibit the movement of high cube containers north of Ipoh. These tunnels range in length from 90 to 340 metres, and it is understood that the presence of solid rock strata beneath the sleepers at both locations could rule out track lowering as an option.

Otherwise, high cube containers of 45 ft length and 9ft 6 in height are frequently carried in the section between Singapore and Ipoh (mostly on services linking Port Kelang with Ipoh ICD and Singapore with Pasir Gudang Port, east of Johor Bahru). To comply with structure gauge limitations on these sections, Indian built BCF container flat wagons with a floor height of 850 mm are used. (These wagons, however, provide insufficient clearance for passage of high cube containers through the above-mentioned tunnels).

Finally, it must be noted that electrified line sections between Kuala Lumpur and Padang Besar may constitute future restrictions to the movements of high cube containers.

### ***Thailand***

ISO containers of 8 ft height, mounted on standard container flat wagons, fit within the minimum structure gauge of the State Railway of Thailand (SRT), although with little safety margin. In the case of ISO containers of 8ft 6 in height, the dimensions of the wagons and their loads are barely within the minimum structure gauge. However, on the link between Padang Besar (at the border between Malaysia and Thailand) and Bangkok, the structure gauge has been enlarged to permit passage of containers with a height of up to 9 ft (2.74 metres).

On standard height container flat wagons, high cube containers infringe the SRT minimum structure gauge by a substantial margin, and even with the expanded structure gauge between Padang Besar and Bangkok, movements are clearly restricted by 6 bridges.

### ***Other countries in South-East Asia***

In view of the long term possible connections of the railways of ASEAN countries<sup>4</sup>, the structure and loading gauge situation in countries other than Malaysia, Singapore and Thailand is summed up hereafter for the links shown in Map 12.

Do the structure and loading gauge dimensions permit the conveyance by rail of containers of specific heights in the following countries?

	<b>Cambodia</b>	<b>Myanmar</b>	<b>Viet Nam</b>
8 ft (2.44 metres)	Yes	No	Yes
8 ft 6 in (2.59 metres)	Yes	No	Yes
9 ft 6 in (2.90 metres)	No	No	Yes

*Note : The above assessment assumes the operation of standard height (1,010 mm) container flat wagons.*

## **3.2 Axle-load**

Restrictions on axle-load are imposed by the maximum permissible vertical forces on track and structures, most notably on bridges. All the countries along the corridor are used to carrying heavy industrial and/or mining products and can therefore accommodate container block trains without any problem, as the latter are relatively light.<sup>5</sup>

### **(i) Assessment of axle load situation in Armenia, Azerbaijan, Finland, Kazakhstan, Islamic Republic of Iran, Russian Federation, Turkmenistan, Uzbekistan**

Container wagons commonly used in the countries concerned are as a rule designed to carry a maximum of three TEU. Although the extreme case would involve the carriage of three 20 foot containers, each loaded to their maximum gross weight of 24 tonnes, in practice, there is little demand for the transportation of containers at or near their maximum gross weights and, in the case of 20 foot containers, even containers loaded with dense commodities rarely weigh in at more than 18 tonnes. When this figure is used for calculation, and given that axle-load standards in the railways in the corridor range from 20 to 23 tonnes<sup>6</sup>, the following picture emerges concerning the tare weight of wagons:

- i. On line sections with an axle-load of 23 tonnes, this leaves a maximum wagon tare weight of 38 tonnes<sup>7</sup>;

<sup>4</sup> Here the countries considered are those on the main land of the Asian continent, i.e. Indonesia and the Philippines have not been included.

<sup>5</sup> In practical terms, given the relative 'light' weight of container trains, it is the axle loading of locomotives rather than that of container wagons which may provide an axle load constraint for certain rail systems. This may typically be the case on metre gauge railway systems or lines. However, no such railway or line are part of the routes making up the corridor. A problem may start to appear only in South-East Asia.

<sup>6</sup> It must be noted that on new lines, the railways of the Islamic Republic of Iran implement a new 25 tonnes axle load standard.

<sup>7</sup> Tare weight =  $23 \times 4 - (18 \times 3) = 38$  tonnes, where 23 is the permissible axle-load, 4 the number of axles, 18 the gross weight considered for each 20 foot container and 3 the number of TEU.

- ii. On line sections with an axle-load of 22.5 tonnes, this leaves a maximum wagon tare weight of 36 tonnes<sup>8</sup>;
- iii. On line sections with an axle-load of 20 tonnes, this leaves a maximum wagon tare weight of 26 tonnes<sup>9</sup>;

These figures are all well above the tare weight of container wagons in operation on the railways in the corridor and it can therefore be safely inferred that axle-load does not pose a constraint to container movements through the corridor.

## **(ii) Assessment of axle load situation in South Asia**

### ***India***

The axle load limitation in force on the Attari - New Delhi and New Delhi - Mumbai sections which continue the north-south corridor in India is currently 20.32 tonnes as is the case on all broad gauge sections nominated by India as part of the Trans-Asian Railway network through its territory. It must be noted that Indian Railway has long term plans for the upgrading of its broad gauge trunk lines to permit axle loading of up to 22.1 tonnes.

Given that the container flat wagons most commonly used on the broad gauge networks of India and Pakistan have a length of 45 ft (13.7 metres), a tare weight of 20-21.5 tonnes and a payload capacity of about 43.5 tonnes (giving a maximum gross weight of 63-65 tonnes and an axle load of 15.75-16.25 tonnes), the axle load applied by Indian Railway does not constitute a constraint to the smooth and efficient operation of container movements.

### ***Pakistan***

The axle load limits currently in force on the line sections continuing the north-south corridor on Pakistan Railways are shown hereafter:

- Koh-i-Taftan / Spezand	17.27 tonnes
- Spezand / Sukkur	17.78 tonnes
- Sukkur / Wagah	22.86 tonnes
- Rohri / Karachi	22.86 tonnes
- Lahore / Peshawar	22.86 tonnes

In general, the light axle load sections are concentrated to the west of Spezand where the railway traverses arid mountainous terrain. However, even these sections pose no restriction on the movement of containers loaded on conventional 2 TEU wagons. Here again, given that the container flat wagons most commonly used on the broad gauge networks of India and Pakistan have a length of 45 ft (13.7 metres) and a tare weight of 20-21.5 tonnes and a payload capacity of about 43.5 tonnes (giving a maximum gross weight of 63-65 tonnes and an axle load of 15.75-16.25 tonnes), this light axle load does not constitute a constraint to

---

<sup>8</sup> Tare weight =  $22.5 \times 4 - (18 \times 3) = 36$  tonnes, where 22.5 is the permissible axle-load, 4 the number of axles, 18 the gross weight considered for each 20 foot container and 3 the number of TEU.

<sup>9</sup> Tare weight =  $20 \times 4 - (18 \times 3) = 26$  tonnes, where 20 is the permissible axle-load, 4 the number of axles, 18 the gross weight considered for each 20 foot container and 3 the number of TEU.

the smooth and efficient operation of container movements. Indeed, in that particular case, the major disability associated with light axle loads on some sections of Pakistan Railways is that they require the use of light locomotives and the double heading of trains on a fairly long distance.

### **(iii) Assessment of axle load situation in South-East Asia**

#### ***Malaysia, Singapore, Thailand***

The container wagons in predominant use throughout the route linking Singapore to Thailand through Malaysia is of 12.8 metres and are capable of carrying a maximum of two 20 ft containers or one 40 ft container.<sup>10</sup> If, as already indicated earlier, one considers the maximum payload of these wagons to be approximately 36 tonnes (calculated as 80 per cent of the maximum allowable gross weight of one 20 ft ISO container, multiplied by 2) and a wagon tare weight of 14 tonnes (giving a maximum gross load of 50 tonnes), the axle load over 4 axles is equivalent to 12.5 tonnes.

In this case, however, one needs to consider that the heaviest locomotives in use in the ASEAN region are operated by the railways of Malaysia and Thailand and have a maximum gross weight of 90 tonnes spread over 6 axles, i.e. an axle load of 15 tonnes. This clearly indicates that the standard for the maximum permissible axle load needs to be established at 15 tonnes.<sup>11</sup>

Malaysia, Thailand and Singapore conform with this minimum requirement. In fact, in Malaysia, the axle load prevailing on major trunk lines is 16 tonnes and on new structures have recently been designed to withstand an axle load of 20 tonnes, a parameter that Malaysia plans to progressively extend throughout its system.

#### ***Other countries in South-East Asia***

In other countries of South-East Asia, due to the fact that the political events of the 1970's and 1980's resulted in rail infrastructure maintenance being left unattended, the present condition of track and structures has deteriorated to the extent that axle load limitations actually lower than the original design have to be imposed to ensure the safe passage of trains.

In Cambodia, the axle load on the Poipet - Phnom Penh section is 10 tonnes. In Myanmar, the axle load applied to the existing main lines is 12.5 tonnes and in Viet Nam the axle load on the Hanoi - Ho Chi Minh City main line is 14 tonnes between Hanoi and Danang and 12 tonnes between Danang and Ho Chi Minh City.<sup>12</sup>

---

<sup>10</sup> The railways of Thailand operate a limited number of wagons of 14.8 metres able to carry one single 45 ft container as an alternative to two 20 ft containers.

<sup>11</sup> "Trans-Asian Railway route requirements: development of the Trans-Asian Railway in the Indochina and ASEAN subregion", New York, 1996, Volume 1, p. 14 and Volume 2, p. 30.

<sup>12</sup> Op. Cit. Volume 3, pp. 44-45.

### 3.3 Commercial speeds

*Commercial* speed, or the speed derived by dividing the distance travelled between ultimate origins and destinations by the total time taken to cover this distance, is one of the principal factors influencing mode choice decisions. Commercial speed itself is influenced by numerous factors falling into three main categories, namely: technical, operational and institutional.

#### ***Technical***

Factors which may be classified under this heading include the design and standard of maintenance of the permanent way, signalling, motive power and rolling stock, all of which will have an influence on the maximum speeds which will be permitted on individual lines. Attainment of target commercial speeds will depend in part on the percentage of the journey which may be run at or near maximum permissible speeds.

#### ***Operational***

Factors of this type include delays to the passage of trains resulting from the need to satisfy operational requirements, such as wagon loading/unloading, train marshalling (assembly/disassembly), brake and other safety checks, wagon number taking, locomotive fuelling and servicing, crew change, bogie exchange or other forms of inter-gauge transfer of rolling stock;

#### ***Institutional***

Delays to trains at national borders resulting from completion of customs and border security formalities are examples of the effect of institutional influences on train commercial speeds.

In establishing technical standards for the corridor, due regard should be given to the first of these factors - i.e. a desirable maximum speed for freight trains which will be compatible with the attainment of a commercial speed competitive with alternative transport modes or more simply to shippers' requirements.

One requirement for container block-train operation in the corridors making up the Trans-Asian Railway network is that trains should cover a distance of 1,000 km per day. This target requirement implies an average commercial speed of 40 km/h.

The real capabilities of the railways in the corridor to achieve such a speed are, however, unequal from one rail system to another.

If one considers that the commercial speed<sup>13</sup> of container block trains will be around 65% per cent of the running speed which in turn is often only 70 per cent<sup>14</sup> of the maximum

---

<sup>13</sup> Essentially, the difference between commercial and average running speeds is that the former include an allowance for stationary time for loading/unloading freight, for carrying out operational checks, transshipment at break-of-gauge stations or train servicing and for completing border crossing formalities. *Average running speeds include no allowance for stopping time unless trains stop in the middle of block sections due to mechanical failure.*

<sup>14</sup> Those figures are averages, it being understood that performances vary from one railway to another. In fact, the percentage value kept here for calculation is higher than is normally the case for freight trains on the basis

permissible speed, achieving commercial speeds of 20 km/h, 30 km/h or 40 km/h would thus require maximum permissible speeds of, respectively 44 km/h, 56 km/h or 88 km/h.

On the railways along the above-mentioned Central Asian routes in the corridor, the maximum permissible speed for freight trains are reportedly as follows:

- Armenia	n.a.
- Azerbaijan	n.a.
- Finland	100 km/h, giving a commercial speed of 45.5 km/h,
- Islamic Republic of Iran	60 km/h, giving a commercial speed of 27.3 km/h,
- Kazakhstan	60 to 80 km/h, giving a commercial speed of 27.3 to 36.4 km/h,
- Russian Federation	80 to 90 km/h, giving a commercial speed of 36.4 to 41 km/h,
- Turkmenistan	60 to 80 km/h, giving a commercial speed of 27.3 to 36.4 km/h,
- Uzbekistan	60 to 80 km/h, giving a commercial speed of 27.3 to 36.4 km/h.

Although no information was made available for Turkmenistan and Uzbekistan, it can reasonably be assumed that the speed indications for Kazakhstan are also applicable to the railways of these two countries. On Iranian railways, while the average speed for freight trains through the system is 60 km/h, it is worth observing that the Mashad - Bafq section under construction is designed for a speed of 100 km/h for freight trains and the Kerman - Zahedan section, also under construction, has a design speed of 120 km/h for freight trains. This seems to indicate a policy by the Iranian Islamic Republic railways to upgrade existing lines for higher speeds when track renewal work is carried out in future. Finally, it must be noted that scheduled freight trains running between Bandar Abbas and Sarakhs cover the 2,535 km distance in 84 hours, giving a commercial speed of 30 km/h.

This tends to indicate that on an end-to-end basis, a commercial speed of around 30 km/h can be achieved along the Central Asian routes, with the performances of some railways compensating for the others. While this speed may be below the 40 km/h target stipulated on other corridors of the Trans-Asian Railway (such as the Northern Corridor<sup>15</sup>), it still is sufficient to offer competitive transit times with shipping on the Helsinki - Bandar Abbas route (see Chapter 5).

---

that to guarantee commercial efficiency of operation along the corridor, the railways concerned will give to container block-trains a running priority equal to that of passenger trains and will endeavor to minimize the number of stops en route and to limit the duration of those stops which are absolutely necessary to service the trains.

<sup>15</sup> The Trans-Asian Railway Northern Corridor connects the railways of Belarus, China, Democratic People's Republic of Korea, Kazakhstan, Mongolia, Poland, Republic of Korea, and Russian Federation.

Along the Caucasus Route, the situation is more difficult to assess due to the lack of detailed information relating to Armenia and Azerbaijan. Political instability between the two countries in the early 1990's and the effect of the collapse of the former Soviet Union in economic terms have reportedly had dramatic consequences on the state of the transport infrastructure in the region. In addition, given that very limited traffic, if any, is currently moving by rail, resources may be diverted to the maintenance needs of other main lines. In any case, to make the Caucasus route competitive with the other routes in the corridor, speed improvements would have to be accompanied by the actions required either to restore full operation through the Djulfa border point, or to develop the link through Astara (see above, Chapter 2, point 2.5.1).

Looking at the continuation of the corridor in South Asia from the perspective of the completion of the Kerman - Zahedan link, it must be noted that in India, the Attari - New Delhi and New Delhi - Mumbai sections are already capable of delivering freight train commercial speeds of 30 km/hour, suggesting that their maximum permissible speeds are of (or greater than) 70 km/hour.

In Pakistan, freight train speeds are limited mainly by the design of rolling stock. Vehicles equipped with vacuum brakes and plain bearings are in predominant use and, like all vehicles of this type, are limited to only 55 km/hour. The commercial speed for container block-trains between Karachi and Lahore is reportedly 20.3 km/h.<sup>16</sup>

Finally, in Malaysia, the maximum permissible speed of freight trains is limited to 56 km/h and their average commercial speeds are in the 19 to 26 km/h range. In Thailand, meanwhile, the maximum permissible speed for freight trains on all main lines is 70 km/h. The container landbridge jointly operated by KTMB and SRT provides a concrete example of commercial speed performances on these two railways. Container block-trains cover the 1,590 km distance between Port Kelang and Bangkok in 60 hours, giving a commercial speed of slightly under 27 km/h. It must be noted that, in Malaysia, most of the West Coast main line and, in Thailand, the entire link between Padang Besar and Bangkok are single track. This results in considerable *en route* stoppage time in crossing loops due to the need to wait for opposing trains.

In summary, although the movements of containers in the corridor can already be delivered at speeds that are satisfactory in terms of transit times, ways should be sought to further improve railway performances in this area. The commercial speed of containers in the corridor could be improved by a combination of two methods. First, stationary time can be reduced by conveying containers in unit or block trains operating to a fixed schedule which reduces the number of stops to those that are absolutely necessary for safe operation or organizational constraints (e.g. crew change, customs inspection). Second, running times can be reduced through an increase in train speeds. In this respect, once the idea of running containers in block-trains is accepted by all railways, these block-trains should be granted a running priority equal to those of intercity express passenger trains. The parallel scheduling of container trains and passenger trains would have the following advantages:

---

<sup>16</sup> Country Report of Pakistan prepared for the study "Development of the Trans-Asian Railway – Trans-Asian Railway in the southern corridor of Asia-Europe routes".



- an increase in line utilization,
- a reduction in locomotive and rolling-stock requirements due to faster turnaround times,
- a reduction in operating costs due to reduced rolling stock requirements as well as reduced manpower requirements and fuel,
- longer duration of track maintenance windows leading to the greater availability of optimum assets.

For such parallel scheduling to be achieved, maximum speeds of 90 to 120 km/h would have to be allowed for container trains in future. This would obviously have a number of financial implications for the railways, the most visible relating to a programme of rolling-stock improvement.

\*       \*

\*

## **- Chapter 4 -**

### **Operational Requirements**

---

Since the attraction of container traffic to the corridor depends in large measure on rail being able to deliver cost effective and reliable services as compared with its competitors in the corridor, it is essential that any operational impediments to the achievement of these goals be removed. In this context the following factors are important:

- compatibility in terms of the type and design of rolling stock employed by neighbouring railway systems in international traffic would ensure rolling stock interoperability when no break-of-gauge is involved. Ideally, systems should cooperate in the design of exchangeable rolling stock to ensure that only the most efficient designs (i.e. those which maximize payload to tare ratios or minimize gross to net ratios, and are capable of running nearly at passenger speeds) are adopted;

- compatibility of train assembly and load scheduling practices between neighbouring railway systems will be essential in order to avoid the necessity of having to re-adjust train loads at borders. The desirability of operating fixed formation unit trains across borders, where track gauge continuity permits, should be recognized and acted upon by the railways concerned; and

- at break-of-gauge points, the provision of fast and reliable container transshipment equipment will be essential to minimize delays.

The success of rail in being able to capture additional container traffic to the corridor will depend heavily on there being adequate capacity for handling containers at rail served terminals in the hinterland and at the major sea ports.

#### **4.1 Compatibility of rolling stock**

Rolling stock compatibility does not seem to be an issue of concern among the railways in the corridor. Indeed, this issue becomes critical where track gauge continuity exists but stops being essential where there is track gauge discontinuity, simply because in such situations there will be no requirement to exchange rolling stock, but rather to exchange the loading conveyed on that rolling stock. In this latter situation, however, it is important to keep in mind that the possible imbalances between the container loading capacity of wagons either side of a break-of-gauge point can result in one system having to employ more wagons to transport a given quantity of containers than the other.

Along the corridor, there is track gauge continuity from Finland down to the border points with the Islamic Republic of Iran, both at the border point at Djulfa between Azerbaijan and the Islamic Republic of Iran, and the border point at Sarakhs between Turkmenistan and the Islamic Republic of Iran. Going through Djulfa means going through

the Caucasus route, and therefore implies looking at rolling stock compatibility among the railways of Armenia, Azerbaijan, Finland and the Russian Federation. Going through Sarakhs means going through the Central Asian route, and therefore implies looking at rolling stock compatibility between the railways of Finland, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan.

As indicated earlier (Chapter 3, point 3.1), the railways of Armenia, Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan were until 1991 constituents of the Soviet Railways and the design standards implemented by each of these railways were, and still are, common to all.

Consequently, there is no technical obstacle to having rolling stock travel all the way from Lujanka, at the border between Finland and the Russian Federation, to either Djulfa or Sarakhs. The obstacle, in this instance, seems more a question of policy among the railways concerned, as it is understood that there is some reluctance by a number of Commonwealth of Independent States (CIS) railways to let their rolling stock run on the railways of other CIS republics. Whatever the reason explaining such reluctance, it must be recognized that container movements along the corridor will only reach optimum operational efficiency if rolling stock is allowed to cross borders.

Given the existence of break-of-gauge points between the railways of the Islamic Republic of Iran and the railways of Azerbaijan and Turkmenistan, rolling stock compatibility is not an issue among the railways of these countries. Nor will it be an issue between the railways of the Islamic Republic of Iran and Pakistan Railways in the south of the Islamic Republic of Iran, once the Kerman - Zahedan section is completed (Chapter 2, point 2.6.1.1) as the connection of the two railways will create another break-of-gauge point between the 1,435 mm railway of the Islamic Republic of Iran and the 1,676 mm line that will start in Zahedan before penetrating the network of Pakistan Railways.

In South Asia, although there is track gauge continuity between Pakistan Railways and Indian Railway, rolling stock compatibility can be an issue as indeed the freight wagons operated by Pakistan Railways are predominantly equipped with vacuum brakes and plain bearings, and are limited to 55 km/h. In addition, rolling stock differences between the two railways are to be found in payload and height between wagon floor and rail tops.

In South-East Asia, meanwhile, container rolling stock compatibility is not an issue between the metre-gauge network of Malaysia, Singapore and Thailand, as is illustrated by the container landbridge operated jointly by the railways of Malaysia and Thailand between Port Kelang (Malaysia) and Bangkok (Thailand).

To be complete, rolling stock differences in terms of the container carrying capacity of wagons operated between neighbouring railway systems sharing the same track gauge can also create problems, in the sense that use of wagons with limited container loading capacity will require longer and heavier trains to be run on through schedules than might be the case if wagons of higher container loading capacity are used. This can sometimes lead to operational difficulties when train lengths exceed the available length of crossing tracks on single line sections or of terminal arrival tracks, or when train gross trailing loads exceed the hauling capability of single locomotives, necessitating «locomotive banking» or a doubling up of motive power assigned to trains. However, this problem does not appear to exist among neighbouring railways of the north-south corridor with track gauge continuity.

## 4.2 Compatibility of train assembly and load scheduling practices

The efficiency of international train operations in the corridor will in large part depend upon there being reasonable consistency in the operating practices of neighbouring railway systems. For example, in situations where there is continuity of track gauge but no consistency in the length of trains operated either side of the border, transit delay and cost penalties will result from the necessity to re-marshall or adjust loading at the border. The two main influences on train lengths are the hauling capacities of locomotives and the available length of crossing/passing, station and terminal sidings. While it may not be possible to achieve compatibility in the former, due mainly to topographical differences between the neighbouring route networks, it should be possible to achieve some degree of compatibility with the latter.

The problems associated with differing train lengths can be overcome by specifying standard train configurations based on unit or block train operation of international container services. Unit trains are trains comprising a fixed number of wagons of a single type, operating between a single origin and destination, with intermediate stops only for train crossing purposes or for operational reasons such as crew or locomotive exchange. Block trains are similar, except that they may comprise more than one type of wagon, but nevertheless operate to fixed formation, single origin/destination principles. In container haulage service, both types of trains should comprise wagons which may be run at or near passenger train speeds to avoid being held in crossing sidings for faster opposing or passing passenger trains. The main advantages of such trains are that by avoiding marshalling yards and intermediate stops for loading/unloading both transit times and operating costs can be very low.

The main principle guiding decisions about train lengths is that wagons should be added up until the point at which either the maximum length for crossing/passing purposes, or the maximum trailing tonnage for single locomotives (of types in predominant use), is reached. The reasoning behind this principle is that long run marginal costs (i.e. operating costs plus wagon and locomotive amortization) will decline with increasing train size up until the point at which another locomotive must be added.

It is understood that all railways in the corridor as well as the railways of India, Pakistan, Malaysia and Thailand, are well experienced in the operation of unit or block container trains between hinterland origins/destinations as well as to seaports, whether these seaports are located in their countries or not. So far as the cross border movements of such trains are concerned, there is no *technical* impediment to such future movement among the CIS republics. Indeed, such movements were common in the days of the former Soviet Union and the railways of the CIS countries in the corridor all have siding lengths of at least 850 metres.

In Finland, the standard length of sidings is reportedly 725 metres (up to 825 metres in some cases), while in the Islamic Republic of Iran it is often comprised between 750 and 800 metres, although at some stations only sidings with a much reduced length are available.

In South Asia, there is little cross border movement of containers between India and Pakistan. It is understood that the configurations of these trains also vary widely, from the

45 bogie wagon (90 TEU) trains operated on broad gauge trunk routes in India to 30 bogie wagon (60 TEU) trains in Pakistan.

In Malaysia and Thailand, the container block-trains between Port Kelang and Bangkok are operated on the basis of a maximum of 27 BCF, i.e. 54 TEU. Given that the sidings are designed to accommodate a 30 wagon freight train (the maximum number of wagons for Malaysian freight trains), the length of sidings on KTMB can be estimated as between 550 and 600 metres. It must be noted that the design for future sidings is for 700 metres in order to accommodate freight trains of 40 wagons. In Thailand, meanwhile, the maximum length of sidings and crossing loops is 500 metres.

### **4.3 The break-of-gauge issue**

#### **4.3.1 The break-of-gauge problem in the Corridor**

One of the major impediments to the smooth flow of railway traffic along international corridors linking parts of Europe with parts of Asia is the lack of a uniform track gauge among the participating railways.

Track gauge is the width between the inner surfaces of each rail, and is conventionally measured in millimetres. In corridor, there are five track gauges<sup>1</sup>, namely: the 1,524 mm gauge in Finland; the 1,520 mm gauge in Armenia, Azerbaijan, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan; and the 1,435 mm gauge as well as 1,676 mm gauge in the Islamic Republic of Iran, albeit the latter is limited to the link between Mirjaveh and Zahedan which is not yet connected to the rest of the Iranian rail system.

In South Asia, the above-mentioned links in India and Pakistan are of 1,676 mm gauge, leaving operation between these two countries free of a break-of-gauge problem. In South-East Asia, the same applies to operation between Malaysia and Thailand which both operate on 1,000 gauge.

The magnitude of the gauge difference between Finland and the Russian Federation is insignificant and does not technically impair rail operation between the two countries. However, the difference between the 1,435 mm gauge on the Iranian Islamic Republic Railways and the 1,520 mm on the railways of its two neighbouring countries in the corridor with which rail-carried goods is or could be exchanged in future, i.e. Azerbaijan and Turkmenistan, is an obstacle to smooth cross-border operation, as will be the difference of gauges between the Islamic Republic of Iran and Pakistan once the Kerman-Zahedan link is completed.

In practical terms, however, only one break-of-gauge point is currently operated in the corridor, namely: the break-of-gauge between Sarakhs (Turkmenistan) and Mashad (Islamic Republic of Iran). As previously explained the break-of-gauge point between Djulfa Azerbaijanskaya and Djulfa Iranskaya stopped being operational when the Iranian authorities shifted the bogie changing equipment to Sarakhs after the eruption of political tensions

---

<sup>1</sup> The 1,067 mm gauge operated by Russian Railways on the island of Sakhalin is not included here as only few route-kilometers are concerned and the area is not of relevance to the study. Also, the 1,676 mm gauge between Zahedan (Islamic Republic of Iran) and Mirjaveh (Pakistan) will be discussed in Chapter 4.

between Armenia and Azerbaijan over Nagorny Karabakh in the early 1990's (Chapter 2, point 2.5.1).

In future, when the Astara-Qazvin section is constructed, another break-of-gauge point will come into being between Azerbaijan and the Islamic Republic of Iran, and if a continuous link between Erilievo and Bandar-E-Torkman/ Gorgan (Chapter 2, point 2.5) were to be established, there would also be another break-of-gauge point between Turkmenistan and the Islamic Republic of Iran. Finally, when the Kerman-Zahedan section is in place, a break-of-gauge point will appear between the Islamic Republic of Iran and Pakistan.

Given the above, attracting traffic to the corridor will require overcoming the break-of-gauge problems. Typically, the types of traffic that will use the corridor as well as their volumes and trade directions will influence the type of equipment that will be installed to solve the problem at a particular location. While it is difficult at this point in time to clearly estimate how traffic will shape up in the corridor in terms of the nature of the cargo as well as volumes, it is interesting to look at the various 'gauge bridging' measures implemented by railways facing a gauge problem at their border-points, i.e. techniques or measures applied in order to overcome the discontinuity of railway track gauge to permit vehicles and/or their loads to pass from one gauge to another. These measures include :

- (i) ***Transshipment.*** The transfer of freight by manual or mechanical means from wagons of one gauge to wagons of another gauge.
- (ii) ***Bogie changing.*** This involves lifting wagons on a set of jacks, rolling out bogies of one gauge and rolling in bogies of the other gauge.
- (iii) ***Use of wagons with variable gauge bogies.*** These are wagons fitted with bogies, or wheelsets, equipped with adjustable axles enabling the distance between the wheel flanges to adjust from one track gauge to another as the wagons are pulled along a special transition track at reduced speed.

Another 'gauge bridging' measure involves the provision of *dual gauge*, i.e. the provision of two different track gauges on a single track foundation through the insertion of a third rail (or sometimes a fourth rail to obtain the so-called 'composite gauge'). Finally, another option is to 'uni-gauge' tracks, i.e. a process involving the conversion of tracks of different gauges to a single gauge standard. However, these two solutions are viable only when different standards are applied within the same country, or for cross-border movements over a very short distances to fit specific requirements such as extending a line section of one country onto the territory of another country to gain access to specific installations or sites, e.g. ports or mining sites. There is no situation requiring such solutions within the north-south corridor and, therefore, only the options of transshipment, bogie-changing or wagons with 'variable gauge' bogies are considered hereafter.

#### **4.3.2 Description of technical solutions to the break-of-gauge problem**

***Transshipment*** techniques vary from basic labour intensive methods to mechanical methods involving equipment with different levels of automation and technological sophistication. The type and volume of the cargo to be transhipped as well as the extent of containerisation all have a role in determining the type of transshipment employed.

The use of containers permits safer and quicker handling of cargo. Transshipping containers requires a transshipment yard with a set of parallel tracks of either gauge. Depending on the type of equipment to be used, the tracks might be separated by an area of heavy duty pavement to allow the operation of vehicles such as reach-stackers.

Rubber-tired gantry cranes or overhead rail mounted gantry cranes – in varying numbers depending on the length of the tracks to be served and the need for high throughput – may also be used. Overhead rail mounted gantry cranes guarantee that the equipment is there as soon as a set of wagons is positioned for transshipment. However, they do not remove entirely the need for some sort of rubber-mounted equipment (gantry or reach-stackers) as it may be necessary to interrupt the journey of one or several container(s), e.g. repair or specific customs requirements.

The type of equipment to be provided will typically depend upon the volumes of containers to be transhipped as well as yard configuration/constraints. For volumes exceeding 50,000 TEU per year, it is likely that either rail-mounted gantry or rubber-tyred gantry would be required in order to minimize the unit cost of transshipment. For smaller volumes, the use of heavy toplifting trucks or reach-stackers would be sufficient.

***Bogie changing*** is an inter-gauge transfer technique by which each wagon and its load is raised off bogies of one gauge and then lowered onto bogies of the other gauge. Two alternative methods are available for bogie exchange, i.e. a labour intensive method and an automated method with little impact on the layout of the facilities. Within the bogie exchanging area proper, the system differs depending upon whether a labour intensive or an automated technique is applied. However, since automated bogie exchange is not in place to date on any of the railways along the corridor, only the labour intensive method is described hereafter.<sup>2</sup>

For a typical labour intensive bogie exchange, a wagon is brought into the shed by a tractor or a small shunting engine, and four electrically actuated portable jacks are positioned under special jacking plates on the wagon. The brake rods are disconnected from the bogies and the wagon is raised off the bogies. These bogies are rolled forward and the different gauge bogies, which have been placed on the track behind the wagon by a mobile crane, are rolled forward into position. The wagon is then lowered onto these bogies, the brake rods are attached, the brakes are tested and the wagon is pushed out by a tractor or a small shunting engine.<sup>3</sup> This labour intensive method for bogie exchange is practiced by the countries in the corridor which face one or more break-of-gauge problem on their rail systems.

---

<sup>2</sup> It is worth noting, however, that automated bogie exchange facilities have been developed and are operated by at least one country with a break-of-gauge problem, namely Australia and that in terms of labour requirements and productivity rates, the Australian Bureau of Transport Economics (BTE) quoted the labour requirement for a labour intensive exchange at one gang of 7 men per exchange track per shift and that of an automated exchange at one gang of three to four men per exchange track per shift. Regarding productivity, it was estimated that for a labour intensive exchange, it was theoretically possible to convert 32 wagons per exchange track per 8 hour shift. For an automated exchange, it was estimated that 56 wagons could be exchanged per exchange track per 8 hour shift.

<sup>3</sup> Bureau of Transport Economics (Australia): *A Study of the Port Pirie Bogie Exchange*, Australian Government Publishing Service, Canberra, 1977, page 6. Quoted in ESCAP's study "The Railway Break-of-gauge Problem and Possible Solutions in the ESCAP Region", New York, 1996, p. 41. Although the exact

***Use of wagons with variable gauge bogies.*** The development of wagons with adjustable wheel-sets is presented as an alternative to the transshipment and bogie-changing methods. This method has in the past been applied to both freight and passenger traffic at the borders between the former Soviet Union and countries of central and eastern Europe, and to passenger traffic between France and Spain. Research and/or operation have also been carried out by other countries such as Bulgaria and Japan.

Although a number of railways in the world have been looking at ways to perfect the technology, freight wagons with the necessary technical design have not been produced in big numbers and, to date, have not been used in sustained commercial operation over long distances.

As compared with both the transshipment and bogie changing methods, the principal advantage of the variable gauge bogie system is that there would be practically no delay to wagons passing through break-of-gauge locations. In addition, the variable gauge bogie system would require a much smaller fleet of wagons to support a given traffic task, as compared with either of the other two gauge bridging methods.

Its principal disadvantage, in relation to the other two gauge bridging methods, is its potentially high capital cost. It is possible also that its operating cost will be higher than that of the other two alternatives, simply because specialized maintenance facilities would be required for the programmed maintenance of bogies equipped with adjustable axles. The need for joint procedures regarding the operation, maintenance and repair of such wagons between several railways may also pose a long-term safety risk with legal and financial implications. It must also be noted that past experiences conducted by the railways of the former Soviet Union showed that the gauge-variable wheelsets added 1.2 to 1.5 tonnes to the weight of a four axle wagon, and diminished the payload capacity of vehicles. In addition, theoretical studies conducted in the Russian Federation have shown that the relevance of such systems is at its best for transport over distances not exceeding 2,500 km, i.e. far shorter than distances along the routes in the corridor.

Finally, it must be noted that continuing research activities in a number of countries in both Europe (Germany, Russian Federation) and Asia (Japan) may yield new prospects for the technique in the future.

### **4.3.3 Advantages vs disadvantages of different solutions**

The advantages and disadvantages of the above-described gauge bridging measures are summarised hereafter:

<b>Solution</b>	<b>Advantages</b>	<b>Disadvantages</b>
<i>Manual transshipment</i>	- Comparatively low capital cost	- Imposes significant delays in wagon transit times and is therefore

---

operating conditions may vary from one location to another, the general operating principles are similar to all such facilities.



		<p>incompatible with the implied notion of rapid transit times associated with through scheduling.</p> <ul style="list-style-type: none"> <li>- Adds locomotive and wagon requirements.</li> <li>- Adds cost in rolling stock utilisation.</li> <li>- Requires specific sheds.</li> <li>- Requires more shunting as sheds are usually built to accommodate between 10 to 15 wagons.</li> <li>- Physical handling of goods increases the risk of damage and pilferage.</li> <li>- Very labour intensive.</li> </ul>
<i>Mechanised transshipment</i>	<ul style="list-style-type: none"> <li>- Comparatively low capital cost</li> <li>- Fast transshipment capabilities</li> <li>- Reduced shunting (provided trackage of sufficient length is provided under cranes)</li> <li>- Least labour intensive transshipment method.</li> <li>- No direct handling of cargo.</li> </ul>	<ul style="list-style-type: none"> <li>- Adds locomotive and wagon requirements.</li> <li>- Adds cost in rolling stock utilisation.</li> </ul>
<i>Bogie exchange</i>	<ul style="list-style-type: none"> <li>- No direct handling of cargo.</li> </ul>	<ul style="list-style-type: none"> <li>- High capital cost.</li> <li>- Imposes significant delays in wagon transit times and is therefore incompatible with the implied notion of rapid transit times associated with through scheduling.</li> <li>- Large operating cost (especially for non-automated exchanges which have large labour requirements).</li> <li>- In the case of imbalanced traffic, additional cost is incurred due to the need to maintain an adequate pool of bogies.</li> <li>- Requires extensive shunting.</li> </ul>
<i>Variable gauge bogie</i>	<ul style="list-style-type: none"> <li>- Imposes very little delay to wagons in transit.</li> <li>- Avoids cost of transshipment and bogie-exchange.</li> </ul>	<ul style="list-style-type: none"> <li>- Can have high capital cost requirements depending on the number of wagons to be purchased or converted.</li> <li>- Requires specialised maintenance staff and equipment.</li> </ul>

In practical terms, if the above techniques are applied to a train of 25 flatcars carrying two TEUs each, the following operational performances could be expected:

<u>Transshipment (1)</u>		<u>Bogie-exchange</u>		<u>Adjustable wheelsets (5)</u>
Using two Reachstackers (2)	Using one rail-mounted gantry	Labour-intens. Method (3)	Automated method (4)	
4 hours	3 hours 40 min.	6 hours	3 hours 40 min.	Within one hour

- (1) Considering a pair of tracks of sufficient length to accommodate the entire 25-wagon trainset, thereby avoiding the shunting movements that would be associated with having to work on a split trainset.
- (2) In the most optimistic case of a yard configuration minimizing movements by the reachstackers.
- (3) Based on information booklet issued by the Iranian Islamic Republic Railways indicating that about 200 bogies can be changed in 24 hours based on two working shifts at the Sarakhs bogie exchange.
- (4) Based on Australian experience.
- (5) Based on technology being developed by DB Cargo for a wagon with adjustable wheelsets suitable for the 1,435 mm, 1,520 mm and 1,668 mm gauges.

#### 4.3.4 Capital costs

In terms of the capital costs relating to the development of each of the above-described technique in relation with container traffic, the cited 1996 ESCAP study indicated the following elements<sup>4</sup> :

- Transshipment :**
- transshipment capacity of 48,000 TEU per year,
  - 2 sets of two parallel tracks (one of each gauge) accom-modating 40 container flat wagons (80 TEUs),
  - container yard storage capacity of 224 TEU stacked three high,
  - 2 reachstackers,
  - paved area between each track of a width of 13 metres,
  - heavy-duty pavement with area of 4,032 square metres.

**Total : US\$ 4 million**

- Bogie-exchange (labour-intensive method)**
- single track (mixed gauge) exchange facility,
  - exchange capacity of 56 wagons per shift,
  - bogie storage tracks
  - approach tracks on either side
  - automated jacking/bogie placement and clearance system

**Total : US\$ 6 million**

<sup>4</sup> Although figures would have to be adjusted to current economic conditions, the range between the various options would in any case remain the same.

***Variable gauge  
bogie***

No cost estimates for the variable gauge bogie system are available, either for the system in place in the railways of the former Soviet Union or for the current TALGO system. However, it is apparent that the cost of (i) converting existing container flat wagons to the system<sup>5</sup>, and (ii) providing the transition tracks and other equipment at break-of-gauge locations would run into figures much higher than the estimates for the other options.

The above suggests that for the foreseeable future, and so far as container traffic is concerned, the favoured solution to break-of-gauge along the corridor is likely to be the transfer of containers between two sets of wagons. Implementing this solution is also the safest in economic terms as, in a first stage, it does not compel the concerned railways to massive investment in yards and handling equipment. In the medium to long term, the solution also allows the railways to use the existing wagons until the end of their technical life-cycle while resorting to bogie-changing or to the use of wagons of adjustable wheel-sets would necessitate, in the worst case, writing-off or, at best, under-using existing assets. Gantry cranes, straddle-carriers and reach-stackers are a common feature on all sea, rail and road terminals around the world and have shown their reliability for the easy, safe and economical movements of containers of all types between different systems. Finally, the more expensive solutions should only be envisaged once traffic forecast have been refined and indicate volumes in sufficient number to justify such investment.

\*       \*

\*

---

<sup>5</sup> Within the range of US\$ 35,000 - 40,000 per wagon; ESCAP's study "The Railway Break-of-gauge Problem and Possible Solutions in the ESCAP Region", New York, 1996, p. 47.

## - Chapter 5 -

### Commercial Requirements

---

There is no guarantee that the mere availability of through railway routes between Northern Europe and the Persian Gulf will automatically encourage shippers based at both ends or along the routes, or within easy reach of the routes, to actually use these routes. In making decisions about route and mode choices, shippers will always be guided by their perceptions of the relative cost, standard and reliability of services offered by alternative modes and operators.

In general, for container shippers, the following service attributes are considered to be important in arriving at decisions about mode and route choice:

- overall level of transportation and handling cost, as measured by the tariffs and charges paid;
- transit time, representing the time interval between despatch of a consignment from a shipper's premises and its arrival at the consignee's premises;
- consignment security, or the extent to which consignments will be secure from damage or pilferage *en route*, since this could affect an operator's insurance cover and hence the overall transportation cost;
- reliability of service – specifically the extent to which an operator or mode can consistently meet promised delivery times for the shipper's consignments;
- comprehensiveness of service provided by operators, in terms of the extent to which a single operator will arrange and accept responsibility for all components of the transportation/handling chain between ultimate origin and destination; and
- availability of real time information on the location of a freight consignment or container at any point in its journey between origin and ultimate destination.

These six attributes can be thought of as comprising the “service package” offered by individual operators, which depending upon its perceived quality will be at the root of a transport operator's ability to win and/or retain business. Not all categories of shippers will rate these attributes in the same order of priority or even in the order of priority suggested above. For shippers of relatively high value commodities, reliability rather than cost may be the most important selection criterion, since reliable service may allow their customers (the consignees) to reduce the inventory level needed to safeguard against unreliable delivery of consignments. For shippers of low value commodities, on the other hand, cost is likely to be the most important criterion, since excessive transportation costs could impair their

competitiveness on international markets. This chapter reviews these elements, taking into account the fact that at this point in time, some elements are difficult to measure (i.e. through freight rates), while others that are measurable (transit times) can change due to the adoption of new techniques and/or policies. In any case, these are all elements which the railways concerned need to apprehend jointly in future if they want to attract traffic to the corridor.

## 5.1 Business environment of container traffic

Two of the well-recognised features of international business are (i) its highly competitive nature and (ii) its global nature. These two features combine to put pressure on shippers to reduce costs while at the same time develop an organisation able to project their goods and image around the world's consumer markets with near-zero defect.

These features are well illustrated by the transferring by western European producers of production facilities to the eastern and southern peripheries of the European continent and, more extensively, to South and South-East Asia. The multi-national companies creating this trend have an imperative requirement for efficiently organising the delivery of components to their manufacturing sites, for shipment of the finished products to distribution facilities for repackaging, labelling, inventory control and, ultimately, for final distribution to consumers. The trend is made easier, and therefore even accelerates, as information technology gives manufacturers the capability to manage much more complex choices in optimisation processes.

One important aspect of transport is that the transport business is not an end in itself, but more, in the eyes of shippers, a 'necessary evil' that is costly, does not add value to their products and constitutes a potential source of disruption in the distribution process. As consumer markets are in a constant evolutionary process, so are the manufacturing processes and objectives of industries, and so are shippers' marketing philosophy and strategy as well as their transport and logistics requirements.

Although the nature of a shipper's business will lead to the attribution of a different weight to each of the above six attributes in their decision to select a particular mode or route, the following answers by a sample of shippers to the question "*Which service is your number one priority when booking an ocean carrier?*" give a broad indication of what guides a shipper's decision process<sup>1</sup>:

1. Schedule reliability	43%
2. Freight rate	38%
3. Transit time	12%
4. Reliable booking and documentation	4%
5. Others	3%

So far as future rail services in the corridor are concerned, the above indications call for the following comments:

---

<sup>1</sup> Containerisation International, « *CI poll shows shipper priorities* », Nov. 1999, p. 63

- reliability and rates remain among the “all-time, top-scoring” determinants for shippers in their selection of a transport mode;
- the fact that transit times are receiving fairly low priority may be misleading. Indeed, in the minds of shippers the comparison of transit times is *between ocean carriers*. In practical terms, this means that any difference in this area between competing ocean carriers would be in most cases of one or two days only, that is to say not significant enough to change the focus of shippers away from rates. If shippers were confronted with the prospect of substantial transit time reductions, they could think differently, provided reliability is guaranteed;
- the low priority given to such elements as cargo tracking and tracing, Electronic-commerce, reliable booking and documentation accuracy is equally misleading. In cost-sensitive times, these elements would receive low priority because they are already in place and have become transparent as they are not subject to operational vagaries, contrary to reliability, or to changing economic circumstances, as opposed to rates. As a result, they are taken for granted and their priority goes down. But while shippers would trade a day or two in transit times for cheaper rates, they would most certainly not accept a reduction in the mass and quality of the information provided, nor less easy access to this information.

## 5.2 Transit times

For the sake of comparing transit times performances between (i) sea and (ii) rail or rail-cum-sea, the following estimates have been made for cargo movements from Helsinki to Tehran via Bandar Abbas, Helsinki to Lahore via Karachi, Helsinki to New Delhi via Mumbai, and Helsinki to Bangkok via Port Kelang.

### 5.2.1 Estimates of sea transit times

In estimating transit times, the following assumptions were made:

- i. rail was arbitrarily chosen for delivery between the main ports and final destinations,
- ii. for the rail movement between ports and final destinations, the commercial speeds for scheduled container block-trains indicated in Chapter 3 (para 3.3) were used,
- iii. given the lack of detailed information on port operation in Bandar Abbas, Karachi, Mumbai and Port Kelang, a 2-day dwell time has been arbitrarily used for calculation.

### ***Helsinki to Tehran***

- Movement to Helsinki port:	1 day
- Sea voyage Helsinki to Bandar Abbas:	28 days
- Transshipment in Bandar Abbas:	2 days
- Rail journey to Tehran (1,443 km):	2.2 days
- <b>Total:</b>	<b>33.2 days</b>

### ***Helsinki to Lahore***

- Movement to Helsinki port:	1 day
- Sea voyage Helsinki to Karachi	36 days
- Transshipment in Karachi:	2 days
- Rail journey to Lahore (1,219 km):	2.5 days
- <b>Total:</b>	<b>41.5 days</b>

### ***Helsinki to New Delhi***

- Movement to Helsinki port:	1 day
- Sea voyage Helsinki to Mumbai:	27 days
- Transshipment in Mumbai:	2 days
- Rail journey to New Delhi (1,510 km):	2.1 days
- <b>Total:</b>	<b>32.1 days</b>

### ***Helsinki to Bangkok***

- Movement to Helsinki port:	1 day
- Sea voyage Helsinki to Port Kelang:	26 days
- Transshipment in Port Kelang:	2 days
- Rail journey to Bangkok (1,590 km):	2.5 days
- <b>Total:</b>	<b>31.5 days</b>

## **5.2.2 Estimates of rail or rail-cum-sea transit times**

In estimating rail or rail-cum-sea transit times, the following assumptions were made:

- the commercial speeds used for each rail segment are those indicated in Chapter 3 (Para. 3.3) with the lowest of the two figures when a bracket is given. This gives the following speeds and transit times through each railway concerned:

Railways transited	Distance	Commercial speed	Transit time
- Finland	283 km	45.5 km/h	6.2 hours
- Russian Federation	2,539 km	36.4 km/h	3 days
- Kazakhstan	815 km	27.3 km/h	1.2 days
- Turkmenistan (through Taxiatah)	890 km	27.3 km/h	1.4 days
- Uzbekistan (through Taxiatah)	533 km	27.3 km/h	19.5 hours
- Turkmenistan (through Nukuss)	509 km	27.3 km/h	18.7 hours
- Uzbekistan (through Nukuss)	1,265 km	27.3 km/h	2 days
- Islamic Republic of Iran (to Tehran)	1,090 km	27.3 km/h	1.9 days
- Islamic Republic of Iran (to Bandar Abbas through Tehran)	2,533 km	27.3 km/h	4 days
- Islamic Republic of Iran (to Bandar Abbas through Mashad-Bafq link)	1,533 km	27.3 km/h	2.3 days

- ii. For lack of sufficient data for each individual border point a half-day dwell time was added at each border crossing. Although this may be too long in some cases (e.g. for cross border movements between Turkmenistan and Uzbekistan<sup>2</sup>), it compensates for what can actually take place at other border points, especially in view of the fact that the picture of customs / railways interaction is not fully clear,
- iii. a one-day dwell time was added at Sarakhs for border crossing and transshipment,
- iv. a two-day dwell time was added at each rail to port transfer,
- v. in the case of the all-rail trip to Pakistan, the completion of the Kerman-Zahedan section will come after the completion of the Mashad-Bafq section, and therefore only this most direct route option (by-passing Tehran) has been considered.

#### **5.2.2.1 Estimates of all-rail transit times**

Table 5.1 sums up the all-rail transit times from Helsinki to Tehran, Bandar Abbas, Lahore and New Delhi through the various route options described in Chapter 2.

#### **5.2.2.2 Estimates of land-cum-sea transit times**

Table 5.2 sums up the land-cum-sea transit times from Helsinki to Lahore, New Delhi and Bangkok through the various route options described in Chapter 2.

---

<sup>2</sup> To take this fact into account, however, only one border point has been considered for movement through the Taxiatah – Charjou section which meanders in and out of the two countries.



Table 5.1 Estimates of all-rail transit times from Helsinki to Tehran, Bandar Abbas, Lahore and New Delhi (*all figures in days unless otherwise indicated*)

Route	Distance (km)	Rail transit time	Border point w/o break-of-gauge			Border point with break-of-gauge			Overall Transit time
			Number	Transit time	Total	Number	Transit time	Total	
<i>Helsinki - Tehran (via Djulfa)</i>	5,060	6	4	0.5	2	1	1	1	9
<i>Helsinki - Tehran (via Astara)</i>	4,520	5.5	3	0.5	1.5	1	1	1	8
<i>Helsinki - Tehran (via Taxiataash)</i>	6,150	8.5	4	0.5	2	1	1	1	11.5
<i>Helsinki - Tehran (via Nukuss)</i>	6,500	9	4	0.5	2	1	1	1	12
<i>Helsinki - Tehran (via Gorgan)</i>	5,570	7.5	3	0.5	1.5	1	1	1	10
<i>Helsinki - Bandar Abbas (via Djulfa)</i>	6,500	8	4	0.5	2	1	1	1	11
<i>Helsinki - Bandar Abbas (via Astara)</i>	5,960	7.5	3	0.5	1.5	1	1	1	10
<i>Helsinki - Bandar Abbas (via Taxiataash - Tehran)</i>	7,600	10.5	4	0.5	2	1	1	1	13.5
<i>Helsinki - Bandar Abbas (via Taxiataash - Mashad/Bafq)</i>	6,600	9	4	0.5	2	1	1	1	12
<i>Helsinki - Bandar Abbas ( via Nukuss - Tehran)</i>	7,950	11	4	0.5	2	1	1	1	14
<i>Helsinki - Bandar Abbas ( via Nukuss - Mashad/Bafq)</i>	6,950	9.5	4	0.5	2	1	1	1	12.5
<i>Helsinki - Bandar Abbas ( via Gorgan)</i>	7,015	9.5	3	0.5	1.5	1	1	1	12
<i>Helsinki - Bandar Abbas (via Caspian Sea)</i>	6,050	5.5	2	0.5	1	← Caspian 5 Sea ops. →			11.5
<i>Helsinki - Lahore (via Taxiataash - Tehran - Kerman/Zahedan)</i>	9,610	14.5	4	0.5	2	2	1	2	18.5
<i>Helsinki - Lahore (via Nukuss - Tehran - Kerman/Zahedan)</i>	9,960	15	4	0.5	2	2	1	2	19
<i>Helsinki - Lahore (via Taxiataash - Mashad/Bafq - Kerman/Zahedan)</i>	8,610	13	4	0.5	2	2	1	2	17
<i>Helsinki - Lahore (via Nukuss - Mashad/Bafq - Kerman/Zahedan)</i>	8,960	13.5	4	0.5	2	2	1	2	17.5
<i>Helsinki - New Delhi (via Taxiataash - Tehran - Kerman/Zahedan)</i>	10,100	15	5	0.5	2.5	2	1	2	19.5
<i>Helsinki - New Delhi (via Nukuss - Tehran - Kerman/Zahedan)</i>	10,500	15.5	5	0.5	2.5	2	1	2	20
<i>Helsinki - New Delhi (via Taxiataash - Mashad/Bafq - Kerman/Zahedan)</i>	9,100	13.5	5	0.5	2.5	2	1	2	18
<i>Helsinki - New Delhi (via Nukuss - Mashad/Bafq - Kerman/Zahedan)</i>	9,500	14	5	0.5	2.5	2	1	2	18.5

Table 5.2 Estimates of land-cum-sea transit times from Helsinki to Tehran, Lahore, New Delhi and Bangkok (all figures in days unless otherwise indicated)

Route	Distance (km)	Rail mov't to Bandar Abbas	Border crossing and transshipment	Transship. in Bandar Abbas	Shipping time from Bandar Abbas to (1)	Transship. in (1)	Rail mov't to destination(2)	Overall Transit time
<i>Helsinki - Lahore (via Taxiataash - Tehran - Bandar Abbas)</i>	10,000	10.5	4	2	3	2	2.5	24
<i>Helsinki - Lahore (via Nukuss - Tehran - Bandar Abbas)</i>	10,354	11	3	2	3	2	2.5	23.5
<i>Helsinki - Lahore (via Taxiataash - Mashad/Bafq - Bandar Abbas)</i>	9,000	9	4	2	3	2	2.5	22.5
<i>Helsinki - Lahore (via Nukuss - Mashad/Bafq - Bandar Abbas)</i>	9,354	9.5	3	2	3	2	2.5	22
<i>Helsinki - New Delhi (via Taxiataash - Tehran - Bandar Abbas)</i>	11,100	10.5	4	2	6	2	2.5	27
<i>Helsinki - New Delhi (via Nukuss - Tehran - Bandar Abbas)</i>	11,440	11	3	2	6	2	2.5	26.5
<i>Helsinki - New Delhi (via Taxiataash - Mashad/Bafq - Bandar Abbas)</i>	10,100	9	4	2	6	2	2.5	25.5
<i>Helsinki - New Delhi (via Nukuss - Mashad/Bafq - Bandar Abbas)</i>	10,440	9.5	3	2	6	2	2.5	25
<i>Helsinki - Bangkok (via Taxiataash - Tehran - Bandar Abbas)</i>	15,440	10.5	4	2	14	2	2.5	35
<i>Helsinki - Bangkok (via Nukuss - Tehran - Bandar Abbas)</i>	15,800	11	3	2	14	2	2.5	34.5
<i>Helsinki - Bangkok (via Taxiataash - Mashad/Bafq - Bandar Abbas)</i>	14,440	9	4	2	14	2	2.5	33.5
<i>Helsinki - Bangkok (via Nukuss - Mashad/Bafq - Bandar Abbas)</i>	14,800	9.5	3	2	14	2	2.5	33

(1) Karachi, Mumbai or Port Kelang

(2) Karachi-Lahore , Mumbai-New Delhi or Port Kelang - Bangkok

In summary the following comparative picture emerges for transit times by sea or by either rail, or sea-cum-rail for movements between Northern Europe and the Persian Gulf with onward connections to South and South-East Asia:

<b>Helsinki to:</b>	<b>Sea <sup>(1)</sup></b>	<b>Rail <sup>(2)</sup></b>	<b>Land-cum-sea <sup>(3)</sup></b>
<b>Tehran</b>	33.2 days	11.5 to 12 days	33.2 days
<b>Lahore</b>	41.5 days	17 to 18.5 days	22 to 24 days
<b>New Delhi</b>	32.1 days	18 to 20 days	25 to 27 days
<b>Bangkok</b>	31.5 days	Not applicable	33 to 35 days

- (1) *With direct sea movements from Helsinki to Bandar Abbas, Karachi, Mumbai or Port Kelang;*  
(2) *Considering the only currently operational route through Central Asia;*  
(3) *All-rail to Bandar Abbas along currently operational route through Central Asia followed by sea transport from Bandar Abbas to Karachi, Mumbai or Port Kelang and rail journey from these ports to final destination.*

The above estimates show a distinct transit time advantage for rail over shipping, reflecting the actual differences in distances as noted in Chapter 2 (point 2.8). However, at this point in time, caution must be exercised in the interpretation of these figures calculated on a series of optimistic assumptions. For example, as regards shipping, the 2-day dwell time in ports used in the calculation may be shorter than is actually the case. As regards rail, the times indicated consider unimpeded movements between countries, especially between the Islamic Republic of Iran and Pakistan, and between Pakistan and India. Meanwhile, land-cum-sea transit times suffer from the absence of regular, direct services from Bandar Abbas to ports in South and South-East Asia. While there is no doubt that the rail and land-cum-sea options are likely to offer attractive transit times in future, much will have to be done to capitalize on this advantage in the fields of tariffs (point 5.3), services (point 5.4 and 5.5) and facilitation (Chapter 6).

### 5.3 Tariffs

At this point in time, very little traffic actually moves through the routes in the corridor. As previously indicated (Chapter 2, point 2.5), there is reason to doubt the current operational readiness of the Caucasus Route. Meanwhile, as regards the Central Asian Route, little traffic is currently being moved through the break-of-gauge point at Sarakhs (for the year 1998 an estimated 256,000 tonnes went through Sarakhs<sup>3</sup>). Finally, as regards the Caspian Sea Route, the ports of Astrakhan and Olya are reportedly used mainly for exports from the Russian Federation to the Islamic Republic of Iran with most of the cargo coming from other regions of the Russian Federation than the ones directly along the corridor. Consequently, juxtaposing existing rail tariffs applied by the railways in the corridor to ocean rates is too imprecise to be of any significance. This section, therefore, concentrates on outlining the principles of modern tariffing that the railways concerned may consider following, if they are to attract shippers to the corridor.

As indicated above, freight rates weigh for as much as 38% in shippers' choice of carrier. Understanding the principle of modern railway pricing is therefore essential if the railways in the corridor are to position themselves adequately in respect with competition

<sup>3</sup> Country Report for the Islamic Republic of Iran.

while being able to cover costs and maximise the net revenue earned for each individual shipment.

In many instances, the railways freight tariffs are those devised in a monopoly-era or in an era where the railways were not subjected to competitive forces similar to the ones that they are facing now. Consequently, the related rate-making procedures applied, and to a large extent still apply, very often to groups of commodities for which single freight rates are set in relation to the length of haul. Such systems do not have the flexibility needed to quickly adjust to the competitive nature of the container business environment.

The application of a modern railway pricing mechanism to the corridor services must take into account the following elements:

- railway's revenue needs,
- analysis of a shipment's point-to-point characteristics,
- assessment of the value of the package put together by the railways, i.e. equipment, facilities, ancillary services, etc, within the shipper's total distribution system,
- package on offer by competing modes,
- railway's costs of providing the service,
- package on offer by competing modes,
- railway's costs of providing the service,
- need to finance replacement of the equipment.

In practice, the pricing department of a railway would first arrange for the shipment's variable costs to be calculated given the specifics of route, wagon type, turnaround times, terminal and main line train operation. In a second step the shipper's needs and the competitive environment would be analysed and a negotiation strategy would be developed. Then, negotiations would take place and the rate would be fixed. The difference between the rate and the calculated variable costs, i.e. the contribution, constitutes the amount that the specific shipment "contributes" to railway overhead costs. It is this net amount that should be maximised.

Two types of problems are imposed by the existing tariff-setting systems: institutional and methodological. Institutional problems are those which adversely affect the relationship between the railway systems and their customers in matters of tariff negotiation, while methodological problems impair the ability of the railway systems to be competitive in terms of price.

### ***5.3.1 Outline of tariff setting methods applied by railways in the corridor***

Most of the railway systems operating in the corridor are members of the Organization for Railways Cooperation, or OSJD<sup>4</sup>, which has provided a forum through which its members can harmonize their approaches to tariff setting. In practice, however, it

---

<sup>4</sup> Abbreviation for the name of the organization in Russian language. OSJD member countries in the corridor are Azerbaijan, the Democratic People's Republic of Korea, the Islamic Republic of Iran, Kazakhstan, the Russian Federation, Turkmenistan and Uzbekistan. Finland, meanwhile, has observer status.

has not fully operated in this way since an '*additive tariff*' concept, whereby individual railway systems apply their own tariff portions to the traffic moving in the corridor, has most often been the norm with these tariff portions being loosely based on "common" transit tariff rates applied to the system's share of the through haulage distance. In reality, therefore, there is no through transit tariff, as such.

Such a fragmented and additive approach to tariff application usually encourages individual railway systems to maximize their revenue from international traffic opportunities, irrespective of whether the resulting tariff rates are competitive with those of competing modes, e.g. shipping lines.

Most OSJD railways use two tariff scales:

- the ETT<sup>5</sup> tariff, which is intended to be applied to rail freight traffic between two OSJD member countries, which must transit through the territory of a third, or more, member countries; and
- the MTT<sup>7</sup> tariff, which is intended to be applied to rail freight traffic between two OSJD member countries, but which is not required to transit through the territory of any other member country.

It is understood that the two tariffs have overlapping areas in their respective sphere of application and that they were not established in the first place with due attention given to cost recovery. With this in mind, and also the fact that the intersection of rates of both scales were raising problems in the choice of scale to apply to specific traffic, OSJD has been taking actions since 1997 to bring both scales closer together.

In practical terms, member countries of OSJD have the possibility to apply discretionary discounted rates either individually, or collectively, in order to be competitive on some routes or traffic segments, as illustrated by the special transit rate applied to traffic along the Trans-Siberian line. Such practices tend to indicate that the OSJD tariff constitutes a maximum – or ceiling – charge from which individual members may discount their own charges. In this regard, new tariff alliances among OSJD members may also indicate that the OSJD tariff system may gradually be fading out.

One example of this trend is the establishment of a tariff policy specific to the CIS states. The policy is determined annually and is applicable from 1 January to 31 December. However, given that the policy is determined with the ETT and MTT systems as reference, the resulting tariff may not differ significantly from that of OSJD, in the sense that both are uninfluenced by the level of the charges of competitive transport modes and both fix ceiling rates from which the charges of individual members can be established through discounting. Special coefficients to the standard rates are also sometimes applied to take into consideration such elements as the type of freight or the type of rolling-stock, etc. One specific example of such a tariff practice is in relation to traffic between the Russian Federation and the Islamic Republic of Iran through the Port of Astrakhan.

Finally, although the idea of through tariff for international movements relating to some specific types of traffic still has to be accepted by many countries, there is a growing

---

<sup>5</sup> Abbreviation from the Russian title.

trend in some other countries that such tariff practices are being put in place. Such a trend is noticeable, for example, on Kazakhstan Railways, Mongolian Railways as well as Russian Railways. However, the indication is that such through tariffs are determined as the average of national tariffs as well as tariff distances on each individual railway, while the primary determinant of railway tariff levels in a competitive environment should be the level of charges of competitors. Such an approach was used by the concerned railways for pricing the “Ostwind” container service between Berlin and Moscow.

### **5.3.2 Modern approach to tariff setting**

While it is common practice for shipping lines to tie the offer of a competitive ocean freight rate to a contractual commitment by a customer of a minimum annual volume of traffic to the services of the shipping line, such practice does not appear to be common to all railways in the corridor, which will offer discounts without any such minimum traffic commitment. Their ability to offer attractive volume discounts to customers would be enhanced if they had an awareness of the cost impacts of attracting committed minimum volumes of traffic. In practice, the greater the volume of committed traffic the greater the contribution to fixed costs and overheads for a given tariff rate (net of discounts).

In the case of railways there are numerous options for structuring tariffs, so as to maximize committed volume. Offers of heavily discounted trainload and wagonload rates are examples of these options, as are offers of incentive rates for directionally balanced loading.

Several options exist to approach tariff setting for container movements in the corridor. These options, which are linked to the degree of freedom of commercial management by the railways, are outlined hereafter. These options for incentive-based tariff alternatives are:

- (i) the selling of train space to customers in exchange for a *trainload tariff*,
- (ii) the selling of wagon space to customers in exchange for a *wagonload tariff*,
- (iii) the selling of container slot space to customers in exchange for a *casual box rate*, and
- (iv) the selling of train paths to external operators in exchange of a *track access charge*.

#### ***Trainload tariff incentives***

Trainload tariffs would be offered to international freight forwarders or shippers who could guarantee sufficient container volume to be able to fill a train on a regular basis. Such forwarders are likely to be able to generate sufficient volume to justify their investment in wagons, and (in some cases) even locomotives.

#### ***Wagonload tariff incentives***

Tariff incentives to encourage loading of individual wagons would be offered to forwarders or shippers who could not generate sufficient container volume to be able to fill trains, but could at least fill one wagon (i.e. 2 or 3 TEU) operating in each direction per day.

### ***Casual box rate***

Casual box rates would be applied to customers who are unable to commit sufficient container volume to qualify either for trainload or wagonload rates. Since the objective of the participating railway systems should be to encourage high volume usage of the available line and train capacity, casual box rates should not be subject to discounting.

### ***Track access agreements and charges***

While the above described tariff approaches would involve continuing operation of services in the corridor by the established railway systems, under the track access system, external operators would be given rights, in exchange for the payment of track access charges, to operate trains on the route infrastructure owned by the established railway systems in the corridor. The systems would retain ownership, and continue to be responsible for maintenance, of all railway route infrastructure, including track, signalling, bridges, terminals and stations.

The charges paid by external operators to the established railway systems should be sufficient to encourage adequate on-going maintenance of the infrastructure, as well as the commitment of investment funds for the replacement of life-expired infrastructure assets.

The principle underlying the construction of track access charges is that they should be comprised of two components:

- a fixed charge component, to cover the cost of investment<sup>6</sup> in railway infrastructure, with reasonable allowance for a rate of return on this investment – the latter intended to provide an incentive for reinvestment to replace life-expired assets; and
- a variable charge component, to cover that portion of route infrastructure maintenance cost which is directly attributable to the loads imposed by trains operating under track access agreements. The principal advantage of allowing external operators to provide train services in the corridor is that through services could be provided by a single operator, who would at the same time establish tariffs, collect haulage revenue, operate terminals, and provide train crews, locomotives and wagons.

The level of this charge and of its components may be varied in order to produce the desired response from new operators. If the level of the fixed charge is set at too high a level, it will provide a disincentive for the operators of short, light and relatively fast freight trains to enter into track access agreements. Conversely, if the variable charge is set at too high a level, it will discourage the operators of heavy, slow trains from entering into track access agreements.

---

<sup>6</sup> This cost is related solely to the incremental investment required to support the traffic covered by the track access agreement.

If the objective of the system owning the infrastructure is to maximize the use of this infrastructure by relatively large numbers of short, light trains, in order to reduce heavy wear and tear on the track, then it will set fixed charges low and variable charges high. If, on the other hand, the owning system's objective is make best use of the available line capacity, it will encourage operation of long and heavy trains, by setting fixed charges high and variable charges low, but in so doing it will bear the burden of the associated increased track maintenance cost.

The principal *advantage* of allowing external operators to provide train services in the corridor is that through services could be provided by a single operator, who would at the same time establish tariffs, collect haulage revenue, operate terminals, and provide train crews, locomotives and wagons. In this way, the fragmented approach to service delivery and pricing would be eliminated, the established railway operators would be freed from the obligation to fund investment in locomotives and rolling stock and could instead channel funds into improved maintenance and rehabilitation of infrastructure, and rail would be able to compete more effectively with shipping operators for transit container traffic in the corridor.

The main *disadvantage* of the track access option is that it would eliminate integrated control over the provision, maintenance and use of infrastructure, and efficiency in each of these activities would then depend critically on the pricing mechanism governing track access. In addition, the option could not work effectively unless *all* railway systems in any given corridor implemented track access agreements and charges – otherwise external operators would not be able to contract with customers for through transportation in the corridor.

In summary, so far as the definition and pricing of future corridor services are concerned, the application of the above principles would appear to be at its most efficient through a joint unit that would ensure consistency of methodology. Short of this approach, shippers may see international rail transport as a disjointed series of country entities, each with their own policies, operating procedures, union agreements, purchasing agreements, etc, which seem to find it difficult to get on with one another. This, however, does not exclude flexibility in the way per-TEU rates are fixed as indeed each shipment should be priced on a point-to-point basis reflecting the actual routing, terminals and facilities used. In practical terms, this also means that different shippers or forwarders may pay different prices for similar services as set policies should reward volumes, premium services, performance contract with early booking, as well as the value of the service provided in the overall distribution cost of shippers. This last point is particularly important as it means that the entity(ies) responsible for marketing rail services in the corridor will have to be aware not only of the transport market but also of the market situation for the goods committed to their care.

In this respect, the ESCAP feasibility study of 1996 had suggested that a possible step to re-engineer tariff-setting practices in the railways concerned could be the creation of a jointly-run entity with full authority to develop and negotiate price/service packages on



behalf of all railway systems serving the corridor.<sup>7</sup> Such an approach would allow the creation of a single authority responsible for negotiating through rates with container customers, on behalf of the participating railway organizations. Currently, a coordinating role is played by international freight forwarders who will “assemble” a through rate by contacting individual railways. But these forwarders do not enjoy the convenience of a “one-stop shop” with railways as they do with shipping lines, and if they attempt to pass on their additional administrative costs to their customers, they risk reducing the competitiveness of rail relative to sea transport services.

#### 5.4 Reliability / Punctuality / Frequency of service

The pressure for continuous cost-reduction in industries and the development of modern management methods favouring limited stock and just-in-time deliveries makes it compelling for shippers to turn to transport operators with near-perfect records in terms of reliability, punctuality and frequency. A client of intermodal services in North-America once described the quality of a “*perfect shipment*” as being founded on four elements, three of which were time-related, i.e. “*one, the shipment on time; two, a stated delivery time; three, delivery without exception*”.

Performing railways, i.e. railways which deliver the goods *on-time, all of the time*, can offer significant benefits to shippers and freight forwarders such as:

- better utilisation of road based assets when rail is used for “trunking” as close as possible to the shippers’ and consignees’ premises,
- the ability for a shipper to be seen as more environmentally-friendly by making use of environmentally-friendly mode of transport,
- in theory more reliable pick-up and delivery services than are available on the increasingly congested highways of many countries,
- lower supply chain costs with high volume movements.

**Reliability** means that the services promised in a contractual agreement between two parties (e.g. shippers and freight forwarders, shippers/ freight forwarders and transport operators) are actually delivered as stipulated, i.e. at the right place, at the promised time on the promised day, in the expected conditions regarding the integrity of the goods.

**Punctuality** is that part of the reliability concept relating to time and means that the advertised schedule, i.e. day/hour of departure/arrival, is always adhered to.

**Frequency** means that the intervals between two consecutive services of a certain type are of a duration that meets a shipper’s production pace and matches his needs to evacuate production towards consuming centres without having to create stocks.

---

<sup>7</sup> United Nations ESCAP, « *Trans-Asian Railway Route Requirements : Feasibility Study on Connecting the Rail Networks of China, Kazakhstan, Mongolia, the Russian Federation and the Korean Peninsula* », 1996, Chapter 6, pp. 121-122.

Reliability and punctuality are important for shippers in terms of inventory and activity planning. Shippers have a strong interest in knowing (i) when the cargo will be reaching their premises and (ii) whether the announced date of delivery is reliable.

Point (i) is an essential input in the planning of the customer's own industrial activities while point (ii) will have repercussions on their operating costs. As a result, if all the elements in the transport chain are not properly organised and controlled, and delays result thereof in the delivery of the goods, customers stand to lose in two ways.

- if goods are late, they may be unable to meet their own deadlines and lose their own customers and in the process damage their credibility (e.g. spare parts, raw materials), a risk that is substantial for those industries implementing the just-in-time concept,
- at the same time they face soaring operating costs as they may have mobilised staff and equipment who will remain idle until the goods arrive.

The aim of moving cargo is very often to replenish stocks. This means that the absence of reliability will have at least two negative effects on a customer's business. Either the customer will adopt a conservative attitude leading to having a greater stock than he would otherwise contemplate to cover the risk of being out of stock; or he will indeed run out of stock and at the same time run the risk of losing competitiveness.

Frequency is important in the just-in-time concept aiming at reducing stock-keeping to a mere minimum. Transport operators must keep in mind that for a customer, stock keeping is unproductive and very costly in terms of:

- immobilised goods,
- additional resources required (warehouse, lifting equipment, staff, etc.)
- commercial risk linked to the fact that stocked products may become obsolete and result in the customer being unable to adapt quickly to qualitative changes in demand.

This induces in customers an attitude by which they are permanently searching to cut down on their operating costs by reducing stocks. One way is therefore to turn to what they perceive as the most reliable transport operators, i.e. one who will always abide by the announced delivery date and time. They will also turn to the operator(s) who will be able to replenish their stock at short notice, which means moving small quantities frequently.

## **5.5 Other aspects of service level**

### ***5.5.1 Security of cargo***

The conditions in which the main haul part of a transportation contract is carried out will have an impact on the customers' company image and that of their products. Wrong choices in the field of transport and logistics can also lead to missing or damaged goods and the best insurance that customers may subscribe to will only compensate direct financial consequences. Seldom will commercial prejudices and the loss of confidence in the customers by their own clients be compensated and these will have in the long term

unquantifiable pernicious effects on the customers' businesses. As a result, shippers will turn to transport operators who will be perceived as offering the best guarantee of *en-route* protection for their cargo.

While the use of containers and operation in block trains with minimum number of stops offers adequate guarantees against en-route damage, the railways still share with other modes of transport the concern over cargo protection against theft.

In that respect, while the use of containers also seem to offer adequate protection, extra vigilance is of the order if only because the sense of security offered by sealed containers may have lulled the attention of the authorities towards demobilisation. An attitude further encouraged by the need to be competitive by reducing overall door-to-door costs by cutting down on an element of cost which, when applied successfully, often leads to a perception that the expenses may not be necessary.

Yet, theft by organised crime against cargo is very much alive. Not so long ago, the National Cargo Security Council (of the US) figures indicated that US companies alone are losing more than US\$10 billion annually from cargo theft and, according to Pinkerton Consulting and Investigations, world-wide total losses could be as high as US\$30 to US\$50 billion each year.<sup>8</sup> While separate estimates for container-related crime are not available, it would be unreasonable to deny the potential threat against container traffic in view of the fact that (i) as traffic keeps developing it is bound to attract increasing attention by organised crime, (ii) the high value of containerised cargo (e.g., fashion merchandises, cosmetics, high-tech products, etc.) understandably increases temptation, and (iii) logistics chains are becoming more extended with ever more "soft-target" points. The problem for all concerned (shippers, freight forwarders and transport operators) is that while pilferage from conventional shipments is likely to lead to comparatively small losses in financial terms, the theft of a single containerload of high value products can be measured in hundreds of thousands of dollars. For example, a single 20ft container of computer hard drives can be worth US\$16 million.

The potential threat to cargo has an influence on the choice of transport modes by shippers (or their instructions to forwarders) and they will naturally inform themselves as to how goods will be handled, and who will handle and carry them throughout all the stages of a door-to-door logistics movement. Acknowledging the threat, shipper's traffic or logistics managers are increasingly selecting freight operators who are aware of the need to monitor all security requirements and have and can keep an unblotted record in this area.

In designing services, the railways in the corridor will have to take all measures to meet shippers' and forwarders' requirements in this area. The use of 20ft containers sealed with internationally-recognised devices and loaded door-to-door should offer adequate guarantee as long as the arrangements is acceptable to customs authorities. On some railways, container wagons are now designed with a device that allows access to the seal and partial opening of the door for checking by customs officers, while preventing full opening as a deterrent to theft. In addition, the operational pattern of the railways with stops at dedicated railway premises with usually a lot of staff around, makes it difficult for trespassers to venture onto railway premises without attracting attention. During main-line operation, running containers in block-trains and giving high operating priority to container block trains

---

<sup>8</sup> Containerisation International, « Crimewave », March 1999.

reduce the number of stops and consequently limit the risk of en-route pilferage. The presence of security guards on board trains carrying high value cargo is sometimes an additional measure adopted by some railways.

### 5.5.2 Information to customers

In the field of long-distance transportation, the main area of recent development has been brought about by the customers' requirement for more detailed information accessible at will at the push of a button. Access to information is seen as essential by shippers who need to mobilise resources, plan their activities and adapt themselves quickly to changing patterns in demand, sometimes requiring a re-routing of cargo already under way.

Arguably, the need for information has always been there, but the time spent to collect and transmit it have been considerably reduced and have become independent of distances between origin and destination. At the same time the development of modern technology is allowing shippers *free-of-charge* and *direct* access *at all times* to information which they feel is rightfully theirs. While in the past shippers were virtually "dispossessed" of their goods during transportation, they now can and want to claim ownership at any time between origin and destination. The product development director of a forwarder described the attitude of shippers logistics saying that *"what has happened is that especially during the past two or three years our customers want to become more involved in being informed as to what is happening in all phases of the transport chains of their goods, and this process is accelerating [...] they want to know what we are doing, and why, and how it will affect what happens to their products [...] shippers expect us to plan movements to conform to their transit times requirements, within their cost parameters. They want us to feed this information to them constantly, so that they can input the data into their production programmes"*.<sup>9</sup>

At the same time, shippers no longer accept to waste time and money filling, signing and sending papers through mail or fax when Information Technology (IT) in the transport sector is making paperless trading a reality.

A group of transportation industry experts has shown that paper costs of carrier pricing, booking requests, booking confirmations, bill of lading preparation and distribution, export declaration preparation and filing, and freight arrival notice dispatch can come to US\$ 150 per shipment. However, portions of that cost can be cut by up to 80% with the right technical solution. Tightly-integrated e-commerce can reduce these carrier expenditures to under US\$ 15. For the ocean shipping industry, that would translate into savings of US\$ 2 billion a year.<sup>10</sup>

In the field of IT, it is again important to benchmark the distance covered by the shipping industry as well as to listen to customers' wishes either expressed directly or through forwarders/logistics providers.

When it comes to electronic communications, few industries have matched the pace at which ocean carriers have embraced Electronic Data Interchange (EDI) to exchange

---

<sup>9</sup> Containerisation International, « Integrated forwarding arrives », October 1999.

<sup>10</sup> Containerisation International, « Getting satisfaction from EDI », June 1999.

information internationally. Ships manifests and bay plans or stowage plans, for example, have been electronically transmitted around the world for over 20 years. Because successful EDI remains transparent it is easy to forget that, when ships arrive for discharge, behind the scenes, a complete manifest from all overseas loading ports has beforehand been lodged with customs. In terms of operation, as container ships have increased in size to the mega 6000 TEU ocean carriers of today, so has the problem of identifying cargo on board. Without the modern electronic bay plan, which pinpoints the location of every container on board a vessel at the press of a button, container terminal operators would not know where to begin cargo operations.

Although operational problems of tracking containers on trains will never be as daunting, the problem is already bigger at terminals and the need of reliable EDI is of paramount importance for advanced communication to customs authorities of the required data so as to facilitate border-crossing. On a commercial level, the implementation of IT is needed if only because shippers will view with the greatest suspicion transport operators who do not implement IT as a matter of fact. More and more transportation companies are finding that they have no choice but to offer shippers information about shipments, schedules and rates on demand. That requires implementing an integrated "Electronic commerce" solution for each and every shipper enabling them to reduce their process steps.

In the field of freight transport, freight forwarders/logistics providers, who increasingly are the entities selecting carriers on behalf of shippers, are increasingly pushing for IT implementation as they themselves depend for their business on being seen as "1000% IT-fit"<sup>11</sup> (see box). The end result for the railways concerned is that attracting business to the corridor implies becoming more and more part of global supply chains with the related requirement to provide the best electronic product as possible with two important basic features, namely: cargo booking capabilities and cargo tracking facilities.

The conclusion is that the shippers' working processes have become so dependent on IT that they have set a trend in the transportation industry that no transport operator hoping to attract traffic can ignore. No shipper will want to revert to pencil, paper, fax machines and clerical staff to have access to information that they expect to find at the tip of their fingers.

### **30 European shippers and their position as regards IT**

1. Are your cargo booking staff connected to the internet?  
Yes 61% - No 39%
2. If you are not communicating electronically with ocean carriers because you are not ready for it, when do you expect to be so?  
This year 20% - Next year 60% -  
After 2001 20%
3. Apart from the ocean carrier's electronic documentation facilities, and assuming that you have internet connection, are you interested in using their Websites for the following services:  
- Container track and trace information : Yes 61% - No 39%  
- Up to date schedule information :  
Yes 62% - No 38%

**Source : Containerisation International, « Who is pushing IT ? », July 1999**

<sup>11</sup> Containerisation International, « Global shippers want the earth », April 1998.

The railways in the corridor will therefore only compete if they too can be seen as “1000% IT-fit”.

Ocean carriers have already taken initial steps to put on line their transaction process as illustrated hereafter:

**Ocean carriers’ website transaction capabilities**

Carrier	Container / Cargo Tracking	Voyage / Schedule Locator	Rate Quote	Booking	Bill of Lading	Custom Reports
Maersk	X	X	X	X	X	
Evergreen	X	X	X	X	X	
APL	X	X	X	X	X	X
COSCO	X	X	X			
OOCL	X	X	X	X	X	
Hanjin	X	X		X	X	

*Source: Containerisation International, “E-Commerce – Taking stock”, November 2000*

For the railways concerned, this development means that there is a need to develop quickly an awareness of the importance placed on IT by shippers as well as their needs and see how their IT systems meet those needs. While the adaptation of existing systems should be studied, the history of grafting ‘old’ systems onto new ones is not a happy one. Adaptation are often lengthy, costly and without the guarantee that the final product will deliver all the information needed. More specifically, the cost of adaptation should be compared with the low cost of buying computers and setting-up internet sites.

It is important to identify the parties involved in the transportation process and identify their needs. The IT system will typically function at four levels, namely:

- public level (shippers, consignees, etc.)
- freight forwarders,
- railways along each route,
- public administrations other than railways.

All of these parties will have different needs.

The *shipper* will want to access information to:

- control the service (direct info to monitor routing, reliability and timeliness, security, etc.);

- be informed of incidents/delays so as to be able to take internal remedial measures (e.g. modification to production planning, rerouting of other consignments, etc.);
- change routing/destination orders to the freight forwarder/operator; flexibility for internal reasons; one or more bill of lading;
- be able to influence later decisions by freight forwarder;
- give direct orders to freight forwarders or transport operators by EDI messages.

The ***freight forwarder*** will want to access information to:

- control the service (direct info to monitor routing, reliability and timeliness, security, etc.);
- be informed of incidents/delays so as to be able to take internal remedial measures (e.g. modification to production planning, rerouting of other consignments, etc.);
- change routing/destination orders to the freight forwarder/operator; flexibility for internal reasons; one or more bill of lading; email or EDI message;
- put pressure on transport operator(s) based on information at disposal for spot problems (e.g. one bill of lading seen not moving) or bottlenecks (several bill of lading delayed over a long period);
- plan future shipments on the basis of actual performances and events monitored;
- place EDI orders to transport operator(s), customs, border police, etc.

The ***railways*** will make use of IT to:

- boost internal operations to make them more efficient and to make them more predictable;
- provide information on actual position of cargo/technical status/events/problems along its part of the corridor, with required level of confidentiality for each freight forwarder or shipper;
- exchange information with other railways / other administrations, especially with regards to border-crossing movements (e.g. wagon interchange including technical visits, bill of lading "interchange" to facilitate border control operations, advance "notice" to facilitate operations planning (train consists, etc.);
- control the movements of its assets outside its the borders of its national rail system (i.e. wagons, locomotives, etc.) for better fleet planning (e.g. wagon distribution);
- keep accurate statistics on commercial / financial aspects of services (volumes per shippers/freight forwarder, full vs. Empty TEUs, tonnages, etc.);
- keep accurate records of operational performances to review and upgrade services (punctuality, cause and location of delays, etc.)

Finally, *other public administrations* will want IT to:

- have early notification of cargo to prepare their work and make checkings more efficient by being more focussed;
- have early notification of cargo to have greater flexibility in the planning of staff utilisation;
- keep easy and accurate data on cargo by type, quantity and origin/destination.

From an organisational point of view the definition of IT requirements will necessitate (i) a thorough and detailed analysis of the documents needed by each of the above interested party so far as their format and the nature of the required information is concerned, (ii) the flow of information needed between two or more of the interested parties and (iii) the deadline for transmitting the information.

## 5.6 General conclusion

Having discussed the elements considered by shippers in their choice of a transport mode, stress should be put on one crucial aspect that the railways will wish to keep in mind when setting their own performance criteria, namely: the overcapacity in the shipping world. In a recent report, the Korea Maritime Institute estimated that in the Europe-Asia trade in 2000, the utilization ratio of the container slots on offer was around 55.1.

This situation puts increased pressure on the railways who want to successfully compete in the international container market to get things organised efficiently and successfully right from the very beginning. Shippers are only too aware of this overcapacity problem and are set to take advantage of it by pushing for more services at always lower rates. In 1998, the Managing Director of forwarding at Philips International put the size of his company's logistics function into impressive perspective. « *When you are spending US\$4 billion per year, you are careful. [...] Global door-to-door networks, lower costs, better service, faster transit times, higher frequencies and improved reliability is what we seek* » Deregulation, transparent door-to-door costing based on one-party contact, shared efficiencies with sound partners, pipeline visibility with no uncertainties, rapid advice on schedule changes, performance measurement to ensure service-level compliance, fewer suppliers offering more, simpler transport instructions and enhanced IT were also on his wish list.<sup>1</sup>

\*      \*

\*

---

<sup>1</sup> Containerisation International, « Global shippers want the earth », April 1998, p.59.





## **- Chapter 6 -**

### **Facilitation of Cross-border Movements of Cargo**

---

Undeniably, the standards to which transport infrastructure is designed and maintained will have an important bearing on the efficiency of transportation and the pertinence of the services offered by the railways in relation to shippers' requirements will be essential to securing adequate container volumes to generate sufficient return on investment.

Yet, another feature of international transport that can be an obstacle to the efficiency of international trade are customs and other procedures at border points. Every international movement involves at least two customs interventions: one at export and one at import points. It is clear, therefore, that the manner in which the relevant authorities conduct their business has a substantial impact on the movement of goods across borders. In addition, at border points into and out of countries transited by movements, the very transit nature of the movements seems lost on local authorities and checks are still the norm.

The reform and streamlining of frontier formalities is generally less costly than investment in infrastructure, although public money may be required to increase resources and develop administrative facilities. However, failure to secure the necessary political commitment and financial resources to reform may severely reduce the benefits of investments in infrastructure.

Administrative rules governing border crossing traffic can operate at three different levels. At the top level, neighbouring countries can be signatories to multilateral agreements and international conventions which guarantee observance of standard procedures for customs clearance and movement of freight consignments across borders. At the middle level, these procedures can be embodied in bilateral agreements between neighbouring governments. Finally, at the level of individual railway organizations, there can be arrangements between neighbouring railways for their joint operation of border stations and associated facilities, for the exchange of rolling stock, and for the sharing of costs, revenues and liabilities associated with border crossing rail vehicles and freight consignments. It is essential that neighbouring countries operate at each of these levels while ensuring that agreements concluded at each level work to support the operation of agreements concluded at every other level.

#### **6.1 International transit agreements and conventions**

##### **6.1.1 Work of ESCAP**

Since 1992, ESCAP has had an active role in demonstrating the benefits of accession by the countries of the region to seven international transit conventions. The main vehicle for ESCAP in this role is Resolution 48/11 of the 48th Commission Session held in Beijing in

April 1992. The seven international conventions covered by Resolution 48/11 are listed in Annex 1, which also indicates the status of each country with respect to accession.

Of the seven conventions, two are of particular relevance to rail transit. These are the Customs Convention on Containers (1972) and the International Convention on the Harmonization of Frontier Control of Goods (1982). Both of these conventions are of great potential benefit to signatory nations, since they codify rules for rapid customs inspection of containers at land borders. The principal feature of these rules is that they confine border customs formalities to a quick inspection of container seals and of documentation (only for the purpose of establishing that they are intact and complete). If adopted and put into effect by the countries of the region, they are likely to result in a marked reduction in border crossing delays and dwell time, which can only serve to benefit rail freight customers.

Of the eight countries in the North-South corridor, as of 5 February 2001, only Finland, the Russian Federation and Uzbekistan had acceded to the Customs Convention on Containers. The International Convention on the Harmonization of Frontier Control of Goods scores a higher rate of accession but, at this point in time, the Islamic Republic of Iran has not yet acceded despite the prominent role of the country in the transit of goods. Turkmenistan has also not acceded. The advantages and requirements under both conventions are briefly outlined hereafter.

#### ***- Customs Convention on Containers, 1972***

##### **(a) Advantages of the temporary importation regime**

###### **(i) Advantages for customs authorities and the national economy**

Customs authorities can avoid the organization of national documentary systems, if they so wish, and the administration of national guarantee systems. However, Customs authorities retain the right, under certain circumstances, to require the furnishing of a form of security and/or the production of Customs documents. In case control measures are to be carried out, Customs authorities can request to check the records kept by container operators or their representatives in the country as regards all container movements. Thus, the Convention provides customs authorities with a flexible instrument to reduce administrative work while at the same time, safeguarding customs control.

###### **(ii) Advantages for the transport industry**

The temporary importation facilities for containers allow the importation of containers into a country without payment or the deposit of duties and taxes and, in principle, without the production of customs documents. As the Convention also provides for the possibility to use temporarily imported containers at least once for internal traffic before re-exportation, container transport operators not only can avoid the deposit of large sums of security upon importation and avoid delays in border crossing procedures, but can also react in a flexible manner to emerging transport needs.

##### **(b) Requirements and obligations under the Convention**

The Customs Convention on Containers requires that containers admitted temporarily into the territory of one of the Contracting Parties must be re-exported within three months –

this period can be extended – and in an unaltered state and cannot be substituted by another or similar container.

The Convention also imposes restrictions as to the use of temporarily imported containers in internal traffic. It is required that the journey in a country of temporary importation shall bring the container by a reasonably direct route to, or nearer to, the place where export cargo is to be loaded or from where the container is to be exported empty. It is also required that the container is used only once in internal traffic before being re-exported.

### (c) Implementation of the Convention

In order to set up and ensure the operation of the temporary importation facilities provided for in the Convention, the following tasks (basic requirements only) have to be carried out by Government authorities and the private sector:

#### (i) Responsibility of the government

- Acceptance of the Convention in accordance with national legal procedures (i.e. publication in the national public law journal) and modification, if need be, of national laws, regulations and administrative instructions in line with the provisions of the Convention;
- Deposit of an instrument of accession at the Legal Office of the United Nations in New York (depository), as per Article 18 of the Convention;
- Training of Customs officials in the operation of the temporary importation procedures.

#### (ii) Responsibility of the transport operator

- Containers need to be marked in line with Annex 1 of the Convention;
- Compliance with the time frame for temporary importation, as per Article 4 of the Convention;
- Compliance with imposed restrictions relating to use in internal traffic, as per Article 9 and Annex 3 of the Convention;
- Keeping detailed records, for submittal if requested, of the movements of each individual container in the country of temporary importation and appointing a national representative, as per Article 7 and Annex 2 of the Convention.

### ***- International Convention on the Harmonization of Frontier Control of Goods (1982)***

#### (a) Advantages of the harmonization of border controls

##### (i) Advantages for border control authorities and the national economy

The harmonization of border controls at the national level facilitates the control procedures for goods upon import, export and in transit and can thus contribute to a better use

of scarce manpower and technical resources at border stations. The Convention provides a framework for national authorities to cooperate among themselves towards this end. The Convention also calls on Governments to provide sufficient and qualified personnel as well as adequate equipment and infrastructure to improve administrative and control procedures at border stations.

The Convention also recommends basic principles to align border crossing procedures among neighbouring countries and adjacent border crossing points. The Convention thus provides the basis for the conclusion of bilateral agreements on concrete measures. These measures can contribute to a better flow of goods in international transport to the benefit of the national economy.

#### (ii) Advantages for the transport industry

Any improved cooperation among the various national border control services as well as improved coordination of border crossing procedures at adjacent border crossing points will speed up the crossing of frontiers by transport vehicles and will reduce waiting time due to nonaligned opening hours.

Apart from Customs procedures, a number of other regulations falling within the competence of various national administrations are emerging more and more often. Examples of such regulations are: medico-sanitary, veterinary, phytosanitary inspections, controls of compliance with technical standards and quality controls in general. The cooperation of the various control and inspection services involved and the abolition of not essential procedures, particularly for transit traffic, could facilitate international transport considerably.

#### (b) Requirements and obligations under the Convention

The Convention aims at a reduction in the requirements for completing formalities and a reduction in the number and duration of all types of controls, be it for health reasons or for quality inspections, and applies to all goods being imported, exported or in transit.

In substance, the Convention covers the following control services at border crossing points:

- Customs procedures and other controls,
- Medico-sanitary inspection
- Veterinary inspection,
- Phytosanitary inspection,
- Control of compliance with technical standards,
- Quality control measures.

### (c) Implementation of the Convention

In order to set up the cooperative facilities provided for in the Convention in a country and to ensure its operation, the following tasks (basic requirements only) have to be carried out by government authorities:

- Acceptance of the Convention in accordance with national legal procedures (i.e. publication in the national public law journal) and modification, if need be, of national laws, regulations and administrative instructions in line with the provisions of the Convention;
- Deposit of an instrument of accession at the Legal Office of the United Nations in New York (depository), as per Article 16 of the Convention;
- Training of officials at border stations to streamline import, export and transit procedures;
- Establishment of coordinated procedures, at the national and international level, covering all relevant border control authorities (customs, veterinary, phytosanitary, etc. controls), as per Articles 4, 6 and 7 of the Convention;
- Provision of adequate resources at border crossing stations, in accordance with Article 5 of the Convention;
- Provision of relevant information to other Contracting Parties, on their request, as per Article 8 of the Convention.

Related to the issue of international transit conventions and agreements are the workshops on land transport facilitation being conducted by ESCAP at the subregional and national level. Flowing from these workshops is a key resolution for the participating countries to establish National Transport Facilitation Committees, on which the railway, highways, customs, and border control agencies as well as the major trade/shipping associations of the country are represented. The primary objective of these committees will be to liaise with governments concerning any desired legislative changes in relation to land transport facilitation.

### **6.1.2 Work of the Organization of Economic Cooperation**

With at least five countries in the corridor being members of Organization of Economic Cooperation<sup>1</sup> (ECO), it is worth mentioning the work of the organization in relation with transport issues as it too can provide leverage to promote transport facilitation. Right at the time of its foundation, ECO has listed transport and communications as a top priority on its agenda and has reflected the importance of unimpeded border-crossing in its “Outline Plan of Action for the Development of Transport in the ECO Region” adopted during the meeting of Ministers of ECO countries held in Almaty in October 1993. Among others, the Plan contains the following actions:

---

<sup>1</sup> Azerbaijan, Islamic Republic of Iran, Kazakhstan, Turkmenistan, Uzbekistan. It must be noted that Pakistan is also a member.

- to conclude bilateral or multilateral agreements within or beyond the region that may be necessary to facilitate transport;
- to study border-crossing and related customs problems with the objective of bringing the border points in conformity with expected traffic density;
- to consider the possibility of acceding to international conventions on road and rail transport modes in relation to facilitation measures and to complete the preparation and signing of a bilateral inter-governmental agreements on international transportation of goods and passengers;
- to prepare and sign multilateral conventions on transi regulations and create a common system of customs procedures in the region in accordance with international laws and conventions;
- to bring about a comprehensive trade and transport regulatory framework for an efficient regime of multimodal transport in the region.

Furthermore, during the ECO summit of 1995 in Islamabad, the organization decided to make 1995-2004 the “Transport and Telecommunications Decade for the ECO Region” with the Almaty Outline Plan as the policy document, and during the ECO extraordinary meeting in Ashgabat in May 1997 certain rail and road routes were designated as priority routes for future development as indicated in the declaration of the meeting. Among the rail routes, were the Kerman - Zahedan and Bafq - Mashad line sections currently under construction and also the Eralievo – Turkmenbashy – Kazandjik - Bandar-E-Torkman line sections whose completion would have significant implications for the routes in the corridor.

## 6.2 Transit facilitation

Facilitation measures in relation to cross-border movements are important to all countries but take on a particular significance for landlocked countries of which there are five in the corridor, namely: Armenia, Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan.

Two important conventions, namely: the *Convention on Statute on Freedom of Transit* of 1921, known as the Barcelona transit convention, and the *Convention on Transit Trade of Land-locked States* of 1965, known as the New York transit convention. These conventions were developed keeping in view the geographical handicaps of landlocked countries and establish their right to have free access to the sea to “*enjoy the freedom of the seas on equal terms with coastal states*”.<sup>2</sup>

However, at this point in time, only Finland has acceded to both conventions. None of the Central Asian countries have acceded to either of the conventions, the Islamic Republic of Iran has only acceded to the Barcelona convention while the Russian Federation is a party only to the New York convention.

---

<sup>2</sup> Preamble to the *Convention on Transit Trade of Land-locked States* – New York – 8 July 1965.

### 6.3 International rail transit agreements

Many countries in Europe and some in Asia (for example, the Islamic Republic of Iran) are parties to the *Convention Concerning the International Transport of Goods by Rail (COTIF)*, Berne 1980, which replaces the traditional national customs document with the International Consignment Note (*CIM*) established under COTIF. The COTIF Convention is valid in most European countries, as well as in the states of the Middle East and Africa, which are connected with the European railway network via rail or via ferry. The Islamic Republic of Iran is also a party to the COTIF Convention.

Meanwhile, the member countries of the Organization for Railways Cooperation (*OSJD*), including among others, countries in the Caucasus and Central Asian regions as well as the Russian Federation, have developed and are using the system known as the *Agreement on International Railway Freight Communications (SGMS)* for the same purpose.

At border points separating neighbouring railway organizations which are signatory to either of the above convention or agreement, the waybill are rewritten from one format to the other. Recognizing the impact of this situation on the efficiency of international movements by rail, both organizations are seeking ways to harmonize the existing procedures. In this respect, it is interesting to note that the Russian Federation has spearheaded efforts to define a new transit document, the so-called GPBRT bill of lading, relating to the operation of container block-trains between Germany and the Russian Federation through Belarus and Poland under the ‘Ostwind’ container services running between Berlin and Moscow.

### 6.4 International agreements and conventions

It is understood that bilateral (sometimes multilateral) agreements govern transit by road and/or rail vehicles at the borders and border stations between countries in the corridor.

Although the limited resources allocated to the study did not permit a detailed analysis of these agreements, the concerned railways should review them to assess whether their strict observance is an obstacle to efficient border-crossing. An *ad hoc* multilateral agreement for the corridor may be desirable to replace or supersede existing bilateral agreements, at least so far as container traffic is concerned.

At regional level, the *Inter-governmental Agreement on International North-South Transport Corridor* signed in Saint Petersburg in September 2000 (Annex 2) encompasses the common desire of the four signatories – India, Islamic Republic of Iran, Sultanate of Oman and Russian Federation – to develop transport linkages and services. However, the agreement only covers the route from India and Oman by sea to and through the Islamic Republic of Iran and further on through the Caspian Sea and the Russian Federation. The corridor designation in the agreement does not cover the all-land routes described in Chapter 2 of this report going through the Caucasus area or the Central Asian region. However, the agreement may be an example to follow for the entire North-South Corridor as outlined in this report.

Rail border crossing times in Western Europe may provide a benchmark to guide the efforts of the railways in the corridor. Between West European railways border crossing times are in the order of 2 to 60 minutes for passenger trains and 20 minutes to 15 hours for



freight trains with stoppage due mostly to break-of-gauge and change of traction. Since 1 January 1993, all customs procedures in the member states of the European Union are conducted within the countries (freight yards, stations of departure or arrival). Only selected types of goods are subject to control procedures at the border points, such as dangerous goods and goods liable to sanitary and phyto-sanitary control. In comparison with the above, border crossing times are twice as long between railways of Eastern Europe. The routes in the North-South corridor would no doubt become more attractive if such times could be equalled, or even only approached, by the railways concerned. Experiences in a number of countries, e.g. the Czech Republic, have shown that the operation of joint border stations/yards could reduce border crossing time by as much as 30 per cent. In this context, a number of other countries in Central and Eastern Europe are cooperating to streamline their procedures and improve overall transit times for international freight movements, among these countries are Austria, Hungary, Romania, Slovakia and Ukraine.

Finally, the efforts developed in the Russian Federation by the Ministry of Transport and the State Customs Committee to promote transit container traffic along the Trans-Siberian line, provide another example of successful actions leading to improved performances by the railways, and could also be a possible source of inspiration for similar actions by railways in the corridor.

## **6.5 Railway adoption of EDI systems**

The adoption of systems for the interchange of customs and trade documentation and data by electronic means (EDI) is one area where the railway organizations lag behind their competitors, particularly ship operators. The ability for consignees and customs authorities at borders to have access to vital customs and trade documentation and consignment status/location data well in advance of the arrival of consignments at borders or at ultimate destinations can only serve to reduce delays in the transportation chain, particularly if the EDI systems adopted are linked to wagon tracking systems.

\*       \*

\*

## - Chapter 7 -

### Conclusions and Recommendations

---

The principal conclusions and recommendations of the report are summarized in this section. The report itself can provide a suitable foundation for a comprehensive development plan for the Trans-Asian Railway network in the North-South corridor connecting Northern Europe to the Persian Gulf. Such a development plan is a prerequisite for the *harmonized* development of the sections of the corridor under the control of the various national railway organizations. Before such a development plan can be finalized, however, it will be necessary to:

- (i) formalize a designated network for the Trans-Asian Railway in the North-South corridor between Northern Europe and the Persian Gulf;
- (ii) define the fundamental and operational priorities for the TAR in this corridor; and
- (iii) agree on a follow-up plan of action for the resolution of information gaps, the more detailed evaluation of the new lines construction programme and the formulation of suitable operational and commercial strategies and plans for the existing components of the corridor.

The main conclusions of the study in relation to each of these elements and the associated follow-up actions considered to be needed are given below.

#### 7.1 TAR network designation

*Conclusion 1:* *A Trans-Asian Railway network in the North-South Corridor of routes between Europe and the Persian Gulf with onward connections to South and South-East Asia was identified by the participating railway organizations on the basis of the three core routes and their possible future variants described in Chapter 2 of this report.*

This network would connect Northern Europe (with Helsinki as the reference point of origin) with the Iranian port of Bandar Abbas at its southern extremity. In addition, it would offer onward shipping connections to South Asia and South-East Asia, and would also provide to the landlocked countries of Central Asia a rail connection to one of the main ports on the Persian Gulf. In its current configuration the corridor has a route length of 12,150 km, of which 50 km in Armenia<sup>1</sup>, 800 km in Azerbaijan, 300 in Finland, 3,900 km in the Islamic Republic of Iran, 1,300 km in Kazakhstan, 3,200 km in the Russian Federation, 1,200 km in Turkmenistan and 1,400 km in Uzbekistan. In addition to the above, the corridor comprises 1,295 km of line section under construction (756 km between Mashad and Bafq, and 539 km

---

<sup>1</sup> All figures rounded to the nearest hundred.

between Kerman and Zahedan in the Islamic Republic of Iran), 1,063 km of planned links (366 km between Astara and Qazvin in the Islamic Republic of Iran, 232 km between Eralievo in Kazakhstan and Bekdash in Turkmenistan, 240 km between Bekdash and Turkmenbashi, and 225 km between Kazandjik and Kuzuletrek in Turkmenistan). A 1,200 km shipping distance across the Caspian Sea is also part of the corridor. Finally, three main international ports are located at both ends of the corridor, namely: the ports of Helsinki (Finland) and Saint Petersburg (Russian Federation) at the northern end, and the port of Bandar Abbas (Islamic Republic of Iran) at the southern end.

Rail linkages totaling 6,550 km complete the corridor either directly or from connected ports in South Asia (4,650 km) and South-East Asia (1,900 km).

The corridor and its future direct rail connection with South Asia contains four different track gauges (1,435 mm, 1,520 mm, 1,524 mm and 1676 mm). There are to date two break-of-gauge locations at which inter-gauge transfer is required (at Djulfa and Sarakhs) but when the links currently under construction as well as those which are planned are completed, there will be three more at, namely: Astara, Zahedan (or Mirjaveh at a later stage) and Gorgan.

**Recommendation 1:** *It is recommended that the North-South corridor between Northern Europe and the Persian Gulf be formally designated as such by the railways located along the corridor.*

## **7.2 Fundamental role and operational priorities**

**Conclusion 2:** *A fundamental role and operational priorities must be established for the Trans-Asian Railway in the North-South Corridor.*

Given its geographical location, the corridor has the potential to serve a number of regions of which the most obvious are Scandinavian countries, countries of Central and Eastern Europe as well as Central Asian countries. It may also attract traffic from / to regions east of the Urals mountains in the Russian Federation by providing import / export routes for goods between these regions and South and South-East Asia. In terms of market, the corridor could actually either compete with shipping, or provide shipping lines with the possibility to carry their containers from major ports in Europe (Bremerhaven, Hamburg, Helsinki, Saint Petersburg) to hinterland places in the Russian Federation, the Caucasus region or Central Asia. It is important that the fundamental role and operational priorities for the TAR network in the North-South corridor be defined in terms of its advantages in satisfying international as well as sub-regional transport demands. Such a definition of role and priorities should fully recognize the need to utilize the potential of the components of this network which are currently in place.

**Recommendation 2:** *The fundamental role of the TAR in the North-South corridor should be identified as the provision of an efficient and competitive means of transporting containers between and among the countries within the corridor, with a minimum of delay at border crossings. The operational priorities should be defined in terms of improving border crossing procedures, train operating practices and tariff competitiveness in order to fulfil the container traffic potential of existing links in the TAR network.*

### 7.3 Completing the network

**Conclusion 3:** *It is apparent that the components of the corridor in the Central Asian route are already in place. However, it seems that the route in the corridor best suited to serve traffic from Northern Europe (as well as other subregions of Europe), the Caucasus Route, does not have all its components in place. Indeed, the efficiency of cross-border operations at Djulfa between Azerbaijan and the Islamic Republic of Iran needs to be assessed and compared to the operational efficiency that would result from constructing the Astara - Qazvin link.*

**Recommendation 3:** *Detailed financial and economic evaluations of the projects relating to each alternative of routing different types of cargo through the Caucasus Route should be undertaken as a matter of priority by the railways concerned.*

### 7.4 Traffic information and forecasting system enhancement

**Conclusion 4:** *The railways in the corridor will only be able to plan its development after potential traffic volumes likely to use it have been assessed. This traffic forecasting task will be greatly facilitated if the railways defined a reliable freight and container traffic information system on an origin/destination basis.*

**Recommendation 4:** *All railways in the corridor should take steps to improve the capability of their management information systems to provide freight and container traffic/volume data on an origin/destination basis. Ideally, the methodology behind the definition of such systems should be done jointly to ensure a consistency of approach for corridor traffic.*

### 7.5 Identifying and achieving targets for competitive rail service

**Conclusion 5:** *The main competition for rail within its target market (i.e. container transportation between and among the countries of the Corridor) is provided largely by combined land and sea transport. In order to divert this traffic to direct transportation by rail, the railways in the corridor must be capable of improving on the service standards (principally transit times and reliability/punctuality) and tariff levels set by competing modes, i.e. road and shipping lines.*

**Recommendation 5:** *The railways concerned should actively cooperate to develop a focused marketing strategy, an operational plan (with an emphasis on operation of container block-trains) and a tariff structure aimed at securing a majority of the container transportation business in the target market. In order to achieve the latter, existing operating agreements between neighbouring railway systems must be amended to allow for the quotation of through commercial tariffs to potential*

*customers and for an appropriate basis of revenue distribution between each system, recognizing that this may require a departure from existing tariff-setting structures and practices.*

## **7.6 Recommended minimum technical standards**

### **Conclusion 6:**

*A primary requirement for the TAR network to carry all kinds of containers, including high cube and super high cube containers, imposes on the railway systems operating within the North-South corridor structure gauge dimensions which are compatible with the highest and widest profile containers in use - unless alternative measures, such as the adoption of low profile wagons, can be applied. Meanwhile, there are obvious advantages, both operational and commercial, in scheduling container block-trains to run at or near passenger speeds. The competitiveness of rail could be further strengthened if the maximum speeds of container block-trains could be lifted to 80 km per hour.*

### **Recommendation 6:** *The following technical and operational standards are recommended for the future development of the Trans-Asian Railway North-South corridor:*

- (i) Structure gauge dimensions should be compatible with the dimensions of super high cube (i.e. 9ft 6in high) containers or alternative measures should be applied to ensure the unimpeded passage of these containers through structures on designated links; these standards should be agreed by all the railways concerned and become the norm in the planning of future infrastructure development programmes as well as rolling-stock replacement programmes;*
- (ii) In the same manner, for designated TAR links, the standard of track and structures should be progressively upgraded as necessary to allow maximum speeds of 80 km/h for container block-trains; and*
- (iii) in general terms, the railways concerned should make all possible efforts to identify sources of operational incompatibility due to technical or work-organization reasons, and seek ways of harmonizing the related procedures, one such important element left out at this stage but that will be crucial in later stage is a review of infrastructure capacity as regards line as well as terminal operations.*

## 7.7 Specific container handling needs

**Conclusion 7:** *Within the scope of the study, limited attention was given to container handling capacity in ports as well as the definition of the desired level of rail / ship interface in ports. This is necessary, not only for the main ports at both ends of the corridor, but also for the ports on the Caspian Sea.*

**Recommendation 7:** *A detailed review of the necessary rail/ship interfaces in the main ports will have to be done in parallel with traffic forecasting. In particular, to build on the intermodal advantage of rail, a review of the rail infrastructure in ports will have to be made to see what measures are needed to allow rail access to container berths and stacking areas at ports (and in general to loading/unloading areas at ICDs) with the objective of allowing direct receipt and dispatch of full length container block-trains. In this regard, greater interaction should be sought between railway administrations and port authorities where this is not already the case. The creation of a permanent consultative body between the two modes could be envisaged.*

## 7.8 Facilitation measures for cross border traffic

**Conclusion 8:** *There has generally been a poor rate of accession by the countries within the North-South Corridor to the international transit conventions identified in Resolution 48/11 of the ESCAP Commission's 48<sup>th</sup> session in April 1992. In particular, there needs to be a better recognition by the relevant countries of the benefits of acceding to the Customs Convention on Containers (1972) and the International Convention on the Harmonization of Frontier Control of Goods (1982), since these implementation of these conventions could streamline customs control procedures and contribute to a smooth and rapid flow of border crossing rail traffic. In addition, border crossing might be facilitated through the adoption of Electronic Data Interchange systems which are linked to computerized wagon tracking/locator systems and which would permit consignees, freight forwarders, border customs authorities and others involved in the international transport chain to have early advice of consignment status/location data and early access to customs and trade documentation. Finally, existing railway agreements adopted on a bilateral basis by neighbouring railways in the corridor may not currently work in favour of increased rail border crossing traffic.*

**Recommendation 8:** *It is recommended that:*

- (i) stronger consideration be given by the countries in the North-South corridor, which have not yet acceded to the above-mentioned international conventions of Resolution 48/11 relevant to rail traffic, to their full accession to these conventions;*

- (ii) *the railways of the North-South corridor take positive steps towards early definition and introduction of EDI systems linked to computerized wagon tracking systems; and*
- (iii) *countries which are party to bilateral rail transit or operating agreements review these agreements, whenever necessary, to ensure that their stipulations are in accordance with the promotion of efficient operationalization of the corridor as well as commercialization of container services in block-trains. The provisions of these agreements should particularly promote the cross-border movements of rolling-stock wherever there is track gauge continuity and the establishment of through international tariffs.*

## 7.9 TAR network development needs

Conclusion 9: *A high level of international cooperation is a prerequisite to the efficient planning and timely implementation of all technical, commercial and institutional actions related to the development of the corridor.*

To secure the required high-level coordination, it is important to set up a dedicated Working Group for the corridor consisting of senior professionals taken from within as well as from outside the railways. The tasks of the Working Groups will be to plan, organise and monitor activities as regards the technical, institutional and commercial aspects relating to the corridor development. Before performing the necessary tasks, it is important that prior to the establishment of the Working Group, the framework under which implementation progress has to be reported and milestone decisions have to be approved be defined. A Coordinating Council in charge of the corridor development might provide such a framework.

Recommendation 9: *It appears that the high-level of cooperation needed to secure the development of the North-South corridor may require the creation of a special corridor Working Group working under high-level authority (possibly ministerial level). All parties concerned – ministries of transport or ministries of railways, railway organizations, customs authorities and port authorities – in all the countries along the three routes in the corridor may wish to consider the creation of a North-South Corridor Development Coordinating Council and the signing of a Memorandum of Understanding to formalize their will to plan and develop the corridor in accordance with a joint time-related Action Plan, and promote the use of the corridor. The Coordinating Council and the Working Group should meet at regular intervals.*

\*       \*

\*

## 48/11 Road and rail transport modes in relation to facilitation measures

*The Economic and Social Commission for Asia and the Pacific,*

*Considering* that it is in the interests of all concerned countries in the region to promote international trade, tourism and transport,

*Noting* that large divergences between national transport facilitation measures exist in the region,

*Being aware* that international coordination and cooperation in the field of transport facilitation could contribute effectively to the development of international trade and transport in the region,

*Recognizing* that harmonized transport facilitation measures at the national and international levels are a prerequisite for enhancing international trade and transport along road and rail routes of international importance,

*Desiring* to secure the greatest possible simplification and harmonization of international land transport regulations and procedures in the region,

*Noting* that a large number of international agreements and conventions already exist in the field of transport facilitation, to which countries in the region may wish to accede or whose provisions could be used as an example for similar regional agreements and conventions,

1. *Recommends* that the countries in the region, if they have not already done so, consider the possibility of acceding to the following:

The Convention on Road Traffic of 1968, and the Convention on Road Signs and Signals of 1968

International customs transit regimes, such as those stipulated in the Customs Convention on the

International Transport of Goods under Cover of TIR Carnets (TIR Convention) of 1975 (as recommended in Economic and Social Council resolution 1984/79 of 27 July 1984)

The Customs Convention on the Temporary Importation of Commercial Road Vehicles of 1956 (currently under review) and the Customs Convention on Containers of 1972, to enact facilities for the temporary importation of goods road vehicles and loading units

The International Convention on the Harmonization of Frontier Control of Goods of 1982, as a legal framework for the harmonization of such operations to minimize border control measures in international transport, harmonize their inspection requirements, and to provide, if possible, for joint inspection locations

The Convention on the Contract for the International Carriage of Goods by Road (CMR) of 1956, to establish internationally acceptable regulations on the legal relationship between road carriers and consignees or consignors;

2. *Also recommends* that the secretariat should examine the needs of individual countries or groups of countries in relation to the adoption of facilitation measures in the field of road and rail transport and, at the request of Governments, provide advisory services, and convene expert group meetings to consider problems, bottlenecks and facilitation measures in the field of road and rail transport.

739<sup>th</sup> meeting  
23 April 1992



**Status of ESCAP member countries' and areas' accession or being party to  
international conventions listed in Commission resolution 48/11, as of 29 October 2001**

Country or area	Convention on Road Traffic (1968)	Convention on Road Signs and Signals (1968)	Customs Convention on the International Transport of Goods under Cover of TIR Carnets (1975)	Customs Convention on the Temporary Importation of Commercial Road Vehicles (1956)	Customs Convention on Containers (1972)	International Convention on the Harmonization of Frontier Control of Goods (1982)	Convention on the Contract for the International Carriage of Goods by Road (CMR) (1956)
<b>Group I: Mainland Asia</b>							
Afghanistan			x	x			
Armenia			q			q	
Azerbaijan			q	q		q	
Bangladesh							
Bhutan							
Cambodia				x			
China					x		
Democratic People's Republic of Korea							
Georgia	q	q	q		q	q	q
Hong Kong, China				x			
India		x					
Islamic Republic of Iran	x	x	x				q
Kazakhstan	q	q	q				q
Kyrgyzstan			q	q		q	q
Lao People's Democratic Republic							
Malaysia							
Mongolia	q	q					
Myanmar							
Nepal							
Pakistan	x	x					
Republic of Korea	x	x	x		x		
Russian Federation	x	x	x		x	x	x
Singapore				x			
Tajikistan	q	q	q				q
Thailand	x	x					
Turkey			x		x		q
Turkmenistan	q	q	q				q
Uzbekistan	q	q	q	q	q	q	q
Viet Nam							
<b>Group II: Island countries</b>							
Brunei Darussalam				x		..	..
Indonesia	x	x	x		x	..	..
Japan						..	..
Maldives						..	..
Philippines	x	x				..	..
Sri Lanka						..	..

*Notes:* Two dots (..) indicate that data are not applicable.  
x - party/acceded.  
q - acceded after adoption of resolution 48/11.

**IN THE NAME OF GOD**

**INTER-GOVERNMENTAL AGREEMENT  
ON INTERNATIONAL  
NORTH-SOUTH TRANSPORT CORRIDOR**

The Government of the Republic of India

The Government of the Islamic Republic of Iran

The Government of the Sultanate of Oman

The Government of the Russian Federation

Hereinafter referred to as “Parties”

DETERMINED to support, develop and strengthen friendly relations and cooperation among them,

UNDERSTANDING growing interrelations of nations in the region and globally,

GIVING significant consideration to extension of external economic ties and raising their efficiency,

ACKNOWLEDGING importance of existing agreements on transit shipments for international trade and speeding up of economic development of the nations,

STRESSING their commitments to facilitation of uninterrupted, timely and effective movement of goods from/to other countries,

WISHING to further develop their respective modes of handling transit of passengers and goods on the basis of prevailing experience and in accordance with the International Conventions and standards,

EXTENDING maximum efforts for the due usage of existing transport infrastructure and performance of passenger and goods transport along the international North-South transport corridor,

HAVE AGREED as follows:

## **ARTICLE 1**

### **DEFINITIONS**

For the purpose of this Agreement the following terms shall mean as follows,

1.1 “All modes of transport”

transport infrastructure and transport modes providing transportation of passengers and goods by rail, sea, road, river and air routes. However, in case of India - transport infrastructure and transport modes providing transportation of goods by sea routes only.

1.2 “Cargo transport” – the kind of transportation service for movement of goods while keeping their physical/chemical properties and mass within the agreed limits.

1.3 “Container” – following transport device:

- fully/partly covered capacity designed for storage of goods;
- of permanent nature, and, because of that, having construction sufficient enough for multiple use;
- specially designed to facilitate transportation of goods by means of one or more types of transport without intermediate reloading of goods;
- designed to secure easy load/unload and easy to handle including its replacement from one transport mode to another;
- of internal volume not less than one cubic meter.

1.4 “*Forwarder*” – legal entity or a physical person who in fact effects cargo movement or who is responsible for the use of a transport facility and who carries out international transport of goods and passengers with their baggage in accordance with the national legislation of the state Parties along the international North-South corridor.

1.5 “*Goods*” – all types of cargoes transported in wagons, containers or by any other means that are not forbidden by the national legislation of the state Parties.

1.6 “*International transit of goods*” – movement of goods through the territory of a Party with their origin/destination points lying outside the State, under customs’ control.

1.7 “*International transport*” - movement of passengers/goods by various modes of transport, carried out through the territories of at least two Parties to this agreement.

1.8 “*International transport corridor*” – a network of main transport systems (both existing and to be constructed) connecting the Parties, as a rule equipped adequately to handle various modes of transport, which shall ensure international transportation of passengers and goods especially in the directions of their most concentration.

1.9 “*International North-South transport corridor*” – from India, Oman via sea to and through Iran, Caspian sea, the Russian Federation and beyond and back.

1.10 “*Passenger*” – the consumer of transport services related to the movement of physical person by any mode of transport, who has concluded a contract for transportation.

1.11 “*Passenger transport*” – the kind of transport service for movement of physical person (passengers) by every mode of transport.

1.12 “*Related installations*” within the framework of international transport corridor shall refer to border crossing points, customs terminals, stations for the exchange of wagon groups, gauge interchange stations, as well as rail road and combined ferry links/ports, both existing and to be constructed, which are of great importance for international transport along the international North-South corridor.

## **ARTICLE 2**

### **OBJECTIVES OF THE AGREEMENT**

2.1 The objectives of this agreement shall be as follows:

- (a) increasing effectiveness of transport ties in order to organize passengers and goods transport along the international North-South transport corridor;
- (b) promotion of access to the international market through rail, road, sea, river and air transport;
- (c) assisting the international transport of goods;
- (d) providing security of travel, safety of goods as well as environmental protection according to the international standards;
- (e) harmonization of transport policies as well as law and legislative basis in the field of transport for the purpose of implementing this Agreement;

- (f) setting up equal non-discriminative conditions for all types of transport service providers from all the Parties in transport of passengers and goods within the framework of the international North-South transport corridor.

2.2 In accordance with the objectives stipulated in the Article 2.1 above, the Parties shall make every effort aimed at:

- a) reducing transit time for passenger and goods transport on their respective territories;
- b) minimizing transit transport cost;
- c) simplifying and unifying all administrative documentation and procedures (including customs) applicable to international transport of passengers and goods through their respective territories in accordance with the adopted international agreements and standards.

### **ARTICLE 3**

#### **GENERAL CONDITIONS**

3.1 Provisions of this Agreement shall regulate international transport and transit of goods and passengers through the national territories of the Parties to this Agreement, carried out by all modes of transport or through combined transport along the routes determined by the Competent authorities of the respective Parties.

3.2 For the purpose of this Agreement, Competent authorities of the Parties to this Agreement shall be as follows:

***In the Republic of India*** – Ministry of Surface Transport (Department of Shipping) and Ministry of Commerce and Industry (Department of Commerce);

***In the Islamic Republic of Iran*** – Ministry of Roads and Transportation;

***In the Sultanate of Oman*** – Ministry of Transport and Housing;

***In the Russian Federation*** - Ministry of Transport and Ministry of Railways.

3.3 This Agreement shall not contradict national legislation of the Parties to this Agreement and shall not restrain the rights and obligations of any party assumed in international agreements to which a Party is a participant.

**ARTICLE 4**  
**ASSISTANCE TO THE INTERNATIONAL TRANSPORT**  
**OF PASSENGERS AND GOODS**

4.1 Each Party shall grant the other Parties the right for international transit of passengers, goods and transport means through its respective state territory on the terms and conditions stipulated by this Agreement.

4.2 State Parties to this Agreement shall provide effective assistance to international transit of goods within their respective state territories.

4.3 State Parties to this Agreement shall have multiple entry visa regime for personnel engaged in international transit of goods and passengers as per the procedure laid down by the respective Parties.

**ARTICLE 5**  
**TAXES, EXCISE AND OTHER DUTIES**

5.1 No taxes, excises and other duties regardless of their names and purposes shall be imposed on the international transit of goods, except related transport expenses and transport infrastructure user fees. The imposition of transport expenses and user fees, etc. shall be on terms which are no less favorable than those levied by the members in respect of transit of goods of other countries.

5.2 Parties shall not impose custom taxes on the goods which are in transit within their territories except customs formalities fees, storage and other services of that nature.

**ARTICLE 6**  
**COORDINATION COUNCIL**

6.1 The competent authorities of the Parties shall form a Coordination Council in order to regulate the issues related to implementation and application of the provisions of this Agreement.

6.2 The Coordination Council consisting of the Competent Authorities of the Parties to this Agreement shall adopt a Statute at its first meeting to be convened within six months of this Agreement entering into force, where it shall set up its own rules and procedures of its activities.

6.3 The Coordination Council shall meet at least once a year or upon request made by any Party to the Agreement.

## **ARTICLE 7**

### **SETTLEMENT OF DISPUTES**

7.1 Any dispute, discord or claim among the Parties which relates to application, interpretation or violation of this Agreement and which cannot be settled by negotiation shall be submitted to the Coordination Council for settlement.

7.2 Any dispute, discord or claim which the Coordination Council fails to settle shall be settled by such other means as the Parties by common consent agree.

## **ARTICLE 8**

### **DESIGNATION OF THE DEPOSITARY**

8.1 *The Islamic Republic of Iran* shall be the Depositary of this Agreement. The Depositary State shall transmit certified copies of this Agreement to the Parties who have signed the Agreement.

8.2 The Depositary State shall inform the Parties regarding accession by the other countries to this Agreement and regarding cessation of this Agreement by any Party.

## **ARTICLE 9**

### **RATIFICATION**

This Agreement is subject to Ratification according to the national requirements of the Parties. The instruments of Ratification shall be deposited with the Ratification.

## **ARTICLE 10**

### **ACCESSION**

10.1 This Agreement shall be open for accession by any country only with the consent of all Parties to this Agreement.

10.2 For a country which has accessed, this Agreement shall come into force 30 days after the date on which that country deposits the instrument of accession with the Depositary State. The country accessing this Agreement shall notify the Depositary State in writing regarding its competent authority/authorities and thereafter the Depositary State shall transmit the same to the competent authorities of the other Parties to this Agreement.

## **ARTICLE 11**

### **ADDITIONS AND AMENDMENTS**

Additions and amendments to this Agreement may be introduced provided that they are agreed to by all competent authorities of the other Parties on the basis of the procedures laid down by the Coordination Council.

## **ARTICLE 12**

### **VALIDITY**

12.1 This Agreement shall be valid for the period of ten years from the date of its entry into force.

12.2 This Agreement will be further extended by similar periods, unless a notification to the contrary is received by the Depositary State from any of the founding Parties to this Agreement at least six months prior to the expiry of the validity of this Agreement.



12.3 Validity of this Agreement may cease in the territory of a Party to this Agreement, given that such a Party shall communicate in writing to the Depositary State of its intentions to cease validity of this Agreement in its territory at least six months prior to the date when it shall do so.

12.4 Obligations assumed in agreements and other contracts signed in accordance with the provisions of this Agreement shall remain valid up to their complete fulfillment even after cessation of this Agreement.

### **ARTICLE 13**

#### **ENTRY INTO FORCE**

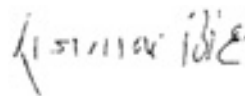
13.1 This Agreement shall come into force 30m days after the date on which any three of the Parties have deposited with the Depositary State the instruments of ratification approved according to their national legislation procedures.

13.2 For the remaining Party, which completes its State formalities later, this Agreement shall come into force 30m days after the date on which that Party deposits the instruments of ratification, approved according to their national legislation procedures, with the Depositary State.

DONE in Saint Petersburg city on the 1370/6/22 (2000/09/12). The original text of this Agreement is done in English and in the national languages of the founding Parties, all of them being equally authentic. For the purpose of interpretation of this Agreement English text shall prevail.

IN WITNESS WHEREOF the undersigned, the representatives of the state Parties duly authorized to that effect, have signed this Agreement.

For the Government of the Republic of India

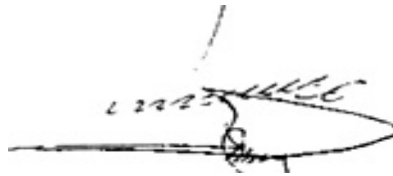


For the Government of the Islamic Republic of  
Iran



For the Government of the Sultanate of Oman

For the Government of the Russian Federation

A handwritten signature in black ink, featuring a series of loops and a long horizontal stroke extending to the left.