FEASIBILITY STUDY FOR RECONSTRUCTING THE OLD OTTOMAN HIJAZ RAILWAY LINE

This report was prepared under the Feasibility Study for Reconstructing the Old Ottoman Hijaz Railway Line (2017-JORTRANS-374) project funded by the COMCEC.
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**Abbreviations**

<table>
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARC</td>
<td>Aqaba Railway Company</td>
</tr>
<tr>
<td>CAREC</td>
<td>Central Asia Regional Economic Cooperation Corridors</td>
</tr>
<tr>
<td>CD</td>
<td>Compact Disk</td>
</tr>
<tr>
<td>COMCEC</td>
<td>The Standing Committee for Economic and Commercial Cooperation of the Organization of the Islamic Cooperation</td>
</tr>
<tr>
<td>EBITDA</td>
<td>Earnings Before Interest Taxes Depreciation and Amortization</td>
</tr>
<tr>
<td>EBRD</td>
<td>European Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>GCC</td>
<td>Gulf Cooperation Council</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HP</td>
<td>Horse Power</td>
</tr>
<tr>
<td>HSTR</td>
<td>High Speed Train Railways</td>
</tr>
<tr>
<td>INSTC</td>
<td>International North South Transport Corridor</td>
</tr>
<tr>
<td>ITC</td>
<td>International Trade Corporation</td>
</tr>
<tr>
<td>JHR</td>
<td>Jordan Hijaz Railways</td>
</tr>
<tr>
<td>MOT</td>
<td>Ministry of Transport of Hashemite Kingdom of Jordan</td>
</tr>
<tr>
<td>OIC</td>
<td>Organization of Islamic Cooperation</td>
</tr>
<tr>
<td>RFC</td>
<td>Rail Freight Corridor</td>
</tr>
<tr>
<td>STR</td>
<td>Speed Train Railways</td>
</tr>
<tr>
<td>TAT</td>
<td>Tajikistan- Afghanistan-Turkmenistan</td>
</tr>
<tr>
<td>TC</td>
<td>Transportation and Economic Corridor Building in Central Asia Project</td>
</tr>
<tr>
<td>TCDD</td>
<td>Turkish State Railways</td>
</tr>
<tr>
<td>TEUs</td>
<td>Twenty Feet Equivalent Unit</td>
</tr>
<tr>
<td>TRACECA</td>
<td>Transit Corridor Europe Caucasus Asia</td>
</tr>
<tr>
<td>UIC</td>
<td>International Union of Railways</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
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</tbody>
</table>
Executive Summary

The report at hand, mainly points out main economic reasons to revive the **Old Ottoman Hijaz** railway line and its importance in the region’s transportation networks and the social and cultural benefits besides economic benefits of introducing a transnational transportation corridor to the countries in the region and mainly to Hashemite Kingdom of Jordan. The project of reviving Hijaz railway aims to enhance mobility of passengers, goods, and tourism inside the Jordanian border and in between the neighbour countries in line with the COMCEC Strategy.

The construction of the Hijaz Railway started at 1st September 1900 as a 1.05 m. narrow-gauge line and reached to Almadina Almonawara in 1908. The cultural motive behind the old Ottoman Railway Project was dominant aspect besides the political, economic and military concerns. The alignment of the railway track was on the way to holy cities of Islamic believe and followed by pilgrims for hadj visits.

The 380 km. section of the Hijaz Railway line is within the boundaries of the Hashemite Kingdom of Jordan and is partially in use with 22 stations. The Railway section between Al-Abyad and Baten Alghol stations are rented to Aqaba Railway Company by Jordan Hijaz Railway Corporation and used by Aqaba Railway Company to transport phosphate to Aqaba port.

Recently the railway transportation in the world is gaining importance mainly because of decreasing carbon emission caused by extensive use of fossil fuels in land transportation and decreasing the transportation costs. The passenger and freight transportation all over the world were increased over the last ten years between 2007 and 2016. This evolution in railway transportation generates development of some important transportation corridors passing through multiple countries to facilitate not only international trade but also cultural exchange through passenger transportation for tourism.

Some of the important transport corridors in neighbouring regions are; **TRACECA** (Transit Corridor Europe Caucasus Asia) also called as Silk Road of 21st Century is multimodal transport corridor connecting Asian and Caucasus countries to Europe over Turkey; **Rail Net of Europe** hosts 11 European Rail Freight Corridors (ERFC) connecting almost all countries in the continent; **CAREC PROGRAM** (Central Asia Regional Economic Cooperation Corridors) is another multi model transport corridor that links between partner countries of the program including Central Asian partner countries and Turkey over Azerbaijan and Georgia (Baku Tbilisi Kars rail link); **GCC Railway** (Gulf Rail Project) starts from Muskat the capital city of Oman and ends at Kuwait City of Kuwait passing over countries of Arab Gulf. The GCC railway is financed by participating countries and expected to be completed at the year 2021.
The Hashemite Kingdom of Jordan is at the crossroad and relevant regional and international transport flows between north (European Union, Turkey and Syria) and south (Kingdom of Saudi Arabia, Yemen and Gulf Countries) and also between east (Asia, Iraq and Iran) and west (North Africa and Egypt). The Hashemite Kingdom of Jordan took place as 114th in ranking with 507 km length railway network while the project partner countries; – Turkey was 20th with 12.008 km railway network and Iraq was 67th in ranking with 2.239 km railway network.

Transportation in Jordan is widely depended on road transport. Ministry of Transport also developed “Jordan National Railway Project” at the year 2011. Jordan National Railway Project plans development of the standard gauge freight railway network linking the key cities of the country, Amman, Mafraq, Zarqa and Aqaba and connecting the country with bordering countries namely Syria, Iraq and Saudi Arabia. The estimated cost of Jordan National Railway Project US$ 4,33 bln. with 2011 prices.

Today, the railway transportation only serves for carrying phosphate mine to Aqaba port. On the other hand, the Jordan Hijaz Railway network has the potential to enable railway transportation through the north to south of the country both for passenger and freight transportation. Currently the Old Hijaz Railway has a challenge to connect some worldwide transport corridors over Turkey when railway links are renewed and extended properly in considerably short investment period with a reasonable investment cost before the realization of “Jordan National Railway Project-JNRP” in which “Reconstructed Jordan Hijaz Railway” can continue to serve as an important section of JNRP when completed.

The existing situation of the Jordan Hijaz Railway network is analysed and recommended strategy has the vision of seeing the rail transport a highly competitive mode of transport: efficient, simple (easy to use), fast, accessible, and comfortable.

It is proposed that the Jordan Hijaz Railway will be reconstructed as a dual gauge track with a design speed of 120 km/h for passenger trains and 90 km/h for freight trains, where narrow and standard gauges railway tracks are on the same line. The narrow gauge rail track will enable to operate existing rolling equipment and standard gauge rail track will facilitate increasing operating capacity for both passenger and freight transportation. Integration capability to standard gauge rail network will be one of the strength of dual gauge railway track.

As broadly discussed in the report;

- 227 km of renovation and modernization investments are planned for the section starting from the Syrian border to the Aqaba Railways line.
- Reconstructing Hijaz Railway investment is to be made by renewing all rail systems, realigning in some sections of existing line in order to reach the desired speed in critical sections, reinforcing works in tunnels and bridges on the existing line.
- The existing rolling stock will be overhauled, repaired and maintained, as well as the new freight and passenger cars and locomotives will be procured, renewal and reorganization of the stations in accordance with the requirements will be completed.
- In terms of transportation safety, it is suggested to take necessary safety and security measures in accordance with international standards especially in the sections close to residential areas and at highway intersections, and to establish signalization systems. The total cost of all investments is estimated to be approximately USD790 million. Approximately 40% of the investments are local, 60% is estimated as foreign.
- It is preferred that investments to be made with PPP model at the possible scale. However, considering the fact that it can support the implementation of the PPP model, it is recommended to initiate studies to obtain long-term & low-interest loans and grants from international financial institutions especially for infrastructure investments.
- Post-investment operating activities were evaluated in four main phases. Based on the passenger and freight volume estimation the break-even will be reached during the third phase and gross profit can be realized as USD4.15 million.

The reconstruction of Hijaz Railways besides its political and financial benefits, its cultural and social benefits are also very promising by creating direct and indirect employment opportunities both during investment and operation phases.

The JHR railway network can be extended to link Queen Alia International Airport and Madounah custom zone where the passenger with high traffic demand. These railway links will also help to decrease traffic load on roads for public transportation purposes.
1. Conceptual Framework Regarding Reconstructing Old Ottoman Hijaz Railway Line

The project of reviving Hijaz railway aims to enhance mobility of passengers, goods, and tourism inside the Jordanian border and in between the neighbour countries in line with the COMCEC strategy and the core principles of enhancing mobility to increase the mobility of goods and people across national borders.

The output of this feasibility study will be presented to private sector to encourage them participating in the investments for reviving old Hijaz Railways route. The project is conceptually built on four reasoning:

i. Reviving the old Hijaz railway helps in enhancing the tourism in the country by introducing new concepts to the touristic routes,

ii. Gulf region is currently implementing a railway network project namely The Gulf Railway, also known as the GCC Railway, is a proposed railway system to connect all six Gulf Cooperation Council (GCC)-member states in the Persian Gulf,

iii. Iraq is one of Jordan’s border countries, the transportation of goods between the two countries is carried out by land transport, establishing a new regional railway network in order to enhance and facilitate the transportation of goods,

iv. COMCEC strategy and its core principle of enhancing mobility and its cooperation area of trade, tourism, transport and communication. The project also crosscuts the sectoral themes, improving transnational transport corridors and the planning of transport infrastructure.

The report points out main economic reasons to revive the railway line in terms of promoting transnational transportation networks in the region to further foster the economic, social and cultural benefits for the countries in the region and mainly for Hashemite Kingdom of Jordan.

The report also points out the current status of the old Hijaz Railway line, with general estimated investment cost in international rates to revive the existing railway line. The report will provide insight and is expected to attract the interest of private sector actors to participate the investments through public private partnership model.

1.1. History of the Old Ottoman Hijaz Railway Line

The construction of the Hijaz Railway started at September 1\textsuperscript{st}, 1900. It was decided that the railway track would be a 1.05 m. narrow-gauge line; however, the Anatolian, northern Syria and Baghdad railways were constructed as 1.435 m. standard-gauge. The reason behind deciding on a narrow-gauge line was that the lesser cost in comparison with standard-gauge line and also easier construction stage. The estimated cost of construction of the Hijaz Railway was about 4 million Ottoman Liras which was equal to almost 18 \% of the Ottoman Empire’s government budget for the year 1901. The finance required for construction of the Hijaz Railway was met through endowment by including Ottoman Sultan and a great number of
Ottoman civil servants and Ottoman citizens, King of Morocco, Khan of Bukhara and Muslim citizens of various countries.

The Hijaz Railway reached to Almadina Almonawara at 1908 and its opening ceremony was held on 1st of September 1908. Along the alignment of the Old Ottoman Hijaz Railway including the extensions, a great number of infrastructural and service establishments were constructed. Some important establishments were:

- Locomotive/Wagon Maintenance Depots and Workshops at Damascus, Kadem, Der'a, Amman, Maan, Tebuk, Medain Salih, Almadina Almonawara and Haifa stations; pier and foundry at Haifa; Hotel at Maan Station; Hospitals at Maan and Tebuk stations; stone bridges, drainage structures and culverts: 2,666
- Steel bridges: 7
- Tunnels: 9
- Stations and annexes: 96
- Water ponds: 7
- Water Tanks: 37

At the year 1915 (year 1331 according to the hegira calendar) the architectural design project for General Directorate of Ottoman Hijaz Railway was developed by a group of architects and engineers headed by famous Turkish architect Kemaleddin who was the Chief Architect of Ministry of Awqaf of the Ottoman Empire. However, the location, where the Ottoman Hijaz Railways General Directorate Building would be constructed, was not mentioned in the source documents at the archives of the Turkish Republic General Directorate of Awqaf.
1.2. Economic and Social Aspects of the Old Ottoman Hijaz Railway Line

The cultural motive behind the Old Ottoman Railway Project was dominant aspect in addition to the political, economic and military concerns. The alignment of the railway track was on the way to holy cities of Islamic believe and followed by pilgrims for hadj visits. The Hijaz Railway enabled continuous and rapid travel from Istanbul the capital city of the Ottoman Empire to Hijaz for pilgrims.

From political and militaristic perspective the railway would facilitate governance of centralized government and potentiate military operations to strengthen defend line at southern part of the Ottoman Empire against potential military attacks. In fact within the short life span the Hijaz Railway extensively used for transportation of military troops and weapons and ammunition during the First World War. On the other hand, the Hijaz Railway
would connect the Red Sea coasts with Syria and Anatolia towards the Istanbul and facilitate the transportation of the commercial goods (e.g. fruits and vegetables, cereals, floor, coal, salt, rise, tobacco) and animals for trading purposes. The local products were transported to new markets, reconstruction works such as construction of public utilities increased, economic activities in many towns on the alignment of railway (e.g. Der’a, Amman, Maan, Tebuk, Haifa) rapidly developed and consequently population increased.

**Figure 1. Historical Map of Old Ottoman Hijaz Railway**

1.3. The Main Route of the Old Ottoman Hijaz Railway Line

The Old Ottoman Hijaz Railway Line has been built as narrow gauge (1050 mm) rail track starting from Damascus–Syria and ending at Almadina Almonawara. The length of the Ottoman
Hijaz Railway between Damascus and Almadina Almonawara was 1464 km. The Ottoman Hijaz Railway was also connected Almadina Almonawara with Istanbul, Haydarpasha main station of capital city of Ottoman Empire via Damascus and the distance of rail track between Haydarpasha and Almadina Almonawara was 2614 km. But the railway line between Haydarpasha and Damascus is standard gauge (1435 mm.) rail track.

The railway line section in Syria, starting from Damascus till to Jordanian border is 138.5 km. in length. Jordanian Section of Ottoman Hijaz Railway is 451.5 km. from Jaber Station at the Syrian border at north till to Saudi Arabia border at south. The remaining section with 874 km. in length between Jordan and Saudi Arabia border and Almadina Almonawara was laid in Saudi Arabia.

Beirut-Damascus and Der’a - Haifa extensions of the Hijaz Railway was also built as narrow-gauge line that would be compatible with the Hijaz Railway. The total length of the Ottoman Hijaz Railway has been reached over 1900 km. at the year 1918 with the extensions.

1.4. Important Stations of the Old Ottoman Hijaz Railway Line

The Old Ottoman Hijaz Railway the narrow gauge line started from Damascus that is the capital city of Syrian Arab Republic and reached to Almadina Almunawara that is one of the holy cities of Islamic belief and recently in the Kingdom of Saudi Arabia.

Damascus was one the important stations of the Hijaz Railway which was the junction for connection to standard gauge railway network of the Ottoman Empire and connected to Istanbul (Haydarpasha) station. Today, Hijaz Railway Station at Damascus also hosts the Railway Museum.

Der’a station at the Jordanian border of Syria Arab Republic was the starting point of the Haifa extension of the Old Ottoman Railway. Der’a station is also one of the important station of the Old Ottoman Hijaz Railway as being the border station between Syria and Hashemite Kingdom of Jordan.

Amman station was one of the stations whose locomotive and wagon maintenance workshops were based. Amman station is still an important station not only as being the capital city of Jordan but also being located at the core of road transportation network of the country and the host city of Queen Alia and Marka International Airports and is hosting the Hijaz Railway Museum.

Maan station was one of the important stations, where there were a Hotel and a Hospital beside the locomotive and wagon maintenance workshops. Maan station hosted HM King Abdullah, the founder of the Hashemite Kingdom of Jordan, during the early stages of the kingdom.
Recently the Old Ottoman Hijaz Railway section does not exist anymore on the land of the Kingdom of Saudi Arabia but Tebuk, Medain Salih and Almadina Almunawara were among the important stations of the railway. Tebuk hosted locomotive and wagon maintenance workshop and also a hospital, Medain Salih and Almadina Almunawara were the stations where locomotive and wagon maintenance workshops were located. Almadina Almunawara station today hosts to the Railway Museum. Haifa, where an extension of Old Ottoman Railway has been built to connect the rail line to Mediterranean coast, was also among the important stations as the gateway of the Old Ottoman Railway to Mediterranean Sea.

1.5. Recent Situation of Hijaz Railway Line

1.5.1. Hijaz Railway Line Outside of Jordan State Boundaries

The Railway network of Turkey was connected to Damascus and also narrow gauge Hijaz Railway at Damascus. Today the railway line starting from Istanbul (Haydarpaşa station) to Tahtakopru station at the Syrian-Turkey border is operated by General Directorate of Turkish State Railways.

In Syrian Arab Republic the section of the old Ottoman Hijaz Railway was in operation before the civil war in the country and operated by Hijaz Railway General Directorate and served for touristic journeys with original locomotives and wagons. It is known that the main train station at Damascus was bombed and damaged seriously at 2014. Syrian Railway was operating scheduled trains from Aleppo to Gaziantep-Turkey, from Aleppo to Mersin-Turkey and from Damascus to Teheran-Iran (via Turkey) till the year 2011.

The Old Ottoman Hijaz Railway section in the Saudi Arabia was completely abandoned. There is not any sign of rail track in most places along the alignment of the old railway; however, the rail track path can still be observed. Some of the buildings and stations of the old Ottoman Hijaz Railway are still standing however they mostly are neglected. The Almadina Almunawara station is used as Railway Museum and station building and maintenance workshop at Madein Salih station are comparatively in better condition.

The Haifa and Al-Quds Stations are still important stations of the area, but the wars in Palestine and Lebanon have caused destruction of most of the rail tracks. Some stations on these rail tracks are in ruins and some are inhabited by local people. The Beirut train station (Mar Mikael) was renewed and is in use as an art and entertainment centre today.

1.5.2. The Hijaz Railway Line within Jordan State Boundaries

The section of the Old Ottoman Railway within the boundaries of the Hashemite Kingdom of Jordan is partially in use. There were 29 stations along the 451.5 km length railway section within in the recent Boundaries of Jordan when Hijaz Railway was constructed.
Recently, 380 km. length section of the railway line is used and there are 22 stations along these section of the railway.
Table 1: The Stations and their location according to Damascus - base (0,0) km.

<table>
<thead>
<tr>
<th>Stations</th>
<th>km</th>
<th>m</th>
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<tbody>
<tr>
<td>Jaber</td>
<td>140</td>
<td>560</td>
</tr>
<tr>
<td>Mafraq</td>
<td>161</td>
<td>868</td>
</tr>
<tr>
<td>Al-Thughrah</td>
<td>177</td>
<td>379</td>
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<tr>
<td>Al-Samrah</td>
<td>185</td>
<td>535</td>
</tr>
<tr>
<td>Zarqa</td>
<td>202</td>
<td>978</td>
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<tr>
<td>Rusaifa</td>
<td>212</td>
<td>436</td>
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<tr>
<td>Ain Ghazal</td>
<td>220</td>
<td>833</td>
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<tr>
<td>Amman</td>
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<td>571</td>
</tr>
<tr>
<td>Al-Qaser</td>
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<td>Al-Lubban</td>
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<td>Al-Jizah</td>
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<td>038</td>
</tr>
<tr>
<td>Dab'ah</td>
<td>279</td>
<td>085</td>
</tr>
<tr>
<td>Khan Zabib</td>
<td>295</td>
<td>686</td>
</tr>
<tr>
<td>Swaqa</td>
<td>309</td>
<td>496</td>
</tr>
<tr>
<td>Al-Qatrana</td>
<td>326</td>
<td>558</td>
</tr>
<tr>
<td>Al-Manzel</td>
<td>348</td>
<td>784</td>
</tr>
<tr>
<td>Al-Abyad</td>
<td>367</td>
<td>497</td>
</tr>
<tr>
<td>Al-Hasa</td>
<td>378</td>
<td>206</td>
</tr>
<tr>
<td>Al-Jroff</td>
<td>397</td>
<td>802</td>
</tr>
<tr>
<td>Onaizah</td>
<td>423</td>
<td>000</td>
</tr>
<tr>
<td>Jerthan</td>
<td>440</td>
<td>784</td>
</tr>
<tr>
<td>Maan</td>
<td>459</td>
<td>158</td>
</tr>
<tr>
<td>Baten Alghol</td>
<td>520</td>
<td></td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways

The Railway section between Al-Abyad and Baten Alghol stations are rented to Aqaba Railway Company by Jordan Hijaz Railway Corporation and used by Aqaba Railway Company to transport phosphate to Aqaba port. The maintenance of this railway section is under responsibility of Aqaba Railway Company. The basic technical specifications of the Old Hijaz Railway in Jordan are:

- Length of the railway line: 380 km
- Axle Load: 10.5 Tons
- Type of Rail: S21
- Length of rails: 9 m
- Width of rail head: 42 mm
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of Rail foot</td>
<td>86 mm</td>
</tr>
<tr>
<td>Height of Rail</td>
<td>60 mm</td>
</tr>
<tr>
<td>Rails gauge</td>
<td>1050 mm</td>
</tr>
<tr>
<td>Type Sleepers</td>
<td>Steel</td>
</tr>
<tr>
<td>Weight of Sleepers</td>
<td>40 kg</td>
</tr>
<tr>
<td>Width of Sleepers</td>
<td>185 cm.</td>
</tr>
<tr>
<td>Switches</td>
<td>Made of S21 rails, 27,012 m.</td>
</tr>
<tr>
<td>Max Speed</td>
<td>35 km/h</td>
</tr>
<tr>
<td>Length of Tunnels</td>
<td>140 m</td>
</tr>
<tr>
<td>Minimum radius at curves</td>
<td>100 m</td>
</tr>
<tr>
<td>Maximum slope</td>
<td>0.26 %</td>
</tr>
</tbody>
</table>

**1.5.3. Current Situation of the Hijaz Railway Line in Jordan**

Project Experts visited the Hijaz Railway route between 6-10 October 2018 and 27-31 October 2018. The observations on the existing condition of the Old Hijaz Railway in Jordan are summarized in following sections further below.

**Substructure**

The ground of superstructure is made-up limestone and similar materials. In some sections refilled platform is narrow. At some narrow refilled platforms edges of sleepers are released. Drainage systems do not exist in some sections. Any problem at slopes of passages, landslide or settlement is not observed along the rail track.

**Picture 2: Deformed Railway Path Steel Sleepers on Railway Section in Amman**

*Source: Site visit, 9 October 2018*
**Superstructure**

Superstructure of the rail line has originally been constructed without using ballast materials. The rails are tied on steel sleepers with bolts. In some sections of the rail track ballast materials were laid out during later years but in general ballast materials are not used along the rail track. The rail track is stable and strong in general. At the alignments any deformation and corrosion do not observed. At the curves deformations are observed on the rails caused by inappropriate super elevation levels even some counter super elevations are observed. Rail joints are not welded. Especially at the curves some of the rail joint bars are damaged or missing.

**Switches**

The switches are built of S21 rails with 27,012 meter length. Rail damages at the switches are observed. At almost all switches the switch frogs are worn, most of the switch blades are broken and switch blades are not precisely fitted to rails.

**Picture 3: Railway Switches on Railway Section in Amman**

*Source: Site Visit, 9 October 2018*

**Parking and Manoeuvre Tracks**

The number and length of parking and manoeuvre tracks along the Jordan Hijaz Railway track are exhibited on the below table according to the railway stations.
**Table 2: Length of Parking and Manoeuvre Tracks by Stations**

<table>
<thead>
<tr>
<th>Name of station</th>
<th>Length of parking and manoeuvre tracks</th>
<th>Name of station</th>
<th>Length of parking and manoeuvre tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amman</td>
<td>6 tracks/ 2 tracks 400m 2 tracks 300m 2 tracks 350m</td>
<td>Alluban</td>
<td>4 tracks/ 1 track 500m 2 tracks 450m 1 track 400m</td>
</tr>
<tr>
<td>Mafraq</td>
<td>4 tracks/ 1 track 500m 2 tracks 450m 1 track 400m</td>
<td>Alsamra</td>
<td>2 tracks: 2 tracks 300m</td>
</tr>
<tr>
<td>Aljeza</td>
<td>3 tracks/ 1 track 500m 1 track 450m 1 track 400m</td>
<td>Alzarqa</td>
<td>3 tracks/ 1 track 400m 2 tracks 350m</td>
</tr>
<tr>
<td>Alqutraneh</td>
<td>4 tracks/ 1 track 360m 1 track 340m 1 track 320m 1 track 300m</td>
<td>Alqaser</td>
<td>4 tracks/ 1 track 400m 1 track 350m 1 track 310m 1 track 300m</td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways, November 2018

**Tunnels**

The tunnels are arched and built of stone. The height of tunnels is 5 m and the wall to wall width is 5 m and width at ballast stool level is 3.80 m.

**Table 3: Tunnels along the Jordan Hijaz Railway Track**

<table>
<thead>
<tr>
<th>Location</th>
<th>Rail Line segment KM</th>
<th>Length of Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alshu’aleh / Alzarqa</td>
<td>201</td>
<td>300 m</td>
</tr>
<tr>
<td>Alqweasmeh</td>
<td>228</td>
<td>140 m</td>
</tr>
<tr>
<td>Aljumruk</td>
<td>236</td>
<td>100 m</td>
</tr>
<tr>
<td>119+300</td>
<td>60 m</td>
<td></td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways, November 2018

The conditions of tunnels are good in general. Some drainage problems were observed within tunnels. Water supply and waste water leakages are observed in the Tunnel between Amman and Al-Qaser stations.
Bridges

Along the railway line under the operation responsibility of Jordan Hijaz Railways there are sixteen stone made bridges. The railway sections where these bridges are built and the lengths of the bridges are described on below table.

Table 4: Bridges along the Jordan Hijaz Railway Track

<table>
<thead>
<tr>
<th>Rail line segment</th>
<th>Km</th>
<th>Type</th>
<th>Length of Bridge (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alsamra</td>
<td>186</td>
<td>stone</td>
<td>56</td>
</tr>
<tr>
<td>Alhashimia</td>
<td>194</td>
<td>stone</td>
<td>52.9</td>
</tr>
<tr>
<td>Alzarqa</td>
<td>205</td>
<td>stone</td>
<td>20.7</td>
</tr>
<tr>
<td>Alzarqa</td>
<td>207</td>
<td>stone</td>
<td>42.9</td>
</tr>
<tr>
<td>Amman</td>
<td>219</td>
<td>stone</td>
<td>41.7</td>
</tr>
<tr>
<td>Amman</td>
<td>228</td>
<td>stone</td>
<td>140</td>
</tr>
<tr>
<td>Aljeza</td>
<td>258</td>
<td>stone</td>
<td>27.5</td>
</tr>
<tr>
<td>Aljeza</td>
<td>268</td>
<td>stone</td>
<td>27.7</td>
</tr>
<tr>
<td>Aljeza</td>
<td>269</td>
<td>stone</td>
<td>31</td>
</tr>
<tr>
<td>Aljeza</td>
<td>270</td>
<td>stone</td>
<td>42.3</td>
</tr>
<tr>
<td>Swaqa</td>
<td>304</td>
<td>stone</td>
<td>20.4</td>
</tr>
<tr>
<td>Swaqa</td>
<td>304</td>
<td>stone</td>
<td>20.4</td>
</tr>
<tr>
<td>Swaqa</td>
<td>310</td>
<td>stone</td>
<td>42.3</td>
</tr>
<tr>
<td>Alquraneh</td>
<td>327</td>
<td>stone</td>
<td>37.5</td>
</tr>
<tr>
<td>Al sultanei</td>
<td>347</td>
<td>stone</td>
<td>18</td>
</tr>
<tr>
<td>Almanzel</td>
<td>350</td>
<td>stone</td>
<td>34.5</td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways, November 2018

Picture 4: Railway Tunnel at Railway Section between Amman and Al Qasr

Source: Site visit, 9 October 2018
The bridges are stone made arch bridges and they are generally in good condition. The width of the bridge floors are 4 meters and width at sleeper beds are 3 meters. Some slugs at bridge pile foundations caused by water erosion are observed. Any corrosion protection does not exist at the steel equipages on the bridge and generally binding junctures are slackened. Sleepers on the steel bridges are partly deformed.

**Road Crossings**

Along the railway track there are 83 road crossings including urban road crossings. Any traffic control and security measures do not exist at the road crossings. At some road crossings asphalt road pavements laid on rails bed. The rapid growth of the cities along the railway track caused increase in number of road crossings.

**Picture 5: Road Crossing in Amman City**

![Road Crossing in Amman City](image)

*Source: Site visit, 9 October 2018*

**Rail Track and Traffic Safety**

There are various causations those are affecting the rail track and rail traffic safety along the Jordan Hijaz railway track.

- Urban settlements very close to rail track along the rail track within the cities and towns (See: Picture 5 and Picture 6)
- Uncontrolled surrounding of rail track within the cities and towns
- Uncontrolled road crossings along the rail track (there are 83 road crossings along the rail track)
- Lack of signalization and effective communication system
- Weekly maintenance and track line watch
- Third party interferences along the railway track (See Picture 7)
Picture 6: Urban Settlement Close to Rail Track (Section south of Amman)

Source: Site visit, 29 November 2018

Picture 7: Damage on Rail Track Caused by Third Party (Section southern Amman)

Source: Site visit, 29 October 2018
Especially along the railway track within the Amman City, settlements are developed very close to railway track. These settlements weaken the railroad and traffic security enormously and also limit the ground zone for the rehabilitation and/or expansion of railway track.

**Picture 8: Third Party Interferences Threatening Traffic Safety**

Source: Site visit, 29 October 2018

**Picture 9: Amman, Jasim Bridge Photographs**

Jasim Bridge, 1903

Jasim Bridge, 1998

Source: Al Baraka Turk The Hijaz Railway Album of Photographs, 1999

Source: Al Baraka Turk The Hijaz Railway Album of Photographs, 1999
Jasim Bridge, October 2018

Source: Site visit 09 October 2018

Picture 10: Photograph Railway Track within Amman City Settlements

Source: Site visit 09 October 2018
**Maintenance Depots and Workshops**

The maintenance depots and workshops along the settlements of Amman Jordan Hijaz Railway are listed on below table.

**Table 5: Maintenance Depots/Workshops of JHR**

<table>
<thead>
<tr>
<th>Location</th>
<th>Age</th>
<th>Working status</th>
<th>Condition of Building</th>
<th>Equipment Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amman station</td>
<td>118</td>
<td>working</td>
<td>Stone - Good</td>
<td>Fully equipped</td>
</tr>
<tr>
<td>Maan station</td>
<td>118</td>
<td>working</td>
<td>Stone - Good</td>
<td>Fully equipped</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways*

Today two maintenance Depot/Workshops at Amman and Maan stations are in service. Equipment status of these two maintenance Depots/Workshops are adequate for the services provided.

**Picture 11: Amman Maintenance Depot**

*Source: Site Visit 30 October 2018*

**Rolling Stocks**

The rolling stocks assets of the Jordan Hijaz Railways are exhibited on below tables according to their functions.
### Table 6: Number and Status of Locomotives of JHR

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity (HP)</th>
<th>Age</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam / Mercado</td>
<td>1100</td>
<td>63</td>
<td>2</td>
</tr>
<tr>
<td>Steam / Bong</td>
<td>1100</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>Steam / Stephenson</td>
<td>1100</td>
<td>65</td>
<td>1</td>
</tr>
<tr>
<td>Steam / Nippon Sharyo</td>
<td>1000</td>
<td>61</td>
<td>2</td>
</tr>
<tr>
<td>Diesel / CAT</td>
<td>830</td>
<td>48</td>
<td>5</td>
</tr>
<tr>
<td>Diesel / Lester</td>
<td>1800</td>
<td>48</td>
<td>8</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways, November 2018*

The tractive stocks in the asset of the JHR are six steam locomotives and thirteen diesel locomotives. Although all these equipments are operating, they are old.

### Table 7: Number of Passenger Wagons of JHR

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Age</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>First class</td>
<td>25 seats per salon</td>
<td>63</td>
<td>10</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways, November 2018*

There are ten passenger wagons in the hauled equipment asset of JHR. All the passenger wagons are renewed and operating; however, they are old in age.

### Table 8: Number of Freight Wagons of JHR

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Age</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covered Wagon</td>
<td>30000 K</td>
<td>63</td>
<td>75</td>
</tr>
<tr>
<td>Diesel tank</td>
<td>48000 L</td>
<td>63</td>
<td>1</td>
</tr>
<tr>
<td>Fuel tank</td>
<td>48000 L</td>
<td>63</td>
<td>4</td>
</tr>
<tr>
<td>Un Covered Wagon</td>
<td>10000 K</td>
<td>63</td>
<td>14</td>
</tr>
<tr>
<td>Water tank</td>
<td>48000 L</td>
<td>63</td>
<td>4</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways November 2018*

There are ninety eight freight wagons in the hauled equipment asset of JHR with various type and capacity. The freight wagons are in operating state however they are old in age.

**Other Transport Vehicles**

Other transport vehicles assets of the Jordan Hijaz Railways are exhibited on below table.
Table 9: Other Transportation Vehicles owned by JHR

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>Age</th>
<th>Number</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup truck</td>
<td>20</td>
<td>4 vehicles</td>
<td>Good</td>
</tr>
<tr>
<td>Automobile (Mercedes)</td>
<td>8</td>
<td>4 vehicles</td>
<td>Good</td>
</tr>
<tr>
<td>Off-road Vehicles (Jeep)</td>
<td>8</td>
<td>4 vehicles</td>
<td>Good</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>8</td>
<td>1 vehicle</td>
<td>Good</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways, November 2018*

The various transport vehicles other than railway rolling stock are for support services at JHR.

**Land Estates**

The land estates spaces allocated for stations of the Jordan Hijaz Railway are exhibited on below table.

Table 10: List of Land Estates of JHR by Stations

<table>
<thead>
<tr>
<th>Name of Station</th>
<th>Land estate space allocated for use of station (1000m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almafraq</td>
<td>67</td>
</tr>
<tr>
<td>Alsamrah</td>
<td>50</td>
</tr>
<tr>
<td>Alzrqa</td>
<td>49</td>
</tr>
<tr>
<td>Amman</td>
<td>45</td>
</tr>
<tr>
<td>Alqaser</td>
<td>6.6</td>
</tr>
<tr>
<td>Alluban</td>
<td>46</td>
</tr>
<tr>
<td>Aljeza</td>
<td>50</td>
</tr>
<tr>
<td>Alquraneh</td>
<td>50</td>
</tr>
<tr>
<td>Alabyad</td>
<td>90</td>
</tr>
<tr>
<td>Alhasa</td>
<td>50</td>
</tr>
<tr>
<td>Aljuruf</td>
<td>29</td>
</tr>
<tr>
<td>Unezeh</td>
<td>50</td>
</tr>
<tr>
<td>Jordan</td>
<td>50</td>
</tr>
<tr>
<td>Maan</td>
<td>99</td>
</tr>
<tr>
<td>Shedyeh</td>
<td>52</td>
</tr>
<tr>
<td>Baten alghoul</td>
<td>36</td>
</tr>
<tr>
<td>Modorah</td>
<td>50</td>
</tr>
</tbody>
</table>

*Source: Jordan Hijaz Railways, November 2018*
Some of the stations along the Jordan Hijaz Railway track are deserted and not used in railway operations.

**Picture 12: Deserted Station Building at Railway Section South of Amman**

Source: Site visit, 29 November 2018

**Employment Structure**

The employment structure of the Jordan Hijaz Railway is exhibited on below tables.

**Table 11: JHR Head Office Staff**

<table>
<thead>
<tr>
<th>POSITIONS</th>
<th>TOTAL NUMBER OF STAFF</th>
<th>(years of employment) 0-5</th>
<th>(years of employment) 6-15</th>
<th>(years of employment) 16-25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Management</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Managers</td>
<td>6</td>
<td>-</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Engineers</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Financiers - Economists</td>
<td>6</td>
<td>1</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Office staff</td>
<td>16</td>
<td>-</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Railway operations staff</td>
<td>48</td>
<td>-</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>84</td>
<td>1</td>
<td>72</td>
<td>11</td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways, November 2018
Table 12: JHR Stations Staff

<table>
<thead>
<tr>
<th>POSITIONS</th>
<th>Number of staff by years of employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TOTAL NUMBER OF STAFF</td>
</tr>
<tr>
<td>Railway operations staff</td>
<td>74</td>
</tr>
</tbody>
</table>

Source: Jordan Hijaz Railways, November 2018

2. Railway Transportation in the World and Worldwide Transport Corridors

Recently the railway transportation in the world is gaining importance and railway improvements and railway transportation figures exhibit increasing trend all over the world. The reasons behind the increasing trend in railway transportation are decreasing carbon emission caused by extensive use of fossil fuels in land transportation and also decreasing the transportation costs as well.

2.1. Freight and Passenger Transportation in the World

The improvement of worldwide railway network and in worldwide freight and passenger transportation figures by railways over the years 2007-2016 are given on below table.

Table 13: World Passenger and Freight Transportation Volumes over the Period 2007-2016

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Km</td>
<td>2825,7</td>
<td>2964,0</td>
<td>2996,6</td>
<td>3161,7</td>
<td>3334,4</td>
<td>3441,0</td>
<td>3560,3</td>
<td>3631,0</td>
<td>3713,0</td>
<td>3731,2</td>
</tr>
<tr>
<td>(Million)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tonne Km</td>
<td>9764,2</td>
<td>9802,3</td>
<td>9262,5</td>
<td>10000,0</td>
<td>10499,9</td>
<td>10563,3</td>
<td>10603,8</td>
<td>10759,1</td>
<td>10177,3</td>
<td>9918,1</td>
</tr>
<tr>
<td>(Million)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length km</td>
<td>1104,2</td>
<td>1108,8</td>
<td>1112,6</td>
<td>1116,4</td>
<td>1117,5</td>
<td>1121,1</td>
<td>1126,2</td>
<td>1137,8</td>
<td>1145,9</td>
<td>1148,6</td>
</tr>
</tbody>
</table>

Source: International Union of Railways, October 2018

The passenger and freight transportation volume all over the world were increased over the ten years between 2007 and 2016. The length of the railway on the world is also increased steadily between 2007 and 2017. The length of railway tracks constructed in this period is about 44000 Km.

The distribution of world railway network and also railway transportation figures between the regions all over the world (in percentages) for the year 2016 are exhibited on the below table.
The Russian Federation realized 23% of freight transportation within world’s freight volume at the year 2016 however she has only 7% of railway track of the world in length. In passenger transportation 80% of transportation volume of the world were realized at Asia & Oceania while the longest share of railway track in length (34%) were in America.

The countries operating the biggest railway networks in the world according to their length are the following.

Table 15: Ten Biggest Railway Networks in the World

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Length of the Railway network (km) year 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States of America</td>
<td>293.564</td>
</tr>
<tr>
<td>2</td>
<td>Public Republic of China</td>
<td>191.270</td>
</tr>
<tr>
<td>3</td>
<td>Russian Federation</td>
<td>87.157</td>
</tr>
<tr>
<td>4</td>
<td>Canada</td>
<td>77.292</td>
</tr>
<tr>
<td>5</td>
<td>Republic of India</td>
<td>68.525</td>
</tr>
<tr>
<td>6</td>
<td>Federal Republic Germany</td>
<td>43.468</td>
</tr>
<tr>
<td>7</td>
<td>Australia</td>
<td>36.965</td>
</tr>
<tr>
<td>8</td>
<td>Republic of Argentina</td>
<td>36.917</td>
</tr>
<tr>
<td>9</td>
<td>Republic of France</td>
<td>29.640</td>
</tr>
<tr>
<td>10</td>
<td>Republic of Brazil</td>
<td>28.538</td>
</tr>
</tbody>
</table>

Source: world.bymap.org, November 2018

The Hashemite Kingdom of Jordan took place as 114th in ranking with 507 km length railway network while the project partner countries were Turkey 20th with 12.008 km railway network and Iraq 67th with 2.239 km railway network in ranking.
The volume of transportation operations of these ten biggest railway networks of the world in terms of freight transportation and also in terms of passenger transportation are exhibited on below tables.

**Table 16: Freight Transportation Operation Volume (ten biggest railway network)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Million T/km</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States of America</td>
<td>2.448.480</td>
<td>2017</td>
</tr>
<tr>
<td>3</td>
<td>Russian Federation</td>
<td>2.943.828</td>
<td>2017</td>
</tr>
<tr>
<td>4</td>
<td>Canada</td>
<td>289.910</td>
<td>2017</td>
</tr>
<tr>
<td>5</td>
<td>Republic of India</td>
<td>654.815</td>
<td>2017</td>
</tr>
<tr>
<td>6</td>
<td>Federal Republic Germany</td>
<td>112.232</td>
<td>2017</td>
</tr>
<tr>
<td>7</td>
<td>Australia</td>
<td>401.660</td>
<td>2015</td>
</tr>
<tr>
<td>8</td>
<td>Republic of Argentina</td>
<td>8.377</td>
<td>2017</td>
</tr>
<tr>
<td>9</td>
<td>Republic of France</td>
<td>33.442</td>
<td>2017</td>
</tr>
<tr>
<td>10</td>
<td>Republic of Brazil</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

*Source: oecd.org/transportation, November 2018*

Freight transportation volume of project partner countries; Republic of Turkey for the year 2017 was 11.661 million t/km. Hashemite Kingdom of Jordan 2,077 tons for the year 2015 (Aqaba railways), there was no freight transportation volume information found for the Republic of Iraq.

**Table 17: Passenger Transportation Operation Volume (ten biggest railway network)**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Million p/km</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States of America</td>
<td>10.492</td>
<td>2016</td>
</tr>
<tr>
<td>2</td>
<td>Public Republic of China</td>
<td>645.955</td>
<td>2016</td>
</tr>
<tr>
<td>3</td>
<td>Russian Federation</td>
<td>206.513</td>
<td>2015</td>
</tr>
<tr>
<td>4</td>
<td>Canada</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Republic of India</td>
<td>1.147.190</td>
<td>2016</td>
</tr>
<tr>
<td>6</td>
<td>Federal Republic Germany</td>
<td>79.257</td>
<td>2016</td>
</tr>
<tr>
<td>7</td>
<td>Australia</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Republic of Argentina</td>
<td>7.362</td>
<td>2016</td>
</tr>
<tr>
<td>9</td>
<td>Republic of France</td>
<td>84.682</td>
<td>2016</td>
</tr>
<tr>
<td>10</td>
<td>Republic of Brazil</td>
<td>15.648</td>
<td>2016</td>
</tr>
</tbody>
</table>

*Source: http://knoema.com, November 2018*

Passenger transportation volume for the project partner countries; Republic of Turkey for the year 2016 was 4.325 million p/km., Hashemite Kingdom of Jordan 19.165 passengers for the
year 2017 (Jordan Hijaz Railways), there was no passenger transportation volume information found for the Republic of Iraq.

The railway operators ranking by the revenue earned through railway operations for the year 2017 is exhibited on below table.

Table 18: Ten Big Railway Operators of the World According to the Revenue

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Railway Operator</th>
<th>Country</th>
<th>Revenue Billion US$ 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Deutsche Bahn</td>
<td>Germany</td>
<td>51,14</td>
</tr>
<tr>
<td>2</td>
<td>SNCF</td>
<td>France</td>
<td>40,12</td>
</tr>
<tr>
<td>3</td>
<td>JSC Russian Railways</td>
<td>Russia</td>
<td>39,04</td>
</tr>
<tr>
<td>4</td>
<td>Indian Railways</td>
<td>India</td>
<td>28,8</td>
</tr>
<tr>
<td>5</td>
<td>East Japan Railway Company (JR East)</td>
<td>Japan</td>
<td>27,76</td>
</tr>
<tr>
<td>6</td>
<td>BNSF Railway</td>
<td>USA</td>
<td>21,38</td>
</tr>
<tr>
<td>7</td>
<td>Union Pacific Corporation</td>
<td>USA</td>
<td>21,24</td>
</tr>
<tr>
<td>8</td>
<td>Central Japan Railway Company</td>
<td>Japan</td>
<td>17,14</td>
</tr>
<tr>
<td>9</td>
<td>West Japan Railway Company (JR West)</td>
<td>Japan</td>
<td>14,12</td>
</tr>
<tr>
<td>10</td>
<td>CSX Corporation</td>
<td>Canada</td>
<td>11,4</td>
</tr>
</tbody>
</table>

Source: www.railway.technology.com/feature/worlds-biggest-railway-operators November 2018

The ranking of railway operators in terms of revenue from railway operations is not parallel with the size of the railway network. The revenue earned from railway operations depends on various factors such as railway transport demand, railway transport tariff etc.

The revenue held by German railway operator Deutsche Bahn is at first place of the ranking according to the revenue of world biggest railway operators, while the Germany is at the 5th rank according to the length of railway network. The total of the revenue earned by three Japanese railway operators (US$ 56,02 Billion) is more than total revenue (US$ 42,63 Billion) of two railway operators of USA while the total length of Japanese Railways (27,311 km) is less than the 1/10th of total length of railway in USA.

The Hashemite Kingdom of Jordan is at the cross-road and relevant regional and international transport flows between north (European Union, Turkey and Syria) and south (Kingdom of Saudi Arabia, Yemen and Gulf Countries) and also between east (Asia, Iraq and Iran) and west (North Africa and Egypt). The region where the Old Ottoman Hijaz Railway has been built and especially Jordan as being the core of regional corridors has great challenges to take part within the international transport corridors via railway connections with bordering countries. Currently the region, where the Old Hijaz Railway has been constructed, has challenge to connect some worldwide transport corridors over Turkey when railway links are renewed and extended properly.
2.2. Transport Corridors in the World

Corridors are lines of concentration of socio-economic activity that connect two or more sovereign countries. Multi-national transport corridors are viewed in a context of agreements between states facilitating trade through infrastructure investments and development of commercial services for moving freight.

The public sector generally takes a large interest in the transport system as part of developing the society and because transport activities build on economies of scale requiring shared resources, and that traffic affects also non-users resulting in potentially conflicting goals. Besides the obvious role of supplying infrastructure, there is often a large share of public ownership in firms supplying transport services. It is most pertinent in passenger transport over short distances, but also railways, airlines, forwarders and postal services have a long tradition of state ownership.

Transport corridors are considered as backbones of transportation networks, linking major centers of articulation (e.g. gateways and hubs) and facing a convergence of freight and passenger flows. Most often, they lie at the intersection of economic, demographic and geographic processes as they perform both market serving and market connecting functions. Thus, the corridor as a notion is neither temporally nor spatially immutable, but rather dynamic, contingent on such key factors as economic context (e.g. trade liberalization), investments in infrastructures, and technological changes (e.g. information corridors) and policies.

Corridors come in two main categories. Formal corridors tend to be expanded the planning and investment framework of public and private actors. On many occasions a form of governance, or at least a forum, has been set in place to address some of its challenges. Functional corridors represent an existing structure of flows along some infrastructure. The corridor is thus an operational reality.

The most structured corridors are obviously those that combine formal and functional characteristics. Transport corridors can also display physical variations on a modal basis as infrastructure layout becomes a determining factor. While airline flow configurations show greater autonomy, rail, road, and maritime transport rely more on accessible physical infrastructures.

In this study the transport corridors those are important for improving trade relations between OIC member countries and between OIC member countries and overall world are emphasised below.

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1 COMCEC "Improving Transnational Transport Corridors In the OIC Member Countries: Concept and Cases"
TRACECA (Transit Corridor Europe Caucasus Asia)

TRACECA is an interstate program and initiated at the conference at Brussels at 1993 by the EU Commission and government of founder countries. Objective of TRACECA is economic development of Black Sea Region Caucasus and Central Asia by means of improvement of international transport. TRACECA multimodal (railway, road, maritime) transport corridor is also called as the Silk Road of the 21st Century.

Recently, the partner countries of TRACECA Program are Armenia, Azerbaijan, Bulgaria, Georgia, Iran, Kazakhstan, Kyrgyzstan, Moldova, Romania, Tajikistan, Turkmenistan, Turkey, Ukraine and Uzbekistan.

Figure 3: Traceca Multimodal Transport Corridors

![Image of TRACECA multimodal transport corridors]

Source: Republic of Turkey Ministry of Transport and Infrastructure, November 2018

The Baku-Tbilisi-Kars railway link also connects the program partner countries located at Central Asia to Europa over Turkey. On the other hand, existing railway link between Turkey and Iran also enable connection of Central Asian partner countries to Europe over Turkey.

European Rail Freight Corridors

Today, there are 11 rail freight corridors in Rail Net of Europe. The Rail Freight Corridor (7)-
The Orient Rail Freight Corridor reaches to Bulgaria-Turkey border and link Rail Net of Europe to Turkey. Among 11 RFC, Rail Freight Corridor 10 (RFC 10) Alpine Western Balkan Corridor is at establishment phase.

Figure 4: European Rail Freight Corridors (2018)

Source: Rail Net Europe November 2018

The partner countries of existing (11) rail freight corridors are given on below table.

Table 19: European Rail Freight Corridors Partner Countries

<table>
<thead>
<tr>
<th>RFC No.</th>
<th>Title of the Corridor</th>
<th>Partner Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC 1</td>
<td>Rhine Alpine Corridor</td>
<td>Netherland, Belgium, Germany, Switzerland, Italy</td>
</tr>
<tr>
<td>RFC 2</td>
<td>North Sea Mediterranean Corridor</td>
<td>United Kingdom, France, Germany, Belgium, Netherland, Luxemburg, Switzerland</td>
</tr>
<tr>
<td>RFC 3</td>
<td>Scandinavian Mediterranean Corridor</td>
<td>Norway, Sweden, Denmark, Germany, Austria, Italy</td>
</tr>
<tr>
<td>RFC 4</td>
<td>Atlantic Corridor</td>
<td>France, Germany, Spain, Portugal</td>
</tr>
<tr>
<td>RFC 5</td>
<td>Baltic Adriatic Corridor</td>
<td>Poland, Austria, Italy, Slovakia, Czech Rep.</td>
</tr>
<tr>
<td>RFC 6</td>
<td>Mediterranean Corridor</td>
<td>Spain, France, Italy, Croatia, Slovenia, Hungary, Serbia</td>
</tr>
<tr>
<td>RFC 7</td>
<td>Orient Corridor</td>
<td>Germany, Czech Rep., Slovakia, Hungary, Austria, Romania, Bulgaria, Greece</td>
</tr>
</tbody>
</table>
## CAREC Program – Central Asia Regional Economic Cooperation Corridors

CAREC Program partner countries are Afghanistan, Azerbaijan, People’s Republic of China, Georgia, Kazakhstan, Kyrgyz Republic, Mongolia, Pakistan, Tajikistan, Turkmenistan and Uzbekistan. CAREC Program transportation network are multimodal corridors and the corridor No. 2 is the link between partner countries of the program including Central Asian partner countries and Turkey over Azerbaijan and Georgia (Baku Tbilisi Kars rail link).

**Figure 5: Map of Six Central Asia Economic Cooperation Corridors**

![Map of Six Central Asia Economic Cooperation Corridors](image)

*Source: CAREC Program, November 2018*
The border crossing railway links between the countries in the region as well as the road network with high standards in quality and safety will create opportunities to be linked the region where the Hijaz Railway lied to CAREC Transport Corridors over Turkey.

The effective transport corridors, other than those connecting the European, African and Asian countries, are generally in the North America. The Toronto-Windsor-Detroit-Chicago corridor which is one of the densest and most integrated. The Vancouver-Seattle corridor in the Pacific Northwest and its counterpart the Los Angeles-San Diego-Tijuana corridor. The Montreal-New York corridor, which connects the Quebec-Windsor corridor to the Boston-Washington Megalopolis.

The NAFTA Corridor links the two largest land gateways of North America, Detroit, Michigan and Laredo, Texas. It dominantly relies upon trucking as about 65% of the value of the NAFTA trade is serviced by this mode.

3. The Current Situation in the OIC Member Countries

Railway transportation infrastructure in OIC member countries and their connections with important transportation corridors are summarised in this section.

3.1. Asian Group

Afghanistan, Albania, Azerbaijan, Bangladesh, Brunei, Indonesia, Iran, Kazakhstan, Kyrgyzstan, Malaysia, Pakistan, Tajikistan, Turkey, Turkmenistan and Uzbekistan and Guyana and Suriname where also included in Asian Group are the OIC member countries those have railway network and they have in country and border crossing railway transportation operations. Maldives is the only country in Asian Group that has no railway network. Brief information on railway network of these countries are listed below.

Afghanistan

The first railway network in Afghanistan is constructed at 1885 and the total length was only 177 km. Recently Afghanistan has three railway lines at the north of the country. The first one is 1522 mm gauge line and connected to Uzbekistan railway network, the second 1435 mm gauge line is connected to Turkmenistan and the third line is in country lines at Faryab province near Turkmenistan border. Railway Operations in Afghanistan deal with freight transportation only but a new line with Iran connection is in progress and this line will be used for passenger operations too. The project Pakistan Uzbekistan 2067 km length railway corridor over Afghanistan and TAT (Tajikistan-Afghanistan-Turkmenistan) railway connection are also developed. Afghanistan is a member of CAREC multimodal transportation corridors program.
Albania

Albania railway network is constructed after the year 1950. The total length of standard gauge rail track is 447 km. Albanian Railway network is linked with Montenegro Railway network. After 1990 maintenance of Albanian railway system was neglected. As a result, the operation volume decreased drastically. Passenger/km was 12 million at 2013 while it was 223 million at 1993 and Ton/km was 22 million while it was 54 million at 1993.

Azerbaijan

The railway operations in Azerbaijan started at 1917. Azerbaijan railway network is 1522 mm broad gauge track and 2932 km in length and 1272 km of the network is electrified. 815 km of electrified section is double track. Azerbaijan is located at the core of Euro-Asia transport corridors and has direct railway connections with Russian Federation, Georgia and Kazakhstan over Caspian Sea. Azerbaijan is one of the member countries of CAREC multimodal transportation corridors program. Azerbaijan is also in TRACECA freight transport network.

Bangladesh

Bangladesh introduced with railway network at the year 1862. Recently Bangladesh operates 2885 km length railway network. The railway network of Bangladesh is multi gauge track which 1838 km section of the railway network is meter gauge track and 682 km section is broad gauge track. The railway operations in Bangladesh are extensively passenger transportation in between 498 railway stations in the country. Passenger transportation volume was 8135 million passenger/km at the year 2014.

Brunei

The 2.5 km length Railway network at Brunei is only 19.3 km 600 mm narrow gauge rail track between Seria and Baulas and 4 km 1533 mm broad gauge rail track which is connecting to Lumat LNG port. The oldest line in the country is 2.5 km, 711 mm gauge Brooketon-Collieny rail track is not in operation for the time being and will going to be used as an open air museum.

Indonesia

Railway operations in Indonesia started at the year 1867. The length of the 1067 mm narrow gauge railway network of Indonesia is 5042 km and generally located at Sumatra. In other regions of the country also standard gauge 1435 mm railway track is on operation.

Iran

The railway network in Iran is firstly established at the year 1914. Recently railway network in
Iran is 12998 km in standard gauge and 1426 km section of the railway network is double track and 146 km section is electrified. Iran has direct railway connection with some bordering countries such as Turkey, Turkmenistan and Pakistan. In near future Iran will have railway connection with Afghanistan.

Kazakhstan

Kazakhstan operates 15500 km length railway network. The railway network in Kazakhstan is 1520 mm gauge track and firstly established at the year 1893. Kazakhstan has direct railway connections with Russian Federation, Kyrgyzstan and China and with Azerbaijan over Caspian Sea. Kazakhstan is located on the Euro-Asia Land Bridge and is one of the partners of New Silk Road Project. Kazakhstan is in the member countries of CAREC multimodal transportation corridors program and also in TRACECA freight transport network.

Kyrgyzstan

The railway network in Kyrgyzstan is 1520 mm wide gauge single track 320 in length. The Railway operations in Kyrgyzstan were started at the year 1915. Kyrgyzstan railways do not deal with in country passenger transportation but operates border crossing passenger transportation to destinations at Kazakhstan and Russian Federation over Kazakhstan. Uzbekistan will also be connected to Balykchy railway station at Issik Kol coast in Kyrgyzstan. Kyrgyzstan is one of the partners of New Silk Road Project and also in TRACECA freight transport network and one of the member countries of CAREC multimodal transport corridors program.

Malaysia

The railway network in Malaysia is 1975,5 km in length. The meter gauge section of the railway network is 1776 km with 767 km double track and remaining standard gauge section is 199,5 km. Railway operations in Malaysia started at the year 1886. Malaysia has also urban transport rail system including mono rail.

Maldives

Maldives does not have any railway network.

Pakistan

Railway operation in Pakistan started at the year 1861. Recently Pakistan railways operates multi gauge (1676 mm, meter gauge and 762 mm narrow gauge) network which is 7791 km in length. Railway operations in Pakistan are both in freight and passenger transportation fields. Pakistan Railways Co. is planning to upgrade 1676 km length section of railway network in 2026 vision to serve China Pakistan Economic Corridor. Pakistan is one of the member countries of CAREC multimodal transport corridors program.
Tajikistan

The railway network in Tajikistan is 1520 mm broad gauge and 680 km in length and connects main western Urban Centers of the country. The projected North-South railway corridor will also enable connections with the southern cities of Tajikistan. Tajikistan Railway network also have connection with Uzbekistan railway network.

Turkey

Railway transportation infrastructure of Turkey is presented in details in section 5.2.1.

Turkmenistan

Railway network in Turkmenistan is 1520 mm broad gauge and 4980 km in length. Turkmenistan railway network is on North South Transit Corridor and also have connection with Trans Caspian Railway Network.

Uzbekistan

Railway network in Uzbekistan is 1522 mm gauge and 4642 km in length and 1685 km length section is electrified. Uzbekistan manages railway operations effectively with almost 90% of in country freight transportation is made by railways and for the year 2017 the freight transportation volume was 11,64 thousand ton/km. Uzbekistan railways also serves to passenger transportation and the volume of passenger transportation was 2127 thousand passenger /km for the year 2017. Uzbekistan has railway connection to TRECECA rail corridor and one of the member countries of CAREC multimodal transport corridors program.

Guyana

Guyana railway network is only 97,4 km and connects the capital city Georgetown with Rosignal.

Suriname

Suriname had 173 km meter gauge railway track built at the year 1912. At 1912 the railway operations were completely stopped.

3.2. Arab Group

Algeria

Railway operations in Algeria were started at the year 1857. Today Algeria has 4200 km. railway network and 1085 km section of the railway network is narrow 1055 mm gauge and remaining is standard 1435 mm gauge. Algeria Railways has both passenger and freight transportation operations.
**Bahrain**

Bahrain is one of the partner countries of Gulf Corporation Council railway network that is under progress. (Please also see section 5.4)

**Comoros**

Comoros does not have any railway network.

**Djibouti**

Djibouti – Ethiopia railway connection started operations in the year 2018. The railway is 759 km length standard gauge rail track and reaches to Port of Doraleh in Djibouti from Addis Ababa and carries both passengers and freight.

**Egypt**

Railway network in Egypt is standard gauge (1435 mm) and 5083 km in length. The railway operations in Egypt started in the year 1854 and today continue with in-country passenger and freight transportation operations.

**Iraq**

Railway transportation infrastructure of Iraq is presented in details in section 5.3.1.

**Jordan**

Railway transportation infrastructure of Jordan is presented in details in section 1.4.

**Kuwait**

Kuwait is one of the partner countries of Gulf Corporation Council railway network that is under progress. (Please see section 5.4)

**Lebanon**

Lebanon railway network was an extension of the Old Ottoman Hedjaz Railways system with 408 km narrow gauge rail track but not in operation anymore.

**Libya**

The narrow gauge railway network in Libya was constructed by Italy at the beginning of the 20th century but the railway system in Libya is not in operation since 1965.

**Mauritania**

Railway network in Mauritania is standard gauge and 704 km in length. Mauritania railway generally deals with freight transportation.

**Morocco**

Morocco railway network is standard gauge and 2067 km in length. Morocco Railways have
connection to Algeria border. Railway operations are in country passenger and freight transportation.

**Oman**

Oman is one of the partner countries of Gulf Corporation Council railway network that is under progress. (Please see section 5.4)

**Palestine**

Palestine railway network as an extension of the Old Ottoman Hedjaz Railways also operated by League of Nations Mandate Administration between 1920 and 1948 and the main line linked El Kantara (Egypt) with Haifa

**Qatar**

Qatar state owned railway Company was established at the year 2011 and developed railway network project to be connected with Gulf Corporation Council railway network that is under progress (Please see section 5.4) and also developed urban rail transportation projects.

**Saudi Arabia**

Please see section 5.4.

**Somalia**

The narrow gauge (950 mm) 114 km railway line in Somalia has been built in 1910 to connect Mogadishu with Villabruzzi and is not in operation for the time being.

**Sudan**

Sudan railway network is 1067 mm narrow gauge track and 5898 km in length. The first railway track was built at 1870 for military purposes. Sudan Railways transports passengers and freight. As at today 1/3 of the railway network is out of operations.

**Syria**

Syria has 2435 km standard gauge railway network. In addition 138,5 km section of narrow gauge (1050 mm) Old Ottoman Hijaz railway between Damascus and Dara at Jordanian border is laid in Syria. Syria has railway connections with Turkey and Iraq and Jordan. Domestic and transborder Railway operations of Syrian Railways are suspended in great extend after the year 2011.

**Tunisia**

The railway network of Tunisia is multi gauge, the Northern part of the network consists of 471 km standard gauge track and the Southern part of the network consists of 1686 km meter gauge track. Tunisia railways transports both passengers and freight.
**United Arab Emirates**

UAE is one of the partner countries of Gulf Corporation Council railway network that is under progress. (Please see section 5.4). Existing 264 km standard gauge railway network in UAE will be connected to GCC railway when completed.

**Yemen**

Yemen does not have any railway network.

**3.3. African Group**

**Benin**

Benin Railways has 578 km meter gauge railway network. Railway operations in Benin started at the year 1906 and today Benin Railways carries passenger and freight within the country. African Rail projects that will commence border crossing operations cover some of the region countries (Burkina Faso, Ivory Coast, and Niger) including Benin.

**Burkina Faso**

Burkina Faso has 622 km meter gauge railway network. Burkina Faso railways manages both passenger and freight transportation operations. Burkina Faso is one of the African Rail Project participants for enabling cross border railway operations.

**Cameroon**

Cameroon railway network is 517 km meter gauge track and connects two big cities of the country. Cameroon railways manages both passenger and freight transportation.

**Chad**

Chad does not have any railway network in operation but two railway links (528 km from N'Djemen - capital city of Chad to Kantere in Cameroon and 826km to Sudan border are under construction.

**Gabon**

Gabon railways are in operation since 1987. The length of railway network in Gabon is 669 km and constructed in standard gauge. Gabon railways operates passenger trains between 23 railway stations in the country.

**The Gambia**

Gambia does not have any railway network.
Guinea

Guinea – Bissau railway network is multi gauge network. 279 km section of the railway network is standard gauge and 880 km section is meter gauge. Guinea – Bissau railway operations cover both in country passenger and freight transportation.

Guinea Bissau

Guinea Bissau does not have any railway network.

Ivory Coast

Ivory Coast has meter gauge railway network which is 660 km in length. Railway operations in Ivory Coast are in country passenger and freight transportation. Ivory Coast is participating in in African Rail Project together with Burkina Faso, Benin and Niger.

Mali

Mali railway network is meter gauge track 729 km in length. The Mali railway runs from Port of Koulikoro via Bamako to Senegal border and continues to Dakar of Senegal.

Mozambique

Mozambique railway network is composed of 2983 km narrow gauge (1067 mm) single line track and 140 km 762 mm narrow gauge track. The narrow gauge network of Mozambique is compatible with neighbouring countries railway networks.

Niger

Niger does not have any railway network but railway line construction has been started at the year 2014 to connect the country with Benin and with Nigeria.

Nigeria

Nigeria has 3505 km length multi gauge railway network. Standard gauge section of Nigeria railway network is 507 km remaining 2998 km section is 1067 mm narrow gauge. Nigeria railways deal with passenger and freight transportation within the country.

Senegal

The meter gauge railway network of Senegal is 906 km in length. Dakar Senegal Bamako Mali 1268 km standard gauge railway project is under progress. Indeed this project is a part of multimodal trans-boundary transport corridor including Senegal, Mali, Burkina Faso, Niger, Nigeria, Cameroon, Chad, Sudan Ethiopia and Djibouti. It is combination of trans-African Highway -5 with combined distance of 8715 km.
Sierra Leone

Narrow gauge (762 mm) railway network has been constructed in Sierra Leone at the year 1897 but the railway operations completely stopped since 1974.

Togo

TOGO has 568 km meter gauge railway network but the railway network is not in operation.

Uganda

Uganda railways were built at the year 1896 a meter gauge railway system. Uganda railways transport passenger and freight through in country routes and have also connection with Kenya.

3.4. Other OIC Member Countries and Relations with Transportation Corridors

Development of the cross border economic relations and trading is dependent on existence of effective and economic transportation potential and infrastructure. Transport corridors are developed to facilitate cross border transportation through effective use of existing infrastructure and international transportation links and adjusting legislative formalities for custom and transit transport formalities to ease procedures for border crossing transportation for transporters of the member states.

There are a number of important transportation corridors those facilitating international trade relations of the OIC member countries.

Initially TRACECA (Transport Corridor Europe- the Caucasus-Asia) is aimed at developing a West-East transport corridor from Europe, across the Black Sea, through the South Caucasus and the Caspian Sea, built on the Trans-European Networks on the EU territory, the Pan European Transport Corridors in Europe, especially the Black Sea Pan European Transport Area and the New Silk Route to Asia. After the start-up phase covering 1993-1995, projects focused on making the physical corridor operational and on strengthening the Black Sea–Caspian link as well as the Central Asian.

In September 1997 Azerbaijan and Georgia jointly proposed to host a Presidential Conference in the Caucasus I 1998 that could lead to the signing of Basic Multilateral Agreement on Transport initiated within the TRACECA program.

A conference was held with participation of Azerbaijan, Bulgaria, Georgia, Kyrgyzstan, Moldova, Romania, Turkey, Ukraine and Uzbekistan and “Basic Multilateral Agreement on International Transport for Development of the Corridor Europe-the Caucasus-Asia was signed with on International Transport for Development of the Corridor Europe-the Caucasus-Asia
and its Technical Annexes on international railway and road transport, international maritime navigation, customs and documentation procedures.

OIC member countries Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Turkey and Uzbekistan are within the TRACECA Transport Corridor. TRACECA Program is providing multimodal transportation links for facilitation of international trade between Central Asia, Caucasus and European countries as well as between OIC member countries.

The Central Asia Regional Economic Cooperation (CAREC) Program is a partnership of 11 countries and development partners working together to promote development through cooperation, leading to accelerated economic growth and poverty reduction. It is guided by the overarching vision of “Good Neighbours, Good Partners, and Good Prospects.”

Since 2001 CAREC has mobilized about US$ 31.5 billion investments for establishment of multimodal transportation networks, energy trade and security and to facilitate free movement of people and freight. OIC member countries Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Pakistan and Uzbekistan are within the members of CAREC Program.

The European Bank for Reconstruction and Development initiated the “Transportation and Economic Corridor Building in Central Asia Project” at the year 2018. The TC Project will be supported by EBRD and Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan. The objectives of the project are i) promoting market-based transport systems with an emphasis on private sector involvement, ii) developing sustainable and integrated transport networks, and iii) broadening economic activity through the development of the sector.

International North South Transport Corridor is a multimodal transport network including railways for moving freight between India, Iran, Afghanistan, Armenia, Azerbaijan, Russia, Central Asia and Europe. Two routes under the INSTC (India-Baku (Azerbaijan) via Bandar Abbas (Iran) are conducted in 2014 and other two routes under consideration will include Kazakhstan and Turkmenistan. The INSTC will synchronize with the Ashgabat Agreement which is a multi-modal Transport agreement signed by India, Oman, Turkmenistan, Uzbekistan, Kazakhstan and Pakistan to facilitate transportation of goods between Central Asia and the Persian Gulf.

One of the prominent transport project at Africa is the East African Railway Master Plan. The East African Railway Master Plan aims to revive the railways serving Tanzania, Kenya, and Uganda adding railways to serve Rwanda and Burundi. The objective is to further the economic development of eastern Africa by increasing the efficiency and speed and lowering the cost of transporting cargo between major ports on the Indian Ocean coast and the interior region. All new railways will be standard gauge and existing narrow gauge railways will be rehabilitated.

Trans African multimodal transport corridor is 1268 km standard gauge railway project. The project includes Dakar-Senegal, Bamako-Mali and connects Senegal, Mali, Burkina Faso, Niger.
Nigeria, Cameroon, Chad, Sudan Ethiopia and Djibouti. Combined distance of the Trans African corridor with Trans African Highway-5 will be 8715 km.

Four of African OIC member countries, Benin, Burkina Faso, Ivory Coast and Niger agreed to invest on railways to commence border crossing operations to facilitate intra-African trade.

Trans Africa Railway line will connect West African coast and East African coast passing over ten countries; Senegal, Burkina Faso, Benin, Nigeria, Cameroon, Chad, Central Africa, South Sudan, Ethiopia and Djibouti and will transport 42 million TEUs containers per year. The Trans Africa Railway line will start at port of Dakar in Senegal and will reach to port of Djibouti and is expected to be completed at the year 2022.

4. Current Situation in the Region Where Hijaz Railways Lie

4.1. Socio-Political Situation in the Region

The region where the Old Ottoman Hijaz Railway constructed is commonly known as the Middle East in geographic and political contexts. The countries in the region are located on the Arab Peninsula and the people of those countries are Arabic descent and the common language is Arabic language except Turkey and Iran. The region is also in the focus of global business world because of fossil fuel resources. The political situation within the region is mostly unstable during the last decade as had been observed time to time over the last century.

On the other hand, some transportation infrastructure investments those aimed connecting the region countries with each other and with international transport corridors are in the region are in progress or are projected. Such as the National Railway Network Project of Jordan (See Section 4.1.14), Nusaybin – Habur railway link project of Turkey (See: Section 4.2.1), Mosul – Zakho railway link project of Iraq (see: Section 4.3.1), Northern railway project of Saudi Arabia (See: Section 4.6.1) and GCC railway network project of Gulf Countries (See: Section 4.6.1). Settlement of the in country and inter country conflicts in the region will facilitate economic relations between the countries in the region and also with the world globally.

Today the main narrow gauge line of Hijaz Railway and its remains are in Syria, Jordan and Saudi Arabia borders. Turkey is also included within the countries where the Old Ottoman Hijaz Railway laid. The Ottoman standard gauge railway network was connecting to Hijaz Railway at Damascus. The extensions of the Old Hijaz Railway reached to Lebanon and Palestine.

The countries those hosted the Old Ottoman Hijaz Railway line between Istanbul and Almadina Almunawara, namely Turkey, Syria, Jordan and Saudi Arabia are OIC member countries. The historical and religious and cultural background and common language facilitate social relations between the people of Jordan, Saudi Arabia and Syria. In general it can be said that
the political relations between these countries and between these countries and Turkey were always kept in moderateness.

Political conflicts emerged in last decade at Syria effected the socio-political relations as well as the economic relations in negative direction between Syria and Jordan and also between Syria and Turkey. Today Turkey is hosting about four millions and Jordan is hosting about five hundred thousands of Syrian refugees. The border gates between Turkey and Syria and between Jordan and Syria are not reflecting the previous dynamic activeness anymore. Social and touristic visits between Syria and bordering countries enormously decreased.

**4.2. Economic Relations Between the Countries in the Region**

The economic relations between the countries where the Hijaz Railway line lies in general were affected negatively by the conflict in Syria. The trade relations between Syria and Turkey, Jordan and Saudi Arabia were decreased continuously while crisis in Syria continued.

The following foreign trade indicators reflect the negative affect of instability in the Syria on foreign trade volume between the countries in the region.

- Imports of Jordan from Syria were decreased in great extend import volume for the year 2017 is only 17,8 % of the import volume for the year 2010. (See Table 26 below)
- Imports of Turkey from Syria were decreased also import volume for the year 2017 is 10,6 % of the import volume for the year 2010. (see Table 23 below)
- Import volume of Syria from Jordan for the year 2017 is about 18,4 % of the import volume for the year 2010. (See Table 26 below) Imports of Syria from Turkey were also decreased, import volume of Syria from Turkey for the year 2017 (USD 1.365 million) is about 26 % in comparison with the import volume for the year 2010(USD 1.845 million).

Trade relations between the countries where the Hijaz Railway Line lied at the present date (Turkey, Syria and Jordan) and OIC member countries are not considerably strong. Only United Arab Emirates is within the partner countries of Turkey in exportation. The OIC member countries within the important foreign trade partners of Jordan are Saudi Arabia, United Arab Emirates, Kuwait, Qatar, Turkey and Indonesia.

The worldwide important trade partners for Turkey are United States of America, European Union, United Kingdom, China, United Arab Emirates and Israel. Saudi Arabia, (See Section 4.1.2) United States of America, Germany, Italy, Japan and South Korea are important trade partners of Jordan. (See Section 4.4). Important export partners of Syria are Lebanon, Egypt,
Saudi Arabia, Turkey, Jordan and Spain and the important import partners are Turkey, Republic of China, Russian Federation, Egypt, Lebanon and South Korea\textsuperscript{2}.

The transportation between countries in the region for personal and trade purposes are depended on land transportation generally. Airway transportation especially for passenger transport is another preferable mode of transport within the region. The sea gate port Aqaba enables connection to Red sea and Mediterranean via Red sea and Suez channel and Aden gulf and Oman Sea via Red Sea for trade and cruise vessels.

The Hashemite Kingdom of Jordan is connected to bordering countries, Iraq, Saudi Arabia, Syria and Palestine by roads. The road connections are also available to Turkey over Syria and Iraq and Arab Gulf countries over Saudi Arabia and over Iraq.

Rail line connections exist in between some countries in the region. (See Figure below) Turkey and Syria are connected with standard gauge railway, the Old Hijaz Railway enable railway connection between Turkey and Jordan over Syria. Turkey and Iraq are connected with standard gauge railway over Syria, which also enables railway connection between Iraq and Syria. But the conflict in Syria caused suspension of the scheduled train round trips between Syria and Turkey, Syria and Iraq. The train trips between Jordan and Syria were also stopped. Recently limited land transportation over Jordan Syria border is started but the railway transportation is still remain suspended.

\textsuperscript{2} ITC Trade Map
Figure 6: Middle East Railways Map

Source: International Union of Railways October 2018

Road network in the region is wider than railway network in the region. Road connections between Turkey and Iraq and Syria and Iran, between Syria and Iraq and Lebanon, between Jordan and Syria and Iraq and Palestine and Saudi Arabia, between Iraq and Saudi Arabia and Iran are used for trade and passenger transportation purposes.

The countries in the region, Jordan, Iraq, Saudi Arabia, Lebanon, Gulf countries and Turkey also have sea ports for loading and unloading commercial goods as well as hosting passenger ships. Jordan is at the core point of transportation ways of the region, located on the way connecting Read Sea and Black Sea and Europa over Turkey.

The trade volume between region countries is also affected negatively by conflict in Syria. The trade volume between Jordan and Syria, Jordan and Iraq, Jordan and Saudi Arabia and Jordan and Turkey are considerably decreased. The progress of reciprocal trade relations and between Jordan and bordering countries and Turkey over the years 2010 – 2017 are given on below tables.
Table 20: Exports and Imports Between Jordan and Turkey (USD Million)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>61</td>
<td>98,1</td>
<td>134,1</td>
<td>103,2</td>
<td>170,5</td>
<td>100,7</td>
<td>86</td>
<td>104</td>
</tr>
<tr>
<td>Imports</td>
<td>558,4</td>
<td>549</td>
<td>951</td>
<td>754,6</td>
<td>849</td>
<td>757</td>
<td>664</td>
<td>683</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>-497,4</td>
<td>-450,9</td>
<td>-816,9</td>
<td>-651,4</td>
<td>-678,5</td>
<td>-656,3</td>
<td>-578</td>
<td>-579</td>
</tr>
</tbody>
</table>

Source: Hashemite Kingdom of Jordan Ministry of Trade and Industry October 2018

The value of exports of Jordan to Turkey, also imports of Jordan from Turkey were steadily increasing between the years 2010 and 2014. After the year 2015 decreasing trend was observed both for exports to Turkey and for imports from Turkey.

Table 21: Exports and Imports Between Jordan and Iraq (USD Million)

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<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>915,5</td>
<td>1010</td>
<td>1011,7</td>
<td>1247,3</td>
<td>1170,5</td>
<td>696,3</td>
<td>470,3</td>
<td>516,1</td>
</tr>
<tr>
<td>Imports</td>
<td>233,9</td>
<td>310,7</td>
<td>205,1</td>
<td>357,3</td>
<td>6,2</td>
<td>1</td>
<td>2,7</td>
<td>1,6</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>681,6</td>
<td>699,3</td>
<td>806,6</td>
<td>890</td>
<td>1164,3</td>
<td>695,3</td>
<td>467,6</td>
<td>514,5</td>
</tr>
</tbody>
</table>

Source: Hashemite Kingdom of Jordan Ministry of Trade and Industry October 2018

The trend observed at the export and import figures between Jordan and Iraq over the years 2010 and 2014 is similar with the foreign trade trend between Jordan and Turkey. While the exports of Jordan to Iraq and were steadily increasing from the year 2010 to the year 2015, decreasing trend was observed after the year 2015. Also the imports of Jordan from were increasing between the years 2010 and 2014, started to decrease after the year 2014 and at the year 2017. At the year 2017 the value of imports from Iraq and also total volume of trade between Jordan and Iraq decreased under values realized at the year 2010.

Table 22: Exports and Imports Between Jordan and Saudi Arabia (USD Million)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>637</td>
<td>632,3</td>
<td>739,4</td>
<td>920</td>
<td>1000,9</td>
<td>1111,6</td>
<td>912,9</td>
<td>807,3</td>
</tr>
<tr>
<td>Imports</td>
<td>3056,9</td>
<td>4187,9</td>
<td>4885</td>
<td>4030,5</td>
<td>4466,1</td>
<td>3069,8</td>
<td>2332,1</td>
<td>2762,7</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>-2419,9</td>
<td>-3555,6</td>
<td>-4145,6</td>
<td>-3110,5</td>
<td>-3465,2</td>
<td>-1958,2</td>
<td>-1419,2</td>
<td>-1955,4</td>
</tr>
</tbody>
</table>

Source: Hashemite Kingdom of Jordan Ministry of Trade and Industry October 2018

Progress of the foreign trade between Jordan and Saudi Arabia was also turned to a negative trend and decreased in a great extend starting from the year 2015 while the trend was steadily increasing both for exports of Jordan to Saudi Arabia between the years 2020 and 2015 and for imports of Jordan from Saudi Arabia between the years 2010 and 2014. The total of foreign
trade volume between Jordan and Saudi Arabia for the year 2017 is under the total foreign trade volume for the year 2010.

Table 23: Exports and Imports between Jordan and Syria (USD Million)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exports</td>
<td>237,16</td>
<td>253,96</td>
<td>197,4</td>
<td>134,26</td>
<td>199,08</td>
<td>118,72</td>
<td>43,12</td>
<td>43,68</td>
</tr>
<tr>
<td>Imports</td>
<td>374,08</td>
<td>373,8</td>
<td>237,16</td>
<td>258,16</td>
<td>151,34</td>
<td>101,22</td>
<td>88,62</td>
<td>66,5</td>
</tr>
<tr>
<td>Trade Balance</td>
<td>-136,92</td>
<td>-119,84</td>
<td>-39,76</td>
<td>-123,9</td>
<td>47,74</td>
<td>17,5</td>
<td>-45,5</td>
<td>-22,82</td>
</tr>
</tbody>
</table>

Source: Hashemite Kingdom of Jordan Ministry of Trade and Industry October 2018

The negative effect of the political instability in the Syria is also reflected to foreign trade between Jordan and Syria. The exports of Jordan to Syria and imports of Jordan from Syria increased at the year 2011 when compared with the export of import figures of the year 2010. After the year 2012 the exports of Jordan to Syria and imports of Jordan from Syria decreased. The volume of exports to Syria for the year 2017 were 17,2 % of the volume of exports of the year 2011 and the volume of imports from Syria were 17,8 % of the volume of imports of the year 2011. The total volume of foreign trade between Jordan and Syria for the year 2017 is 17,5 % of the foreign trade volume between two countries for the year 2011.

4.3. Trade and Transportation Between the Countries in the Region

The trade relations of the countries in the region are outspread at wide spectrum of countries. The trade relations between the countries in the region and other OIC countries are not considerably significant when the foreign trade figures of the countries in the region are considered.

The Hashemite Kingdom of Jordan has a series of bilateral agreements in fields of foreign trade and economic corporation with the project partner countries and also with the bordering countries. Some of these agreements related with foreign trade and economic corporation and the date of agreements are listed below.

**Jordan-Turkey Relations**

- A technical cooperation agreement was signed at 03 February 2014
- A partnership agreement to constitute of free trade scope between two countries was signed at 01 December 2009
- An agreement on mutual administrative cooperation for application of Custom legislation was signed at 01 December 2009
- An agreement on reciprocal execution of incentives and protection of investments was signed at 02 August 1993
- An agreement of avoiding double taxation on income and properties was signed at 06 June 1985

54
An agreement on maritime transport signed at 24 March 2010
Memorandum of Understanding on Civil Aviation were signed at 28 June 2001 and 01 November 1998

**Jordan-Iraq Relations**

- An agreement on International Road Transport and Goods was signed at 23 November 1989
- An agreement on technical and economic cooperation was signed at 01 May 1980
- An agreement on Transport, Movement and Trade was signed at 10 November 1960
- An agreement on air transport was signed at 04 November 1953
- A Trade agreement was signed at 30 September 1953
- An agreement of free trade zone was signed at 06 February 2003
- An agreement on International Road Transport was signed at 30 March 2000
- An agreement on sea trade and seaport was signed at 19 February 1995

**Jordan-Syria Relations**

- A free trade agreement was signed at 08 October 2001
- An agreement of mutual administrative cooperation for application of custom legislation, avoidance, detection, and control of custom violation was signed at 08 October 2001
- A cooperation agreement on standardization was signed at 18 August 2000
- An agreement on International Road Transport was signed at 03 August 1999
- An agreement on air services was signed at 21 April 1976
- An agreement on economic cooperation and commercial exchange was signed at 06 April 1975
- An amending agreement of economic exchange and transport and transit regulation was signed at 26 April 1965
- An agreement to regulate the economic exchange, transportation and transit was signed at 18 February 1953

**Jordan-Saudi Arabia Relations**

- An agreement on International Road Transport was signed at 26 November 2001
- An amendment to the agreement on the economic cooperation was signed at 22 November 1966
- An agreement on for establishment of scheduled air services was signed at 20 November 1963
- An economic cooperation agreement was signed on 30 October 1962
Foreign trade figures and foreign trade partner countries of the Hashemite Kingdom of Jordan and project partner countries (Republic of Turkey and Republic of Iraq) of this research are specifically analysed in section 4 (See Section 4.4 below). In summary, it is observed that OIC countries are not specifically important foreign trade partners of these three countries. Same conclusion can also be reached for other countries in the region.

The Kingdom of Saudi Arabia is one of the largest economies in the region when the foreign trade volume is considered. The foreign trade volume\(^3\) of Saudi Arabia for the year 2017 reflects a reduction comparatively with previous years. Saudi Arabia’s exports of goods was US$ 376 Billion at the year 2013 and US$ 218 at the year 2017 and the volume of goods imported by Saudi Arabia was US$ 168 Billion at the year 2013 and US$ 130 Billion at the year 2017. The OIC member countries within the ten partner countries of Saudi Arabia for exports are Kuwait, Egypt, Turkey and Bahrain. At the year 2017 the total volume of the exports to these four OIC member countries consists 3.7 % of total exports of Saudi Arabia while total volume of exports to United States of America and China was 5.2 % of total export volume. Also in import of goods the OIC member Countries are not in significant partners of Saudi Arabia while the volume of goods imported from the Republic of China consists 14.5 % of total volume of goods imported.

The United Arab Emirates is another big economy in the region. At the year 2016 total volume of export of goods was US$ 360 Billion and volume of import of goods was US$ 268 Billion. Within OIC member Countries Saudi Arabia, Turkey and Qatar were in top ten export partners of the United Arab Emirates while any OIC member countries was not in top ten import partners of the United Arab Emirates for the year 2016.

Total volume of exports of the Syria Arab Republic of was US$ 748 Million while the total volume of imports was US$ 4178 Million for the year 2016\(^4\). OIC member countries Egypt, Jordan and Turkey were within big ten export partners of Syria while Turkey Lebanon and Egypt were within big ten import partners.

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\(^3\) Santander Trade Portal
\(^4\) OEC Atlas
5. Analyses Performed at Selected Three OIC Member Countries

5.1. Jordan

Transportation system of the Hashemite Kingdom of Jordan is mainly focused on road network. Beside the road transportation infrastructure there are about 600 km. length railway network in Jordan. Maritime transportation has an important role for importation and exportation of trade commodities through Aqaba port. In freight and passenger transportation from other countries to Jordan and from Jordan to abroad air transportation is also extensively used.

5.1.1. Existing Transportation Infrastructure in Jordan

Highway Transportation Infrastructure

The road network of Jordan consists of 7.900 km. road in length with about 3.400 km. classified as main road. Jordan Long-Term National Transport Strategy Project (2014 - 2030) does not envisage any investments for construction of new roads except some links and ring roads but envisages road improvements and maintenance to achieve a minimum standard of pavement conditions across the main roads, road safety measures aimed to enhance the road safety, road widening to improve narrow roads and to increase road capacity of selected links to solve bottlenecks, road measures included in JNTS National Transport Safety Programme, incentives to fleet (trucks, private cars) renewal, also for reduction of environmental impacts and tolled highways.
Figure 7: Road Map of Jordan

Source: Elizon Maps – October 2018
Maritime Transportation Infrastructure

The Aqaba port is the only sea gate of Jordan and has special importance in foreign trade of the country. Various imported commercial goods are delivered and also various export goods are shipped at Aqaba port.

Jordan Long-Term National Transport Strategy Project envisages investments for improvement of Aqaba port facilities in the short term phase (2014 - 2018) including relocation of main port facilities to south port, new cruise ship terminals at main port, development of berths for bulk commodities at middle port, upgrading existing passenger ferry terminal at the middle port, rehabilitation of oil terminal at south port, new liquid terminals at south port, rehabilitation of industrial port at south port, new general cargo, Ro-Ro and grain terminals, new port area infrastructures at south port. Integration of port and railway project development is envisaged during medium term phase (2019 - 2024) and expansion container terminal at middle port (phase 3) is envisaged during long-term phase (2024 - 2030).

Railway Transportation Infrastructure

The old Hijaz Railway section is operated by Jordan Hijaz Railway Corporation and only 227 km. length section from Syria border till Al-Abyad station is operated for passenger transportation for tourism purposes. The railway section between Al-Abyad and BatenAlghol stations is 168,5 km and rented to Aqaba Railway corporation by Jordan Hijaz Railway Corporation.

Jordan Long-Term National Transport Strategy Project envisages only optimisation and making the best use of existing facilities to secure the phosphate traffic during short term and medium term phases. The “National Railway Network project, core south - north corridor from Aqaba to Syrian border” as a part of the Red Sea – Black Sea land bridge is envisaged to be implemented during the medium – term (2019 - 2024) and long term (2025- 2030) phases. See below map.
Airway Transportation Infrastructure

In Jordan recently core point for cargo and passenger airway transportation with scheduled flights is Queen Alia International airport nearby Amman. Amman Marka International airport is also in operation for cargo and passenger flights and Aqaba King Hussein International airport is strongly specialized for touristic flights.

Jordan Long-Term National Transport Strategy Project envisages development of a series of policies and regulations to align international and European aviation regulations and rehabilitation and expansion of Queen Alia International airport phase - 2 investments and passenger terminal development at Aqaba King Hussein International airport during short term and rehabilitation of east road access at Queen Alia International airport, rehabilitation, expansion and operation of Amman Marka International airport specialized for low cost, charter and executive flights in the medium and long term.
5.1.2. Transport Infrastructure Projects in Jordan

Ministry of Transport of Hashemite Kingdom of Jordan prepared and announced “Jordan Long Term National Transport Strategy and Action Plan” at the year 2012. The Long Term National Transport Strategy is a combination of policy measures to achieve of the final goal which can be summarized as to have a transport system to face the future demand for multimodal approach and supporting the economy and the people of Jordan. The framework of measures for coordination between different modes and cooperation between different transport authorities is also stated by the Long Term National Transport Strategy.


Jordan National Railway network project envisages three main links;

- **Aqaba – Syria link (north – south line):** 509 km. mainline can be said as the backbone of the network, will connect the Jordan’s only port with capital city Amman and industrial cities Zarqa and Mafraq and will be extended to Jordan Syria border.
- **Zarga – Iraq link:** Zarga – Iraq link, 290 km. rail line will connect the main line of railway network to Jordan - Iraqi border.
- **Link to Saudi Arabia:** 91 km. rail line will be connected the main line via Zarqa-Iraq link. Saudi Arabia connection will be a part of the transport corridor that will connect GCC countries with Europe via Syria/Iraq and Turkey.

The estimated cost of Jordan National Railway Project US$ 4.33 bln. with 2011 prices. The project cost includes US$ 2.97 bln. railway infrastructure, US$ 0.55 bln. rolling stock and US$ 0.81 bln. real estate development (land ports and hospitality and services facilities). The project infrastructure including real estate development will be realized a state owned “Infrastructure Company” and the railway network will be operated by a private “Operating Company”.

Another important public transportation project in Hashemite Kingdom of Jordan is Amman Zarqa Rapid Bus Transportation project. The project aims at connecting Zarqa (one of the crowded cities of Jordan) to capital city Amman. Implementation of Amman-Zarqa Rapid Bus Transportation project could not be commenced yet because of financial obstacles.
5.1.3. International Trade within the Region and within OIC Member Countries

Foreign trade indicators of Jordan over the years 2013 – 2017 are shown in below table. Import of goods and services are increased at the year 2017 while decrease is observed at the years 2014 – 2016. The import of goods and services were decreased and also export of goods and services increased at the year 2017 while decreased at the years 2015 and 2016. The average of export of services was 44.5% of total exports in value within the years 2013 – 2017 while the rate of exports of services increased to 53.3% for the year 2017.

The total value of exports as a percentage of GDP decreased to 57% for the year 2017 while the rate for the year 2013 was 72%. On the other hand, value of exports as a percentage of GDP also decreased to 35.6% while the rate was 42.4% for the year 2013.

Table 24: Jordan Foreign Trade Indicators

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports of Goods (million USD)</td>
<td>22,067</td>
<td>22,930</td>
<td>20,332</td>
<td>19,207</td>
<td>20,055</td>
</tr>
<tr>
<td>Exports of Goods (million USD)</td>
<td>7,913</td>
<td>8,385</td>
<td>7,829</td>
<td>7,509</td>
<td>7,458</td>
</tr>
<tr>
<td>Imports of Services (million USD)</td>
<td>4,500</td>
<td>4,532</td>
<td>4,578</td>
<td>4,438</td>
<td>4,582</td>
</tr>
<tr>
<td>Exports of Services (million USD)</td>
<td>6,026</td>
<td>6,597</td>
<td>5,760</td>
<td>6,233</td>
<td>6,371</td>
</tr>
<tr>
<td>Imports of Goods and Services (Annual % Change)</td>
<td>4.3</td>
<td>-0.9</td>
<td>-3.0</td>
<td>-6.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Exports of Goods and Services (Annual % Change)</td>
<td>2.6</td>
<td>7.5</td>
<td>-9.0</td>
<td>-2.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Imports of Goods and Services (in % of GDP)</td>
<td>72.0</td>
<td>69.7</td>
<td>60.5</td>
<td>56.2</td>
<td>57.0</td>
</tr>
<tr>
<td>Exports of Goods and Services (in % of GDP)</td>
<td>42.4</td>
<td>43.3</td>
<td>37.6</td>
<td>35.1</td>
<td>35.6</td>
</tr>
<tr>
<td>Trade Balance (million USD)</td>
<td>-11,648</td>
<td>-11,966</td>
<td>-10,333</td>
<td>-9,588</td>
<td>-10,656</td>
</tr>
<tr>
<td>Trade Balance (Including Service) (million USD)</td>
<td>-9,944</td>
<td>-9,460</td>
<td>-8,592</td>
<td>-8,130</td>
<td>-8,595</td>
</tr>
<tr>
<td>Foreign Trade (in % of GDP)</td>
<td>114.3</td>
<td>113.1</td>
<td>98.1</td>
<td>91.3</td>
<td>92.6</td>
</tr>
</tbody>
</table>

Source: World Trade Organization - October 2018

Imports of goods were in decreasing trend after 2014 but increased almost same volume as in 2014 at 2017 while imports of services were increasing steadily.

Export of goods and services were decreased after 2014. Main export products and their percentages in total exports for the year 2017 are given in below table.
Table 25: Main Export Products (2017)

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special garments for professional, sporting or other purposes</td>
<td>18.1%</td>
</tr>
<tr>
<td>Mineral or chemical potassic fertilizers</td>
<td>6.3%</td>
</tr>
<tr>
<td>Medicaments consisting of mixed or unmixed products</td>
<td>5.7%</td>
</tr>
<tr>
<td>Natural calcium phosphates and natural aluminium, calcium phosphates</td>
<td>5.0%</td>
</tr>
<tr>
<td>Parts of aircraft and spacecraft</td>
<td>3.4%</td>
</tr>
<tr>
<td>Medicaments consisting of two or more constituents</td>
<td>3.1%</td>
</tr>
<tr>
<td>Tomatoes, fresh or chilled</td>
<td>3.0%</td>
</tr>
<tr>
<td>Transmission apparatus for radio-telephony,</td>
<td>2.4%</td>
</tr>
<tr>
<td>Live sheep and goats</td>
<td>2.2%</td>
</tr>
<tr>
<td>Diphosphorus pent oxide; phosphoric acid</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

Source: World Trade Organization - October 2018

Garment products and mineral fertilizers and derivatives of mineral fertilizers were more than 30% of total exports volume of Jordan for the year 2017.

Main import products and their percentages in total exports for the year 2017 are shown in below table.

Table 26: Main Import Products (2017)

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor cars and other motor vehicles principally transport of persons</td>
<td>7.2%</td>
</tr>
<tr>
<td>Petroleum gas and other gaseous hydrocarbons crude</td>
<td>5.8%</td>
</tr>
<tr>
<td>Petroleum oils and oils obtained from bituminous minerals</td>
<td>5.4%</td>
</tr>
<tr>
<td>Petroleum oils and oils obtained from bituminous minerals (excl. Crude)</td>
<td>5.3%</td>
</tr>
<tr>
<td>Spark-ignition reciprocating or rotary internal combustion piston engines</td>
<td>2.7%</td>
</tr>
<tr>
<td>Gold, incl. gold plated with platinum, unwrought or not further worked</td>
<td>2.5%</td>
</tr>
<tr>
<td>Medicaments consisting of mixed or unmixed products</td>
<td>2.2%</td>
</tr>
<tr>
<td>Transmission apparatus for radio-telephony</td>
<td>1.9%</td>
</tr>
<tr>
<td>Fabrics, knitted or crocheted,</td>
<td>1.6%</td>
</tr>
<tr>
<td>Motor vehicles for the transport of goods</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Source: World Trade Organization - October 2018

About than 28% of imports volume of Jordan were motor vehicles, engines and engine parts and petroleum products and derivatives of petroleum products for the year 2014.
Foreign trade partners of Hashemite Kingdom of Jordan exhibit a wide spectrum of countries both in exportation and importation. The OIC member countries, Kingdom of Saudi Arabia, United Arab Emirates, Kuwait and Qatar are main partner countries of Jordan when exports of Jordan for the year 2017 is considered. The total value of exports to these four OIC member countries is 23,3% of total exports of Jordan while the share of United States of America is 21,5% in total exports of Jordan.

Table 27: Main Partner Countries of Jordan 2017

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>21.5%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>11.3%</td>
</tr>
<tr>
<td>Iraq</td>
<td>7.3%</td>
</tr>
<tr>
<td>India</td>
<td>6.9%</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>4.7%</td>
</tr>
<tr>
<td>Kuwait</td>
<td>4.6%</td>
</tr>
<tr>
<td>Qatar</td>
<td>2.2%</td>
</tr>
<tr>
<td>China</td>
<td>2.2%</td>
</tr>
<tr>
<td>Lebanon</td>
<td>1.9%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*

OIC Member countries, the Kingdom of Saudi Arabia, United Arab Emirates and Republic of Turkey are in main partner countries of Jordan beside the United States of America and Republic of China when the year 2017 imports are considered. The total share of these three OIC member countries is 21,7% while total share of USA and China is 23,3% within the total value of imports of Jordan for the year 2017.

Table 28: Main Partner Countries of Jordan (2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>13.5%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>13.5%</td>
</tr>
<tr>
<td>United States</td>
<td>9.8%</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>4.9%</td>
</tr>
<tr>
<td>Germany</td>
<td>4.4%</td>
</tr>
<tr>
<td>Italy</td>
<td>4.0%</td>
</tr>
<tr>
<td>Turkey</td>
<td>3.3%</td>
</tr>
<tr>
<td>Japan</td>
<td>2.8%</td>
</tr>
<tr>
<td>South Korea</td>
<td>2.7%</td>
</tr>
<tr>
<td>India</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*
5.2. Turkey

5.2.1. Railway Infrastructure and Connection with the Hijaz Railway

History of Railway Network within the present national boundaries of the Republic of Turkey started at the year 1856 with granting privilege for construction of 130 km length Aydin – Izmir railway line by Ottoman Empire. Roads and Roads Construction Department of the Ministry of Public Works of Ottoman Empire has carried responsibility and management for construction of railway network within the borders of Ottoman Empire. At September 24, 1872 Ottoman Empire Railway Administration has been established for management of construction and operation of railways.

Within the boundaries of Ottoman Empire total length of the railway network constructed were 8.619 km till to the year 1923 when the Turkish Republic founded. At the year 1923 only 4.136 km section of 8.619 km railway network of Ottoman Empire were in national boundaries of Turkish Republic and 1.377 km section of railway network were operated by Turkish State and 2.404 km section of railway network were operated by foreign companies.

Republic of Turkey enacted law to nationalize the railway network and for operating the railway network "Anatolian and Baghdad Railways General Directorate" under the Ministry of Public Works which was established at May 24, 1924. At May 31, 1927, "General Directorate of State Railways and Harbours" under Ministry of Public Works was established for directing both construction and operations of state railways. The "General Directorate of State Railways and Harbours" was associated under subordination of Ministry of Transportation in 1939.

Today, "General Directorate of State Railways" of Republic of Turkey operates 12.608 km length railway network including 10.195 km length conventional railway line and 1.213 km length High Speed Train railway line.

Old Hijaz Railway that started from Damascus of Syria and passes over Jordan from Syria border at north till to Saudi Arabia Border at south and till to Almadina Monawara of Saudi Arabia was a part of the railway network those has been constructed during Ottoman Time but now Hijaz Railway lies out of the borders of the Republic of Turkey. The railway network of Republic of Turkey connects to Old Hijaz Railway at Tahtakopru station that is at Syrian border of Turkey and Maydan Ikbiz station of Syria. The rail track connecting from Turkey to Syria and the rail track section in Syria till Damascus is standard gauge track. The narrow gauge Old Hijaz Railway starts from Damascus station and end at Almadina Monawara station. The second connection between the Turkish railway network and the Syrian railway network is at Çobanbey border station of Turkey.

Republic of Turkey took important steps for improvement of railway network of Turkey within last decade and the following important investments to be realized or programmed for constructing new railway tracks or renewing some existing railway tracks.
High Speed Train Railways (Hstr) Projects

- Ankara – Istanbul HSTR track:
  First phase of 513 km length Ankara – Istanbul High Speed Railway track with 250 km/h operating speed, Ankara – Eskishehir section was completed at the year 2009 and second section Eskishehir – Pendik was also completed at the year 2014. Gebze – Halkali suburban railway line is under progress and Ankara – Istanbul HSR track will be connected to Europe continuously via Marmaray sub-marine tunnel passage.

- Ankara – Konya HSTR track:
  Ankara – Konya HSTR track was completed at the year 2011. The length of Ankara - Konya HSR track is 213 km and the operating speed is 300 km/h. Ankara – Konya HSR also enables Konya – Eskishehir – Istanbul connection.

- Ankara - Izmir HSTR track:
  Ankara- Izmir HSTR track is under progress. The length of Ankara – Izmir HSR track will be 624 km and the operating speed is projected as 250 km/h.

- Ankara - Sivas HSTR track:
  Ankara – Sivas HSTR track is under progress. The length of Ankara – Sivas track will be 405 km and the operating speed is projected as 250 km/h.

Speed Train Railways (Str) Projects

- Konya - Karaman STR track:
  Konya - Karaman STR track is under progress. The length of Konya – Karaman STR track will be 102 km and the operating speed is projected as 200 km/h.

- Bursa - Bilecik STR track:
  Bursa – Bilecik STR track is under progress. The length of Bursa – Bilecik STR track will be 166 km and the operating speed projected as 200 km/h.

- Sivas – Erzincan STR track:
  Sivas – Erzincan STR track’s construction will be realized in three segments, the first segment, Sivas – Zara is on progress and projects for second and third segments is going to be prepared. Operating speed of Sivas – Erzincan STR track is projected as 200 km/h.

- Karaman – Mersin – Adana – Gaziantep STR track:
  Karaman – Mersin – Adana – Gaziantep STR track is under progress and the operating speed of Karaman – Mersin – Adana – Gaziantep STR track is projected as 200 km/h.
Planned Conventional Railway Track Projects

- Gebze – Sabiha Gökçen Airport – Yavuz Sultan Selim Bridge – New İstanbul Airport – Halkalı conventional railway project.
- Halkalı (İspartakule) – Kapıkule conventional railway project.
- Bursa – Gemlik conventional railway project.
- Eskişehir – Kütahya (Alayunt) – Afyonkarahisar (Zafer Airport) – Burdur – İsparta – Antalya (north – south corridor) conventional railway project.
- Antalya – Burdur – Denizli – Aydın – İzmir conventional railway project.
- Yerköy – Kayseri speed railway project.
- Kayseri – Nevşehir – Aksaray conventional railway project.
- Tokat Turhal conventional railway project.
- Gaziantep – Nizip – Şanlıurfa – Mardin – Nusaybin conventional railway project.
- Kahramanmaraş – Nurdağ conventional railway project.
- Erzincan – Erzurum – Kars conventional railway project.
- Sivas-Malatya-Elazığ-Diyarbakır conventional railway project.
- Gölbaşı-Adıyaman-Kahta conventional railway project.
- Erzincan-Gümüşhane-Trabzon conventional railway project.
- Siirt-Kurtalan conventional railway project.

Today, railway connection between the Republic of Turkey and the Republic of Iraq is achieved through 70 km railway segment that lies on Syria. State Railways of the Republic of Turkey also projected new railway track about 150 km in length that will be lied on the segment between Nusaybin (station Turkey – Syria border) to Habur (Turkey – Iraq) border. On the other hand, the Republic of Iraq is also projecting 167 km double track railway between Mosul – Duhok –Zakho (at Iraq Turkey border). Realization of these railway investments Turkey and Iraq will be directly connected with railways.

5.2.2. International Trade within the Region and Within OIC Member Countries

The Republic of Turkey is located at the core point of the transport corridors which connects the region with Europe. The import of goods in value decreased at the years 2014 – 2016 in comparison with the imports in value for the year 2013, while an increased was realized at the year 2017 but the value of imported goods is still less in comparison with the year 2013. The similar decreasing trend is observed in the value of goods exported for the years 2014-2017 in comparison with the year 2014.

The value of exports of services exceeded the value of services imported over the years 2013 – 2017.
For the year 2017, total value of goods and services imported was 29.3% of GDP while total value of goods and services was 24.8% of GDP.

Table 29: Turkey Foreign Trade Indicators

<table>
<thead>
<tr>
<th>Years</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports of Goods (million USD)</td>
<td>251,661</td>
<td>242,177</td>
<td>207,199</td>
<td>198,610</td>
<td>233,800</td>
</tr>
<tr>
<td>Exports of Goods (million USD)</td>
<td>151,803</td>
<td>157,610</td>
<td>143,883</td>
<td>142,557</td>
<td>157,020</td>
</tr>
<tr>
<td>Imports of Services (million USD)</td>
<td>23,018</td>
<td>23,054</td>
<td>20,819</td>
<td>22,215</td>
<td>22,662</td>
</tr>
<tr>
<td>Exports of Services (million USD)</td>
<td>47,400</td>
<td>51,030</td>
<td>45,910</td>
<td>37,634</td>
<td>43,392</td>
</tr>
<tr>
<td>Imports of Goods and Services (Annual % Change)</td>
<td>8.0</td>
<td>-</td>
<td>0.4</td>
<td>1.7</td>
<td>3.7</td>
</tr>
<tr>
<td>Exports of Goods and Services (Annual % Change)</td>
<td>1.1</td>
<td>8.2</td>
<td>4.3</td>
<td>-</td>
<td>1.9</td>
</tr>
<tr>
<td>Imports of Goods and Services (in % of GDP)</td>
<td>28.1</td>
<td>27.6</td>
<td>26.0</td>
<td>24.9</td>
<td>29.3</td>
</tr>
<tr>
<td>Exports of Goods and Services (in % of GDP)</td>
<td>22.3</td>
<td>23.8</td>
<td>23.3</td>
<td>22.0</td>
<td>24.8</td>
</tr>
<tr>
<td>Trade Balance (million USD)</td>
<td>- 79,917</td>
<td>- 63,593</td>
<td>- 48,128</td>
<td>- 40,892</td>
<td>- 58,949</td>
</tr>
<tr>
<td>Trade Balance (Including Service) (million USD)</td>
<td>- 56,299</td>
<td>- 36,918</td>
<td>- 23,900</td>
<td>- 25,629</td>
<td>- 39,005</td>
</tr>
<tr>
<td>Foreign Trade (in % of GDP)</td>
<td>50.4</td>
<td>51.4</td>
<td>49.3</td>
<td>46.8</td>
<td>54.2</td>
</tr>
</tbody>
</table>

Source: World Trade Organization, October 2018

Exports volumes of goods and services of Turkey decreased after the year 2014 but increase was observed for the year 2017. Similar trend observed for imports of goods and services of Turkey.

The main export products of Turkey for the year 2017 are exhibited on below table.

Table 30: Main Export Products (2017)

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor cars and other motor vehicles principally designed for transport of persons</td>
<td>7.5%</td>
</tr>
<tr>
<td>Gold, incl. gold plated with platinum, unwrought or not further worked than semi manufactured</td>
<td>4.2%</td>
</tr>
<tr>
<td>Motor vehicles for the transport of goods, including chasis with engine and cab</td>
<td>3.1%</td>
</tr>
</tbody>
</table>
The three exports items of Turkey with the largest in volume are motor vehicles for transport of persons, gold and derivatives products of gold and motor vehicles for transport of goods. Total volume of these three exports items is the 15% of total exports volume for the year 2017.

Main import products of Turkey for the year 2017 are shown in below Table.

### Table 31: Main Import Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, incl. gold plated with platinum, unwrought...</td>
<td>7.1%</td>
</tr>
<tr>
<td>Petroleum oils and oils obtained from bituminous...</td>
<td>4.2%</td>
</tr>
<tr>
<td>Motor cars and other motor vehicles principally designed for the transport of persons</td>
<td>3.7%</td>
</tr>
<tr>
<td>Parts and accessories for tractors, motor vehicles</td>
<td>2.6%</td>
</tr>
<tr>
<td>Ferrous waste and scrap; re-melting scrap ingots of iron and steel</td>
<td>2.6%</td>
</tr>
<tr>
<td>Transmission apparatus for radio-telephony, radio telegraphy radio broadcasting</td>
<td>1.8%</td>
</tr>
<tr>
<td>Coal; briquettes, ovoids and similar solid fuels manufactured from coal</td>
<td>1.7%</td>
</tr>
<tr>
<td>Diodes, transistors and similar semiconductor devices</td>
<td>1.6%</td>
</tr>
<tr>
<td>Polymers of propylene or of other olefins, in primary forms</td>
<td>1.2%</td>
</tr>
<tr>
<td>Medicaments consisting of mixed or unmixed products</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization - October 2018*
The three import items of Turkey with the largest in volume are gold and derivative products of gold, petroleum products and derivatives of petroleum products and motor vehicles for transport of persons. Total volume of these three imports items is the 17.9% of total imports volume for the year 2017.

Turkey’s foreign trade partners exhibit a wide spectrum of countries both in exportation and importation. Any country in the region and also any OIC country were not within the top ten trade partner of Turkey when the import figures for the year 2017 are considered. On the other hand, only the United Arab Emirates was within the top ten trade partners of Turkey within the countries of the region and also within OIC member countries when export figures for the year 2017 is considered (5.8% of total value of exports).

Table 32: Main Partner Countries of Turkey (2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>9.6%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6.1%</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>5.8%</td>
</tr>
<tr>
<td>United States</td>
<td>5.5%</td>
</tr>
<tr>
<td>Italy</td>
<td>5.4%</td>
</tr>
<tr>
<td>France</td>
<td>4.2%</td>
</tr>
<tr>
<td>Spain</td>
<td>4.0%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2.5%</td>
</tr>
<tr>
<td>Israel</td>
<td>2.2%</td>
</tr>
<tr>
<td>Belgium</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*

Table 33: Main Partner Countries of Turkey (2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>10.0%</td>
</tr>
<tr>
<td>Germany</td>
<td>9.1%</td>
</tr>
<tr>
<td>Russia</td>
<td>8.3%</td>
</tr>
<tr>
<td>United States</td>
<td>5.1%</td>
</tr>
<tr>
<td>Italy</td>
<td>4.8%</td>
</tr>
<tr>
<td>France</td>
<td>3.5%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3.0%</td>
</tr>
<tr>
<td>South Korea</td>
<td>2.8%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2.8%</td>
</tr>
<tr>
<td>Spain</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*
Turkey has railway and also highway connection with all the bordering countries, such as with Syria at south, with Iraq at south east, with Iran at east, with Georgia at north east and connection with the Traceca freight transport network via Iran and Georgia, with Bulgaria at north west and connection with the Trans-European transport network via Bulgaria and with Greece at west. Turkey also has connection with seaway connections with the countries those are on Black Sea and Mediterranean coasts.

The quality and efficiency of both railway and highway infrastructure of Turkey were significantly improved during first two decades of 21st century and the role of the Turkey in regional transit trade transportation is gained importance.

Turkey is also connected to some neighbouring countries via pipelines for oil and gas transportation such as Iraq (Kirkuk – Yumurtalik), Azerbaijan via Georgia, Iran and Russia Federation and has pipeline connection with Greece (Trans - Anatolia “Tanap” pipeline) for transit transportation of Shahdeniz - Azerbaijan natural gas to Europe.

Turkey will also have a potential for connecting to GCC Railway in the future and enabling this connection the role of Turkey as being a bridge on the way to Europe.
5.3. Iraq

5.3.1. Railway Infrastructure and Connection with the Hijaz Railway

Background of Iraqi railways goes to early 20th century. At 1903 “Societe Imperial Ottomane du Chemin de fer de Bagdad” has been established to realize Istanbul - Konya – Baghdad - Basra standard gauge (1435 mm) railway connection. Construction of Istanbul Baghdad railway continued even during the First World War and Istanbul – Baghdad Railway connection has been realized at the year 1918.

Recently, Republic of Iraq has 2,339 km. length standard gauge railway network. Main links of Iraqi railway network are,

- Rabia (at north west of the country on Syria – Iraq border) – Mosul – Baghdad – Basrah – Umm Qasir link, connects Aleppo of Syria (and Nusaybin of Turkey via Syria) to Umm Qasir at Basrah Gulf.
- Kirkuk – Abu Kamal (at west of the country on Syria – Iraq border link, reaches to Syrian border and connect to Baghdad and further to Basrah Gulf with Abu Kamal Baghdad link.
- Republic of Iraq government intent to improve extend Iraqi national railway network and to connect the country with the eastern and middle part of Europa as well as the Arabic Gulf. Iraqi Ministry of Transportation adopted a plan to implement rail line projects. The eastern and western railway lines projects are advertised by Republic of Iraq National Investment Commission to attention of foreign and national investors.

The Eastern Railway Line Which Includes the Following Projects

- Mosul – Duhok – Zakho (at Turkish border) 167 km. two way line with design speed of 200 km/h for passenger and 140 km/h for freight transportation
- Kirkuk – Sulamaniyah 118 km. one way line with design speed of 200 km/h for passenger and 140 km/h for freight transportation
- Baghdad – Ba’quba – Kirkuk – Erbil – Mosul railway and Khanigee – Muntryiah (at Iraqi – Iranian Border) branch line, 555 km. two way line with design speed of 250 km/h for passenger and 140 km/h for freight transportation (Islamic Republic of Iran also planned to extend Iranian railway network to Shalamcheh at Iraqi border) 5
- Bagdad – Kut – Imara – Basrah 504 km. two way line with design speed of 250 km/h for passenger and 140 km/h for freight transportation

5 www.almonitor.com, Article by Adnan Abu Zeed, 30 November 2018
The Western Railway Line Which Includes the Following Projects

- Kut – Nasiriyyah 173 km. two way line with design speed of 250 km/h for passenger and 140 km/h for freight transportation
- Kut – Ba’quba 250 km. one way line with design speed of 250 km/h for passenger and 140 km/h for freight transportation
- Basrah – Fao 110 km. one way line with design speed of 140 km/h for passenger and 100 km/h for freight transportation
- Basrah – Shalamjah 35 km. one way line with design speed of 120 km/h for passenger and 80 km/h for freight transportation
- The circular line around City of Baghdad, 140 km. two way line with design speed of 200 km/h for passenger and 140 km/h for freight transportation
- Shiaebah – Safwan railway connection with Kuwait and Gulf Countries with design speed of 250 km/h for passenger and 140 km/h for freight transportation

5.3.2. International Trade Within the Region and Within OIC Member Countries

The foreign trade indicators of the Republic of Iraq over the years 2013 – 2017 are given on below table.

Total value of goods imported was decreased for the years 2014 – 2017 in comparison with the year 2013. But the decrease in value of exported goods is drastically decreased after the year 2014 in comparison with the years 2013 – 2014.

Total value of the Goods and services exported is 32.5 % of GDP while total value of goods and services imported is 40.9 of GDP for the year 2016.

Table 34: Iraq Foreign Trade Indicators

<table>
<thead>
<tr>
<th>Years</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports of Goods (million USD)</td>
<td>61,000</td>
<td>59,000</td>
<td>52,000</td>
<td>47,900</td>
<td>41,222</td>
</tr>
<tr>
<td>Exports of Goods (million USD)</td>
<td>89,742</td>
<td>84,630</td>
<td>49,320</td>
<td>43,735</td>
<td>45,525</td>
</tr>
<tr>
<td>Imports of Services (million USD)</td>
<td>14,353</td>
<td>14,482</td>
<td>12,200</td>
<td>10,037</td>
<td>n/a</td>
</tr>
<tr>
<td>Exports of Services (million USD)</td>
<td>3,092</td>
<td>3,873</td>
<td>4,961</td>
<td>4,835</td>
<td>n/a</td>
</tr>
<tr>
<td>Years</td>
<td>2013</td>
<td>2014</td>
<td>2015</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Imports of Goods and Services (in % of GDP)</td>
<td>36.0</td>
<td>36.9</td>
<td>40.9</td>
<td>40.9</td>
<td>36.3</td>
</tr>
<tr>
<td>Exports of Goods and Services (in % of GDP)</td>
<td>39.7</td>
<td>41.3</td>
<td>34.9</td>
<td>32.5</td>
<td>37.6</td>
</tr>
<tr>
<td>Trade Balance (million USD)</td>
<td>39,321</td>
<td>38,781</td>
<td>-10,253</td>
<td>-8,785</td>
<td>n/a</td>
</tr>
<tr>
<td>Trade Balance (Including Service) (million USD)</td>
<td>27,961</td>
<td>28,121</td>
<td>-3,894</td>
<td>-3,583</td>
<td>n/a</td>
</tr>
<tr>
<td>Foreign Trade (in % of GDP)</td>
<td>75.7</td>
<td>78.3</td>
<td>75.8</td>
<td>73.4</td>
<td>73.9</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*

Imports and exports volume of Iraq were decreased starting from the year 2014. Exports volume for the year 2016 is 52.4 % of the export volume of the year 2013. Imports volume for the year 2016 is 77% of the import volume of the year 2013.

The republic of Iraq is a petroleum oil exporting country and share of the petroleum products is over 99 % of total exports of Iraq in monetary terms. The main export products of Iraq for the year 2017 are exhibited on below table.

**Table 35: Main Export Products (2015)**

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum oils and oils obtained from bituminous minerals</td>
<td>99.3%</td>
</tr>
<tr>
<td>Petroleum oils and oils obtained from bituminous containing 70 % by weight of petroleum oils</td>
<td>0.5%</td>
</tr>
<tr>
<td>Lubricant preparations, incl. cutting-oil preparations</td>
<td>0.2%</td>
</tr>
<tr>
<td>Raw skins of sheep or lambs, fresh, or salted, dried limed, pickled or otherwise preserved</td>
<td>0.0%</td>
</tr>
<tr>
<td>Guts, bladders and stomachs of animals (other than fish) fresh, chilled, frozen, salted</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization- October 2018*

Exports volume of petroleum products and derivatives of petroleum products is over 99.9 % of total exports volume of Iraq for the year 2015.

**Table 36: Main Import Products (2014)**

<table>
<thead>
<tr>
<th>Product</th>
<th>Percentage in Total Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum gas and other gaseous hydrocarbons</td>
<td>17.2%</td>
</tr>
</tbody>
</table>
Petroleum gas and material for petroleum industry (tubes, pipes, profiles) have the largest share in the import volume of Iraq (38.6%) for the year 2014.

The countries in the region do not have any significant share within the export volume of Republic of Iraq however United Arab Emirates, Egypt, Jordan, Iran and Morocco are within the top ten main partner countries. The OIC countries do not have any significant share within the import volume of the Republic of Iraq except the United Arab Emirates and Iran and Indonesia. The share of goods and services imported from the United Arab Emirates is about 14.9%, from Iran Islamic Republic is about 1.6%, Republic of Indonesia is about 1.4% of total imports of the Republic of Iraq while share of the Republic of China is 28% of the total imports of Iraq in monetary terms.

**Table 37: Main Partner Countries of Iraq (2017)**

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Arab Emirates</td>
<td>0.2%</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.2%</td>
</tr>
<tr>
<td>Lebanon</td>
<td>0.0%</td>
</tr>
<tr>
<td>Italy</td>
<td>0.0%</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.0%</td>
</tr>
<tr>
<td>Jordan</td>
<td>0.0%</td>
</tr>
<tr>
<td>Iran</td>
<td>0.0%</td>
</tr>
<tr>
<td>Morocco</td>
<td>0.0%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization - October 2018*

**Table 38: Main Partner Countries of Iraq (2017)**

<table>
<thead>
<tr>
<th>Country</th>
<th>% of Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>28.3%</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>14.9%</td>
</tr>
<tr>
<td>South Korea</td>
<td>7.8%</td>
</tr>
<tr>
<td>United States</td>
<td>6.6%</td>
</tr>
<tr>
<td>Country</td>
<td>Contribution</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Japan</td>
<td>4.2%</td>
</tr>
<tr>
<td>Italy</td>
<td>2.5%</td>
</tr>
<tr>
<td>India</td>
<td>2.2%</td>
</tr>
<tr>
<td>France</td>
<td>2.0%</td>
</tr>
<tr>
<td>Iran</td>
<td>1.6%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

*Source: World Trade Organization - October 2018*

Also the OIC member countries do not have a significant share within the total volume of exports or imports of the Republic of Iraq. Turkey has an important intermediary role for foreign trade of Iraq through joint operations for transit transportation of crude oil between Kirkuk (Iraq) and Yumurtalik (export sea port in Turkey) via pipe line. Iraq and Turkey also connected with highway and Iraq Turkey highway connection is extensively used for trading between two countries and also for transit transportation through Turkey.

### 5.4. Transport Infrastructure Projects in the Region

Recently the countries in the region have credible projects and investments on improvement of railway network. The projects related with improvement of the railway transportation in the Jordan is stated in the section 4.3.2 and as being the project partner countries, Turkey is stated in the section 4.1.1 and Iraq in the section 4.2.1.

Other important projects related with railway improvement in the countries within the region are summarized below.

**Kingdom of Saudi Arabia**

Kingdom of Saudi Arabia completed the railway network which connects Dammam that is one of the important ports of the Kingdom at Arab Gulf coast and Riyadh. Eastern railway network is operated by Saudi Railways Organization (SRA) both for freight and passenger transportation operations since 1951.

Kingdom of Saudi Arabia Public Investment Fund established the Saudi Railways Company (SAR) in 2006 in order to realize North Railway project to connect the northern part of the country with eastern and central regions of the Kingdom and also Alharamen High Speed Train project that connects Makkah al Mukarramah and Almadina Almonawara via Jeddah.

Northern Railway section between Riyadh and Hail is in operation and the section between Hail and Qurayyat at Jordanian border will be in operation in the near future.

Alharamen High Speed Train is in operation with 360 km/h operating speed since March 2018.
SAR’s railway extension projects, connecting Al Baitha bauxite mines to Ras Al-Khair port and Ras-Al Khair port to Jubail and the section connecting Jubail and Dammam and also internal network at the Industrial City of Jubail are on progress. The section that will connect Damman and Ras-Al Khair will also be a section of GCC Railway.

Kingdom of Saudi Arabia will also construct 663 km length section of Gulf Cooperation Council (GCC) railway within borders of the Kingdom.

**Gulf Rail (GCC Railway) Project**

The route of Gulf Cooperation Council Railway project starts from Muskat the capital city of Oman and ends at Kuwait City of Kuwait passing over countries of Arab Gulf. The GCC railway is financed by participating countries and expected to be completed at the year 2021. The total length of the GCC railway will be 2117 km and passing over borders of Oman (306 km), United Arab Emirates (684 km), Kingdom of Saudi Arabia (663 km), Qatar (283 km), Bahrain (36 km) and Kuwait (145 km). (See Figure below)

**Figure 9: Map of GCC Railway Route**

![GCC Railway Route Map](source: www.thebig5hub.com – October 2018)
5.5. Analyses for Reconstruction of the Hijijaz Railway Line

Transport demand in the Hashemite Kingdom of Jordan both for passenger and freight transportation is increasing in each year due to increase in the population of the country and also with the economic growth. In addition, touristic transport demand will increase when stability in the region secured.

A part of the land transport demand will shift to railway transportation after commencement of railway transportation by JHR and cause decrease in the traffic load on roads and also traffic accidents.

In section 1.4.2, the analysis of the existing situation of the Jordan Hijaz Railway network is given. The recommended alignment for reconstruction of the Jordan Hijaz Railway is principally the alignment of existing railway track between Jaber station at Syrian border and Al Abyad station at southern section of the existing railway. Jordan Hijaz Railways made has rental agreement with Aqaba Railway Company for allocation of the railway section between Al Abyat and Baten Alghol stations to be operated for transportation of phosphate mines to Aqaba port. The maintenance of this section of the railway track is also under responsibility of the Aqaba Railway Company. The situation of rented railway section is better in comparison with the remaining part of the railway track as the necessary maintenance and repairs are carried by the Aqaba Railway Company.

There will be probable difficulties during construction phase within the cities where the railway track passes. Massive urbanization and settlements close to railway track may be considered one of the weaknesses related with the recommended railway route within borders of Hashemite Kingdom of Jordan. The operating speed of the reconstructed railway is expected to be 60-70 km/h for freight transportation and 80-90 km/h for passenger transportation while the maximum operating speed on the existing railway track is about 35 km/h. Expectations of higher operating speed requires wider radius at horizontal curves and such requirements may cause to resettlement for the local people in the alignment. Another weakness is difficulties in current alignment. Developing a railway cargo logistic centre at outer part of the city may be solution for avoiding such difficulties in handling cargo traffic at Amman.

Transportation in Jordan is widely depended on road transport. Today, the railway transportation is only serves for carrying phosphate mine to Aqaba port. The Jordan Hijaz Railway network enable railway transportation through the north to south of the country. On the other hand, the proposed reconstruction for Jordan Hijaz railway will enable an effective railway connection with Syria. “The Jordan Long Term National Transport Strategy Project” envisages that the main backbone of the Jordan National Railway Project south north link between Aqaba and Amman (Sahab) to be completed in medium term, and Syria Link in the long term. On the other hand, reconstruction of the Jordan Hijaz railway is expected to be completed and will commence its operations within four years, in other words, before Jordan National Railway network investments realised, JHR can start serving effectively for both
passenger and cargo transportation in north-south link. The Syria link of Jordan National Railway Network Project is planned to be realized in long term period while the Jordan Hijaz Railway can be linked to Syria following the completion of reconstruction period. To serve Jordan transportation infrastructure as a different mode of transportation should be considered as strength for Jordan Hijaz Railway.

It is proposed that the Jordan Hijaz Railway will be reconstructed as a dual gauge track where narrow and standard gauges railway tracks are on the same line. The narrow gauge rail track will enable to operate existing rolling equipment and standard gauge rail track will facilitate increasing operating capacity for both passenger and freight transportation. Integration capability to standard gauge rail network will be one of the strength of dual gauge railway track.

**Strengths and Opportunities**

- Adoption of shifting freight transport from highways to railways all over the world will facilitate our investment in finding international long-term financing.

- It is foreseen that the passenger transportation made by highways will increase considerably when the population increase is taken into consideration, and that railway transportation will take a significant share from passenger transportation with the investment to be made.

- Negative impacts to the environment will be largely eliminated by renewal of vehicles and rail systems.

- Considering the almost inoperable railway network due to political developments and instability in the region, our planned investment on the current alignment of the railway line will provide an advantage in terms of timing of the investment and efficiency on the investment cost.

- Planned railway investments in Iraq, Iran and Turkey, are complementary to the international railway network in the region in the future. Our planned investment at this stage will have a facilitating and accelerating effect on Jordan's integration into the international rail network.

- Although there are some problems in the current infrastructure, it is an important advantage for our investment to be solved with infrastructure reinforcement.

- It is an important advantage that this infrastructure will be used effectively for at least 15 more years in the operation after the investment to be made.
• It is an important advantage that the planned investment is made with dual rail system and that international standards can be achieved and the existing wagons and locomotives can be used.

• The developed road and air transportation infrastructure in the country is considered as an important advantage for JHR to be integrated with these transportation systems.

• It is an advantage that the reconstruction and operationalization of existing railroad line to provide accessibility through nostalgic touristic tours especially in domestic and foreign tourism activities and with the political stability in the medium term, the planned investment will bring a great deal of convenience, especially in religious tourism.

• The use of the current line in our investment will also provide time and cost advantages for expropriation and similar issues with no or very limited need for new land acquisition.

• It is understood that the planned customs area in Maoduna (about 16 km) and the connection to the new Queen Alia Airport (about 1,7 km) will significantly increase the use of our line and bring alternative transportation opportunities for these two investments. In order to make these two additional lines, necessary studies should be started.

Weaknesses and Threats

• The situation of political instability and war, especially in Syria, is an obstacle to Jordan's connection to the international rail networks

• The unavailability of railway links between Jordan, Iran, Iraq, Saudi Arabia and Turkey is a major drawback for Jordan for being a part of international transport corridors those are planned and those are already in operation.

• A field track condition survey of the Jordanian section of the Hijaz railway line was carried out during October and November 2018. The track condition was found to be generally poor in most of its parts having disadvantaged from not being substantially maintained or renewed in recent years.

• There were a number of areas of the railway that exhibited defects that would pose a significant risk to the safe operation of the railway. The defects giving particular concern on the railway track are the faults on the railway, decayed sleepers and the amount of wear and corrosion to the rails. This has resulted in deep pitting in the rail web to the point where the web is perforated for the full depth of the web and a reduction in the thickness of the metal to the rail head and foot.
5.6. Analyses of Investment Requirements and Operating Phase

5.6.1. Recommendations on Reconstruction Processes

Under the circumstances and expectations following strategy is recommended for reconstructing the Old Hijaz Railway in Jordan.

1. Reconstructing approximately 227 km. single line – dual gauge (narrow + standard) railway between Jaber Station and Al Abyad Station
   1.1. Principally on the existing alignment, some minor changes in alignment should be decided during design and engineering projects preparation phase
   1.2. Necessary improvements and enforcements on rail track path including earth and concrete structural works where necessary
   1.3. Replacement of steel sleepers with precast concrete sleepers
   1.4. Replacement of rails with comply with UIC standards
   1.5. Improvement of side and manoeuvre tracks at stations on freight traffic route

2. Repair and maintenance of bridges and tunnels and taking enforcement measures where necessary

3. Restoration of stations along the rail track in consideration with authentic structure
   3.1. Improvement of passenger utilities at stations
   3.2. Improvement of logistic platforms and warehouses of the stations on freight traffic route

4. Increase the road safety and traffic safety measures
   4.1. Equipping road crossings with communication and signalization systems and road barriers where needed
   4.2. Fencing the railway track surrounding where necessary

5. Repair existing rolling equipment

6. Procurement of new rolling equipment

5.6.1.1 Alignment

In reconstruction of JHR network principally the existing railway line alignment will be traced. Some rail realignment works is required to reduce or eliminate adverse community impacts caused by the presence of railroad alignments and the operation of trains through cities and towns. The existing rail alignment passes through residential neighborhoods intersect numerous local roads at-grade. This project aims to align the railroad operations to reduce negative impacts on the local community. Options for freight rail realignment should be examined in conjunction with rail alignment development.

To establish the rehabilitation plan on the route alignment, the existing route alignment and right-of-way will not be changed unless absolutely necessary.
• The alignment should be modified at the horizontal curves to account for the newly proposed design speed. The minimum radius allowed for horizontal circular curve should be considered in accordance with the recommended design speed.

• The need for transition curves and their design should also be considered as required by the alignment.

• As a result of the higher design speed, it is vital to introduce adequate super elevation on horizontal curves. This is necessary to ensure a better distribution of load on both rails, reduce the wear and tear of the rails and rolling stock, neutralize the effect of lateral forces, and to provide comfort to passengers.

• Ensure that the thicknesses and materials used as the ballast and sub-ballast are suitable to resist the expected traffic load as forecasted. This is necessary to provide the longitudinal and lateral stability of the track through the proper distribution of load from the sleepers to the formation.

• Incorporate the design and construction of turnouts on all stations along the railway line.

• The alignment passes through highly populated urban areas and crosses many roads. Therefore, it is vital that special attention be given to the safety procedures and measures along the whole railway line specially at crossings

5.6.1.2 Design Criteria

The length of the railway track to be reconstructed is 227 km total length for cost estimation purposes is assumed as 260 km in consideration with incremental increase in length due to necessary changes in alignment at some spots of rail track.

The objectives of defining the design standards to be applied for the reconstruction of the railway are to ensure optimal operating conditions for safety and to keep low maintenance costs. The construction standards are summarised in the following parts. The track is composed of rails, sleepers, fastenings, ballast, roadbed, etc. The criteria for the track should be defined according to the annual passing tonnage and maximum operating speed of the line.

The basic criteria in design of Jordan Hijaz Railway track are:

**Rail gauge (dual):**

1050 mm
1435 mm

**The design speeds at the railway to be reconstructed will be:**

For passenger trains 120 km/h
For freight trains 90 km/h
The operating speeds at the railway to be reconstructed will be:
For passenger trains 80 - 90 km/h
For freight trains 60 - 70 km/h

The axle load will be: 20 tons per axle

The Railway Design Standards issued by UIC should be taken into consideration beside well known international design standards by selected the railway design engineer.

Indicative design criteria of the various components of the railway are summarized below;

**Design criteria for horizontal circular curve radius and super elevation (cant)**

The minimum radius of horizontal curves can be 450 - 550m while existing minimum radius of horizontal curves is 100m and side and manoeuvre and parking tracks at stations. Following tables show Chinese standards for minimum radius and super elevation according to various design speeds. These standards are provided as an example, the selected Railway Design Engineer for the preparation of construction projects/drawings should calculate and propose the assumptions and criteria used during the development of the engineering projects in consultation with JHR engineers;

**Table 39: Chinese standards for minimum radius of horizontal curves**

<table>
<thead>
<tr>
<th>Speed (km/h)</th>
<th>Minimum radius (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>450</td>
</tr>
<tr>
<td>100</td>
<td>550</td>
</tr>
<tr>
<td>120</td>
<td>800</td>
</tr>
<tr>
<td>140</td>
<td>1200</td>
</tr>
<tr>
<td>160</td>
<td>1600</td>
</tr>
<tr>
<td>200</td>
<td>1800</td>
</tr>
</tbody>
</table>

**Table 40: Chinese standards for actual cant for mixed traffic (standard gauge)**

<table>
<thead>
<tr>
<th>Speed</th>
<th>Radius</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
<th>1400</th>
<th>1600</th>
<th>1800</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 km/h</td>
<td>55</td>
<td>45</td>
<td>35</td>
<td>30</td>
<td>25</td>
<td>25</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>100 km/h</td>
<td>80</td>
<td>65</td>
<td>55</td>
<td>45</td>
<td>40</td>
<td>35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>120 km/h</td>
<td>125</td>
<td>95</td>
<td>75</td>
<td>65</td>
<td>55</td>
<td>50</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>140 km/h</td>
<td>---</td>
<td>---</td>
<td>105</td>
<td>90</td>
<td>75</td>
<td>65</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>160 km/h</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
<td>90</td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>
The selected railway design engineer should also take in consideration UIC standards in determination of:

- **Design criteria of gauge on curves**
- **Design criteria for transition curves**
- **Design criteria for choice of rails**
  (The choice of rail section should take into account the following parameters: speed, axle load, traffic of the track, sleeper spacing, lifetime, and eventual reuse. However, European railway authorities have established practical and easy to use guidelines. Thus, it has been customary in Europe for standard gauge tracks to use for low traffic (with a daily traffic load not exceeding 25,000t) a rail section of a weight of 54 kg per meter of length. For heavy traffic loads (> 35,000t) a rail of a weight of 60 kg/m is suggested. For a daily traffic loads from 25,000 t to 35,000 t, if timber sleepers are used, then a rail profile of 54 kg/m is sufficient, whereas in case of concrete sleepers, a rail section of 60 kg/m is suggested.)
- **Design criteria for sleepers**
  (there are three types of sleepers - wooden source, steel source and concrete source - in which have various characteristics in terms of handling, maintenance and maintenance cost, track circuiting, track elasticity, creep, scrap value, etc.) another calculation that Railway Design Engineer should work is the sleeper density and spacing of the sleepers (spacing is not kept uniform throughout the rail length, it's closer near the joints because of the weakness of the joints and the impact of moving loads on them and also the spacing will change according to the type of the sleeper selected as for fish-plated and welded tracks). The dual gauge precast concrete sleepers and 49E1 (S49) are recommended in reconstruction of the single line railway track.

**Figure 10: Sketch – Dual Gauge Sleeper**

![Dual Gauge Sleeper](image)

*Source: Drafted by researcher- November 2018*
Figure 11: Rail (49 E1) Profile

Source: Kardemir Product catalogue November 2018

- **Design criteria for ballast and sub ballast,** Railway Design Engineer will propose the ballast material in parallel to the other design specifications agreed. (Ballast material should possess the following properties; It should be tough and wear resistant, should be hard so that it does not get crushed under the moving loads, should be generally cubical with sharp edges, should be non-porous and should not absorb water, should resist both attrition and abrasion, should be durable and should not get pulverized or disintegrated under adverse weather conditions, should allow for good drainage of water, should be economical). There are different types of materials used in the ballast layer such as sand, moorum, coal ash or cinder and broken stone. The Railway Design Engineer should propose most suitable material in parallel to the other design criteria like speed and tonnage of the line.

- **Design criteria of stations and maintenance buildings;** Stations and maintenance facility buildings shall be designed in accordance with national codes. The goal for station and maintenance facility buildings is to optimize the design in regard to site design, energy, water, materials use, indoor air quality, construction practices, and management.

### 5.6.2. Cost Estimations for Reconstructing Old Ottoman Hijaz Railway Line

Approximately 227 km section of the Hijaz Railway between Jaber station at Syria border and Al Abyad station will be reconstructed principally following the alignment of the existing railway track minor changes in alignment may be decided during project preparation phase where deemed necessary. The new railway track will be reconstructed as single line with dual gauge (1050 mm and 1435 mm) railway track.
Construction of additional railway lines is not recommended for this phase.

The activity for preparation of reconstruction projects should include two very important impact assessment studies in parallel to the engineering design studies of the rail route. These are environmental impact assessment and social impact assessment studies. Environmental impact assessment study has to be made in order to assess likely environmental impacts of a proposed reconstruction of the JHR, the rail route and realignments suggested by the design engineer (if necessary) and identifying options to minimise environmental damage (if any). The main purpose should focus on the likely impacts of the construction phase and proposed investments. The study should provide the decision makers an opportunity to identify key issues and stakeholders that have a potential for adverse impact. The study should be conducted with a structured approach for obtaining and evaluating environmental information prior to its use. This information consists, basically, of predictions of how the environment is expected to change if certain alternative actions are implemented and advice on how best to manage environmental changes if one alternative is selected and implemented.

Social impact assessment study have to be completed to help governments, private sector investors and individuals to understand and anticipate the likely consequences of proposed reconstruction of JHR rail tracks on communities and human population. The social impact assessment for the proposed investments have to be carried out to analyse how the realignment of some parts of Hijaz rail track and reconstruction of current rail track will affect the population on the route, identify and develop solutions to mitigate any adverse impacts (if any). The importance should be given to the population of the settlements throughout the route but the study mostly target neighbours whom can be affected from land accusation and any resettlement that might be required because of realignment of the rail track due to design criteria.

The major activities are listed and defined in summary for the reconstruction of Jordan Hijaz Railway below:

1. **Preparation of the Reconstruction Projects**

The engineering projects for the reconstruction of the Jordan Hijaz Railway will include the following:

- Research Study of Environmental Impact Assessment
- Research Study of Social Impact Assessment
- Mapping
- Alignment study
- Horizontal and vertical curves design
- Land survey
- Drainage survey
- Hydrological conditions
- Geotechnical conditions
- Technical survey of infrastructures – Track condition survey
- Technical survey of infrastructures – Sleeper condition survey
- Technical survey of infrastructures – Bridges and culverts condition survey
- Earth work plans and dimensional drawings
- Determining specifications for ballasting materials
- Concrete works projects
- Sleepers design
- Switches design
- Sleepers and Rail installation projects
- Signalization and communication system design
- Road crossings lighting system design
- Static projects for strengthening railway bridges
- Drainage systems and culverts projects
- Drainage systems design for inside of tunnels
- Fencing systems design for railway track surrounding
- Quantity surveys and preparation of bill of quantities

2. **Supervision of Reconstruction Activities**

Supervision services will include the works performed under the each single contract related with reconstruction process and providing advisory services to Jordan Hijaz Railway Corporation during implementation of reconstruction activities.

- Review reconstruction projects and recommend necessary project revisions during implementation phase
- Checking bill of quantities and recommend revisions where necessary
- Preparation of all bidding documents (including procurement documentation) for design and construction of railway rehabilitation comprising;
  - Instructions to Bidders, Bid Data Sheet, Evaluation and Qualification Criteria, Bidding Forms, Eligible Countries, General Conditions of Contract, Particular Conditions of Contract, Contract Forms.
  - Design Criteria, Specifications, Bank Guarantee and Certificate, Change/Variation Order, As per Employer’s Requirements.
  - Supplementary information (Bridge and Culvert data) as per Employer’s Requirements.
  - All necessary technical drawings
- Providing advise during evaluation of bids
- Supervision of disassembling of existing railway track
- Supervision of procurement or production of precast concrete sleepers including necessary testing activities
- Providing advice during selection of supplier(s) for procurement of rails
- Supervision of rail track Substructure construction works
• Providing advisory services for selection and procurement of ballasting materials
• Supervision of rail track superstructure construction works
• Supervision of installation of signalization and communication systems
• Supervision of restoration of stations
• Supervision of necessary tests during reconstruction works
• Control of progress reports of contractors
• Training for counterpart staff with the transfer of expertise by on-the-job trainings

The Consultant Team will have the following expertise to ensure the timely completion of the works and the supervision,

• Railway rehabilitation experience
• Railway track design expertise
• Railway structures design expertise (drainage, culverts, bridges)
• Experience in the administration of design-build contracts
• Familiarity with procedures in the administration of internationally funded projects (of the specific funding agency)

3. **Railway Substructure**

Railway Substructure will include the following works for preparation of the railway track base appropriate to install railway superstructure:

• Disassembling existing railway track
• Earth works along the rail track alignment
• Levelling of earth
• Compacting and ballasting
• Drainage works along the railway track alignment
• Drainage works inside the tunnels
• Strengthening works for bridges embanking
• Construction of culverts,
• Preparations of foundations for sleepers

4. **Railway Superstructure**

• Precast concrete dual gauge sleepers
• Rails
• Rail joints and track fastening materials
• Installation of sleepers and rails on the rail track substructure
• Welding rail edges
• Installation of side and manoeuvre tracks at stations
• Installation of Switches
5. **Repair and Maintenance Works of Bridges and Tunnels**
   - Necessary repair and maintenance and strengthening works of bridges
   - Necessary repair and maintenance and strengthening works of tunnels

6. **Signalization and Communication System**
   - Installation of signalization and communication system along the railway track
   - Equipping road crossings with signalization and road barriers where needed

7. **Works to Assure the Railway Track and the Traffic Safety on Railway Track**
   - Fencing the railway track surrounding where necessary
   - Lighting the railway track surrounding and road crossings where necessary

8. **Restoration of Stations Along the Rail Track in Consideration with Authentic Structure**
   - Restoration station building and supplementary service buildings
   - Improvement of passenger utilities at stations
   - Improvement of logistic platforms and warehouses of the stations on freight traffic route

9. **Repair Existing Rolling Equipment**
   - Repair & maintenance of Steam Locomotives
   - Repair of maintenance of Diesel Locomotives
   - Repair and maintenance of Passenger Wagons
   - Repair and Maintenance of Freight Wagons

10. **Procurement of New Rolling Equipment**
    - Standard gauge compatible diesel main line locomotives
    - Standard gauge compatible diesel shunting locomotives
    - Standard gauge compatible diesel passenger locomotives
    - Standard gauge compatible various types of freight wagons
    - Standard gauge compatible passenger coach

Recommended initial investment on rolling equipment are for the commencement phase. Additional rolling equipment should also be procured during further periods in consideration with improvement in transport demand.
Some samples for freight wagons considered during the cost estimations;

**Picture 13: Samples for Freight Wagons**

Platform wagon for container

Tanker wagon

Platform freight wagon

Covered freight wagon

Bunker wagon

Open wagon
5.6.2. Cost Estimates for Reconstruction of Jordan Hijaz Railway

5.6.2.1. Capital Investments

1. Preparation of Reconstruction Projects
The scope for preparation of reconstruction projects is stated in subsection (1) of section 5.6.2 above. The cost of preparation of reconstruction projects is (5 %) of total estimated reconstruction costs in consideration with the world wide practices and local conditions in Jordan.

2. Supervision of Reconstruction Activities
The scope of supervision of reconstruction activities is stated in subsection (2) of section 5.6.2 above. The cost of supervision of reconstruction activities is assumed (3 %) of total estimated reconstruction costs in consideration with the worldwide practises and local conditions in Jordan.

3. Railway Substructure
The works to be performed within the scope of railway substructure including required materials in compliance with the reconstruction projects and mobilization of necessary machinery and equipment during construction phase are stated in subsection (3) of section 5.6.2 above. The average unit cost of constructing the railway substructure including all the construction and auxiliary materials is estimated US$ 1,600.000/km. considering the approximate costs of previous implementations on similar land structure in the region and also necessity of importation of most of the required construction materials. Estimated unit cost for railway substructure was also discussed with and verified by Turkish State Railways technical staff and railway contractors.

4. Railway Superstructure
The works to be performed within the scope of railway superstructure including required materials in compliance with the reconstruction projects and mobilization of necessary machinery and equipment during construction phase are stated in subsection (4) of section
5.6.2 above. The average unit cost of constructing the railway substructure including all the construction and auxiliary materials is estimated US$ 900,000/km, considering the approximate costs of previous implementations on similar land structure in the region and also necessity of importation of most of the required construction materials. Estimated unit cost for railway superstructure was also discussed with and verified by Turkish State Railways technical staff and railway contractors.

5. Repair and Maintenance Works of Bridges and Tunnels
The costs for maintenance works of sixteen bridges (650 meters in total) and four tunnels (600 meters in total) (See Section 1.4.2) along the alignment of rail track to be reconstructed including required materials is estimated US$ 1,000,000 on lump sum basis considering the observations on present conditions of bridges and tunnels during field studies along the Jordan Hijaz Railway alignment and local conditions for such repair and maintenance works.

6. Signalization and Communication System
The costs for installation signalization and communication system along the rail track and equipping road crossings with signalization and barriers where needed is estimated including required materials US $ 25,000,000 on lump sum basis considering the international average costs for similar works.

7. Works to Assure the Railway Track and the Traffic Safety on Railway Track
The average unit cost of fencing the railway track surrounding and lighting the railway track surrounding and road crossings where necessary is estimated US $ 15,000/km considering the observations along the Jordan Hijaz Railway alignment and local conditions for such works.

8. Restoration of Stations Along the Rail Track in Consideration with Authentic Structure
The costs for Restoration station building and supplementary service buildings, improvement of passenger utilities at stations, improvement of logistic platforms and warehouses of the stations on freight traffic route is estimated including restoration and improvement projects and required materials US $ 600,000 on lump sum basis considering the local construction costs.

5.6.2.2. Rolling Stock Investments

9. Repair Existing Rolling Equipment
The costs for repair of the rolling equipment is estimated US $ 5,000,000 on lump sum basis considering the present conditions of existing rolling equipment.

10. Procurement of New Rolling Equipment
Unit cost per standard gauge compatible diesel locomotives, diesel manoeuvre locomotives and average unit cost for various types of freight wagons are estimated as follows considering the declared sales prices of major producers;
Diesel Main Line Locomotive unit cost : US $ 5.000.000 per unit
Diesel Shunting Locomotive unit cost : US $ 2.000.000 per unit
Diesel passenger locomotive unit cost : US $ 3.000.000 per unit
Various Types of freight wagons average unit cost : US $ 150.000 per unit
Passenger Coach unit cost : US $ 1.250.000 per unit

Following table summarizes the cost items of reconstruction of Jordan Hijaz Railway investments.

The unit cost estimations stated above and the investment cost calculations for the reconstruction of Jordan Hijaz Railway depending on these unit cost estimations (please see Table 44) were discussed at the validation meeting held in Amman at December 16, 2018 with presence of representatives of Turkish Republic Ministry of Transportation and Infrastructure and Turkish Republic State Railways, General Directorate of Jordan Hijaz Railways, Hashemite Kingdom of Jordan Ministry of Transport, Ministry of Economy and Research Group (G&G Consulting Turkey& Tibah Consultants Jordan) (see Appendix XX Validation Meeting - List of Participants).

**Table 41: Estimated Total Cost of Investments for Reconstruction of JHR (US$)**

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Estimated Unit</th>
<th>Estimated Unit cost (US$)</th>
<th>Unit Cost Item (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Sub Structure</td>
<td>260 km</td>
<td>1.600.000/km</td>
<td>416.000.000</td>
</tr>
<tr>
<td>Railway Super Structure</td>
<td>260 km</td>
<td>900.000/km</td>
<td>234.000.000</td>
</tr>
<tr>
<td>Repair and Maintenance of Bridges and Tunnels</td>
<td>16 Bridges, 4 Tunnels</td>
<td>Lump sum</td>
<td>1.000.000</td>
</tr>
<tr>
<td>Signalization and communication system</td>
<td>Along the rail track</td>
<td>Lump sum</td>
<td>25.000.000</td>
</tr>
<tr>
<td>Railway Track and Traffic Safety Works</td>
<td>50 km</td>
<td>15.000/km</td>
<td>750.000</td>
</tr>
</tbody>
</table>

**Sub Total Reconstruction Works** 676.750.000

Restoration of Stations and Improvement of Passenger Facilities & Logistic Platforms

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Estimated Unit</th>
<th>Unit Cost Item (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration of Stations and Improvement of Passenger Facilities &amp; Logistic Platforms</td>
<td>5 Stations</td>
<td>Lump sum</td>
</tr>
<tr>
<td>Repair existing Rolling Equipment</td>
<td>Various</td>
<td>Lump Sum</td>
</tr>
</tbody>
</table>

**Restoration and Repair Works** 5.600.000

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Estimated Unit</th>
<th>Unit Cost Item (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement of Diesel Locomotives</td>
<td>2 Units</td>
<td>5.000.000/unit</td>
</tr>
<tr>
<td>Procurement of Diesel Shunting Locomotives</td>
<td>2 Units</td>
<td>2.000.000/unit</td>
</tr>
<tr>
<td>Procurement of Diesel Passenger Locomotives</td>
<td>2 Units</td>
<td>3.000.000/unit</td>
</tr>
</tbody>
</table>
The following table summarizes the local and foreign parts of each cost components of the reconstructing of Hijaz Railway investments. Most of the repair and restoration works are estimated as mainly local (around 90%) whereas procurement of new rolling equipment (locomotives, wagons, etc) will be foreign.

### Table 42: Local and Foreign Components of Reconstrcuting of JHR Investments (US$)

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>% Local Component</th>
<th>% Foreign Component</th>
<th>Total Cost per Cost Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Sub Structure</td>
<td>40</td>
<td>60</td>
<td>416,000,000</td>
</tr>
<tr>
<td>Railway Super Structure</td>
<td>40</td>
<td>60</td>
<td>234,000,000</td>
</tr>
<tr>
<td>Repair and Maintenance of Bridges and Tunnels</td>
<td>90</td>
<td>10</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Signalization and communication system</td>
<td>40</td>
<td>60</td>
<td>25,000,000</td>
</tr>
<tr>
<td>Railway Track and Traffic Safety Works</td>
<td>90</td>
<td>10</td>
<td>750,000</td>
</tr>
<tr>
<td>Sub Total Reconstruction Works</td>
<td></td>
<td></td>
<td>676,750,000</td>
</tr>
<tr>
<td>Restoration of Stations and Improvement of Passenger Facilities &amp; Logistic Platforms</td>
<td>90</td>
<td>10</td>
<td>600,000</td>
</tr>
<tr>
<td>Cost Item</td>
<td>%</td>
<td>Local Component (US$)</td>
<td>%</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----</td>
<td>-----------------------</td>
<td>----</td>
</tr>
<tr>
<td>Repair existing Rolling Equipment</td>
<td>80</td>
<td>4.000.000</td>
<td>20</td>
</tr>
<tr>
<td>Restoration and Repair works</td>
<td>-</td>
<td>4.540.000</td>
<td>-</td>
</tr>
<tr>
<td>Procurement of Diesel Locomotives</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Procurement of diesel Manoeuvre locomotives</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Procurement of diesel passenger locomotives</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Procurement of Freight Wagons</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Procurement of Passenger Coach</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td><strong>Procurement of Rolling Equipment</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Preparations of Reconstruction Project</td>
<td>40</td>
<td>13.540.000</td>
<td>60</td>
</tr>
<tr>
<td>Supervision of Reconstruction Activities</td>
<td>50</td>
<td>10.150.000</td>
<td>50</td>
</tr>
<tr>
<td><strong>Sub Total Services</strong></td>
<td>-</td>
<td><strong>23.690.000</strong></td>
<td>-</td>
</tr>
<tr>
<td><strong>Project Administration Services</strong></td>
<td>100</td>
<td>3.400.000</td>
<td>-</td>
</tr>
<tr>
<td><strong>Sub Total Reconstruction works, Restoration, Repair Procurement and Services</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Contingencies</td>
<td>40</td>
<td>3.120.000</td>
<td>60</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>306.325.000</td>
<td>479.875.000</td>
<td>786.200.000</td>
</tr>
</tbody>
</table>

### 5.6.3. Operating Phase Analyses for JHR

Ministry of Transport of the Hashemite Kingdom of Jordan estimated that the total volume of freight transport demand for the goods exported and imported by Jordan will rise to 46 million tons in 2030 while the total volume of transport demand was 25 million tons at the base year 2010.

The reconstruction of the Jordan Hijaz Railway is expected to start at the year 2023. The freight transport demand volume estimated by the Ministry of Transport for the year 2024 will reach almost to 38 million tons. The standard gauge rail line that will be installed on dual gauge railway to be reconstructed will be operated for freight transportation. Railway transportation is competitive mode of transportation against road transport. JHR railway network will have chance to have reasonable share from the increasing volume of freight transport demand.
5.6.3.1. Estimations for Freight Transportation

The future freight transportation is mainly influenced by the import/export growth rates that have been calculated for the horizon years. Having a total import volume in 2010 of 15 million tons, the import volumes will almost double by 2030 with 28 million tons. The following table summarises the annual import volumes by commodity group for the base year 2010 and for the three horizon years.

Table 43: Annual Import Volumes by Commodity Groups (thousand tons)

<table>
<thead>
<tr>
<th>Commodity Groups</th>
<th>2010</th>
<th>2018</th>
<th>2024</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>1578</td>
<td>2046</td>
<td>2295</td>
<td>2530</td>
</tr>
<tr>
<td>Food &amp; Beverages</td>
<td>1128</td>
<td>1463</td>
<td>1641</td>
<td>1809</td>
</tr>
<tr>
<td>Wood</td>
<td>462</td>
<td>608</td>
<td>815</td>
<td>1061</td>
</tr>
<tr>
<td>Energy</td>
<td>7442</td>
<td>9153</td>
<td>11412</td>
<td>13923</td>
</tr>
<tr>
<td>Raw materials</td>
<td>1071</td>
<td>1393</td>
<td>1628</td>
<td>1875</td>
</tr>
<tr>
<td>Metal Products</td>
<td>664</td>
<td>872</td>
<td>1139</td>
<td>1453</td>
</tr>
<tr>
<td>Construction</td>
<td>557</td>
<td>723</td>
<td>811</td>
<td>894</td>
</tr>
<tr>
<td>Fertilizer &amp; Chemical Products</td>
<td>841</td>
<td>1094</td>
<td>1448</td>
<td>1869</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>779</td>
<td>1026</td>
<td>1375</td>
<td>1790</td>
</tr>
<tr>
<td>Others</td>
<td>504</td>
<td>664</td>
<td>890</td>
<td>1159</td>
</tr>
</tbody>
</table>

Source: www.mot.gov.jo

For the export volumes, an increase is forecasted from about 10 million tonnes in 2010 to almost 18 million by 2030. This strong growth is mainly due to the high increase of cement exports that are expected to Syria. The following table summarises the annual export volumes by commodity group for the base year 2010 and the three horizon years.

Table 44: Annual Export Volumes by Commodity Groups (thousand tons)

<table>
<thead>
<tr>
<th>Commodity Groups</th>
<th>2010</th>
<th>2018</th>
<th>2024</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>602</td>
<td>780</td>
<td>876</td>
<td>965</td>
</tr>
<tr>
<td>Food &amp; Beverages</td>
<td>507</td>
<td>657</td>
<td>737</td>
<td>813</td>
</tr>
<tr>
<td>Wood</td>
<td>152</td>
<td>200</td>
<td>268</td>
<td>348</td>
</tr>
<tr>
<td>Energy</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Raw materials</td>
<td>5495</td>
<td>5975</td>
<td>6380</td>
<td>6817</td>
</tr>
</tbody>
</table>

6 The Hashemite Kingdom of Jordan Ministry of Transport “Jordan Long Term National Transport Strategy”
5.6.3.2. Estimations for Passenger Transportation

The Jordan Hijaz Railway currently does not operate scheduled passenger trains. The passenger operations of the JHR are only to organize nostalgic travels for tourist groups upon demand.

The number of passengers carried by the JHR over the period 2010 – 2018 is listed below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>39695</td>
</tr>
<tr>
<td>2011</td>
<td>10991</td>
</tr>
<tr>
<td>2012</td>
<td>15095</td>
</tr>
<tr>
<td>2013</td>
<td>14770</td>
</tr>
<tr>
<td>2014</td>
<td>18540</td>
</tr>
<tr>
<td>2015</td>
<td>13280</td>
</tr>
<tr>
<td>2016</td>
<td>19019</td>
</tr>
<tr>
<td>2017</td>
<td>19165</td>
</tr>
<tr>
<td>2018</td>
<td>10349 (as at the end of June)</td>
</tr>
</tbody>
</table>

Estimations for the domestic transport demand for passengers presented in Jordan National Transport Strategy mainly calculated as a factor of increase in the population.

“The following figure shows the development of total number of domestic trips until the horizon years 2018, 2024, 2030 as they have calculated with the JNTS Transport Model. Since the major input factor for the calculation is the increase in population, the increase of trips from 2010 to 2030 is in line with the increase of population. Compared to 2010, the number of trips is estimated to increase by more than 50 percent until 2030.

__________________________

7 The Hashemite Kingdom of Jordan Ministry of Transport “Jordan Long Term National Transport Strategy”
Figure 12: Development of Population and Number of Trips

Following the reconstruction of the Jordan Hijaz Railway network, the scheduled passenger trains will be operated to carry passenger between the stations along the railway alignment. The railway travels by Jordan Hijaz Railways after reconstruction process will be faster and a lot more safety in comparison with the existing conditions of the railway network. At the beginning of passenger transport operations renewed nostalgic passenger wagons on narrow gauge will be used. Depending on development of demand for railway travel after a while new passenger train sets can be put in service. Touristic railway travels will also be organized to the stations those enable road connection to attractive tourist destinations (e.g. Maan, Petra, Karak, Wadi Rum) beside the special round trips.

Operating Phase Financial Analyses are undertaken on EBITDA (Earnings Before Interest Taxes Depreciation and Amortization) basis.

5.6.3.3. Estimations for Operating Costs

The operating cost for the railway operations following the reconstruction processes will be composed of the following cost items;

---

8 Jordan National Transport Strategy
• Labour Cost
• Fuel and Lubricants Cost
• Rolling stock maintenance
• Rail Track maintenance
• Energy cost for signalization and communication

The operating costs are variable in their characteristics and differentiated with the load and density of the railway operations and will demonstrate incremental increasing trend parallel to the work load and density of railway operations.

The Operating Costs are estimated as of the following:

1. Labour Cost

The employment requirement of trains to be operated for the commencement year is estimated for freight and passenger trains separately:

Standard staff requirement for freight trains: 1 Machinist per train

Standard staff requirement for passenger trains: 1 Machinist, 1 Chief Conductor, 2 Conductors per train

At the commencement year the 728 freight train service and 1040 passenger train services and 150 touristic round trip train services are estimated to be realized.

The train staff requirement and estimated wage rates and annual costs are summarized below.

Table 45: Train Staff Requirement and Annual Costs US$

<table>
<thead>
<tr>
<th>Train staff</th>
<th>Number of train staff</th>
<th>Wage/Month US$</th>
<th>Cost/Year US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Train Machinist</td>
<td>2</td>
<td>1000</td>
<td>24.000</td>
</tr>
<tr>
<td>Freight Train Machinist for substitution</td>
<td>1</td>
<td>1000</td>
<td>12.000</td>
</tr>
<tr>
<td>Passenger Train Machinist</td>
<td>5</td>
<td>1000</td>
<td>60.000</td>
</tr>
<tr>
<td>Passenger Train Machinist for substitution</td>
<td>2</td>
<td>1000</td>
<td>24.000</td>
</tr>
<tr>
<td>Chief Conductor</td>
<td>5</td>
<td>1100</td>
<td>66.000</td>
</tr>
<tr>
<td>Conductor</td>
<td>12</td>
<td>900</td>
<td>129.600</td>
</tr>
<tr>
<td>Conductor for substitution</td>
<td>3</td>
<td>900</td>
<td>32.400</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>-</td>
<td>348.000</td>
</tr>
</tbody>
</table>

*Source: Prepared by Author*
Labour costs will increase 50% when the first threshold, 1,000,000 tons freight volume handled and 350,000 carried passenger volume to be achieved and 40% more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved. Labour cost is assumed to increase 60% when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is reached.

2. **Fuel and Lubricants Cost**

Fuel and lubricants costs for Freight Trains (Diesel Locomotives) is assumed US$ 1800 per trip and for passenger trains is assumed US$ 1000 per trip.

For the commencement year estimated total cost for fuel and lubricants:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>For Freight trains</td>
<td>US$ 1,310,000</td>
</tr>
<tr>
<td>For Passenger Trains</td>
<td>US$ 1,190,000</td>
</tr>
<tr>
<td>Total</td>
<td>US$ 2,500,000</td>
</tr>
</tbody>
</table>

Fuel and lubricants costs will increase 100% when the first threshold, 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 90% more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved. Fuel and Lubricant costs are assumed to increase 60% when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is reached.

3. **Rolling Stock Maintenance Cost**

Rolling stock maintenance cost is assumed 0.3% of procurement cost for freight train rolling equipment and US$ 300,000 for passenger train rolling equipment including repair and maintenance materials and consumables.

Jordan Hijaz Railways maintenance depots/workshops are on service and any additional employment is not required.

For commencement year rolling stock estimated maintenance costs:

| Maintenance of freight trains | US$ 600,000 |
| Maintenance of passenger trains | US$ 550,000 |
| Total maintenance cost for rolling stock | US$ 1,150,000 |

Rolling stock maintenance costs will increase 40% when the first threshold, 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 30% more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved because of increase in number of rolling stock. Rolling stock maintenance cost is assumed to increase 60% when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is reached.
4. **Rail Track Maintenance Cost**

Rail track maintenance, the permanent track and installations are assumed about 0.5 % of reconstruction costs.

For commencement year estimated rail track maintenance cost including maintenance materials and consumables is US$ 5,000,000.

Rail track maintenance costs will increase 20 % when the first threshold, 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 15 % more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved because of increase in traffic volume on rail track. Rail track maintenance costs are assumed to increase 60 % when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is reached.

5. **Energy Cost for Signalization and Communication**

Electric energy cost for signalization and communication installations are estimated about US$ 500 per day. Total electric energy cost will be US$ 180,000 for the commencement year.

Energy costs for signalization and communication will increase 20 % when the first threshold, 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 15 % more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved because of increase in traffic volume on rail track. Energy costs are assumed to increase 60 % when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is reached.

6. **Administrative Expenses**

The administrative costs are related with the general administration of the Jordan Hijaz Railway Corporation. The administrative costs are fixed costs in characteristics and following the reconstruction processes the administrative costs will not be affected during the commencement phase of the reconstructed railway network. During the subsequent phases general administrative costs naturally will increase when the volume of operations reach over a certain level. Increase in volume of railway operations may require additional positions at managerial and technical level during the future periods after commencement of railway operations.

It is assumed that the administrative costs will remain as it is now till the 1st threshold- 1,000,000 tons freight volume and 350,000 passenger volume will be realised. During the 1st threshold additional USD400,000 are estimated to be spend while the 2nd threshold of operations volume will increase Administrative Costs for additional USD300,000. On the other hand, 3rd threshold volume of operations will bring about 60% increase in the Administrative costs.
7. **Other Operating Costs**

Other operating costs are the costs required to manage railway operations along the railway alignment. Such as freight handling and management of passenger flow in and out of train stations and management of station works and security of freight and passenger operations. Other operating costs are semi-variable in characteristics and will be change in consideration with the volume of railway operations.

**Labour Cost at Stations**

Additional employment requirements for stations along the railway track alignment and annual cost estimations are exhibited on Table 46.

**Table 46: Staff Requirements for Stations and Annual Costs US $**

<table>
<thead>
<tr>
<th>Train staff</th>
<th>Number of train staff</th>
<th>Wage/Month US$</th>
<th>Cost/Year US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineers</td>
<td>3</td>
<td>1500</td>
<td>54,000</td>
</tr>
<tr>
<td>Technicians</td>
<td>6</td>
<td>1100</td>
<td>79,200</td>
</tr>
<tr>
<td>Shunting Locomotive Machinist</td>
<td>2</td>
<td>1000</td>
<td>24,000</td>
</tr>
<tr>
<td>Shunting Locomotive Machinist for substitution</td>
<td>1</td>
<td>1000</td>
<td>12,000</td>
</tr>
<tr>
<td>Station officers</td>
<td>10</td>
<td>850</td>
<td>66,000</td>
</tr>
<tr>
<td>Workers</td>
<td>20</td>
<td>700</td>
<td>168,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42</strong></td>
<td></td>
<td><strong>403,200</strong></td>
</tr>
</tbody>
</table>

*Source: Calculated by Author*

Labour costs of stations will increase 40% when the first threshold 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 30% more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved because of increase in workload. Labour costs are assumed to increase 60% when the 3rd threshold, 4,600,000 tons freight volume handled and 720,000 passenger volume is realised.

8. **Miscellaneous Operating Expenses**

Miscellaneous operating expenses of the stations other than staff are assumed annually US$ 25,000 per station the total annual cost will be US$ 125,000 for five stations along the railway track alignment.
Energy costs for signalization and communication will increase 40% when the first threshold, 1,000,000 tons handled freight volume and 350,000 carried passenger volume to be achieved and 30% more when the next threshold that 2,426,000 tons handled freight volume and 500,000 carried passenger volume is achieved because of increase in work load. Miscellaneous costs are assumed to increase 60% during the 3rd threshold operations volume will be reached.

Table 47: Total Operating Costs at Different Operation Volumes US$

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Commencement year</th>
<th>1st threshold</th>
<th>2nd threshold</th>
<th>3rd threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour costs</td>
<td>348.000</td>
<td>522.000</td>
<td>730.800</td>
<td>1,169.000</td>
</tr>
<tr>
<td>Fuel and lubricants</td>
<td>2,500.000</td>
<td>5,000.000</td>
<td>7,192.800</td>
<td>11,513.000</td>
</tr>
<tr>
<td>Rolling stock maintenance</td>
<td>1,150.000</td>
<td>1,610.000</td>
<td>2,093.000</td>
<td>3,349.000</td>
</tr>
<tr>
<td>Rail track maintenance</td>
<td>3,350.000</td>
<td>6,000.000</td>
<td>6,900.000</td>
<td>11,040.000</td>
</tr>
<tr>
<td>Energy costs for signalization and communication</td>
<td>180.000</td>
<td>216.000</td>
<td>248.400</td>
<td>397.000</td>
</tr>
<tr>
<td><strong>Total operating costs</strong></td>
<td><strong>7,528.000</strong></td>
<td><strong>11,368.000</strong></td>
<td><strong>17,165.000</strong></td>
<td><strong>27,468.000</strong></td>
</tr>
<tr>
<td>Administrative Expenses</td>
<td>-</td>
<td>400.000</td>
<td>700.000</td>
<td>1,120.000</td>
</tr>
<tr>
<td>Other operating costs labour</td>
<td>403.200</td>
<td>564.480</td>
<td>733.824</td>
<td>1,174.000</td>
</tr>
<tr>
<td>Miscellaneous Expenses</td>
<td>125.000</td>
<td>175.000</td>
<td>227.500</td>
<td>364.000</td>
</tr>
<tr>
<td><strong>Total Other Operating Costs</strong></td>
<td><strong>528.200</strong></td>
<td><strong>739.480</strong></td>
<td><strong>961.324</strong></td>
<td><strong>1,538.000</strong></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>8,056.200</strong></td>
<td><strong>12,507.480</strong></td>
<td><strong>18,826.324</strong></td>
<td><strong>30,126.000</strong></td>
</tr>
</tbody>
</table>

5.6.3.4. Estimations for Operating Revenues

The operating revenues for railway operations are mainly freight transport fees and passenger tickets. The Jordan Hijaz Railway Corporation will determine freight transportation fees according to the types and volume/weight of freight items on ton/km or volume/km basis. The passenger tickets will be determined on distance to the destination and the quality of the services (if the services provided differentiate in quality).

The revenue of railway operations is differentiated in parallel with the volume of the transportation operations (in other words sales of transportation services). In services sector like as transportation, the supply of services should be in parallel to the demand for those services. The railway transportation is relatively cheap in cast in comparison with land
transportation and increase in the provision of railway transportation services will attract the transport demand which currently provided by land transportation today.

Table 48: Basic Assumptions for Calculating Operating Revenue at the Commencement Year

<table>
<thead>
<tr>
<th>Operations</th>
<th>1st threshold</th>
<th>2nd threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity of Freight Trains: 400 ton (10 wagons)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Utilization rate : 70 %</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Average fee for ton/km : US$ 0.05</td>
<td>US$ 0.05</td>
<td>US$ 0.05</td>
</tr>
<tr>
<td>Average distance : 130 km.</td>
<td>130 km.</td>
<td>130 km.</td>
</tr>
<tr>
<td><strong>Passenger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity of Passenger Trains 250 pax (5 wagon)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilization rate : 80 %</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Average Fee per passenger: US$ 6</td>
<td>US$ 6</td>
<td>US$ 6</td>
</tr>
<tr>
<td>Capacity Tourist Trains 125 pax (5 Wagon)</td>
<td>125 Pax</td>
<td>125 Pax</td>
</tr>
<tr>
<td>Utilization rate : 80 %</td>
<td>80 %</td>
<td>80 %</td>
</tr>
<tr>
<td>Average Fee per passenger: US$ 10</td>
<td>US$ 10</td>
<td>US$ 10</td>
</tr>
</tbody>
</table>

At the commencement year the 728 (2 services/day x 7 days/week x 52 weeks/year) freight train service and 1040 (4 services/day x 5 day/week x 52 weeks/year) passenger train services and 150 (3 services/week x 50 weeks/year) touristic round trip train services are estimated to be realized and 202,840 ton goods (26,499.200 ton/km) and 208,000 passengers and 15,000 tourists will be carried.

The freight revenue for commencement year : US$ 1,324,960
The passenger revenue for commencement year : US$ 1,398,000

**Total Operating Revenue** : US$ 2,722,960

At the next threshold 1,000,000 ton goods and (130,000,000/km) and 350,000 passengers (including 15000 tourists) will be carried.

The freight revenue when 1st threshold achieved : US$ 6,500,000
The passenger revenue when 1st threshold achieved : US$ 2,160,000

**Total Operating Revenue** : US$ 8,660,000
At the second threshold 2,426,000 ton goods (315,800,000 ton/km) and 500,000 passengers (including 15,000 tourists) will be carried.

- The freight revenue when 2\textsuperscript{nd} threshold achieved: US$ 15,769,000
- The passenger revenue when 2\textsuperscript{nd} threshold achieved: US$ 3,060,000

\textit{Total Operating Revenue} \hspace{1cm} : \textbf{US$ 18,829,000}

At the third threshold 4,600,000 tons goods (598,000,000 ton/km) and 720,000 passengers (including 15,000 tourists) will be carried.

- The freight revenue when 3\textsuperscript{rd} threshold achieved: US$ 29,900,000
- The passenger revenue when 3\textsuperscript{rd} threshold achieved: US$ 4,380,000

\textit{Total Operating Revenue} \hspace{1cm} : \textbf{US$ 34,280,000}

<table>
<thead>
<tr>
<th>Table 49: Operating Revenue by Different Operations Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
</tr>
<tr>
<td>Freight</td>
</tr>
<tr>
<td>Passenger</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

\textit{Source: prepared by researcher}

\textbf{5.6.4. Financial and Socio-Economic Evaluations}

\textbf{Financial Evaluations}

The analyses of the financial results of the operations of JHR following the completion of the proposed investments are made for four different volumes of operations.

The assumptions for operating period are made on the estimated fees and volumes of operations for freight and passenger transportation. The following calculations are made with a discrete approach considering the least possible realisations such as;

- The freight transportation fee (US$ 0,05/ton/km),
- Average distance for cargo transportation (130 km out of 227 km total length of rail track alignment),
- Capacity utilization (70 %)
- Freight volume (202,840 tons) and
- Passenger transportation volume (208,000 pax/year) for the commencement year.
Other levels of operational volumes are also analysed by considering certain thresholds will be reached throughout the economic life of the investments.

The breakeven level for the operations calculated over EBITDA can be reached at the 2nd threshold with freight volume of 2.4 million tons of cargo and 485 thousands of passenger transportation.

The 3rd threshold suggests very modest share from the overall estimations of Jordan National Transportation Strategy Jordan in terms of passenger and cargo transportation; The suggested freight volume that will be serviced by JHR is the 10% of the annual freight volume (imports and exports) estimation of JNTS for the year 2030 and 5% of the estimated domestic travels are assumed to be provided by JHR till the year 2030.

**Commencement year**

The freight and the passenger transportation volumes are calculated in accordance with the estimated capacity utilization of rolling stock inventory for the commencement year.

Freight volume : 202,840 Tons – 26,499,200 ton/km
Passenger volume : 208,000 pax.
Touristic Train Services volume : 15,000 pax.

**1st Threshold**

Freight volume : 1,000,000 Tons – 130,000,000 ton/km
Passenger volume : 335,000 pax.
Touristic Train Services volume : 15,000 pax.

**2nd Threshold**

Freight volume : 2,426,000 Tons – 315,800,000 ton/km
Passenger volume : 485,000 pax.
Touristic Train Services volume : 15,000 pax.

**3rd Threshold**

Freight volume : 4,600,000 Tons – 598,000,000 ton/km
Passenger volume : 705,000 pax.
Touristic Train Services volume : 15,000 pax.

The following table summarises the estimated total operational revenue and total operational costs of 4 different levels operations for JHR.
Table 50: Summary of Estimated Operational Revenue and Operational Costs (US$)

<table>
<thead>
<tr>
<th>Description</th>
<th>Commencement Year</th>
<th>1st threshold</th>
<th>2nd threshold</th>
<th>3rd threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenue</td>
<td>2.722.960</td>
<td>8.660.000</td>
<td>18.829.000</td>
<td>34.280.000</td>
</tr>
<tr>
<td>Total Costs</td>
<td>8.056.200</td>
<td>12.507.480</td>
<td>18.826.324</td>
<td>30.126.000</td>
</tr>
<tr>
<td>Difference (EBITDA)</td>
<td>(5.333.240)</td>
<td>(3.847.480)</td>
<td>2676</td>
<td>4.154.000</td>
</tr>
</tbody>
</table>

Figure 13: Revenue-Cost-EBITDA (Million US$)

Source: Prepared by researcher

The breakeven point will be reached at operation volume estimated for the 2nd threshold when 500,000 pax total volume of passengers transportation and 2,426,000 tons total freight volume or 315,800.000 ton/km freight transportation are achieved.
Sustainability of the Jordan Hijaz Railways depends on achievement critical level of operations (2nd threshold) and following the achievement to critical level ensuring increase in operation volume. At the 3rd threshold operation results is expected to be positive (operational profit) and the EBITDA ration is 12.1 percent.

**Cost Benefit Analysis**

Jordan Hijaz Railway operations is expected to reach at breakeven level on EBITDA basis on the second year of operation following the commencement year and financial profit will be generated starting from the third year of operation. The operational profit is assumed to be increased thirty five per cent at the consequent years of operation parallel to increase in demand for freight transportation and increase in capacity utilization rate. At the eleventh year of operation the freight handled is expected to reach 25 % of total estimated freight transportation demand of the country (please see section 5.6.3.1) and will continue same profit level till to eighteenth year of operation and will reach to peak level at the eighteenth year (due to prospective increase in overall transport demand) and reached profit level will be continued at the end of the assumed economic operational life of the investment (forty five years).

The investment costs and financial results by years of operations are summarized on below table.
Table 51: Investments and Operational Profit by Years (USD 1000)

<table>
<thead>
<tr>
<th>Years (Investment)</th>
<th>Investment Costs</th>
<th>Years (Operations)</th>
<th>Operational Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50.000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>150.000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>250.000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4 (*)</td>
<td>336.000</td>
<td>-</td>
<td>(5.333)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>(3848)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>5.608</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>7.591</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>10.220</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>13.798</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>18.826</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>9</td>
<td>25.149</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>10</td>
<td>33.947</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>11-16</td>
<td>38.000</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>17-45</td>
<td>41.800</td>
<td></td>
</tr>
</tbody>
</table>

(*) Commencement Year

Net Present Value

It is obvious that payback of the transportation infrastructure investments take longer time in comparison with other sectors. Transportation infrastructures are accepted as social and strategic investments rather than economic.

For calculation of Net Present Value for investment on Reconstruction of Jordan Hijaz Railway the LIBOR for US Dollar (as at February 14, 2019 2.49375 per cent) is used.  

Calculated Net Present Value of Investments

(Cash Outlays) during the investment phase (USD 1000) : 746.399

Calculated Net Present Value of Operational Profits on EBITDA BASIS

(Cash Inflow) during the economic life of the project (USD) : 768.139

Difference (Net Present Value of the project) is positive : 21.740

9 [www.globalrates.com]
In other words according to the calculated Net Present Value figures Benefit/Cost Ratio for the project is positive.

Benefit/Cost Ratio: 1,029

Calculated Internal Rate of Return of the project is 2.64185 % that is higher than the discount rate used for Net Present Value calculations (alternative financing cost).

Internal rate of return : 2.64185

**Socio-Economic Evaluations**

The Hijaz railway reconstruction project will have positive effects to stimulate economic activities of the country during construction and operation phases.

The expected positive effects are:

- Create direct and indirect employment opportunities both during investment and operation phases
- Stimulate construction activities along the railway alignment and near surrounding of stations (e.g. road links to urban settlements, hospitality service utilities) beside the railway reconstruction activities during the investment phase
- Stimulate improvement of service sector along the railway alignment (e.g. hospitality services, substantial transport services, retail trade of consumables) both during investment and operation phases
- Decrease freight traffic load on roads decrease the carbon emission caused by freight trucks during operation phase
- Decrease passenger traffic load on roads decrease the carbon emission caused by passenger cars during operation phase
- The railway track will connect the urban settlements with high population density and high passenger traffic demand (e.g. Mafraq, Zarqa, Amman). The JHR railway network can be extended to link Queen Alia International Airport and Madounah custom zone where the passenger with high traffic demand. These railway links will also help to decrease traffic load on roads for public transportation purposes.
- Results in improvement of road traffic safety and decrease financial and social costs caused by traffic accidents during operation phase
- Decrease freight transport costs in the region during operation phase
- Increase in land estate value along the railway track alignment
- Boost the opportunity to be connected to international railway networks and stimulate international trade activities during operation phase
- Increase the accessibility to natural and historical tourist attraction destinations nearby railway surrounding
- Increase value of land estate assets of Jordan Hijaz Railway Corporation
- Jordan Hijaz Railway will be reconstructed on existing rail track alignment. Expropriation requirement will be at minimum level and the expropriation costs will be minimized in comparison with any alternative alignments.
- The ground where the existing rail track alignment flows is solid and flat in comparison with alternative alignments. Then the earthwork costs will also be minimized.
- The existing bridges and tunnels along the railway alignment will be used. Repair and strengthening costs for such structures will be lower in comparison with constructing new bridges and tunnels.
- The existing station buildings and facilities will be renewed and utilized. The costs incurred will be lower in comparison with building new stations and station facilities.

In view of the analysis and the results of this study, a recommended strategy should have the vision of seeing the rail transport a highly competitive mode of transport: efficient, simple (easy to use), fast, accessible, and comfortable. Achieving this vision requires the following main efforts:

1. Develop effective rail infrastructure by using the existing assets effectively;
2. Develop robust commercial capabilities; and
3. Improve legal and regulatory frameworks

Within the framework of the above-mentioned strategy, a specific strategy is formulated for the current project with the vision of making the line a preferred mode of transport for trade and passengers thus the improved railway line will facilitate increased regional cooperation and integration. However, priority infrastructure investments are necessary to achieve the followings:

1. Identify a methodology for prioritizing specific investment projects.
2. Fill gaps and missing links in existing railway line
3. Renovate important parts of existing rail infrastructure,
4. Modernize and replace rolling stock, and
5. Modernize information technologies.

The Project will restore the Jordan's railway infrastructure by rehabilitating its existing track. The railway's operations will be improved through organizational restructuring with award to a private railway operator of a concession to operate the railway commercially under a PPP arrangement. The PPP Railway Operator can be selected after competitive international bidding for the concession. The rehabilitation investment and the associated restructuring will together set the stage for efficient rail services, which in turn realizes the Project's objectives: improving the transport sector's efficiency by increasing the diversity of transport modes and routes, and resurrecting the railway on a sustainable basis by reconstructing the Hijaz railway route.

There is an urgent need to influence policy discourse and policy formulation on the salient regulatory and policy choices at hand.

This includes the following measures:

- Access for international freight services to be extended throughout an extensive, defined rail freight network when realized.
- A new directive on the regulation of railway track and railway traffic safety on the Community's railways.
- Evaluating existing charging frameworks and setting a policy to charge for rail network access based on competitive pricing strategy considering the marginal costs.
• Evaluating the provision of capacity.
• Adopting and implementing systematic railway maintenance management system that include periodical evaluation of railway network condition. Based on this evaluation a maintenance programs should be proposed and implemented.
• Separation of infrastructure investments from operations.
• Adopting international financial reporting standards and introducing cost accounting system to trace the operating revenues and costs for passenger and freight transportations separately.
7. Conclusions

This study aims to reconstruct and modernize the Hijaz Railways and restore JHR to serve for domestic freight and passenger transportation.

Both the political and economic problems and damages in certain sections of Hijaz railway lines in this region caused Hijaz Railways not to be utilized.

However, the current developments on railway investments in Turkey, Iraq, Iran and Saudi Arabia and the prospects of reaching a political solution in Syria in the coming years requires Jordan to be prepared for new prospects and developments in rail transportations.

This study, named as "the Feasibility Study Reconstructing the Old Ottoman Hijaz Railway Line" is prepared with the co-financing of COMCEC and JHR. The Hijaz rail line is mostly idle with very limited use for many years. The study aimed to analyze the economic benefits and develop an investment program for Hijaz railways to put into operation in an efficient way and to make a positive contribution to the national economy.

The proposed investment is aimed at achieving the highest utilization of the existing infrastructure with optimal utilization of limited resources. In order to realize the investment, the required financial resources are assumed to be provided through the support of the PPP model and / or international financial institutions.

The investment covers the 227 km railway line – 260 km with station links- which is under the control of the JHR and will be completed as a single line dual gauge.

The necessary infrastructure investments will be realized on the rail line, the whole rail system will be renewed, existing the rolling stock assets will be repaired and modernized, and the new locomotives and wagons to be purchased will be integrated into the system. Necessary arrangements and renewals will be realized at the existing stations and also a signalling system will be established by making investments that will provide safety and security along the whole railway line. Thus, the rail system will be safe and will be operated with a minimum negative impact on the environment.

In addition to all physical investments, required human resources during operations phase will be employed and trainings will be provided for ensuring their successful integration to the system.

The approximate value of all the investments outlined above is USD 790 million. According to a similar railroad investment in this scale, a considerable savings can be achieved. At the end of the investments, it is estimated that JHR will receive a sufficient share from the freight and passenger transport demand in the country.
According to the investment program, investments will be completed within next four years and operating phase is planned to start at the end of the fourth year. The JHR will gain operating profit from the fifth year of the operating phase.

The realisation of this investment initially requires following steps will be ensured;

- All JHR technical staff will be prepared for supervising and monitoring the investment phase
- The financing of the investments will be secured
- Efficient project management system and mechanisms will be established with the trained project management team

The necessary preparatory studies will be commenced for the planned rail line extension with new connections to Queen Alia Airport and new custom zone in Maoduna in order to timely respond to the freight and passenger transportation demands. Besides, JHR will consider extending the rail line to Aqabe port which is one of the important gates of Jordan in terms of freight transportation and will start analysing such extension together with Aqabe Rail Corporation. Similar studies are planned to be made for extending the Hijaz Railways to some of the major tourist destinations and industrial sites of Jordan. These investments will provide JHR to gain its historical importance for the country again.

As a conclusion, the proposed investment plan with the preparations for additional investments summarised above are shaping the JHR’s vision for the future as revitalizing JHR to gain its importance in the transportation sector of the Hashemite Kingdom of Jordan with its modern operating systems competing with international standards and serving for the well-being of the country.
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24. Osmanlıda Ulaşım Çamlıca Basım Yayın İstanbul Editörler Vahdettin Engin Ahmet Uçar Osman Doğan
25. Improving Transnational Transport Corridors In the OIC Member Countries: Concepts and Cases, COMCEC Coordination Office September 2017
26. Governance of Transport Corridors in OIC Member States: Challenges, Cases, Policy Lessons COMCEC Coordination Office February 2018
Appendix 1. Questionnaire for Hijaz Railway Online Survey

Dear Madame/Sir

The Secretariat of the COMCEC, Standing Committee for Economic and Commercial Cooperation of the Organization for Islamic Cooperation provides funding for financing and monitoring programs and projects aimed at institutional capacity building in Organization of Islamic Cooperation (OIC) countries and the international organizations operating in the economic and commercial spheres in the OIC.

The project for "Feasibility Study Reconstructing the Old Ottoman Hedjaz Railway Line and Adding New Lines to Connect Region Countries In Order to Operate the Transportation of the Goods and Passengers" of the Jordan Hedjaz Railway of Hashemite Kingdom of Jordan is within the projects those are entitled to receive funding support for the 5th COMCEC Project Funding Call.

Here we kindly ask your opinion and consideration on impact of improvement of Jordan Hedjaz Railway Line on development of social and economic relations within region and other OIC member countries. We will appreciate by obtaining your esteemed response on following issues.

The information you give us will be kept strictly confidential and will only be used as statistical data. Thank you for your cooperation.
1. Within the last decade in Middle East countries an increasing trend on improvement of railway transportation infrastructure are observed.

(e.g. Jordan National Railway Project, High Speed Railway Projects and other miscellaneous railway projects of Turkey, Gulf Railway Project of Gulf Corporation Council Countries, Alharemen Express Train and South North Train Projects of Saudi Arabia, Railway Sector Investment Opportunities announcement of Iraq)

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither disagree nor agree</th>
<th>Agree</th>
<th>Strongly agree</th>
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Improvement of railway network between bordering countries facilitates trade relations among them.

Improvement of railway network between bordering countries creates cost effectiveness on international trade.
2. There is not a direct railway connection between Jordan and Iraq. The transportation of commercial goods between two countries are carried out by land transport at present.

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<tr>
<th>Strongly disagree</th>
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Connecting Jordan and Iraq with railway facilitates improvement of trade relations among these countries.

Improvement of railway network between Jordan and Iraq creates cost effectiveness of trade between these countries.

- [ ] Strongly disagree
- [ ] Disagree
- [ ] Neither disagree nor agree
- [ ] Agree
- [ ] Strongly agree
3. Jordan and Iraq are not directly connected with railway with Saudi Arabia that is a border country of both.

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<tr>
<th>Strongly disagree</th>
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<td>Connecting Jordan and Iraq with railway to Saudi Arabia facilitates improvement of trade relations among these countries.</td>
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4. Jordan and Iraq do not have any railway connection to Europe via Turkey.

<table>
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## Appendix 2. Address List of Online Survey

### JORDAN
- info@mot.gov.jo
- Nourhan.Shuqman@mot.gov.jo
- krishan_hussein@yahoo.com
- arc@go.com.jo
- fbmasua@hotmail.com
- sg@mot.gov.jo
- mahmoud.abedal-salam@mot.gov.jo
- nhamdan@mot.gov.jo
- okaradsheh@mot.gov.jo
- lmuflleh@mot.gov.jo
- nerefej@mot.gov.jo
- analshik@mot.gov.jo
- ihiari@mot.gov.jo
- nhassan@mot.gov.jo
- aloubani@mot.gov.jo
- hmheisen@mot.gov.jo
- shajhamad@mot.gov.jo
- mabuhammad@mot.gov.jo
- info@mit.gov.jo
- jamil.zayed@mit.gov.jo
- ibrahim.h@mit.gov.jo
- omari@mit.gov.jo
- jftp@mit.gov.jo
- Emad.t@mit.gov.jo
- info@mof.gov.jo
- Fjcc@Nets.Com.Jo
- Jci@Aci.Org.Jo

### IRAQ
- mt_office@motrans.gov.iq
- m_strcw@motrans.gov.iq
- strcw@motrans.gov.iq
- foreign_relation@motrans.gov.iq
- media@motrans.gov.iq
- Mt_office@yahoo.com
- Mt_office@motrans.gov.iq
- Mot2office@gmail.com
- media@scr.gov.iq
- info@src.gov.iq
- salamjsalom@yahoo.com
- info@ficc.org.iq
- ficcbaghdad@yahoo.com

### TURKEY
- asirkilicaslan@tcdd.gov.tr
- ranapekin@tcdd.gov.tr
- hasanhuseyinguney@tcdd.gov.tr
- ismailcaglar@tcdd.gov.tr
- ismailhmurtazaoglu@tcdd.gov.tr
- mustafacavusoglu@tcdd.gov.tr
- alihsanuygun@tcdd.gov.tr
- bilaltirnakci@tcdd.gov.tr
- ibrahimkekec@tcdd.gov.tr
- mesutayman@tcdd.gov.tr
- mehmetondes@tcdd.gov.tr
- erolyanar@udhb.gov.tr
Appendix 3. Short Report on On-line Survey

The online survey was sent to 60 relevant officials from Turkey, Iraq and Jordan. 7 participants from Jordan and 1 Turkish participant who reside in Iraq filled the questionnaire. The participants were asked to score a couple of statements by using the following criteria:

1- Strongly disagree
2- Disagree
3- Neither disagree nor agree
4- Agree
5- Strongly Agree

The above figures shows that all the participants agree with all these seven statements. The statement that all the participants marked as "strongly agree" is "connecting Jordan and Iraq with railway to Saudi Arabia as well as Europe via Turkey facilitates improvement of trade relations in the region".
## Appendix 4. Indicative Investment and Procurement Plan

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2. Preparation of Reconstruction Projects
3. Supervision Activities
4. Railway Substructure
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Milestones:
1. Determination of Investment & Financing Model completed (end of second quarter of 2019)
2. Detailed design and engineering works completed (end of second quarter of 2020)
3. Railway Substructure works completed (end of 2021)
4. Repair and maintenance works completed (end of 2021)
5. Railway Superstructure works completed (end of 2022)
6. Signalization and communication system completed (end of 2022)
7. Railway Track & Traffic Safety on Railway Track completed (end of 2022)
8. Restoration of Stations completed (end of 2021)
9. Test run and trial operations completed (end of second quarter of 2023)