

# THE GULF COOPERATION COUNCIL RAILWAY

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The members of Gulf Co-operation Council – Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates (UAE), and Oman – are proposing to build a heavy railway line to link all six states. It is intended to run from Kuwait City to Muscat via Saudi Arabia and the United Arab Emirates with a loop via causeways through Bahrain and Qatar. This will present a formidable task in a region where there is little or no history of railways with the exception of Saudi Arabia and to a lesser extent the UAE. This will involve the co-ordination of standards across six states and integrating with the existing heavy rail system in Saudi Arabia and the proposed rail networks of the other five states. Heavy rail has advantages over road transport for long haul freight and passenger transportation in terms of operational efficiency, carbon dioxide emissions, and cost. However, these advantages have not been apparent for the GCC members – Saudi Arabia and Oman aside – because they do not kick-in for shorter distances involved in domestic transportation. Kuwait, Qatar, and UAE have a maximum internal journey of 250 km to 300 km with Bahrain considerably less. This gives a potential journey by road of up to five hours. It is only when considering transport between GCC member states as they become more closely economically integrated that the advantages of heavy rail become apparent. This paper aims to present an overview of the risks involved with this project from design to construction and operation. While the research will focus on the analysis and response to technical risks concerned with the challenging terrain, through-running, signalling, and communication, it will also outline the legal and commercial risks of ticketing, customs, tariffs and regulation and the political issues between member states.

Keywords: project management, risk management, civil engineering.

## INTRODUCTION

The Gulf Co-operation Council rail project is a very ambitious attempt to connect the six member states with a railway running the length of the Arabian Peninsula from Kuwait via Saudi Arabia and the United Arab Emirates to Oman over challenging terrain. There will be either a loop or branches to link to Bahrain and Qatar. Only Saudi Arabia, of the above states, has any experience of constructing and operating heavy railways and that experience is fairly limited. This line has produced echoes in scale of the narrow-gauge Hejaz Railway (Nicholson, 2005) of a century ago. It was built by the Ottomans with German technical assistance. It ran from Damascus to Medina and opened in 1914. It proved to be short-lived and closed in 1915 during the

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First World War. It was never successfully re-opened south of the Saudi Arabian border with Jordan although parts of the line are still in operation to the north.

## THE GULF CO-OPERATION COUNCIL

### Background

The Co-operation Council for the Arab States of the Gulf (GCC) was established in 1981 by the Kingdom of Saudi Arabia (KSA), Kuwait, Bahrain, Qatar, the United Arab Emirates (UAE), and Oman. They are all monarchies, absolute in the case of Saudi Arabia and Oman, federal in the case of the UAE and constitutional in the other states. The logic of the GCC was to provide protection from the real or perceived threats from their powerful Arab neighbours of Iraq and Syria plus the strong regional power of Iran and the threat of radical Islam. Iraq invaded Kuwait in 1990 while Iran claimed sovereignty over Bahrain from 1957 to 1965 (Downs, 2012). It seems possible that the membership of the GCC will be expanded at some stage to include the two remaining Arab monarchies: Jordan and Morocco. Jordan shares a land border with Saudi Arabia. The inclusion of Yemen will bring the whole of the Arabian Peninsula into the GCC. The Candidate States are low to medium income in contrast with the high income Member States. All current members have significant oil and gas reserves although the oil reserves in the case of Bahrain and Oman are depleting.

*Table 1: GCC Member States*

Member state	Population	GDP (PPP) US\$ billion	GDP per capita US\$	Land area km <sup>2</sup>	Oil reserves million bbl.	Gas reserves million m <sup>3</sup>
KSA	26,939,583	740.500	25,700	2,149,690	267,017	8,028,000
UAE	5,473,972	271.200	49,000	83,600	97,800	6,089,000
Oman	3,154,135	90.660	28,500	309,501	5,500	850,030
Kuwait	2,695,318	165.900	43,318	17,818	101,500	1,798,000
Qatar	2,042,444	189.000	102,800	11,571	25,382	25,200,000
Bahrain	1,234,571	32.440	28,200	765	125	92,030

### Economic Development in the GCC

The changing circumstances of the GCC countries into the 21st century have led to rapid urbanization and growth of cities such as Riyadh, Muscat, Abu Dhabi and especially Dubai. In addition, there is pressure to diversify away from oil and gas, particularly in those countries where their oil reserves are running down. This is leading GCC countries towards exploitation of mineral wealth and industrialisation plus moving into other sectors such as real estate and tourism. It has demonstrated a need for the GCC countries to economically integrate to meet the above challenges (Aluwaisheg, 2004). The GCC was founded with the objective of being a regional bloc although this has now moved towards becoming an economic, monetary and military confederation intended to meet the needs of its citizens in response to democratic change within the Arab world, radical Islam and Iranian pressure.

Saudi Arabia is probably leading the move to integration, and it will have the leading role with effective hegemony over the federation. Other GCC states, with the exception of Bahrain appear to be rather less enthusiastic about closer integration. Economic union within the GCC has developed with a Customs Union being declared in 2003 and a Common Market in 2008. This was intended to remove all barriers to trade in services and investment. A single currency for the GCC – the Khaleeji – is

proposed although Oman and the UAE have recently withdrawn from this. The new currency is not expected to be launched before 2015 in the four remaining countries.

### Rail Projects in the GCC

The improvement of transportation and communications by use of rail transport has been identified as a means to achieve the above goals. All GCC member states have domestic railway systems under development apart from the main GCC line. These include urban metro systems for Abu Dhabi City, Dubai, Bahrain, and Kuwait City as well as long distance mixed freight and passenger lines in Saudi Arabia and the UAE.

*Table 2: Rail Projects within GCC (Frost & Sullivan, 2011)*

Project	Budget	Length	Target	Coverage	Usage
GCC Rail Network	\$30.0 bn	2,177 km	End 2017	Kuwait City-Muscat	Mixed
Qatar Rail System	\$25.0 bn	850 km	Mid 2015	North-South	Mixed
UAE Etihad Railway	\$10.9 bn	1,500 km	End 2015	All of UAE	Mixed
Dubai Metro	\$10.6 bn	180 km	End 2015	All of Dubai	Passenger
Bahrain Rail Masterplan	\$7.9 bn	103 km	End 2025	All of Bahrain	Passenger
Abu Dhabi Metro	\$7.0 bn	131 km	End 2020	Abu Dhabi City	Passenger
Kuwait City Rapid Transit	\$7.0 bn	171 km	End 2016	Kuwait City	Passenger
Saudi Land Bridge Rail	\$7.0 bn	950 km	End 2014	Jeddah-Riyadh	Mixed
Haramain High Speed Rail	\$7.0 bn	444 km	End 2014	Mecca-Medina	Passenger
North-South Railway	\$5.3 bn	1,486 km	Complete	Al-Haditha-Riyadh	Mixed

## THE GCC RAILWAY

### Justifications

Railways make better use of space for transporting people and freight. Rail uses 60-80% less energy, results in 80% less carbon dioxide emissions and is 30% cheaper. It is also much safer and causes in less noise pollution (Frost & Sullivan, 2011). It has less scope for disruption due to climatic factors. The rail transportation of bulk solids and liquids as well as containerised cargo will be cheaper than road provided that the journey is over 500km. For shorter journeys, the overheads associated with trips to and from the railhead will erode this advantage. The GCC members, with the exception of Saudi Arabia and Oman are geographically small. Domestic trips will have a maximum 'stretch' of 250-300km. Hence for domestic freight transport within most GCC states, rail tends to be at a disadvantage compared with road.

Further economic integration within the GCC will result in longer journeys and ensure that the advantages of rail will kick-in. The economic diversification away from oil and gas – where pipeline is the best form of transportation – towards industrialisation and exploitation of mineral resources will justify the high capital costs of a railway.

### The Route

The main route for the railway follows the coast from Kuwait City to Jubail in Saudi Arabia and on to Dammam where there is an existing line to Riyadh. The route continues along this line to Al Hofuf and then on to Ghuwarfat in the UAE. It then goes direct to Sohar in Oman via Al Ain and hence to Muscat with a loop via Abu Dhabi, Dubai and Fujairah to Sohar. The total length will be around 1,770km. In addition a loop was proposed from Dammam via a new causeway to Bahrain and on

by another causeway/bridge to Qatar before re-joining the main line at Salwa giving a total length of 2,177km.

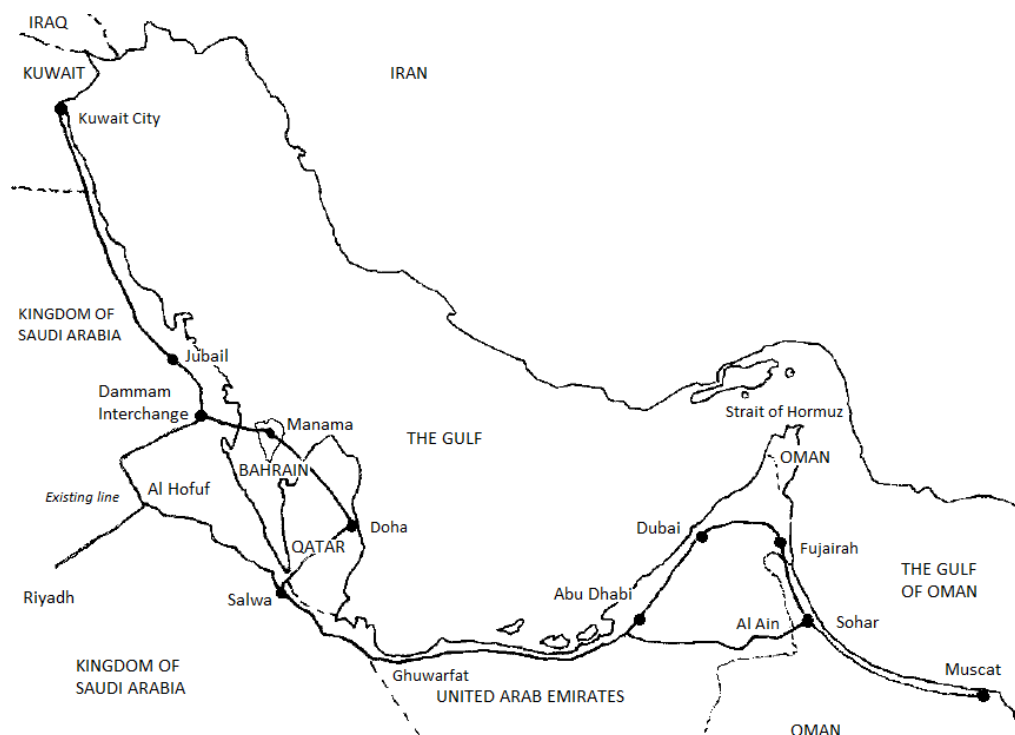


Figure 1: Proposed Route

There will be seven large stations and four smaller stations on the line. It is hoped that the line will be go beyond the GCC to Jordan and the European Union (Yousef, 2013)

Table 3: Stations on the GCC Railway (after GPCA, 2013)

Station	Line	Type	Member State
Kuwait City	Main Line	Large	Kuwait
Jubail	Main Line	Small	KSA
Dammam Interchange	Main Line	Large	KSA
Manama	Branch or Loop Line	Large	Bahrain
Doha	Branch or Loop Line	Large	Qatar
Salwa	Main Line	Small	KSA
Abu Dhabi	Loop Line	Large	UAE
Dubai	Loop Line	Large	UAE
Fujairah	Loop Line	Small	UAE
Sohar	Main Line	Small	Oman
Muscat	Main Line	Large	Oman

### Finance for the Railway

The total cost of the line is currently estimated at around US\$15.5 billion (Arab News, 2013). The proposals suggest that the cost of the construction of the line be carried by the members proportional to the length of track running in their state. Each state will construct their own stations, freight terminals and branch lines plus links to national railway and urban transportation systems. The causeway linking Saudi Arabia with

Bahrain will probably have to be largely financed by the Saudis. Similarly the bridge/causeway linking Bahrain with Qatar will probably be financed by Qatar if it goes ahead. The procurement of rolling stock is expected to use private funding.

This will result in an unequal distribution of cost with Kuwait, for example, paying far less than Oman and the UAE. Saudi Arabia is expected to make the largest contribution to the costs. Each country will opt for different funding approaches to reflect their varying economic circumstances. These might involve public private partnerships or funding packages from banks and the use of Islamic Bonds.

The basic line runs from Kuwait City through to Muscat. The full line includes the loop via Bahrain and Qatar. This includes around 180km of connecting lines to traffic nodes and ports, airports and industrial cities. The existing US-built line from Dammam via Al Hofuf to Riyadh (Henry, 1952) and the proposed extensions in Oman not included in the figures below.

*Table 4: Funding criteria: the length of track within each Member State (GPCA, 2013)*

Member State	Basic line	Percentage	With loop	Percentage
Kuwait	145km	8.2%	145km	6.7%
Kingdom of Saudi Arabia	635km	35.9%	695km	31.9%
Bahrain	–	–	64km	2.9%
Qatar	–	–	283km	13.0%
United Arab Emirates	684km	38.6%	684km	31.4%
Oman	306km	17.3%	306km	14.1%
Total	1,770km	100.0%	2,177km	100.0%

## **RISKS IDENTIFIED**

### **Introduction**

The risks facing this project can be divided into three main groups:

- Technical risks related to co-ordination of issues such as the loading gauge of the railway, the standards of train protection and the signalling systems used for the system so as to ensure that through-running is possible.
- Economic and financial risks concerned with the provision of finance for the project and its economic viability.
- Political and legal risks associated with any failure to fully implement the GCC Customs Union and Common Market.

The main focus of this research is the analysis and possible responses to the technical risks. These will be dealt with in the section below. The economic and political risks will not be analysed in detail as they fall outside the scope of the research but are outlined so as to set the technical risks in context.

### **Economic and Financial Risks**

The total cost of the project has been estimated at \$15.5 billion using 200kph diesel power or \$25.6 billion using 350kph electric power. Some commentators argue that the cost could end up at \$30 billion (Frost & Sullivan, 2011). The largest contribution to costs will probably come from Saudi Arabia with an economy flush with liquidity. Saudi Arabia has the cash to provide sovereign guarantees and make it easier to secure

private sector funding. Saudi Arabia has a number of on-going strategic rail projects and is also planning a \$3 billion light rail system for Riyadh. They are likely to use a public private partnership for the latter.

The second biggest contribution will come from the UAE who suffer from tighter financial constraints. They also have to pay for the Etihad Rail Project and the Abu Dhabi Metro not to mention completing the Dubai Metro. They will certainly require funding packages to ensure that the projects go ahead. Stage one of the Etihad Railway has been financed by a consortium of banks.

The other major section of the line is in Oman who received an offer of a package of assistance from the GCC of \$10 billion over 10 years, although this has yet to be received. This is intended for infrastructure developments part of which is earmarked for the GCC railway and the potential extensions to Duqm, Salalah, and Yemen.

The section in Kuwait is very short and will not be a problem in financial terms. The causeway link to Bahrain is expected to cost \$4.5 billion for a 90km line. It is currently undergoing a feasibility study. The link from Qatar to the main line in KSA will not present any financial problems. The Bahrain-Qatar causeway and line, by contrast, looks years away at the moment. It will probably depend on Qatar to provide the bulk of the funding and this is not likely to be forthcoming at this stage. However the link was promised as part of the successful 2022 FIFA World Cup bid so it could well be revived. Recent unrest in Bahrain (Mabon, 2012) has turned Qatari opinion against a link. The other sections appear to present few problems for funding although the domestic rail systems in Kuwait and Bahrain appear to be experiencing slippage.

Of more concern than capital requirements, will be the operational viability of the project. This will require through running of goods trains and through ticketing for passengers. This in turn will depend on political decisions on the common market and border controls within the GCC. This falls into the remit of political and legal risks.

### **Political and Legal Risks**

The economic case for the GCC railway appears to be based on an assumption that there will be free movement of goods and people throughout the council area. The economic underpinnings for the line depend on continued economic growth and more trade between GCC member states (Shediac et al, 2011). At the moment, long queues of trucks at border control posts are all too familiar. Despite that, trade within the GCC has continued to grow although most trade is still with the rest of the world.

For freight, this will require a joint customs system for all member states to permit a single point of entry into the GCC and a uniform tariff for imported goods. That would eliminate custom controls at borders within the GCC. It would also require free movement of people throughout the GCC with no passport controls at borders. Hence passenger trains would not be able to travel through borders without stopping.

All the above issues were included in the GCC plans for economic integration (Hertog, 2007). The customs union was declared in 2003 and the common market in 2008. The proposed monetary union was planned to take effect by 2010 (Buiter, 2008). However the withdrawal of Oman and the UAE has cast doubt on the single currency project which is currently running five years behind schedule (World Bank, 2010). The perception is that the whole integration programme is running behind schedule. In particular the failure to implement the sharing of customs duty on goods entering the GCC remains outstanding. There is agreement of zero import duty on inter-GCC trade but it is not implemented consistently. Inter-GCC trade is rising but

remains very small in comparison with trade with rest of the world (Shediac et al, 2011). If the issues of import duty and border controls are not fully resolved before the planned opening of the line in 2017, this could cause real problems for the project.

## **TECHNICAL ISSUES**

### **Technical risk identification**

Ostensibly technical co-ordination should not appear to be a problem as only one GCC member – Saudi Arabia – had a functioning heavy rail system when the project was first mooted (ignoring the Dubai Metro). However, each member state is likely to have its own objectives and agenda. In some cases the GCC railway will be only a small component in the developing domestic rail networks. The terrain with shifting sand dunes and at times a narrow coastal strip between the sea and rocky outcrops may also represent a challenge for railway construction and operation.

Technical standards are a frequently encountered issue with rail systems running across international borders. This can affect the gauge of the railway – the distance between the tracks – that was once a major problem when travelling from France with standard gauge to Spain with a broader gauge. This will not be a problem with the GCC railway but the loading gauge – the distance between platforms and the height required for tunnels and bridges – is more likely to cause conflict.

Freight transport is likely to be the issue here. The loading gauge will affect the size of solid/liquid bulk carriers and containers that the system is designed to carry. Most containers were originally of a standard 2.4m width by 2.4m height with varying lengths. However the advent of taller 'hi-cube' containers of 2.9m or 3.2m height has complicated this. Even more challenging, the practice of 'double-stacking' of standard containers on freight trains, is common in countries such as India, China, and the USA. If this practice is to be employed on the GCC railway, it will require bigger tunnels and higher bridges. It will also complicate the use of overhead electrification systems on such lines. In this case the wires would have to be 7.45m above track level resulting in even higher bridges and more expensive tunnelling. This leads to a potential point of conflict concerns the issue of running with diesel powered or electric locomotives. It, in turn, probably depends on whether the prime motivation for building the rail system is to run slow diesel-powered goods trains or high speed electric-powered passenger trains. The other technical issues such as signalling and train protection systems need to be consistent throughout the railway.

### **Technical risk analysis**

Many of these issues solve themselves given the preponderance of standard gauge railways in the region and the emerging world standards for train protection and signalling systems. Where conflicts arise, the established systems used in Saudi Arabia will certainly prevail over the other mooted systems. A political decision was required to resolve the connected issues such as loading gauge, the speed of operation and the mode of traction. All these will impinge upon the cost. The loading gauge will be particularly an issue in the mountainous areas of the UAE and Oman as it will impact on the cost of tunnelling. Electrification will increase the capital costs given the installation of overhead wires and this will also require higher tunnels and bridges. A high speed line will be more expensive to construct and to maintain than one of conventional speed especially in the challenging conditions of the GCC.

It became clear that GCC member states had very different objectives in mind for the rail network. Qatar clearly favoured electric powered fast passenger trains as did

Oman. However the other four states wanted diesel powered trains throughout. This would lead to problems for through running with either locomotive changes needed at the borders or diesel traction for through trains under the overhead wires.

Given that double-stacking of containers is likely to be desired by most states, this will mean that electrification will either not be possible on any section of the GCC railway without massive headroom for the wires or else the tracks will have to be duplicated with and without overhead equipment with all the added expense.

Qatar clearly has an agenda to establish a modern high-speed passenger rail network in time for the 2022 FIFA World Cup and probably see an electrified system as the most appropriate for this (Nambiar, 2012). Qatar also has the fourth biggest reserves of natural gas in the world and this is well suited to generating electricity.

Oman is in a very different economic category to Qatar but the motivations may also be similar. Oman has ambitious plans to link the GCC railway beyond Muscat to the special economic zone of Duqm and to Salalah and beyond. Oman also wishes to develop tourism and sees the construction of a fast passenger-oriented railway network as part of that strategy. Oman's reserves of oil are depleting fast. They do have decent reserves of natural gas although this is likely to be costly to exploit. Oman also has ambitions to develop solar power. They probably see an electrified rail network as more suited to their future energy potential.

Saudi Arabia has the objective of transporting bulk minerals and passenger traffic. Its current lines are diesel powered as are most of its planned lines. However the KSA is currently planning the Haramain High Speed Rail project that is expected to run with 360kph electric trains from Mecca to Medina via Jeddah. This line is primarily intended to transport Hajj pilgrims. The UAE is aiming at containerized goods transport and passenger traffic (Nambiar, 2012). The UAE intend to go for diesel power on its proposed Etihad Rail network with the option to electrify the route at some unspecified future date (Gavin, 2012).

The long distances involved with the GCC railway along with the arid nature and sparse population has convinced the most member states that diesel power is the best and most cost-effective option at least for the moment. The very low price for diesel in the GCC that has in the past promoted the development of road transport adds to these cost advantages of diesel trains over electric.

The problems associated with the terrain should not be insurmountable given technical advances along with careful planning and preparation and by selecting paths using the most stable dunes. This may involve consultation with the local Bedouin to establish the exact track route to use through the dunes (Kuwait Times, 2012).

### **Response to technical risks**

It was agreed to establish a GCC Railway Authority to oversee the application of consistent technical standards for the railway as well as methods of procurement. This will deal with issues such as train protection and signalling plus also loading gauge and tunnel/bridge heights to ensure safe through running. This should avoid the problem of different member states building their portion of the line to meet their own technical objectives and in line their budgetary situation. The connected issues of diesel versus electric traction, the double-stacking of containers and loading gauge used, remained points of contention that were resolved by a political solution.



The GCC Railway Authority needs to ensure the use of common standards and specifications, interoperability and regional integration of the GCC railway. This is so as to co-ordinate with the Saudi Railway Organization, Saudi Arabian Railway, the UAE National Transport Authority, Etihad Railways, Qatar Rail, and the Kuwait Transport Company.

It was been decided that the European Train Control System (ETCS) Level Two would be used for the GCC railway (GPCA, 2013). This system has no trackside signals with control by radio. It is a well-established system that is in commercial use for high speed lines throughout Europe. It will be possible to get competitive bids for installation. It is well suited for mixed high and low speed traffic

While all the current GCC members are all high income states, there are marked differences in liquidity even between Saudi Arabia and the UAE and particularly so when compared to Oman and Bahrain. This disparity may have helped to resolve the issue of traction power. The proposed \$10 billion package of assistance to Oman from the GCC for infrastructure projects may have been the factor that helped to persuade them to come into line over diesel traction. The announcement that diesel traction will be employed in Oman was made in January 2013.

Qatar is in a different position with the highest per capita income in the GCC. The line through Qatar is less central to the GCC railway than for other member states. The original proposals show a loop from the main GCC line going through Bahrain and Qatar. Saudi Arabia appears very keen to build a new causeway link to take the line to Bahrain but is not so enthusiastic about the proposed road and rail marine crossing 'Friendship Bridge' from Bahrain to Qatar. At the moment all road traffic to Bahrain has to travel via Saudi Arabia. A direct link to Qatar would reduce the dependency of Bahrain on Saudi Arabia.

Also Qatar has lost out in a major long-standing territorial dispute with Bahrain over the Hawar Islands and their oil and gas potential (Wiegand, 2012). A clash in 2010 between Bahraini fishermen and the Qatari military reignited this dispute. As things stand, there are doubts if the full loop will be built in the immediate future and there may only be branches from the main line to serve Bahrain and Qatar. Hence the choice of traction power by Qatar will have little impact on the main GCC line. However through running of double-stacked container trains to Qatar may not be possible if the branch is equipped with standard overhead wires.

The tunnels in the mountainous areas of the UAE and Oman will be built to facilitate double-stacking of containers. Air-conditioned diesel powered passenger trains will run at two hour intervals at 200kph mostly during the day. Container and bulk freight trains will run at 80-120kph mostly at night (GPCA, 2013). There appear to be technical solutions to the challenges presented by the difficult terrain.

## **CONCLUSIONS**

The line was proposed by the GCC in order meet its strategy objectives of increasing trade between members and economic integration. This integration was seen as an approach to dealing with external and internal threats to sovereignty and security.

It would appear that the measures to be taken such as the establishment of the GCC Railway Authority to oversee the overall implementation of the project will go some way to solve the technical issues identified above. This appears likely to deal with the most, if not all, of the risks associated with technical co-ordination.

The key political decisions about the specification of the railway appear to have been taken that will resolve other technical issues. The line will be diesel powered and will be designed to a loading gauge suitable to accommodate double-stacked containers. That leaves the political issues concerning the completion of the Common Market that remains beyond the remit of this research.

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